Dear Sir,

RE: GEOTECHNICAL ASSESSMENT REPORT
BAIRNSDALE LANDFILL - STAGE 2
BAIRNSDALE VIC

We have pleasure in submitting our geotechnical assessment report for the sourcing of clay material to construct an engineered clay liner at the above site. Three copies of the report are provided for your information.

We trust this report meets your current requirements for the design of the above project. Please contact the undersigned, or Mr. Bojan Knezevic at this office on (02) 6023 3799 for any queries regarding this report or further assistance.

For and on behalf of
COFFEY GEOSCIENCES PTY LTD

TONY EDWARDS - PRINCIPAL

Distribution:

3 copies Infrastructure Solutions Pty Ltd
1 copy Coffey Geosciences Pty Ltd Library
Original Held by Coffey Geosciences Pty Ltd
TABLE OF CONTENTS

1. INTRODUCTION

2. FIELDWORK

3. LABORATORY TESTING

4. SITE CONDITIONS
   4.1 Regional Geology
   4.2 Subsurface Conditions
   4.3 Groundwater

5. GEOTECHNICAL ASSESSMENT
   5.1 Investigation Finding.
      5.1.1 Soil Permeability
      5.1.2 Soil Dispersion
      5.1.3 Liner Materials
   5.2 Earthworks
      5.2.1 Excavation Conditions
      5.2.2 Fill Placement

6. APPLICABILITY

IMPORTANT INFORMATION ABOUT YOUR COFFEY REPORT

Table 2. Extraction Zones for Clay Liner Materials

Figure
   1 Field Investigation Plan

Appendix
   A Results of Field Investigation
   B Results of Laboratory Tests
1. INTRODUCTION

This report presents a geotechnical assessment for the source of clay material to construct an engineered clay liner at the Bairnsdale Landfill – Stage 2, Bairnsdale VIC. Coffey Geosciences Pty Ltd (Coffey) carried out the geotechnical assessment that was commissioned by Mr Trevor Woodcock of Infrastructure Solutions Pty Ltd in accordance with our proposal (AW1781/1-PAA, dated 07 June 2004).

The objectives of the assessment were to determine the suitable soil from the available soil sourcing area, for use as a clay liner at the proposed landfill extension.

The scope of the work carried out to meet the above objectives included:

- Fieldwork involving the excavation and logging of 20 test pits;
- Assessment of subsurface conditions, including groundwater conditions;
- Laboratory testing including five Falling Head Permeability and eleven Emerson Crumb tests;
- Recommendations for suitable earthworks, and
- Preparation of this geotechnical report.

2. FIELDWORK

The fieldwork was carried out on 26 August 2004 and comprised excavation of twenty test pits to depths ranging from 1.8 to 3.5m below the ground level.

A geotechnician from Coffey observed the excavation of the test pits and logged the encountered subsurface soils and conditions within the test pits. Disturbed and bulk soil samples were collected from the test pits and returned to our laboratory for further assessment and testing.

Engineering excavation logs, together with explanation sheets outlining the terms and symbols used in their preparation, are presented in Appendix A.

3. LABORATORY TESTING

The following geotechnical laboratory tests were undertaken to assist in assessing the engineering properties of the soils at the site:

- 4 No. Falling Head Permeability Tests using distilled water;
- 1 No. Falling Head Permeability Test using saline solution;
- 10 No. Emerson Crumb Tests using distilled water, and
- 1 No. Emerson Crumb Test using saline solution.

The laboratory testing was performed in Coffey’s NATA accredited laboratories in Melbourne and Sydney. The results of the tests are included in Appendix B of this report.
4. SITE CONDITIONS

4.1 Regional Geology

The published map 'Geological Survey of Victoria, Baimsdale sheet, 1:250,000' indicates that the near surface geology of the site as:

- Quaternary aged Paludal lagoon deposits comprising silts and clays;
- Quaternary Fluvial deposits comprising gravels, sands and silts, and
- Tertiary deposits of Seaspray and Sale groups.

The results of our fieldwork indicate the presence of alluvial soils generally below a thin layer of topsoil at the site.

4.2 Subsurface Conditions

The subsurface conditions encountered within the test pits at the site during our fieldwork are summarised in Table 1.

4.3 Groundwater

Standing groundwater was observed within the test pit TP15 only at depth of 2.2m below existing ground level at the time of our investigation. Fluctuations in groundwater level and seepage could occur due to rainfall, change in temperature and other factors.

<table>
<thead>
<tr>
<th>Interpreted Unit</th>
<th>Depth to Top of Unit (m)</th>
<th>Unit Thickness (m)</th>
<th>Description of Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil</td>
<td>0.0</td>
<td>0.2</td>
<td>SANDY SILT: low plasticity, fine to medium grained sand, dark grey, pale brown, brown. Not observed in test pit TP20.</td>
</tr>
<tr>
<td>Alluvium</td>
<td>0.2</td>
<td>Not Penetrated (&gt;3.5m)</td>
<td>SANDY CLAY, CLAYEY SAND, SAND, SILTY CLAY, GRAVELLY SAND: low, medium and high plasticity, fine to medium grained sand, fine to course grained gravel, orange, pale grey, red mottles, grey; very stiff or dense to very dense. COBBLES IN SAND MATRIX in test pits TP2, TP14, TP15 and TP20 at depths of 2.5m, 1.6m, 0.8m and 0.7m, respectively.</td>
</tr>
<tr>
<td>Weathered Rock</td>
<td>1.7</td>
<td>Not Penetrated</td>
<td>MUDDSTONE: slightly weathered, light grey. Observed in test pit TP3 only.</td>
</tr>
</tbody>
</table>
5. GEOTECHNICAL ASSESSMENT

5.1 Investigation Finding.

5.1.1 Soil Permeability

Four Falling Head Permeability tests were carried out on remoulded soil samples collected from the test pits and resulted in permeability rates of between $3.0 \times 10^{-9}$ m/sec and $8.8 \times 10^{-11}$ m/sec using distilled water.

One additional Falling Head Permeability test was carried out on a remoulded Silty Clay sample of high plasticity, using 2% saline solution instead of distilled water in order to observe the effects that a saline, landfill leachate may have on the permeability of the soil. The results of the test using the saline solution indicated little or no apparent impact on the permeability of the sample, which recorded a permeability of $1.9 \times 10^{-10}$ m/sec.

The laboratory soil samples used in all permeability tests were remoulded to a dry density ratio of approximately 95% Standard within a moisture ratio of ±2% of Standard Optimum Moisture Content (SOMC) and test results are presented in Appendix B of this report.

5.1.2 Soil Dispersion

A total of eleven Emerson Crumb tests were carried out in our laboratory in order to assess the dispersion characteristics of the soils. Ten of the tests were performed using potable water and one duplicate test using saline solution of 2%.

On the basis of the Emerson Crumb testing it was apparent that most of the Clayey soils are mildly dispersive when subject to potable water however the duplicate sample tested with saline solution was only slightly dispersive. Given the leachate from municipal landfills is commonly of a saline nature we assess the dispersion of the clays will not be significant in the application as a liner.

5.1.3 Liner Materials

On the basis of the field observations and the results of the laboratory tests we recommend the materials encountered in the test pits and as shown in Table 2 following the text of this report as being suitable for use as a liner for the landfill if adequately compacted and moisture conditioned. We have included in the chart some mixing of materials in adjoining layers that on the basis of the laboratory testing are expected to meet the specified criteria provided they are adequately mixed. Because of the variable nature of the soils across the site we recommend that the potential liner materials should be excavated and mixed under direction of a geotechnical practitioner, then stockpiled, sampled and tested for permeability compliance prior to placement.

5.2 Earthworks

5.2.1 Excavation Conditions

Excavation of the alluvial soils should be achievable using conventional earthmoving equipment such as excavators and scrappers. Minor water inflows are likely to be encountered if excavation is extended into the more granular materials such as where encountered in TP15 particularly following extended rainfall periods.

5.2.2 Fill Placement

The new Clay liner material should be placed and compacted to an engineering specification in general accordance with recommendations outlined in AS3798-1996, “Guidelines for Commercial and Residential
The following procedure is recommended as a guide for site preparation and the placement of controlled fill.

- The soils exposed after excavation to the design base level should be scarified to a depth of about 150mm, moisture conditioned to within ±2% of Standard Optimum Moisture Content (SOMC) and then re-compacted to a minimum dry density of 98% Standard in accordance with AS1289 5.1.1, 5.4.1 or 5.7.1.

- Any soft or weak areas identified during the compaction process that do not respond to further compaction should be removed and replaced with suitable site materials in layers not exceeding 250mm thickness and should be compacted to the above criteria.

- Subsequent layers of general fill or the Clay liner material fill should be placed in uniform 250mm loose thickness layers, moisture conditioned and compacted to the above criteria. The final layer of the Clay liner should be maintained in a moist condition until covered with a protective layer to prevent drying and cracking.

Earthworks should be carried out during dry weather conditions, if possible. Provision should be made for effective diversion of surface water from outside the site. The surface runoff from the site should be treated to remove excess sediments before discharge.

6. APPLICABILITY

Recommendations and opinions contained in this report are based on the interpretation of subsurface conditions from the investigation test pits and information from published geological maps. The nature and continuity of the subsoil away from the test locations are inferred, but it must be appreciated that actual conditions could vary from the assumed geotechnical model. If conditions other than those described are encountered, Coffey should be engaged to assess whether the recommendations should be revised.

The attached “Important Information about Your Coffey Report” provides additional information in the uses and limitations of this report.

For and on behalf of
COFFEY GEOSCIENCES PTY LTD

Tony Edwards - Principal
Materials from TP’s, 14, 15 & 20 not assessed as suitable for liner use.

Refer to figure 1 for test pit locations.
Notes:

**LEGEND**

† T.P Denotes approximate location of Test Pit.
Important information about your Coffey Report

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

Your report is based on project specific criteria

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

Subsurface conditions can change

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

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

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

Your report is prepared for specific purposes and persons

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

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

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

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

**Geoenvironmental concerns are not at issue**
Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

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

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

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

Results of Field Investigation

Explanation Sheets

Engineering Logs
DEFINITION:
In engineering terms soil includes every type of unconsolidated or partially consolidated inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME
Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

<table>
<thead>
<tr>
<th>NAME</th>
<th>SUBDIVISION</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulders</td>
<td></td>
<td>&gt;200 mm</td>
</tr>
<tr>
<td>Cobbles</td>
<td>coarse</td>
<td>63 mm to 200 mm</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>20 mm to 63 mm</td>
</tr>
<tr>
<td></td>
<td>fine</td>
<td>6 mm to 20 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.36 mm to 6 mm</td>
</tr>
<tr>
<td>Gravel</td>
<td>coarse</td>
<td>600 μm to 2.36 mm</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>200 μm to 600 μm</td>
</tr>
<tr>
<td></td>
<td>fine</td>
<td>75 μm to 200 μm</td>
</tr>
</tbody>
</table>

DENSITY OF GRANULAR SOILS

<table>
<thead>
<tr>
<th>TERM</th>
<th>DENSITY INDEX (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very loose</td>
<td>Less than 15</td>
</tr>
<tr>
<td>Loose</td>
<td>15 - 35</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>35 - 65</td>
</tr>
<tr>
<td>Dense</td>
<td>65 - 85</td>
</tr>
<tr>
<td>Very Dense</td>
<td>Greater than 85</td>
</tr>
</tbody>
</table>

MINOR COMPONENTS

<table>
<thead>
<tr>
<th>TERM</th>
<th>ASSESSMENT GUIDE</th>
<th>PROPORTION OF MINOR COMPONENT IN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace of</td>
<td>Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component</td>
<td>Coarse grained soils: &lt;5%</td>
</tr>
<tr>
<td>With some</td>
<td>Presence easily detected by feel or eye, soil properties little different to general properties of primary component</td>
<td>Fine grained soils: &lt;15%</td>
</tr>
</tbody>
</table>

MOISTURE CONDITION

- Dry: Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
- Moist: Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
- Wet: As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

<table>
<thead>
<tr>
<th>TERM</th>
<th>UNDRAINED STRENGTH $s_u$ (kPa)</th>
<th>FIELD GUIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>&lt;12</td>
<td>A finger can be pushed well into the soil with little effort.</td>
</tr>
<tr>
<td>Soft</td>
<td>12 – 25</td>
<td>A finger can be pushed into the soil to about 25mm depth.</td>
</tr>
<tr>
<td>Firm</td>
<td>25 – 50</td>
<td>The soil can be indented about 5mm with the thumb, but not penetrated.</td>
</tr>
<tr>
<td>Stiff</td>
<td>50 – 100</td>
<td>The surface of the soil can be indented with the thumb, but not penetrated.</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>100 – 200</td>
<td>The surface of the soil can be marked, but not indented with thumb pressure.</td>
</tr>
<tr>
<td>Hard</td>
<td>&gt;200</td>
<td>The surface of the soil can be marked only with the thumbnail.</td>
</tr>
<tr>
<td>Friable</td>
<td></td>
<td>Crumbles or powders when scraped by thumbnail.</td>
</tr>
</tbody>
</table>

SOIL STRUCTURE

ZONING

- Layers: Continuous across exposure or sample
- Lenses: Discontinuous layers of lenticular shape
- Pockets: Irregular inclusions of different material

CEMENTING

- Weakly cemented: Easily broken up by hand in air or water
- Moderately cemented: Effort is required to break up the soil by hand in air or water

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS


TRANSPORTED SOILS

- Aeolian soil: Deposited by wind.
- Alluvial soil: Deposited by streams and rivers.
- Colluvial soil: Deposited on slopes (transported downslope by gravity).
- Fill: Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
- Lacustrine soil: Deposited by lakes.
- Marine soil: Deposited in ocean basins, bays, beaches and estuaries.
**SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION**

<table>
<thead>
<tr>
<th>FIELD IDENTIFICATION PROCEDURES</th>
<th>USC</th>
<th>PRIMARY NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluding particles larger than 60 mm and basing fractions on estimated mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COARSE GRAINED SOILS</strong> (greater than 60 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than half of coarse fraction is smaller than 2.0 mm</td>
<td>GW</td>
<td>GRAVEL</td>
</tr>
<tr>
<td>More than half of coarse fraction is larger than 2.0 mm</td>
<td>GP</td>
<td>GRAVEL</td>
</tr>
<tr>
<td><strong>FINER GRAINED SOILS</strong> (less than 60 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than half of coarse fraction is smaller than 2.0 mm</td>
<td>GM</td>
<td>SILTY GRAVEL</td>
</tr>
<tr>
<td>More than half of coarse fraction is larger than 2.0 mm</td>
<td>GC</td>
<td>CLAYEY GRAVEL</td>
</tr>
<tr>
<td>IDENTIFICATION PROCEDURES ON FRACTIONS &lt;0.2 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DRY STRENGTH</strong></td>
<td><strong>DILATANCY</strong></td>
<td><strong>TOUGHNESS</strong></td>
</tr>
<tr>
<td>None to Low</td>
<td>Quick to slow</td>
<td>None</td>
</tr>
<tr>
<td>Medium to High</td>
<td>None</td>
<td>Medium</td>
</tr>
<tr>
<td>Low to medium</td>
<td>Slow to very slow</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>None</td>
<td>High</td>
</tr>
<tr>
<td>Medium to high</td>
<td>None</td>
<td>Low to medium</td>
</tr>
<tr>
<td><strong>SOILS &amp; CLAY</strong> (less than 60 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid limit less than 50</td>
<td>ML</td>
<td>SILT</td>
</tr>
<tr>
<td>Liquid limit greater than 50</td>
<td>CL</td>
<td>CLAY</td>
</tr>
<tr>
<td><strong>HIGHLY ORGANIC SOILS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEAT</td>
</tr>
</tbody>
</table>

**COMMON DEFECTS IN SOIL**

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
<th>DIAGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARTING</td>
<td>A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering or bedding. May be open or closed.</td>
<td>![Diagram of Parting]</td>
</tr>
<tr>
<td>JOINT</td>
<td>A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints &lt;0.2 mm in length.</td>
<td>![Diagram of Joint]</td>
</tr>
<tr>
<td>SHEARED ZONE</td>
<td>Zone in clayey soil with roughly parallel, near planar, curved or undulating boundaries containing closely spaced, smooth or sickened, curved intersecting joints which divide the mass into tendrilic or wedge shaped blocks.</td>
<td>![Diagram of Sheared Zone]</td>
</tr>
<tr>
<td>SHEARED SURFACE</td>
<td>A near planar curved or unslating, smooth, polished or sickened surface in clayey soil. The polished or sickened surface indicates that movement (in many cases very little) has occurred along the defected area.</td>
<td>![Diagram of Sheared Surface]</td>
</tr>
<tr>
<td>SOFTENED ZONE</td>
<td>A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.</td>
<td>![Diagram of Softened Zone]</td>
</tr>
<tr>
<td>TUBE</td>
<td>Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter.</td>
<td>![Diagram of Tube]</td>
</tr>
<tr>
<td>TUBE CAST</td>
<td>Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.</td>
<td>![Diagram of Tube Cast]</td>
</tr>
<tr>
<td>INFILLED SEAM</td>
<td>Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.</td>
<td>![Diagram of Infilled Seam]</td>
</tr>
</tbody>
</table>
# Engineering log - Excavation

Client: **Infrastructure Solutions Pty Ltd**

Principal: **Bairnsdale Landfill - Stage 2**

Test pit location: **Refer to Figure 1**

---

## Excavation No. TP01

**Date started:** 12.8.2004  
**Date completed:** 12.8.2004  
**Logged by:** MFT  
**Checked by:**

---

### Equipment type and model:
- **Backhoe**

### Excavation dimensions:
- 5m long, 0.8m wide

### Notes, samples, tests, etc.

### Material Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Soil Type</th>
<th>Plasticity or Particle Characteristics, Colour, Secondary and Minor Components.</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>SANDY SILT: low plasticity, dark grey, fine to medium grained sand</td>
<td>D</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>SANDY CLAY: medium plasticity, orange to pale grey, fine to medium grained sand</td>
<td>M</td>
<td>VSt</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>CLAYEY SAND: fine to medium grained, orange, low plasticity clay with red staining</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>SAND: fine to medium grained, orange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>Test pit TP01 terminated at 3m</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Sketch

---

### Notes, samples, tests

<table>
<thead>
<tr>
<th>Method</th>
<th>N</th>
<th>X</th>
<th>B</th>
<th>R</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support</td>
<td>S</td>
<td>N</td>
<td>shoring</td>
<td>nil</td>
<td>penetration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>water</td>
<td>no resistance ranging to refusal</td>
<td></td>
</tr>
</tbody>
</table>

---

### Classification Symbols and Soil Description

- **VS:** very soft  
- **S:** soft  
- **F:** firm  
- **St:** stiff  
- **VSt:** very stiff  
- **H:** hard  
- **Fb:** friable  
- **VL:** very loose  
- **L:** loose  
- **MD:** medium dense  
- **D:** dense  
- **VD:** very dense
**Engineering log - Excavation**

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1

---

**equipment type and model:** Backhoe  
**Pit Orientation:**  
**Eastings:** m  
**Northings:** m  
**datum:**  
**excavation dimensions:** 5m long 0.8m wide  
**x**  
**y**  
**z**  
**date started:** 12.8.2004  
**date completed:** 12.8.2004  
**Logged by:** MFT  
**Checked by:**

---

### excavation information

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>water</th>
<th>notes, samples, tests</th>
<th>graphic log</th>
<th>classification symbol</th>
<th>material</th>
<th>moisture condition</th>
<th>consistency/density index</th>
<th>pocket penetrometer kPa</th>
<th>structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>N</td>
<td>D</td>
<td></td>
<td></td>
<td>RL metres</td>
<td>ML SANDY SILT: low plasticity, brown to pale grey, fine to medium grained sand</td>
<td></td>
<td>M</td>
<td>F</td>
<td>60</td>
<td>Topo soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CL SILTY CLAY: medium plasticity, orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>009 Alluvial</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP SAND: fine to medium grained, orange with red mottles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test pit TP02 terminated at 3m</td>
</tr>
</tbody>
</table>

---

**soil type:** plasticity or particle characteristics, colour, secondary and minor components.  
**material:**

#### medium grain size

- No. 1: Undisturbed sample 50mm diameter  
- No. 2: Undisturbed sample 63mm diameter  
- No. 3: Disturbed sample  
- No. 4: Vane shear (kPa)  
- No. 5: Bulk sample  
- No. 6: Environmental sample  
- No. 7: Refusal

**notes, samples, tests:***

- **Uo:** undisturbed sample 50mm diameter  
- **Ud:** undisturbed sample 63mm diameter  
- **D:** disturbed sample  
- **V:** vane shear (kPa)  
- **Bs:** bulk sample  
- **E:** environmental sample  
- **R:** refusal

---

**classification symbols and soil description:**

- **based on unified classification system**

**moisture:**

- **D:** dry  
- **M:** moist  
- **W:** wet

**Wp:** plastic limit  
**Wl:** liquid limit

**consistency/density index:**

- **VS:** very soft  
- **S:** soft  
- **F:** firm  
- **SL:** stiff  
- **VS:** very stiff  
- **H:** hard  
- **Fb:** friable  
- **VL:** very loose  
- **L:** loose  
- **MD:** medium dense  
- **D:** dense  
- **VD:** very dense

---

**Sketch**

---

**support:**

- **S:** shoring  
- **N:** nil  
- **BH:** backhoe bucket  
- **R:** ripper  
- **E:** excavator

**penetration:**

- **2.3:** resistance to penetration

**water:**

- **water level on date shown**
- **water inflow**
- **water outflow**

---

**Form GEC 2 1/2 sheet 3 TP02**

---

**FINDS:**

- **AW1781/1**
**Engineering log - Excavation**

**Client:** Infrastructure Solutions Pty Ltd

**Principal:**

**Project:** Bairnsdale Landfill - Stage 2

**Test pit location:** Refer to Figure 1

<table>
<thead>
<tr>
<th>equipment type and model:</th>
<th>Backhoe</th>
<th>Excavation No.: TP03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date started:</td>
<td>12.8.2004</td>
<td></td>
</tr>
<tr>
<td>Date completed:</td>
<td>12.8.2004</td>
<td></td>
</tr>
<tr>
<td>Logged by:</td>
<td>MFT</td>
<td></td>
</tr>
<tr>
<td>Checked by:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- **datum:** excavation dimensions:
  - 5m long
  - 0.8m wide
  - structure and additional observations
  - null

**Material Substance:**

<table>
<thead>
<tr>
<th>material</th>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM</td>
<td>SILTY SAND: fine to medium grained, grey</td>
</tr>
<tr>
<td>CH</td>
<td>SILTY CLAY: high plasticity, orange to pale grey</td>
</tr>
<tr>
<td>CL</td>
<td>SANDY CLAY: medium plasticity, orange to pale grey with red mottles, fine grained sand</td>
</tr>
<tr>
<td>D</td>
<td>MUDSTONE: low strength, slightly weathered, light grey Refusal Test pit TP03 terminated at 1.8m</td>
</tr>
</tbody>
</table>

**Sketch**

**Additional Observations:**

- Test pit TP03 terminated at 1.8m

**Consistency/density index:**

- VS: very soft
- S: soft
- F: firm
- SSL: stiff
- VSL: very stiff
- HH: hard
- Fb: friable
- VL: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense

**Support symbols:**

- N: natural exposure
- X: existing excavation
- BH: backhoe bucket
- B: bulldozer blade
- R: ripper
- E: excavator

**Penetration:**

- 2: no resistance ranging to refusal

**Notes, samples, tests:**

- Uds: undisturbed sample 50mm diameter
- Ud: disturbed sample
- V: vane shear (kPa)
- Bs: bulk sample
- E: environmental sample
- R: refusal

**Classification symbols and soil description:**

- based on unified classification system

**Consistency/density index:**

- VS: very soft
- S: soft
- F: firm
- SSL: stiff
- VSL: very stiff
- HH: hard
- Fb: friable
- VL: very loose
- L: loose
- MD: medium dense
- D: dense
- VD: very dense

**Soil description:**

- very soft
- soft
- firm
- stiff
- very stiff
- hard
- friable
- very loose
- loose
- medium dense
- dense
- very dense
**Engineering log - Excavation**

Client: **Infrastructure Solutions Pty Ltd**

Principal: **Bairnsdale Landfill - Stage 2**

Test pit location: **Refer to Figure 1**

---

**Excavation No.: TP04**

**Date started:** 12.8.2004

**Date completed:** 12.8.2004

**Logged by:** MFT

---

**Excavation information**

<table>
<thead>
<tr>
<th>Pit Orientation:</th>
<th>Easting: m</th>
<th>Northing: m</th>
<th>Datum:</th>
</tr>
</thead>
</table>

---

**Material substance**

| equipment type and model: Backhoe | excavation dimensions: 5m long 0.8m wide |

---

**Notes, samples, tests**

- **U** : undisturbed sample
- **D** : disturbed sample
- **R** : refusal

---

**Classification symbols and soil description based on unified classification system**

- **Moisture:**
  - **D:** dry
  - **W:** wet

- **Plastic limit:**
  - **Wp:** plastic limit

- **Liquid limit:**
  - **Wl:** liquid limit

---

**Consistency/density index**

- **VS:** very soft
- **S:** soft
- **F:** firm
- **St:** stiff
- **VSf:** very stiff
- **H:** hard
- **Fb:** friable
- **VL:** very loose
- **L:** loose
- **MD:** medium dense
- **D:** dense
- **VO:** very dense

---

**Notes:**

- Topsoil: Silt loam
- Above: Clayey silt

---

**Sketch**

Test pit TP04 terminated at 3m
**Engineering log - Excavation**

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:** Coffey Geosciences Pty Ltd

**Project:** Bairnsdale Landfill - Stage 2

**Test pit location:** Refer to Figure 1

---

**Equipment type and model:** Backhoe  
**Pit Orientation:** None Observed

**Excavation dimensions:** 5m long, 0.8m wide

**Material Substance**

<table>
<thead>
<tr>
<th>Classification Symbol</th>
<th>Material</th>
<th>Soil Type: Plasticity or Particle Characteristics, Colour, Secondary and Minor Components.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
<td>M D Topsoil</td>
</tr>
<tr>
<td>CH</td>
<td>SILTY CLAY: high plasticity, orange</td>
<td>VST Alluvial</td>
</tr>
</tbody>
</table>

**Structure and Additional Observations**

- Test pit TP05 terminated at 3m

---

**Sketch**
## Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1

### Excavation No. TP06

**Date started:** 12.8.2004  
**Date completed:** 12.8.2004  
**Logged by:** MFT  
**Checked by:**

<table>
<thead>
<tr>
<th>method</th>
<th>support</th>
<th>notes, samples, tests</th>
<th>material</th>
<th>material description</th>
<th>consistency/density index</th>
<th>classification symbols and soil description based on unified classification system</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>None Observed</td>
<td>water</td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
<td>M</td>
<td>VS</td>
<td>very soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Silty Clay: high plasticity, orange becoming orange to pale grey in colour, with red mottles</td>
<td>D</td>
<td>VSW</td>
<td>soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SANDY CLAY: medium plasticity, orange to pale grey with red mottles, fine grained sand</td>
<td>F</td>
<td>S</td>
<td>hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fb</td>
<td>friable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VL</td>
<td>very loose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>loose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MD</td>
<td>medium dense</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D</td>
<td>dense</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VD</td>
<td>very dense</td>
</tr>
</tbody>
</table>

**Test pit TP06 terminated at 3m**
Client: **Infrastructure Solutions Pty Ltd**
Principal:
Project: **Bairnsdale Landfill - Stage 2**
Test pit location: **Refer to Figure 1**

<table>
<thead>
<tr>
<th>Client: Infrastructure Solutions Pty Ltd</th>
<th>Test pit location: Refer to Figure 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal:</td>
<td></td>
</tr>
<tr>
<td>Project: <strong>Bairnsdale Landfill - Stage 2</strong></td>
<td></td>
</tr>
<tr>
<td>Test pit location: <strong>Refer to Figure 1</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Excavation Information

**Excavation No.:** TP07  
**Date started:** 12.8.2004  
**Date completed:** 12.8.2004  
**Logged by:** MFT  
**Checked by:**

<table>
<thead>
<tr>
<th>Excavation No.</th>
<th>Office Job No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP07</td>
<td>AW1781/1</td>
</tr>
</tbody>
</table>
Client: Infrastructure Solutions Pty Ltd

Principal: Bairnsdale Landfill - Stage 2

Test pit location: Refer to Figure 1

Excavation No.: TP08

Date started: 12.8.2004

Date completed: 12.8.2004

Logged by: MFT

Test pit location: 5m long, 0.8m wide

Excavation dimensions: 5m long, 0.8m wide

Equipment type and model: Backhoe

Notes, samples, tests:
- Undisturbed sample 50mm diameter
- Disturbed sample 63mm diameter
- Vane shear (kPa)
- Bulk sample
- Environmental sample

Material Substance:
- SANDY SILT: low plasticity, brown, fine to medium grained sand
- SILTY CLAY: high plasticity, orange to pale grey, with red mottles
- SANDY CLAY: medium plasticity, orange to pale grey, fine grained sand
- SILTY CLAY: medium plasticity, orange to pale grey

Sketch
**Engineering log - Excavation**

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1

---

**Equipment type and model:** Backhoe  
**Excavation dimensions:** 5m long 0.8m wide

---

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>notes, samples, tests, etc</th>
<th>graphic log</th>
<th>classification symbol</th>
<th>material</th>
<th>material information</th>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
<th>moisture condition</th>
<th>consistency/density index</th>
<th>structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>N</td>
<td>None Observed</td>
<td></td>
<td>RL m</td>
<td>depth</td>
<td>M</td>
<td></td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
<td>F</td>
<td>VSt</td>
<td>Topsoil Alluvial</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY CLAY: high plasticity, brownish orange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td>RL m</td>
<td></td>
<td></td>
<td></td>
<td>SILTY CLAY: medium plasticity, orange to pale grey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td>RL m</td>
<td></td>
<td></td>
<td></td>
<td>SANDY CLAY: medium plasticity, orange to pale brown, fine grained sand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td>RL m</td>
<td></td>
<td></td>
<td></td>
<td>CLAYEY SAND: fine to medium grained, orange</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test pit TP09 terminated at 3m

---

**Sketch**
Client: Infrastructure Solutions Pty Ltd
Principal: Bairnsdale Landfill - Stage 2
Test pit location: Refer to Figure 1

Date started: 13.8.2004
Date completed: 13.8.2004
Logged by: MFT
Checked by: [Signature]

Equipment type and model: Backhoe
Equipment dimensions: 5m long, 0.8m wide

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>notes, samples, tests</th>
<th>classification symbol</th>
<th>material characteristics</th>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
<th>consistency/density index</th>
<th>consistency/density index kPa</th>
<th>refusal</th>
<th>structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>N</td>
<td>None Observed</td>
<td>0.5</td>
<td>M</td>
<td>Sandy Sand: low plasticity, brown, fine to medium grained sand.</td>
<td>Topsoil</td>
<td>Alluvial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>None</td>
<td>None Observed</td>
<td>1.0</td>
<td>F</td>
<td>Silty Clay: high plasticity, brownish orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>None</td>
<td>None Observed</td>
<td>1.5</td>
<td>X</td>
<td>Cling Clay: high plasticity, orange to pale brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>V</td>
<td>None Observed</td>
<td>2.0</td>
<td>V</td>
<td>Clayey Sand: fine to medium grained, orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>None</td>
<td>None Observed</td>
<td>3.0</td>
<td>V</td>
<td></td>
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</tr>
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<td>B6</td>
<td>None</td>
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<td>3.5</td>
<td>V</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>None</td>
<td>None Observed</td>
<td>4.0</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test pit TP10 terminated at 3m
### Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1

<table>
<thead>
<tr>
<th>equipment type and model</th>
<th>Backhoe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit Orientation:</td>
<td></td>
</tr>
<tr>
<td>notes, samples, tests, etc</td>
<td></td>
</tr>
<tr>
<td>datum:</td>
<td></td>
</tr>
<tr>
<td>excavation dimensions:</td>
<td>5m long 0.8m wide</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>water</th>
<th>notes, samples, tests</th>
<th>graphic log</th>
<th>classification symbol</th>
<th>material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>RL metres</td>
<td></td>
<td>soil type: plasticity or particle characteristics, colour, secondary and minor components.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ML</td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CH</td>
<td>SILTY CLAY: high plasticity, orange</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CL</td>
<td>SILTY CLAY: medium plasticity, orange to pale grey with red mottles</td>
</tr>
</tbody>
</table>

- Test pit TP11 terminated at 3.4m
- MFT

**Support**  
- N: natural exposure  
- X: existing excavation  
- BH: backhoe bucket  
- B: bulldozer blade  
- R: ripper  
- E: excavator

**Additional observations**  
- becoming orange to pale grey with with black mottles in colour

**Sketch**

**Support**  
- N: natural exposure  
- X: existing excavation  
- BH: backhoe bucket  
- B: bulldozer blade  
- R: ripper  
- E: excavator

**Notes, samples, tests**  
- Undisturbed sample 50mm  
- Undisturbed sample 63mm  
- Disturbed sample  
- Vane shear (kPa)  
- Bulk sample  
- Environmental sample  
- Refusal

**Consistency/density index**  
- VS: very soft  
- S: soft  
- F: firm  
- St: stiff  
- VSt: very stiff  
- H: hard  
- Fb: friable  
- VL: very loose  
- L: loose  
- MD: medium dense  
- D: dense  
- VL: very dense
## Engineering log - Excavation

### Test pit location: Refer to Figure 1

| Client: | Infrastructure Solutions Pty Ltd |
| Principal: | Bairnsdale Landfill - Stage 2 |
| Test pit location: | Refer to Figure 1 |

**Equipment and Method**
- **Type and Model:** Backhoe
- **Support:** Natural exposure, existing excavation
- **Penetration:** 1.25m
- **Note, Samples, Tests:**
  - Undisturbed sample 50mm diameter
  - Undisturbed sample 63mm diameter
  - Disturbed sample
  - Vane shear (kPa)
  - Bulk sample
  - Environmental sample

### Material Substance

<table>
<thead>
<tr>
<th>Datum</th>
<th>Structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>SANDY SILT: low plasticity, brown to medium grained sand</td>
</tr>
<tr>
<td>CH</td>
<td>SILTY CLAY: high plasticity, orange, with some fine grained sand</td>
</tr>
<tr>
<td>CL</td>
<td>SILTY CLAY: medium plasticity, orange to pale grey with red mottles</td>
</tr>
</tbody>
</table>

### Excavation Information

| Date started: | 13.8.2004 |
| Date completed: | 13.8.2004 |

### Notes, Samples, Tests

- **Notes:**
  - Undisturbed sample 50mm diameter
  - Undisturbed sample 63mm diameter
  - Disturbed sample
  - Vane shear (kPa)
  - Bulk sample
  - Environmental sample

- **Support:** Natural exposure, existing excavation
- **Penetration:** 1.25m
- **Water:**
  - Water level: on date shown
  - Water inflow
  - Water outflow

### Material Description

- **Soil Type:**
  - Plasticity or particle characteristics, colour, secondary and minor components.

### Classification Symbols and Consistency/Density Index

<table>
<thead>
<tr>
<th>Classification Symbols</th>
<th>Consistency/Density Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS</td>
<td>Very Soft</td>
</tr>
<tr>
<td>S</td>
<td>Soft</td>
</tr>
<tr>
<td>F</td>
<td>Firm</td>
</tr>
<tr>
<td>St</td>
<td>Stiff</td>
</tr>
<tr>
<td>VSf</td>
<td>Very Stiff</td>
</tr>
<tr>
<td>H</td>
<td>Hard</td>
</tr>
<tr>
<td>Fb</td>
<td>Fibrile</td>
</tr>
<tr>
<td>VL</td>
<td>Very Loose</td>
</tr>
<tr>
<td>L</td>
<td>Loose</td>
</tr>
<tr>
<td>MD</td>
<td>Medium Dense</td>
</tr>
<tr>
<td>D</td>
<td>Dense</td>
</tr>
<tr>
<td>VD</td>
<td>Very Dense</td>
</tr>
</tbody>
</table>

---

**Sketch**

- Test pit: TP12 terminated at 3m

---

**Additional Observations**

- **Notes:**
  - Undisturbed sample 50mm diameter
  - Undisturbed sample 63mm diameter
  - Disturbed sample
  - Vane shear (kPa)
  - Bulk sample
  - Environmental sample

- **Support:** Natural exposure, existing excavation
- **Penetration:** 1.25m
- **Water:**
  - Water level: on date shown
  - Water inflow
  - Water outflow
**Engineering log - Excavation**

Client: **Infrastructure Solutions Pty Ltd**  
Principal:  
Project: **Bairnsdale Landfill - Stage 2**  
Test pit location: **Refer to Figure 1**

**Excavation No.: TP13**

**Date started:** 13.8.2004  
**Date completed:** 13.8.2004  
**Logged by:** MFT  
**Checked by:**

---

### Excavation Information

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>notes, samples, tests</th>
<th>excavation dimensions:</th>
<th>Pit Orientation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td></td>
<td>N</td>
<td></td>
<td>5m long 0.8m wide</td>
<td>E</td>
</tr>
</tbody>
</table>

### Material Substance

<table>
<thead>
<tr>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANDY SILT: low plasticity, brown to medium grained sand</td>
</tr>
<tr>
<td>SILTY CLAY: high plasticity, orange</td>
</tr>
</tbody>
</table>

### Additional Observations

- Becoming orange to pale grey with red mottles in colour
- Test pit TP13 terminated at 3m

### Sketch

- Topsoil
- Alluvial

---

### Notes, Samples, Tests

- **U<sub>50</sub>** undisturbed sample 50mm diameter
- **U<sub>63</sub>** undisturbed sample 63mm diameter
- **D** disturbed sample
- **V** vane shear (kPa)
- **Bs** bulk sample
- **R** refusal

### Classification Symbols and Soil Description

- **VS**: very soft  
- **S**: soft  
- **F**: firm  
- **St**: stiff  
- **VS**: very stiff  
- **H**: hard  
- **Fb**: friable  
- **VL**: very loose  
- **L**: loose  
- **MD**: medium dense  
- **D**: dense  
- **VG**: very dense

---

### Notes

- **method**
  - N: natural exposure  
  - X: existing excavation  
  - BH: backhoe bucket  
  - B: bulldozer blade  
  - R: ripper  
  - E: excavator

- **support**
  - N: nil  
  - S: shoring  
  - NL: natural ground

- **penetration**
  - 1  
  - 2  
  - 3  
  - 4

- **notes, samples, tests**
  - **water**
  - **water level**
  - **water inflow**
  - **water outflow**

---

**Consistency/Density Index**

- **moisture**
  - **D**: dry  
  - **M**: moist  
  - **W**: wet  
  - **Wp**: plastic limit  
  - **Wl**: liquid limit

---

**Additional Observations**

- **datum**
  - **R.L. Surface:** Not Measured

---

**Structure and Additional Observations**

- **Consistency/Density Index**
  - **VS**: very soft  
  - **S**: soft  
  - **F**: firm  
  - **St**: stiff  
  - **VS**: very stiff  
  - **H**: hard  
  - **Fb**: friable  
  - **VL**: very loose  
  - **L**: loose  
  - **MD**: medium dense  
  - **D**: dense  
  - **VG**: very dense

---

**Form GEC 1.2 Issue 3 Rev. 2**
# Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1  
**Excavation No.:** TP14  
**Logged by:** MFT  
**Date started:** 13.8.2004  
**Date completed:** 13.8.2004  
**Checked by:** [Signature]

---

### Excavation information

<table>
<thead>
<tr>
<th>Method</th>
<th>Support</th>
<th>Notes, samples, tests</th>
<th>Material</th>
<th>Consistency/density index</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>N</td>
<td></td>
<td>ML: Sandy Silt; low plasticity, brown, fine to medium gray, fine grained sand</td>
<td>M: hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CL: Sandy Clay; medium plasticity, orange to pale gray, fine grained sand</td>
<td>F: soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SC: Clayey Sand; fine to medium grained, orange</td>
<td>VST: very stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Material</td>
<td>VD: very dense</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Notes, samples, tests</td>
<td>consistency/density index</td>
</tr>
</tbody>
</table>

### Excavation dimensions

- 5m long
- 0.8m wide

### Material substance

- Sand matrix 200mm in diameter, rounded, fine to coarse grained orange sand, with some fine to coarse grained gravel

---

### Sketch

- Test pit TP14 terminated at 3m
Test pit location: Refer to Figure 1

Excavation No. TP15

Date started: 13.8.2004
Date completed: 13.8.2004

Test pit location: Refer to Figure 1

<table>
<thead>
<tr>
<th>equipment type and model: Backhoe</th>
<th>Pit Orientation:</th>
<th>Easting: m</th>
<th>R.L. Surface: Not Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>excavation dimensions: 5m long 0.8m wide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>excavation information</th>
<th>material substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>method</td>
<td>penetration</td>
</tr>
<tr>
<td>BH</td>
<td>N</td>
</tr>
</tbody>
</table>

ML SANDY SILT: low plasticity, brown, fine to medium grained sand
Silty sand: fine to medium grained, brownish orange

Cobble in a sand matrix up to 200mm in diameter, rounded, fine to coarse grained orange sand, with some fine to coarse grained gravel
becoming orange to pale grey in colour
becoming medium to coarse grained sand

CLAYEY SAND: medium to coarse grained, pale grey, with some cobbles up to 100mm in diameter
Test pit TP15 terminated at 3m

Sketch

method | natural exposure | existing excavation | backhoe bucket | bulldozer blade | ripper | excavator |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>X</td>
<td>B</td>
<td>R</td>
<td>E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

support | Shoring | N | N | N | N |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 resistance ranging to refusal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

notes, samples, tests | Ud0 | Ud3 |
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>undisturbed sample 50mm diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>undisturbed sample 63mm diameter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

classification symbols and soil description based on unified classification system

m |f |s |v |h |tr |vd |vp |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>very soft</td>
<td>soft</td>
<td>firm</td>
<td>stiff</td>
<td>very stiff</td>
<td>hard</td>
<td>friable</td>
<td>very loose</td>
</tr>
<tr>
<td>D</td>
<td>M</td>
<td>W</td>
<td>Wp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry</td>
<td>moist</td>
<td>wet</td>
<td>plastic limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>moisture</td>
<td>liquidity limit</td>
<td>consistency/density index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- 123 denotes method
- MFT
- NFT
# Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1  

**Excavation No.** TP16  
**Date started:** 13.8.2004  
**Date completed:** 13.8.2004  
**Logged by:** MFT  
**Checked by:**  

---

**Excavation dimensions:** 5m long, 0.8m wide  
**Pit Orientation:**  
**Easting:** m  
**Northing:** m  
**R.L. Surface:** Not Measured  
**Datum:**  

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>notes samples, tests, etc.</th>
<th>graphic log</th>
<th>classification symbol</th>
<th>material</th>
<th>material description</th>
<th>moisture condition</th>
<th>consistency/density index</th>
<th>structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>N</td>
<td>N</td>
<td>None Observed</td>
<td>RL metres</td>
<td>ML</td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CL</td>
<td>SILTY CLAY: medium plasticity, orange to pale grey</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP</td>
<td>SAND: fine to medium grained, orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test pit TP16 terminated at 3m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Sketch**

---

**Material substance**

- **SANDY SILT:** low plasticity, brown, fine to medium grained sand
- **SILTY CLAY:** medium plasticity, orange to pale grey
- **SAND:** fine to medium grained, orange

---

**Notes, samples, tests:**
- **U₅₀:** undisturbed sample 50mm diameter
- **U₆₃:** undisturbed sample 63mm diameter
- **D:** disturbed sample
- **V:** vane shear (kPa)
- **Bs:** bulk sample
- **E:** environmental sample
- **R:** refusal

---

**Consistency/density index**

- **VS:** very soft
- **S:** soft
- **F:** firm
- **St:** stiff
- **VSt:** very stiff
- **H:** hard
- **Fb:** friable
- **VL:** very loose
- **L:** loose
- **MD:** medium dense
- **D:** dense
- **VS:** very dense

---

**Sketch:**

---

**Form GEO 3.2 Issue 3 Rev.2**
# Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1  
**Date started:** 13.8.2004  
**Date completed:** 13.8.2004  
**Logged by:** MFT  
**Checked by:** [Signature]

---

<table>
<thead>
<tr>
<th>equipment type and model: Backhoe</th>
<th>Pit Orientation:</th>
<th>notes, samples, tests</th>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
</tr>
</thead>
<tbody>
<tr>
<td>excavation dimensions: 5m long, 0.8m wide</td>
<td></td>
<td></td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
</tr>
<tr>
<td>excavation information</td>
<td>material substance</td>
<td>material</td>
<td>consistency/density index</td>
</tr>
<tr>
<td>method</td>
<td>penetration</td>
<td>notes</td>
<td>R.L. Surface</td>
</tr>
<tr>
<td>BH</td>
<td>N</td>
<td>None Observed</td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td>S</td>
<td>ML</td>
<td>VST</td>
</tr>
<tr>
<td>VST</td>
<td>F</td>
<td>CL</td>
<td>X</td>
</tr>
<tr>
<td>VST</td>
<td>F</td>
<td>ML</td>
<td>X</td>
</tr>
</tbody>
</table>

**Notes, samples, tests**
- **U_{50}** undisturbed sample 50mm diameter
- **U_{63}** undisturbed sample 63mm diameter
- **V** vane shear (kPa)
- **Bs** bulk sample
- **E** environmental sample
- **R** refusal

**Classification symbols and soil description**
- **S** very soft
- **VS** soft
- **F** firm
- **S** stiff
- **VS** very stiff
- **V** hard
- **L** very loose
- **D** loose
- **MD** medium dense
- **D** dense
- **VD** very dense

**Additional observations**
- **Test pit TP17 terminated at 3.1m**
### Engineering log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1

<table>
<thead>
<tr>
<th>method</th>
<th>support</th>
<th>water</th>
<th>notes, samples, tests, etc</th>
<th>graphic log</th>
<th>classification symbol</th>
<th>material</th>
<th>medium condition</th>
<th>consistency/density index</th>
<th>soil type: plasticity or particle characteristics, colour, secondary and minor components.</th>
<th>structure and additional observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td>ML</td>
<td>SANDY SILT: low plasticity, brown, fine to medium grained sand</td>
<td>M</td>
<td>F</td>
<td>VS</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2</td>
<td>CH</td>
<td></td>
<td></td>
<td></td>
<td>CH</td>
<td>SILTY CLAY: high plasticity, orange with red mottles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td>CL</td>
<td>SILTY CLAY: medium plasticity, orange to pale grey with some fine to medium grained sand and cobbles up to 200mm in diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SC</td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td>CLAYEY SAND: fine to coarse grained, orange to pale grey with some cobbles up to 200mm in diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Refusal Test pit TP18 terminated at 2.4m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Sketch**

---

**Notes:**  
- **Excavation No.** TP18  
- **Date started:** 13.8.2004  
- **Date completed:** 13.8.2004  
- **Logged by:** MFT  
- **Checked by:** [Signature]

---

**Soil Description:**  
- SANDY SILT: low plasticity, brown, fine to medium grained sand.  
- SILTY CLAY: high plasticity, orange with red mottles.  
- SILTY CLAY: medium plasticity, orange to pale grey with some fine to medium grained sand and cobbles up to 200mm in diameter.  
- CLAYEY SAND: fine to coarse grained, orange to pale grey with some cobbles up to 200mm in diameter.  
- Refusal Test pit TP18 terminated at 2.4m

---

**Classifications:**  
- VS = very soft  
- S = soft  
- F = firm  
- SI = stiff  
- V = very stiff  
- D = dry  
- M = moist  
- W = wet  
- Wp = plastic limit  
- Wl = liquid limit

---

**Consistency/Density Index:**  
- Very Soft  
- Soft  
- Firm  
- Stiff  
- Very Stiff  
- Dry  
- Moist  
- Wet  
- Plastic Limit  
- Liquid Limit

# Engineering Log - Excavation

**Client:** Infrastructure Solutions Pty Ltd  
**Principal:** Bairnsdale Landfill - Stage 2  
**Test pit location:** Refer to Figure 1  

<table>
<thead>
<tr>
<th>Test pit No.: TP19</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client:</strong></td>
</tr>
<tr>
<td><strong>Principal:</strong></td>
</tr>
<tr>
<td><strong>Test pit location:</strong></td>
</tr>
</tbody>
</table>

## Excavation Information

<table>
<thead>
<tr>
<th>No.</th>
<th>Support</th>
<th>Pit Orientation</th>
<th>Easting</th>
<th>R.L.</th>
<th>Surface</th>
<th>Datum</th>
<th>Depth (m)</th>
<th>Notes, Samples, Tests</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Material Substance

<table>
<thead>
<tr>
<th>ML</th>
<th>ML</th>
<th>CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML</td>
<td>ML</td>
<td>CH</td>
</tr>
</tbody>
</table>

**Material:**

- **ML:** Sandy Silty: Low plasticity, brown, fine to medium grained sand
- **ML:** Silty Clay: High plasticity, orange, trace cobbles up to 100mm in diameter
- **ML:** Sandy Clay: Medium plasticity, orange to pale grey with red mottles and trace cobbles up to 100mm in diameter

**Notes:**

- Test pit TP19 terminated at 3m
**Engineering log - Excavation**

Client: **Infrastructure Solutions Pty Ltd**  
Principal:  
Project: **Bairnsdale Landfill - Stage 2**  
Test pit location: Refer to Figure 1

<table>
<thead>
<tr>
<th>equipment type and model: Backhoe</th>
<th>Pit Orientation:</th>
<th>Easting: m</th>
<th>R.L. Surface:</th>
<th>Nothing: m</th>
<th>datum:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>excavation dimensions: 5m long, 0.8m wide</th>
<th>material substance</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>method</th>
<th>penetration</th>
<th>support</th>
<th>water</th>
<th>notes, samples, tests</th>
<th>depth</th>
<th>classification symbol</th>
<th>material</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>N</td>
<td>None Observed</td>
<td></td>
<td></td>
<td>RL metres</td>
<td></td>
<td>COBBLES IN A SAND MATRIXX 200mm in diameter, rounded, medium to coarse grained orange sand</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Become orange to pale grey in colour</td>
</tr>
</tbody>
</table>

Test pit TP20 terminated at 3.5m
APPENDIX B

Results of Laboratory Tests
### Test Results

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Remoulded Dry Density</th>
<th>Remoulded Moisture Content</th>
<th>Remoulded Falling Head Permeability</th>
<th>Remoulded Falling Head Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP 6 0.5 - 0.8m</td>
<td>1.46</td>
<td>26.6</td>
<td>1.9 x 10</td>
<td>1.9 x 10</td>
</tr>
</tbody>
</table>

**Notes:**
1. Specimen remoulded to 95% of Standard Maximum Dry Density and at Standard Optimum Moisture Content.
2. Tested with 2% saline solution.
3. Sample and Compaction Data received from CG (Albury) on the 31/08/04.
4. 0% Percentage of material retained on 19mm sieve.
5. 5.5 kPa pressure was applied to the sample.

**Remarks:** Samples supplied by CG (Albury) on the 31/08/04.

---

![NATA Accredited Laboratory](image)

NATA Accredited Laboratory Date: September 17, 2004

No.4 31

Authorised Signature: James Russell

Laboratory Manager

---

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. This document shall not be reproduced except in full.
### Test Results

**Client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**Principal:**  
**Project:** Bairnsdale Landfill - Stage 2  
**Location:** Johnstons Road, Bairnsdale  
**Job No.:** AS1289 5.1.1 2.1.1  
**Test Date:** 17 - 26/08/2004  
**Test Procedure:** AS1289 5.1.1 2.1.1

<table>
<thead>
<tr>
<th></th>
<th>Maximum Dry Density t/m³</th>
<th>Optimum Moisture Content %</th>
<th>Field Moisture Content %</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP3</td>
<td>0.80 - 1.00m</td>
<td>1.61</td>
<td>23.5</td>
</tr>
<tr>
<td>TP4</td>
<td>2.60 - 2.80m</td>
<td>1.80</td>
<td>15.5</td>
</tr>
<tr>
<td>TP6</td>
<td>0.50 - 0.80m</td>
<td>1.54</td>
<td>26.0</td>
</tr>
<tr>
<td>TP6</td>
<td>2.50 - 2.70m</td>
<td>1.94</td>
<td>11.0</td>
</tr>
<tr>
<td>TP9</td>
<td>1.50 - 1.60m</td>
<td>1.85</td>
<td>14.0</td>
</tr>
<tr>
<td>TP14</td>
<td>0.50 - 0.60m</td>
<td>1.96</td>
<td>11.5</td>
</tr>
<tr>
<td>TP16</td>
<td>2.50 - 2.60m</td>
<td>1.71</td>
<td>18.5</td>
</tr>
<tr>
<td>TP17</td>
<td>2.30 - 2.50m</td>
<td>1.81</td>
<td>15.5</td>
</tr>
<tr>
<td>TP19</td>
<td>1.40 - 1.50m</td>
<td>1.73</td>
<td>18.0</td>
</tr>
<tr>
<td>TP19</td>
<td>2.00 - 2.10m</td>
<td>1.97</td>
<td>10.5</td>
</tr>
</tbody>
</table>

**Remarks:**

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Authorised Signature  
NATA Accredited Laboratory  
No. 431

[Signature]

Alastair Catton
## test results

**client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**principal:**  
**project:** Bairnsdale Landfill - Stage 2  
**location:** Johnstons Road, Bairnsdale  
**job no.:** AW1781/1  
**laboratory:** MELBOURNE  
**date:** 31/08/04  
**test report:** AB  
**test procedure:** AS1289 6.7.2 (Falling Head Permeability)  
**test date:** 19 - 27/08/2004

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>TP3 0.80 - 1.00m</th>
<th>TP4 2.60 - 2.80m</th>
<th>TP9 1.50 - 1.60m</th>
<th>TP17 2.30 - 2.50m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy Clay</td>
<td>1.61</td>
<td>1.80</td>
<td>1.85</td>
<td>1.81</td>
</tr>
<tr>
<td>Optimum Moisture Content</td>
<td>23.5</td>
<td>15.5</td>
<td>14.0</td>
<td>15.5</td>
</tr>
<tr>
<td>Field Moisture Content</td>
<td>25.3</td>
<td>15.1</td>
<td>12.6</td>
<td>14.8</td>
</tr>
<tr>
<td>Moisture Variation</td>
<td>+ 1.8</td>
<td>- 0.4</td>
<td>- 1.4</td>
<td>- 0.7</td>
</tr>
<tr>
<td>Target Density Ratio</td>
<td>95</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Actual Density Ratio</td>
<td>95.0</td>
<td>95.0</td>
<td>94.6</td>
<td>95.0</td>
</tr>
<tr>
<td>Moisture Ratio of sample</td>
<td>100.4</td>
<td>100.0</td>
<td>102.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Water Type</td>
<td>potable</td>
<td>potable</td>
<td>potable</td>
<td>potable</td>
</tr>
<tr>
<td>Sample Description</td>
<td>SANDY CLAY</td>
<td>CLAYEY SILT</td>
<td>CLAYEY SAND</td>
<td>SILTY CLAY</td>
</tr>
<tr>
<td>Permeability m/s</td>
<td>5.2 E -10</td>
<td>3.0 E -9</td>
<td>1.2 E -9</td>
<td>8.8 E -11</td>
</tr>
</tbody>
</table>

**Authorization:**  
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**Authorised Signature:**  
NATA Accredited Laboratory  
No. 431  
A. Cattton
**determination of emerson class number**

**client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**principal:**  
**project:** BAIRNSDALE LANDFILL - STAGE 2  
**location:** JOHNSTONS ROAD, BAIRNSDALE

**job no.:** AW1781/1  
**laboratory:** MELBOURNE  
**date:** 31/08/04  
**test report:** AC

**test procedure:** AS12893 .8.1  
**sample identification:** TP3 0.80 - 1.00m

---

### Test Data

**Air Dried Crumbs**
- **Time start of test:** 11.12 19/08/04  
- **Time dispersion commences:** 15:15 19/08/04  
- **Time dispersion completed:** 16:30 19/08/04

**Immersion of Air Dried Crumbs**
- **Does not slake:**  
- **Slakes:**  
- **Swell:**  
- **Does not swell:**
- **Complete dispersion:**  
- **Partial dispersion:**  
- **No dispersion:**

**Remoulded Material**

- **Time start of test:**
- **Time dispersion commences:**
- **Time dispersion completed:**

**Immersion of Remoulded Material**
- **Disperses:**
- **Does not disperse:**
- **Calcite or gypsum:**
  - **Present:**
  - **Absent:**
- **Vigorous shaking:**
  - **Disperses:**
  - **Flocculates:**

**Material Description**

SANDY CLAY, medium plasticity, orange

**Type of water used:** distilled  
**Water temperature:** 19°C

---

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[Signature]

ALASTAIR CATTON

NATA Accredited Laboratory  
No. 431
# Determination of Emerson Class Number

**Client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**Job No.:** AW1781/1  
**Laboratory:** MELBOURNE  
**Date:** 31/08/04  
**Test Report:** AD

### Test Data

#### Air Dried Crumbs

<table>
<thead>
<tr>
<th>Test Data</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Start of Test</td>
<td>11.12 19/08/04</td>
</tr>
<tr>
<td>Time Dispersion Commences</td>
<td>11.30 19/08/04</td>
</tr>
<tr>
<td>Time Dispersion Completed</td>
<td>12.30 19/08/04</td>
</tr>
</tbody>
</table>

#### Remoulded Material

<table>
<thead>
<tr>
<th>Test Data</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Start of Test</td>
<td></td>
</tr>
<tr>
<td>Time Dispersion Commences</td>
<td></td>
</tr>
<tr>
<td>Time Dispersion Completed</td>
<td></td>
</tr>
</tbody>
</table>

### Material Description

**CLAYEY SILT, medium plasticity, orange**

### Test Procedure

#### Sample Identification

- **Sample:** TP4  
- **Depth:** 2.60 - 2.80m

#### Test Procedure

- **AS12893.8.1**

#### Immersion of Air Dried Crumbs

- **Test Data**
  - Does not slake
  - Slakes
  - Swell
  - Does not swell

#### Immersion of Remoulded Material

- **Dispersion**
  - Disperses
  - Does not disperse
  - Calcite or Gypsum
    - Present
    - Absent
  - Vigorous Shaking
    - Disperses
    - Floculates
  - Emerson Class Number: 2

---

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NATA Accredited Laboratory  
No. 431

Alastair Catton
# Determination of Emerson Class Number

**Client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**Job No.:** AW1781/1  
**Laboratory:** MELBOURNE  
**Date:** 1/09/04  
**Test Report:** AM

## Test Data

### Air Dried Crumbs
- **Time Start of Test:** 11:25  
  **Date:** 31/08/04

### Remoulded Material
- **Time Start of Test:** 8:25  
  **Date:** 1/09/04

## Material Description
- **Type of Water Used:** 1% saline  
- **Water Temperature:** 20°C

## Test Results

### Immersion of Air Dried Crumbs
- **Emerson Class Number:** 6

### Immersion of Remoulded Material
- **Calcite or Gypsum:** Present (X)  
- **Vigorous Shaking:** Disperses (X)  
- **Flocculates:** X

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[Signature]  
ALASTAIR CATTON

**NATA Accredited Laboratory No. 431**
**determination of emerson class number**

<table>
<thead>
<tr>
<th>client:</th>
<th>INFRASTRUCTURE SOLUTIONS PTY LTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>principal:</td>
<td></td>
</tr>
<tr>
<td>project:</td>
<td>BAIRNSDALE LANDFILL - STAGE 2</td>
</tr>
<tr>
<td>location:</td>
<td>JOHNSTONS ROAD, BAIRNSDALE</td>
</tr>
</tbody>
</table>

**job no:** AW1781/1  
**laboratory:** MELBOURNE  
**date:** 1/09/04  
**test report:** AE

**test procedure:**  
**sample identification:**  

<table>
<thead>
<tr>
<th>Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>air dried crumbs</td>
</tr>
</tbody>
</table>
| time start of test: 8:55  
| time dispersion commences: 31/08/04  
| remoulded material |  
| time start of test: 8:25  
| time dispersion commences: 1/09/04  
| material description |  
| SILTY CLAY, high plasticity, brown  
| type of water used: distilled  
| water temperature: 20 °C  

**immersion of air dried crumbs**  
- does not slake [X]  
- slakes [ ]

- swell [ ]  
- does not swell [X]

- complete dispersion [ ]  
- partial dispersion [X]  
- no dispersion [X]

**immersion of remoulded material**  
- dispersions [X]  
- does not disperse [ ]

- calcite or gypsum  
  | present [ ]  
  | absent [X]

- vigorous shaking  
  | disperses [ ]  
  | flocculates [ ]

Emerson class number: 3

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Authorised Signature:  
NATA Accredited Laboratory  
No. 431  
ALASTAIR CATTON
determination of emerson class number

client: INFRASTRUCTURE SOLUTIONS PTY LTD
principal:
project: BAIRNSDALE LANDFILL - STAGE 2
location: JOHNSTONS ROAD, BAIRNSDALE

job no: AW1781/1
laboratory: MELBOURNE
date: 31/08/04
test report: AF

test procedure: AS1289 3.8.1
sample identification: TP6 2.50 - 2.70m

---

**test data**

**air dried crumbs**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.12 19/08/04</td>
<td>Time start of test</td>
</tr>
<tr>
<td>11.30 19/08/04</td>
<td>Time dispersion commences</td>
</tr>
<tr>
<td>12.30 19/08/04</td>
<td>Time dispersion completed</td>
</tr>
</tbody>
</table>

**remoulded material**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**material description**

CLAYEY SAND, fine to coarse, orange

type of water used: distilled
water temperature: 19°C

---

**immersion of air dried crumbs**

- [ ] does not slake
- [ ] slakes
- [ ] swell
- [ ] does not swell

---

**immersion of remoulded material**

- [ ] disperses
- [ ] does not disperse

---

**calcite or gypsum**

- [ ] present
- [ ] absent

---

**vigorou shaking**

- [ ] disperses
- [ ] flocculates

---

Emerson class number 2

---

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NATA Accredited Laboratory
No. 431

ALASTAIR CATTON
determination of emerson class number

client: INFRASTRUCTURE SOLUTIONS PTY LTD
principal:
project: BAIRNSDALE LANDFILL - STAGE 2
location: JOHNSTONS ROAD, BAIRNSDALE

job no: AW1781/1
laboratory: MELBOURNE
date: 31/08/04
test report: AG

test procedure: AS1289.3.8.1
sample identification: TP9 1.50 - 1.60m

test data

air dried crumbs

time start of test: 11.21 19/08/04
time dispersion commences: 11.30 19/08/04
time dispersion completed: 12.30 19/08/04

remoulded material

time start of test:
time dispersion commences:
time dispersion completed:

material description

CLAYEY SAND, fine to coarse, orange

type of water used: distilled
water temperature: 19 °C

immersion of air dried crumbs

does not slake ☐
slakes ☒

swell ☐
does not swell ☒

complete dispersion ☐
partial dispersion ☒
no dispersion ☐

immersion of remoulded material

disperses ☐
does not disperse ☒
calcite or gypsum
present ☐
absent ☐

calcareous or gypsum present

disperses ☐
flocculates ☐

Emerson class number 2

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Authorized Signature
NATA Accredited Laboratory No. 431

ALASTAIR CATTON
<table>
<thead>
<tr>
<th>Client:</th>
<th>INFRASTRUCTURE SOLUTIONS PTY LTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal:</td>
<td></td>
</tr>
<tr>
<td>Project:</td>
<td>BAINDSdale LANDFILL - STAGE 2</td>
</tr>
<tr>
<td>Location:</td>
<td>JOHNSTONS ROAD, BAINDSdale</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Job No:</th>
<th>AW1781/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory:</td>
<td>MELBOURNE</td>
</tr>
<tr>
<td>Date:</td>
<td>31/08/04</td>
</tr>
<tr>
<td>Test Report:</td>
<td>AH</td>
</tr>
</tbody>
</table>

Test Procedure: AS1289 3.8.1
Sample Identification: TP14 0.50 - 0.60m

### Test Data

#### Air Dried Crumbs
- Time Start of Test: 11.25 19/08/04
- Time Dispersion Commences: 19/08/04
- Time Dispersion Completed: 19/08/04

#### Remoulded Material
- Time Start of Test: 11.50 20/08/04
- Time Dispersion Commences: 20/08/04
- Time Dispersion Completed: 20/08/04

#### Material Description
- SANDY CLAY, medium plasticity, grey brown

Type of Water Used: distilled
Water Temperature: 19°C

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Authorised Signature: ALASTAIR CATTON
NATA Accredited Laboratory No. 431
## determination of emerson class number

**client:** INFRASTRUCTURE SOLUTIONS PTY LTD  
**principal:**  
**project:** BAIRNSDALE LANDFILL - STAGE 2  
**location:** JOHNSTONS ROAD, BAIRNSDALE  
**job no.:** AW1781/1  
**laboratory:** MELBOURNE  
**date:** 31/08/04  
**test report:** AI

**test procedure:** AS1289 3.8.1  
**sample identification:** TP16 2.50 - 2.60m

### test data

**air dried crumbs**
- **time start of test:** 8:37  
  **time dispersion commences:** 8:47  
- **time dispersion completed:** 10:30

- **immersion of air dried crumbs**
  - does not slake [ ]  
  - slakes [ ]  
  - swell [ ]  
  - does not swell [ ]

- **remoulded material**
  - **time start of test:**  
  - **time dispersion commences:**  
  - **time dispersion completed:**

- **material description**
  - **CLAYEY SILT, high plasticity, grey**

- **type of water used:** distilled  
- **water temperature:** 20 °C

### test report

- **calcite or gypsum**
  - present [ ]  
  - absent [ ]

- **vigorou shaking**
  - disperses [ ]  
  - flocculates [ ]  

- **Emerson class number:** 2

---

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**Authorised Signature**

NATA Accredited Laboratory  
No. 431  
ALASTAIR CATTON
determination of emerson class number

client: INFRASTRUCTURE SOLUTIONS PTY LTD
principal:
project: Bairnsdale Landfill - Stage 2
location: Johnstons Road, Bairnsdale

job no: AW1781/1
laboratory: MELBOURNE
date: 31/08/04
test report: AJ

test procedure: AS1289 3.8.1
sample identification: TP17 2.30 - 2.50m

---

**test data**

### Air Dried Crumbs

<table>
<thead>
<tr>
<th>Time Event</th>
<th>Time Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time start of test</td>
<td>11:12 19/08/04</td>
</tr>
<tr>
<td>Time dispersion commences</td>
<td>11:30 19/08/04</td>
</tr>
<tr>
<td>Time dispersion completed</td>
<td>12:30 19/08/04</td>
</tr>
</tbody>
</table>

**Immersion of Air Dried Crumbs**

- [ ] does not slake
- [X] slakes
- [ ] swell
- [ ] does not swell
- [ ] complete dispersion
- [X] partial dispersion
- [ ] no dispersion

---

**Remoulded Material**

<table>
<thead>
<tr>
<th>Time Event</th>
<th>Time Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time start of test</td>
<td></td>
</tr>
<tr>
<td>Time dispersion commences</td>
<td></td>
</tr>
<tr>
<td>Time dispersion completed</td>
<td></td>
</tr>
</tbody>
</table>

**Material Description**

- SILTY CLAY, high plasticity, brown

---

**Test Procedure**

- Sample identification:
  - [X] 451289 3.8.1
  - [X] TP17
  - 2.30 - 2.50m

---

**Calcite or Gypsum**

- [ ] present
- [ ] absent

---

**Type of Water Used**

- [X] distilled

---

**Water Temperature**

- 19° C

---

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Authorised Signature

NATA Accredited Laboratory

No. 431

ALASTAIR CATTON
determination of emerson class number

client: INFRASTRUCTURE SOLUTIONS PTY LTD
principal: 
project: Bairnsdale Landfill - Stage 2
location: Johnstons Road, Bairnsdale

job no: AW1781/1
laboratory: MELBOURNE
date: 31/08/04
test report: AK

test procedure: AS1289 3.8.1
sample identification: TP19 1.40 - 1.50m

test data

air dried crumbs

- time start of test: 8:37 23/08/04
- time dispersion commences:
- time dispersion completed:

remoulded material

- time start of test: 9:30 24/08/04
- time dispersion commences:
- time dispersion completed:

material description

SANDY CLAY, medium plasticity, orange, some fine to medium gravel

type of water used: distilled
water temperature: 20°C

does not slake

immersion of air dried crumbs

slakes

swell

does not swell

complete dispersion

partial dispersion

no dispersion

immersion of remoulded material

disperses

does not disperse

calcite or gypsum

present

absent

vigorous shaking

disperses

floculates

Emerson class number 5

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Authorised Signature
NATA Accredited Laboratory
No. 437

ALASTAIR CATTON
determination of emerson class number

client: INFRASTRUCTURE SOLUTIONS PTY LTD
principal:
project: BAIRNSDALE LANDFILL - STAGE 2
location: JOHNSTONS ROAD, BAIRNSDALE

job no: AW1781/1
laboratory: MELBOURNE
date: 31/08/04
test report: AL

test procedure: AS1289 3.8.1
sample identification: TP19 2.00 - 2.10m

test data

air dried crumbs

time start of test: 8:37 23/08/04
time dispersion commences: 8:50 23/08/04
time dispersion completed: 10:30 23/08/04

remoulded material

time start of test:
time dispersion commences:
time dispersion completed:

material description

SANDY CLAY, medium plasticity, orange, some fine to medium gravel

type of water used: distilled
water temperature: 20°C

immersion of air dried crumbs

does not slake ☐ slakes ☑

swell ☐ does not swell ☐

complete dispersion ☐ partial dispersion ☑ no dispersion ☐

immersion of remoulded material

disperses ☐ does not disperse ☐
calcite or gypsum present ☐ absent ☐

vigorous shaking

disperses ☐ flocculates ☐

Emerson class number 2

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No. 431

ALASTAIR CATTON