

JOHN HOLLAND PTY LTD

SOUTHWOOD PROJECT – GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

HUON DISTRICT, TASMANIA

HO154/1-AG 30 August 2002 HO154/1-AG AG 30 August 2002

John Holland Pty Limited, 70 Trenerry Crescent, ABBOTSFORD VIC 3067 Coffey 📷

Attention: Mr Trevor Webster

Dear Sir,

RE: Southwood Project -Geotechnical & Hydrogeological Investigation

Please find attached our report on the geotechnical and hydrogeological assessment of the proposed Southwood project development at a site near the confluence of the Arve and Huon rivers.

Please feel free to contact the undersigned if you have any queries on this report.

For and on behalf of COFFEY GEOSCIENCES PTY LTD

BARRY MCDOWELL HOBART OFFICE MANAGER

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Coffey Geosciences Pty Ltd an example

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Important Information About Your Coffey Report.

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1. INTRODUCTION

1.1 General

This report describes the geotechnical investigations and hydrogeological investigations carried out for John Holland Pty Ltd (JH) on the proposed project located at the Southwood site, Huon, Tasmania.

Mr. Trevor Webster of JH commissioned Coffey Geosciences Pty Ltd (Coffey) to carry out the geotechnical investigation works for this project following acceptance of Coffey's proposal ref Ho154/1-AB of 1 August 2002, based on the brief supplied by John Holland Development Investment Pty Ltd (JHDI).

It is understood that the project comprises the construction of the following main features:

- Power Station;
- Mechanising Yard;
- Veneer Mill and Saw Mill;
- Wood fibre Mill and Fuel processing; and
- Stromwater Pond 1

Coffey has undertaken a preliminary geotechnical assessment for this site and the information is presented in the report referenced HO53/1-AB, dated 23 August 2000. The findings of that report have been addressed as part of the evaluation carried out in this report.

An A1 sized contour plan of the site and proposed layout was provided by Forestry Tasmania for field use. Preliminary earthworks site plans and sections produced by GHD, were provided by JHDI in PDF format to assist in planing the field work and provide a base for geotechnical plans. Recent air photos (24/2/02) were sourced from Services Tasmania.

The development is expected to cover some 40ha area. Preliminary earthworks sections for the merchandising yard (GHD drawings 3210596-04 to –07) indicate cuts and fills up to 9m high, but typically 2 to 4m high.

1.2 Scope of Work

The purpose of this investigation, as described in the JHDI brief are to:

- Meet the relevant conditions set out in the development approval (Geo1, Geo2, GW1, part GW3, and GW4);
- Provide information to enable the economic design of the various structures on site.

The scope of work was limited by JH due to time constraints and site access issues prior to construction commencing. The scope is, however consistent with a staged approach appropriate to investigation and development of such a large site where final decisions on the exact location and nature of development have yet to be finalised. The scope of work adopted was as follows:

- 1 borehole to assess foundation conditions for potential pile or large scale footings at the power station site. To be converted to a temporary groundwater monitoring well (destroyed during construction of the power station) to satisfy GW4 and GEO1 assessment;
- 1 'deep' groundwater monitoring well (to standard environmental protocols) to assess and monitor

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groundwater conditions before and during construction and operation. Location to be confirmed with GHD and MRT;

- 1 borehole completed as a groundwater monitoring well (replaces the original probe hole in JH brief) to be located immediately down gradient of the proposed stormwater storage dam (as shown on current drawings) to assess groundwater conditions on the up slope part of the site and allow monitoring down gradient of the storage dam during operations;
- 4 test pits across the proposed mil sites to assess foundation bearing capacities;
- 3 pits to obtain CBR samples from the sub grade depth (to be confirmed) for proposed hardstand areas (pavement design can be provided by Coffey if required);
- Clay borrow assessment by test pitting in areas identified by the walkover;
- Laboratory testing of clay borrow materials to assess suitability in terms of DPIWE guidelines and relevant national standards;
- Laboratory testing of subgrade samples to assess CBR characteristics;
- Development, permeability testing and sampling of groundwater monitoring wells;
- Reporting of geotechnical findings and recommendations for bearing capacities, cut and fill batter angles, foundation concepts, pond concepts and any further work required to achieve detailed design;
- Assessment of hydrogeological conditions on the site, development of a conceptual model for input to an impact risk assessment by GHD (water quality data will not be available in time to incorporate in a draft report).

2. FIELD WORK

2.1 General

The field work consisted of:

- Drilling three boreholes (SMB1, SMB2 and SMB3) using a truck-mounted drill rig at the locations shown on Figure 1, to a maximum depth of 31.5 metres (BH1). Locations were limited by the inability to access areas away from established roads and formed tracks. Logging of the materials penetrated was undertaken during drilling, followed by installation of groundwater monitoring wells in the three boreholes for water sampling. Development, purging, sampling and permeability testing of the monitoring wells was also conducted (see Section 2.2);
- Excavation of 13 test pits using a 20t excavator at the locations shown on Figure 1, to a maximum depth of 6.7 metres (TP1). Logging, soil sampling and observations of groundwater conditions were were carried out during excavation. Some of these test pits were excavated to recover samples for CBR and associated testing (STP2, STP3 & STP13), while STP1, STP4, STP5, STP7 and STP8 are "foundation" pits for the assessment of the soils at the formation levels of proposed building. Test pits STP6, and STP9 to STP12 were excavated at the north western corner of the development site investigating the presence of clayey materials for construction of a dam, intended to be located in that vicinity.

 Geological and geomorphological observations from site walkovers, and office based assessment of air photos.

The three boreholes were planned to intersect varying underlying geological conditions, due to proposed drill depths and location within the Southwood site. Unforseen conditions present in SMB1 resulted in extension of the borehole some 20m beyond the proposed target depth to establish bedrock. Easy washbore drilling in silt, sand and clay layers, with only 2 recognised gravel/ cobble horizons, persisted to a depth of 27.2 metres, before any rock core was recoverable. The conditions encountered in this borehole extended the total drill metres for the project, and the total drilling program by 1.5 days.

The other two boreholes (SMB2 and SMB3) did not encounter hard rock that could deliver a core sample. SPT tests were carried out within clay layers in these boreholes.

The borehole drilling and excavation of the test pits were carried out in the period 12 to 15 August 2002. Site walkovers were undertaken on 8 August and 27 August 2002, with bore permeability testing conducted on 20 August 2002.

The engineering logs and photos of boreholes and test pits are presented in Appendix A, together with explanation sheets defining the terms and symbols used in their preparation. Monitoring well details and falling head permeability testing records are presented in Appendix B.

The test pits have been located by hand held GPS and map estimates. Forestry Tasmania personnel surveyed the locations of the boreholes .

2.2 Monitoring Well Installation

Three ground water monitoring wells were installed in boreholes drilled between the 12^h and 15th August. The wells are designated SMB1, SMB2 and SMB3 (see Figure 1).

All wells were constructed using machine slotted 3m PVC screen at the base of the hole and screw-jointed PVC casing to surface. Graded sand was used to backfill the boreholes around each monitoring well, with 0.5m of bentonite and 0.5m concrete comprising the final 1m below surface. All wells were completed with 100mm PVC casing covers and caps, standing approximately 1m above ground surface.

Soil and rock types encountered during drilling of the wells were described in the field and logs of boreholes are provided in Appendix A.

2.2.1 Well Development

Wells were developed on completion of each borehole. SMB1 failed to record a standing water level once installation was complete. Development of SMB2 and SMB3 continued until the bulk of drilling fines had been removed, or the water level was reduced to the base of the well.

A summary of conditions for each groundwater well is provided in Table 1.

2.2.2 Bore Survey

The completed monitoring wells (SMB1, SMB2 and SMB3) were surveyed to establish their respective locations and elevation. Survey locations were conducted by Forestry Tasmania and are presented on the logs in Appendix B.

2.2.3 Groundwater Sampling

Groundwater sampling was conducted by a Coffey scientist on 15^h August 2002. Samples were taken to establish baseline information for the long-term monitoring of water quality. Prior to sampling, the water level at each bore was recorded and then each well was purged to standard environmental protocols, i.e. between 3 and 5 bore volumes were removed and field water quality parameters (pH, EC and temperature) were measured prior to sampling.

Groundwater samples were recovered from two of the three wells SMB2 and SMB3; with samples retaining the borehole nomenclature. Samples were decanted immediately into appropriate sample containers, then placed in eskies with ice, and dispatched to the designated laboratory (WSL) using standard environmental sample handling and chain of custody protocols.

All work was conducted in general accordance with standard Coffey environmental protocols with respect to sampling procedures.

Bore	Construction	Drill	Screen	Geology	Measured	Stick	RL of	рΗ	EC
No.	& Monitoring Date	Depth	Interval	of the screened interval	depth from water to top of PVC	up of PVC	natural surface		(dS/m)
SMB1	14/08/02	31.5m	5.11- 8.11m	Silty Sand	Dry well*	0.6m	103.55	NA	NA
SMB2	14/08/02	10.8m	6.85- 9.85m	Silty Clay	3.42m	0.95m	93.68	3.89	0.08
SMB3	15/08/02	6.5m	3.7- 6.7m	Sandy Clay	2.99m	0.55m		5.15	0.21

Table 1: Summary of Monitoring Bore

* Borehole water level measured at 16.5m when borehole depth at 31.5m. Well installed as temporary monitoring point to assess perched groundwater within influence of the development.

3. LABORATORY WORK

3.1 Geotechnical

For the test pits located at the footprints of the proposed structures, a set of CBR, Standard Compaction and Atterberg Limits testing was undertaken on three samples recovered from test pits STP2, STP3 and STP13, to assess the soil subgrade for design of pavements in the merchandising yard and access roads. In addition, two samples were selected from test pits STP6 and STP11 for laboratory permeability, Standard Compaction and Atterberg Limits testing to assess the properties of the soils and weathered rock for possible use as clay liner for proposed dams on the site.

Samples collected during previous fieldwork by GHD (Sample 1, MY1 and MY2) and tested by Cofey, are included in this report for completeness. The results of the laboratory testing are summarised in Table 2 and presented in Appendix C.

Test Pit Location	Sample Depth	Atterberg	Limits		Std Compa	ction	CBR	Permeability
		PI (%)	LL (%)	Linear Shrink (%)	Max Dry Density (t/㎡)	Optimum Moisture Cont (%)	(%)	(m/sec) *
STP2	2.0-2.5m	10	35	6.5	1.64	19.0	13	
STP3	2.0-2.5m	18	36	7.5	1.90	13.0	11	
STP13	1.0-1.5m	6	27	3	1.73	18.0	20	
STP6	0.4-1.2m	26	55	10.5	1.44	30.5		3.5E – 9
STP11	0.4-1.2m	15	37	7.5	1.44	21.5		1.2E - 8
Sample#1 (existing gravel pit)	Surface	N.P	N.P	0	1.97	9.5	90	
MPY1	0.5-1.0m	9	28	6	1.71	19.5	20	
MPY2	>0.5m	11	37	8				

Table 2 Summary of Geotechnical Laboratory Test Results

*compacted sample tested at MDD and OMC.

3.2 Water Quality

Water testing was undertaken on samples recovered from two of the three monitoring boreholes and sent to WSL laboratories in Melbourne, where the following tests were performed:

- Aromatic hydrocarbons (2 tests)
- TPH (2 tests)
- Total N (2 tests)
- Total P (2 tests)
- Anions content (CI, PO4, SO4, CO3, HCO3) (2 tests)
- Cations content (Ca, Mg, Na, K, Al) (2 tests), and
- Faecal Coliforms & Streptococci (2 tests)

3.2.1 Groundwater Analytical Results

The analytical results are summarised in Table 3 and presented in Appendix D.

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Analysis	Monitoring Bore SMB2	Monitoring Bore SMB3					
Faecal Coliforms	Absent	Detected					
Faecal Strep.	Low levels present	Low levels present					
Total N (mg/L)	2.5	3.9					
Total P (mg/L)	0.21	0.52					
Aromatic Hydrocarbons (mg/L)	<0.001	<0.001					
TPH (mg/L)	<0.1	<0.1					

Table 3	Summary	of Groundwater	Analytical	Results
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Note: details of anions and cations are provided in the laboratory reports.

4. SITE CONDITIONS

4.1 Location & Existing Developments

The proposed development site occupies an area of about 40ha and is situated on a broad ridge, trending roughly north-south, bordered on 3 sides (west, south, east) by an incised meander of the Huon River, where the Arve River flows into the Huon.

Existing site development consists of the recently constructed Geeveston/Judbury Road, bridge over the Huon River, forestry tracks, as well as other excavated flat areas.

4.2 Geology

The Geological Atlas 1:250,000 digital series Geology of Southeast Tasmania produced by Mineral Resources Tasmania (1999 edition) indicates that the proposed development site is underlain by Permian Age siltstone and sandstone deposits.

Further geology and geomorphology information can be found in the report titled "Geomorphic Values Survey: Barnbaback Block, Huon Forest District prepared by Mr. C Sharples for Forestry Tasmania (Huon Forest District). This report indicates that the area is underlain by Permian marine siltstone and sandstone bedrock, with an erosion remnant of Quaternary glacio-fluvial material forming a 'cap' on the top of the high level terrace at the site.

Observations for this study include the following:

- Bedrock comprising Permian siltstone, mudstone and some sandstone beds exposed in road cuttings (see Figure 2) and sub crop around the site. Highly weathered, low to medium strength, bedding dip approximately 5 towards the SW (with potential for minor variations), sub vertical joint sets striking NW-SE and NE-SW, and sub vertical shear/fault zones (containing altered and weathered material) striking approximately N-S;
- Quaternary glacio-fluvial alluvium, exposed in road cuts across the site, comprising Silty Sand,

Sandy Clay and Silt with varying proportions of generally matrix supported, rounded gravel and cobbles (10 to 40%), and some Sandy Gravel lenses (clast supported). Sand and silt are generally fine grained, with low to medium plasticity clay and silt.

4.3 Geomorphology

4.3.1 General

The site is located on the crest and side slopes of a broad ridge with gentle upper slopes of approximately 5 to 10°, side slopes in the range of 10 to 20°, and locally 25 to 30° at the toe beside the Huon River (see Figure 2). The morphology is that of a remnant alluvial aggradation terrace at approximately RL100 to 106m that has been dissected by erosion of the Huon River (current approximate RL 40m) to produce lower degradation terraces and isolated remnants of alluvium (see Figures 2 to 4). Gullies and stream courses dissect the side slopes of the ridge, with head slopes in the region of 30°, discharge to the relatively narrow (<20m) modern floodplain of the Huon River. The Weld Plains to the west of the site represent a lower level (approximately RL 50m) alluvial terrace system that has also been mapped further downstream of this location.

Active natural erosion was not evident on any of the side slopes, which are blanketed with thick vegetation comprising button grass and heath on the terrace remnants and eucalypt forest on the slopes. The vegetation distribution reflects surface soil development, with a generally poorly drained peat sward occurring on the terrace remnants, and clay/silt colluvial soils developed over bedrock on side slopes.

Specific zones of groundwater seepage on side slopes were not observed during site walkovers due to the masking effects of persistent wet weather in recent months. However seepage is indicated towards the base of the alluvial terrace remnants and on the steeper lower bedrock slopes above the Weld Plains and the recent Huon River flood plain.

4.3.2 Landslides and Slope Stability

The previous work undertaken by Coffey (report ref HO53/1-AB, dated August 2000) had described a possible ancient landslide in bedrock on the side slopes at the SW end of the site (below the proposed power station and water pond). The geomorphology of this feature and 2 other possible large landslide €atures were confirmed by an overview of topographic maps and air photos for this study. The 3 possible landslide features are marked A, B and C on Figure 2.

A site walkover of the features has not revealed any field evidence to support the existence of andslides. If these features are landslides they are ancient failures that occurred in bedrock at a critical point in the down cutting of the Huon River, possibly several thousand years ago during rapid climate change at the end of the last glacial period.

Due to the age of features A, B and C, the degree of erosion and degradation, the absence of any evidence for recent or ongoing instability and the proposed location of development at least 50 to 100m from the crest of these features it is assessed that they do not pose a threat to site development.

Evidence of small scale recent and active slope instability, including in the heads of gullies, is absent. Soil creep is occurring on the bedrock and colluvium slopes along the Huon River, and there is potential for undercutting and local failures on these slopes. It is assessed that such failures would be very unlikely to undercut or other wise affect the main upper terrace area.

4.4 Sub Surface Conditions

The information on sub surface conditions inferred from the test pits, boreholes and mapping observations that are to be encountered in the 2 main development areas is summarised in Tables 4 and 5 below. Natural scale cross sections presented in Figures 3 and 4 depict the main geological units, observed groundwater levels and extrapolated indicative bedrock structure.

Geotechnical Unit	Thickness, m	Typical depth, m	Comments
Topsoil – Peat sward	0.2-0.5	0.3	Root zone & peat, generally wet, restricted drainage due to underlying coffee rock layer.
White Sand/Silt, or	0.3-0.4	0.6	STP1, STP3 &STP13 typically non-plastic silts and in a very loose state
Natural Clays	0.3-0.5	0.5	Occurs occasionally on the high level terrace in place of the white sand and coffee rock (e.g. STP1), typical pocket penetrometer tests range 170-300 kPa
Organic/Fe layer, partially cemented ('coffee rock')	0.05-0.2	0.7	Underlying the white sand silt layer (e.g. STP3 & STP13)
Alluvium (Glacio- fluvial)	5 to 25	6 to 26 Approx base RL 80m in the east to 90- 100m in the west	Sand, silt and clay, fine grained, low to medium plasticity, with some gravel to gravelly. Some zones or lenses of sandy gravel (e.g. gravel pit in the NE of the terrace), medium dense to dense; soil matrix generally returned pocket penetrometer values of 300 to 600 kPa. Excavated in all test pits on the main terrace, except TP10 which encountered bedrock at 1m depth on the terrace margin.
Residual soils	0.5 to 2	6 to 28	1.5m of black high plasticity clay intercepted in SMB1, possible weathered carbonaceous mudstone or organic soil at the base of the alluvium?
Bedrock			Siltstone, mudstone and sandstone, extremely to highly weathered and very low to low strength for in the upper 1 to 5m (depending on lithology and presence of steep shear zones). The 50% core recovery from 27.2 to 31.5m in SMB1 was extremely weathered, and fractured.

Table 4: Southern Area, Main High terrace,	Power station, Fuel storage, Merchandising Yard
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Ground Unit	Thickness, m	Typical depth, m	Comments
Topsoil	0.05-0.5	0.3	Silt/Clay soil with root zone & peat, generally wet
Residual soils	0.4-0.7	0.9	Typically clayey silts and sandy silts (uncovered at STP4 to STP12 inclusive). The residual cohesive soils were typically stiff, but occasionally firm, while the non plastic soils ranged from loose to dense
3edrock	Extremely weathered approx 0.5-2	Extremely weathered 2-3	Siltstone and sandstone, extremely to highly weathered, very low to low strength (rock ripper used from 0.5m depth at STP4, 2.2m at STP5 & from 2.6m at STP7). Steeply joints dipping to wards the west noted in some test pits.

Table 5 North West Area, Bedrock Slopes, Veneer Mill, Saw Mill, Woodfibre Mill & Dry Mill

4.5 Groundwater

Surface water and saturated topsoil conditions were prevalent at the time of the field work for this study. Ponded water in the soils on the main terrace and other remnants suggest that the drainage of the soil is impeded by the development of a thin partly cemented 'coffee rock' layer at about 1m depth...

The test pits generally did not encounter ground water, with the exception of the north-western corner of the site were some seepage was encountered in three of the test pits, as follows: STP6 (seepage from the southern side at 1.8m depth), STP10 (seepage at the northern corner at 0.9m depth), and STP12 (seepage at the southern side at 1.6m depth). This is the location of the proposed stormwater dam.

Standing water levels within two monitoring wells SMB2 and SMB3 were measured at 2.43m and 2.44m below ground level respectively. These water levels represent shallow groundwater within sandy aquifers overlying clayey alluvium. The monitoring well SMB1 is dry indicating that there is no perched aquifer at this location beneath the topsoil on the main terrace. The standing water level measured in the borehole before installing the well was 16.5m (with the hole collapsed back to 25m from 31m), suggesting that the silty sand and sandy clay materials are vertically well drained.

The results of hydraulic tests conducted in the monitoring wells (presented in Appendix B) indicate permeabilities in the order of 10¹ to 10² m/day for the perched sandy aguifers and approximately 10⁻³ m/day for the unsaturated silty sand materials in SMB1.

A conceptual model for the groundwater system based on site observations and investigations is presented in Figure 5. This model is considered appropriate for developing a groundwater impact risk assessment and using as the basis for establishing a long term groundwater monitoring network at the site, once development locations are finalised and access is available to suitable monitoring sites.

The major groundwater implication for development is that site earthworks that strip the upper layers of alluvium will be exposing the deeper alluvial aquifer to direct infiltration from site activities.

5. DISCUSSION AND RECOMMENDATIONS

5.1 Slope Stability

Natural slope stability is not considered to be a significant risk to the development provided standoffs of 100m from the potential ancient landslide features (Figure 2) and the crests of side slopes steeper than 20° are maintained. Any structures that are required inside the stand off zone will need a specific investigation to assess local subsurface conditions and risk of slope instability.

5.2 Earthworks for the Merchandising Yard

Site development will involve cuts up to 8 metres (as shown on Drawing 3210596-04, CH 100 at the location of the power station), and fills of up to about 7 metres (see CH 200 through the Fuel processing unit).

Excavation using ordinary earthworks machinery should be capable of excavating to the required foundation level, although ripping may be required on the western limit of the yard if siltstone and sandstone bedrock is encountered (will depend on final subgrade levels). The excavated materials should be suitable for usage to build up the formation levels for the foundations of the structures.

The general procedure recommended for engineered fill under roads and structures are as follows:

- Strip all existing fill, topsoil to spoil or stockpile for re-use as landscaping material only.
- Compact the exposed surface (upper 150mm) to a dry density ratio of 98% Standard Compaction (AS1289 54.1-1993). In any area where the above level of compaction cannot be achieved, excavate to a depth of 0.3 meters and fill with clean granular fill and compact as specified above.
- Place and compact clean fill in 150mm thick (compacted) layers to 95% Standard under roads and to 98% Standard under buildings and hard stand areas.
- The upper 150mm beneath road pavements should be compacted to 98% S tandard Compaction.

Clay fill should be placed within +/- 2% of Standard Optimum Moisture Content. Where fill consists of clean sand and gravel, then it shall be compacted to a minimum 80% Density Index (AS1289 56.1-1993).

Where fill is placed on slopes in excess of 1V:8H (7°), a prepared surface should be benched/stepped into the natural slope. Proper sub-surface drainage should be provided beneath the new fill, as appropriate.

Based on the laboratory test results a subgrade CBR of 10 is recommended for the merchandising yard area.

5.3 Cut and Fill Batter Stability

Excavated slopes, not exceeding 8 metres height in natural ground areas should be constructed no steeper than the following:

- 1 V: 2H in alluvium, colluvium and residual soil;
- 1V:1.5H in extremely weathered rock;
- 1V:0.5H in highly weathered to fresh, sub-horizontally bedded rock.

Fill slopes constructed under engineering control should not be steeper than 1V:2H.

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For all slopes:

- slope drainage should consist of catch drains
- erosion protection should be provided.

Support by retaining wall or specific investigation and design of slopes will be required if steeper slopes than those indicated above are required.

5.4 Foundations Of Structures

5.4.1 Shallow Foundations

Provided that the earthworks are undertaken in accordance with AS AS3798 "Guidelines on Earthworks for Commercial and Residential Developments", and the recommendations in Section 5.3, an allowable bearing capacity of 100 kPa should be available for the design of the foundations of new structures on fill.

Consideration should be given to the potential for differential settlement of foundations constructed partially on natural ground and partially on fill. Piled foundations for footings and slabs on fill may be appropriate for settlement sensitive structures.

Subject to inspection of all footings by a suitably qualified and experienced geotechnical engineer at the time of the foundation excavations, an allowable bearing capacity of 200 kPa should be available on alluvium and residual soils.

Shallow footings on weathered rock may have an allowable bearing capacity of 1000kPa, subject to inspection of all footings by a suitably qualified and experienced geotechnical engineer.

5.4.2 Deep Foundations

Piled foundations for heavily loaded structures on alluvium could include driven or bored piles. Preliminary estimates of allowable capacity are as follows:

- Driven or bored piles in very stiff clay, shaft resistance 20 to 25kPa;
- Driven piles in granular soils, shaft resistance 20kPa;
- Bored piles in granular soils, shaft resistance 10kPa;
- Driven piles end bearing capacity on extremely to highly weathered rock, 1000kPa;
- Bored piles end bearing capacity on extremely to highly weathered rock, 500kPa.

Note that large diameter bored piles may have advantages in terms of capacity achieved through large shaft surface area and stiffness of the pile for sensitive structures. Depending on the sensitivity of structures to settlement piles may have to be taken to rock. Further investigation will be required to assess site conditions sufficiently for detailed design and costing of foundations.

5.5 'Clay' Liner for Dams

Samples collected from residual soil and weathered rock in the NW area of the site are considered suitable for use as low permeability liner materials. The low plasticity, observed field moisture contents and compacted permeability values of 1x10⁸ to 3x10⁹ m/s indicate that design requirements required in the development approval can be achieved. Borrow would involve stripping of approximately 0.3m of top soil followed by excavation of 1 to 2m of suitable material. Further assessment and testing will be required when a clay borrow

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area is finalised to ensure that the overall (bulk) natural properties will be suitable.

5.6 Construction Monitoring of Merchandising Yard

Variations in ground conditions may occur between test locations. If conditions other than those described are encountered, further advice should be sought without delay.

During excavation, site visits should be made by a Geotechnical Engineer or Engineering Geologist to ensure that the uncovered ground conditions are as those anticipated during the site investigation stage.

During the field compaction of the fill materials, layer thickness and coverages by the compactor should be carefully controlled and density in places and compaction tests taken as required for the relevant level of fill construction.

5.7 Further Investigations

Additional investigations will be required at the location of all structures to assess specific footing and foundation conditions. This work should be conducted in conjunction with detailed design studies when the location of structures has been finalised. The power station site in particular will require investigation to establish the parameters for the design of piled foundations. We recommend that at least 3 boreholes will need to be drilled to rock, with Standard Penetration Tests undertaken at 1.5 metre intervals. Coring of the rock should be conducted for at least 3 m in at least 2 of the boreholes.

Further investigation and laboratory testing is also recommended on the foundations of and the materials to be used for the dam construction.

Establishment of a long term groundwater monitoring well system will be required once the location of structures is finalised and access is available to suitable long term monitoring sites. The long term monitoring system will need to be designed to allow monitoring of the major aquifer systems and associated contamination pathways identified in the conceptual groundwater model. At this stage we would envisage an additional 3 or 4 wells.

For and on behalf of COFFEY GEOSCIENCES PTY LTD APPENDIX A

Engineering Logs of Boreholes and Test Pits



APPENDIX B

Monitoring Bore Permeability Test Results



APPENDIX C

Laboratory Test Results – Soil



APPENDIX D

Laboratory Test Results – Groundwater



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E	ng	in	eering Log - Borehole							Sheet Office	Job N	lo.:	1 of 4 HO154/1			
Clie	nt:	John Holland Pty Ltd									[Date sta	started: 12.8.2002		12.8.2002	
Prin	cipal: John Holland Development & Investment Pty Ltd									[Date co	mple	ted:	: 14.8.2002		
Proj	ect:			Sout	hwo	od P	rojec	t			L	_ogged	by:		AGG	
Bore	ehole	e Loc	ation:	See	Figu	re 1,	TBA				(Checke	d by:	:	BMcD	
drill r	nodel	and	nountir	ng:					slope:	-90°				R.L.	Surface: TBA m	
hole dri	diame illinc	eter: a inf	orma	tion	100mm	ו	mat	erial s	bearing ubstance	:				datu	im:	
method	benetration	torout	water	notes samples, tests, etc	RL	depth	graphic log	classification symbol	material soil type: plasticity or particle characteris colour. secondary and minor componen	tics,	moisture condition	consistency/ density index	00 A hand	00 evened	structure and additional observations	
_		3				metres			Quartzite cobbles		M	L	- 0	$\frac{1}{\omega 4}$		
W								CL	SILTY CLAY: medium palsticity, some gravel and rounded	cobbles,		VSt			Alluvium	
						2 - - 3 -				- 4						
								· SM · · · ·	SILTY SAND: quartz sand particles, white, some to gravel and cobbles	o trace		MD/D			Most fines washed out with bore watt minor sandy residue around collar, er drill to 11.6m	
meth AS AD RR W CT HA DT B V T *bit s e.g.	nod	by si	auger s auger d roller/tri washbo cable to hand au diatube blank b V bit TC bit uffix ADT	crewing* rilling* cone re bol iger it	su T C pei 1	8 pport timberin casing metration 2 3 4 ter 10/1/98 on date water i water c	g N no resist ranging t refusal 8 water lu e shown nflow putflow	nil ance o	notes, samples, tests U _{so} undisturbed sample 50mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressure meter Bs bulk sample R refusal	classificat soil descri based on i system moisture D dry M mo W wei Wp pla WI liqu	tion sym ription unified c bist t stic limit uid limit	bols and classificat	tion		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 VD very dense	

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Principal: John Holland Development & Investment Pty Ltd Date completed:										ted:	14.8.2002		
Project:		Sout	hwc	od P	rojec	t			L	ogged	by:		AGG
Borehole L	ocation	See	Figu	re 1,	TBA				(Checke	d by:		BMcD
drill model ar	nd mount	ng:					slope:	-90°				R.L.	Surface: TBA m
hole diamete	er: informa	ation	100mn	า	mat	erial s	ubstance					datu	m:
ation		notes				6	material			∖∕ ex	e et c		structure and
penetra	port ter	tests, etc		donth	phic lo	ssificati	soil type: plasticity or particle characterist	ics.	oisture odition	nsistenc nsity ind	kP	2 E Pa	additional observations
₽ 123 > ₽	sup		RL	depth metres	- gra	s da: Syn ci	colour, secondary and minor component	ts.		g g g g	200 200 1 1		
				-			gravel and cobbles (continued)						-
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→ method H AS H AD	auger : auger (screwing* drilling*	su T C	pport timbering casing	g N	nil	notes, samples, tests U ₅₀ undisturbed sample 50mm diameter	classificat soil descr based on	tion sym iption unified c	bois and	ion		consistency/density index VS very soft S soft
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e.g.	ADT			water of	outflow								VD very dense

Engineering Log - Borehole Shet 3 of 4 Office Job No.: H0154/1 H0154/1 Client: John Holland Pty Ltd Date started: 12.8.2002 Principal: John Holland Development & Investment Pty Ltd Date completed: 14.8.2002 Project: Southwood Project Logged by: AGG Borehoe Location: See Figure 1, TBA Checked by: BMCD drill model and mounting: 100m earing: datur: hole diameter: 100m material wiggood wiggood for the phile diameter: 100m samples, etcl, wiggood structure and additional observations view of the phile diameter 100m sature: additional observations view of the phile diameter 100m soil type: plasticity or particle characteristics, colour, secondary and minor components. additional observations view of the phile diameter No diameter No diameter No diameter No diameter view of the phile diameter No diameter No diameter No diameter additional observations view of the phile diameter No diameter No diameter No diameter No diameter view of the	3
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Principal: John Holland Development & Investment Pty Ltd Date complete: 14.8.2002 Project: Southwood Project Logged by: AGG Borehole Location: See Figure 1, TBA Checked by: BMCD Immediand mounting: 90° R.L. Surface: TBA m hole diameter: 100mm bearing: datum: Immediand mounting: 100mm samples, datum: Immediand mounting: 100mm bearing: datum: Immedian mounting: 100mm bearing: datum: Immedian mounting: 100mm bearing: datum: Immedian mounting: 100mm samples, datum: Immedian mounting: 100mm samples, datum: Immedian mounting: 100mm soil type: plasticity or particle characteristics, bissi op op op op op op op op op o	٥
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Top Top Top Samples, tests, etc RL depth metres Soil type: plasticity or particle characteristics, colour, secondary and minor components. M VSt/H MD/D N	
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CL SANDY CLAY: medium plasticity, brown, quartz and some VSt/H	_
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22 SM SILTY SAND: fine, brown, with some clay, some MD/D	
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T Mathematical Support Notes, samples, tests Classification symbols and consistency/density index AS auger screwing* T timbering N nil U undisturbed sample soil description VS vanuer screwing*	
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netl AS AD RR V THA DT B V	hod		au au rol wa ca ha dia bla V	ger so ger dr ler/trio ashbor ble to nd aug atube ank bit bit	crewing* illing* cone e ol ger	su T C pei 1 wa wa	32 pport timbering casing metration 2 3 4 ter 10/1/98 on date	g N no resist ranging t refusal 3 water le e shown	nil ance o	notes, samples, tests U ₂₀ undisturbed sample 50mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressure meter Bs bulk sample	classifica soil desc based on system moisture D dn M m W we W we W p pli	tion sym ription unified o oist et astic limi	l bols and classificat	ion		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose

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hod	er er			bhic log e recovery	material rock type; grain characteristics, colour, structure, minor components	thering ration	es st	tima treng	ted jth	Is ₍₅₀₎ MPa D- diam-	0 %	de spa n	fect acing nm	t	ype, ind	defect descrij clination, planar coating, thick	rity, roughne	SS,
met	wate	RL	depth metres	grap core	Continued from non-cored borehole	wea alte	L L	ב∑ר	₩	etral A- axial	RQI	30 100	300 3000 3000	partic	ular			general
NQ			- - 28 - - - - - - - - - - 29		SILTSTONE: medium to high, black, highly weathered, moderately fractured <50mm core pieces Core Loss 27.8-29.4m	_												- - - - - -
			- - - - - - - - - - - - - - - - - - -		SILTSTONE: extremely weathered, intense fracturing <50mm core pieces, clay along structures SILTSTONE: extremely weathered, silicified. Core Loss 30.5-31.5m	-												- - - - - - - - - - - - - - - - - - -
			- 32_ - - 33_ - - 34_ - - 34_ - - 35_		SMB1 terminated at 31.5m										strong	¢.	defects	- - - - - - - - - - - - - - - - - - -
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SPT SW QUARTZ SAND: fine to medium, white/pink with pale brown silt SW QUARTZ SAND with dark brown silt, some cobbles SW QUARTZ SAND with dark brown silt, some cobbles SW QUARTZ SAND: fine, pale brown silt SW QUARTZ SAND: fine, pale brown silt CH SILTY CLAY: high plasticity, white D St/Vst SILTY CLAY: high plasticity, white D
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SPT 1 SW QUARTZ SAND with dark brown silt, some cobbles Harder drill area 3-3.5m, cobbles of quartzite SPT 1 SW QUARTZ SAND: fine, pale brown silt Harder drill area 3-3.5m, cobbles of quartzite 1 SW QUARTZ SAND: fine, pale brown silt Harder drill area 3-3.5m, cobbles of quartzite 4 1 CH SILTY CLAY: high plasticity, white D 5 1 CH SILTY CLAY: high plasticity, white D
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Cli	ent:			John	Ho	lland	Pty L	.td			I	Date sta	arted:	14.8.2002
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Во	rehole	Loca	ation:	See	Figu	re 1,	TBA				(Checke	d by:	BMcD
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E N	123	3 00	ÿ		RL	metres	ь ХХХХ	δi ö	colour, secondary and minor components Road surface, siltstone and dolerite cobbles, with br	s. rown	ЕХ М	8-8 VD	1 Š č		Fill. Low water return to surface, wate
_						-			silt/clay	-					moving thru road at ~500
						- - 1 - - - 2		· SM	SILTY SAND with some clay, fine, light brown			L/MD			
						-			2.3-3m log backfill						Old log at 2.3m
						3		CL	SANDY CLAY: medium plasticity, white, some silt			St/Vst	$\left\{ \left \right \right\}$		Alluvium
				SPT 4,4,4 N*=8		- - - - - - - - - - - - - - - - - - -			Borehole SMB3 terminated at 6.55m						
meth AS AD	lod	a	uger so	crewing*	su T C	pport casing	g N	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter	classifica soil desc based on	tion sym ription unified d	bols and	tion		consistency/density index VS very soft S soft
RR W CT HA DT B V T *bit s e.g.	shown	rr v c h d b V T T by su	oller/trid ashboi able to and au iatube lank bi bit C bit fix DT	cone re ol ger t	pei 1 Wa Wa	ter 10/1/9 on date water i	no resist ranging t refusal 8 water le e shown inflow putflow	ance o evel	D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressure meter Bs bulk sample R refusal	moisture D dry M mc W we Wp pla WI liq	y oist et astic limi juid limit	t			F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

C)	Mi ey	7 Ģ	çot	clence	s Pl	ly Lb	AC	N 056 33	5 516		-	Test pit	No.		STP1	
Eı	ngi	ine	er	ing lo	ŋ.	- Ex	ca	/atio	on		5	Sheet	loh l	No	1 of 2 ••••••••••••••••••••••••••••••••••••	
Clie	ent:			Johr	n Ho	lland	Pty L	.td				Date sta	artec	d:	14.8.2002	Ð
Prin	ncipal:			Johr	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		I	Date co	mple	ete	ed: 14.8.2002	_
Pro	ject:			Sout	thwo	od P	rojec	t			I	_ogged	by:		ASAZ	2
Tes	st pit lo	ocati	on:	Арр	roxi	mate	GPS	: 484	840.00mE 5233285.00mN		(Checke	d by	y:	BMcD	J
equi	ipment t	type a	and m	odel:	Excava	ator 20t, C).75m bi	ucket	Pit Orientation:					R	R.L. Surface: See plan for approx	kimat
exca	avation	dime		a:	m long	m wic	e mat	orial e	ubstance					d	datum:	
method		Support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 hand	200 Penetro	additional observations	
ш		N							TOPSOIL: peat sward		W		6	10	Topsoil	
								ML	SANDY SILT: pale grey		М	VL				
						0. <u>5</u>		OL	ORGANIC SILT			<u> </u>	$ _{\times}$		Allundum	
						-		ML	SANDY CLAYEY SILT: low to medium plasticity. light			H/D	$\left \right $	*		
						1.0		-	brown-light orange, ~10% to 15% subrounded gravels, grav increase with depth up to 200mm	/els						
						=										
						1. <u>5</u>										
						-										
						2. <u>0</u>										
						2. <u>5</u>										
						=										
						3. <u>0</u>								×		
						-										
						3. <u>5</u>										
						-										
						4 0										
s	sketch	1				4.0						I				
met N X BH	thod	natu exis bacl	ral exp ting ex	oosure kcavation ucket	su T pe	pport timbering	g N	nil	notes, samples, tests clas U _{so} undisturbed sample soil 50mm diameter base D disturbed sample syst	esificati descri ed on u tem	ion sym ption unified o	bols and	ion		<mark>consistency/density index</mark> VS very soft S soft F firm	
B R		bullo rippe	lozer b er	blade		234	no anging t	0	V vane shear (kPa) Bs bulk sample mois	sture					St stiff VSt very stiff	
E HA		exca hand	vator 1 auge	r	€	ater	etusal		R refusal D M	dry moi	ist				H hard Fb friable	
DT		diat	ibe		-▼	water le on date	evel e shown		W Wp	plas	stic limi	t			VL very loose L loose	
						water in	nflow		WI	ııqu	na iimit				D dense	

Terr pit No. STP1 Sheet 2 of 2 Office Job No. HO154/1 Dint John Holland Pty Ltd Date standed: 14.8.2002 Protection Southwood Project Logged by: ASA2 respective and mode Researce 20.0°En todat Pa Oscillation Checked by: BMCD respective and mode Technological substance Interview BMCD Service and respective information Total substance Interview Service and Service and respective information Total substance Interview Service and Service and respective information R.L. unders Service and mode oncomponentic. Service and mode oncomponentic. Service and mode oncomponentic. respective information R.L. unders Service and mode oncomponentic. M HD Interview respective information R.L. unders Service and mode oncomponentic. Service and substance Service and substance Service and substance respective information R.L. unders Service and mode oncomponentic. Service and substance Service and substance respective information R.L. unders Service and substance Service and substance Service and substance respective information	Coffey Geoscience	15. Pty Ltd ACN 056 3	35 516		F
Engineering log - Excavation Sheet 2 of 2 Office Job No: Holfsd/1 John Holland Pty Ltd Ellent: John Holland Pty Ltd Date stande: 14.8.2002 Project: Southwood Project Logged by: ASAZ respective and note: Exempt 20.07% RLS utfore: BMcD respective and note: Exempt 20.07% RLS utfore: September 20.07% respective and note: Exempt 20.07% RLS utfore: September 20.07% respective and note: Exempt 20.07% RLS utfore: September 20.07% respective and note: model Second 20.07% Second 20.07% respective and note: notes: respective and notes: second 20.07% respective and note: respective and notes: second 20.07% second 20.07% respective and note: respective and notes: second 20.07% second 20.07% respective and notes: respective and notes: second 20.07% second 20.07% respective and notes: respective and notes: second 20.07% second 20.07% respective: notes: respective: second 20.07% second 20.07% respective: notes: respective: second 20.07% second 20.07% respective: notes: respective: secon				Test pit No.	STP1
Delimit: John Holland Pty Ltd Date started: 14.8.2002 Project: Southwood Project Logged by: ASAZ Project: Southwood Project Logged by: ASAZ rest pit location: Approximate GPS: 484840.00mE 5233285.00mN Checked by: BMcD rest pit location: Approximate GPS: 484840.00mE 5233285.00mN Checked by: BMcD rest pit location: Integration of the comparison of the compari	Engineering lo	og - Excavati	on	Sheet Office Job No.	2 of 2 : HO154/1
Principal: John Holland Development & Investment Pty Lti. Date complete: H. 42.02 Principal: Southwood Project: Date complete: Back 200 ASA2 Text principal: Material Substance Date complete: Back 200 Date complete: Back 200 Splanet regeneration Excert 20.07 blocks: Principal: Principal: Principal: Reference Date complete: Back 200	Client: Joh	n Holland Pty Ltd		Date started:	14.8.2002
Project: Southwood Project Loged by: EASZ Decked by: EMCD Project rest pit location: Approximate GPS: 484840.00mE 5233285.00mN Checked by: EMCD EMCD Project rest pit location: Text pit location: Text pit location: R.L. Surface: See pite for approximate GPS: 484840.00mE 5233285.00mN R.L. Surface: See pite for approximate GPS: 484840.00mE 5233285.00mN Number of the optimate of the optite optite optimate of the optite optimate of the optim	Principal: Joh	n Holland Developr	nent & Investment Pty Ltd	Date completed	i: 14.8.2002
Test pit location: Approximate GPS: 484840.00mE 533285.00mN Checked by: BMCP spapement type and model: Executed: 20,075m bucket Pt Orientation: R.L. Surface: See plan for approximate GPS: 484840.00mE See plan for approximate GPS: 484840.00mE See plan for approximate GPS: 484840.00mE See plan for approximate GPS: Association: R.L. Surface: See plan for approximate GPS: See plan for approximate GPS: Association: See plan for approximate GPS: See plan for approximat	Project: Sou	thwood Project		Logged by:	ASAZ
Build Present Model: Excevator 20, 0.75m bucket Pil Orientation: R.L. Surface: See plan for approxime scaward minimum scaward mininter scaward minimum scaward minimum scaward mininter scaward min	Test pit location: App	roximate GPS: 48	4840.00mE 5233285.00mN	Checked by:	BMcD
Normalization Integral in the problem Integral in the problem<	equipment type and model:	Excavator 20t, 0.75m bucket	Pit Orientation:	R.	L. Surface: See plan for approxim
understand notes samples, 123 notes samples, tests, etc. understand tests, etc. understests, etc. <thu< td=""><td>excavation information</td><td>material</td><td>substance</td><td></td><td>1</td></thu<>	excavation information	material	substance		1
M N SANDY CLAYEY SLT: but to medium plasticity, light M H/D 4.5 SANDY CLAYEY SLT: but to medium plasticity, light M H/D 5.0 5.0 Solution (continued) N H/D 5.5 5.5 Solution (continued) N H/D 6.9 6.5 Solution (continued) N N 6.5 Solution (continued) N N N 7.5 Solution (continued) N N N No refusal N N N N No refusal N N N N Solution N N N N No refusal N N N	pouge 1 2 3 3 1 2	depth depthic log databilic action withou	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition consistency/ density index 100 hand 200 band meter	structure and additional observations
Skotch			Test pit STP1 terminated at 6.7m	ravels	< No refusal

			-	Test pit	No.	STP2
Engineerir	ng log - Excav	ation		Sheet Office J	lob No.:	1 of 1 HO154/1
Client:	John Holland Pty L	d		Date sta	arted:	14.8.2002
Principal:	John Holland Deve	lopment & Investment Pty Ltd		Date co	mpleted:	14.8.2002
Project:	Southwood Projec			Logged	by:	ASAZ
Test pit location:	See Figure 1			Checke	d by:	BMcD
equipment type and model	Excavator 20t, 0.75m bu	ket Pit Orientation:			R.L.	Surface: See plan for approximati
excavation dimensions: excavation inform	m long m wide mation mat	rial substance			datu	m:
method penetration support	notes samples, tests, etc RL metres	Solution of the solution of th	, moisture condition	consistency/ density index	100 hand 200 5 penetro- 400 meter	structure and additional observations
	D	TOPSOIL: peat sward ML SANDY GRAVELLY SILT: low plasticitry, pale orange brown, with some clay, gravel becomes coarser with Topson for the some clay, gravel	e to pale M depth M	D/St		Topsoil Alluvium <u>No refusal: groundwater not encountered</u> during excavation
sketch Sketch N natural exposu X existing excav BH backhoe bucka BH backhoe bucka R ripper E excavator HA hand auger DT diatube	et e support T timbering N penetration 1 2 3 4 ranging t ranging t water water water level on date shown	nil U _{so} undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	Classification sym soil description based on unified system D dry M moist W wet Wp plastic lim W limit limit	nbols and classificat	ion	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

Çŋ	ſſċļ	7 Ģ	P06	clence	6. Pi	ly Lb	AC	N 056 33	5 516		-	Test pit	No.		
г.	aai	inc	~ r	ina la	a	Гу	~ ~`	oti			ç	Sheet			1 of 1
Eľ	ngi	ne	er	ing io	g.	·EX	cav		n		(Office J	lob N	o.:	HO154/1
Clie	nt:			Johr	n Ho	lland	Pty L	td			[Date sta	arted:		14.8.2002
Prin	cipal:			Johr	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		[Date co	mplet	ted:	14.8.2002
Proj	ect:			Sout	hwc	od P	rojec	t			L	ogged	by:		ASAZ
Test	t pit lo	ocati	on:	App	roxi	mate	GPS	: 484	720.00mE 5233312.00mN		(Checke	d by:		BMcD
equip	vation	type a dime	na ma nsions	:	Excava m long	m wid	e	lcket	Pit Orientation:					R.L.	. Surface: See plan for approxima
ex	cava	tion	info	ormation	Ī		mat	erial s	ubstance				1		1
method	benetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 hand 200 A penetro-	300 m meter	structure and additional observations
ш		N							TOPSOIL: peat sward		W	VL			Topsoil
						0.5	Hi.	SP	SAND: fine grained, pale grev		м				
							ET TAT	Pt	PEAT: ~50-100mm	\square		04.4/01			
						1.0	XXX	ML SM	CLAYEY GRAVELLY SILT: tine to medium grained, pale orange, with some clay SILTY SAND with some clay light grange dense	\square		St/VSt			Alluvium
						-						_			
						1.5									
						-		•							
						2 0									
						2. <u>0</u>									Bulk sample for CBR testing
				D		- -									
_						2. <u>5</u>			Test pit STP3 terminated at 2.6m					\parallel	No refusal; Groundwater not encounted during excavation
						-									
						35									
						<u> </u>									
SI	ketch	1													
met N B B R E HA	hod	natur exist back bulld rippe exca hand	al exp ing ex hoe bu ozer b r vator auger	osure cavation ucket lade	su T 1	pport timbering 2 3 4 7 7 7 7 7 7 7 7 7	g N no anging t efusal	nil o	notes, samples, tests cla U _{so} undisturbed sample soi 50mm diameter bas D disturbed sample sys V vane shear (kPa) mo Bs bulk sample D R refusal D	issificat il descri sed on u stem bisture dry moi	ion sym ption unified c	bols and	ion		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable
DT		diatu	be			water le on date water ir water o	evel shown nflow utflow		W Wp WI	wet p pla: liqu	stic limi id limit	t			VL very loose L loose MD medium dense D dense VD very dense

	a ng y		PUQ	Ç BŞEBÇİŞ	₽ Г 1	у сы	AC	N 056 33	5 516		1	Test pit	No.		STP4
E	ngi	ne	er	ing lo	g -	Ex	cav	<i>v</i> atio	on		5	Sheet	loh N'	o ·	1 of 2
Clie	ent:			Johr	U Ho	lland	Ptv L	.td				Date sta	arted:	0.:	14.8.2002
Prir	ncipal:			Johr	н Но	lland	Deve	elopn	ent & Investment Ptv Ltd		[Date co	mplet	ed:	14.8.2002
Pro	iect:			Sout	hwo	od P	roiec	t	,,		1	_oaaed	bv:		ASAZ
Tes	st nit la	ocati	n.	App	roxi	mate	GPS	: 484	561.00mE 5233418.00mN		(Checke	d bv		BMcD
equi	pment t	ype a	nd mo	del:	Excava	itor 20t, C	.75m bi	ucket	Pit Orientation:				a 0).	R.L	. Surface: See plan for approxima
exca	avation	dime	nsions	: 1	m long	m wid	е							dati	um:
ex	cavat	tion	info	rmation			mat	erial s	ubstance						
method	benetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteris colour. secondary and minor componen	tics, ts.	moisture condition	consistency/ density index	00 hand	00 m meter	structure and additional observations
ш		N	-			_			TOPSOIL: organics		W		- 00	<u>υ 4</u>	Topsoil
						- - 0. <u>5</u>		CL	CLAYEY SILT: medium plasticity, pale orange to p with some rootlet inclusions	ale brown	м	St			Residual/Colluvial
							<u> </u>		SILTSTONE: fine grained, pale cream, low to med	ium					Rock, near vertical joints, iron stained
						1. <u>0</u>			strength, extremely weathered						upping westwards, <200mm spacing
						1. <u>5</u>									
							. <u> </u>								
						2. <u>0</u>	· ·								
						-									
						2. <u>5</u>									
							 	•							
						3.0									
							· ·								Rock ripper used from 3m
						35	· ·								
						- J.J	· ·								
	<u>katak</u>					4.0									
me N X	thod	natur	al expo	osure	su T	pport timbering	j N	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter	classifica soil desc based or	ation sym ription n unified c	bols and	ion		consistency/density index VS very soft S soft
BH B		back bulld	hoe bu ozer bl	ade	per 1	netration			D disturbed sample V vane shear (kPa)	system					F firm St stiff
R E		rippe exca	r vator			r r r	io anging t efusal	0	Bs bulk sample R refusal	moisture D dr	y				VSt very stiff H hard
HA DT		hand diatu	auger be		wa	ter water le	evel			M m W w	oist et				Fb friable VL very loose
						on date	shown			Wp pl WI lid	astic limi quid limit	t			L loose MD medium dense
					-	water in water o	utflow								D dense VD very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

	1				÷		AC	N 056 33	5516		-	Test pit	No.		STP4	
Er	ngi	ine	eer	ing lo)d -	Ex	ca	/atio	on		:	Sheet			2 of 2	- 5
Clie	nt [.]			 Johr	J 1 Ho	lland	Ptv I	td				Date sta	ob N	NO.:	14.8.2002	0
Prin	cinal			Johr	1 Ho	lland	Devi	lonn	nent & Investment Ptv I td			Date co	mole	hted	14 8 2002	Æ
Proi	ioct.	•		Sour	thwc	nanu od P	roiec		ient & investment i ty Ltu				hy:	ieu.	4547	6
т				4 nn	rovi	mata	CDS	· 10/	1561 00mE 5222418 00mN			Chasks	Uy.		RMaD	ð
eauir	oment	tvpe	and m		Excava	ator 20t. 0	0.75m b	ucket	Pit Orientation:			спеске	u by	r. R.L	Surface: See plan	for approximat
exca	vation	n dime	ension	6:	m long	m wid	e		The ononadom					dat	um:	
ex	cava	atio	n infe	ormation			mat	erial s	ubstance				-			
method	5 penetration	3	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteris colour, secondary and minor componen	stics, nts.	moisture condition	consistency/ density index	100 hand	300 benetro- 400 meter	structure a additional obse	ind rvations
ш						4. <u>5</u>			SILTSTONE: fine grained, pale cream, low to mee strength, extremely weathered (continued)	dium					Rock, near vertical joints, dipping westwards, <200	, iron stained, mm spacing
						5.0	<u> </u>		Test pit STP4 terminated at 4.7m						Close to refusal	
						5. <u>5</u>										
						6.5										
						7.5										
						8.0										
S	ĸetcł	n														
met N X BH	hod	natu exis bac	ıral exp ting ex	posure ccavation ucket	su T pe	pport timbering] N	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter D disturbed sample	classific; soil desc based or system	ation sym ription n unified o	bols and	ion		consistency/density in VS very s S soft F firm	idex oft
B R E HA DT		bull ripp exc han diat	dozer I er avator d auge ube	n	wa	2 3 4 r r r ter water le on date	anging t efusal evel e shown	o	V vane shear (kPa) Bs bulk sample R refusal	moisture D dr M m W w Wp pl WI lic	y oist et astic limi quid limit	t			St stiff VSt very s H hard Fb friable VL very lc L loose MD mediu D dense	tiff bose m dense

Coffey Geosciences Pty Ltd ACN 056 335 516

20	T Ç	ſĢ	çoq	clence	ș Pl	ty Lt	AC	N 056 33	5 516		-	Test pit	No.		STP5
C .		n	۰ ۰ ۳	ina la		E٧	<u></u>	(ati -	n an		S	Sheet			1 of 1
	ngi		eer	ing id	Ŋ.	EX	cav		DN		(Office J	ob N	lo.:	HO154/1
Clie	ent:			Johr	n Ho	lland	Pty L	.td			[Date sta	arted		14.8.2002
Prin	cipal:			Johr	ı Ho	lland	Deve	elopn	ent & Investment Pty Ltd		[Date co	mple	ted:	14.8.2002
Proj	ject:			Sout	thwo	od P	rojec	t			l	_ogged	by:		ASAZ
es:	t pit lo	ocati	on:	App	roxi -	mate	GPS	: 484	550.00mE 5233698.00mN		(Checke	d by	:	BMcD
quip	pment t	ype : dime	and mo	odel:	Excava m long	n wic	1.75m bi le	ucket	Pit Orientation:					R.L	. Surface: See plan for approxim
ex	cava	tior	info	ormation	1		mat	erial s	ubstance						
method	benetration	sunnort	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	00 Hand	100 meter	structure and additional observations
ш		N				-			TOPSOIL: organics		М				
						-		CL	CLAYEY SILT: medium plasticity, pale brown, some rootle	ets		St			
						0. <u>5</u> –			SILTSTONE: fine grained, cream, very low to low strength	h,					Rock joints dipping westwards, <200
						-		•							ripping became very difficult at 3m
						1. <u>0</u> –									
						-									
						1. <u>5</u>	· ·								
						-		•							
						2. <u>0</u>	· ·								
						-	· _ ·								
						2. <u>5</u>									
						-			SILTSTONE: fine grained, cream, medium strength, highly	у					
						3. <u>0</u>	 		weatherd						
							· _ ·		Tast bit STD5 torminated at 2.2m						Effective refusal; groundwater not
						3. <u>5</u>			rest pit 31F3 terminated at 3.5m						encountered during excavation
						-									
						4.0									
ŀ	xetch					4.0									
	hod	natu exis bacl bullo rippe exca hand diate	ral exp ting ex thoe b lozer b tozer tvator d auge ibe	oosure ccavation ucket Jlade	su T pe	pport timbering 2 3 4 ter water lu	g N anging t efusal	nil o	notes, samples, tests classical U _{go} undisturbed sample soid 50mm diameter bas D disturbed sample sys V vane shear (kPa) mode Bs bulk sample D R refusal D	assificat il descr sed on stem Disture dry mo we	tion sym ription unified c obst	bols and	ion		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose
						- water in	flow		WI	l liqi	uid limit	L			MD medium dense
					<u> -</u>	water o	utflow								VD very dense

Ŷ	. Kżł		744	r ot a frite	¢• 1−1		AC	N 056 33	5516	•	Test pit	No.	STP6
Er	ngi	ne	er	ing lo	g -	Ex	ca	/atio	on		Sheet	loh No ·	1 of 1
Clie	nt:			John	Ho	lland	Pty L	.td			Date st	arted:	14.8.2002
Prin	cipal:			John	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		Date co	mpleted	: 14.8.2002
Proj	ect:			Sout	hwo	od P	rojec	t			Logged	l by:	ASAZ
Test	t pit lo	catio	on:	Аррі	roxi	mate	GPS	: 484	406.00mE 5233768.00mN		Checke	ed by:	BMcD
equip	oment t	ype a	nd mo	del: I	Excava	ator 20t, C).75m bi	ucket	Pit Orientation:			R.I	L. Surface: See plan for approxim
exca	vation of caval	dimer tion	isions: info	rmation	n long	m wid	e mat	erial s	ubstance			da	tum:
method	benetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	00 hand 00 Apenetro- 00 meter	structure and additional observations
Ц		N	-			-			TOPSOIL: organics, peat	W		- 00 4	Topsoil
								011		M	E/04]	Desidual
						0. <u>5</u>		СН	orange, some roots		F/St		Residual
				D				MI	SII Ti slightly gloway low to modium plasticity groups state		L1		
						1. <u>0</u>		IVIL	cream,				
									SILTSTONE: fine grained, cream, low strength, extremely weathered, highly fractured				Rock
						1. <u>5</u>	· ·						
							· ·						
_						2.0	. — .		Test pit STP6 terminated at 2m				
						2. <u>5</u>							
						3. <u>0</u>							
						3. <u>5</u>							
	ketch					4.0							
meti N X BH R E	hod	natur existi backl bulld ripper exca	al expo ng exo noe bu ozer bl vator	osure cavation Icket lade	su T 1	pport timbering 2 3 4	g N no ranging t refusal	nil	notes, samples, tests classi U _{ao} undisturbed sample soil de 50mm diameter based D disturbed sample syster V vane shear (kPa) moistur Bs bulk sample moistur R refusal D	ication syn scription on unified n ure dry	mbols and classifica	tion	consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard
HA DT		hand diatu	auger be		wa	ter water le on date water ir water o	evel e shown hflow utflow		M W Wp Wi	moist wet plastic lin liquid limi	nit t		Fb friable VL very loose L loose MD medium dense D dense VD very dense

Çq	fięy	7 Ģ	P0 6	clence	ș. Pl	ly Lis	AC	N 056 33	5 516		-	Test pit	No.	STP7
Er	ngi	ne	er	ing lo	g.	- Ex	cav	/atio	on		\$	Sheet	lah Na	1 of 1
Clier	nt:			John	Ho	lland	Pty L	.td				Date sta	arted:	14.8.2002
Prino	cipal:			John	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		I	Date co	mplete	ed: 14.8.2002
Proje	ect:			Sout	hwc	od P	rojec	t			I	_ogged	by:	ASAZ
Test	pit lo	ocati	on:	Аррі	roxi	mate	GPS	: 484	463.00mE 5233870.00mN		(Checke	d by:	BMcD
equip	ment t	type a	nd mo	odel: I	Excava	ator 20t, C).75m b	ucket	Pit Orientation:				R	R.L. Surface: See plan for approxima
xcav	vation o	dime tion	nsions info	rmation	m long	m wid	e mat	erial s	ubstance				d	latum:
lethod	penetration	upport	ater	notes samples, tests, etc		depth	raphic log	assification	material soil type: plasticity or particle characteristic	s,	noisture ondition	onsistency/ ensity index	0 hand 85 penetro-	structure and additional observations
Е Ц	123	3 00 N	>		RL	metres	-g	30	colour, secondary and minor components. TOPSOIL: organics		E 8 W	88	96 4 86 4	Topsoil
						0. <u>5</u>		ML/CL	CLAYEY SILT: medium plasticity, pale brown to pale	orange	М	St/VSt		Residual
Salatara.						- 1 0			SILTSTONE: fine grained cream very low to low st	enath				Rock
						-	· ·		highly weathered	ongui,				
						1.5	· ·							
2000000						-								
						2 0								
0.0000						-	· ·							
						25	· ·							
		-							Test pit STP7 terminated at 2.6m					Groundwater not encountered during excavation
						3.0								Ripper used from 2.6m
ľ						-								
						3.5								
						4 0								
24	etch													
H	nod	natu exist back bulld rippe exca hance	al exp ing ex hoe bu ozer b r vator auger	osure cavation ucket lade	su ⊤ 1	pport timbering 2 3 4 r r	g N no anging t efusal	nil	notes, samples, tests U ₅₀ undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	classifica soil desc based on system moisture D dr M m	tion sym ription unified o y	bols and	ion	consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable
т		diatu	be			water le on date water ir water o	evel shown nflow utflow			W we Wp pla WI liq	et astic limi juid limit	t		VL very loose L loose MD medium dense D dense VD very dense

C (Πe	YÇ	ęo	science	ș P	ty Lis	AC	N 056 33	5 516		_					
											٦	Fest pit	No.		STP8	1
Eı	ngi	in	eel	ring lo	pd -	- Ex	ca	/atio	on		S	Sheet		1	of 1	5
Clie	ent:			 Johr	1 Ho	lland	Pty L	.td				Date sta	arted:	.:	15.8.2002	0
Prin	cipal	:		Johr	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		[Date co	mplete	d:	15.8.2002	
Proj	ject:			Sou	thwo	ood P	rojec	t			l	_ogged	by:		ASAZ	
Гes	t pit l	oca	ion:	Арр	roxi	mate	GPS	: 484	513.00mE 5233847.00mN		(Checke	d by:		BMcD	U
equi	pment	type	and m	odel:	Excava	ator 20t, C).75m bi	ucket	Pit Orientation:				F	R.L. Su	rface: See plan for ap	proxima
	vation	dim	ension	s:	m long) m wic	e mat	orial e	ubstance				d	latum:		
method	penetration		water	notes samples, tests, etc	RI	depth	graphic log	classification	material soil type: plasticity or particle characteristics, colour, secondary and minor components		moisture condition	consistency/ density index	-on-thand 000 hand 000 kbanetro	00 meter	structure and additional observatio	ns
ш	12	3 1	1		KL.	-		0 0	TOPSOIL and organics		M/W	00	8679	4 T(opsoil	
						-										
						0. <u>5</u>			SILTSTONE: fine grained, cream, very low to low strer	ngth,				R	ock	
						-	· _ · ·		extremely weathered							
						1. <u>0</u>										
						-	. — .									
						1. <u>5</u>	· ·									
							· ·		Test sit CTD0 to reside to 4.0 m					c	lose to refusal; groundwater n	ot
						2. <u>0</u>			Test pit STP8 terminated at 1.8m					l er	ncountered during excavation	
						2. <u>5</u>										
						-										
						3. <u>0</u>										
						-										
						3. <u>5</u>										
						-										
						4.0										
J																
net I SH I I A DT	thod	nat exi bul ripp exc har dia	ural ex sting e khoe b dozer er avator d auge ube	coosure kcavation uucket blade r	su T 1	pport timbering 2 3 4 2 3 4 2 3 4 1 1 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	g N anging t refusal evel	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	classifica soil desc based on system moisture D dri M mi W we	ation sym ription o unified c y oist et	bols and	ion		consistency/density indexVSvery softSsoftFfirmStstiffVStvery stiffHhardFbfriableVLvery loose	
					_	on date	shown			Wp pla WI liq	astic limi quid limit	t			L loose MD medium den	se
						water in water o	nflow utflow								D dense VD very dense	

φų.	a nça		704	(ICIC)		аў са	AC	N 056 33	516		1	Test pit	No.		STP9
Eı	ngi	ne	er	ing lo	Ŋ.	- Ex	cav	<i>v</i> atio	on		9	Sheet	loh N	lo ·	1 of 1 HO154/1
Clie	ent:			Johr	1 Ho	lland	Pty L	.td				Date sta	arted	:	15.8.2002
Prin	cipal:			Johr	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		[Date co	mple	ted:	15.8.2002
Proj	ject:			Sout	thwo	od P	rojec	t			L	_ogged	by:		ASAZ
Tes	t pit lo	ocatio	on:	App	roxi	mate	GPS	: 484	389.00mE 5233900.00mN		(Checke	d by	:	BMcD
equip	pment	type a	nd mo	del:	Excava	ator 20t, 0).75m bi	ucket	Pit Orientation:					R.L	. Surface: See plan for approxima
exca	ivation	dimer	info	rmation	m long	m wic	e mat	orial c	ubstance					dat	um:
thod	penetration	bout	e	notes samples, tests, etc		denth	phic log	ssification	material		isture Idition	isistency/ isity index	hand Pronoting	balanda meter	structure and additional observations
E	123	3 ms	wat		RL	metres	gra	cla: syn	colour, secondary and minor components.		E S M	der So	200 200	1 300 400	Topsoil
						-		мы	CLAVEX SILT: modium to high placticity, pale brown/cros			E/St			Posidual
				D		0. <u>5</u> –			friable, with some gravel			1)Ot			
						1. <u>0</u>			SILTSTONE: fine grained, cream, very low to low strength highly weathered	h,					Rock
						-	· _ · ·								
						1. <u>5</u>	· ·								
						-	· ·								
						2.0			Test pit STP9 terminated at 2m				╟┼	+	No refusal; groundwater not encountered during excavation
						2. <u>5</u>									
						3. <u>0</u>									
						-									
						3. <u>5</u>									
						-									
						4.0									
5	κeiCΠ	1													
met N	thod	natur	al exp	osure	su T	pport timbering	g N	nil	notes, samples, tests cla U _{so} undistutbed sample soi	assificat	tion sym	bols and			consistency/density index VS very soft
X BH B R E HA		exist back bulld rippe exca hand	ng exe hoe bu ozer bl r vator auger	cavation ucket lade	pe 1	netration 2 3 4	no anging t efusal	o	bumm diameter bax D disturbed sample sys V vane shear (kPa) Bs bulk sample mo R refusal D M	sed on stem bisture dry mo	unified c	classificat	ion		S soft F firm St stiff VSt very stiff H hard Fb friable
DT		diatu	be		⊥	water le on date	evel shown		W Wp WI	we p pla liqu	t Istic limi uid limit	t			VL very loose L loose MD medium dense
					-	water o	utflow								VD dense VD very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

C q	i i i i	Y Ģ	606	clence	ș Pi	iy Liq	AC	N 056 33	5 516		-	F 1 11	NI-		
_		_				_						i est pit	NO.		STP10
E	ng	ine	er	ing lo	g -	Ex	cav	atio	on		(Sheet Office J	ob N	o.:	1 of 1 HO154/1
Clie	ent:			Johr	n Ho	lland	Pty L	td			[Date sta	arted:		15.8.2002
Prin	ncipal	:		Johr	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		I	Date co	mplet	ed:	15.8.2002
Pro	ject:			Sout	thwc	od Pi	rojec	t			I	_ogged	by:		ASAZ
Гes	t pit l	locat	on:	Арр	roxi	mate	GPS	: 484	303.00mE 5233898.00mN		(Checke	d by:		BMcD
equi	pment	type a	and mo	odel:	Excava	ator 20t, 0	.75m bi	ucket	Pit Orientation:					R.L.	Surface: See plan for approxim
exca	cava	atior	nsions info	ormation	m long	m wid	e mat	erial s	ubstance					dati	ım:
method	5 penetration	Support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristic colour, secondary and minor components.	S,	moisture condition	consistency/ density index	100 hand 200 A penetro-	400 meter	structure and additional observations
Ш		N				_			TOPSOIL: peat and organics		M/W				Topsoil
				D	-	0. <u>5</u>		ML	CLAYEY SILT: medium plasticity, orange stained gre	∍у	D	St/VSt			Residual/Colluvium
					-	1.0 1.5 1.5		SM	SILTY SAND: fine grained, pale gray		M				Seepage at 0.9m depth at Northern corner, ~0.5 liters per second
_						2. <u>0</u>			Test pit STP10 terminated at 2.1m						No refusal
						2.5 									
	Ketti														
mel N BH B R E HA DT	thod	natu exis bacl bullo rippo exca hano diato	ral exp ting ex thoe bu lozer b er tvator d auger ube	osure cavation ucket lade	su T 1	pport timbering 2 3 4 r r r ter water le	g N anging t efusal evel	nil o	notes, samples, tests U _{go} undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	classifica soil desc based on system moisture D dr M m W w	ation sym cription n unified o y voist et	bols and	ion		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose
						on date water ir water o	shown flow utflow			Wp pla WI liq	lastic limi quid limit	t			L loose MD medium dense D dense VD very dense

20	fie j	7 G	606	clence	ș Pl	ly Lia	AC	N 056 33	5 516		-	Fest pit	No.	SI	PT11	
-r	nai	in	<u>e</u> r	ina la	nu -	- Fx	้เกม	<i>v</i> atio	n		\$	Sheet		1 of 1		
											(Office J	ob No.	: HC	9154/1	1
rin	nt:			Johr	т ПО. n Но	lland		.u olonn	oont & Invostmont Ptv I td			Date sta	intea:	15. J. 15	0.2002 8 2002	
roi		-		Sour	thwc		roiec	topii	ient & investment Fly Lla				mpieteo	Δ.S	Δ <i>7</i>	72
est	t nit l	ocat	ion:	Ann	roxi	mate	GPS	· 484	267 00mF 5233840 00mN			Checke	d by:	RN	ne leD	ð
quip	oment	type	and mo	odel:	Excava	ator 20t, 0).75m bi	ucket	Pit Orientation:			oneeke	R	.L. Surface:	See plan fo	r approxim
kca	vation	dime	ensions	:	m long	m wic	le						da	atum:		
	penetration		n info	notes samples, tests, etc		depth	mat Iraphic log	tassification	wbstance material soil type: plasticity or particle characteristic	·S,	noisture condition	ionsistency/ lensity index	⁰⁰ hand ⁰⁰ benetro- motor		structure an dditional observ	d ations
: 1	12	3 ⁰	o ≤ I		RL	metres	6	0 %	TOPSOIL		W	00	2889	₹ Topsoil, V	egetation and roc	t zone
						0. <u>5</u> –		МН	CLAYEY SILT: medium plasticity, orange stained, pa	ale grey	м	St		Residual	Colluvium	
				D												
						1. <u>0</u>										
								· SM	SILTY SAND: fine grained, pale grey, silt decreasing depth	l with	1	MD				
						1. <u>5</u>										
-						2. <u>0</u>			Test nit SPT11 terminated at 2 1m					No refusa	II: groundwater no	t encounte
															Cavalion	
						2. <u>5</u>										
						3. <u>0</u>										
						3. <u>5</u>										
						4.0										
netl	hod	natu	ural exp	osure cavation	su T	pport timbering	g N	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter	classifica soil desc based or	ation sym ription	bols and	ion	consis ∀S S	s tency/density ind very sof soft	ex
H A T		bac bull ripp exc han diat	khoe b dozer b er avator d auge ube	ucket Ilade	pe 1 wa	atter water loop date	no ranging t refusal evel e shown	0	D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	system moisture D dr M m W w Wp pl WI lic	y oist et astic limi quid limit	t		F St H Fb VL L MD	firm stiff very stiff hard friable very loo loose medium	se dense
						water in water o	nflow outflow							D VD	dense very der	SP

C 20	ΠĘ¥	7 G 4	206	clence	ș Pl	iy Lb	AC	N 056 33	5 5 16		-	Fest pit	No.	STP12	
Er	nai	ne	er	ina lo	a -	Ex	cav	/atio	on		ŝ	Sheet		1 of 1	- 5
lie	- 9 -			John	9 Hol	lland	Ptv I	td				Office J	ob No	.: HO154/1 15-8-2002	1
Prin	cipal [.]			Johr	n Ho	lland	Deve	elopn	ent & Investment Ptv Ltd		I	Date co	mplete	d: 15.8.2002	١Ē
Proi	ect:			Sout	hwo	od P	roiec	t.	, <u>, , , , , , , , , , , , , , , , , , </u>			_oaaed	bv:	ASAZ	6
Test	pit la	catio	n:	Ασο	roxi	mate	GPS	: 484	290.00mE 5233752.00mN		(Checke	d by:	BMcD	0
equip	mentt	ype a	nd mo	del:	Excava	ator 20t, 0).75m bi	ucket	Pit Orientation:				R	R.L. Surface: See pla	n for approxima
exca	vation	dimen	sions:	. 1	m long	m wic	e						d	atum:	
ex R	enetration	tion	info	notes samples,			bol ci	erial s	ubstance material		ure tion	stency/ y index	hand penetro-	ອງ ອງ structure additional obs	and ervations
metho	<u>م</u> 123	oddns	water	tests, etc	RL	depth metres	graph	classi symb	soil type: plasticity or particle characteristics colour, secondary and minor components.	,	moist	consi densi	kPa 000000000000000000000000000000000000	400	
Ц		N				-			TOPSOIL and root zone					Topsoil	
						0.5		СН	SILTY CLAY: medium to high plasticity, orange staine cream,	ed,	M/W	F/St		Residual	
														Extensive roots	
				D				ML	SANDY CLAYEY SILT: low plasticity, pale grey		м	St			
						1. <u>0</u>									
			ŀ		-	-	<u>XXI</u>	·SM	SILTY SAND: with numerous quartzite rock pieces			MD			
			►			1. <u>5</u>			SILTSTONE: fine grained hale grey low to medium s	trenath				Rock: seenage from so	ithern and at
						-	· ·		extremely weathered, highly fractured Test pit STP12 terminated at 1.8m					1.6m depth No refusal	
						2. <u>0</u>									
						2. <u>5</u>									
						3. <u>0</u>									
						-									
						3. <u>5</u>									
						-									
						4.0									
SI	ketch														
meti N K BH R E HA DT	hod	natura existi backt bulldo ripper excav hand diatut	al expo ng exo noe bu ozer bl vator auger pe	osure cavation cket ade	suj T 1 wawa wa	pport timbering 2 3 4 ter water lu on date	g N anging t refusal	nil	notes, samples, tests U _{so} undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample R refusal	classifica soil desc based on system moisture D dr M m W we	ation sym ription i unified o y oist et astic limi	bols and	ion	consistency/density VS very S soft F firm St stiff VSt very H hard Fb friabl VL very	index soft stiff e loose
						water in	nflow			WI lic	quid limit	-		MD medi	um dense e
					<u> </u>	water c	utflow							VD very	dense

••				4-951 94-54	₽ 1 -1	y Lu	AC	N 056 33	5 5 1 6		1	Fest pit	No.		STP13
Er	ngi	ne	er	ing lo	g -	- Ex	cav	<i>v</i> atio	on		5 (Sheet Office .I	lob I	No.:	1 of 1 HO154/1
Clie	nt:			John	Но	lland	Pty L	.td			[Date sta	arted	1:	15.8.2002
Prin	cipal:			John	n Ho	lland	Deve	elopn	ent & Investment Pty Ltd		[Date co	mple	eted:	15.8.2002
Proj	ect:			Sout	hwc	od P	rojec	t			L	_ogged	by:		ASAZ
Test	t pit lc	ocatio	on:	Аррі	roxi	mate	GPS	: 484	846.00mE 5233508.00mN		(Checke	d by	<i>'</i> :	BMcD
equip	oment t	ype a	nd ma	del: I	Excava	ator 20t, C).75m bi	ucket	Pit Orientation:					R.L	. Surface: See plan for approximation
exca	vation	dimer	nsions	: 1	n long	m wid	e							dati	um:
ex	cava	lion	Into	ormation			mat	eriai s	ubstance					<u>ــــــــــــــــــــــــــــــــــــ</u>	
method	1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristi colour, secondary and minor component	ics, s.	moisture condition	consistency/ density index	100 hand	300 ed penetro	structure and additional observations
ш		N				-			TOPSOIL		W				Topsoil
						-		ML	GRAVELLY SILT: non plastic to low plasticity, pale	grey, partly		St			
						0. <u>5</u> –		OL	ORGANIC SILT with some gravels			F			
							Шļ	014		nnn/r - !-		145			
					1	1. <u>0</u>		GW	Sity GRAVEL: medium to coarse grained, pale ora brown; sub-rounded quartzite gravels of low to med strength	nge/pale lium	М	MD			Alluvium
				D			0 0 0 1		ouongun						gravels up to 150mm in size Close to refusal; groundwater not
		-				1.5	o 0		Test pit STP13 terminated at 1.5m					╈	encountered during excavation
						-									
						2. <u>0</u>									
						-									
						2. <u>5</u>									
						3. <u>0</u>									
						3.5									
s	ketch					4.0									
meti N X BH B	hod	natur exist back bulld	al exp ing ex hoe bu ozer b	osure cavation icket lade	su T 1	pport timbering netration 2 3 4] N	nil	notes, samples, tests U _{go} undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa)	classifica soil desc based on system	ition sym ription unified c	bols and	ion		consistency/density index VS very soft S soft F firm St stiff
R E HA DT		rippe exca hand diatu	vator auger be			tter water le on date water in water o	no anging t efusal e shown nflow utflow	0	Bs bulk sample R refusal	moisture D dry M ma W we Wp pla WI liq	y pist et astic limit uid limit	t			VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

90	n e	79	FOG	<u>CIBNC</u> B	s ru	رسا :	ACN	056 3	35 516			_			
-	•		5		-	-						Bor	ehole	No.	SMB1A
Fr	nui	ine	۰er	ina l	- na	Pi	₽ 7 ∩r	net	er			She	et		1 of 1
lier	• 9 nt:			John	Holla	and F	Pty Ltd	1				Off Dat	ice Jo e star	D NO.: ted:	14.8.2002
Princ	cipal	:		John	Holla	and L	Develo	opme	ent & l	nvestment Pty Ltd		Dat	e com	pleted:	14.8.2002
Proje	ect:			Sout	hwoo	d Pr	oject			-		Log	iged b	y:	AGG
Bore	hole	Loca	ation:	See	Figure	e 1, T	BA					Che	ecked	by:	BMcD
rill	mod	el an	d mou	unting:						slope:	-90°			R.L	. Surface:
ole dril	dian ling	neter I info	orma	tion				ma	terial	bearing substance	g:			dat	um:
ernoa	penetration	pport	ater	notes samples, tests, etc	well		denth	aphic log	assification mbol	material	characteristics	s,	oisture ndition	nsistency/ insity index	structure and additional observations
E	12	3 00	Ň		details OOO	RL	metres	ß	s) CI	colour, secondary and mino	r components.		Εŭ	ŭõ	
							-								
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							<u>1</u>								
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							7								
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etho	bd				suppo	ort	8		notes, sa	mples, tests	classification s	symbol	s and		consistency/density index
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Revision A

Coffey Geosciences Pty Ltd ACN 056 335 516

Principal: John Holland Development & Investment Pty Ltd Date complete: 15.8.2002 Project: Southwood Project Loggio by: AGG Southwood Project Loggio by: BMcD telenotic See Figure 1, TBA model and moving down in the source of the source o		ngli ent:	10	eri	Johr	ug - H Hollan		UN Ltd	iet	er			Office Jo	b No.: ted [.]	HO154/1 15.8.2002
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I 1 23 Image: Second and Addition Comparison. L C Image: Second and Addition Comparison. L C VD Fill. Low water return to surmoving thru road at -500 Image: Second and Addition Comparison. Image: Second andite Comparison. Image: Second	nethod	penetratio	support	vater	samples, tests, etc	well	de	epth	jraphic log	lassification symbol	material soil type: plasticity or particle	characteristics,	noisture condition	consistency/ lensity index	structure and additional observa
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			FAL	LING HEAD T	EST													
Hvorslev, 1951 - Well Point : Filter in Uniform Sc	il		Elapsed	TEST DATA Depth to	Active	Active Head/	1.00	+				Active H Head	lead / Initia I vs Time	al			1	_
Fixed Parameters SWL = Standing Water Level D = diameter of test section or ID of casing d = diameter of standpipe L = length of test section estimated k_h/k_v where k_v = vertical coefficient of permeabili k_h = horizontal coefficient of permeabili m = transformation ratio = $\sqrt{k_v/k_v}$	Unit m bGL m m ratio ty ty ratio	Value 8.71 0.100 0.057 8.71 5.00 2.236	1 ime (mins) 0 0.17 0.33 0.50 0.67 0.83 1.00 1.17 1.50	Water (mbGL) 0.00 1.70 2.20 3.55 3.71 3.74 3.80 3.82 3.84	Head (m) 8.71 7.01 6.51 5.16 5.00 4.97 4.91 4.89 4.87	Initial Head 1.00 0.80 0.75 0.59 0.57 0.57 0.56 0.56	l Head (H _/ /H ₀)			1 ₁₁₁₁	1 1							
T = basic time lag = t when $(H_t/H_0 = 0.37)$ Water Level at t ₁ Water Level at t ₂ H ₂ Water Level at t ₂ Water Level at t ₂ SWL d Bentonite / grout sea +D+	mins I	1.1	2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 20.00 20.00 25.00 30.00	3.88 3.94 3.96 3.97 3.98 4.00 4.02 4.05 4.15 4.29 4.41 4.50 4.61 4.72 4.81 4.91 4.97 5.04 5.10 5.36 5.50	4.83 4.77 4.75 4.74 4.73 4.71 4.69 4.66 4.56 4.42 4.30 4.21 4.10 3.99 3.90 3.80 3.74 3.67 3.61 3.35 3.21	0.55 0.55 0.54 0.54 0.54 0.54 0.54 0.52 0.51 0.49 0.48 0.47 0.46 0.45 0.45 0.44 0.42 0.41 0.38 0.37	Active Head / Initia Active Head / Initia Poton	0	10 m ³ /m	20 k _v	30 El	40	50 me (mins)	60 7() 80) (day	300	
← k _h k _v Chosen time t ₁	mins	10.0	35.00 40.00 60.00	5.76 6.11 7.84 8.71	2.95 2.60 0.87	0.34 _ 0.30 _ 0.10	8.68E-0	08	1.7	4E-08	3.88E	-08	7.50E-03	3 1.	50E-03	3	.35E-0	3
$H_1 = active Head at time t_1$ $H_2 = active Head at time t_2$	m	4.56 2.60	50.00	0.71		-	4.21E-0	06	8.4	3E-07	1.88E	-06	3.64E-0 ⁻	1 7.:	28E-02	1	.63E-0	1
Coffey Geosciences																		
Drawn - AGG Approved -				John H South	Iolland Pty Li	td t										FIGU	RE B1	
Scale - Aug 2002				Hydroge Falling Head	ological Stuc	e SMB#1									jo	ob no. I	Ho <u>1</u> 54/	1

			FAL	LING HEAD	TEST							
Hvorslev, 1951 - Well Point : Filter in Uniform So Fixed Parameters SWL = Standing Water Level D = diameter of test section or ID of casing d = diameter of standpipe L = length of test section estimated k_h/k_v where k_v = vertical coefficient of permeabilit k_h = horizontal coefficient of permeabilit	il Unit mbGL m m ratio ry	Value 3.42 0.100 0.057 10.80 5.00	Elapsed Time (mins) 0.00 0.17 0.33 0.50 0.66 0.83 1.00 1.17	TEST DATA Depth to Water (mbGL) 0.00 1.55 2.57 2.95 3.06 3.10 3.12 3.13	Active Head (m) 3.42 1.87 0.85 0.47 0.36 0.32 0.30 0.29	Active Head/ Initial Head 1.00 0.55 0.25 0.14 0.11 0.09 0.09 0.08	1.00 - ਜਿੰਪ 0.10 - pe		Acti H	ve Head / Initial ead vs Time		
m = transformation ratio = $\sqrt[4]{H_v}$ T = basic time lag = t when (H _v /H ₀ = 0.37) H ₁ H ₁ Water Level at t ₁ Water Level at t ₂ SWL H ₂ Bentonite / grout seal	ratio mins	2.236 1.1	$\begin{array}{c} 1.33 \\ 1.50 \\ 1.66 \\ 1.83 \\ 2.00 \\ 3.00 \\ 4.00 \\ 5.00 \\ 6.00 \\ 7.00 \\ 10.00 \\ 15.00 \\ 20.00 \\ 25.00 \\ 30.00 \end{array}$	3.15 3.16 3.19 3.20 3.24 3.27 3.30 3.31 3.32 3.34 3.37 3.39 3.41 3.42	0.27 0.26 0.23 0.22 0.18 0.15 0.12 0.11 0.10 0.08 0.05 0.03 0.01 0.00	0.08 0.07 0.06 0.05 0.04 0.03 0.03 0.02 0.01 0.01 0.00 0.00	Active Head / Initial Head		10.00 1: Elapse	5.00 20.00 d Time (mins)	25.00	30.00 35.00
←D+ A A A A A A A A A A A A A A A A A A A					Variable Head (Determination	k _h	k _v 	k _{mean} = m/s	k _h	k _v m ³ /m²/day = m/d I	k _{mean} ay
Chosen time t_1 Chosen time t_2 $H_1 = active Head at time t_1H_2 = active Head at time t_2$	mins mins m m	0.8 20.0 0.32 0.03			$k_{h} = \frac{d^{2} \ln(2mL/I)}{8L (t_{2}-t_{1})}$ Basic Time Lag $k_{h} = \frac{d^{2} \ln(2mL/I)}{8LT}$	D) In(H ₁ /H ₂) Determination	4.78E-07 3.52E-06	9.57E	08 2.14E-07 07 1.57E-06	4.13E-02 3.04E-01	8.26E-03 6.08E-02	1.85E-02 1.36E-01
Coffey Geosciences	•										1	
Drawn - AGG Approved - Date - Aug 2002				John Sou Hydrog	Holland Pty Lt thwood Project jeological Stud	d : ies						FIGURE B2
Scale - Not to Scale				Falling Hea	d Test of Bore	SMB#2					joł	o no. Ho154/1



			Geotechnical	Resources Environme Ph;	ntel Technical Project 6 Church Street, Hawtho (03) 9853 3396, Fax: (0	Management orn, Vic, 3122 3) 9853 0189
Ca lient orinci oroja	lifornia be : JOHN HOLLA ipal : ct : SOUTHWOO on : TASMANIA	aring	g ratio test res	sults	job no : HO154 laboratory : MELBO data : 27/08, test report : AA	A/1 DURNE 102
est abo	procedure : ratory compaction r	nethod :	AS1289 6.1.1 AS1289 5.1.1			
sam	ple number :		TP 2	TP 3	TP 13	
dept	h:	m	2.0 - 2.5m	2.0 - 2.5m	1.0 - 1.5m	
oca	tion:	2	REFER TO FIGURE 1	REFER TO FIGURE 1	REFER TO FIGURE 1	
date	sampled:		N.A	N.A	N.A	
dete	tested:		26-Aug-02	26-Aug-02	26-Aug-02	
sam	ple description:		GRAVELLY SILTY CLAY, medium plasticity, orange brown, fine to coarse gravel	SANDY CLAY / CLAYEY SAND, fine to coarse, orange brown, low plasticity, some gravel	clayay GRAVELLY SAND, orange brown, fine to coarse, gravel fine to coarse, low plasticity.	
nax	imum dry density:	t/m ³	1.64	1.90	1.73	
opti	mum moisture cont	ent: %	19.0	13.0	18.0	
field	moisture content:	%	17.4	13.0	15.0	
%	retained on 19mm	:	4.8	0	8.2	
	dry density	before soeking	1.60	1.86	1.70	
	ر/m ³	after soaking	1.59	1.85	1.70	
1.23	density ratio	:	98	98	98	
. test	moisture ratio):	105	100	97	
C.B.R	number of days s	oaked:	4	4	4	
1	surcharge:	kg	4.5	4.5	4.5	
	moisture conte top 30mm	nt %	24.1	15.4	21.4	
e.	moisture conte remaining sen	nple	23.4	13,9	18.1	
	swell after soaki	ng: %	0.0	0.5	0.0	
	penetration:	mm	5.0	5.0	5.0	
1		0/_	13	11	20	

Coffey Geosciences Pty Ltd



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Authorised Signature NATA No 1040

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Epite Gmehling

Coffey Geosciences Pty Ltd A.C.N. 058 335 516

Geotechnical Resources Environmental Technical Project Management 16 Church Street, Hawthorn, Vic, 3122 Ph: (03) 9853 3396, Fax: (03) 9853 0189

test result	S				
client : JOHN HOLLAN principel : project : SOUTHWOOD location : TASMANIA test procedure : AS1289	D CONSTRUC	CTIONS PTY LTD 1 - 3.3.1 - 3.4.1		job no : H01 laboratory : MEL date : 28/0 test report : AB test date : variou	54/1 BOURNE 08/02
Location		TP 2	TP 3	 TP 6	TP 11
Depth m		2.0 - 2.5	2.0 - 2.5	0.4 - 1.2	0.4 - 1.2
Liquid limit	WZ	, 35	36	55	37
Plastic limit	Wp	25	18	29	22
Plasticity Index	ĺp	10	18	26	15
Linear Shrinkage	L.S.	6.5	7.5	10.5	7.5
curling / crumbling		crumbling	neither	neither	crumbling

Form Number L1.0R1 Varsion 5.0

Coffey (BB)



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remarks ; Notes 1. sampled by B McDowell, tested "as received"

Authorised Signature

NATA No 431

2. curling / crumbling refers to the condition of the linear shrinkage sample after constant drying

Emie Amehling

Coffey Geosciences Pty Ltd ALC.N. 058 335 518

Geotechnical Resources Environmental Technical Project Management 16 Church Street, Hawthorn, Vic, 3122 Ph: (03) 9853 3396, Fax: (03) 9853 0189

test result	s				
client : JOHN HOLLAN principal : project : SOUTHWOOD location : TASMANIA test procedure : AS1289	D CONSTRU 3.1.2 - 3.2	2.1 - 3.3.1 - 3.4.1	job no : laboratory : data : test report : test data ;	H0154/1 MELBOURNE 28/08/02 AC various	
Preparat	ion method	: oven dried, dry sieved			100
Location		TP 13			
Depth m		1.0 - 1.5			
Liquid limit	WL	. 27			
Plastic limit	Wp	27			
Plasticity Index	ĺp	6			
Linear Shrinkage	LS.	3			
curling / crumbling		crumbling			

Form Number L1.0R1 Version 5.0

Coffey (BB)

remarks ; Notes 1. sampled by B McDowell, tested "as received" 2. curling / crumbling refers to the condition of the linear shrinkage sample after constant drying



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Authorised Signature

NATA No 431

Emie Gmehling

Coffey Geosciences Pty Ltd AC.N. 058 335 518

a	

			ich no f	H0154/1	
ONSTRUCI	TIONS PTY LTD		Jub no : Jahoratory :	MELBOURNE	
			date :	28/08/02	
			test report :	AD	
3 (Triaxial 1	Permeability)		test data :	22/08/02	
2	TP 6	TP 11			
	0.4 - 1.2	0.4 - 1.2	<u>.</u>		
t/m³	1.44	1.60			
%	30.5	21.5			
t/m ³	1.839	1.908			
96	32.4	22.6			
t/m ³	1.41	1.56			
%	98	<i>98</i>			
96	97	103			
96	0	0			
~	-				
	3.5E - 9	1.2 E - 8			
	distilled	distilled			
	TP 6 SILTY	CLAY, medium to h	igh plasticity, mot	tled grey yellow brown	
	TP 11 SILTY	CLAY, medium to h	high plasticity, mot	ttled grey yellow brown	
	The san	nple was remoulded i	in five layers at 98	1% SMDD @ OMC	
3					
					- 199
	3 (Triaxial 1 1/m ³ % 1/m ³ % % %	3 (Triexial Permeability) 1 TP 6 0.4 - 1.2 Um ³ 1.44 % 30.5 Um ³ 1.839 % 32.4 Um ³ 1.41 % 98 % 97 % 0 3.5E - 9 distilled TP 6 SiLTY TP 11 SiLTY The san	3 (Triaxial Permeability) TP 6 TP 11 0.4 - 1.2 0.4 - 1.2 t/m ³ 1.44 1.60 % 30.5 21.5 t/m ³ 1.839 1.908 % 32.4 22.6 t/m ² 1.41 1.56 % 98 98 % 97 103 % 0 0 3.5E - 9 1.2 E - 8 distilled distilled TP 6 SILTY CLAY, medium to h TP 11 SILTY CLAY, medium to h The sample was removided The sample was removided	laboratory : dete : test report : 3 (Triaxial Permeability) TP 6 TP 11 0.4 - 1.2 0.4 - 1.2 Um ³ 7.44 1.60 % 30.5 21.5 t/m ³ 1.839 1.908 % 32.4 22.6 t/m ⁷ 1.41 1.56 % 98 98 % 97 103 % 0 0 3.5E - 9 1.2 E - 8 distilled TP 6 SILTY CLAY, medium to high plasticity, mother that the second of the	Isborstory : MELBOURNE dite : 28/08/02 test report : AD 3 / Trinxial Pormeshility / test dete : 22/08/02 TP 6 TP 11 0.4 - 1.2 0.4 - 1.2 1 0.4 - 1.2 2 0.4 - 1.2 2 1.44 1.60 % 30.5 21.5 27 1.839 1.908 % 32.4 22.6 2 1.41 1.65 5 % 98 98 38 % 97 103 5 % 0 3.5E - 9 1.2 E - 8 distilled TP 6 SILTY CLAY, medium to high plasticity, mottled grey yallow brown TP 13 SILTY CLAY, medium to high plasticity, mottled grey yallow brown TP 13 SILTY CLAY, medium to high plasticity, mottled grey yallow brown The sample was remoulded in five layers at 98% SMDD @ OMC

Coffey Geosciences Pty Ltd A,C,N, 058 335 516

t/m

1.97

maximum dry density:

	Geotechnical	Resources	Environment 16 Ph: (0	al Technical Church Street, 3) 9853 3396,	Project Managemu Hawthorn, Vic, 31 Fax: (03) 9853 01	ent 22 89
california bearin client : GHD PTY LTD principal : project : SOUTHWOOD location : TASMANIA	g ratio test res	ults	j la d	ob no : aboratory : late : est report :	H0142/1 MELBOURNE 01 May 02 AB	
test procedure : laboratory compaction method :	A\$1289 6.1.1 A\$1289 5.1.1					1999). 1
sample number :	# 1					
depth: m	-			19. 		
location:	REFER TO FIGURE 1					
date sampled:	18-Apr-02					
dete tested:	30-Apr-02					
sample description:	SANDY GRAVEL, fine to coarse, light grey white, fine to coarse sand		-			



L2.6R1 Ş

opti	mum moisture cor	ntent: %	9.5		
field	moisture content	: %	2.7		
%	retained on 19mr	п:	34		
	dry density	before soaking	1.93		
	t/m ³	after soaking	1.94		
	density rati	o:	98		
. tesl	moisture rati	io:	101		
C.B.R	number of days	soakad:	4		
	surcharge:	kg	9.0		
	moisture cont top 30mr	ent % n	11.0	23	
	moisture cont remaining sa	ent % mple	9.8		
	swell after soak	ing: %	0.0		
	penetration:	mm	2.5		
	C.B.R. value:	%	90		



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1 Jack Authorised Signature Ernie Smehling

1040 NATA No

Coffey Geosciences Pty Ltd A.C.N. 056 335 516

Technical Project Management Environmental Geotechnical Resources 16 Church Street, Hawthorn, Vic, 3122 Ph: (03) 9853 3396, Fax: (03) 9853 0189

-						12
test result	S					10
client : GHD PTY LTD principal : project : SOUTHWOOD location : TASMANIA				job no : Ho leboratory : M date : 1/ test report : Ac	0142/1 ELBOURNE 05/02 C	
test procedure : AS1289 Preparat	3.1.2 - 3.2.1 ion method : 0	- 3.3.1 - 3.4.1 ven dried, <u>dry sieved</u>			04/02 	
2019	20	2 <u>8</u>	ATTERBE			
Sample identificati	on	sample 1	MPY1	MPY 2		96 <u>19</u> 5
Liquid limit	WL	, N.Р	28	37		
Plastic limit	Wp	N.P	19	26		
Plasticity Index	I₽	N. P	9	11		
Linear Shrinkage	L.S.	0	6	8		
curling / cracking		none	crumbling	crumbling		

Coffey (B)



2. curling / crecking refers to the condition of the linear shrinkage sample after constant drying



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Authorised Signature

Ernie Gmehling NATA No 431

Coffey EXH

Environmental | Technical | Project Management

16 Church Street, Hewthorn, Vic, 3122 Ph: (03) 9853 3396, Fax: (03) 9853 0189

clien princ proje locat	t: GHD PTY LT ipal: ct: SOUTHWOO ion: TASMANIA	0		job no : laboratory : report date : test report :	H0142/1 MELBOURNE 06 May 02 AF	
test leboi	procedure : retory compaction me	ethod :	AS1289 6.1.1 AS1289 5.1.1	5.95 5.95		
sam	ple number :		MPY 1			
dept	h:	m				
loca	tion:		REFER TO FIGURE 1			
date	sampled:		18-Apr-02			
date	tested:		3-May-02			
sam	ple description:		GRAVELY SAND, fine to coarse, brown, fine to coarse gravel, fines of low plasticity.	2		
max	imum dry density:	t/m ³	1.71			
opti	num moisture conte	nt: %	19.5			
field	- moisture content:	%	19.3		- 22	
%	retained on 19mm:		5.2			
	dry density	before soaking	1.68			
	t/m ³	after soaking	1.70			00000
	density ratio:	0099 3.0	99			
l. tos	moisture ratio:		98			
C.B.A	number of days soa	aked:	4			
	surcharge:	kg	4.5			
	moisture conten top 30mm	t %	21.0	6782		
	moisture conten remaining samp	nt % ble	20.0			
3	swell after soaking	: %	0.0			
	penetration:	mm	5.0			
	C.B.R. value:	%	20			

Geotechnicel Resources



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	MICROB	IOLOGI	CAL RESULTS	ORM	Water	(2002)						
Report No:		W484/02	2	Cof	fev Ge	oscien	ces	National As	sociation of	Torting		
Order No: Page: 1 of 1 Submitted by: B McDowell					ABN: 57 0: 289-291 L Hobart T	56 335 516 iverpool St 'AS 7000		Authorities, Australia				
Date report	issued:	22/08/02 (M S	Jilley Sharpe, Microbiologist)	Phone: (03) 6234 9955 Fax: (03) 6234 9577				This document may not he reproduced except in full.				
Sample Number	Lab. Number	Sample Description	Sample Site	. Date Collected	Time Collected	Date Received	Date Tested	Tests Required *	FC /100mL	<i>E.coli</i> /100mL	FS /100mL	
H0154/1 SMB#2	02/W8/243	Water	Southwood bore	15/08/02	nr	16/08/02	16/08/02	FC, E.coli , FS	<10	<10	20 (est)	
H01541 SMB#3	02/W8/244		Southwood bore					H	10 (est)	10 (est)	10 (est)	
							`					

*tests were performed on samples as received

est = estimate

Test Methods

FC (Faecal Coliforms), E.coli, AS4276.7-1995; FS (Faecal Streptococci), AS4276.9-1995.

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____ **

WATER ECOscience

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nr = not recorded

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WSLConsultants[™] WSL Consultants Pty. Ltd.

Enviroscience

A.C.N. 004 752 676 A.B.N. 49 004 752 676 2-8 Harvey Street, Richmond, Victoria 3121, Australia Telephone: +61 3 9429 4666 Facsimile: +61 3 9429 2294 Email: wsl@wsl.com.au Web: www.wsl.com.au

Date : 28-Aug WSL Report N	-2002 lo: 481485														
M2 1 100 M000 0	EC: 18572	Client: Colley Hoba	rt Job Refere	eoce: H0154	n.							5.5.8			
LABNUM	Received	Semple	POTASSIUM	NUIDOS	CALCIUM	MAGNESIUM	ALKALINITY 35 CaCO3	BI- CARBONATE 23 CaCO3	CARBONATE ns CaCOJ	HYDROXIDB III CICO3	CHLORIDB	SULPHATE	(A	PHOSPHORUS	TOTAL NITROGEN
481486	19-Aug-2002	SMB#2	2.4	6.1	0.51	1.5	6	8	<2	<2	13	रा	45	0,21	2.5
48)487	19-Aug-2002	SMB#3	9.2	18	7.2	13	90	90	<2	<2	22	<i< td=""><td>340</td><td>0.52</td><td>3,9</td></i<>	340	0.52	3,9

A blank space indicates no test performed

Results expressed as mg/L where applicable





28-RUG-2002

12:56



A.C.N. 904 752 676 A.B.N. 49 004 752 676 2-8 Harvey Street, Richmond, Victoria 3121, Australia Telephone: +61 3 9429 4666 Facsimile: +61 3 9429 2294 Email: wsl@wsl.com.au Web: www.wsl.com.au

Date : 28-Aug-20 WSL Report No: WSL JobNumber:	02 481486 18572 (Client: Coffey Hobart	Job Reference: H0154/1							
LAB NUM	Received	Sample	ТРН С6-С9	ТРН C10-C14	TPH C15-C28	ТРН C29-C36	BENZENE	TOLUENE	ETHYL BENZENE	XYLENES
481486	19-Aug-200	2 SMB#2	<0.1	<0,1	⊲0.1	<0.1	<0.001	<0.001	⊲0.001	<0.001
481487	19-Aug-200	2 SMB#3	<0.1	0.1	0.6	<0.1	<0.001	0.001	100.0>	<0.001

Ablank space indicates no test performed

Results expressed as mg/L





28-AUG-2002

12:57



WSL Consultants Pty. Ltd. A.C.N. 004 752 676 A.B.N. 49 004 752 676 2-8 Harvey Street. Richmond, Victoria 3121, Australia Telephone: +61 3 9429 4666 Facsimile: +61 3 9429 2294 Email: wsl@wsl.com.au Web: www.wsl.com.au

ate : 18-Aug-20	01									
ISL Report No:	481486									
'SL JobNombor:	18572	Client	Colley Hobart	Job Reference: H0154	n					
LABNUM	Receiv	ved	Sample	NAP	ACY	ACE	FLU	рне	ANT	FLA
481486	19-Aug-	2002	SMB#Z	<0.001	⊲0.001	<0.001	<0.001	<0.001	<0.001	<0.001
481487	19-Aug-	2002	S)/(B#3	<0.001	<0.001	<0,001	<0.001	<0.001	<0.001	<0.001

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H H H Total PAH's refers only to the sum of individual PAH's tested above.

D & blash space indicates no test performed



Results expressed as mg/L



TOTAL* **IPY** BGP DBÁ BKF BAP PYR BBF CHR BAA PAH . <0.01 100.0> <0,001 <0.001 -0.001 40.001 <0.001 <0.001 <0.001 <0,001 40.01 <0.001 <0.001 40,001 <0.001 400.0> <0.001 <0.001 <0.001 -0.001









LEGEND
Borehole with Groundwater level
Quaternary Alluvium
Permian Sedimentary Rocks (apparent dip in section)
Shear Zone, Projection of mapped, others will be present

N	o. Description	Drawn	Approved	Date	Coffey	Geoscie	nces Pty Ltd ACN 056 335 516 Geotechnical Resources Environmental Technical Project Management
					Drawn	SB	JOHN HOLLAND PTY ITD - SOUTHWOOD PROJECT Drawing No.:
					Approved	B McD	GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS
					Date	AUG' 2002	CROSS-SECTION A - A' & B - B'
C	Issued for Tender	SB	B McD	29/8/02	Scale	NTS	Job No. : HO154/1-AE







