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SUMMARY REPORT
on
SITE ASSESSMENTS

NORTH COORANBONG INVESTIGATION AREA
AVONDALE ROAD, ALTON ROAD &
FREEMANS DRIVE, COORANBONG

Prepared for
J W PLANNING PTY LTD
On behalf of
Johnson Property Group Pty Ltd

Project 31720A
MARCH 2005

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TABLE OF CONTENTS

APPENDICES

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Project No 31720A
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7 March 2005

SUMMARY REPORT ON
SITE ASSESSMENTS
NORTH COORANBONG INVESTIGATION AREA

1. INTRODUCTION

This report presents a summary of the findings of preliminary and additional site assessments previously conducted by Douglas Partners Pty Ltd (DP) for the various parcels of land within the "North Cooranbong Investigation Area", and has been collated at the request of Mr Jason Wasiak of J W Planning Pty Ltd on behalf of Johnson Property Group Pty Ltd.

The investigations were conducted to assess possible opportunities and constraints to future site development with respect to geotechnical and potential site contamination issues.

A Master Plan, Appendix A, was provided by J W Planning Pty Ltd, showing the core holdings within the "North Cooranbong Investigation Area".

The investigations generally comprised a "Preliminary Site Assessment", followed by additional investigations to further assess particular issues identified in the preliminary assessment. Reports previously conducted by DP are summarised in Table 1, below:

Table 1 – Investigations Undertaken by DP

Report No	Date	Investigation Title	Description	Reference No	
31393	11/12/01	Preliminary Site Assessment	Lots 1 to 4, Part Lots 5 & 6, Lots 7 to 10 and Part Lot 11, DP 3533, Avondale Rd, Cooranbong	1	App E*
31393-1	24/1/02	Effluent Sludge Dam Assessment	Lot 10, DP 3533, Avondale Rd, Cooranbong	2	
31498	24/7/02	Preliminary Site Assessment	Lot 1, DP 170378, Lot 2, DP 825266, Lot Pt 15, DP 182756, Lot 1, DP 348173 & Lot 21, DP 865588, Alton Rd & Freemans Dr, Cooranbong	3	App C*
31498A -01	1/4/03	Additional Contamination Assessment	Lot 2, DP 825266, Lot 21, DP 865588 & Lot 1, DP 348173, Alton Rd & Freemans Drive, Cooranbong	4	
31498A -02	9/4/03	Additional Contamination Assessment	Lot 1, DP 170378, Alton Rd, Cooranbong	5	
31498A -03	8/4/03	Additional Contamination Assessment	Lot Pt 15, DP 182756, Alton Rd, Cooranbong	6	
31720	20/10/03	Preliminary Site Assessment	Lot 1, DP 825266	7	App D*
31720-1	13/11/03	Additional Geotechnical & Contamination Assessment	Lot 1, DP 170378, Lot 2, DP 825266, Lot Pt 15, DP 182756, Lot 1, DP 348173, Lot 21, DP 865588, & Lots 1 to 11, DP 3533,	8	App E*

Note to Table 1: * A full copy of the report is provided in the noted Appendix.

Drawing 1, Appendix A, shows the investigation areas for the above assessments.

In addition, we have also considered the adjacent site areas (shown as Areas 1 to 5 on Drawing 1), for the assessment, as requested. Investigations associated with these areas was limited to a brief inspection from site boundaries. Specific on-site assessments, however, were not conducted.

2. WORK SUMMARY

The following table provides a summary of the work conducted by DP for each investigation.

Table 2 – Work summary of Previous Assessments

Report No	Reference	Description of Work	Purpose
31393	1	PCA – Site inspection & brief history review including discussions with Jason Wasiak UCA – Desktop study, review of plans (geological, acid sulphate, topographic, orthophoto and aerial) & site inspection	PCA & UCA to assess site condition and identify potential geotechnical and site contamination constraints
31393-1	2	Effluent Sludge Dam Assessment – Background review, site inspection, groundwater monitoring well installation sampling & analysis of sludge material and groundwater	Additional assessment to assess potential migration and groundwater impact from sludge dam & classify sludge material
31498	3	PCA – Site inspection & brief history review including discussions with Jason Wasiak & site owners UCA – Desktop study, review of plans (geological, acid sulphate, topographic, orthophoto and aerial) & site inspection	PCA & UCA to assess site condition and identify potential geotechnical and site contamination constraints
31498A-01	4	Subsurface investigation via test bores & pits, soil sampling, laboratory analysis	Additional contamination assessment to further assess potential contamination issues identified in Reference 3
31498A-02	5	Walkover, surface sampling and analysis by Microbiologist, subsurface investigation via test bores & pits, installation of groundwater monitoring wells, surface and subsurface chemical and microbiological laboratory analysis, microbiological risk assessment	Additional contamination assessment to further assess potential contamination issues identified in Reference 3
31498A-03	6	Walkover, surface sampling and analysis by Microbiologist, subsurface investigation via test bores, surface and subsurface chemical and microbiological laboratory analysis, microbiological risk assessment	Additional contamination assessment to further assess potential contamination issues identified in Reference 3
31720	7	PCA – Site inspection & brief history review including discussions with Jason Wasiak, site owner & searches with NSW EPA, DLWC & LMCC, subsurface investigation via bores, installation of groundwater monitoring wells, surface water and groundwater sampling and analysis UCA – Desktop study, review of plans (geological, acid sulphate, topographic, soil landscape and aerial) & site inspection, subsurface investigation via test pits & laboratory testing for soil erodibility	PCA & UCA to assess site condition and identify potential geotechnical and site contamination constraints Investigation to assess potential migration of contaminants from the effluent sludge dam (Ref 2) onto the site
31720-1	8	Subsurface investigation via test pits, laboratory testing for soil erodibility, review of existing PCA's undertaken, additional surface water and groundwater sampling and laboratory analysis within Lot 1, DP 170378	Additional assessment to identify potential natural resources, erosion potential and potential migration of contaminants from the areas already investigated within the "North Cooranbong Investigation Area"

Notes to Table 2:
PCA – Preliminary Contamination Assessment
UCA –Urban Capability Assessment

Reference should be made to individual reports for details.

For the preparation of the current summary report a brief site inspection was conducted from site boundaries on the 24 August 2004 by an engineer from DP, to identify potential geotechnical or contamination constraints within adjacent Areas 1 to 5 as shown on Drawing 1, Appendix A

3. RESULTS

3.1 Geotechnical Considerations

The following geotechnical considerations were addressed in the urban capability assessments:

- erosion hazard;
- slope stability;
- uncontrolled filling;
- excavatability;
- soil reactivity;
- saturated, low-lying soils;
- acid sulphate soils;
- natural resources.

The general site conditions can be summarised as follows:

Erosion Hazard

The results of laboratory testing indicated that the dominant soils at the site (i.e. clay) is non dispersive. There is however, a potential for adverse impacts resulting from erosion of upper silty sand topsoil materials, such as impacts on water quality due to sediment laden run-off during and following development. Owing to the limited quantity of this material encountered in all pits for depths ranging from 0.1 m to 0.3 m, erosion and sedimentation are readily amenable to mitigation measures such as, silt fences, revegetation / reshaping batters, drainage structures (catch drains), sediment traps and sedimentation basins.

Slope Stability

There was generally no evidence of previous or incipient deep seated instability observed over the site. The site is generally considered to have a low risk of instability with respect to the natural topography.

There was, however, evidence of erosion and surficial creep within batter slopes (cut and fill) identified within the site. Specific areas affected by cut and fill would need to be assessed at a later stage in the development.

Uncontrolled Filling

Localised areas of filling, including stockpiles, which generally appear to have been placed in a non-engineered manner, as defined in AS 2870-1996 (Ref 9), were observed across the site and would not be suitable for support of structures.

Subsurface investigation should be undertaken to assess the depth, extent and properties of filling if development is proposed in these areas.

Excavatability

Soils observed across the site, in test pits, test bores, erosion scours and exposed cuts generally comprised silty sands, clayey sands, silty / sandy clays, and weathered rock, which can be readily excavated by conventional earthmoving equipment. However, excavatability of the underlying rock should be assessed on a site specific basis during detailed investigations prior to development.

Soil Reactivity

Foundation design for future structures and pavement construction will be influenced by a number of factors including the reactivity of site soils. Laboratory testing of soil properties has not been undertaken as part of this assessments.

Soil reactivity can readily be accommodated in design, and should be confirmed during future detailed investigations prior to development by classifying building sites in accordance with AS 2870-1996 (Ref 9).

Saturated Soils / Poor Ground

Localised saturated surface soils were observed in various locations across the site including gullies, low lying areas, creek/ponds, drains, effluent ponds, transpiration areas, etc.

Saturated areas are likely to result in localised softening and in swelling behaviour of surrounding soils which should also be considered for future detailed investigation and design.

Acid Sulphate Soils

Based on the Acid Sulphate Soil Risk Map for Morisset, it is unlikely that acid sulphate soil conditions are present at the site, with the exceptions of the low lying portions of the south-eastern corner of the site in close proximity to Freemans Drive. Specific investigation and procedures for management of acid sulphate soils will therefore only be required if future development is proposed in these areas. Aggressive ground conditions (i.e. naturally acidic soils) may however be present within the site and should be considered for future detailed investigations.

Natural Resources

Based on the results of the investigations, subsurface conditions across the site are anticipated to generally comprise silty / sandy clays to depths between 0.45 m and 3.0 m overlying bedrock.

The suitability of this material as a resource will depend on the proposed use. Additional laboratory testing may be required to assess the materials suitability for specific uses.

While shallow bedrock was encountered in a number of pits across the investigation areas, bedrock generally comprised sandstone or siltstone. Gravelly sands (possible weathered conglomerate) were encountered in one pit at the edge of a former quarry. No other pits identified significant gravel quantities, however, extensive subsurface investigation within the site has not been undertaken at this time and may uncover other areas of gravel deposits.

General

- reference should be made to individual reports for details;
- adjacent Areas 1 to 5, are likely to contain similar geotechnical conditions to those investigated in the North Cooranbong Investigation Area, with the exception of Area 5;

- Area 5 contains a number of cut / fill batters and a large dam in the north-eastern corner of the site. Additional investigation of the site will be required prior to development in the vicinity of Area 5 to confirm long term stability of the dam embankment, if the dam is proposed to be retained.

3.2 Preliminary Contamination Assessment

The preliminary contamination assessments (PCA) generally included a brief site history and site inspection to assess the site condition and assess potential contamination issues. The results of the assessments suggested the following areas of potential contamination, as shown in Table 3, below.

Table 3 – Potential Site Contamination

Location/Description	Potential Contaminants
Lots 1 to 11, DP 3533	
- Effluent Sludge Dam (Quarry A)	- Faecal coliforms, e-coli, nitrogen, phosphorus, heavy metals, bacteria, viruses
- Imported filling - within Quarries A and B - adjacent to the north-east portion of the bitumen runway - minor fill beneath runways - localised dumped mounds of fill adjacent to tracks - ash filling along access road to Quarry A	- heavy metals, - hydrocarbons, - pesticides,- PCB's, asbestos, etc
- Cooranbong Land Ground facilities - fuel storage - workshop/maintenance areas	- hydrocarbons, heavy metals, pesticides, PCB's, asbestos
- Irrigation of treated effluent over the grassed area north-east of the bitumen runway	- Faecal coliforms, e-coli, nitrogen, phosphorus, heavy metals, bacteria, viruses
- Numerous car wrecks within the site	- Hydrocarbons, heavy metals
Lot 2 DP 825266	
- surface soils south-western boundary adjacent to chicken sheds (from migration of surface waters from upslope chicken sheds)	- nutrients, heavy metals, pesticides
Lot 1 DP 348173	
- septic system	- nutrients, heavy metals, hydrocarbons
- car bodies (surface soils)	- hydrocarbon, heavy metals, PAH
- localised filling (driveways, building pads, old wells)	- heavy metals, hydrocarbons, PAH, pesticides, PCB's asbestos, etc
- minor surface staining in timber garage	- heavy metals, hydrocarbons
Lot 21 DP 865588	
- former orchard (surface soils)	- pesticides/herbicides, heavy metals
- filling along driveway and in lower confined area	- heavy metals, hydrocarbon, PAH, pesticides, PCB's, asbestos, etc

Table 3 – Potential Site Contamination (continued)

Location/Description	Potential Contaminants
Lot Pt 15 DP 182756	
- filling (driveways, building pads, turning bay, etc)	- heavy metals, hydrocarbon, PAH, pesticides, PCB's, asbestos, etc
- unsealed ground in shed (spills/leaks)	- heavy metal, hydrocarbons, PAH
- septic system	- nutrients, heavy metals, hydrocarbons
- chicken waste (surface soils and embankment)	- nutrients, heavy metals, pesticides
- chicken shed floors	- pesticides/herbicides, heavy metals, nutrients
- surface soils/filling associated with chicken waste/carcasses	- possible chicken diseases
Lot 1 DP 170378	
- filling (include stockpiles and manure stockpiles)	- heavy metals, hydrocarbons, nutrients
- filling (driveways, building pads, etc)	- heavy metals, hydrocarbons, PAH, pesticides, PCBs, asbestos, etc
- septic system	- nutrients, heavy metals, hydrocarbons
- chicken waste (surface soils)	- nutrients, heavy metals, pesticides
- chicken shed floors	- pesticides/herbicides, heavy metals, nutrients
- diesel tank (surface spills)	- heavy metals, hydrocarbons
- localised staining in sheds (surface soils)	- heavy metals, hydrocarbons, PAH
- fibro sheet fragments in fill (access track)	- asbestos
- impact on water quality in Felled Timber Creek due to surface run-off	- nutrients, heavy metals, biosolids, pesticides
- surface soils/fill associated with chicken waste/carcasses	- possible chicken diseases
Lot 1, DP 825266	
- surface soils associated with rubbish stockpiles	- hydrocarbons, heavy metals etc
- surface soils previously utilised for intensive market gardens & orchards	- residual pesticides
- potential filling – central northern portion of site	- heavy metals, hydrocarbons, PAH, pesticides, PCBs, asbestos, etc
- unsealed floors within workshop and sheds in north-east portion site	- hydrocarbons and heavy metals
- effluent disposal system	- nutrients, heavy metals, hydrocarbons
- potential migration from upstream effluent sludge ponds (groundwater/surface water)	- Faecal coliforms, e-coli, nitrogen, phosphorus, heavy metals

Based on our observations, the land use associated with adjacent site Areas 1 to 5 comprised the following:

- Areas 1 to 4 – Rural and residential premises;
- Areas 1 and 5 – Primary School.

Potential site contamination (if any), within Areas 1 to 5 is likely to be limited / localised as found within the core investigation area (i.e. localised hydrocarbon impact, localised filling, effluent disposal/treatment systems, orchards, etc), which can be readily addressed if development is proposed.

Area 5, however, contains a large dam in the north-eastern corner of the site, which is understood to contain treated effluent. The dam may contain elevated chemical and microbiological contaminants, which could impact on groundwater on and off-site. Additional investigation of the dam will be required prior to development to investigate potential contamination issues and migration potential.

3.3 Additional Contamination Assessment

Additional surface/subsurface investigation was undertaken to further assess potential contamination issues identified within the preliminary investigations as outlined in Table 2 above.

The additional assessments identified the following with respect to potential contamination:

Table 4 – Summary/Description of Contamination Issues

Report No	Description	Results
31393-1	Lot 10, DP 3533, Avondale Rd, Cooranbong	- Effluent sludge classified as "Restricted Use 2" in accordance with NSW EPA Biosolid Guidelines - Groundwater impact has occurred due to the migration from the effluent sludge dam; - Treatment/remediation will therefore be required prior to development; - Additional investigation recommended to further assess implications of identified groundwater impact
31498A-01	Lot 2, DP 825266, Lot 21, DP 865588 & Lot 1, DP 348173, Alton Rd & Freemans Drive, Cooranbong	- All soil chemical analysis results were within NSW EPA health based criteria for low density landuse with the exception one sample collected within timber garage (Lot 1, DP 348173) which indicated localised hydrocarbon impact; - No significant impact identified downslope of effluent disposable area; - Acid sulphate soil conditions not encountered within 3 m of ground surface within southern portion of Lot 2, DP 865588. Deeper investigation will be required if development is likely to result in excavation/dewatering below 3 m depth within the "Constrained Area".
31498A-02	Lot 1, DP 170378, Alton Rd, Cooranbong	- Minor localised hydrocarbon impact in near surface soils; - Presence of fibro fragments containing asbestos in localised areas; - Impact of groundwater and surface water from chicken burial pits and surface soils associated with cattle and surface compost in the vicinity of the creek (heavy metals, nutrients and microbiological impact); - Remediation/validation and spelling of site will be required prior to development.
31498A-03	Lot Pt 15, DP 182756, Alton Rd, Cooranbong	- Minor localised hydrocarbon impact in near surface soils; - Presence of fibro fragments containing asbestos in surface fill and localised areas; - Localised impact on near surface soils downslope of effluent disposal area (nutrients, hydrocarbons and heavy metals); - Incomplete composted materials within burial pits (microbiological); - Remediation/validation and spelling of site will be required prior to development.

Table 4 – Summary/Description of Contamination Issues (continued)

Report No	Description	Results
31720	Lot 1, DP 825266	- Minimal impact on groundwater quality identified from migration of contaminants from the effluent sludge ponds; - Impact on surface water from sludge ponds, however may be occurring (microbiological); - Off-site impact from sludge dam, while expected to be minimal may be occurring ; - Additional assessment recommended to determine potential health risks and implications to development.
31720-1	Lot 1, DP 170378, Lot 2, DP 825266, Lot Pt 15, DP 182756, Lot 1, DP 348173, Lot 21, DP 865588, & Lots 1 to 11, DP 3533,	- Impact of groundwater and surface water from chicken burial pits and surface soils associated with cattle and surface compost in the vicinity of the creek in Lot 1, DP 170378 (heavy metals, nutrients and microbiological impact), still occurring, however, contaminant levels considerable reduced after rainfall (flushing-dilution); - Main potential contaminants sources which may results in off-site impact are: o Burial pits and surface soils associated with cattle and surface compost within Lot 1, DP 170378; o Effluent sludge ponds located in lot 10, DP 3533.

Notes to Table 4:

Report 31720 – No detailed subsurface investigation undertaken on Lot 1, DP 825266 to assess potential contamination with the exception of the potential migration of contaminants from the effluent sludge ponds (Lot 10, DP 3533);

Preliminary contamination issues addressed above are shown in Drawing 2, Appendix A.

4. REMEDIAL MEASURES

Based upon the results of the above preliminary and detailed site assessments, the "North Cooranbong Investigation Area" is generally considered to be suitable for future residential development, provided remedial works and additional detailed investigations, as required, are undertaken to address the contamination issues outlined above in Tables 3 and 4.

Areas requiring remedial works are generally expected to be localised and associated with near surface soils, with the exception of the effluent sludge dam and chicken burial pits. Remedial measures are likely to include the following:

- Detailed investigation as required including additional investigation of Lots 1 to 11, DP 3533 and Lot 1, DP 825266 ;
- Localised excavation and removal of hydrocarbon impacted soils (workshops / sheds / garages, fuel storage areas, car wrecks, etc);
- Classification, excavation and removal or re-use of localised fill materials;
- Decommissioning and appropriate treatment of effluent treatment systems and associated effluent disposal areas;
- Investigation, remediation by removal and disposal, and validation of bonded fibro sheeting materials by a qualified occupational hygienist;
- Localised excavation and disposal of surface soils potentially impacted from former use as orchards/market gardens (if required).

Remedial requirements for the effluent sludge dam is likely to include:

- Appropriate decommissioning of the effluent treatment dam;
- Excavation, treatment and disposal of effluent sludge to an appropriate disposal facility/allowable land application site (see Reference 2 for details).

Remedial requirements for the chicken sheds sites is likely to include:

- Stripping of near surface soils from the floors of the chicken sheds, treatment, disposal and validation;
- Excavation, treatment and disposal of the contents of burial pits, followed by validation within areas to be redeveloped for residential purposes;
- Spell the site for a period of at least three months, followed by additional microbiological assessment of surface soils prior to development.

As residential development is not proposed west of the creek line within Lot 1, DP 170378, it is therefore unlikely that burial pits over the entire site will need to be removed. Removal of burial pits immediately west of the creek (especially recent pits), and surface stockpiles of chicken/cattle waste west of the creek is, however, required to minimise the potential for adverse impact on groundwater and creek water quality due to leaching and migration. Additional groundwater and surface water investigation will be required to confirm that there will be minimal impact on water if burial pits over Area 3 (with the exception of pits adjacent to the creek) are left in place. Remedial recommendations should also be confirmed by regulatory authorities (i.e. EPA accredited auditor).

Reference should be made to individual reports for details regarding specific remedial requirements.

Remedial requirements within Areas 1 to 5 are also expected to be generally localised and readily remediated, as above. The large dam in Area 5 will require additional investigation to assess remedial requirements (if any) prior to development.

5. COMMENTS / RECOMMENDATIONS

Geotechnical and environmental issues identified in the preliminary and detailed site assessments within the 'North Cooranbong Investigation Area' have been identified and are shown on Drawing 2, Appendix A.

The issues were generally localised and can be readily addressed prior to and/or during development through appropriate investigation, design and remedial measures (where required).

In general, remedial requirements associated with identified contamination issues are likely to require the following:

- Additional detailed investigation to address potential contamination issues addressed in the preliminary site assessments (primarily Lots 1 to 11, DP 3533 & Lot 1, DP 825266;
- Preparation of a remedial action plan (RAP) to detail the principles, methods and procedures by which the remediation and site validation will be achieved;
- Completion of remedial works, which is likely to include excavation, treatment (as required), removal, and resting of the site (as required);
- Validation to confirm remedial measures have been undertaken in accordance with RAP and that the site is suitable for the intended use.

The site is considered to be suitable for future urban / residential development, subject to localised remedial measures being undertaken.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Matthew Blackert
Environmental Engineer

Stephen Jones
Principal

Chris Bozinovski
Associate

REFERENCES:

1. Douglas Partners Pty Ltd, “Report on Preliminary Site Assessment, Lots 1 to 11, DP 3533, Avondale Road, Cooranbong”, Report 31393, December 2001.

2. Douglas Partners Pty Ltd, “Report on Effluent Sludge Dam Assessment, Lot 10, DP 3533, Off Avondale Road, Cooranbong”, Report 31393-1, January 2002.

3. Douglas Partners Pty Ltd, “Report on Preliminary Site Assessment, Lot 1, DP 170378, Lot 2, DP 825266, Lot Pt 15, DP 182756, Lot 1, DP 348173, Lot 21, DP 865588, Alton Road and Freemans Drive, Cooranbong, NSW”, Report 31498, July 2002.

4. Douglas Partners Pty Ltd, “Report on Additional Contamination Assessment, Lot 2, DP 825266, Lot 21, DP 865588, Lot 1, DP 348173, Alton Road and Freemans Drive, Cooranbong, NSW”, Report 31498A-01, April 2003.

5. Douglas Partners Pty Ltd, “Report on Additional Contamination Assessment, Lot 1, DP 170378, Alton Road, Cooranbong, NSW”, Report 31498A-02, April 2003.

6. Douglas Partners Pty Ltd, “Report on Additional Contamination Assessment, Lot Pt 15, DP 182756, Alton Road, Cooranbong, NSW”, Report 31498A-03, April 2003.

7. Douglas Partners Pty Ltd, “Report on Preliminary Site Assessment, Proposed Rezoning from Rural to Urban, North Cooranbong Investigation Area”, Report 31720, October 2003.

8. Douglas Partners Pty Ltd, “Report on Additional Geotechnical & Contamination Assessment, Avondale Greens & Avondale Estate, Cooranbong”, Report 31720-1, November 2003.

9. Australian Standard AS 2870-1996 "Residential Slabs and Footings - Construction", June 1996, Standards Australia.

APPENDIX A

Notes Relating To This Report
Master Plan
Drawing 1
Drawing 2

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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LAKE MACQUARIE CITY COUNCIL

Cooranbong

Adj. adjoining land not specifically assessed but considered

Copyright Lake Macquarie City Council and Land and Property Information NSW

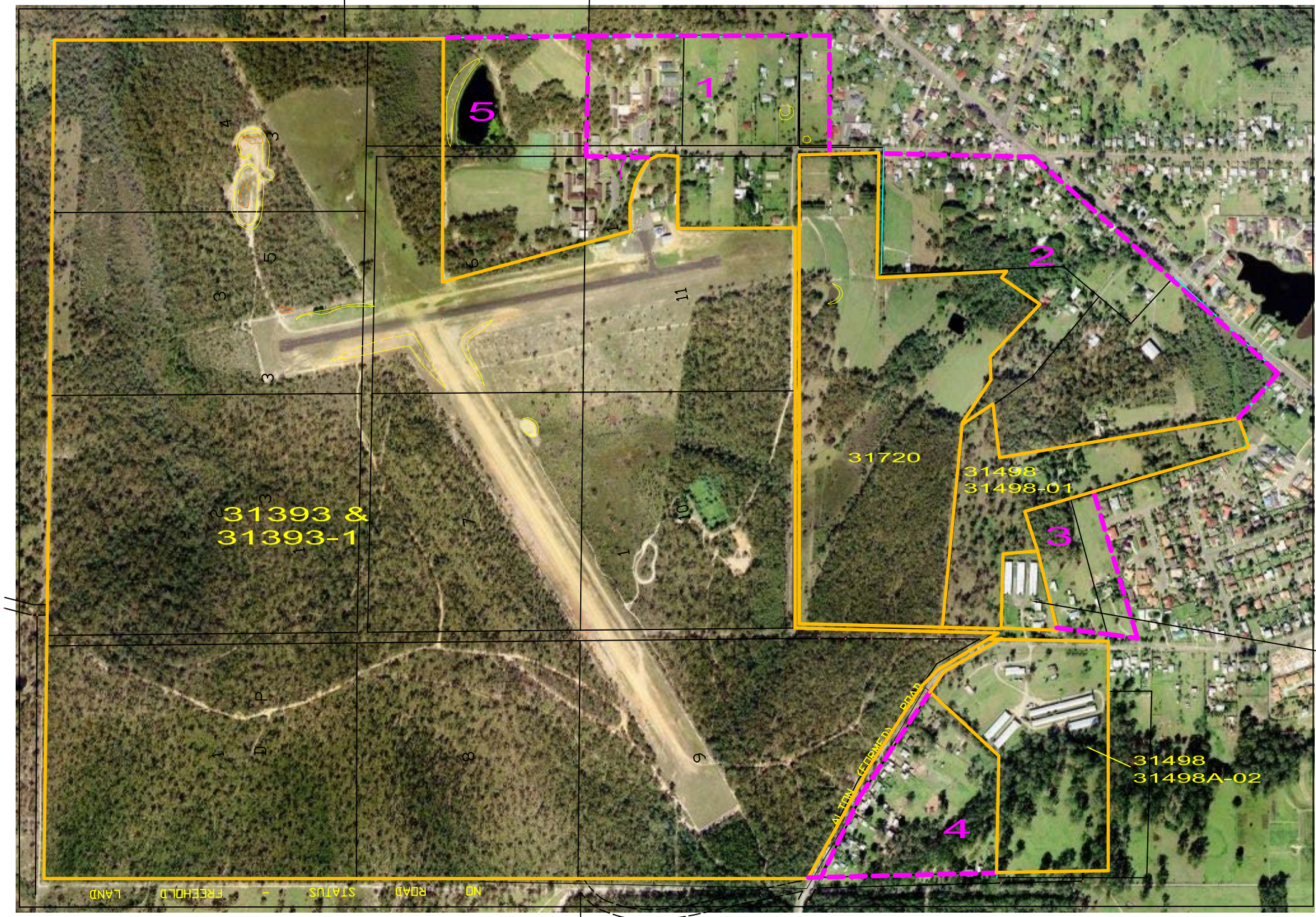
Lake Macquarie

N

SCALE 1:12000

-500 50100 5800

METRES



LEGEND

APPROXIMATE SITE BOUNDARY

31393 PROJECT No OF SITE ASSESSMENT UNDERTAKEN FOR LAND PARCEL

APPROXIMATE SITE BOUNDARIES - ADJACENT PROPERTIES

1 ADJACENT SITE AREAS - REFER TO TEXT

40 0 40 80 120 160 200 Metres

NOTE: SITE ASSESSMENT 31720-1 INVESTIGATED AREAS (31398 & 31498)

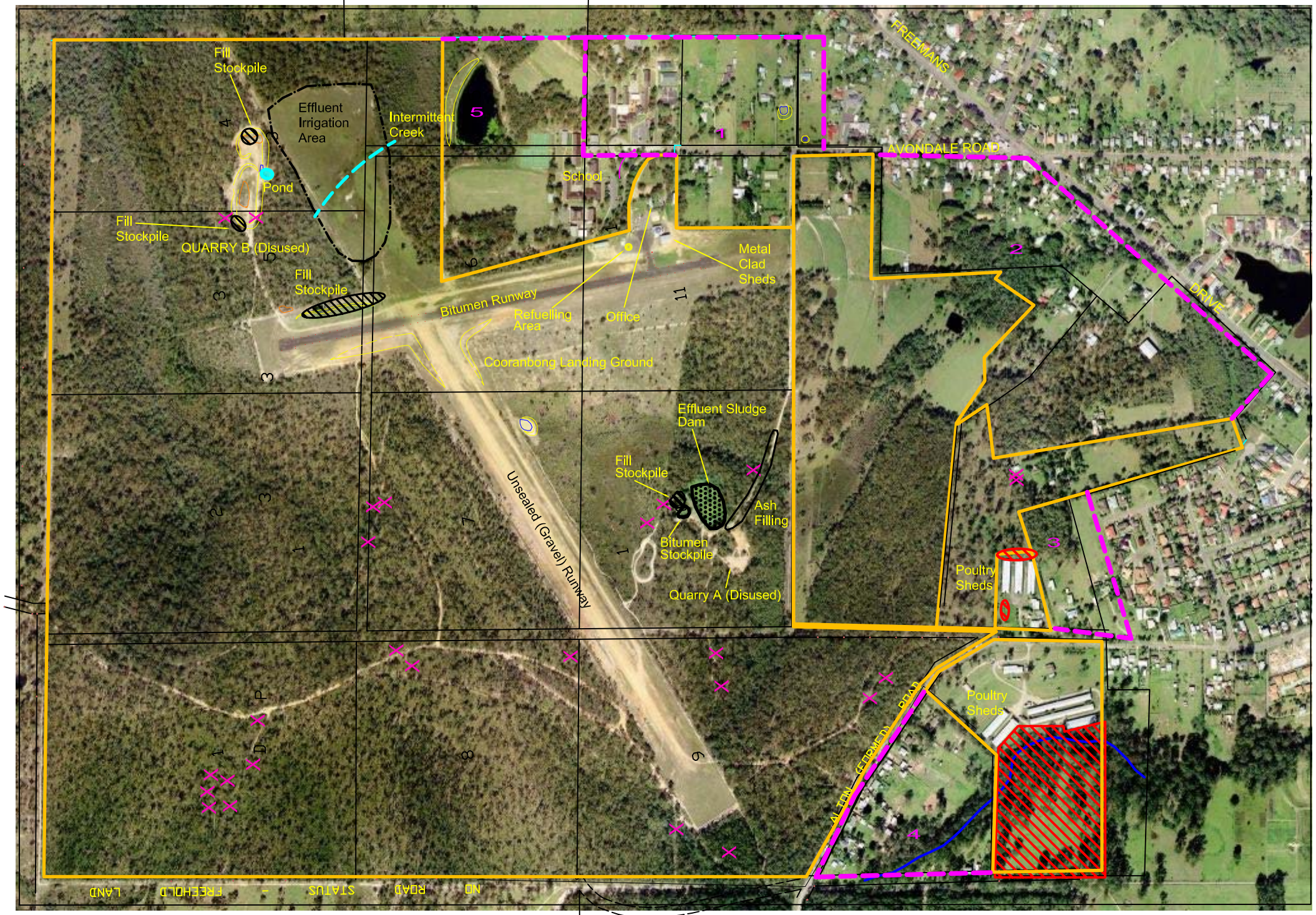
DRAWING ADAPTED FROM PLAN SUPPLIED BY CLIENT, REF MGABASEMAPA

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: NORTH COORANBONG INVESTIGATION AREA
SUMMARY REPORT ON SITE ASSESSMENTS
AVONDALE ROAD, ALTON ROAD & FREEMANS DRIVE, COORANBONG

CLIENT: J W PLANNING PTY LTD			ref:p:\31720a\31720a-1-1
DRAWN BY: PH	SCALE: 1:10000	PROJECT No: 31720A	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE CAR WREck LOCATION
- FILL STOCKPILE
- EFFLUENT IRRIGATION AREA
- INTERMITTENT CREEK
- APPROXIMATE SITE BOUNDARIES - ADJACENT PROPERTIES
- APPROXIMATE AREA IDENTIFIED TO CONTAIN CHICKEN BURIAL PITS AND MANURE STOCKPILES
- FELLED TIMBER CREEK
- 5 ADJACENT SITE AREAS - REFER TO TEXT

40 0 40 80 120 160 200 Metres

DRAWING ADAPTED FROM PLAN SUPPLIED BY CLIENT, REF MGABASEMAPA

NOTE: REFER TO INDIVIDUAL REPORTS FOR DETAILS

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: NORTH COORANBONG INVESTIGATION AREA
ENVIRONMENTAL CONSTRAINTS
AVONDALE ROAD ALTON ROAD & FREEMANS DRIVE, COORANBONG

CLIENT: J W PLANNING PTY LTD			ref:p:\31720a\31720a-2
DRAWN BY: PH	SCALE: 1:10000	PROJECT No: 31720A	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 2

APPENDIX B

Report – Project 31393

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT
ON
PRELIMINARY SITE ASSESSMENT

LOTS 1 TO 11, DP 3533
AVONDALE ROAD, COORANBONG

Prepared For

AVONDALE ADVENTIST COLLEGE

PROJECT 31393

December 2001

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
ON
PRELIMINARY SITE ASSESSMENT

LOTS 1 TO 11, DP 3533
AVONDALE ROAD, COORANBONG

Prepared For
AVONDALE ADVENTIST COLLEGE

PROJECT 31393
December 2001

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ACEA The Association of Consulting Engineers Australia

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TABLE OF CONTENTS

ATTACHMENTS

CB:lg
Project 31393
cb:31393
11 December 2001

REPORT ON
PRELIMINARY SITE ASSESSMENT
LOTS 1 TO 11, DP 3533
AVONDALE ROAD, COORANBONG

1. INTRODUCTION

This report presents the findings of a preliminary site assessment undertaken for the 210 ha site off Avondale Road, Cooranbong.

The work was undertaken at the request of Mr Jason Wasiak of Harper Somers Pty Ltd, on behalf of the Avondale Adventist College.

It is understood that future development within the site may include a range of land uses. Details of possible future land use were not available at the time of the investigation.

The preliminary assessment was required to consider the suitability of the land for proposed future development and identify potential geotechnical and site contamination constraints to development.

The assessment comprised the following:

- **Desktop Study and Review of**
  - published geological plans
  - acid sulphate risk map
  - topographic plan
  - orthophoto plan
  - 1:5000 aerial photo overlay (Ref 19181) by Harper Somers Pty Ltd.

- **Discussion with Jason Wasiak of Harper Somers Pty Ltd**

- **Site Inspection (26 September 2001)**
  Visual appraisal of:
  - Topography;
  - geology/soils;
  - vegetation;
  - drainage;
  - site condition.

2. CHARACTERISTICS OF SITE

2.1 Description/Location

The site comprises Lots 1 to 4, Part Lots 5 & 6, Lots 7 to 10 and Part Lot 11, DP 3533, as shown in Drawing 1 attached.

The site comprises a combined area of about 210 ha which incorporates the Cooranbong Landing Ground and two disused quarries. It has a frontage of about 200 m to Avondale Road, and is located north-west of Freemans Drive, Cooranbong.

It is generally bounded to the north, east and west by bush land to the south-east by a school and residential development, and the south by existing poultry sheds.

2.2 Geology

Reference to the Sydney Basin 1:500 000 Geological Series Sheet indicates that the site is underlain by the Triassic aged Narrabeen Group generally comprising chert sandstone, quartzose sandstone, conglomerate, shale and claystone.

Subsurface investigation was not undertaken at this stage of the assessment. The preliminary assessment of site geology was based on observations made during the site inspection (ie exposed surface soils within the site).

A shallow soil profile was generally observed within erosion scours over the site, which comprised a silty topsoil overlying sandy clay and silty clay soils. Sandstone outcrops were encountered at the base of some of the erosion scours. Pebbly sandstone was also present in exposed batters within the disused quarries.

Previous subsurface investigation for the Cooranbong Sewerage Scheme undertaken south of the site (Ref 2) indicated a sandy clay/clayey sand soil profile in the order of 1 m to 2 m thick, underlain by sandstone and pebbly sandstone.

2.3 Topography/Site Features

The site comprises a gently undulating landscape, with broad crests and ridges, and long gently inclined slopes with gradients generally <10%.

A network of gullies generally fall away from the centrally located ridge.

Local relief (distance between high and low topographic features) is generally less than 30 m. Site levels range from RL 40 m (AHD) to RL 10 m (AHD).

Deep erosion scours (up to 0.5 m) and fretting were observed at various locations, generally where vegetation was sparse along cleared tracks. Desiccation cracking was also observed within clays exposed by erosion.

A network of unsealed tracks were present within the site as shown on Drawing 1 attached.

A bitumen sealed runway (Cooranbong Landing Ground) is aligned north-south and located over the central-eastern portion of the site. An unsealed (gravel) runway is also located approximately perpendicular to the sealed runway. Gradients along runways were less than 4° and appear to have been formed by minor cut/fill earthworks. The runway reserves (adjoining verges) were approximately 100 m wide, cleared of trees, and comprised a covering of medium dense grass.

Imported fill materials were observed along the north-east portion of the runway and generally comprised various materials including the following:

- clayey/sandy soils and gravel;
- building rubble (concrete, timber, bricks, etc);
- tree branches, stumps;
- green waste;
- electrical wire;
- PVC and clay pipe;
- fibrous sheet fragments (possibly asbestos based);
- car tyres.

Facilities associated with the Cooranbong Landing Ground included a brick and tile office and amenities building; various metal clad sheds with concrete floors (ie. hangers, maintenance workshop, etc); bitumen hardstand area; and a open refuelling area comprising a concrete slab, bowser and underground fuel tanks.

Two disused quarries were located within the site as described below:

Quarry A

- located within the central southern portion of the site;
- appears to be filled with a grey-brown effluent sludge (ie. sludge dam)
- Comprised a south-east (downslope) fill batter approximately 1.5 m high with slopes of 40°;
- abundant trees were observed to be growing within the batter;
- Dense, lush green vegetation was present within and in the immediate vicinity of the sludge dam;
- the sludge dam appears to be close to its capacity (ie. within 0.5 m of the crest of the batter). There was also evidence that overtopping/migration has occurred in the past (ie. accelerated vegetation growth downslope of the dam);
- an imported fill stockpile approximately 30 m diameter, 1 m to 2 m high, was located immediately north-west of the sludge dam, and comprised a dense cover of grass, and clay/sand soils and ash at the surface with some concrete rubble;
- a stockpile of old bitumen fragments (approximately 1 m high and 3 m diameter was located adjacent to the imported fill stockpile;
- the unsealed access road to the quarry comprised ash filling at the surface over a length of 150 m from the quarry towards the south-east;
- erosion was evident within exposed soils in the vicinity of the former quarry (ie where vegetation was absent).

Quarry B

- located within the north-east corner of the site;
- comprised a stripped surface of weathered sandstone with cut batters up to 2 m to 3 m high with localised slopes of up to 80°;

- erosion and fretting was evident within exposed soils and batters;
- stockpiles of green waste (trees, branches, tree trunks, mulch, etc) were present over the north-east portion of the quarry. The stockpiles also contained soil, some concrete, bricks, timber, fibrous sheet fragments (possibly asbestos), bitumen fragments and coal fragments;
- imported fill stockpiles were also observed over the eastern corner of the quarry comprising dark grey silty sand with ash and coal fragments, and stockpiles of concrete rubble with some clay pipe fragments and fibrous sheet fragments (possibly asbestos). A grass covered soil and rock stockpile was also present;
- a water filled pond was present within the central southern area of the quarry, and contained light brown turbid water;
- a car wreck and trailer were also present within the quarry.

A cleared grassed area immediately north-east of the bitumen runway is understood to be utilised for irrigation of treated domestic effluent. An intermittent creek was present in the base of the gully which bisects the grass area. Low lying soils in the vicinity of the creek were saturated at the time of the inspection.

The following were also observed at various locations within the site, generally adjacent to existing tracks:

- car wrecks;
- metal materials, oven, washing machine, etc;
- corrugated roof sheets;
- empty drums and containers;
- localised fibrous sheet fragments (possibly asbestos);
- rubbish (plastic bags, plastic, paper, etc).

Site features are shown on Drawing 1 attached.

2.4 Soil Landscape

Reference to the soil landscape series sheet 9131-9231 for Gosford – Lake Macquarie prepared by the Department of Conservation and Land Management indicates that site soils generally comprise the Doyalson erosional landscape.

A brief description of typical soil characteristics are present below:

- erosion hazard;
- seasonal waterlogging;
- high run-on (footslopes);
- strong acidity;
- foundation hazard (localised);
- high plasticity, moderate to high shrink-swell (clays);
- low fertility.

2.5 Vegetation

Vegetation over the majority of the site generally comprised open eucalypt forest (bushland).

Cleared areas were observed as follows:

- Cooranbong Landing Ground runway reserves (corridors), generally grassed and about 100 m wide;
- grassed area immediately north-east of the bitumen runway which is understood to be utilised for irrigation of treated domestic effluent;
- Quarry A – dense lush green vegetation (grass and exotic trees) within and in the immediate vicinity of the sewerage sludge dam area (disused quarry);
- Quarry B – stripped soils/weathered rock from former quarrying activities;
- unsealed tracks within the site.

2.6 Drainage System

The predominant site drainage features comprised a network of gullies radiating from the central ridge/crest. These gullies generally direct surface water from the upper slopes to Felled Timber Creek and Dora Creek and eventually to Lake Macquarie. The upper slopes are therefore well drained.

Low lying saturated soils were however observed in the vicinity of the intermittent creek bisecting the grassed area north-east of the bitumen runway, which is likely to be a result of irrigation activities.

2.7 Acid Sulphate Soil Conditions

Reference to the Morisset Acid Sulphate Soil Risk Map prepared by the Soil Conservation Service of NSW indicates that there is no known occurrence of acid sulphate soils within the site.

A low probability acid sulphate soils between depths of 1 m to 3 m are located approximately 300 m south of the site.

It should be noted that risk maps are based on an assessment of the geomorphic environment, and should be used as a guide only.

3. GEOTECHNICAL CONSIDERATIONS FOR DEVELOPMENT

The following geotechnical considerations for development were identified in the preliminary assessment:

- erosion hazard;

- slope stability;
- uncontrolled filling;
- excavatability;
- soil reactivity;
- saturated soils.

3.1 Erosion Hazard

The results of the assessment suggest that there is a potential for adverse impacts resulting from soil erosion (ie. impacts on water quality due to sediment – laden run-off during and following development). Although potential adverse impacts were identified, erosion and sedimentation are readily amenable to mitigation measures such as:

- silt fences;
- re-vegetation/re-shaping batters;
- drainage structures (catch drains);
- sediment traps;
- sedimentation basins, etc.

3.2 Slope Stability

The factors influence stability and the classification of risk of instability are discussed by Walker et al (Ref 1).

There was no evidence of previous or incipient deep seated instability observed over the site. There was, however, evidence of erosion and surficial creep within batter slopes (cut and fill) associated with Quarries A and B, and general erosion scours within the site. The general site area is considered to be low risk with respect to slope stability in accordance with Reference 1.

Slope stability issues should however be considered in conjunction with further geotechnical investigation for detailed design purposes. This should include guidelines for permissible cut and fill operations, and treatment of existing cut and fill batters.

3.3 Uncontrolled Filling

Localised areas of filling including stockpiles placed in an uncontrolled manner were observed in the following areas; as shown on attached Drawing 1:

- ***Quarry A***
  - effluent sludge dam and associated fill batter.
  - imported fill stockpiles immediately north-west of the effluent sludge dam.

- **Quarry B**
  - imported fill stockpiles over the north-west and north-east corners of the site.

- **North-East of Bitumen Runway**
  - imported fill immediately north-east and parallel to the bitumen runway.

- **Runways**
  - localised filling associated with the construction and grading of runways.

Descriptions of observed fill materials were provided in Section 2.3. Filling generally appears to have been placed in an uncontrolled manner.

Subsurface investigation should be undertaken to identify the depth, extent and properties of filling if development is proposed over these areas.

3.4 Excavatability

Soils observed in exposed cuts and erosion scours generally comprised silty sands, clayey sands, clays and weathered rock which can be readily excavated by conventional earthmoving equipment. Heavy ripping or blasting may be required for bedrock of higher strength. Excavatability of rock should be assessed on a site specific basis during detailed investigations prior to development.

3.5 Soil Reactivity

Foundation design for future structures and pavement construction will be influenced by the plasticity and shrink-swell reactivity of underlying soils.

Desiccation cracking in plastic clays was observed in erosion scours and exposed soils within the site.

Soil reactivity can readily be accommodated in design, and should be confirmed during future detailed investigations prior to development.

3.6 Saturated Soils

Saturated surface soils were observed within the site as follows:

- base of gully (intermittent creek) which bisects the grassed area immediately north-east of the bitumen runway;
- soils in the vicinity of the effluent sludge dam (Quarry A);
- soils in the vicinity of the pond located within the central southern area of Quarry B;
- localised areas within erosion scours along exposed tracks.

Saturated areas are likely to result in localised softening of surrounding soils which should also be considered for future detailed investigation and design.

3.7 Acid Sulphate Soil Conditions

Based on the Acid Sulphate Soil Risk Map for Morisset, it is unlikely that acid sulphate soil conditions are present within the site. Specific procedures for management of acid sulphate soils will therefore not be required for future development. Aggressive ground conditions (ie naturally acidic soils) may however be present and should be considered for future detailed investigations.

4. PRELIMINARY CONTAMINATION ASSESSMENT

The preliminary contamination assessment comprised brief discussions with Jason Wasiak of Harper Somers Pty Ltd, and a site inspection on 26 September 2001 to assess site conditions. The results of the assessment suggested the following areas of potential contamination which will need to be addressed for future development:

Table 1 – Potential Site Contamination

Location/Description	Potential Contaminants
Effluent Sludge Dam (Quarry A)	- Faecal coliforms, e-coli, nitrogen, phosphorus, heavy metals, bacteria, viruses
Imported filling - within Quarries A and B - adjacent to the north-east portion of the bitumen runway - minor fill beneath runways - localised dumped mounds of fill adjacent to tracks - ash filling along access road to Quarry A	- heavy metals - hydrocarbons - pesticides - PCB's - asbestos, etc
Cooranbong Land Ground facilities - fuel storage - workshop/maintenance areas	- hydrocarbons - heavy metals - pesticides - PCB's - asbestos
Irrigation of treated effluent over the grassed area north-east of the bitumen runway	- Faecal coliforms, e-coli, nitrogen, phosphorus, heavy metals, bacteria, viruses
Numerous car wrecks within the site	- hydrocarbons - heavy metals

The areas identified above are shown on Drawing 1 attached.

It is noted that potential contaminants will depend on a number of factors including the following:

- original source of fill materials and previous activities associated with the source;
- level of previous treatment associated with effluent sludge and effluent irrigation.

Further investigations will be required to assess the depth, extent, contaminant concentrations and associated issues with areas identified to contain potential contamination.

Of a particular concern is the environmental impact observed in the vicinity of the effluent sludge dam (ie. Quarry A) and the potential for further adverse impact and migration. The sludge dam appears to be close to capacity with evidence of over-topping and migration of leachate over the downslope south-east batter (ie. evidenced by accelerated vegetation growth and exotic species). There is also the potential for groundwater impact, as it is unlikely that the original quarry was designed for containment of sludge materials.

5. RECOMMENDATIONS

Future development over the site should address the geotechnical and contamination considerations identified above.

The following recommendations relate to further investigation to enable more detailed design for the development.

- assessment of possible contamination as summarised in Table 1, Section 4;
- lot classification to AS 2870-1996 (Ref 3) for footing design;
- earthworks procedures and specifications;
- pavement thickness design for new internal roads.

The above investigations could be undertaken concurrently, and would involve subsurface investigation, in situ testing, laboratory testing of soils samples, and engineering analysis.

In addition, the site is located within a proclaimed mine subsidence district. Future development should also consider possible mine subsidence issues.

In conclusion, the results of this preliminary geotechnical and contamination assessment have identified issues that should be considered prior to development. Areas not identified as requiring specific investigation are considered suitable for future development, subject to appropriate engineering design. This is not to say that areas requiring more detailed

investigation are not suitable for development, but will require further assessment to identify possible constraints.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Chris Bozinovski
Associate

Stephen R Jones
Principal

REFERENCES

1. Walker B, et al "Geotechnical Risks Associated with Hillside Development", Australian Geomechanics News, No 10, December 1985.

2. Douglas Partners Pty Ltd, "Geotechnical Investigation, Cooranbong Sewerage Scheme, Sewer Reticulation, Cooranbong", Project No 18477, October 1996.

3. Australian Standard As 2870-1996, "Residential Slabs and Footings – Construction", Standards Association of Australia.

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Table 1 - Classification of Risk of Slope Instability

INTRODUCTION

In the Sydney Basin, which includes Wollongong to Newcastle and inland to Lithgow, there are many naturally occurring slopes which are the result of weathering and downslope transport of a mantle of soil and rock fragments. These may be unstable and will continue to move at varying rates, usually only appreciable over very long periods of time. However, on some sites the rate is fast enough to have a significant effect upon hillside development. Natural factors that effect the rate are:

* geology.
* nature and extent of the mantle of soil and rock fragments.
* groundwater.
* slope gradient and topography.
* vegetation.

Unstable rock slopes also occur.

ASSESSMENT PROCEDURE

The risk of slope instability should be assessed by an experienced geotechnical consultant. An assessment would normally include:

* study of geological and topographic maps supplemented by the consultant's experience in the area.
* consideration of information made available by the client about the site and its surrounding area (including previous instability, building distress and drainage problems) and development proposals.
* visual appraisal of the site and surrounding area including signs of instability, soil and rock exposures, seepage and vegetation.
* collection of basic geological measurements from the site to produce a geological sketch model.
* consideration of possible effects of high rainfall.

The assessment applies to the site at the time of the inspection.

Although the assessment is predominantly deductive and incorporates judgement based on experience, in many cases it will be sufficient to enable development to proceed. On very high, high and some medium risk sites geotechnical investigations will be required to confirm the assessment and define development options. The scope of any investigation depends upon the risk of instability and the proposed development and will involve subsurface investigations and possibly soil testing to improve the geotechnical consultant's understanding of the site.

DEVELOPMENT

Building techniques are available to enable development of many higher risk sites. Inappropriate development on the site and neighbouring properties can cause slope failure and serious damage. Inappropriate development includes:

* unsupported excavation or placement of fill.
* excessive clearing of vegetation.
* introduction of water to the slope.
* surface footings founded on the mantle of soil and rock fragments.

The owner's decision to develop the site involves an acceptance of a level of risk following development as assessed by the consultant. Even with suitable hillside construction techniques some minor cracking may occur.

Some sites may be unsuitable for economic development.

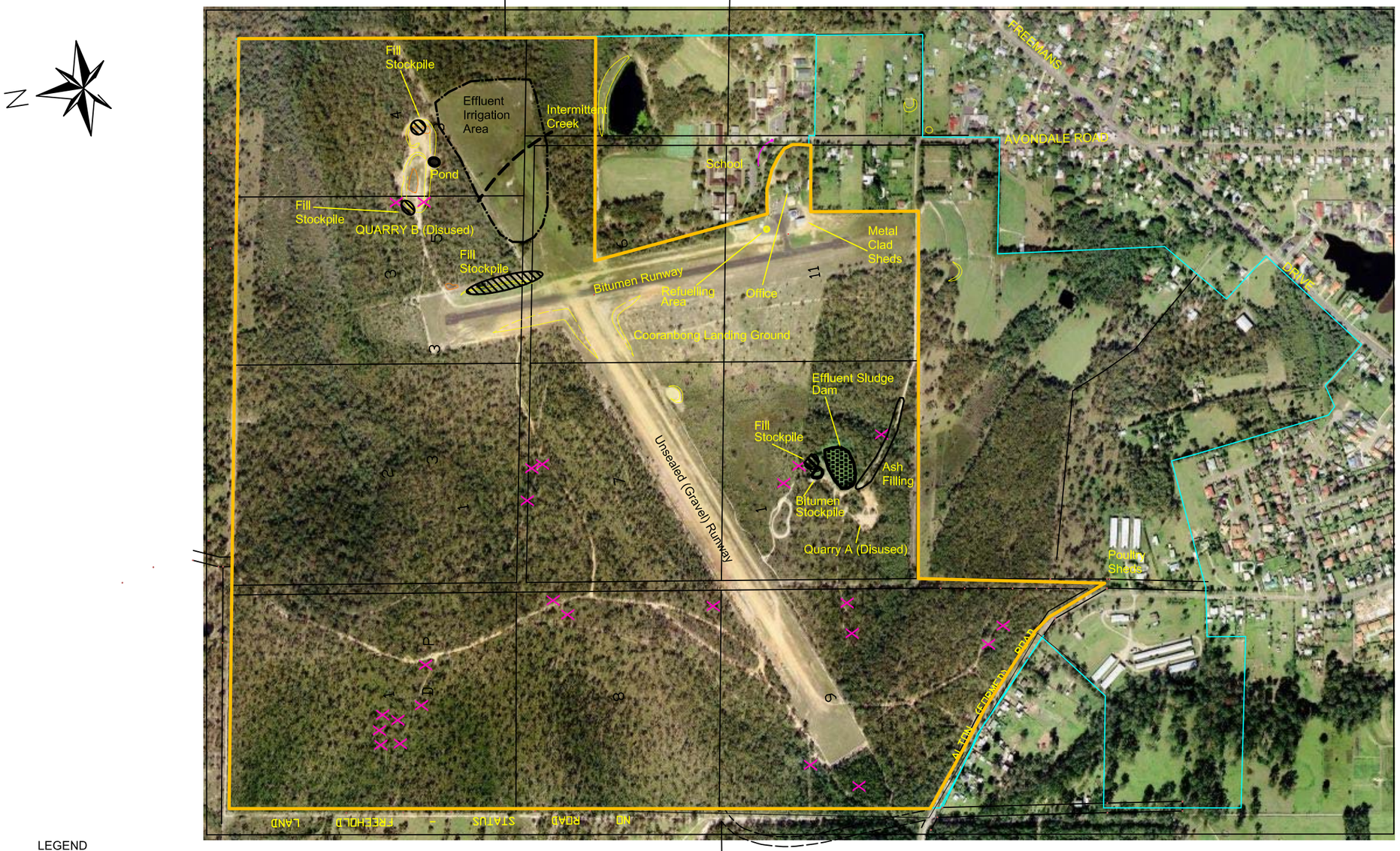
Other engineering constraints unrelated to slope instability may apply.

CLASSIFICATION

The following table has been produced to provide both a simplified classification which can be readily understood by a lay person and to provide a uniform language for geotechnical consultants.

RISK OF INSTABILITY	EXPLANATION	IMPLICATIONS FOR DEVELOPMENT
VERY HIGH	Evidence of active or past landslips or rock face failure; extensive instability may occur.	Unsuitable for development unless major geotechnical work can satisfactorily improve the stability. Extensive geotechnical investigation necessary. Risk after development may be higher than usually accepted.
HIGH	Evidence of active soil creep or minor slips or rock face instability; significant instability may occur during and after extreme climatic conditions.	Development restrictions and/or geotechnical works required. Geotechnical investigation necessary. Risk after development may be higher than usually accepted.
MEDIUM	Evidence of possible soil creep or a steep soil covered slope; significant instability can be expected if the development does not have due regard for the site conditions	Development restrictions may be required. Engineering practices suitable to hillside construction necessary. Geotechnical investigation may be needed. Risk after development generally no higher than usually accepted.
LOW	No evidence of instability observed; instability not expected unless major site changes occur.	Good engineering practices suitable for hillside construction required. Risk after development normally acceptable.
VERY LOW	Typically shallow soil cover with flat to gently sloping topography.	Good engineering practices should be followed.

This table is an extract from GEOTECHNICAL RISKS ASSOCIATED WITH HILLSIDE DEVELOPMENT as presented in Australian Geomechanics News, Number 10, December, 1985, which discusses the matter more fully.



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE CAR WRECK LOCATION
- FILL STOCKPILE
- EFFLUENT IRRIGATION AREA
- INTERMITTENT CREEK

DRAWING ADAPTED FROM PLAN SUPPLIED BY CLIENT, REF MGABASEMAPA

40 0 40 80 120 160 200 Metres

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: PRELIMINARY SITE ASSESSMENT
LOTS 1 TO 11, DP 3533
AVONDALE ROAD, COORANBONG

CLIENT: AVONDALE ADVENTIST COLLEGE			ref:p:\31720a\31720a-1
DRAWN BY: PH	SCALE: 1:10000	PROJECT No: 31393	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1

APPENDIX C

Report – Project 31498

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT
ON
PRELIMINARY SITE ASSESSMENT

LOT 1 DP 170378
LOT 2 DP 825266
LOT PT 15 DP 182756
LOT 1 DP 348173
LOT 21 DP 865588
ALTON ROAD AND FREEMANS DRIVE
COORANBONG NSW

Prepared for
HARPER SOMERS PTY LTD

On behalf of
AVONDALE GREENS PTY LTD

PROJECT 31498
JULY 2002

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
ON
PRELIMINARY SITE ASSESSMENT

LOT 1 DP 170378
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JULY 2002

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TABLE OF CONTENTS

ATTACHMENTS

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CB:MB:lg
Project 31498
mb:31498
24 July 2002

REPORT ON
PRELIMINARY SITE ASSESSMENT
LOT 1 DP 170378, LOT 2 DP 825266, LOT Pt 15 DP 182756,
LOT 1 DP 348173 & LOT 21 DP 865588
ALTON ROAD & FREEMANS DRIVE, COORANBONG

1. INTRODUCTION

This report presents the findings of a preliminary site assessment undertaken for five allotments off Alton Road and Freemans Drive, Cooranbong.

The work was undertaken at the request of Mr Jason Wasiak of Harper Somers Pty Ltd, on behalf of Avondale Greens Pty Ltd.

The preliminary assessment was required to consider the suitability of the land for proposed future development and identify potential geotechnical and site contamination constraints to development.

The assessment comprised the following:

- ***Desktop Study and Review of:***
  - published geological plans;
  - acid sulphate risk map;
  - topographic plan;
  - orthophoto plan;
  - 1:4000 aerial photo overlay (Ref 20402) by Harper Somers Pty Ltd.

- ***Site Inspection (7 and 25 June 2002):***

  Visual appraisal of:
  - Topography;
  - geology/soils;
  - vegetation;
  - drainage;
  - site condition.

- ***Brief Discussions with:***
  - Mr & Mrs Jackson (owner and residents of Lot 1 DP170378);
  - Mr Ian Mears (owner of Lot Pt15 DP182756);
  - Mr Ross Twine (owner of Lot 1 DP348173 and Lot 21 DP865588);
  - Mr Jason Wasiak of Harper Somers Pty Ltd.

2. CHARACTERISTICS OF SITE

2.1 Description/Location

The sites involved in this study include Lot 1 DP 170378, Lot 2 DP 825266, Lot Pt 15 DP 182756, Lot 1 DP 348173, Lot 21 DP 865588, as shown in Drawing 1 attached.

The five allotments comprise a combined area of about 21.5 ha, which incorporates two properties containing chicken sheds, one residential property, and two semi-cleared

undeveloped properties. Access to Lot 1, DP 170378; Lot Pt 15, DP 182756; and Lot 2, DP 825266 is via Alton Road, Cooranbong. Lot 1 DP 348173 and Lot 21 DP 865588 are accessed via Freemans Drive.

The sites are generally bounded to the north, east and west by bush land and rural properties, and to the south by rural and residential development.

Felled Timber Creek bisects Lot 1 DP 170378.

2.2 Geology

Reference to the Sydney Basin 1:500 000 Geological Series Sheet indicates that the site is underlain by the Triassic aged Narrabeen Group generally comprising chert, sandstone, quartzose sandstone, conglomerate, shale and claystone.

A shallow soil profile was generally observed within erosion scours, drains and cuts within the sites, which comprised a silty topsoil overlying sandy clay, silty clay and sandy soils. Sandstone outcrops were encountered at the base of some of the erosion scours, and within deeper cuts adjacent to access roads within Lot 1 DP 170378 and Lot 1 Pt 15 DP 182756, which currently contains chicken sheds.

Subsurface investigation was not undertaken at this stage of the assessment. The preliminary assessment of site geology was based on observations made during the site inspection (ie. exposed surface soils within the site).

Similar site observations were observed during the December 2001 investigation (Ref 1) on the adjacent north-east site encompassing the Cooranbong Landing Ground.

2.3 Topography/Site Features

The following site features were observed during site visits on 7 and 25 June 2002.

2.3.1 Lot 1 DP 170378

The lot can be separated into three areas:

Area 1: Eastern Portion

The eastern portion of Lot 1 DP 170378, east of Felled Timber Creek, with an approximate area of 5.18 ha, contains five chicken sheds, a residential premises and two storage sheds (previously chicken sheds).

The area is situated immediately west of Lot Pt 15, DP 182756, and has a frontage to Alton Road of approximately 390 m. The area generally slopes towards Felled Timber Creek (west/south-west) at slopes of 2° to 7°, with steeper slopes involved in areas of cut and fill for current and former building pads.

Area 1 contains five operational corrugated iron chicken sheds, with fibro sheeting over the lower portion of the external walls. The floors of the chicken sheds are unsealed, and presumably contain natural soils from cut/fill operations undertaken to construct the level shed platform. Saw dust was spread over the floor to collect chicken faeces. The saw dust is periodically scraped from the floors for sale (chicken manure), or used as fertiliser over the site including the western portion of the site (ie. Area 3, west of Felled Timber Creek). Each chicken shed has a separate gas, water and grain storage facilities. Open unlined dish drains running parallel to the chicken sheds drain stormwater from the sheds to the central portion of the lot towards Felled Timber Creek (ie. Area 2).

Two corrugated iron storage sheds with partially concreted floors are located in the north-eastern portion of the area. A car and various tools, machinery, oils, paints and chemicals were stored in the southern most shed (formerly utilised as a chicken shed). The southern end of this shed contained a concrete floor with paints, oils, disinfectants, acid, batteries, etc stored on shelves. Various oil containers were also stored directly on the concrete floor. An above

ground diesel tank was also located within this area. Some localised hydrocarbon staining was observed throughout the shed, over concrete and unsealed areas.

The shed to the north contained a stockpile of sawdust, stored chemicals (mainly disinfectants/sanitisers), and a collection of machinery/equipment. An old septic tank was observed immediately adjacent to the south-western wall.

A brick/weatherboard residential premises is located in the south-east portion of the area with an in-ground swimming pool. A septic/transpiration areas for domestic effluent disposal is located south of the residence. The transpiration area at the time of the investigation was saturated and had a distinctive sewage odour.

Above ground water storage tanks were also present within Area 1.

Gravel driveways provide access across the site. Filling material including coal/chitter and possibly ash have been utilised for pavement construction.

The area has been subject to significant cut and fill operations in the construction of level pads for the chicken sheds. Four grassed near level pads were situated in the north-eastern portion of the site, which previously contained chicken sheds.

A cutting up to 3 m high was situated along the eastern side of the large chicken sheds. The cutting was battered at about 70° and comprised highly weathered low to medium strength sandstone. The cutting was generally covered with dense vegetation.

Fill pads for the chicken sheds (up to 3 m high with a 30° batter) have presumably been formed with material derived from the cuttings. At the time of the inspection on 25 June 2002, transport of chickens was being undertaken, preventing access in the vicinity of the chicken sheds due to quarantine restrictions.

Scattered machinery, corrugated iron, metal and empty 20 L drums, PVC/metal piping, were observed across the site during the inspection. Some staining was observed within open unlined dish drains beside the chicken sheds.

An open unlined drain is located adjacent to the north-east and north-west site boundary which discharges over the northern portion of the area (north-east of the chicken sheds). This area contained saturated/water logged surface soils.

Site features are shown on Drawing 1 attached.

Area 2: Central Portion

The central portion of Lot 1 DP 170378 (approx area of 3.24 ha) is low lying and comprises a medium dense to dense cover of mature trees and bush. Felled Timber Creek with steep eroded banks up to 3 m high meanders through the area from north to south. The creek contained flowing water about 200 mm deep at the time of the investigation.

An unsealed track from Area 1 bisects Area 2 to provide access to Area 3, and contains a small timber bridge over Felled Timber Creek.

A localised water logged grassed area is situated in the south-western corner of the Area 2, immediately adjacent to the fence-line separating Area 2 and 3.

Scattered car parts, piping, timber and a small ash/rubbish stockpile were observed along the creek banks. Some filling including fibro sheet fragments (possibly asbestos), concrete and bricks were observed in the unsealed track between the chicken sheds adjacent to Area 2.

Area 3: Western Portion

The western portion of Lot 1 DP 170378 contains a semi-cleared grazing area with slopes ranging from 1° to 4°, generally sloping to Felled Timber Creek towards the east to south-east. Scattered mature trees were present around the perimeter of the area. The remainder of the area is grassed. A number of shallow ponds containing surface water are located in the eastern and north-eastern portions of the area draining towards the creek.

Two stockpiles (approximately 5 m base diamater and up to 1.5 m high) containing chicken manure were located within the area. The stockpiled materials also appeared to have been spread across the grassed area. Several chicken carcases were observed in one stockpile. Numerous chicken bones were also observed in the stockpiles.

2.3.2 Lot 2 DP 825266

The site comprises an irregular area of about 5.05 ha, and is located immediately north of the existing chicken sheds associated with Lot Pt 15, DP 182756. Ground slopes fall towards the north to north-west in the western portion of the area at 2° to 4°. Slopes in the eastern portion of the site fall towards the east to north-east at 2° to 4°.

Local relief (distance between high and low topographic features) is generally less than 15 m to 20 m. Site levels range from about RL 30 m (AHD) to RL 10 m (AHD).

Vegetation generally comprised a sparse to medium dense cover of mature trees and grass. Some localised areas of ponded water (water logged soils) were observed along the northern boundary of the site.

A small area approximately 20 m in diameter, located adjacent to the north-eastern corner of the neighbouring chicken shed, contained a dense cover of small ferns and grass with moist to saturated surface soils which appeared to be a result of surface water run-off from Lot Pt 15, DP182756.

A small stockpile of tree branches, timber, metal and cardboard was observed within the site approximately 20 m north of the neighbouring chicken sheds. A couple of fallen mature trees were also observed within the site.

A gravel access track was located within the site entering from a western boundary gate.

2.3.3 Lot Pt 15 DP 182756

The site is situated at the top of a local crest, at an approximate level of RL 30 m. The eastern portion of the site is generally level. Site slopes over the western portion generally fall towards the west at slopes of 1° to 5°.

The site contains three corrugated iron chicken sheds with fibro sheeting over the lower portion of the external walls, built on level clay pads. Each chicken shed has a separate gas, water and grain storage facilities. Open drains running parallel to the chicken sheds drain stormwater from the sheds to the eastern portion of the site which discharges towards the north over Lot 2 DP 825266. A compost bin is situated between the two most northern chicken sheds.

A corrugated iron storage shed with partially concreted flooring is located in the southern portion of the site. A tractor, trailer and various tools, machinery, oils, paints and other garage items were stored in the shed. A large above ground LPG tank was situated immediately north of the storage shed.

A weatherboard residential premises is located in the south-western corner of the site, containing a carport, in-ground swimming pool and transpiration area for domestic effluent disposal.

A gravel driveway and turning bay provides access for vehicles.

A dense/lush grass covered embankment is located adjacent to the northern boundary over the north-west corner of the site. It is understood that this area was utilised as a truck turning bay and comprised batters up to 3 m to 4 m high, with slopes up to 35°. The lush vegetation suggests that the embankment may also be utilised for the disposal of chicken manure/waste. The composition of the fill embankments, or materials contained within the embankment were generally not visible due to the dense vegetation. Chicken manure, grass and clay was, however, evident in the batter along the northern and western sides.

Localised areas of filling were observed across the site containing sawdust, chicken manure, clay, grass and tyres. Lush green grass was observed in the vicinity of the chicken sheds and over the site, which is likely to be due to the presence of chicken manure. Filling was also observed within driveways and along the southern boundary of the property, mostly consisting of sandy gravel, coal/chitter and possibly ash. Minor filling has also been used to raise the pads on which the chicken sheds have been constructed.

Scattered machinery, corrugated iron, metal, and empty 44 gallon drums were observed across the site during the inspection. Some dark staining was observed within open unlined dish drains beside the chicken sheds.

Some saturated/water logged surface soil conditions were observed along the eastern and north-western boundaries of the site.

2.3.4 Lot 1 DP 348173

The site comprises a near level surface with slopes generally falling to the south, south-east at 3° to 4°. The site is approximately 8070 m^2 in area and contains a residential dwelling, a metal clad garage/shed, a fibro clad garage, a timber/corrugated iron carport, a garden shed and a site office shed (used as an arts/craft room).

An in-ground swimming pool is situated at the rear of the residence. The residential premises is serviced by an on-site septic system which is located adjacent to the eastern side of the house.

The site comprises a medium dense to dense cover of mature trees and bushes in the western portion of the site. The remainder of the site contains manicured grass and landscaped areas including scattered mature trees.

Several car bodies were located along the northern boundary of the property, and a bus was located near the eastern boundary of the site. A covered stockpile of nitrogen fertiliser was located in the north-western corner of the backyard.

Minor oil-staining over surface soils was observed on the floor of the timber/corrugated iron carport, which was partially concreted. The two other garages contained concrete floor slabs.

Localised coal/chitter (possibly ash) and gravel filling was observed within driveway materials. Minor cut and fill was also observed beneath the garages, which appears to have been derived from on-site soils.

It is understood that the site also contained two wells which have since been decommissioned.

2.3.5 Lot 21 DP 865588

The site comprises a near level landscape. Site slopes generally fall between 4° to 6° in a southerly direction over the northern portion of the site, and reduce to 2° to 3° over the lower lying southern portion of the site.

Local relief (distance between high and low topographic features) is generally less than 15 m to 20 m. Site levels range from about RL 20 m (AHD) to RL 3 m (AHD), according to Mr Twine.

The site has been partially cleared and used for livestock grazing. The central area of the site generally contained a medium to dense cover of small trees and grass with scattered mature trees.

The southern portion of the site (shown as "Constrained Area" on Drawing 1) comprised low lying partially cleared land containing an open unsealed drain. Saturated/water logged surface soils and ponding water were observed over this area.

An unsealed driveway runs parallel to the eastern boundary of the site and provides access to the residence within Lot 1 DP 348173.

2.4 Soil Landscape

Reference to the soil landscape series sheet 9131-9231 for Gosford – Lake Macquarie prepared by the Department of Conservation and Land Management indicates that site soils generally comprise the Doyalson erosional landscape. A brief description of typical soil characteristics is present below:

- erosion hazard;
- seasonal waterlogging;
- high run-on (footslopes);
- strong acidity;
- foundation hazard (localised);
- high plasticity, moderate to high shrink-swell (clays);
- low fertility.

The western portion of Lot 1 DP 170378 indicates that site soils encroach upon the Yarramalong landscape. A brief description of typical soil characteristics is present below:

- flooding;
- stream bank erosion hazard;
- seasonal waterlogging;
- foundation hazard;
- low fertility.

2.5 Vegetation

Vegetation observed for each lot is discussed in Section 2.3.

Cleared areas were observed as follows:

- semi-cleared bushland within Lot 2, DP825266, Lot 21, DP 865588 and western portion (Area 3) of Lot 170378;
- Lot Pt 15 DP182756 and eastern portion (Area 1) of Lot 1 DP170378;
- unsealed tracks within the sites.

Accelerated (lush) vegetation was observed in areas associated with the chicken sheds, and areas likely to have been fertilised using chicken manure.

2.6 Drainage System

The predominant site drainage features vary between allotments and are discussed in Section 2.3. The drainage systems comprise a network of gullies/man made drains and general surface sheet flows. The drainage paths direct surface water from the upper to lower slopes.

Localised low lying saturated surface soils were observed in various areas within allotments as discussed in Section 2.3.

2.7 Acid Sulphate Soil Conditions

Reference to the Morisset Acid Sulphate Soil Risk Map prepared by the Soil Conservation Service of NSW indicates that there is no known occurrence of acid sulphate soils within the majority of the sites.

A low probability of acid sulphate soil conditions is however indicated at depths of greater than 3 m in the southern portion of Lot 21 DP 865588, including the "Contained Area" shown on Drawing 1 attached.

It should be noted that risk maps are based on an assessment of the geomorphic environment, and should be used as a guide only.

3. GEOTECHNICAL CONSIDERATIONS FOR DEVELOPMENT

The following geotechnical considerations for development were identified during the site inspection:

- erosion hazard;
- slope stability;
- uncontrolled filling;
- excavatability;
- soil reactivity;
- saturated , low-lying soils.

3.1 Erosion Hazard

The results of the assessment suggest that there is a potential for adverse impacts resulting from soil erosion (ie. impacts on water quality due to sediment laden run-off during and following development). Although potential adverse impacts were identified, erosion and sedimentation are readily amenable to mitigation measures such as:

- silt fences;
- re-vegetation/re-shaping batters;
- drainage structures (catch drains);
- sediment traps;
- sedimentation basins, etc.

3.2 Slope Stability

There was generally no evidence of previous or incipient deep seated instability observed over the allotments. The sites are generally considered to have a low risk of instability with respect

to the natural topography. Areas affected by cut and fill may have a higher risk of instability and would need to be further assessed at a later stage in the development, as found within Lot 1 DP 170378 (Area 1) and Lot Pt 15 DP 182756 (ie. current chicken sheds).

Not withstanding the above comments it is considered that the site is suitable for the proposed development with respect to slope instability.

Slope stability issues should be considered in conjunction with further geotechnical investigation for detailed design purposes. This should include subsurface investigation of any deep fills that may be retained in the development guidelines for permissible cut and fill operations, and treatment of existing cut and fill batters.

3.3 Uncontrolled Filling

Localised areas of filling, including stockpiles, which may have been placed in a non-engineered manner were observed in the following areas.

- *Lot 1 DP 170378*
  - under the existing chicken sheds, storage sheds and residential premises;
  - the pads associated with the former chicken sheds;
  - the transpiration beds located to the south-west of the house;
  - within Area 3 (western paddock);
  - within unsealed pavements.

- *Lot Pt 15 DP182756*
  - under the existing chicken sheds, and other site buildings;
  - within the raised embankment located in the north-western corner of the site;
  - within unsealed pavements;
  - observed minor surface filling across the site.

- *Lot 1 DP 348173*
  - Minor filling beneath garages and residential premises;
  - Minor surface filling within unsealed pavements.

- *Lot 21 DP 865588*
  - Minor filling associated with the unsealed driveway;
  - minor stockpiles observed with the southern "Constrained Area".

Descriptions of observed fill materials were provided in Section 2.3. Filling generally appears to have been placed in an uncontrolled manner, as defined in AS 2870-1996 (Ref 2).

Subsurface investigation should be undertaken to identify the depth, extent and properties of filling if development is proposed over these areas.

3.4 Excavatability

Soils observed in exposed cuts and erosion scours generally comprised silty sands, clayey sands, clays and weathered rock which can be readily excavated by conventional earthmoving equipment. Heavy ripping or blasting may be required for bedrock of higher strength. Excavatability of rock should be assessed on a site specific basis during detailed investigations prior to development.

3.5 Soil Reactivity

Foundation design for future structures and pavement construction will be influenced by the plasticity shrink-swell reactivity and depth of underlying soils.

Desiccation cracking in plastic clays was observed in erosion scours and exposed soils within the site.

Soil reactivity can readily be accommodated in design, and should be confirmed during future detailed investigations prior to development in accordance with AS 2870-1996.

3.6 Saturated Soils

Saturated surface soils were observed within the allotments as follows:

- along the northern boundary, near transpiration areas, within drains, within Area 2 and within the lower lying areas (i.e. pond and gullies within Area 3) of, Lot 1 DP 170378;
- at the eastern end along the southern side of Lot Pt 15 DP182756 within and in close proximity to the open drains;
- within the lower portion of Lot 21 DP 865588 and close to the open channel running through the lot;
- along the northern portion of Lot 2 DP825266 in lower lying areas.

Saturated areas are likely to result in localised softening and in swelling behaviour of surrounding soils which should also be considered for future detailed investigation and design.

3.7 Acid Sulphate Soil Conditions

Based on the Acid Sulphate Soil Risk Map for Morisset, it is unlikely that acid sulphate soil conditions are present within the allotments, except for the low lying southern portion of Lot 21 DP 865588. Specific procedures for management of acid sulphate soils should therefore only be considered if future development is proposed within the southern portion of Lot 21 DP 865588 (ie. associated with the "Constrained Area"). Aggressive ground conditions (ie. naturally acidic soils) may however be present within other allotments and should be considered for future detailed investigations.

4. PRELIMINARY CONTAMINATION ASSESSMENT

The preliminary contamination assessment comprised brief discussions with Mr and Mrs Jackson (owners of Lot 1 DP 170378), Mr Ian Mears (owner of Lot Pt 15 DP182756) and Mr Ross Twine (owner of Lot 1 DP 348173 and Lot 21 DP 865588), and a site inspection on 7 and 25 June 2002 to assess site conditions.

The following information was obtained from the above discussions:-

- ***Lot 1 DP 170378***
  - Mr & Mrs Jackson owned site for last 14 years, leasing out the existing five chicken sheds;
  - Inghams previously owned site for about 7 years prior;
  - Chicken sheds have been in operation for last 40 to 50 years;
  - Area 3 was previously used as an orchard (west of Felled Timber Creek);
  - The levelled pads in the north-eastern portion of the site previously contained chicken sheds;
  - No known underground storage tanks.

- ***Lot Pt 15 DP 182756***
  - Mr Mears owned site since 1988 and leased out existing three chicken sheds;
  - Inghams previously owned site;
  - Chicken sheds have been in operation since 1965;
  - Bushland previous to current use;
  - Always utilised gas for heating;
  - No known underground storage tanks;

- ***Lot 1 DP 348173***
  - Existing residential premises built in 1926;
  - Mr Twine owned property since 1986 and extended original house;
  - Site previously contained two wells (15 ft and 40 ft deep) which have been decommissioned prior to Mr Twine owning site.

- ***Lot 21 DP 865588***
  - Vacant undeveloped site, previously used for an orchard and for cattle grazing associated with nearby Dairy.

- ***Lot 2 DP 825266***
  - Vacant semi-cleared bushland; has only been used for cattle grazing according to Mr Mears.

Chicken bones, chicken carcasses and chicken manure was observed in fill material within Lot 1, DP 170378 and Lot P15 DP 182756.

A number of viral, bacterial, parasitic, fungal and protozoan diseases may be associated with former/current chicken operations. According to the current site owners, there has been no history of disease, however.

Based on discussion with the Department of Agriculture, Rural Lands Protection Board and Hunter Health, the likely risk of chicken diseases remaining within soils on former chicken shed sites is considered to be low.

The potential presence of such diseases from former chicken operations, however, should be assessed prior to re-development.

The results of the assessment suggested the following areas of potential contamination which will need to be addressed for future development.

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Table 1 – Potential Site Contamination

Location/Description	Potential Contaminants
Lot 2 DP 825266	
- surface soils south-western boundary adjacent to chicken sheds (from migration of surface waters from upslope chicken sheds)	- nutrients, heavy metals, pesticides
Lot 1 DP 348173	
- septic system	- nutrients, heavy metals, hydrocarbons
- car bodies (surface soils)	- hydrocarbon, heavy metals, PAH
- localised filling (driveways, building pads, old wells)	- heavy metals, hydrocarbons, PAH, pesticides, PCB's asbestos, etc
- minor surface staining in timber garage	- heavy metals, hydrocarbons
Lot 21 DP 865588	
- former orchard (surface soils)	- pesticides/herbicides, heavy metals
- filling along driveway and in lower confined area	- heavy metals, hydrocarbon, PAH, pesticides, PCB's, asbestos, etc
Lot Pt15 DP 182756	
- filling (driveways, building pads, turning bay, etc)	- heavy metals, hydrocarbon, PAH, pesticides, PCB's, asbestos, etc
- unsealed ground in shed (spills/leaks)	- heavy metal, hydrocarbons, PAH
- septic system,	- nutrients, heavy metals, hydrocarbons
- chicken waste (surface soils and embankment)	- nutrients, heavy metals, pesticides
- chicken shed floors	- pesticides/herbicides, heavy metals, nutrients
- surface soils/filling associated with chicken waste/carcasses	- possible chicken diseases
Lot 1 DP 170378	
- filling (include stockpiles and manure stockpiles)	- heavy metals, hydrocarbons, nutrients
- filling (driveways, building pads, etc)	- heavy metals, hydrocarbons, PAH, pesticides, PCBs, asbestos, etc
- septic system	- nutrients, heavy metals, hydrocarbons
- chicken waste (surface soils)	- nutrients, heavy metals, pesticides
- chicken shed floors	- pesticides/herbicides, heavy metals, nutrients
- diesel tank (surface spills)	- heavy metals, hydrocarbons
- localised staining in sheds (surface soils)	- heavy metals, hydrocarbons, PAH
- fibro sheet fragments in fill (access track)	- asbestos
- impact on water quality in Felled Timber Creek due to surface run-off	- nutrients, heavy metals, biosolids, pesticides
- surface soils/fill associated with chicken waste/carcasses	- possible chicken diseases

It is noted that potential contaminants will depend on former site activities and the source of fill materials.

Further investigations will be required to assess the depth, extent, contaminant concentrations and associated issues with areas identified to contain potential contamination.

5. RECOMMENDATIONS

Future development of the site should address the geotechnical and contamination considerations identified above.

The following recommendations relate to further investigation to enable more detailed design for future development:

- assessment of potential contamination as summarised in Table 1, Section 4;
- site classification to AS 2870-1996 (Ref 2) for footing design;
- earthworks procedures and specifications;
- pavement thickness design for new internal roads;
- acid sulphate soil assessment as outlined above.

The above investigations could be undertaken concurrently, and would involve subsurface investigation, in situ testing, laboratory testing of soils samples, and engineering analysis.

In addition, the site is located within a proclaimed mine subsidence district. Future development should also consider possible mine subsidence issues.

In conclusion, the results of this preliminary geotechnical and contamination assessment have identified issues that should be considered prior to development. Areas not identified as requiring specific investigation are considered suitable for future development, subject to appropriate engineering design. This is not to say that areas requiring more detailed investigation are not suitable for development, but will require further assessment to identify possible constraints.

6. LIMITATION

The results of the above assessment were based on visual observations and discussions with various personnel. The assessment is not intended to be a definitive or quantitative investigation of the potential environmental impacts.

This report has been prepared solely for the use of Harper Somers Pty Ltd and Avondale Greens Pty Ltd and any reliance assumed by other parties on this report shall be at such party's own risk. Any liability resulting from use of the report by other parties cannot be transferred to Douglas Partners Pty Ltd.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Matthew Blackert
Environmental Engineer

John Harvey
Principal

Chris Bozinovski
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REFERENCES

1. Douglas Partners Pty Ltd, "Preliminary Site Assessment, Lot 1 to 11, DP 3533, Avondale Road, Cooranbong", Project No 31393, December 2001.

2. Australian Standard As 2870-1996, "Residential Slabs and Footings – Construction", Standards Association of Australia.

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Table 1 - Classification of Risk of Slope Instability

INTRODUCTION

In the Sydney Basin, which includes Wollongong to Newcastle and inland to Lithgow, there are many naturally occurring slopes which are the result of weathering and downslope transport of a mantle of soil and rock fragments. These may be unstable and will continue to move at varying rates, usually only appreciable over very long periods of time. However, on some sites the rate is fast enough to have a significant effect upon hillside development. Natural factors that effect the rate are:

* geology.
* nature and extent of the mantle of soil and rock fragments.
* groundwater.
* slope gradient and topography.
* vegetation.

Unstable rock slopes also occur.

ASSESSMENT PROCEDURE

The risk of slope instability should be assessed by an experienced geotechnical consultant. An assessment would normally include:

* study of geological and topographic maps supplemented by the consultant's experience in the area.
* consideration of information made available by the client about the site and its surrounding area (including previous instability, building distress and drainage problems) and development proposals.
* visual appraisal of the site and surrounding area including signs of instability, soil and rock exposures, seepage and vegetation.
* collection of basic geological measurements from the site to produce a geological sketch model.
* consideration of possible effects of high rainfall.

The assessment applies to the site at the time of the inspection.

Although the assessment is predominantly deductive and incorporates judgement based on experience, in many cases it will be sufficient to enable development to proceed. On very high, high and some medium risk sites geotechnical investigations will be required to confirm the assessment and define development options. The scope of any investigation depends upon the risk of instability and the proposed development and will involve subsurface investigations and possibly soil testing to improve the geotechnical consultant's understanding of the site.

DEVELOPMENT

Building techniques are available to enable development of many higher risk sites. Inappropriate development on the site and neighbouring properties can cause slope failure and serious damage. Inappropriate development includes:

* unsupported excavation or placement of fill.
* excessive clearing of vegetation.
* introduction of water to the slope.
* surface footings founded on the mantle of soil and rock fragments.

The owner's decision to develop the site involves an acceptance of a level of risk following development as assessed by the consultant. Even with suitable hillside construction techniques some minor cracking may occur.

Some sites may be unsuitable for economic development.

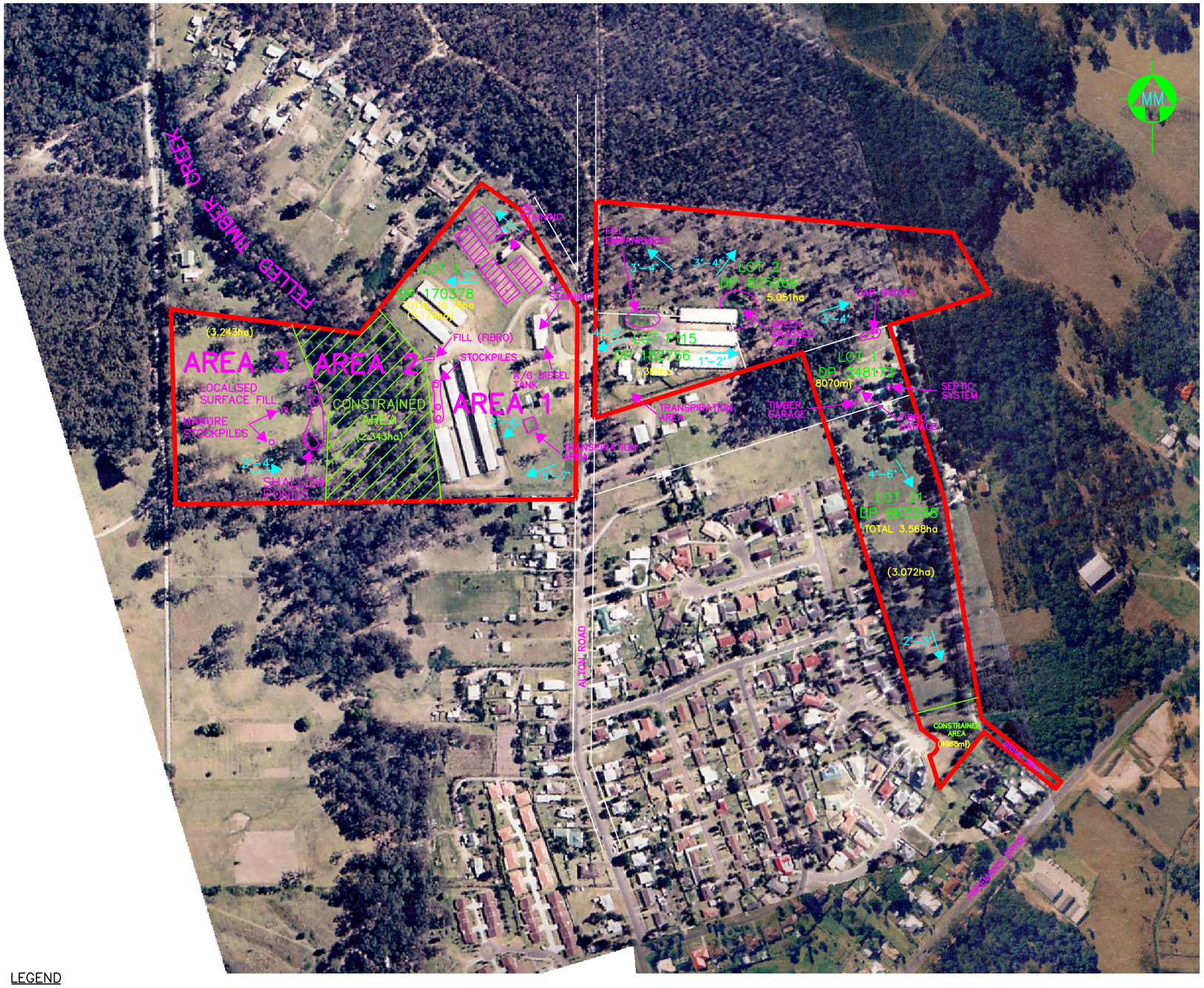
Other engineering constraints unrelated to slope instability may apply.

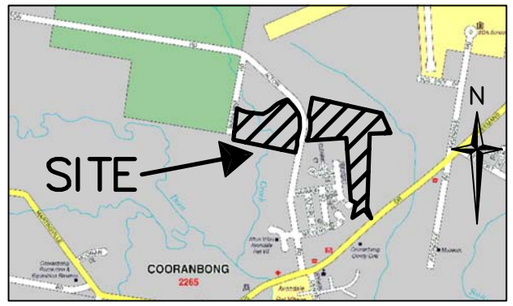
CLASSIFICATION

The following table has been produced to provide both a simplified classification which can be readily understood by a lay person and to provide a uniform language for geotechnical consultants.

RISK OF INSTABILITY	EXPLANATION	IMPLICATIONS FOR DEVELOPMENT
VERY HIGH	Evidence of active or past landslips or rock face failure; extensive instability may occur.	Unsuitable for development unless major geotechnical work can satisfactorily improve the stability. Extensive geotechnical investigation necessary. Risk after development may be higher than usually accepted.
HIGH	Evidence of active soil creep or minor slips or rock face instability; significant instability may occur during and after extreme climatic conditions.	Development restrictions and/or geotechnical works required. Geotechnical investigation necessary. Risk after development may be higher than usually accepted.
MEDIUM	Evidence of possible soil creep or a steep soil covered slope; significant instability can be expected if the development does not have due regard for the site conditions	Development restrictions may be required. Engineering practices suitable to hillside construction necessary. Geotechnical investigation may be needed. Risk after development generally no higher than usually accepted.
LOW	No evidence of instability observed; instability not expected unless major site changes occur.	Good engineering practices suitable for hillside construction required. Risk after development normally acceptable.
VERY LOW	Typically shallow soil cover with flat to gently sloping topography.	Good engineering practices should be foilowed.

This table is an extract from GEOTECHNICAL RISKS ASSOCIATED WITH HILLSIDE DEVELOPMENT as presented in Australian Geomechanics News, Number 10, December, 1985, which discusses the matter more fully.





LOCALITY PLAN

LEGEND

FORMER CHICKEN SHED

APPROXIMATE SLOPE DIRECTION AND ANGLE

SITE BOUNDARY

DRAWING ADAPTED FROM PLAN SUPPLIED BY HARPER SOMERS PTY LTD, REF NO. 20402

0 100 200 300 400 m

SCALE 1:5000

T:\31498

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: PRELIMINARY SITE ASSESSMENT
ALTON ROAD, COORANBONG

CLIENT: HARPER SOMERS PTY LTD

DRAWN BY: LG	SCALE: 1:5000	PROJECT No: 31498	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1

APPENDIX D

Report – Project 31720

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Integrated Practical Solutions

REPORT
ON
PRELIMINARY SITE ASSESSMENT

PROPOSED REZONING FROM RURAL TO URBAN
NORTH COORANBONG INVESTIGATION AREA

Prepared For

JW PLANNING PTY LTD

PROJECT 31720

OCTOBER 2003

Douglas Partners
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REPORT
ON
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ACEA The Association of Consulting Engineers Australia

DOUGLAS PARTNERS 40 1963-2003

TABLE OF CONTENTS

ATTACHMENTS

Appendix A
Drawing 1 – Test Location Plan and Site Constraints

Appendix B
Notes Relating to this Report
Test Bore Report Sheets, Bores 1 to 3
Test Pit Report Sheets, Pits 4 to 16

Appendix C
Laboratory Report Sheets

Appendix D
Quality Assurance / Quality Control
Chain of Custody Sheets

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MB:MPG:ph
Project 31720
P:/31720/Docs/31720.doc
20 October 2003

REPORT ON
PRELIMINARY SITE ASSESSMENT
PROPOSED REZONING FROM RURAL TO URBAN
NORTH COORANBONG INVESTIGATION AREA

1. INTRODUCTION

This report presents the findings of a preliminary site assessment for the proposed North Cooranbong Investigation area. The work was carried out at the request of Mr Jason Wasiak of J W Planning Pty Ltd.

The proposed development includes the rezoning of Lot 1, DP 825 266, located on the corner of Blue Wren Drive and Avondale Road, Cooranbong, which covers an approximate area of 27 ha.

The investigation was required to assess geotechnical and contamination issues/constraints to development.

Potential constraints which were addressed in the assessment included:

- identification of surface soils and surface topographical units;
- identification of areas containing rock outcrops or likely to contain shallow bedrock;
- identification of areas with potential slope instability issues;
- identification of erosion potential;

- identification of areas of poor geotechnical conditions and implications to development;
- identification of areas containing possible acid sulphate soils;
- identification of potential natural resources including gravel and clays;
- discussions with Mine Subsidence Board (MSB) regarding past mining activities and likelihood of mine subsidence;
- identification of past and present potential contaminating activities;
- identification of the potential for off-site impact from potential contaminants.

Douglas Partners Pty Ltd (DP) have previously undertaken investigations within the "Avondale Estate Investigation Area", located to the north-west of the site (Report 31393, Ref 1, and 31393-1, Ref 2). As part of the current investigation, assessment of the potential for migration of contaminants from the upslope sludge ponds to the subject site has also been undertaken.

The assessment comprised the following:

- Desktop Study and Review;
- Site Inspection (24 April 2003 and 8 May 2003);
- Brief Discussions with Mr Herb Pocock (owner and resident of site), and Mr Jason Wasiak of J W Planning Pty Ltd.
- Searches with NSW Environmental Protection Authority (EPA), Department of Land and Water Conservation (DLWC), Lake Macquarie City Council (LMCC).
- Fieldwork including groundwater wells and test pits;
- Laboratory testing.

For the purposes of the investigation, the client supplied DP with a site plan indicating areas with different development potential, including residential, rural residential and associated drainage basin and buffer zones.

2. BACKGROUND

A preliminary site assessment was undertaken in December 2001 by DP (Report No 31393) for a 210 ha parcel of land immediately north/northwest of the subject site (Avondale Estate Investigation Area), which identified potential contamination concerns associated with the effluent sludge dam located approximately 90 m north of the site which is believed to contain effluent from the Sanitarium Health Food Co and Avondale Estate.

An additional investigation was undertaken in January 2002 by DP (Report No 31393-1), which investigated further the effluent sludge dam. The assessment provided comment on the condition of the sludge dam, a classification of the sludge materials and the potential for groundwater impact.

The results of the assessment found that the effluent sludge within the three sludge basins were classified as "Restricted Use 2" in accordance with NSW EPA Biosolids Guidelines, which limits the land application uses of the material.

Groundwater sampling and analysis indicated that elevated levels of copper, lead and zinc were found in groundwater from wells installed during the previous investigation, both up and down gradient of the sludge dam. Elevated copper and zinc levels were also found in the effluent sludge.

Slightly increased zinc levels were also found in groundwater samples taken down-gradient of the sludge ponds suggesting possible migration from the effluent sludge ponds.

Total nitrogen levels were also found to be elevated down-gradient of the sludge dam when compared to up-gradient levels. Although there are no specific guideline values for nutrient levels, the ANZECC guidelines for aquatic ecosystems suggest that algal problems have been known to occur in rivers and streams for total nitrogen levels in excess of 0.1 to 0.75 mg/L. The groundwater levels down-gradient of the sludge dam are approximately two orders of magnitude greater than this level.

The results of the groundwater assessment therefore indicated that groundwater impact has occurred as a result of disposal/storage of effluent sludge in the sludge dam.

Groundwater levels measured on 28 November 2001 indicated that groundwater flows towards the south from the sludge ponds at a gradient of about 1.7° (generally consistent with the local topography), towards the current investigation site.

Due to the close proximity of the sludge dams to the current investigation site (approx 90 m), there is a potential for surface water and groundwater impact from migration of contaminants from the sludge ponds.

3. CHARACTERISTICS OF SITE

3.1 Description/Location

The site is identified as Lot 1, DP 825 266 and is located on the corner of Blue Wren Drive and Avondale Road, Cooranbong. The site is an irregularly shaped area about 27 ha in area and has access from both 86 Avondale Road and Alton Road.

The site is bounded by Avondale Road to the east, Avondale Estate investigation area to the north and west (including effluent sludge pond and Cooranbong Airstrip), and Avondale Greens investigation area and existing rural and residential properties to the south.

3.2 Geology

Reference to the 1:100 000 Newcastle Coalfield Regional Geology Sheet Reference No 9231, indicates that the site is underlain by Narrabeen Group of Early Permian aged Newcastle Coal Measures, which generally consist of sandstone, conglomerate, siltstone and claystone.

Preliminary subsurface investigation was undertaken across the site and is discussed below.

3.3 Topography/Site Features

The site topography generally comprises slopes in the order of 1° to 5°.

Relevant site features were observed during site visits on 24 April 2003 and 8 May 2003, and are discussed below.

A weatherboard house, metal clad workshop and a number of metal clad sheds and small chicken pens were located in the far eastern portion of the site, which is currently being utilised by Mr Herb Pocock (the current site owner).

The majority of the cleared areas across the site are currently being utilised for grazing of horses and cattle. Permanent fencing and temporary electric fences have been established across the majority of the site including the site boundaries to contain and segregate the horses. The northern and western boundary fences have only recently been built (approximately 12 months ago). The ground surface on either side of the fence line has been cleared and is extremely boggy / waterlogged in the north-western portion of the site.

Several existing dams were observed on the site together with an existing intermittent creek flows through the site to the south-east. These are described in Section 3.6.

A number of localised fill stockpiles were observed in the central northern portion of the site, containing car tyres, timber, fallen timber/branches, metal car pieces and general domestic refuse. A few small stockpile were also located in the south-eastern portion of the site and contained car parts and farm equipment, wire and general farm parts.

A minor track constructed with brick and concrete filling was also observed in the central portion of the site over a 20 m to 30 m section providing access to the creek from the north.

Minor localised coal/chitter and gravel surface filling was also observed along internal access tracks around the residential premises.

3.4 Soil Landscape

Reference to the soil landscape series sheet 9131-9231 for Gosford – Lake Macquarie prepared by the Department of Conservation and Land Management indicates that site soils generally comprise the Doyalson erosional landscape. Typical characteristics of these soils include the following:

- erosion hazard;
- seasonal waterlogging;
- high run-on (foot slopes);
- strong acidity;
- foundation hazard (localised);
- high plasticity, moderate to high shrink-swell (clays);
- low fertility.

The western portion of Lot 1 DP 825266 indicates that site soils encroach upon the Yarramalong landscape. Typical soil characteristics of these soils include the following:

- flooding;
- stream bank erosion hazard;
- seasonal waterlogging;
- foundation hazard;
- low fertility.

3.5 Vegetation

Vegetation on the site generally comprised a dense covering of semi-mature to mature trees with a thick covering of undergrowth across the south western portion of the site, with a thick grass and shrub covering in the north west drainage basin area.

The majority of the remaining site has been cleared with the exception of pockets of semi-cleared bush in the central and south-eastern portion of the site. A line of mature pine trees are located along the south eastern and eastern boundary of the site. A partially grassed, cleared area is located in the north-eastern corner of the site, which is currently utilised for grazing a number of horses.

3.6 Drainage System

A low lying drainage basin runs through the site from the north west corner of the site to the south east corner of the site. The basin spans approximately 110 m maximum width in the north west portion of the site and narrows into a constructed channel of approximately 1 m to 2 m width, in the lower south-east portion of the site.

At the time of the investigation surface water was flowing from the Avondale Estate site into the drainage basin at a number of locations along the northern boundary of the site, generally through constructed unsealed drainage channels. The drainage area was very boggy at the time of the investigation and was partially inundated with 100 mm to 200 mm of surface water in the north-western portion of the basin.

A dam approximately 25 m to 30 m wide is located in the south eastern corner of the site, which has a spillway diversion channel, which overflows into the constructed channel immediately to the south of the dam.

A second dam is located in the central northern portion of the site and is approximately 20 m long. Both dams appeared to be nearly full at the time of the investigation.

Several low berms of less than 1 m vertical height have been constructed in the north-eastern portion of the site, with the northern berm diverting surface water into the northern dam.

3.7 Acid Sulphate Soil Conditions

Reference to the Morisset Acid Sulphate Soil Risk Map prepared by the Soil Conservation Service of NSW indicates that there is no known occurrence of acid sulphate soils within the site.

It should be noted that risk maps are based on an assessment of the geomorphic environment and should be used as a guide only.

4. FIELD WORK

4.1 Methods

Field work was undertaken between 24 April 2003 and 29 July 2003 and comprised the following:

- walk-over inspection of the site by an experienced engineer on 24 April 2003;
- drilling of three test bores (Bores 1 to 3) to depths of 4.6 m to 6.2 m using a combination of 4WD mounted and bobcat mounted drilling rigs;
- installation of groundwater monitoring wells within Bores 1 to 3;
- measurement of groundwater levels in each well;
- collection of representative groundwater samples from Bore 1 to 3 and from former Bore 2 located to the north of the site (Report No 31393, Ref 2);
- collection of one surface water sample from runoff entering the site from the north;
- excavation by backhoe of 13 test pits (Pits 4 to 16) to depths of 2 m to 2.7 m.

The bores/pits were set out by a Geo-environmental Engineer from DP who also logged the subsurface profile at each location and collected samples for identification and testing purposes.

The test locations were initially set-out with reference to site features such as fences and vegetation. Test locations were subsequently surveyed by SurDevel Pty Ltd, and the as-surveyed locations of all test pits/bores are shown in Drawing 1 Appendix A.

Samples were collected at regular depth intervals or changes in strata directly from the drill rig augers (bores), or directly from the walls of excavation or material within the excavator bucket (test pits). Augers were screwed into the ground at discrete depths and retracted without rotation to minimise sample disturbance whilst drilling test bores. Care was taken to remove any extraneous material deposited on the outer auger flights as the auger was withdrawn from the borehole.

Well Design, Installation and Sampling

Three groundwater wells were installed to assess the on-site groundwater quality due to the presence of upstream effluent leachate ponds by intercepting groundwater, migrating from up-gradient areas to the site. The location of the sludge ponds are shown on Drawing 1, Appendix A.

The groundwater wells were constructed of 50 mm diameter flush threaded Class 18 PVC, in accordance with current industry standards and installed within boreholes, using solid flight augers from a 4WD mounted drilling rig.

A 3 m machine slotted PVC screen with an end cap was installed from a depth of about 1 m above the observed water table (where practical), to up to 2 m below the water table (ie. to intercept possible floating product). A filter pack was installed in the bore annulus consisting of 5/2 graded and washed gravel. A bentonite seal (between 0.5 m to 1.1 m thick) was placed above the filter pack within the bore annulus, to prevent surface water migration into the well.

Details of well design and construction are shown on Test Bore Report Sheets in Appendix B.

Drilling and well installation was undertaken under QA/QC protocol to minimise the risk of cross contamination.

The groundwater wells were surveyed for location and elevation by SurDevel Pty Ltd.

Following installation, the wells were developed by removing a minimum of five bore volumes of groundwater using a stainless steel bailer to ensure an efficient hydraulic connection between the well and the formation.

Groundwater samples from the wells were collected using a disposable stainless steel bailer and preserved in laboratory prepared containers for analysis. Water samples were labelled with individual and unique identification, including project number, sample location and sample depth. The samples were then placed into a cooled, insulated and sealed container for transport to the laboratory. The samples were delivered to the laboratory within the recommended holding times for analysis. The groundwater level was allowed to recover from the effects of purging prior to sampling. Samples were collected under strict QA/QC protocols.

The depth to groundwater was measured prior to sampling in each well to assist in determining groundwater flow direction.

Surface Water Sampling

One surface water sample (S1) was collected from a small drain at the northern boundary of the site, approximately 90 m downstream of the effluent sludge ponds on the 15 May 2003 as shown on Drawing 1 Appendix A. The surface water was entering the site from the northern property after recent local rainfall. Sample collection, preservation, and in situ testing was undertaken as per groundwater sampling.

Decontamination Procedures

Prior to each sampling event, sampling equipment was decontaminated using phosphate-free detergent and tap water to prevent cross-contamination. Disposable gloves were used for each sampling event.

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Quality Assurance/Quality Control

The work was undertaken in accordance with the DP quality system and procedures for contamination assessments as presented in the Company's field procedures manual. A list of the procedures used and information on quality assurance and quality control, including analysis of replicate samples, is provided in Appendix D.

The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard chain-of-custody form. Copies of completed forms are contained in Appendix D.

4.2 Results

Walk Over Survey

The pertinent site observations made during the walk over survey are as follows:

- no significant areas of surface rock outcrops were observed on the site;
- no signs of erosion were present across the site;
- very soft boggy surface conditions were observed within the drainage basin;
- the drainage basin was covered with ponded water which appeared to be flowing slowly to the south-east at the time of the investigation;
- the ground surface generally slopes at less than 5°;
- no obvious signs of deep seated or active instability were observed during the walk over survey;
- two dams were located within the site, which appear to be in good condition, with no obvious signs of previous instability or erosion within the embankments.

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Test Pits/Bores

Details of the subsurface conditions encountered in the test pits are presented in the attached test pit or test bore report sheets. These should be read in conjunction with the attached general notes, which explain the descriptive terms and classification methods.

A summary of the conditions encountered within the pits and bores is presented below:

From (m)	To (m)	Description
0	0.1/0.3	Silty sand (topsoil) with trace to abundant rootlets and roots, was encountered in the majority of pits. Topsoils generally comprised silty clays/clayey silts in low lying areas (i.e. Bore 1 to 3, Pits 8 to 10)
0.1/0.3	1.0/2.7	Generally stiff to hard silty/sandy clays were encountered in all pits, however, very soft to firm silty or sandy clays were encountered to depths ranging between 0.35 m to 1.5 m (i.e. Bore 1 to 3, Pits 8 to 10) located in low lying areas.
0.6/2.0	1.1/6.2	Extremely weathered sandstone or siltstone bedrock was encountered in Bores 1 to 3 and Pits 8, 9 and 12. Pebbly sandstone was encountered within Bore 3 and Pits 9 and 12. The majority of bores/pits however indicated extremely weathered sandstone characteristics below about 2 m in depth.

Groundwater seepage was observed during excavation/drilling from depths between 0.2 m to 1.5 m in Bores 1 to 3 and in Pits 8 to 10. Groundwater was not encountered in any of the remaining test pits.

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The following groundwater levels were measured on 20 May 2003 following development and purging:

Table 1 – Groundwater Levels

Bore/Well	PVC Stickup (m)	RL Ground Level (m AHD)	Depth of Groundwater Below Ground level (m)	Groundwater RL (m AHD)
1	~0.5	10.9	0	10.9
2	~0.5	13.4	1.25	12.2
3	~0.5	12.8	0	12.8
BH2 (previous investigation)	0.15	18.1	1.7	16.4

Notes to Table 1:

RL – Reduced Level (AHD)

BH2 – Former Bore 2 (Report 31393-1) immediately down-gradient of sludge ponds.

The groundwater levels measured in the wells were used to estimate the groundwater flow direction and gradient.

Based on this information, groundwater flows towards the south, which is generally consistent with the local topography, at a gradient of about 1.8°. This is consistent with previous measurements undertaken by DP in November 2001.

It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

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5. LABORATORY TESTING

Soil Dispersion/Erodibility

Six selected soil samples were subjected to Emerson crumb testing. The results are summarised in Table 2 below.

Table 2 – Emerson Crumb Test Results

Location	Depth (m)	Description	Emerson Class No
Pit 4	0.5	Sandy Clay – grey mottled orange-brown	5
Pit 7	0.6	Sandy Clay/Clayey Sand – Light grey/orange	6
Pit 11	0.4	Sandy Clay – Light orange mottled red	6
Pit 13	0.5	Sandy Clay – Light orange	6
Pit 14	0.7	Silty Clay – Light grey mottled red/orange	6
Pit 16	0.7	Silty Clay some sand – Light grey mottled red	6

The results of the above tests indicate that the clay is not dispersive.

Groundwater Quality

Groundwater and surface water samples were analysed by Australian Laboratory Services Pty Ltd (ALS), a National Association of Testing Authorities, Australia (NATA) registered laboratory.

One groundwater sample collected from each on the three installed wells (1 to 3), one sample from Bore 2 installed during our previous investigation (Report No 31393-1) and one surface water sample (S1) were tested for the following analytes with reference to the NSW EPA Biosolids Guidelines (Ref 5) to investigate the potential for groundwater impact from the effluent sludge ponds:

- heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn);
- organochlorine pesticides (OCP);
- polychlorinated biphenyls (PCB);

- nutrients (total nitrogen, total phosphorous);
- microbiological contaminants (faecal coliform and E-coli);
- pH, electrical conductivity.

The results of analysis are presented on the laboratory report sheets, Appendix C, and summarised in Table 3 below.

Table 3 – Results of Groundwater Analysis

Sample Identification	Current						Jan-02			Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (20 Values Sl Moderately Syste Fresh
	S1	B1	B2	B3	D1	GW2	GW2	GW1	GW3			
pH	5.19	5.5	5.56	5.01	5.04	4.21	4.8	4.5	5.2	0.01	6.5-8.5***	6.5-8.5 (1)
Electrical Conductivity (uS/cm)	97	815	322	674	670	694	767	930	745	1	NC	200-300(3)
Nutrients												
Total Nitrogen as N	0.3	2.5	0.4	0.2	<0.1	203	38.1	67.3	0.34	0.1	NC	0.35 (1)(2)
Total Phosphorus	0.01	<PQL	<PQL	<PQL	<PQL	0.05	0.2	0.8	0.1	0.01	NC	0.01 (1)(2)
Metal												
As	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.0005	<0.0005	<0.0005	0.001	0.007	0.013#
Cd	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	<0.001	<0.001	0.001	0.002	0.0002
Cr	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.003	0.01	0.002	0.001	0.05**	0.001##
Cu	<PQL	0.006	0.006	0.005	0.005	0.003	0.007	0.007	0.007	0.001	2	0.0014
Pb	<PQL	0.002	0.002	0.001	0.001	0.002	0.002	0.008	0.005	0.001	0.01	0.0034
Hg	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.0005	<0.0005	<0.0005	0.0001	0.001	0.00006###
Ni	<PQL	0.005	0.009	0.003	0.005	0.003	0.012	0.012	0.004	0.001	0.02	0.011
Se	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.0005	<0.0005	<0.0005	0.01	0.01	NC
Zn	0.01	0.085	0.084	0.092	0.082	0.023	0.22	0.37	0.13	0.005	NC	0.008
OCPs												
Total OCPs	all <PQL	all <PQL	all <PQL	all <PQL	all <PQL	all <PQL	all <PQL	all <PQL	all <PQL	0.0005/0.002	NC	NC
Aldrin + Dieldrin	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.00001	<0.00001	<0.00001	0.0005	0.0003	NC
Chlordane	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.00001	<0.00001	<0.00001	0.0005	0.001	0.00003
DDT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.00001	<0.00001	<0.00001	0.002	0.02	0.000006
Heptachlor	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.000005	<0.000005	<0.000005	0.0005	0.0003	0.00001
PCBs	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<0.0001	<0.0001	<0.0001	0.001	NC	NC
Microbiological Parameters												
Faecal Coliforms (CFU/100 mL)	420	<PQL	<PQL	<PQL	<PQL	<PQL	<9	<9	<9	1	NIL	NC
E-Coli (CFU/100 mL)	420	<PQL	<PQL	<PQL	<PQL	<PQL	<9	<9	<9	1	NIL	NC

Notes to Table 3:

Results expressed in mg/L unless otherwise stated

PQL - Practical Quantification Limits

NC - No Criteria

** - Chromium (VI)

*** - Aesthetic Guideline Value

- Arsenic (V) (conservative)

- Chromium (VI)

- Mercury (Inorganic)

(1) - Trigger Values for physical and chemical stressors for south-east Australia for Slightly Disturbed Ecosystems (Table 3.3.2)

(2) - For Freshwater Lakes and Reservoirs (Conservative)

(3) - Typical Value for coastal NSW rivers (Table 3.3.3)

Exceeds Drinking Water Guidelines

Exceeds Anzecc 2000 Guidelines - Fresh Waters

D1 - Duplicate Sample of Bore 3

B2-Sludge - Same well as GW2

GW1, GW2 & GW3 - Groundwater well samples tested for Project 31393, January 2002.

6. GEOTECHNICAL CONSIDERATIONS FOR DEVELOPMENT

The following geotechnical considerations for development were identified during the site inspection:

- erosion hazard;
- slope stability;
- uncontrolled filling;
- excavatability;
- soil reactivity;
- saturated, low-lying soils;
- acid sulphate soils;
- mine subsidence issues;
- natural resources.

6.1 Erosion Hazard

Upper soils present on-site were observed to be erodable.

Water quality may be impacted due to sediment laden run-off during and following development from the upper silty sand topsoil material. Owing to the limited quantity of this material encountered in all pits for depths ranging from 0.1 m to 0.3 m, erosion and sedimentation are readily amenable to mitigation measures such as, silt fences, revegetation / reshaping batters, drainage structures (catch drains), sediment traps and sedimentation basins. However, the results of the laboratory testing indicated that the dominant soils at the site (i.e. clay) is non-dispersive.

6.2 Slope Stability

There was generally no evidence of previous or incipient deep seated instability observed over the site. The site is generally considered to have a low risk of instability with respect to the natural topography.

It is therefore considered that the site is suitable for the proposed development with respect to slope instability.

In the event that significant cuts or fills are proposed for the site, further geotechnical investigation to specifically assess slope stability issues should be undertaken.

6.3 Uncontrolled Filling

Localised areas of filling, including stockpiles, which may have been placed in a non-engineered manner were observed in the following areas.

- Within the two farm dams located in the south-eastern corner and northern portion of the site;
- Constructed berms situated in the north-eastern portion of the site;
- Concrete, brick and soil filling placed in the central portion of the site for access to the creek;
- Areas around the existing house and associated buildings.

Descriptions of observed fill materials were provided in Section 3.3. Filling generally appears to have been placed in an uncontrolled manner, as defined in AS 2870-1996 (Ref 3), and would not be suitable for support of structures.

Subsurface investigation should be undertaken to identify the depth, extent and properties of filling if development is proposed over these areas.

6.4 Excavatability

Soils observed within test pits comprised silty sands and silty / sandy clays to depths ranging from 1 m to 3.5 m. It is anticipated that these materials can be readily excavated by conventional earthmoving equipment. However, excavatability of the underlying rock should be assessed on a site specific basis during detailed investigations prior to development, if deep excavation is proposed.

6.5 Soil Reactivity

Foundation design for future structures and pavement construction will be influenced by a number of factors including the reactivity of site soils. Laboratory testing of soil properties has not been undertaken as part of this assessment. The soil landscape maps (See Section 3.4) indicate that the clays may have a moderate to high shrink-swell characteristic.

Soil reactivity can readily be accommodated in design, and should be confirmed during future detailed investigations prior to development by classifying building sites in accordance with AS 2870-1996 (Ref 3).

6.6 Saturated Soils / Poor Ground

Saturated surface soils were observed within the site as follows:

- Within the low lying drainage basin and associated constructed channel, draining from the north-western corner of the site to the south-eastern corner of the site. Results of Bores 1 to 3, drilled on the edges of the drainage basin, indicated that soft to firm conditions exist within the top metre of the surface, the soft soils may be deeper within the drainage basin;
- Upslope of the contour berms at the time of investigation. Saturation of these soils is most likely to occur following rainfall events.

Saturated areas are likely to result in localised softening and in swelling behaviour of surrounding soils which should also be considered for future detailed investigation and design.

Poor soils, such as encountered in Bores 1 to 3, Pits 8 and 10, anticipated within the drainage basin, would be unsuitable for support of structures or pavements. It should be noted that better conditions were encountered in Pit 9, excavated within the southern portion of the drainage basin.

6.7 Acid Sulphate Soil Conditions

Based on the Acid Sulphate Soil Risk Map for Morisset, it is unlikely that acid sulphate soil conditions are present within the site. Aggressive ground conditions (ie. naturally acidic soils) may however be present within the site and should be considered for future detailed investigations.

6.8 Mine Subsidence Issues

Discussions and correspondence with the Mine Subsidence Board (MSB) indicate the site is not within a proclaimed mine subsidence district and is not subject to any building restrictions imposed by the MSB.

6.9 Natural Resources

Based on the results of the investigations, subsurface conditions across the site are anticipated to generally comprise silty / sandy clays to depths between 1.0 m and 2.5 m.

The suitability of this material as a resource will depend on the proposed use. Additional laboratory testing may be required to assess the materials suitability for specific uses.

6.10 Flood Level and Proposed Allotments

It is understood that a hydrological assessment is being undertaken others. The results of this assessment indicates that significant portions of the site are below the 1 in 100 year flood level. Lake Macquarie City Council's subdivision code states that all lots that are not 500 mm above the 1:100 year average recurrence interval storm, will be required to have a flood height of 500 mm above the 1:100 year average recurrence interval storm. Consequently, some low lying areas of the site may not be suitable for residential development without site regrading works.

7. PRELIMINARY CONTAMINATION ASSESSMENT

The preliminary contamination assessment comprised the following:

- brief discussions with Mr Herb Pocock the site owner;
- searches with LMCC;
- searches with NSW EPA;
- review of historical aerial photos;
- search of nearby registered groundwater bores through DLWC;
- site inspection on 24 April and 8 May 2003 to assess site conditions.

The following information was obtained from discussions with Mr Pocock:-

Lot 1, DP 825 266

- The site has been owned by the Pocock family for over 100 years;
- The site is Zoned 1(a) - Rural Production land;
- Horse stables were the first development on the site and were constructed in 1913;
- Eastern portion of the site was utilised as an orchard;
- The remainder of the site was utilised as an intensive market garden, which supplied the Newcastle Markets;
- No farming activities were undertaken beneath the flight path (within the eastern portion of the site) or within wet areas (i.e. drainage basin);

- A subdivision application was submitted to Council in 1950 to subdivide off a small parcel of the north-eastern corner of the site to construct a residential premises. The subdivision did not however proceed;
- The orchards were removed around 1962;
- White oil, lime sulphur, borda and copper sulphate were the only pesticides utilised on the orchards;
- Some standard fertilisers were also used on the orchards;
- The low lying area in the northwest of the site was cleared in 1972 after a severe fire burnt out the majority of bushland in the area;
- The northern dam was constructed in 1976;
- No underground storage tanks are located on the site;
- Mr Pocock was unaware of any potential contamination issues associated with the site;
- Site has one unregistered groundwater well located in close proximity to the house, and currently only utilised for emergencies or fire fighting. In the past the well was used for stock watering, prior to town water being connected;
- Majority of other wells in the area were constructed by his father and have now been decommissioned;
- The site currently maintains an operational Aerated wastewater treatment system with an irrigation disposal system located in the eastern portion of the site, near the existing house. No obvious signs of surface overflow or nutrient migration were observed at the time of investigation.

7.2 Council Records Search

Correspondence with Lake Macquarie City Council indicated that four Building Application (BA) / Development Applications (DA) have been submitted based on the records that the council held. The following list is of the submitted BA's and DA's and a brief description of the proposed alterations/development:

- No 979/50 – Details not available;
- No 91/00562 –Boundary Adjustment approved;
- 92/00161 – Rural Boundary Adjustment approved;
- 92/00296 – Dwelling application approved.

Review of the Section 149 Planning Certificate (Certificate No 2004/122) for Lot 1, DP 825266 provided by LMCC indicated the following:

- The site address is 86 Avondale Road, Cooranbong within the Coorumbung Parish in the County of Northumberland;
- The site is currently owned by Mr Herbert John Robert Pocock;
- The site is currently zoned Rural 1 (a);
- The site is not proclaimed to be within a mine subsidence district;
- Development within the site is not restricted because of the likelihood of acid sulphate soils;
- Development within the site is not restricted by the Unhealthy Building Land policy;
- The site has no matters arising under the Contaminated Land Management Act 1977.

7.3 NSW Environmental Protection Authority

A property information inquiry with the NSW EPA indicated that the site has no statutory notices issued under the provision of the Contaminated Land and Management Act.

7.4 Review Of Historical Aerial Photos

The following historical aerial photos were reviewed:

Table 4 – Aerial Photo Review

Year	Approximate Scale	Black and White/Colour
1954	1:40,000	B & W
1966	1:40,000	B & W
1975	1:40,000	B & W
1984	1:40,000	B & W
1994	1:25,000	Colour

1954 Aerial Photograph

- The western portion of the site appears to be uncleared and heavily vegetated;
- The eastern portion of the site has been mainly cleared of trees. The central and north eastern corner appears to be used for orchards of crops;
- No dams are located on the site;
- The current residence and workshop buildings are present;
- Majority of land to west, south and north has been undeveloped;
- Only the north/south runway is present to the north of the site. It appears to be unsealed and directly in line with the Pocock's residence.
- Only a few other residential buildings have been developed to the east and north-east of the site.

1966 Aerial Photograph

- A small dam appears to have been constructed in the south-eastern corner of the site;
- A number of berms have been constructed across the central and north-eastern portion of the site;
- Mature orchards appear to be located in the north-eastern corer of the site;
- An additional two sheds appear to have been constructed immediately west of the existing residence and workshop.

1975 Aerial Photograph

- The drainage channel appears to have been mainly cleared and subsequently grassed;
- The orchards appear to have been removed;
- A cleared, disturbed area is located in the central northern portion of the site and may have been subject to earthworks or stockpiling of material;
- A well defined track has been established along the southern edge of the drainage basin from the north west corner of the site to the former cleared paddocks;
- The sludge disposal ponds and access road, have been created to the north of the site.

1984 Aerial Photograph

- The site remains relatively unchanged since 1975, with the exception of the construction (extension) of a large dam in the south-east of the site and also in the northern portion of the site;
- The pine trees bordering the southern boundary entrance to the property of Avondale Road are also now evident.

1994 Aerial Photograph

- The site appears to remain largely unchanged since 1984.
- Development surrounding the site continues to expand.

The review of aerial photos, was difficult due to the relatively small scale and poor resolutions.

7.4 Groundwater Bore Search - DLWC

A groundwater bore search with the Department of Land and Water Conservation indicated that the nearest registered bore is located approximately 150 m south-west of the site and is authorised for domestic and stock use.

7.5 Potential Contaminants

The results of the assessment have indicated the following areas of potential contamination which will need to be addressed for future development.

- Surface soils surrounding localised rubbish stockpiles may contain contaminants including hydrocarbons and heavy metals;
- Surface soils previously utilised for intensive market gardens and orchards (eastern portion of site) may contain residual pesticides;
- Near surface soils within the central northern portion of the site, identified as being disturbed in the late 1960's or early 1970's may contain filling material of unknown origin;
- Minor surface hydrocarbon and heavy metal impact may have occurred within unsealed floors within the workshop and sheds in the north-eastern portion of the site;

- The effluent disposal system may have resulted in elevated levels of nutrients, heavy metals and hydrocarbons in the surrounding soils. The AWTS and irrigation area should be appropriately decommissioned prior to re-development of the effected area of the site;
- Groundwater and surface water impact may have resulted from migration from the upstream effluent sludge ponds. Refer to Section 8 for details.

With the exception of the effluent sludge ponds, the majority of potential contaminants above are generally localised and unlikely to impact on neighbouring properties.

Further investigations will be required to assess the depth, extent, contaminant concentrations and associated issues with areas identified to contain potential contamination, prior to development.

8. ASSESSMENT OF MIGRATION OF CONTAMINANTS FROM SLUDGE PONDS

As part of the current assessment three groundwater monitoring wells were installed within the site, to assess the potential migration of contaminants from the effluent sludge ponds located approximately 90 m upstream of the site.

One groundwater sample was collected from each on the three installed wells.

One sample was also collected from Bore 2 (GW2) located immediately down slope of the effluent sludge ponds within the neighbouring property. This bore was previously sampled on 28 November 2001(Report No 31393-1).

One surface water sample was also collected from a small drain at the northern boundary of the site, approximately 90 m downstream of the effluent sludge ponds on the 15 May 2003. The surface water was entering the site from the northern property after recent local rainfall.

The results of groundwater and surface water sampling were presented in Table 3 (Section 5) and indicated the following:

- Electrical conductivity and pH levels were found to be outside the ANZECC 2000 guidelines for fresh waters within all groundwater samples. The marginally low pH levels however may be attributed to the naturally low-lying saturated soil in the area.
- Elevated concentration of Total Nitrogen above the ANZECC 2000 guidelines for fresh waters was found within Bores 1 and 2. Nitrogen and Phosphorus concentrations within Bore 2 (GW2) were above the ANZECC 2000 guidelines for fresh waters, as occurred when this bore was previously sampled in November 2001. Results indicate however, that nutrient concentrations are significantly lower in the current investigation bores, suggesting that migration of nutrients from the effluent sludge ponds has only occurred in the near vicinity of the ponds.
- Elevated copper and zinc concentrations were found within the current investigation wells above the ANZECC 2000 guidelines for fresh waters. Results however indicate that heavy metals concentrations have generally fallen in Bore 2 (GW2) since November 2001, and are below background concentrations previously measured in Bore 3 (GW3). Heavy metal concentrations within the current investigation wells were generally below the background levels also.
- No Faecal coliforms or E-Coli were detected in any of the groundwater samples. Elevated concentrations of both Faecal coliforms and E-Coli above the Australian Drinking Water Guidelines were detected within the surface water sample, however, and indicate surface water impact is occurring from the neighbouring site. The source and associated health risk will need to be further assessed prior to development of the site. It is anticipated that the source of the Faecal coliforms and E-Coli within surface waters is associated with the effluent sludge ponds on the adjacent site.

The above results indicate that impact on groundwater quality from the migration of contaminants from the effluent sludge ponds to the current investigation site (Lot 1 DP 825266) is minimal. Impact from surface water runoff onto the property from the Avondale Estate may, however, be occurring, as indicated by the elevated faecal coliform result. A potential for off-site impact from the sludge dam onto neighbouring properties to the south/south-east of Lot 1, 825266, while expected to be minimal, is possible and should be investigated further. Additional microbiological assessment should be undertaken to determine the potential health risks and therefore implication to development.

9. RECOMMENDATIONS

Future development over the site should address the geotechnical and contamination issues identified above.

The following recommendations relate to further investigation to enable more detailed design for the development.

- assessment of possible contamination as outlined in Section 7.5 and Section 8 including
  - assessment of potential contaminants within surface soils associated with fill stockpiles and former market gardens / orchards, workshop and sheds and central north portion of site which may contain filling;
  - assessment of potential contaminants within surface soils surrounding effluent disposal system
  - assessment of potential for off-site impact of E-Coli from surface waters;
  - assessment of the health risks associated with E-Coli and Faecal coliforms within surface waters on site; and the need for further remediation measures such as decommissioning of the effluent sludge ponds. This would include further sampling of the surface water and analysis and comment by a microbiologist;
- lot classification to AS 2870-1996 (Ref 3) for footing design;
- earthworks procedures and specifications;
- pavement thickness design for new internal roads.

The above investigations could be undertaken concurrently, and would involve subsurface investigation, in situ testing, laboratory testing of soils samples, and engineering analysis.

In conclusion, the results of this preliminary geotechnical and contamination assessment have identified issues that should be considered prior to development. The site is considered suitable for future development, subject to the above issues being addressed, and appropriate engineering design.

10. LIMITATIONS OF THIS REPORT

DP have performed investigation and consulting services for this project in general accordance with current professional and industry standards for land contamination investigation.

Whilst every effort has been made to ensure a representative programme of field and laboratory sampling and testing, conditions different to those identified during these tasks may exist. Therefore DP, nor any other reputable consultant, can provide unqualified warranties nor does DP assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change over time in response to variations in natural conditions, chemical reactions and other events, eg. groundwater movement and/or spillage's of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

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No site investigations can be thorough enough to provide absolute confirmation of the presence or absence of substances which may be considered contaminating, hazardous or polluting. Similarly the level of testing undertaken cannot be considered to unequivocally characterise the degree or extent of contamination on the site. In addition, regulatory or guideline criteria for the evaluation of environmental soil and groundwater quality are frequently being reviewed and concentrations of contaminants which are considered acceptable in the present may in the future be considered unacceptable.

This report and associated documentation and the information herein have been prepared solely for the use of J W Planning Pty Ltd and any reliance assumed by other parties on this report shall be at such parties own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

Matthew Blackert
Geotechnical Engineer

Reviewed by:

Stephen R Jones
Principal

Michael P Gawn
Geotechnical Engineer

REFERENCES

1. Douglas Partners Pty Ltd, "Report on Preliminary Site Assessment, Lots 1 to 11, DP 3533, Avondale Road, Cooranbong", Project 31393, December 2001.
2. Douglas Partners Pty Ltd, "Report on Effluent Sludge Dam Assessment, Lot 10, DP 3533, Off Avondale Road, Cooranbong", Project 31393-1.
3. Australian Standard AS 2870-1996 "Residential Slabs and Footings - Construction", June 1996, Standards Australia.

APPENDIX A

Drawing 1 – Test Location Plan

LEGEND

APPROXIMATE TEST BORE LOCATION

APPROXIMATE TEST BORE LOCATION (NOV 2001 - REPORT 31393-1)

APPROXIMATE TEST PIT LOCATION

SITE BOUNDARY

APPROXIMATE SURFACE WATER SAMPLE LOCATION

ANTICIPATED EXTENT OF WEAK NEAR SURFACE SOILS

DRAWING ADAPTED FROM PLAN SUPPLIED BY CLIENT, REF MGABASEMAPA

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Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: TEST LOCATION PLAN
PRELIMINARY GEOTECHNICAL ASSESSMENT
NORTH COORANBONG INVESTIGATION AREA

CLIENT: J W PLANNING PTY LTD			
DRAWN BY: PH	SCALE: as shown	PROJECT No: 31720	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1

APPENDIX B

Notes Relating to this Report
Test Bore Report Sheets, Bores 1 to 3
Test Pit Report Sheets, Pits, 4 to 16

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments
Sandstone:	More than 50% of the rock consists of sand sized (.06 to 2mm) fragments
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fs	Rock substance unaffected by weathering, limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics (Reference).

Strength Term	Is(50) MPa	Field Guide	Approx. qu MPa*
Extremely Low:	0.03	Easily remoulded by hand to a material with soil properties	0.7
Very Low:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Low:	0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium:	1	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
High:	3	A piece of core 150 mm long x 50 mm dia. cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very High:	10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely High:		A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	

* The approximate unconfined compressive strength (qu) shownin the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks

Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with occasional shorter and longer sections.
Slightly Fractured:	Core lengths are generally 300 mm - 1000 mm with occasional longer sections and occasional sections of 100 mm - 300 mm.
Unbroken:	The core does not contain any fracture.

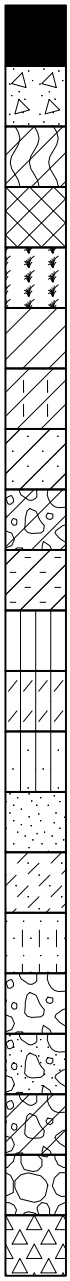
REFERENCE

International Society of Rock Mechanics, Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1 Final Draft October 1972

Log\GRAPHIC-SYMBOLS 24/11/2003 4:38:57 PM

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

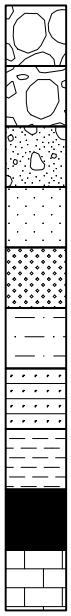
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

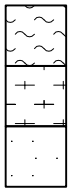
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

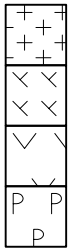


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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TEST BORE REPORT

CLIENT: JW Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

DATE: 8 May 2003
PROJECT No: 31720
SURFACE LEVEL: RL 10.9

BORE No: 1
SHEET 1 **of** 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth	Tests	Results	Contamination Observations	Water	Well Construction Details
0.25	SILTY CLAY: Very soft to soft, dark grey silty clay, M>>Wp			0.15	A				Stickup = 0.5m
	SILTY CLAY/CLAYEY SILT: Soft to firm, light grey silty clay, trace fine grained sand, M>>Wp			0.45	A				
	Becoming stiff from about 0.8m Sand content increasing with depth		S	1.0		2,3,4 N=7			Bentonite seal from surface to 0.6m
				1.45	pp	270–370 kPa			
1.6	SANDY CLAY: Stiff to very stiff, light grey fine grained sandy clay with some silt, M>>Wp			1.8	A				
			S	2.0		3,6,7 N=13	Possible slight sewage odour from 2m		50mm Class 18 Slotted PVC from 2.5m to 5.5m
	With some siltstone and fine to medium gravel from 2.35m			2.45	pp	500–>600 kPa			
2.9	SANDSTONE: (Silty fine to coarse grained sand?), extremely weathered, light grey–orange fine to coarse grained sandstone with some interbedded sandy clay lenses, saturated			3.3	A				5/2 gravel filter from 0.6m to 5.5m
				5.0	A				
5.5	Test Bore 1 terminated at 5.5m.								

RIG: 4WD mounted drill rig **DRILLER:** Atkins **LOGGED:** Blackert **CASING:** Uncased

TYPE OF BORING: 100mm Ø solid flight auger (TC bit)

WATER OBSERVATIONS: Slight seepage from 0.8m (surface)

REMARKS: Ponded surface water 3m from bore

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
D Disturbed soil sample	S Standard penetration test
PID_a Ambient PID	U_x Tube sample (x mm dia.)
PID_h Headspace PID	W Water

CHECKED:
Initials:
Date: 23/10/03

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TEST BORE REPORT

CLIENT: JW Planning Pty Ltd
DATE: 15 May 2003
BORE No: 2
PROJECT: Preliminary Geotechnical Assessment
PROJECT No: 31720
LOCATION: North Cooranbong Investigation Area
SURFACE LEVEL: RL 13.4
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth	Tests	Results	Contamination Observations	Water	Well Construction Details
0.45	SILTY CLAY/CLAYEY SILT: Very soft to soft, grey silty clay, trace fine grained sand, M>>Wp			0.4	A				Stickup = 0.5m
	SANDY SILTY CLAY: Firm to very stiff, light grey sandy silty clay, M>Wp			0.8	A,pp	190–200 kPa			Bentonite seal from surface to 1.1m
	Sand content increasing with depth		S	1.0		2,4,6 N=10			
	From 1.0m, becoming stiff to hard, mottled orange			1.45	pp	550–>600 kPa		▽	
1.5	SANDY CLAY: Very stiff to hard, light grey fine to coarse grained sandy clay, M>Wp								
	Sand content increasing with depth, grading to extremely weathered sandstone		S	2.0		4,6,7 N=13			
	From about 2.5m, strong resistance to drilling			2.45	pp	550–570 kPa			
				2.9	A				50mm Class 18 slotted PVC from 1.5m to 4.5m
3.5	SANDSTONE: Extremely weathered, light grey fine to coarse grained sandstone with trace fine to medium subrounded gravel, wet to saturated								5/2 gravel filter from 1.1m to 4.5m
				4.3	A				
4.6	Test Bore 2 terminated at 4.6m, TC bit refusal.			4.55	A				

RIG: 4WD mounted drill rig **DRILLER:** Atkins **LOGGED:** Blackert **CASING:** Uncased
TYPE OF BORING: 100mm Ø solid flight auger (TC bit)
WATER OBSERVATIONS: Seepage from about 1.5m
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
D Disturbed soil sample	S Standard penetration test
PID_a Ambient PID	U_x Tube sample (x mm dia.)
PID_h Headspace PID	W Water

CHECKED:
Initials:
Date: 23/10/03

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TEST BORE REPORT

CLIENT: JW Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

DATE: 15 May 2003
PROJECT No: 31720
SURFACE LEVEL: RL 12.8

BORE No: 3
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth	Tests	Results	Contamination Observations	Water	Well Construction Details
0.3	SILTY CLAY: Very stiff to firm, grey silty clay, trace fine grained sand and some rootlets, M>>Wp			0.4	A			▽	Stickup = 0.15m Bentonite seal from surface to 0.5m
0.7	SILTY CLAY: Soft to firm, light grey silty clay trace fine grained sand, M>>Wp								
1	SANDY SILTY CLAY: Firm to very stiff, light grey mottled orange-red fine to coarse sandy silty clay with trace siltstone and subrounded fine to medium gravel, M>>Wp		S	1.0		2,3,3 N=6			
				1.45	pp	220 kPa	Possible slight unusual odour from 1.5m to 2.5m		
2	From 1.5m, grading to extremely weathered sandstone sand content increasing with depth		S	2.0		7,11 for 0.1 (refusal)			
2.5	PEBBLE SANDSTONE/CONGLOMERATE: Extremely weathered, light grey/orange mottled green fine to coarse grained sandstone with intermixed fine to medium grained siltstone and subrounded gravel, wet to saturated.			2.25	pp	>600 kPa			
3	From 2.3m, strength increasing with depth, orange			2.9	A				Class 18 slotted PVC from 2.85m to 5.85m
4									5/2 gravel filter from 3.0m to 5.85m
5				4.4	A				
6				5.9	A				
6.2	Test Bore 3 terminated at 6.2m, TC bit refusal.								
7									
8									
9									

RIG: 4WD mounted drill rig **DRILLER:** Atkins **LOGGED:** Blackert **CASING:** Uncased

TYPE OF BORING: 100mm Ø solid flight auger (TC bit)

WATER OBSERVATIONS: Seepage from about 0.5m depth

REMARKS: 14m from northern boundary

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
D Disturbed soil sample	S Standard penetration test
PID_a Ambient PID	U_x Tube sample (x mm dia.)
PID_h Headspace PID	W Water

CHECKED:
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 24

PIT No: 4
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.1	TOPSOIL - Grey silty sand with abundant rootlets, moist to very moist	D	0.05	
	SANDY CLAY - Very stiff to hard, grey sandy clay, M>Wp			
	from 0.4m, mottled orange-brown	D,pp	0.5	450 kPa
	sand content decreasing with depth			
0.8	SILTY CLAY - Hard, light grey mottled orange-red silty clay with trace iron-cemented gravel and fine to medium sand, M>Wp	D,pp	0.9	>500 kPa
1				
	from 1.5m, sand content increasing with depth	D,pp	1.4	420->600 kPa
1.9	SANDY CLAY - (Extremely weathered sandstone), very stiff to hard, light grey mottled orange-red fine to coarse grained sandy clay, M>Wp			
2		D,pp	2.1	360-380 kPa
2.7	TEST PIT DISCONTINUED AT 2.7m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 15.9

PIT No: 5
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey silty sand with some roots, moist to very moist	D	0.1	
0.2	CLAYEY SAND / SANDY CLAY - Hard, light brown-orange clayey fine to medium grained sand, moist to very moist	D,pp	0.5	480 kPa
	from 0.7m, clay continue with depth			
1		D,pp	1.0	490-530 kPa
1.45	SILTY CLAY - Very stiff to hard, light grey-orange mottled red silty clay with some fine to medium sand, trace iron-cemented gravel, M>Wp	D,pp	1.5	320-480 kPa
	from 1.8m, sand content increasing with depth possible (extremely weathered sandstone)			
2				
		D	2.3	
2.4	TEST PIT DISCONTINUED AT 2.4m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 17.6

PIT No: 6
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey silty sand with abundant roots / rootlets, moist to very moist	D	0.15	
0.25	SANDY CLAY - Very stiff to hard, grey-orange fine to medium grained sandy clay, M>Wp			
	sand content decreasing with depth	D,pp	0.5	300-350 kPa
0.7	SILTY SANDY CLAY - Very stiff to hard, light grey-orange silty sandy clay, M>Wp			
1	from 1.1m, with some iron-cemented gravel	D,pp	1.0	350-400 kPa
1.5	SILTY CLAY - Very stiff, light grey mottled orange-red silty clay with trace fine to medium sand and iron-cemented gravel, M>Wp	D,pp	1.5	350-380 kPa
	from 1.8m, grading to extremely weathered sandstone			
2	sand content increasing with depth	D	2.2	
2.3	TEST PIT DISCONTINUED AT 2.3m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/9/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 13.8

PIT No: 7
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey silty sand with some roots, moist	D	0.1	
0.25	SANDY CLAY / CLAYEY SAND - Very stiff to hard, light grey-orange sandy clay/clayey sand, M>Wp	D,pp	0.6	360-420 kPa
1	claycontent increasing with depth			
1.25	SANDY CLAY - Stiff, light grey mottled orange-red fine to coarse grained sandy clay with some iron-cemented gravel, M>Wp	D,pp	1.3	150-200 kPa
	from 1.7m, grading to extremely weathered sandstone			
2		D	2.1	
2.2	TEST PIT DISCONTINUED AT 2.2m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U,	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 8.7

PIT No: 8
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY CLAY / CLAYEY SILT - Firm, dark grey clayey silt with abundant rootlets, M>>Wp	D,pp	0.2	80-100 kPa
0.35	CLAYEY SILT / SILTY CLAY - Firm to stiff, light grey clayey silt/silty clay with trace fine grained sand, M>>Wp	D,pp	0.5	160 kPa
1	silt content decreasing with depth	D,pp	0.9	150 kPa
	from about 1.2m, very stiff, mottled orange	D,pp	1.5	310-360 kPa
	sand content increasing with depth			
1.9	SILTSTONE - (Silty clay), extremely weathered, grey siltstone	D,pp	2.2	300 kPa
2				
2.4	TEST PIT DISCONTINUED AT 2.4m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: Slight seepage from 0.35m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 10

PIT No: 9
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	CLAYEY SILT / SILTY CLAY - Dark grey clayey silt with abundant rootlets, M>>Wp	D	0.15	
0.25	CLAYEY SAND - Very loose to loose, grey clayey sand, wet to saturated			
0.35	SANDY CLAY - Stiff to very stiff, light grey sandy clay, M>Wp	D,pp	0.5	120-180 kPa
1	clay content increasing with depth	D,pp	1.1	150-220 kPa
1.5	PEBBLE SANDSTONE - (Gravelly sandy clay), extremely weathered, light grey mottled orange pebble sandstone with some iron-cemented layers	D	1.6	
2				
2.1	TEST PIT DISCONTINUED AT 2.1m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: Slight seepage from 0.2m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 12.1

PIT No: 10
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey sandy silt with abundant rootlets, very moist to wet	D	0.1	
0.15	SANDY CLAY / CLAYEY SAND - Firm, light grey clayey sand, moist to very moist			
	from about 0.4m, sandy clay	D,pp	0.5	80-100 kPa
	sand content decreasing with depth			
	from 0.8m, mottled red			
0.9	SANDY SILTY CLAY - Stiff to very stiff, light grey mottled red sandy silty clay, M>>Wp	D,pp	1.0	40-80 kPa
1				
		D,pp	1.4	300-330 kPa
	from 1.6m, saturated			
2		D	2.0	
2.1	TEST PIT DISCONTINUED AT 2.1m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: Seepage from 0.5m, strong seepage from 1.6m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 15.5

PIT No: 11
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.1	SILTY SAND - Grey, silty fine to medium grained sand, moist	D	0.05	
	SAND - Light orange fine to medium grained sand with some clay, moist			
0.3	SANDY CLAY - Stiff to very stiff, light orange mottled red sandy clay, M>Wp	D,pp	0.4	200-220 kPa
0.65	SANDY SILTY CLAY - Very stiff, light grey mottled orange-red sandy silty clay, M>>Wp	D,pp	0.8	310-330 kPa
1	sand content increasing with depth			
		D,pp	1.5	320-400 kPa
	from 1.6m, grading to extremely weathered sandstone			
2		D	2.0	
2.2	TEST PIT DISCONTINUED AT 2.2m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 10

PIT No: 12
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Dark grey silty sand with some rootlets, moist			
0.15	SAND - Grey/ orange silty fine to medium grained sand, some clay, moist	D	0.2	
0.25	SANDY CLAY/CLAYEY SAND - Stiff, light orange mottled red sandy clay, M>Wp	D,pp	0.5	110 kPa
	from 0.7m, trace gravel, orange			
1 1.0	SANDSTONE - Highly to extremely weathered, light grey mottled orange sandstone with some fine to medium gravel	D	1.1	
		D	1.9	
2 2.0	TEST PIT DISCONTINUED AT 2.0m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 18

PIT No: 13
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Grey silty sand with some rootlets, moist	D	0.1	
0.3	SANDY CLAY - Very stiff, light orange fine to medium grained sandy clay, M>Wp	D,pp	0.5	270-380 kPa
1	strength and sand content increasing with depth	D,pp	1.2	420->600 kPa
1.4	SILTY SANDY CLAY - Hard, light grey mottled orange-red silty fine to medium grained sandy clay with some iron-cemented gravel, M>Wp	D,pp	1.5	450-550 kPa
2	grading to extremely weathered sandstone	D	2.1	
2.3	TEST PIT DISCONTINUED AT 2.3m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MJ
Date: 23/10/03

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 21

PIT No: 14
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Grey silty sand with some to abundant roots/rootlets, moist			
0.15	SILTY CLAY - Very stiff, light orange silty clay with some sand, M>Wp	D,pp	0.4	300-330 kPa
0.6	SILTY CLAY - Very stiff to hard, light grey mottled red-orange silty clay with trace fine to medium sand, M>Wp	D,pp	0.7	380-420 kPa
1	from 1.0m, with trace iron-cemented sand	D,pp	1.3	360-450 kPa
2	grading to extremely weathered siltstone			
2.1	TEST PIT DISCONTINUED AT 2.1m	D,pp	2.1	300-390 kPa

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MG
Date: 23/10/03

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 18.8

PIT No: 15
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Dark grey silty sand with abundant rootlets, moist	D	0.1	
0.2	SILTY CLAY - Stiff to very stiff, light orange silty clay with some sand, M>Wp	D,pp	0.4	180-350 kPa
0.6	SILTY CLAY - Very stiff, light grey mottled red silty clay with some fine grained sand, M>Wp	D,pp	0.8	320-390 kPa
1				
	sand content increasing with depth	D	1.3	
1.7	CLAYEY SAND - (Sandstone), light grey mottled orange-red clayey fine to medium grained sand (extremely weathered sandstone), very moist to wet	D	1.9	
2				
2.1	TEST PIT DISCONTINUED AT 2.1m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MJ
Date: 23/10/03

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Geotechnical Assessment
LOCATION: North Cooranbong Investigation Area

PROJECT No: 31720
SURFACE LEVEL: RL 22.2

PIT No: 16
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Grey silty sand some rootlets, moist	D	0.1	
0.2	SILTY CLAY - Very stiff to hard, light orange silty clay with some fine to medium sand, M>Wp	D,pp	0.4	430-450 kPa
0.6	SILTY CLAY - Hard, light grey mottled red silty clay with some fine to medium sand, M>Wp	D,pp	0.7	450->600 kPa
1	from 1.0m, with some iron-cemented gravel			
	from 1.5m, light grey			
	sand content increasing with depth			
2		D,pp	2.0	390-450 kPa
2.1	TEST PIT DISCONTINUED AT 2.1m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: MP
Date: 23/10/03

Douglas Partners
Geotechnics · Environment · Groundwater

APPENDIX C

Laboratory Report Sheets

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117

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Hunter Region Mail Centre NSW 2310
Australia

15 Callistemon Close
Warabrook NSW 2304

Phone (02) 4960 9600
Fax: (02) 4960 9601
newcastle@douglaspartners.com.au

DETERMINATION OF EMERSON CLASS NUMBER OF SOIL

Client: J W Planning Pty Ltd

Project: Preliminary Geotechnical Assessment

Location: Lot 1, DP 825266
North Cooranbong

Project No: 31720
Report No: N03-137
Report Date: 11.8.03

Date of Test: 7.8.03
Page: 1 of 1

SAMPLE NO	DEPTH (m)	DATE SAMPLED	DESCRIPTION	WATER TYPE	WATER TEMP	CLASS NO.
TP4	0.5	30.7.03	Grey mottled orange/brown sandy clay	Distilled	18°	5
TP7	0.6	30.7.03	Light grey/orange sandy clay/clayey sand	Distilled	18°	6
TP11	0.4	30.7.03	Light orange mottled red sandy clay	Distilled	18°	6
TP13	0.5	30.7.03	Light orange sandy clay	Distilled	18°	6
TP14	0.7	30.7.03	Light grey mottled red/orange silty clay	Distilled	18°	6
TP16	0.7	30.7.03	Light grey mottled red silty clay with some sand	Distilled	18°	6

Test Method(s): AS 1289 3.8.1 - 1997

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001

Remarks:

FORM NO R005 REV 4 DATE OF ISSUE FEBRUARY 2003

NATA Accredited Laboratory No 1670
This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full

Approved Signatory:

Tested: DM
Checked: DM

D Millard
Laboratory Manager

ALS Environmental

RECEIVED
29 MAY 2003

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10208
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	0
ADDRESS:	PO BOX 324 HUNTER REGION MAIL CENTRE 2310	**LABORATORY:**	NEWCASTLE
		DATE RECEIVED:	15/05/2003
		DATE COMPLETED:	27/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	1
PROJECT:	31720-COORANGBONG		

COMMENTS

pH and Conductivity conducted by ALS Newcastle, NATA Site No. 1656.

All other analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
WARABROOK NSW 2304

Phone: 61-2-4968 9433
Fax: 61-2-4968 0349
Email: kathy.mcdermott@alsenviro.com

Signatory Greg Vogel

Batch: NE10208
Sub Batch: 0
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1									
		Date Sampled		15/05/2003									
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1									
EA-005-P	pH Value		0.01	5.19									
EA-010-P	Conductivity @ 25'c	uS/cm	1	97									
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001									
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001									
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001									
EG-020F	Copper - Filtered	mg/L	0.001	<0.001									
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001									
EG-020F	Lead - Filtered	mg/L	0.001	<0.001									
EG-020F	Selenium - Filtered	mg/L	0.01	<0.01									
EG-020F	Zinc - Filtered	mg/L	0.005	0.010									
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001									
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	0.01									
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	0.3									
EK-062A	Total Nitrogen as N	mg/L	0.1	0.3									
EK-067A	Total Phosphorus as P	mg/L	0.01	0.01									

Batch: NE10208
Sub Batch: 0
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202							
		Date Sampled		15/05/2003	15/05/2003	15/05/2003							
				METHOD BLANK	LCS	MS							
				CHECKS AND SPIKES									
EA-005-P	pH Value		0.01	----	----	----							
EA-010-P	Conductivity @ 25'c	uS/cm	1	<1	101%	----							
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	97.0%	124%							
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001	96.0%	101%							
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	92.0%	95.0%							
EG-020F	Copper - Filtered	mg/L	0.001	<0.001	101%	128%							
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001	99.0%	110%							
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	94.0%	102%							
EG-020F	Selenium - Filtered	mg/L	0.01	<0.01	102%	123%							
EG-020F	Zinc - Filtered	mg/L	0.005	<0.005	103%	106%							
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	94.0%	92.0%							
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	<0.01	95.0%	93.0%							
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	<0.1	102%	93.0%							
EK-062A	Total Nitrogen as N	mg/L	0.1	----	----	----							
EK-067A	Total Phosphorus as P	mg/L	0.01	<0.01	93.0%	89.0%							

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10208
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	1
ADDRESS:		**LABORATORY:**	NEWCASTLE
	PO BOX 324	**DATE RECEIVED:**	15/05/2003
	HUNTER REGION MAIL CENTRE 2310	**DATE COMPLETED:**	27/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	1
PROJECT:	31720-COORANGBONG		

COMMENTS

Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

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Phone: 61-2-4968 9433
Fax: 61-2-4968 0349
Email: kathy.mcdermott@alsenviro.com

Signatory

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

NATA Accredited Laboratory Number 825

Batch: NE10208
Sub Batch: 1
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1									
		Date Sampled		15/05/2003									
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1									
EP-066-WS	Total Polychlorinated biphenyls	ug/L	1	<1									
EP-066S-WS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-WS	Decachlorobiphenyl	%	1	94									

Batch: NE10208
Sub Batch: 1
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION										
		Laboratory I.D.		100	101	102								
		Date Sampled		15/05/2003	15/05/2003	15/05/2003								
				METHOD BLANK	NPCBW226 SCS	NPCBW226 DCS								
				CHECKS AND SPIKES										
EP-066-WS	Total Polychlorinated biphenyls	ug/L	1	<1	97.0%	101%								
EP-066S-WS	**POLYCHLORINATED BIPHENYL SURROGATE**													
EP-066S-WS	Decachlorobiphenyl	%	1	92	91	95								

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10208
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	2
ADDRESS:		**LABORATORY:**	NEWCASTLE
	PO BOX 324	**DATE RECEIVED:**	15/05/2003
	HUNTER REGION MAIL CENTRE 2310	**DATE COMPLETED:**	27/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	1
PROJECT:	31720-COORANGBONG		

COMMENTS

Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

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Signatory

Batch: NE10208
Sub Batch: 2
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION										
		Laboratory I.D.		1										
		Date Sampled		15/05/2003										
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1										
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**													
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5										
EP-068A-WS	HCB	ug/L	0.5	<0.5										
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1										
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5										
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5										
EP-068A-WS	Aldrin	ug/L	0.5	<0.5										
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5										
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5										
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5										
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5										
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5										
EP-068A-WS	DDE	ug/L	0.5	<0.5										
EP-068A-WS	Endrin	ug/L	0.5	<0.5										
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5										
EP-068A-WS	DDD	ug/L	0.5	<0.5										
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5										
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5										
EP-068A-WS	DDT	ug/L	2	<2										
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5										
EP-068A-WS	Methoxychlor	ug/L	2	<2										
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**													
EP-068S-WS	Dibromo-DDE	%	1	88										

Batch: NE10208
Sub Batch: 2
Date of Issue: 27/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANGBONG

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION										
		Laboratory I.D.		100	101	102								
		Date Sampled		15/05/2003	15/05/2003	15/05/2003								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NOCOPW358 SCS	NOCOPW358 DCS								
				CHECKS AND SPIKES										
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**													
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5	94.0%	88.2%								
EP-068A-WS	HCB	ug/L	0.5	<0.5	99.5%	95.4%								
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1	91.9%	99.9%								
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5	98.5%	94.8%								
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5	98.8%	94.7%								
EP-068A-WS	Aldrin	ug/L	0.5	<0.5	93.2%	99.1%								
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5	95.6%	94.1%								
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5	84.8%	91.9%								
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5	90.7%	98.9%								
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5	81.7%	88.5%								
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5	87.4%	94.9%								
EP-068A-WS	DDE	ug/L	0.5	<0.5	94.1%	92.6%								
EP-068A-WS	Endrin	ug/L	0.5	<0.5	30.1%	33.2%								
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5	86.0%	89.7%								
EP-068A-WS	DDD	ug/L	0.5	<0.5	90.1%	98.0%								
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5	94.9%	98.7%								
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5	92.3%	101%								
EP-068A-WS	DDT	ug/L	2	<2	100%	95.9%								
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5	100%	86.8%								
EP-068A-WS	Methoxychlor	ug/L	2	<2	86.6%	100%								
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**													
EP-068S-WS	Dibromo-DDE	%	1	103	115	95								

RECEIVED
29 MAY 2003

ALS Environmental

ORGANICS QUALITY CONTROL REPORT

BATCH NO: NE10208

DATE BATCH RECEIVED: 16/05/2003

CLIENT: Douglas Partners

DATE BATCH COMPLETED: 27/05/2003

PROJECT: 31720 Cooranbong

Method Code	Test	Matrix	Method Reference		QC Lot Number	Date Samples Extracted	Date Samples Analysed
			Extraction	Analysis			
EP-066	PCB	Water	USEPA 3510B	USEPA 8270B	NPCBW226	22/05/03	23/05/03
EP-068	Pesticides	Water	USEPA 3510B	USEPA 8270B	NOCOPW358	22/05/03	23/05/03

Where applicable, internal standards are added to sample extracts prior to instrumental analysis. Absolute peak areas and retention times fall within the criteria specified in the individual methods. Continuing Calibration (CC) standards are run at the frequency of 1 in every 20 samples.

Abbreviations: SV = semivolatile, V = volatile

*: In-house methods

A Campbell Brothers Limited Company

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-066 : PCB

QC LOT No. : NPCBW226
MATRIX: Water

ANALYST : R. AYOUBI

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Conc	DCS Conc	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	ug/L	ug/L	%	%	Low	High	%
EP-066 : PCB									
Total PCBs	<LOR	10.0	9.7	10.1	99	3	75	115	20
EP-066 : PCB SURR									
Decachlorobiphenyl	92%	10.0	90.9	95.4	93	5	67	120	20

COMMENTS:
1) The control limits are based on ALS laboratory statistical data. (Method QWI-ORG/07)
2) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-068 : Pesticides

QC LOT No. : NOCOPW358 ANALYST N. MAHABIR

MATRIX: Waters

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Rec.	DCS Rec.	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	%		%	%	Low	High	%
EP068A : OC Pesticides									
a-BHC	<0.5	5.0	94	88.2	91.1	6.37	78.5	103	0 - 20
HCB	<0.5	5.0	99.5	95.4	97.5	4.21	65.9	111	0 - 20
b- & g-BHC	<1.0	10.0	91.9	99.9	95.9	8.34	72.9	106	0 - 20
d-BHC	<0.5	5.0	98.5	94.8	96.7	3.83	78.6	101	0 - 20
Heptachlor	<0.5	5.0	98.8	94.7	96.8	4.24	76.1	104	0 - 20
Aldrin	<0.5	5.0	93.2	99.1	96.2	6.14	77.3	103	0 - 20
Heptachlor epoxide	<0.5	5.0	95.6	94.1	94.9	1.58	78.1	101	0 - 20
Chlordane peak no 1	<0.5	5.0	84.8	91.9	88.4	8.04	72.5	101	0 - 20
Endosulfan 1	<0.5	5.0	90.7	98.9	94.8	8.65	80.6	103	0 - 20
Chlordane peak no. 2	<0.5	5.0	81.7	88.5	85.1	7.99	77.1	105	0 - 20
Dieldrin	<0.5	5.0	87.4	94.9	91.2	8.23	81.4	99.4	0 - 20
DDE	<0.5	5.0	94.1	92.6	93.4	1.61	78.4	99.4	0 - 20
Endrin	<0.5	5.0	30.1	33.2	31.7 *	9.79	45.2	119	0 - 20
Endosulfan 2	<0.5	5.0	86	89.7	87.9	4.21	77.7	102	0 - 20
DDD	<0.5	5.0	90.1	98	94.1	8.4	79.6	102	0 - 20
Endrin aldehyde	<0.5	5.0	94.9	98.7	96.8	3.93	78	105	1 - 20
Endosulfan sulfate	<0.5	5.0	92.3	100	96.2	8.01	79.4	102	0 - 20
DDT	<2.0	5.0	100	95.9	98	4.19	63.5	115	0 - 20
Endrin ketone	<0.5	5.0	100	86.8	93.4	14.1	78.2	105	0 - 20
Methoxychlor	<2.0	5.0	86.6	100	93.3	14.4	53.7	131	0 - 20
EP068B : OP Pesticides									
Dichlorvos	<0.5	5.0	94.2	100	97.1	5.97	78	105	0 - 20
Demeton-s-methyl	<0.5	5.0	89.2	81.5	85.4	9.02	79.2	102	0 - 20
Monocroptophos	<2.0	5.0	12.8	10.6	11.7	18.8	0	87.2	0 - 20
Dimethoate	<0.5	5.0	83.9	89.6	86.8	6.57	71.2	107	0 - 20
Diazinon	<0.5	5.0	92.5	79.9	86.2	14.6	77.4	102	0 - 20
Chlorpyrifos methyl	<0.5	5.0	83.1	90.5	86.8	8.53	76.4	107	0 - 20
Parathion methyl	<2.0	5.0	84.9	85.9	85.4	1.17	77.1	107	0 - 20
Malathion	<0.5	5.0	93.8	101	97.4	7.39	76.6	105	0 - 20
Fenthion	<0.5	5.0	93.3	93.1	93.2	0.22	76.7	105	0 - 20
Chlorpyrifos	<0.5	5.0	89	96.8	92.9	8.4	80	104	0 - 20
Parathion	<2.0	5.0	97.3	95.9	96.6	1.45	67.7	113	0 - 20
Pirimphos ethyl	<0.5	5.0	86.4	57.8	72.1	39.7 *	54	115	0 - 20
Chlorfenvinphos Z	<0.5	5.0	90.7	99.6	95.2	9.35	77.8	104	0 - 20
Bromophos ethyl	<0.5	5.0	87.7	94.7	91.2	7.68	76.3	108	0 - 20
Fenamiphos	<0.5	5.0	82.2	88.1	85.2	6.93	74.4	103	0 - 20
Prothiofos	<0.5	5.0	87.2	95.2	91.2	8.77	76	108	0 - 20
Ethion	<0.5	5.0	93.1	101	97.1	8.14	73.4	108	0 - 20
Carbofenthion	<0.5	5.0	88.1	95.4	91.8	7.96	76.2	105	0 - 20
Azinphos methyl	<0.5	5.0	89.2	86.5	87.9	3.07	71.8	109	0 - 20

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-068 : Pesticides

QC LOT No. : NOCOPW358 ANALYST N. MAHABIR

MATRIX: Waters

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Rec.	DCS Rec.	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	%		%	%	Low	High	%
EP068C : Triazines									
Simazine	<0.5	5.0	90.3	83.8	87.1	7.47	30.3	151	0 - 20
Atrazine	<0.5	5.0	101	92.1	96.6	9.22	23.5	120	0 - 20
EP068D : Pyrethroids									
Cypermethrins(multipeaks)	<2.0	5.0	95.4	99.9	97.7	4.61	75.9	107	0 - 20
EP068S : OC Surrogate									
Dibromo-DDE	103%	10.0	115	94.7	105	19.4	69.9	118	0 - 20
EP068T : OP Surrogate									
DEF	84.3%	10.0	99.7	80.7	90.2	21.1 *	75.5	115	0 - 20

COMMENTS:

1) The recovery control limits are based on ALS laboratory statistical data. (Method QWI-ORG/07)

2) The control limits on RPD (relative percent deviation) are fixed.

3) * : Recovery or RPD falls outside of the recommended control limits.

ALS Environmental

RECEIVED
13 JUN 2003

CERTIFICATE OF ANALYSIS

CONTACT:	Matthew Blachent	**BATCH:**	**NE10208**
CLIENT:	Douglas Partners		
ADDRESS:	Box 324	**LABORATORY:**	SYDNEY
	Hunter Region Mail Centre NSW 2310	**DATE RECEIVED:**	15/05/2003
EMAIL:	-	**DATE COMPLETED:**	19/05/2003
ORDER No.	43874	**SAMPLE TYPE:**	Water
PROJECT:	Cooranbong-31720	**No. OF SAMPLES:**	1

NOTES

This is the Final Report and supersedes any preliminary report with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY : SYDNEY MICROBIOLOGY LABORATORY

ADDRESS
Australian Laboratory Services Pty. Ltd.
277 - 289 Woodpark Road,
Smithfield. NSW. 2164
Australia

PHONE: 61-2-8784 8555
FAX: 61-2-8784 8500

DATE ANALYSED: 16/05/2003
TIME ANALYSED: 10:55:00 AM

ALS ID NE10208	SAMPLE ID	Thermotolerant Coliforms (By MF) MW006 Confirmed CFU/100mL	E.coli (by MF) MW006 Confirmed CFU/100mL	
1	S1 15/5/03	420	420	

KEY:
< = Estimate less than
~ = Estimated
ND = Not Determined
CS = Customer Supplied
> = Greater than
# = Presumptive
INT = Interference
NR = Not Required

825 - Corporate

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

Signed:
Name: Mary Eastman
Position: Business Manager
Dated: May 19, 2003

A Campbell Brothers Limited Company

ALS Environmental

RECEIVED
05 JUN 2003

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10351
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	0
ADDRESS:	PO BOX 324 HUNTER REGION MAIL CENTRE 2310	**LABORATORY:**	NEWCASTLE
		DATE RECEIVED:	20/05/2003
		DATE COMPLETED:	31/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	5
PROJECT:	31720-COORANBONG		

COMMENTS

Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
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WARABROOK NSW 2304

Phone: 61-2-4968 9433
Fax: 61-2-4968 0349
Email: kathy.mcdermott@alsenviro.com

Signatory Greg Vogel

LABORATORIES

AUSTRALASIA		*AMERICAS*
Brisbane	*Hong Kong*	*Vancouver*
Melbourne	*Singapore*	*Santiago*
Sydney	*Kuala Lumpur*	*Antofagasta*
Newcastle	*Bogor*	*Lima*
Auckland	*Mumbai*	

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NATA Accredited Laboratory Number 825

Batch: NE10351
Sub Batch: 0
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5					
		Date Sampled		20/05/2003	20/05/2003	20/05/2003	20/05/2003	20/05/2003					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BORE 1	BORE 2	BORE 3	B2-SLUDGE	D1					
EA-005-P	pH Value		0.01	5.50	5.56	5.01	4.21	5.04					
EA-010-P	Conductivity @ 25'c	uS/cm	1	815	322	674	694	670					
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
EG-020F	Copper - Filtered	mg/L	0.001	0.008	0.006	0.005	0.003	0.005					
EG-020F	Nickel - Filtered	mg/L	0.001	0.005	0.009	0.003	0.005	0.003					
EG-020F	Lead - Filtered	mg/L	0.001	0.002	0.002	0.001	0.002	0.001					
EG-020F	Selenium - Filtered	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
EG-020F	Zinc - Filtered	mg/L	0.005	0.085	0.084	0.092	0.023	0.082					
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	1.68	0.07	0.04	203	0.05					
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	0.8	0.3	0.2	<0.1	<0.1					
EK-062A	Total Nitrogen as N	mg/L	0.1	2.5	0.4	0.2	203	<0.1					
EK-067A	Total Phosphorus as P	mg/L	0.01	<0.01	<0.01	<0.01	0.05	<0.01					

Batch: NE1035I
Sub Batch: 0
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION										
		Laboratory I.D.		200	201	202								
		Date Sampled		20/05/2003	20/05/2003	20/05/2003								
				METHOD BLANK	LCS	MS								
				CHECKS AND SPIKES										
EA-005-P	pH Value		0.01	----	----	----								
EA-010-P	Conductivity @ 25'c	uS/cm	1	<1	100%	----								
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	97.0%	107%								
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001	99.0%	100%								
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	105%	97.0%								
EG-020F	Copper - Filtered	mg/L	0.001	<0.001	99.0%	101%								
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001	97.0%	102%								
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	98.0%	103%								
EG-020F	Selenium - Filtered	mg/L	0.01	<0.01	100%	109%								
EG-020F	Zinc - Filtered	mg/L	0.005	<0.005	104%	107%								
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	93.0%	98.0%								
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	<0.01	100%	109%								
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	<0.1	102%	88.0%								
EK-062A	Total Nitrogen as N	mg/L	0.1	----	----	----								
EK-067A	Total Phosphorus as P	mg/L	0.01	<0.01	107%	93.0%								

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10351
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	1
ADDRESS:		**LABORATORY:**	NEWCASTLE
	PO BOX 324	**DATE RECEIVED:**	20/05/2003
	HUNTER REGION MAIL CENTRE 2310	**DATE COMPLETED:**	31/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	5
PROJECT:	31720-COORANBONG		

COMMENTS

Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
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Fax: 61-2-4968 0349
Email: kathy.mcdermott@alsenviro.com

Signatory

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NATA Accredited Laboratory Number 825

Batch: NE10351
Sub Batch: 1
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5					
		Date Sampled		20/05/2003	20/05/2003	20/05/2003	20/05/2003	20/05/2003					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BORE 1	BORE 2	BORE 3	B2-SLUDGE	D1					
EP-066-WS	Total Polychlorinated biphenyls	ug/L	1	<1	<1	<1	<1	<1					
EP-066S-WS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-WS	Decachlorobiphenyl	%	1	90	89	88	95	93					

Batch: NE10551
Sub Batch: 1
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102							
		Date Sampled		20/05/2003	20/05/2003	20/05/2003							
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NPCBW227 SCS	NPCBW227 DCS							
				CHECKS AND SPIKES									
EP-066-WS	Total Polychlorinated biphenyls	ug/L	1	<1	98.0%	95.0%							
EP-066S-WS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-WS	Decachlorobiphenyl	%	1	96	92	89							

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR MATTHEW BLACKERT	**BATCH:**	NE10351
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	2
ADDRESS:		**LABORATORY:**	NEWCASTLE
	PO BOX 324	**DATE RECEIVED:**	20/05/2003
	HUNTER REGION MAIL CENTRE 2310	**DATE COMPLETED:**	31/05/2003
		SAMPLE TYPE:	WATER
ORDER No.:	43874	**No. of SAMPLES:**	5
PROJECT:	31720-COORANBONG		

COMMENTS

Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

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Signatory

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NATA Accredited Laboratory Number 825

Batch: NE10351
Sub Batch: 2
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5					
		Date Sampled		20/05/2003	20/05/2003	20/05/2003	20/05/2003	20/05/2003					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BORE 1	BORE 2	BORE 3	B2-SLUDGE	D1					
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	HCB	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1	<1	<1	<1	<1					
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Aldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	DDE	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Endrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	DDD	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	DDT	ug/L	2	<2	<2	<2	<2	<2					
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-068A-WS	Methoxychlor	ug/L	2	<2	<2	<2	<2	<2					
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-WS	Dibromo-DDE	%	1	102	93	85	94	98					

Batch: NE10351
Sub Batch: 2
Date of Issue: 31/05/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720-COORANBONG

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION										
		Laboratory I.D.		100	101	102								
		Date Sampled		20/05/2003	20/05/2003	20/05/2003								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NOCOPW359 SCS	NOCOPW359 DCS								
				CHECKS AND SPIKES										
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**													
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5	87.0%	89.0%								
EP-068A-WS	HCB	ug/L	0.5	<0.5	70.8%	83.2%								
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1	84.0%	89.3%								
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5	95.4%	94.4%								
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5	94.0%	92.6%								
EP-068A-WS	Aldrin	ug/L	0.5	<0.5	93.0%	90.4%								
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5	93.9%	90.2%								
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5	82.4%	87.7%								
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5	91.7%	89.6%								
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5	84.1%	81.1%								
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5	94.2%	91.1%								
EP-068A-WS	DDE	ug/L	0.5	<0.5	94.9%	90.7%								
EP-068A-WS	Endrin	ug/L	0.5	<0.5	85.2%	95.0%								
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5	91.7%	89.4%								
EP-068A-WS	DDD	ug/L	0.5	<0.5	92.5%	88.3%								
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5	96.3%	89.6%								
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5	95.0%	90.8%								
EP-068A-WS	DDT	ug/L	2	<2	98.1%	95.6%								
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5	97.1%	95.8%								
EP-068A-WS	Methoxychlor	ug/L	2	<2	83.9%	94.0%								
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**													
EP-068S-WS	Dibromo-DDE	%	1	85	83	87								

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	Matthew Blackert	BATCH:	NE10351
CLIENT:	Douglas Partners		
ADDRESS:	PO Box 3246 Hunter Region Mail Centre NSW 2310	LABORATORY:	SYDNEY
		DATE RECEIVED:	20/05/2003
EMAIL:	-	DATE COMPLETED:	22/05/2003
ORDER No.	43874	SAMPLE TYPE:	Water
PROJECT:	Cooranbong - 31720	No. OF SAMPLES:	5

NOTES

This is the Final Report and supersedes any preliminary report with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY : SYDNEY MICROBIOLOGY LABORATORY

ADDRESS
Australian Laboratory Services Pty. Ltd.
277 - 289 Woodpark Road,
Smithfield. NSW. 2164
Australia

PHONE: 61-2-8784 8555
FAX: 61-2-8784 8500

DATE ANALYSED: 21/05/2003
TIME ANALYSED: 1:00:00 PM

ALS ID NE10351	SAMPLE ID	Thermotolerant Coliforms (By MF) MW006 Confirmed CFU/100mL	E.coli (by MF) MW006 Confirmed CFU/100mL	
1	Bore 1 20/5/03	<1	<1	
2	Bore 2 20/5/03	<1	<1	
3	Bore 3 20/5/03	<1	<1	
4	B2-Sludge 20/5/03	<1	<1	
5	D1 20/5/03	<1	<1	

KEY:
< = Estimate less than
~ = Estimated
ND = Not Determined
CS = Customer Supplied
> = Greater than
# = Presumptive
INT = Interference
NR = Not Required

825 - Corporate

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Signed:
Name: Mary Eastman
Position: Business Manager
Dated: May 22, 2003

A Campbell Brothers Limited Company

ALS Environmental

ORGANICS QUALITY CONTROL REPORT

BATCH NO: NE10351

DATE BATCH RECEIVED: 21/05/2003

CLIENT: Douglas Partners

DATE BATCH COMPLETED: 29/05/2003

PROJECT: 31720

Method Code	Test	Matrix	Method Reference		QC Lot Number	Date Samples Extracted	Date Samples Analysed
			Extraction	Analysis			
EP-066	PCB	Water	USEPA 3510B	USEPA 8270B	NPCBW227	26/05/03	27/05/03
EP-068	Pesticides	Water	USEPA 3510B	USEPA 8270B	NOCOPW359	26/05/03	27/05/03

Where applicable, internal standards are added to sample extracts prior to instrumental analysis. Absolute peak areas and retention times fall within the criteria specified in the individual methods. Continuing Calibration (CC) standards are run at the frequency of 1 in every 20 samples.

Abbreviations: SV = semivolatile, V = volatile

*: In-house methods

A Campbell Brothers Limited Company

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-066 : PCB

QC LOT No. : NPCBW227 ANALYST : S.Green
MATRIX: Water

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Conc	DCS Conc	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	ug/L	ug/L	%	%	Low	High	%
EP-066 : PCB									
Tot. PCBs	<LOR	10.0	9.8	9.5	97	3	75	115	20

COMMENTS:
1) The control limits are based on ALS laboratory statistical data. (Method QWI-ORG/07)
2) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-068 : Pesticides

QC LOT No. : NOCOPW359 ANALYST S.Green

MATRIX: Waters

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Rec.	DCS Rec.	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	%		%	%	Low	High	%
EP068A : OC Pesticides									
a-BHC	<0.5	5.0	87	89	88	2.27	78.5	103	0 - 20
HCB	<0.5	5.0	70.8	83.2	77	16.1	65.9	111	0 - 20
b- & g-BHC	<1.0	10.0	84	89.3	86.7	6.12	72.9	106	0 - 20
d-BHC	<0.5	5.0	95.4	94.4	94.9	1.05	78.6	101	0 - 20
Heptachlor	<0.5	5.0	94	92.6	93.3	1.5	76.1	104	0 - 20
Aldrin	<0.5	5.0	93	90.4	91.7	2.84	77.3	103	0 - 20
Heptachlor epoxide	<0.5	5.0	93.9	90.2	92.1	4.02	78.1	101	0 - 20
Chlordane peak no 1	<0.5	5.0	82.4	87.7	85.1	6.23	72.5	101	0 - 20
Endosulfan 1	<0.5	5.0	91.7	89.6	90.7	2.32	80.6	103	0 - 20
Chlordane peak no. 2	<0.5	5.0	84.1	81.1	82.6	3.63	77.1	105	0 - 20
Dieldrin	<0.5	5.0	94.2	91.1	92.7	3.35	81.4	99.4	0 - 20
DDE	<0.5	5.0	94.9	90.7	92.8	4.53	78.4	99.4	0 - 20
Endrin	<0.5	5.0	85.2	95	90.1	10.9	45.2	119	0 - 20
Endosulfan 2	<0.5	5.0	91.7	89.4	90.6	2.54	77.7	102	0 - 20
DDD	<0.5	5.0	92.5	88.3	90.4	4.65	79.6	102	0 - 20
Endrin aldehyde	<0.5	5.0	96.3	89.6	93	7.21	78	105	1 - 20
Endosulfan sulfate	<0.5	5.0	95	90.8	92.9	4.52	79.4	102	0 - 20
DDT	<2.0	5.0	98.1	95.6	96.9	2.58	63.5	115	0 - 20
Endrin ketone	<0.5	5.0	97.1	95.8	96.5	1.35	78.2	105	0 - 20
Methoxychlor	<2.0	5.0	83.9	94	89	11.4	53.7	131	0 - 20
EP068B : OP Pesticides									
Dichlorvos	<0.5	5.0	83.3	87.8	85.6	5.26	78	105	0 - 20
Demeton-s-methyl	<0.5	5.0	88.4	82.4	85.4	7.03	79.2	102	0 - 20
Monocroptophos	<2.0	5.0	18.4	15.4	16.9	17.8	0	87.2	0 - 20
Dimethoate	<0.5	5.0	73.7	81.9	77.8	10.5	71.2	107	0 - 20
Diazinon	<0.5	5.0	87.7	84.7	86.2	3.48	77.4	102	0 - 20
Chlorpyrifos methyl	<0.5	5.0	83.4	80.5	82	3.54	76.4	107	0 - 20
Parathion methyl	<2.0	5.0	90	90.5	90.3	0.55	77.1	107	0 - 20
Malathion	<0.5	5.0	97.8	95.1	96.5	2.8	76.6	105	0 - 20
Fenthion	<0.5	5.0	92.2	88.1	90.2	4.55	76.7	105	0 - 20
Chlorpyrifos	<0.5	5.0	91.5	88.1	89.8	3.79	80	104	0 - 20
Parathion	<2.0	5.0	88.5	88.7	88.6	0.23	67.7	113	0 - 20
Pirimphos ethyl	<0.5	5.0	80.6	72.4	76.5	10.7	54	115	0 - 20
Chlorfenvinphos Z	<0.5	5.0	94.1	91	92.6	3.35	77.8	104	0 - 20
Bromophos ethyl	<0.5	5.0	83.7	83.6	83.7	0.12	76.3	108	0 - 20
Fenamiphos	<0.5	5.0	82	85.8	83.9	4.53	74.4	103	0 - 20
Prothiofos	<0.5	5.0	84.8	87.4	86.1	3.02	76	108	0 - 20
Ethion	<0.5	5.0	90.1	86.4	88.3	4.19	73.4	108	0 - 20
Carbofenthion	<0.5	5.0	84.8	89	86.9	4.83	76.2	105	0 - 20
Azinphos methyl	<0.5	5.0	86	98.7	92.4	13.8	71.8	109	0 - 20

BATCH QUALITY CONTROL -- CONTROL SPIKE/DUPLICATE

ALS EP-068 : Pesticides

QC LOT No. : NOCOPW359 ANALYST S.Green

MATRIX: Waters

COMPOUND	Blank Conc	Spike Level	SPIKE QC RESULTS				Control Limits		
			SCS Rec.	DCS Rec.	Average Rec.	RPD	Rec.		RPD
	ug/L	ug/L	%		%	%	Low	High	%
EP068C : Triazines									
Simazine	<0.5	5.0	96.4	97.6	97	1.24	30.3	151	0 - 20
Atrazine	<0.5	5.0	94.6	97.6	96.1	3.12	23.5	120	0 - 20
EP068D :Pyrethroids									
Cypermethrins(multipeaks)	<2.0	5.0	91	102	96.5	11.4	75.9	107	0 - 20
EP068S : OC Surrogate									
Dibromo-DDE	85.1%	10.0	82.7	86.8	84.8	4.84	69.9	118	0 - 20
EP068T : OP Surrogate									
DEF	83.1%	10.0	81.8	84.9	83.4	3.72	75.5	115	0 - 20

COMMENTS:

1) The recovery control limits are based on ALS laboratory statistical data. (Method QWI-ORG/07)

2) The control limits on RPD (relative percent deviation) are fixed.

3) * : Recovery or RPD falls outside of the recommended control limits.

APPENDIX D

Quality Assurance / Quality Control Chain of Custody Sheets

QUALITY ASSURANCE/QUALITY CONTROL FOR WATER SAMPLING NORTH COORANBONG INVESTIGATION AREA

Quality Assurance (QA) was maintained by:

- compliance with a Project Quality Plan written for the objectives of the study;
- using qualified engineers to undertake the field supervision and sampling;
- following the DP operating procedures for sampling, field testing and decontamination as presented in Table D1;
- using NATA registered laboratories for sample testing, that generally utilise standard laboratory methods of the US EPA, the APHA and NSW EPA.

Table D1: Field Procedures

Abbreviation	Procedure Name
FPM LOG	Logging
FPM DECONT	Decontamination of Personnel and Equipment
FPM ENVID	Sample Identification, Handling, Transport and Storage of Contaminated Samples
FPM PIDETC	Operation of Field Analysers
FPM ENVSAMP	Sampling of Contaminated Soils

(from Douglas Partners Field Procedures Manual)

Quality Control (QC) of the laboratory programme was achieved by the following means:

- check replicate - a specific sample was split in the field, placed in separate containers and labelled with different sample numbers, and sent to the laboratory for analysis;
- method blanks - the laboratory ran reagent blanks to confirm the equipment and standards used were uncontaminated;
- laboratory replicates - the laboratory split samples internally and conducted tests on separate extracts;
- laboratory spikes - samples were spiked by the laboratory with a known concentration of contaminants and subsequently tested for percent recovery.
- single control sample (SCS)/ duplicate control sample (DCS) - controlled laboratory sample materials tested by the laboratory for percent recovery, and used for monitoring laboratory preparation technique and reproducibility.

Discussion

A. Check Replicate

The Relative Percent Difference (RPD) between replicate results is used as a measure of laboratory reproducibility and is given by the following:-

$$RPD = \frac{ABS(\text{Replicate result 1} - \text{Replicate result 2})}{(\text{Replicate result 1} + \text{Replicate result 2})/2} \times 100$$

The RPD can have a value between 0% and 200%. An RPD data quality objective of up to 50% is generally considered to be acceptable.

A summary of the results of the soil replicate QA/QC testing is provided in Table D2.

TABLE D2 - RESULTS OF QUALITY CONTROL ANALYSIS - GROUNDWATER

Analyte	B3	Duplicate D1	RPD (%)
pH	5.01	5.04	1
Electrical Conductivity (uS/cm)	674	670	1
Nutrients			
Total Nitrogen as N	0.2	<0.1	N/A
Total Phosphorus	<PQL	<PQL	N/A
Metal			
As	<PQL	<PQL	N/A
Cd	<PQL	<PQL	N/A
Cr	<PQL	<PQL	N/A
Cu	0.005	0.005	0
Pb	0.001	0.001	0
Hg	<PQL	<PQL	N/A
Ni	0.003	0.005	50
Se	<PQL	<PQL	N/A
Zn	0.092	0.082	11
OCPs			
Total OCPs	all <PQL	all <PQL	N/A
Aldrin + Dieldrin	<PQL	<PQL	N/A
Chlordane	<PQL	<PQL	N/A
DDT	<PQL	<PQL	N/A
Heptachlor	<PQL	<PQL	N/A
PCBs	<PQL	<PQL	N/A
Microbiological Parameters			
Faecal Coliforms (CFU/100 mL)	<PQL	<PQL	N/A
E-Coli (CFU/100 mL)	<PQL	<PQL	N/A

Average RPDs ranged from 0% to 50%, with results generally within the acceptable limits.

B. Method Blanks

All method blanks returned results lower than the laboratory detection limit, therefore are acceptable.

C. Laboratory Spikes

Recoveries in the order of 70% to 130% are generally considered to be acceptable. The average percent recovery for individual organic contaminants ranged from 88% to 128%, which is generally within the quality control objectives. The results should however be qualified and may slightly under-estimate or over-estimate contaminant concentrations in certain samples (i.e. biased low or high respectively).

D. Single Control Sample (SCS)/ Duplicate Control Sample (DCS)

Average recoveries fro SCS/DCS samples ranged from 70.8% to 115%, which is generally within the quality control objectives. Recoveries for one OCP and One OPP species were however below 70% recovery but were within the laboratory control limits due to the nature of the analyte. RPDs between the SCS and DCS samples ranged from 0% to 21%, which is within the quality control objectives.

CONCLUSIONS

In summary, it is noted that the magnitude of RPDs for field replicates (i.e. blind replicates) are generally higher than those for laboratory replicates. Field replicate results generally show greater variability than laboratory replicates, because they measure both field and laboratory reproducibility.

The accuracy and precision of the soil testing procedures, as inferred by the QA/QC data is generally considered to be of sufficient standard to allow the data reported to be used to interpret site contamination conditions.

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Coonanbong
Project No: 31720 DP Order No: 43874
DP Contact Person: Matthew Blachent
Prior Storage: esky / fridge / shelved (circle)

To: ALS PTY LTD
5 Rosegum Close
Warabrook NSW 2304
Ph: (02) 4968 9433
Attn: Kathryn McDermott

Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: Heavy Metals	OCP	PCB	Total N	Total Phosphorus	Faecal Coliforms	E-coli	pH	EC	(1)	TCLP	Notes
S1	15/5/03	W		✓	✓	✓	✓	✓	✓	✓	✓	✓	1		Metals: As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn
PQL (S)		mg/kg													
PQL (W)		mg/L													

Batch No: NE102908
Batched Date: 15/5/03
☐ ORG ☐ Soil ☐ Water ☐ Ambient ☐ Chilled ☐ Other ___ °C ☐ Subcontract Work ☐ Bottle Return ☐ Imm, Anal, Actioned
2 x 1L NAT
1 x 1L H2SO4 Plastic
1 x 1L AMBER H2SO4
1 x 250ml HNO3
1 x STERILE JAR

FAXED

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 15/5/03
Total number of samples in container: 1
Results required by:
TAT (Circle): (Standard) 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature:
Date: 15/5/03 Lab Ref: 3pm.

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

Douglas Partners
Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Coorabong
Project No: 31720 DP Order No: 43874
DP Contact Person: Matthew Blackert
Prior Storage: esky / fridge / shelved (circle)

To: ALS PTY LTD
5 Rosegum Close
Warabrook NSW 2304
Ph: (02) 4968 9433
Attn: Kathryn McDermott

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: Heavy Metals (see notes)	OCP	PCB	Total N	Total Phosphorus	Faecal Coliforms	E-Coli	pH	EC						TCLP	Notes
1	Bore 1	20/5/03	W		✓	✓	✓	✓	✓	✓	✓	✓	✓							Metals
2	Bore 2		W		✓	✓	✓	✓	✓	✓	✓	✓	✓							As, Cd, Cr, Cu,
3	Bore 3		W		✓	✓	✓	✓	✓	✓	✓	✓	✓							Pb, Hg, Ni,
4	B2-Spare		W		✓	✓	✓	✓	✓	✓	✓	✓	✓							Se, Zn
5	D1	↓	W		✓	✓	✓	✓	✓	✓	✓	✓	✓							
PQL (S)			mg/kg																	
PQL (W)			mg/L																	

Batch No: NE10351 ORG
Batched Date: 20/5/03
☐ Soil ☐ Ambien
☑ Water ☑ Chilled
☐ Other ___ °C
☐ Subcontract Work
☐ Bottle Return
☐ Imm, Anal, Action
5 X 1L NAT
5 X 1L ~~H2SO4~~ PLAS
5 X 1L AMBER
5 X 250 HNO3
5 X BACTO

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 20/5/03
Total number of samples in container: 5
Results required by:
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature:
Date: 20/5/03 Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

Fmdi 21/5/03 11am

0 - INORG
1 - PUD

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CHAIN OF CUSTODY FIELD SHEET

Client: JW Planning Pty Ltd
Project: Urban Capability & Preliminary Contamination Assessment Project No: 31720
Location: North Cooranbong Investigation Area

Field								DP Office	Despatch	Notes
Sample ID	Depth (m)	Duplicate/ Replicate Sample	Sample Type S-soil W-water	Container Type G-glass P-plastic	Sampling By	Sampling Date	Sampling Time	Received by: MB Date: 15/5/03 Storage Location*	Book 165 Date: 15/5/03	
S1	—	—	W	G/P	MB	15/5/03	12.45	Fridge	/	
Bore 3	—	D1	W	G/P	MB	20/5/03	1.30pm	↓	/+D1	
Bore 1	—	—	W	G/P	"	"	2.00pm		/	
Bore 2	—	—	W	"	"	"	2.10		/	
B2 - Sludge	—	—	W	"	"	"	2.40		/	

Default containers for soil: glass = clear 125/250 mL with teflon liner, plastic =press seal bag
*Default storage: Glass containers in fridge, plastic containers shelved, all water samples in fridge

ALS Environmental

SAMPLE RECEIPT ADVICE

COMPANY: DOUGLAS PARTNERS PTY LTD
ATTENTION: MR MATTHEW BLACKERT
DATE: May. 17, 2003
FROM: Wonnie Condos, ENV NEWCASTLE

ALS has received samples pertaining to your reference: 43874

For future reference the batch number on this order is: NE10208

All samples and paper work were received in good order.
Samples have been received within recommended holding times.
Samples chilled when received.
Samples received in appropriately pretreated and preserved containers.
Please direct any turnaround/technical queries to Cindy Suen.
Any queries relating to sample condition/numbering/breakages should be directed to Wonnie Condos.
ANALYTICAL WORK FOR THIS BATCH WILL BE CONDUCTED AT ALS SYDNEY
All aqueous samples are stored for two weeks and solid samples for three months from the date of completion of the batch, unless specific arrangements are made otherwise.

Purchase Order Number: 43874
Project Name: 31720-COORANBONG

You can expect results to be reported as detailed below:

All Environmental Results May. 26, 2003

A L S - SERVICING YOUR NEEDS BETTER

AUSTRALIAN LABORATORY SERVICES P/L
ABN: 84 009 936 029

BRISBANE	SYDNEY	MELBOURNE	NEWCASTLE	AUCKLAND
Tel: 61-7-3243 7222	Tel: 61-2-8784 8555	Tel: 61-3-9538 4444	Tel: 61-2-4968 9433	Tel: 64-9-379 9437
Fax: 61-7-3243 7218	Fax: 61-2-8784 8500	Fax: 61-3-9538 4400	Fax: 61-2-4968 0349	Fax: 64-9-379 1449

ALS Environmental

SAMPLE RECEIPT ADVICE

COMPANY: DOUGLAS PARTNERS PTY LTD
ATTENTION: MR MATTHEW BLACKERT
DATE: May. 23, 2003
FROM: Wonnie Condos, ENV NEWCASTLE

ALS has received samples pertaining to your reference: 43874

For future reference the batch number on this order is: NE10351

All samples and paper work were received in good order.
Samples have been received within recommended holding times.
Samples chilled when received.
Sample containers do not comply to pretreatment/preservation standards (AS,APHA,USEPA)
Volatile organic compound analysis may be compromised as sample containers contained headspace.
Please direct any turnaround/technical queries to Cindy Suen.
Any queries relating to sample condition/numbering/breakages should be directed to Wonnie Condos.
ANALYTICAL WORK FOR THIS BATCH WILL BE CONDUCTED AT ALS SYDNEY
All aqueous samples are stored for two weeks and solid samples for three months from the date of completion of the batch, unless specific arrangements are made otherwise.

Purchase Order Number: 43874
Project Name: 31720-COORANBONG

You can expect results to be reported as detailed below:

All Environmental Results May. 29, 2003

Comments: HNO3 field filtered preserved containers should be supplied for dissolved metal analysis.

A L S - SERVICING YOUR NEEDS BETTER

AUSTRALIAN LABORATORY SERVICES P/L
ABN: 84 009 936 029

BRISBANE	SYDNEY	MELBOURNE	NEWCASTLE	AUCKLAND
Tel: 61-7-3243 7222	Tel: 61-2-8784 8555	Tel: 61-3-9538 4444	Tel: 61-2-4968 9433	Tel: 64-9-379 9437
Fax: 61-7-3243 7218	Fax: 61-2-8784 8500	Fax: 61-3-9538 4400	Fax: 61-2-4968 0349	Fax: 64-9-379 1449

APPENDIX E

Report – Project 31720-1

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT

on

ADDITIONAL GEOTECHNICAL & CONTAMINATION ASSESSMENT

AVONDALE GREENS & AVONDALE ESTATE COORANBONG

Prepared for

J W PLANNING PTY LTD

Project 31720-1

NOVEMBER 2003

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
on
ADDITIONAL GEOTECHNICAL &
CONTAMINATION ASSESSMENT

AVONDALE GREENS & AVONDALE ESTATE
COORANBONG

Prepared for
J W PLANNING PTY LTD

Project 31720-1
NOVEMBER 2003

Douglas Partners Pty Ltd
ABN 75 053 980 117

Box 324
Hunter Region Mail Centre
NSW 2310 Australia

15 Callistemon Close
Warabrook, NEWCASTLE

Phone: ***02 4960 9600***
Fax: *02 4960 9601*
e-mail: *newcastle@douglaspartners.com.au*

ACEA The Association of Consulting Engineers Australia

DOUGLAS PARTNERS 40 1963-2003

Douglas Partners
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TABLE OF CONTENTS

ATTACHMENTS

MPG:MB:ph

Project No:31720-1

P:\31720/Docs/31720-1.doc

13 November 2003

REPORT ON
ADDITIONAL GEOTECHNICAL & CONTAMINATION ASSESSMENT
AVONDALE GREENS & AVONDALE ESTATE
COORANBONG

1. INTRODUCTION

This report presents the findings of additional geotechnical and contamination assessment undertaken for the following areas:

- Avondale Greens Investigation Area;
- Avondale Estate Investigation Area.

These investigation areas are shown on Drawing 1, attached and are defined as follows:-

Avondale Green Investigation Area

- Lot 1, DP 170378
- Lot Pt 15, DP 182756
- Lot 2, DP 825266
- Lot 1, DP 348173
- Lot 21, DP 865588

Avondale Estate Investigation Area

- Lots 1 to 11, DP 3533.

The work was undertaken at the request of Mr Jason Wasiak of J W Planning Pty Ltd.

The additional assessment was required to address issues raised by Lake Macquarie City Council (LMCC) for the future development of the above areas. This report addresses Items D and E as outlined in our proposal P5124 dated 27 May 2003.

The assessment comprised:

Item D

- Identification of potential natural resources (including gravels and clays) within the two investigation areas;
- Additional analysis of erosion potential by means of Emerson class dispersion testing on retrieved samples.

Item E

Identification of potential contaminant migration from the above areas onto adjacent properties. A number of potential contaminants were identified within the above areas during previous investigations by Douglas Partners Pty Ltd (DP). Additional investigation to assess the potential migration of these contaminants included:

- Review of existing information and previous investigations by DP;
- Water sampling from Felled Timber Creek within Lot 1, DP 170378 and laboratory analysis for a range of analytes, including faecal strep, salmonella, faecal coliforms, heavy metals including As, Cd, Cr, Cu, Pb, Hg, Ni and Zn, total nitrogen, total phosphorus, ammonia, total sulphates;
- Re-testing of the groundwater wells installed within Lot 1, DP 170378 for the above range of analytes;
- Investigation of migration of contaminants from the effluent/sludge pond located within the Avondale Estate investigation area into the North Cooranbong investigation area and adjoining land.

It should be noted that Items D and E (including the assessment of migration of contaminants from the effluent sludge dam) have been discussed separately for the North Cooranbong investigation area under separate cover (i.e. Report No 31720 – Dated October 2003, Ref 1).

2. BACKGROUND

A preliminary site assessment was undertaken in July 2002 by DP (Report No 31498, Ref 2) for the Avondale Greens Estate, which identified potential contamination concerns associated with the current and former areas usage.

Additional investigations were undertaken in April 2003 by DP (Report No 31498A-01 to 31498A-03, Ref 3 to 5), to further assess the potential contaminants identified within the preliminary site assessment.

The additional assessment included sampling and analysis of groundwater within Lot 1, DP170378 and surface water sampling and analysis within Felled Timber Creek. Groundwater and surface water were analysed for a range of potential contaminants to assess the potential impact from the chicken burial pits and chicken manure stockpiles located on the site.

The results of the assessment indicated that there is some potential impact on groundwater quality flowing towards the creek, which is likely to be attributed to the presence of the burial pits. The results of analysis on creek water also suggested that there is impact on surface water quality in the creek over the central area of the site, which could be attributed to groundwater seepage or migration of surface waters. The quality of creek water entering the site was, however, found to be comparable to that leaving the site.

It was noted however that Felled Timber Creek was not flowing at the time of sampling and the results of testing on surface water may not therefore be representative of typical creek water quality when water is flowing.

Additional groundwater and surface water investigation was therefore recommended to confirm that minimal impact on water will result if burial pits within the site (with the exception of pits adjacent to the creek) are left in place. Refer to Report No 31498A-02 (Ref 4) for details.

A separate preliminary site assessment was undertaken in December 2001 (Report No 31393, Ref 6) for Avondale Estate, which identified potential contamination concerns associated with the current and former areas usage.

Additional investigations were undertaken in January 2002 by DP (Report No 31393-1, Ref 7), to assess the effluent sludge dams located on Avondale Estate, which was considered to be of particular concern in the preliminary site assessment.

The investigation involved installing groundwater wells upstream and downstream of the sludge dam and sampling both the groundwater in the wells and the sludge within the dam. The results of the investigation indicated that heavy metal and nutrient groundwater impact had occurred due to migration from the effluent sludge dam. Further investigation was recommended to assess the implications of impact on groundwater from elevated nutrient and heavy metal concentrations.

Additional potential contaminants were identified in the above reports however are unlikely to result in adverse impact off-site. Potential contaminants identified included:-

- Hydrocarbon impact within surface soils in vicinity of garage Lot 1, DP 170378, Lot 15, DP 182756 and Lot 1, DP 348173 and above ground diesel tank within Lot 1, DP 170378.
- Asbestos materials within Lot 1, DP 17037 and Pt Lot 15, DP 182756.
- Nutrient, heavy metal and microbiological impact from effluent disposal system Lot 1, DP 170378, Lot Pt 15, DP 182756 and Lot 1, DP 348173 and Lot 21, DP 865588.
- Potential contaminants associated with the chicken sheds in Lot 1, DP 170378 and Pt Lot 15, DP 182756.

The potential for off-site migration of these contaminants is discussed in Section 6.3.

3. FIELD WORK

3.1 Item D – Natural Resources & Emerson Class Testing

Field work was carried out between 28 and 29 July 2003, and comprised the following:

- 17 backhoe excavated test pits to depths up to 3 m within the Avondale Estate and Avondale Greens Estate;
- Logging by a geo-environmental engineer of the subsurface conditions encountered in the pits;
- Sampling of the subsurface soils for laboratory testing and identification purposes.

3.2 Item E – Assessment of Migration from Burial Pits (Lots 1, DP 170378)

Field work was carried out on 28 July 2003 and comprised the following:

- Purging of the three groundwater wells previously installed in February 2003, using a stainless steel bailer;
- Collection of one groundwater sample from each well using a stainless steel bailer into appropriately preserved laboratory containers for analysis;
- Collection of three surface water samples within Felled Timber Creek into appropriately preserved laboratory containers for analysis (i.e. upstream of the site (C1A), downstream of the site (C3A), and within the site (C2A)). At the time of sampling the creek was not flowing, and samples were collected from pools of stagnant water. It should be noted however that considerable rainfall had fallen within the month prior to sampling.

Reference should be made to Report No 31720 (Ref 1) for details regarding the migration of potential contaminants from the effluent sludge dam.

3.3 Decontamination Procedures

Prior to each sampling event, sampling equipment was decontaminated using phosphate-free detergent and tap water to prevent cross-contamination. Disposable gloves were used for each sampling event.

Stainless steel sampling equipment was used and decontaminated using methylated spirits in combination with phosphate-free detergent and tap water to prevent cross-contamination for all microbiological sampling.

3.4 Quality Assurance/Quality Control

The work was undertaken in accordance with the DP quality system and procedures for contamination assessments as presented in the Company's field procedures manual. A list of the procedures used and information on quality assurance and quality control, including analysis of replicate samples, is attached.

The process of obtaining samples and their transportation, storage and delivery to laboratories for analysis was documented on a DP standard chain-of-custody form. Copies of completed forms are attached.

4. RESULTS

Test Pits

Details of the subsurface conditions encountered in the test pits are presented in the attached test pit report sheets. These should be read in conjunction with the attached general notes, which explain the descriptive terms and classification methods.

A summary of the conditions encountered within the pits is presented below:

From (m)	To (m)	Description
0	0.2 / 0.9	Fill – Filling was encountered in Pits 306 and 316 and comprised clayey gravely sand in Pit 306 and sandy silty clay in Pit 316.
0	0.05/0.3	Silty sand / sandy clay topsoil with trace to abundant rootlets and roots, was encountered in all pits with the exception of Pits 306, 314, 315 and 316. Deeper silty clayey sand layers were encountered in Pit 303 to 0.8 m, Pit 311 from 0.6 m to 1.1 m, Pit 313 from 0.25 m to 0.6 m and Pit 315 from 0.25 m to 0.7 m. Clayey silt (topsoil) was encountered in Pits 307 and 309.
0.0/0.3	0.45/3.0	Generally stiff to hard silty / sandy clays were encountered in all pits. However firm to stiff clay was encountered in Pit 306 from 0.7 m to 2.1 m, located in a low lying area.
0.65/2.3	1.2/4.0	Extremely weathered sandstone or siltstone bedrock was encountered in Pits 300 to 301, 304, 306, 308, 313, 317. Pebbly sandstone was encountered within Pit 314.

Groundwater seepage was observed during excavation at depths ranging from 0.4 m to 1.9 m in Pits 309, 313 and 315.

Measurement of groundwater levels were undertaken in three wells, installed during a previous investigation. The location of these wells is indicated on Drawing 1.

Groundwater level measurements for 5 February 2003 and 28 July 2003 are shown in Table 1 below.

Table 1 – Groundwater Levels

Location	RL Top of Casing (m AHD)	Stickup of Casing (m)	Depth to Water from Top of Casing (m)		RL Groundwater (m AHD)	
			5 February	28 July	5 February	28 July
GW1	9.51	0.71	5.52	5.41	3.99	4.1
GW2	6.74	0.74	3.38	2.84	3.36	3.9
GW3	6.86	0.76	4.32	4.01	2.54	2.85

Notes to Table 1:
RL – Reduced Level (AHD

The above groundwater levels indicate that the groundwater has risen between 0.1 m and 0.5 m since February 2003.

It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

5. LABORATORY TESTING

5.1 Soil Dispersion/Erodibility

Ten selected soil samples were subjected to Emerson crumb testing. The results are summarised in Table 2 below.

Table 2 – Emerson Crumb Test Results

Pit	Depth (m)	Description	Emerson Class No
300	0.5	Silty Clay trace sand– light grey mottled orange-red	6
304	0.9	Sandy Clay– Light orange mottled red	6
305	0.4	Silty Clay some sand– Light orange	6
307	0.5	Silty Sandy Clay – Grey	6
308	0.5	Sandy Clay some silt – Light orange	6
308	0.8	Silty Sandy Clay some sand – Light grey mottled orange-red	6
309	0.3	Silty Clay trace sand – Light orange	6
310	0.4	Sandy Clay – Light orange	6
312	0.5	Silty Clay some sand – Light orange	6
317	0.5	Sandy Clay – Light orange	6

The results of the above tests indicate that the clays are not dispersive.

5.2 Groundwater/Surface Water Quality (Lot 1, DP 170378)

Groundwater and surface water samples were analysed by Australian Laboratory Services Pty Ltd (ALS), (chemical contamination testing) and Enviro-Managers Pty Ltd (microbiological testing), which are both National Association of Testing Authorities, Australia (NATA) accredited laboratories.

One groundwater sample collected from each on the three installed wells (GW1 to GW3) and one sample from upstream, downstream and on-site within Felled Timber Creek (C1 to C3) were sampled and tested for the following potential contaminants.

- Faecal Streptococcus;
- Salmonella;
- Faecal Coliforms;
- Heavy Metals (As, Cd, Cr, Cu, Pb, Zn, Hg & Ni);
- Total Nitrogen;

- Total Phosphorus;
- Ammonia;
- Total Sulphate.

The results of analysis are presented on the laboratory report sheets attached, and summarised in Tables 3 below.

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Table 3 – Results of Groundwater and Surface Water Analysis (Lot 1, DP 170378)

Sample Identification	GW1	GW1A	GW2	GW2A	DGW1	GW3	GW3A	C1	C1A	C2	C2A	C3	C3A	Laboratory PQL	ANZECC (2000) [4]	
															Fresh	Marine
Metal																
As	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.003	<PQL	0.005	<PQL	0.001	<PQL	0.001	0.013[1]	NC
Cd	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	0.0002	0.7
Cr	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	0.001[2]	4.4[2]
Cu	<PQL	0.001	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	0.0014	1.3
Pb	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	<PQL	<PQL	<PQL	0.001	0.0034	4.4
Hg	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0001	0.00006[3]	0.1[3]
Ni	<PQL	<PQL	0.002	0.001	0.002	0.004	0.006	<PQL	<PQL	0.005	<PQL	<PQL	0.001	0.001	0.011	7
Zn	0.003	<0.005	**0.021**	**0.036**	**0.015**	**0.019**	**0.042**	**0.009**	**0.01**	0.003	**0.011**	0.003	**0.013**	0.001	0.008	15
Nutrients																
Ammonia as N	0.11	<PQL	0.03	0.02	0.02	0.16	0.23	0.51	0.1	**18**	0.03	0.84	0.07	0.01	0.9	0.91
Total Nitrogen as N	**1.8**	**12.4**	**20.2**	**21**	**20.3**	**8**	**17.1**	**2**	**0.4**	**36.2**	**0.8**	**5.2**	**0.7**	0.1	0.35*	0.12*
Total Phosphorus as P	**0.58**	**2.54**	**0.59**	**2.08**	**0.47**	**1.52**	**4.03**	**0.58**	**0.1**	**5.05**	**0.09**	**0.62**	0.14	0.01	0.025*	0.025*
Total Sulphate	24	23	23	17	23	16	13	6	7	3	3	1	3	1	1000**	

Notes To Table 3:

Results expressed in mg/L unless otherwise stated
PQL - Practical Quantification Limits
NC - No Criteria
(1) - Arsenic (V) (conservative)
(2) - Chromium (VI)
(3) - Mercury (Inorganic)
(4) - Trigger Values for Slightly to Moderately Disturbed Systems

GW1 to GW3 - (Groundwater samples collected 5/2/03)
GW1A to GW3A (Groundwater samples collected 28/7/03)
DGW1 ia a duplicate of sample GW2
* Trigger Values for NSW eastern flowing coastal Rivers
** - For Protection of Livestock
Concentrations Exceed ANZECC Fresh Water Trigger Values
C1 to C3 - (Creek water samples collected 5/2/03)
C1A to C3A (Ceek water samples collected 28/7/03)

Groundwater Wells (GW1A, GW2 & GW3)

Comparison of Samples Throughout the Site

The results of chemical analysis on groundwater from the upgradient well (sample GW1A), compared with downgradient wells (samples GW2A and GW3A), indicated the following:

- Zinc levels remain significantly higher in the downgradient wells;
- Nitrogen levels remain higher in downgradient wells;
- Phosphorus levels remain similar or marginally higher in downgradient wells.

Comparison With Previous Results

The results of the current chemical analysis on groundwater compared to previous analysis undertaken in February 2003, indicate the following:

- Zinc levels have marginally increased in downgradient wells;
- Nitrogen has increased by approximately seven times in the upgradient well (GW1), however have remained similar for the downgradient wells;
- Phosphorus levels have increased by two to four times above previous levels.

Microbiological testing of groundwater compared to previous analysis undertaken in February 2003, indicate the following:

- Faecal Streptococcus numbers have fallen to undetectable levels within all groundwater samples. Downgradient wells had previously detected minor numbers within groundwater in February 2003;
- Faecal Coliforms (thermotolerant Coliforms) numbers have fallen to undetectable levels within all groundwater samples. Downgradient well GW2 had previously detected a minor number within the duplicate sample taken in February 2003;
- No salmonella was detected within the groundwater samples from current and previous testing.

Creek Water (C1, C2 & C3)

Elevated levels of zinc and nutrients (nitrogen and phosphorus) were detected during the current testing of creek water as occurred in the previous investigation. The results are discussed below:-

- Zinc levels within the creek have increased by up to four times since February 2003, however remain relatively similar from upstream to downstream;
- Nutrient levels (nitrogen, phosphorus and ammonia) have decreased significantly from February 2003, with levels relatively similar or slightly increased from upstream to downstream;
- Levels of nutrients and heavy metals within creek water on the site (C2A) were not detected in significantly greater concentrations than upstream or downstream samples, as was previously found in February 2003.

Microbiological testing of creek water compared to previous analysis undertaken in February 2003, indicate the following:

- Faecal Steptococcus and Faecal Coliforms (thermotolerant Coliforms) numbers have significantly decreased in the creek within the site (i.e. sample C2A);
- Relatively high bacterial contamination was still found in all samples tested;
- Faecal Steptococcus and Faecal Coliforms (thermotolerant Coliforms) numbers however are 2 to 13 times lower upstream.

6. COMMENTS

6.1 Item D - Erosion Hazard

The results of the laboratory testing indicated that the dominant soils at the site (i.e. clay) is non-dispersive.

There is a potential for adverse impacts resulting from erosion upper silty sand topsoil material, such as impacts on water quality due to sediment laden run-off during and following development. Owing to the limited quantity of this material encountered in all pits for depths ranging from 0.1 m to 0.3 m, erosion and sedimentation are readily amenable to mitigation measures such as, silt fences, revegetation / reshaping batters, drainage structures (catch drains), sediment traps and sedimentation basins.

6.2 Natural Resources

Based on the results of the investigations, subsurface conditions across the site are anticipated to generally comprise silty / sandy clays to depths between 0.45 m and 3.0 m overlying bedrock.

The suitability of this material as a resource will depend on the proposed use. Additional laboratory testing may be required to assess the materials suitability for specific uses.

While shallow bedrock was encountered in a number of pits across the two investigation areas, bedrock generally comprised sandstone or siltstone. Gravelly sands (possible conglomerate) were encountered in Pit 314 at the edge of a former quarry. No other pits identified significant gravel quantities, however extensive subsurface investigation within Avondale Estate has not been undertaken at this time and may uncover other areas of gravel deposits.

6.3 Item E - Potential migration of contaminants off-site

The main potential contaminant sources which have the potential to result in off-site impact from the Avondale Greens Estate and Avondale Estate are as follows:

- Burial pits and stockpiles of chicken/cattle waste within Lot 1, DP 170378;
- Effluent sludge dam located in Lot 10, DP 3533.

Other potential contaminants identified within the two estates (and detailed in our Reports Ref 4 and 7) are unlikely to migrate onto neighbouring properties as they are generally immobilised within subsurface soils and are located in areas without shallow groundwater, away from creeks which would allow transportation.

Lot Pt 15, DP 182756

Potential contaminants including hydrocarbons and heavy metals, microbiological and nutrients and asbestos were identified with surface soils and subsurface soils, however are unlikely to migrate of site as the site does not have a shallow water table and is not in close proximity to a creek.

Lot 1, DP 348173 and Lot 21, DP 865588

Potential contamination including hydrocarbons and heavy metals were identified with near surface soils, however, are localised and unlikely to migrate off-site as the site does not contain a shallow water table and is not in close proximity to a creek.

Lot 2, DP 825266

No potential contaminants were identified in the contamination assessment for the site, with the exception of potential burial pits near the western boundary of Lot Pt 15, DP 182756. Potential migration off-site is therefore considered unlikely.

Lots 1 to 11, DP 3533

With the exception of Lot 10, the effluent sludge dam in potential contaminants including heavy metals, hydrocarbons, pesticides, PCB, asbestos may be located across the site. As the source of these potential contaminants are localised within the soil profile and away from areas with creeks and shallow water table, off-site migration of these potential contaminants is unlikely.

The grassed area in the northern portion of the site, utilised for irrigation of treated effluent may contain elevated microbiological contaminants, nutrients and heavy metals, Local topography in the vicinity of the site slopes to the east / south-east towards the eastern and southern boundary of the site. During heavy rainfall it may therefore be possible for surface waters (originating from the irrigation area) to migrate off-site, however, provided the effluent disposal area has been appropriately designed for the quality and quantity of the applied effluent, it is expected that natural attenuation would minimise the risk of off-site impact from this area. Reference should be made to the site specific reports for details.

The issue of migration of potential contaminants from the effluent sludge dam is addressed within DP Report 31720 October 2003 (Ref 1).

Lot 1, DP 170378

The results of the current investigation in regard to Lot 1, DP 170378 indicate:

- Concentrations of metals and nutrients have increased in groundwater samples since previously testing and still indicate impact is occurring from the site (i.e. burial pits);
- Microbiological parameters, while still elevated appear to have been reduced within the creek due to recent rainfall. Current levels, however suggest an increase from upstream to downstream, indicating possible migration and impact to the creek from within the site. There is a possibility of off-site migration of these contaminants via surface water transportation, as indicated by the results of water sample C3, taken from within Felled Timber Creek, downstream of the site.
- Microbiological levels within the groundwater have fallen to undetectable levels within groundwater since February 2003. This may suggest that these decreased contaminant levels are as a result of flushing of the groundwater in the vicinity of the site, transporting the contaminants off-site. As discussed in our previous report, a possible source for contaminants include the burial pits or surface manure stockpiles located on site. While these potential source of contaminants remain on site, there is a continued potential for off-site migration via groundwater.
- Similarly, concentrations of heavy metals and nutrients above the seepage level in ANZECC within creek water, were detected in the current sampling event.

Consequently, there is a potential for off-site migration by surface water transportation.

7. RECOMMENDATIONS

Lot 1, DP 170378

The necessity for remedial measures within the site is dependant on the proposed development. However, there is evidence of continuing off-site migration of contaminant downstream. Consequently, as a minimum, it is suggested that the remedial works as described in the previous report (Ref 4) are undertaken. These remedial works are summarised below.

- remediation and validation of localised hydrocarbon impacted surface soils in the vicinity of the garage and above ground diesel tank (Bores 136 to 139) should be undertaken prior to redevelopment of the site;
- removal and validation of soil/fragments containing asbestos materials (ie. surface fill and ground surface within the garage/shed). The lower walls of the chicken sheds containing possible asbestos sheeting should also be appropriately removed and validated;
- appropriate decommissioning of the existing septic tank, associated pipe work, and effluent disposal area within the site should be undertaken prior to redevelopment;
- remediation and validation of chicken burial pits, surface soils associated with the chicken shed, and cattle waste/compost stockpiles:
  - excavation, lime treatment and disposal of the contents of burial pits, followed by validation;
  - stripping of near surface soils from the floors of the chicken sheds, lime treatment, disposal and validation;
  - stripping of cattle waste/compost stockpiles from the surface over Areas 2 and 3, lime treatment, disposal and validation;
  - spell the site for a period of at least three months, then conduct further microbiological assessment on surface soils prior to development.

Reference 4 should be consulted for full details of the remedial requirements and other relevant information. A remedial action plan (RAP) should be prepared to detail the remedial activities, acceptance criteria, testing requirements and validation works.

Lots Pt 15, DP 182756, Lot 1, DP 348173, Lot 21, DP 865588, Lot 2, DP 825266, Lots 1 to 11, DP 3533

While it is expected that off-site migration of potential contamination from these sites is minimal, with the exception of the effluent sludge pond on Lot 10, DP 3533, site specific remediation and additional assessment should be undertaken as outlined in our specific site assessment reports prior to redevelopment.

8. LIMITATIONS

DP have performed investigation and consulting services for this project in general accordance with current professional and industry standards for land contamination investigation.

Whilst every effort has been made to ensure a representative programme of field and laboratory sampling and testing, conditions different to those identified during these tasks may exist. Therefore DP, nor any other reputable consultant, can provide unqualified warranties nor does DP assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change over time in response to variations in natural conditions, chemical reactions and other events, eg. groundwater movement and/or spillage's of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

No site investigations can be thorough enough to provide absolute confirmation of the presence or absence of substances which may be considered contaminating, hazardous or polluting. Similarly the level of testing undertaken cannot be considered to unequivocally characterise the degree or extent of contamination on the site. In addition, regulatory or guideline criteria for the evaluation of environmental soil and groundwater quality are frequently being reviewed and concentrations of contaminants which are considered acceptable in the present may in the future be considered unacceptable.

This report and associated documentation and the information herein have been prepared solely for the use of J W Planning Pty Ltd and any reliance assumed by other parties on this report shall be at such parties own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

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REFERENCES:

1. Douglas Partners Pty Ltd, "Preliminary Geotechnical Assessment, Proposed rezoning from rural to urban, North Cooranbong Investigation Area" Project 31720 October 2003.

2. Douglas Partners Pty Ltd, "Report on Preliminary Site Assessment, Lot 1, DP 170378, Lot 2, DP 825266, Lot Pt 15, DP 182756, Lot 1, DP 348173, Lot 21, DP 865588, Alton Road and Freemans Drive, Cooranbong, NSW" Project 31498 July 2002.

3. Douglas Partners Pty Ltd, "Report on Additional Contamination Assessment, Lot 2, DP 825266, Lot 21, DP 865588, Lot 1, DP 348173, , Alton Road and Freemans Drive, Cooranbong, NSW" Project 31498A-01 April 2003.

4. Douglas Partners Pty Ltd, "Report on Additional Contamination Assessment, Lot 1, DP 170378, Alton Road, Cooranbong, NSW" Project 31498A-02 April 2003.

5. Douglas Partners Pty Ltd, "Report on Additional Contamination Assessment, Lot Pt 15, DP 182756, Alton Road, Cooranbong, NSW" Project 31498A-03 April 2003.

6. Douglas Partners Pty Ltd, "Report on Preliminary Site Assessment, Lot 1 to 11, DP 3533, Avondale Road, Cooranbong, NSW" Project 31393 December 2001.

7. Douglas Partners Pty Ltd, "Report on Effluent Sludge Dam Assessment, Lot 10, DP 3533, Off Avondale Road, Cooranbong" Project 31393-1 January 2002.

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments
Sandstone:	More than 50% of the rock consists of sand sized (.06 to 2mm) fragments
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fs	Rock substance unaffected by weathering, limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics (Reference).

Strength Term	Is(50) MPa	Field Guide	Approx. qu MPa*
Extremely Low:	0.03	Easily remoulded by hand to a material with soil properties	0.7
Very Low:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Low:	0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium:	1	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
High:	3	A piece of core 150 mm long x 50 mm dia. cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very High:	10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely High:		A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	

* The approximate unconfined compressive strength (qu) shownin the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks

Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with occasional shorter and longer sections.
Slightly Fractured:	Core lengths are generally 300 mm - 1000 mm with occasional longer sections and occasional sections of 100 mm - 300 mm.
Unbroken:	The core does not contain any fracture.

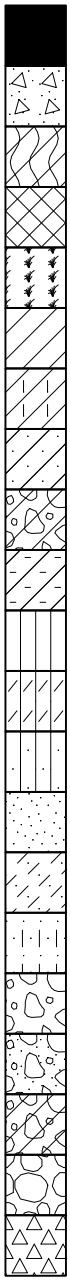
REFERENCE

International Society of Rock Mechanics, Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1 Final Draft October 1972

Log\GRAPHIC-SYMBOLS 24/11/2003 4:38:57 PM

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

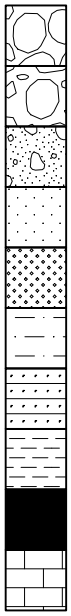
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

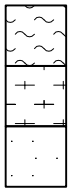
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

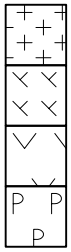


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 300
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Grey silty sand with trace rootlets, moist to very moist	D,pp	0.15	180 kPa
0.3	SILTY CLAY - Very stiff, light grey mottled orange-red silty clay with trace fine grained sand, M>Wp	D,pp	0.5	300-340 kPa
	sand content increasing with depth	D,pp	0.9	390 kPa
0.95	CLAYEY SAND - Light grey fine to coarse grained clayey sand, moist to very moist			
1.3	SANDSTONE - Extremely weathered, light grey mottled grey fine to coarse grained sandstone	D	1.25	
		D	1.35	
1.9	TEST PIT DISCONTINUED AT 1.9m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 301
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	CLAYEY SAND - Light grey clayey sand with some rootlets, damp to moist	D,pp	0.1	150 kPa
0.25	SILTY CLAY - Very stiff, light brown mottled orange silty clay, M>Wp	D,pp	0.4	230 kPa
0.55	SILTY CLAY - Very stiff, light grey mottled red silty clay, M>Wp	D,pp	0.65	230 kPa
1.05	SILTY CLAY - Very stiff, light grey mottled light brown silty clay, M>Wp	D,pp	1.2	280 kPa
1.3	SANDSTONE - Extremely low strength, extremely weathered, light grey mottled orange sandstone	D	1.35	
1.95	TEST PIT DISCONTINUED AT 1.95m slow progress / refusal			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.1.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 302
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.05	TOPSOIL - Brown clayey sand topsoil with abundant rootlets			
	CLAY - Very stiff, orange-brown clay with trace sand, M>Wp	D,pp	0.3	370-380 kPa
0.65	SANDSTONE - Extremely low strength, extremely weathered, light grey sandstone			
1	from 1.0m, very low to low strength	D	1.0	
1.2	TEST PIT DISCONTINUED AT 1.2m refusal			
2				
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 303
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Brown silty sand with some rootlets, damp	D	0.2	
0.25	SILTY SAND - Orange-brown silty sand with trace clay, moist	D	0.5	
0.8	SILTY CLAY - Very stiff, orange-brown silty clay, M>Wp	D,pp	1.0	230 kPa
1.5	SILTY CLAY - Hard, light grey mottled red silty clay with trace ironstained gravel, M>Wp	D,pp	2.0	450-500 kPa
3.0	TEST PIT DISCONTINUED AT 3.0m limit of reach			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 308
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.15	TOPSOIL - Light grey-grey clayey sand with abundant rootlets, moist	D	0.1	
	SANDY CLAY - Very stiff to hard, light orange sandy clay with some silt, M>Wp	D,pp	0.5	270-450 kPa
0.7	SILTY SANDY CLAY - Very stiff to hard, light grey mottled orange-red silty sandy clay, M>Wp	D,pp	0.8	370-420 kPa
1.2	SANDY CLAY - (Extremely weathered sandstone), very stiff to hard, light grey mottled red sandy clay, M<Wp	D,pp	1.4	360-420 kPa
1.9	SANDSTONE - Extremely weathered, light grey mottled red fine to medium grained sandstone (clayey sand)	D	2.0	
2.2	TEST PIT DISCONTINUED AT 2.2m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: Possible slight seepage from 0.85m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 304
DATE: 28 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey-brown silty sand with abundant roots, moist to very moist	D	0.15	
0.25				
0.3	CLAYEY SAND - Light orange mottled red clayey fine to medium grained sand, moist to very moist			
	SANDY CLAY - Very stiff to hard, light orange mottled red fine to medium grained sandy clay, M>Wp	D,pp	0.5	>400 kPa
	from 0.7m, becoming stiff to very stiff	D,pp	0.9	200-250 kPa
1				
	from 1.6m, with some iron-cemented gravel			
1.75	SILTY CLAY - Hard, light grey mottled orange-red silty clay with some fine to medium grained sand, M>Wp	D,pp	1.8	>450 kPa
2				
2.3				
2.4	SANDSTONE - Extremely weathered, light grey mottled orange red fine to coarse sandstone	D	2.35	
	TEST PIT DISCONTINUED AT 2.4m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U,	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: SB
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 305
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.1	SILTY SAND - Grey silty sand with some roots, moist			
	SILTY CLAY - Very stiff, light orange silty clay with some fine to medium sand, M>Wp	D,pp	0.4	220-280 kPa
0.6	SILTY CLAY - Hard, light grey mottled red silty clay, trace fine to medium sand	D,pp	0.8	>400 kPa
1				
	from 1.5m, sand content increasing with depth, with some iron-cemented gravel	D	1.6	
	from 1.9m, grading to extremely weathered siltstone	D	2.0	
2.1	TEST PIT DISCONTINUED AT 2.1m			
2				
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 306
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	FILLING - Generally comprising light grey partially cemented clayey gravelly sand with some roots, moist	D D	0.1 0.15	
0.2	TOPSOIL - Grey sandy clay / clayey sand with some roots, moist			
0.3	SANDY SILTY CLAY - Stiff to very stiff, light orange fine to medium sandy silty clay, M>Wp	D,pp	0.5	170-240 kPa
	from 0.7m, M>>Wp, firm to stiff	D,pp	0.9	70-130 kPa
1				
1.2	SILTY CLAY - Firm to stiff, light grey mottled orange-red silty clay trace to some fine to medium sand and iron-cemented gravel, M>>Wp	D,pp	1.3	70-90 kPa
	from 1.8m, light grey grading to sandstone			
2				
2.1	SANDSTONE - (Clayey sand), extremely weathered, light grey mottled red fine to medium grained sandstone with some fine to medium gravel	D	2.2	
2.3	TEST PIT DISCONTINUED AT 2.3m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 307
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	CLAYEY SILT - Very soft to soft, dark grey clayey silt with some roots / rootlets, very moist	D	0.15	
0.3	SILTY SANDY CLAY - Stiff, grey silty sandy clay, M>>Wp	D,pp	0.5	120-200 kPa
	from 0.7m, stiff to very stiff			
1				
2		D,pp	2.0	350-450 kPa
2.2	TEST PIT DISCONTINUED AT 2.2m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 309
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
0.15	TOPSOIL - Dark grey clayey silt with some rootlets, moist	D	0.1	
	SILTY CLAY - Very stiff, light orange silty clay with trace fine to medium sand, M>Wp	D,pp	0.3	290-320 kPa
0.5	SILTY CLAY - Stiff to very stiff, light grey mottled orange silty clay, M>Wp			
0.85		D,pp	0.8	120-190 kPa
	SILTSTONE - Extremely weathered, light grey siltstone, wet	D	0.9	
1.0	TEST PIT DISCONTINUED AT 1.0m near backhoe refusal			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 310
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing: Type	Depth (m)	Results
	SILTY SAND - Grey silty sand with trace roots, moist	D	0.1	
0.25	SANDY CLAY - Hard, light orange sandy clay, M>Wp	D,pp	0.4	>600 kPa
0.65	SILTY SANDY CLAY - Hard, light grey mottled red silty fine to medium grained sandy clay, M>Wp	D,pp	0.8	450 kPa
1.3	SILTY CLAY - Hard, light grey mottled orange silty clay (extremely weathered siltstone)	D,pp	1.4	>600 kPa
1.7	SILTSTONE - Extremely weathered, light grey-grey mottled red siltstone	D	1.9	
2.0	TEST PIT DISCONTINUED AT 2.0m			

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 311
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing: Type	Depth (m)	Results
	TOPSOIL - Grey silty sand with abundant rootlets, moist	D	0.1	
0.2	SANDY CLAY - Stiff to very stiff, light orange sandy clay, M>Wp Mottled red from 0.4m	D	0.3	
0.6	SAND - Light grey mottled orange fine to medium grained with some clay, moist from 0.8m, partially cemented	D	0.7	
1		D	1.0	
1.1	SILTY CLAY - Very stiff, light grey mottled red silty clay, M>Wp	D,pp	1.2	230 kPa
1.35	SANDY CLAY / CLAYEY SAND - Light grey mottled orange clayey sand, moist	D	1.8	
2	grading to extremely weathered sandstone			
2.1	TEST PIT DISCONTINUED AT 2.1m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: SB
Date: 13.11.03

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 312
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SILTY SAND - Grey silty sand some rootlets, moist to very moist	D	0.1	
0.2	SILTY CLAY - Very stiff, light orange silty clay with some sand, M>Wp	D,pp	0.5	250-300 kPa
0.65	SANDY CLAY - Hard, light grey mottled orange-red sandy clay, M<Wp	D,pp	0.7	400-430 kPa
1	from 1.4m, light grey mottled red, trace fine to medium gravel, grading to extremely weathered sandstone			
2	moisture content increasing with depth	D	2.1	
2.3	TEST PIT DISCONTINUED AT 2.3m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U,	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 313
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Dark grey silty sand with abundant roots, very moist	D	0.1	
0.25	CLAYEY SAND - Very loose to loose, light grey clayey sand, very moist to saturated	D,pp	0.5	<50 kPa
0.6	SANDY CLAY / CLAYEY SAND - Stiff to very stiff, light grey mottled orange clayey sand/ sandy clay, M>>Wp	D,pp	0.8	230-290 kPa
1	moisture content decreasing with depth			
1.4	SANDY CLAY - Hard, light grey sandy clay, M>Wp	D,pp	1.5	>600 kPa
	from 1.7m, grading to extremely weathered sandstone			
1.9	SANDSTONE - Extremely weathered, light grey fine to medium grained sandstone	D	2.2	
2				
2.4	TEST PIT DISCONTINUED AT 2.4m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: Seepage from 0.4 m to 0.6 m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 314
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	SANDY CLAY - Orange sandy clay with some to intermixed fine to medium gravel from 0.7m to 1.1m, clayey	D	0.3	
0.45	GRAVELLY SAND - (Pebbly sandstone?), light grey-orange fine grained partially cemented gravelly fine to medium grained sand, moist	D	0.6	
	From 0.7m to 1.1m, with some clay	D	0.9	
1.1	GRAVELLY SAND - (Extremely weathered pebbly sandstone), light grey/orange fine to medium gravelly sand with trace clay (extremely weathered conglomerate/pebbly sandstone)	D	1.2	
		D	1.9	
2.0	TEST PIT DISCONTINUED AT 2.0m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.11.03

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 315
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	CLAYEY SAND - Grey clayey sand, very moist to wet	D	0.1	
0.25	SILTY GRAVELLY SAND - Very loose to loose, light grey silty gravelly sand, wet to saturated	D	0.4	
0.7	SANDY CLAY - Stiff to very stiff, light grey mottled orange sandy clay, M>>Wp	D,pp	0.8	120-250 kPa
1	from 1.0m, with some ironcemented gravel	D,pp	1.2	190-320 kPa
1.8	SILTY CLAY - Very stiff, light grey mottled red silty clay with some fine to medium gravel, M>>Wp (possibly extremely weathered sandstone)	D,pp	1.95	270-390 kPa
2				
2.1	TEST PIT DISCONTINUED AT 2.1m			
3				

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: Seepage from 0.5m to 0.7m, strong seepage from 1.9m

REMARKS: Very boggy conditions

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials: BB
Date: 13-11-03

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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 316
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	FILLING - Generally comprising light grey-orange mottled red sandy silty clay, M>Wp	D	0.5	
0.9	SILTY SAND - Grey silty sand, moist			
1.1	SANDY CLAY - Stiff to very stiff, light orange sandy clay, M>Wp	D,pp	1.2	190-240 kPa
		D,pp	2.0	120-180 kPa
2.2	TEST PIT DISCONTINUED AT 2.2m			

RIG: 4WD Cat Backhoe

LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U,	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13-11-03

Douglas Partners
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TEST PIT REPORT

CLIENT: J W Planning
PROJECT: Additional Geotechnical Investigation
LOCATION: Avondale Greens & Avondale Estate, Cooranbong

PROJECT No: 31720
SURFACE LEVEL: -

PIT No: 317
DATE: 29 Jul 03
SHEET 1 OF 1

Depth (m)	Description of Strata	Sampling & Testing		
		Type	Depth (m)	Results
	TOPSOIL - Grey silty sand with abundant rootlets, moist	D	0.1	
0.2	SANDY CLAY - Very stiff to hard, light orange sandy clay, M>Wp	D,pp	0.5	>600 kPa
	from 0.7m, mottled red			
0.8	SANDY CLAY - Hard, light grey mottled orange-red sandy clay with some iron-cemented gravel	D,pp	1.0	>600 kPa
1				
	sand content increasing with depth			
	from 1.6m, light grey mottled red	D,pp	1.7	290-420 kPa
	from 1.9m, grading to sandstone			
2				
2.1	SANDSTONE - Extremely weathered, light grey mottled orange sandstone	D	2.2	
2.3	TEST PIT DISCONTINUED AT 2.3m			
3				

RIG: 4WD Cat Backhoe
LOGGED: Blackert

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	PID	Photo Ionisation Detector
D	Disturbed sample	U_x	Tube sample (x mm dia.)
M	Moisture content (%)	Wp	Plastic limit

CHECKED
Initials:
Date: 13.1.03

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Douglas Partners Pty Ltd
ABN 75 053 980 117

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Australia

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Warabrook NSW 2304

Phone (02) 4960 9600
Fax: (02) 4960 9601
newcastle@douglaspartners.com.au

DETERMINATION OF EMERSON CLASS NUMBER OF SOIL

Client: J W Planning Pty Ltd

Project: Additional Geotechnical Investigation

Location: Avondale Green Estate and Avondale Estate, Cooranbong

Project No: 31720
Report No: N03-140
Report Date: 22.8.03

Date of Test: 12.8.03
Page: 1 of 1

SAMPLE NO	DEPTH (m)	DATE SAMPLED	DESCRIPTION	WATER TYPE	WATER TEMP	CLASS NO.
TP 300	0.5	30.7.03	Light grey mottled orange/red silty clay with trace sand	Distilled	16.3	6
TP 304	0.9	30.7.03	Light orange mottled red sandy clay	Distilled	16.3	6
TP 305	0.4	30.7.03	Light orange silty clay with some sand	Distilled	16.3	6
TP 307	0.5	30.7.03	Grey silty sandy clay	Distilled	16.3	6
TP 308	0.5	30.7.03	Light orange sandy clay with some silt	Distilled	16.3	6
TP 308	0.8	30.7.03	Light grey mottled orange/red silty sandy clay	Distilled	16.3	6
TP 309	0.3	30.7.03	Light orange silty clay with trave sand	Distilled	16.3	6
TP 310	0.4	30.7.03	Light orange sandy clay	Distilled	16.3	6
TP 312	0.5	30.7.03	Light orange silty clay with some sand	Distilled	16.3	6
TP 317	0.5	30.7.03	Light orange sandy clay	Distilled	16.3	6

Test Method(s): AS 1289 3.8.1 - 1997

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001

Remarks:

NATA Accredited Laboratory No 1670
This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full

Approved Signatory:

Tested: DM
Checked: DM

D Millard
Laboratory Manager

RECEIVED
13 AUG 2003

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR GREG TAYLOR	**BATCH:**	NE11026
CLIENT:	DOUGLAS PARTNERS PTY LTD	**SUB BATCH:**	0
ADDRESS:		**LABORATORY:**	NEWCASTLE
	PO BOX 324	**DATE RECEIVED:**	28/07/2003
	HUNTER REGION MAIL CENTRE 2310	**DATE COMPLETED:**	07/08/2003
		SAMPLE TYPE:	WATER
ORDER No.:	46370	**No. of SAMPLES:**	6
PROJECT:	31720		

COMMENTS

Sulphate determined after HCl digest. Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
WARABROOK NSW 2304

Phone: 61-2-4968 9433
Fax: 61-2-4968 0349
Email: kathy.mcdermott@alsenviro.com

Signatory Greg Voget

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

Batch: NE11026
Sub Batch: 0
Date of Issue: 07/08/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION					
	Laboratory I.D.			1	2	3	4	5	6
	Date Sampled			28/07/2003	28/07/2003	28/07/2003	28/07/2003	28/07/2003	28/07/2003
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	C1A	C2A	C3A	GW1A	GW2A	GW3A
ED-041	Sulphate - Turbidimetric	mg/L	1	7	3	3	23	17	13
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
EG-020F	Copper - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.006
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
EG-020F	Zinc - Filtered	mg/L	0.005	0.010	0.011	0.013	<0.005	0.036	0.042
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK-055A	Ammonia as N	mg/L	0.01	0.10	0.03	0.07	<0.01	0.02	0.23
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	0.01	0.01	0.02	0.06	12.0	<0.01
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	0.4	0.8	0.7	12.4	9.0	17.1
EK-062A	Total Nitrogen as N	mg/L	0.1	0.4	0.8	0.7	12.4	21.0	17.1
EK-067A	Total Phosphorus as P	mg/L	0.01	0.10	0.09	0.14	2.54	2.08	4.03

Batch: NE11026
Sub Batch: 0
Date of Issue: 07/08/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 31720

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202							
		Date Sampled		28/07/2003	28/07/2003	28/07/2003							
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	LCS	MS							
				CHECKS AND SPIKES									
ED-041	Sulphate - Turbidimetric	mg/L	1	<1	----	----							
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	95.0%	101%							
EG-020F	Cadmium - Filtered	mg/L	0.001	<0.001	97.0%	101%							
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	91.0%	96.0%							
EG-020F	Copper - Filtered	mg/L	0.001	<0.001	94.0%	100%							
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001	93.0%	97.0%							
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	100%	101%							
EG-020F	Zinc - Filtered	mg/L	0.005	<0.005	101%	106%							
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	98.0%	93.0%							
EK-055A	Ammonia as N	mg/L	0.01	<0.01	104%	107%							
EK-059A	Nitrite and Nitrate as N	mg/L	0.01	<0.01	93.0%	85.0%							
EK-061A	Total Kjeldahl Nitrogen as N	mg/L	0.1	<0.1	107%	108%							
EK-062A	Total Nitrogen as N	mg/L	0.1	----	----	----							
EK-067A	Total Phosphorus as P	mg/L	0.01	<0.01	96.0%	97.0%							

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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Cooranbong North
Project No: 31720 DP Order No:
DP Contact Person: Greg Paglo
Prior Storage: esky / fridge / shelved (circle)

To: ALS PTY LTD
5 Rosegum Close
Warabrook NSW 2304
Ph: (02) 4968 9433
Attn: Kathryn McDermott

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: Metals #	TP	TN	Total Sulphate	Ammonia	TCLP	Notes
(1)	C1A	28/7/03	W		-	-	-	-	-	✓	Metals to be filtered
(2)	C2A	↓	↓		-	✓	-	✓	-		
(3)	C3A				-	✓	-	✓	-		
(4)	GW1A				-	✓	-	✓	-		
(5)	GW2A				-	✓	-	✓	-		
(6)	GW3A	↓	↓		✓	✓	-	✓	-		
	PQL (S)		mg/kg								
	PQL (W)		mg/L								

FAXED

Batch No. NE11026 ☐ ORG
Batched Date: 28/7
☐ Soil ☐ Ambient
☑ Water ☑ Chilled
☐ Other °C
☐ Subcontract Work
☐ Bottle Return
☐ Imm, Anal, Actioned
12 x 1L NAP
6 x 1L H_2SO_4 (P)

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 28/7/03
Total number of samples in container: 18
Results required by:
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: IOMN 12:5 30/7 IOMN
Date: 28/7 Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

SRANE11026

ALS Environmental

SAMPLE RECEIPT ADVICE

COMPANY: DOUGLAS PARTNERS PTY LTD
ATTENTION: MR GREG TAYLOR
DATE: Jul. 31, 2003
FROM: Zoran Dokonal, ENV NEWCASTLE

ALS has received samples pertaining to your reference: 46370

For future reference the batch number on this order is: NE11026

All samples and paper work were received in good order.
Samples have been received within recommended holding times.
Samples chilled when received.
Samples received in appropriately pretreated and preserved containers.
Please direct any turnaround/technical queries to Cindy Suen.
Any queries relating to sample condition/numbering/breakages should be directed to Zoran Dokonal.
ANALYTICAL WORK FOR THIS BATCH WILL BE CONDUCTED AT ALS SYDNEY
All aqueous samples are stored for two weeks and solid samples for three months from the date of completion of the batch, unless specific arrangements are made otherwise.

Purchase Order Number: 46370
Project Name: 31720

You can expect results to be reported as detailed below:

All Environmental Results Aug. 06, 2003

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A.B.N. 18 072 428 810

A.C.N. 072 428 810

www.enviromanagers.com.au

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22 AUG 2003

Analytical Report

Douglas Partners
PO Box 324
Hunter Region Mail Centre
NSW, 2310

Phone: **0249 609600**
Fax: **0249 609601**

Contact Name: **Mr Matthew Blackert**

Report Number: **H03/0803**

Sample(s) Received: **28/07/2003**
Client Reference: **Water**
Batch Number: **H02095**

Results Approved By:

The tests, calibrations or measurements covered by this document have been performed in accordance with NATA requirements which include the requirements of ISO/IEC 17025 and are traceable to national standards of measurement.

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Accreditation No. (Chemical Testing)
Accreditation No. 14193 (Biological Testing)

Tomas D. Cardona
Microbiologist

Results:

Client Id		C1A	C2A	C3A	GW1A	GW2A
Laboratory Id		H02095/001	H02095/002	H02095/003	H02095/004	H02095/005
Faecal Streptococcus MF						
Method: APHA 9230	*Units: cfu/100mL*	30	285	170	-	-
Faecal Streptococcus MPN #						
Method: APHA 9230	*Units: MPN/100mL*	-	-	-	<0.3	<0.3
Salmonella spp. #						
Method:	*Units: cfu/100mL*	ND	ND	ND	ND	ND
Thermotolerant Coliforms MF						
Method: APHA 9222	*Units: cfu/100mL*	64	120	840	-	-
Thermotolerant Coliforms MPN						
Method: APHA 9221	*Units: MPN/100mL*	-	-	-	<0.3	<0.3

Date Reported: Tuesday August 12, 2003

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4/13 Geary Place
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nowralab@enviromanagers.com.au
P.O. Box 3105
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Fax: 02 4423 2083

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HEATHERBRAE NSW 2324
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RAYMOND TERRACE NSW 2324
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Analytical Report — *Report No: H03/0803*

Results:

Client Id		**GW3A**				
Laboratory Id		**H02095/006**				
Faecal Streptococcus MF						
Method: APHA 9230	*Units: cfu/100mL*	-				
Faecal Streptococcus MPN #						
Method: APHA 9230	*Units: MPN/100mL*	<0.3				
Salmonella spp. #						
Method:	*Units: cfu/100mL*	ND				
Thermotolerant Coliforms MF						
Method: APHA 9222	*Units: cfu/100mL*	-				
Thermotolerant Coliforms MPN						
Method: APHA 9221	*Units: MPN/100mL*	<0.3				

Notes:

Notes: Samples GW1A, GW2A and GW3A were analysed by MPN methods for Faecal Coliforms and Faecal Streptococcus.
This report supersedes any reports previously issued relating to the sample(s) included.
# Denotes method not covered by NATA terms of accreditation.
Test(s) commenced on day of receipt of sample(s) into the Laboratory.
Samples analysed as received.
Symbols Used:
< = less than.
> = greater than.
MPN = Most Probable Number.
cfu = Colony Forming Units.
ND = Not Detected by the conditions of this test.

Date Reported: Tuesday August 12, 2003

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HEATHERBRAE:
13 Motto Lane,
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help@enviromanagers.com.au
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RAYMOND TERRACE NSW 2324
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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Cooranbong North
Project No: 31720 DP Order No:
DP Contact Person: Greg Taylor
Prior Storage: esky / fridge / shelved (circle)

To: Environmental Managers
13 Mello Lane
Heatherbrae
Ph: 4987 4150
Attn: Tom Cardona

Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: Faecal Coliforms	Faecal Strep	Salmonella													TCLP	Notes
C1A	28/7/03	W		✓	✓	✓														
C2A	↓	↓		✓	✓	✓														
C3A				✓	✓	✓														
GW1A				✓	✓	✓														
GW2A				✓	✓	✓														
GW3A	↓	↓		✓	✓	✓														
PQL (S)		mg/kg																		
PQL (W)		mg/L																		

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 28-7-03
Total number of samples in container: 12
Results required by:
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: TOM CARDONA
Date: Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

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CHAIN OF CUSTODY FIELD SHEET

Client: JW Planning Pty Ltd
Project: ADDITIONAL CONTAMINATION ASSESSMENT Project No: 31720
Location: Lot 1, DP 870378 Alton Rd, Cooranbong

Field								DP Office	Despatch	Notes
Sample ID	Depth (m)	Duplicate/ Replicate Sample	Sample Type S-soil W-water	Container Type G-glass P-plastic	Sampling By	Sampling Date	Sampling Time	Received by: CT Date: 28/7/03 Storage Location*	☑ ALS+ENVIRO-MIN Date: 28/7/03	
C1A	–	–	W	P	CT	28/7/03	11:30	fridge	✓	Metals to
C2A	–	–	W	P	↓	↓	↓	↓	✓	be filtered from
C3A	–	–	↓	↓	↓	↓	12pm	↓	✓	one of the
GW1A	–	–	↓	↓	↓	↓	12:30pm		✓	natural
GW2A	–	D1	↓	↓	↓	↓	12:45		✓	containers
GW3A	–	–	↓	↓	↓	↓	1pm	↓	✓	

Default containers for soil: glass = clear 125/250 mL with teflon liner, plastic =press seal bag
*Default storage: Glass containers in fridge, plastic containers shelved, all water samples in fridge

LOCALITY PLAN

LEGEND

- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE GROUNDWATER WELLS (GW) & SURFACE WATER (C) SAMPLE LOCATIONS
- APPROXIMATE SITE BOUNDARY - AVONDALE ESTATE
- APPROXIMATE SITE BOUNDARY - AVONDALE GREENS ESTATE

40 0 40 80 120 160 200 Metres

DRAWING ADAPTED FROM PLAN SUPPLIED BY CLIENT, REF MGABASEMAPA

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: TEST LOCATION PLAN
ADDITIONAL GEOTECHNICAL INVESTIGATION
AVONDALE GREENS ESTATE & AVONDALE ESTATE, COORANBONG

CLIENT: J W PLANNING PTY LTD

DRAWN BY: PH	SCALE: 1:10000	PROJECT No: 31720	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1