Geotechnical Investigation for Proposed HEZ Light Industrial Development

December, 2007

WIPS Management

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1. Introduction

At the request of WIPS Management, PB has carried out geotechnical investigation at the proposed WIPS Management production and warehouse site located off HEZ Drive, within the Hunter Economic Zone (HEZ). The HEZ is approximately 900Ha in size and is located south of the villages of Pelaw Main, Kurri Kurri and Weston within the Cessnock Local Government Area. The HEZ site has been designated for industrial/commercial development. The location of the WIPS Management site is shown on Figure 1.

The WIPS Management site is to be developed for the manufacture of prefabricated walls. Based on architectural drawings provided by Justin Long Design current at the time of the investigation, the development will comprise industrial steel framed metal clad buildings totalling approximately 3Ha in area, with above and below ground storage tanks, and an access road off HEZ Drive with car/truck parking.

PB have completed a separate desk top study to assess mine subsidence impacts at the site which is detailed in PB report 2122647A.Pr_0333.doc. This report addresses the field investigation, laboratory results and provides geotechnical recommendations relevant to the development. The issues addressed in this investigation are detailed below:

- assess foundation conditions at locations of proposed structures
- assess subgrade conditions for proposed pavements, parking and hardstand areas
- assess excavation conditions at the location of the proposed under ground tank, and
- provide parameters and recommendations to assist in planning and design of proposed structures and footings.

2. Method of investigation

The fieldwork for the geotechnical investigation was conducted on 5 April 2006. The subsurface investigation involved excavation of 11 test pits (TP1 to TP11) with a 5.8 tonne excavator. Test pits were excavated within the proposed footprint of buildings, hardstand and pavement areas and storage tanks. Test pits were positioned by GPS with 1m accuracy. Test pit locations are shown on attached Figure 2.

Test pits were excavated to a maximum depth of 3m or prior refusal. The strength and relative density of the subsurface soils was assessed in the field by bucket resistance and tactile methods. Pocket penetrometer testing was conducted on recovered cohesive soils. All fieldwork was supervised by a geotechnical engineer, who logged the soil profiles, undertook field testing and sampling, and recorded site observations.

Selected soil samples were tested at PB's NATA accredited laboratory in Singleton for Linear Shrinkage, Standard Compaction and 4 day soaked California Bearing Ratio.

Detailed engineering test pit logs and explanatory notes are attached in Appendix B. Laboratory reports are attached in Appendix C.

3. Results of investigation

3.1 Site description

The site is located within gently undulating terrain north of Mount Tomalpin. The northern end of the site forms a broad ridge which slopes away to the north at approximately 3-4^{o} and to the south at 4-6^{o}. Drainage occurs generally via overland flow to the north and south. Two broad gullies at the south end of the site drain towards Swamp Creek to the east at approximately 2-3^{o} and are each fed by culverts under HEZ drive. No surface water was observed at the site; however boggy ground was present at the outlet of the southern most culvert.

At the time of the investigation, the site was mostly vegetated by semi open forest. The north western corner of the site (approximately 2.3Ha) was cleared and used for materials stockpiling associated with HEZ construction works. Stockpiles of topsoil, mulch and general rubble/spoil were observed. The approximate height and extent of these areas is shown on Figure 2. Minor fill was observed across the cleared area up to a typical depth of 0.3m to 0.5m.

HEZ drive adjacent to the site was generally in fill with embankments up to 3m high along the low lying gully areas. Cut up to 1m was noted at the northern end of the site. The embankments generally sloped at 28^{o} to 32^{o} and were not vegetated. Drainage swales and sediment control fences were also located along HEZ Drive and the stockpile area. The fences were mostly observed to be full or overflowing at the time of investigation. Some rill erosion was observed along the cut/fill batters of HEZ Drive. Major rilling was present on the topsoil stockpiles to the north. Limited bank erosion was also observed within the larger (southern) gully. No rock outcrop was observed at the site.

3.2 Subsurface description

Reference to the Newcastle Coalfield Regional Geology Map indicates that the site is underlain by conglomerate, sandstone and siltstone of the Branxton Formation. Subsurface investigation indicates that soils at the site are generally hard residual silty clays and gravely clays. Gravely clays were encountered in test pits TP4, TP5 and TP7. Shallow refusal on distinctly weathered sandstone occurred in these test pits at between 0.85m and 1.6m depth. Silty clays were encountered in test pits TP3, TP6, and TP8 to TP11. Silt clays were generally underlain by extremely weathered to distinctly weathered siltstone and sandstone at between 0.8m to 2.5m depth. Fill was encountered in TP9 and TP10 at 0.5 and 0.3m depth.

Alluvial sandy silt and silty sand soils were encountered in TP1 and TP2 which were excavated in and near the gully on the south part of the site. Extremely weathered to distinctly weathered siltstone and sandstone was encountered at 2.5m and 3.3m depth.

Detailed engineering logs and explanatory notes are attached in Appendix B.

3.3 Laboratory results

Bulk soil samples and disturbed soil samples retrieved during field work for the geotechnical assessment were sent to Parsons Brinckerhoff's NATA accredited Singleton laboratory for testing. Laboratory test reports are presented in Appendix C and the results summarised in the following sections.

3.3.1 California bearing ratio

Laboratory testing for pavement design comprised three compaction and four-day soaked CBR tests on samples of materials expected to be encountered at subgrade level. The results of the CBR laboratory testing are summarised in Table 3.1.

Table 3.1 CBR results

Location	Sample depth (m)	Max^{m} dry density t/m^{3}	Optimum moisture content OMC (%)	Swell after soaking (%)	CBR % 2.5mm
TP 9	1.0-1.3	1.76	16.0	0.5	3.5
TP 10	0.5-1.1	1.65	19.6	1.4	2.0
TP 11	0.4-0.9	1.62	19.6	0.2	3.0

3.3.2 Linear shrinkage

Three disturbed samples were tested to determine the reactivity of the residual clay soils across the site. The results of the linear shrinkage testing are summarised in Table 3.2.

Table 3.2 Linear shrinkage results

Location	Sample depth (m)	Soil description	Linear shrinkage %
TP3	0.6-0.75	Silty CLAY	12.5
TP6	0.35-0.8	Silty CLAY	15.0
TP7	0.25-0.4	Silty CLAY	9.5

4. Discussion & recommendations

4.1 Mine subsidence

PB have completed a separate desk top study to assess mine subsidence impacts at the site which is detailed in PB report 2122647A.Pr_0333.doc. This report concluded that the Homeville Top Seam workings which underlie the proposed WIPS Management site are unlikely to have a significant impact on the development due to:

- the depth of the workings being greater than 150m, and
- the full extraction and anticipated collapsed condition of the workings (therefore further subsidence is unlikely).

It is noted however, that some provision for re-levelling of movement sensitive structures or equipment should be made.

4.2 Earthworks

4.2.1 Site preparation

Earthworks should be carried out in accordance with the recommendations outlined in AS3798-1996 “Guidelines for Earthworks for Commercial and Residential Developments”.

Prior to construction of pavements or structures and placement of any fill, the construction area should be stripped to remove all uncontrolled fill, vegetation, topsoil, root affected or other potentially deleterious material. Stripping depths are expected to vary between 0.2m and 0.6m depth with a typical depth being 0.3m. Stripped materials should be stockpiled for landscaping purposes or removed from site, as they are unsuitable for re-use as engineered fill.

4.2.2 Engineered fill

If filling is required materials preferred for use are well graded granular materials such as ripped or crushed rock, free of deleterious substances and which have a maximum particle size of 75mm. Gravely clay and distinctly weathered sandstone materials excavated from the east part of the site during construction may be suitable for reuse as fill if required, but should be inspected by a qualified geotechnical engineer prior to use.

Soil materials present in the stockpiles on the northwest part of the site contain topsoil, mulch and general rubble/spoil. These materials would be unsuitable for use as site fill.

Engineered fill should be compacted in layers not greater than 200mm loose thickness to a minimum density of 98% of Standard Compaction for cohesive soils or 70% Minimum Density Index for cohesionless soils. Clayey soils should be compacted to within ±2% of Standard Optimum Moisture Content.

All engineered fill should be tested under Level 1 inspection and testing in accordance with AS3798 – “Guidelines on Earthworks for Commercial and Residential Developments”.

All permanent fill batter slopes should be no steeper than 2H in 1V and protected from erosion. Alternatively, steeper fill embankments may be retained with properly designed and constructed retaining walls.

4.2.3 Reactive soils

Field investigation results indicate that the residual clay soils at the site are slightly to moderately reactive. The site is classified in accordance with AS2870 as Class M. Lightly loaded footings for structures should be designed to accommodate surface movements in the range of 20mm to 40mm.

4.2.4 Excavations

Architectural drawings provided by Justin Long Designs during the investigation indicate that an underground water storage tank will be constructed on the east part of the between the location of test pits TP4 and TP5. On this part of the site backhoe refusal on medium to high strength sandstone was encountered at 0.85m to 1.05m depth. Excavation below this depth is likely to require the use of rock breaking equipment.

If excavation is required across other parts of the site during construction it is anticipated that the natural soil materials on site could be excavated using a conventional bulldozer blade or excavator bucket to the depths indicated on the test pit logs. Refusal on extremely to distinctly weathered sandstone and siltstone was encountered in most test pits across the site at depths of between 0.8m and 3.3m . Excavation below the depth of refusal is expected to be slow and may require the use of hydraulic rock breaking equipment.

Temporary excavation batters in soil or extremely weathered siltstone or sandstone should be graded no steeper than 1.5 Horizontal (H) in 1 Vertical (V), while any permanent batters should be graded no steeper than 2H in 1V. Batters should be protected from erosion by re-directing any surface water flows from the batter face and revegetating. If steeper batters are required they should be supported by a properly engineered retaining wall. Any distinctly weathered (or fresher) sandstone may be excavated at a permanent batter slope of 1H in 1V subject to an inspection by an engineering geologist or geotechnical engineer.

4.2.5 Erosion

Based on PB's experience across the HEZ site surface soils are considered to be highly susceptible to erosion once exposed. Removal of vegetation prior to construction will therefore increase the potential for soil erosion. Soil erosion during construction will require management; however levels of erosion should be able to be maintained within normally acceptable levels by adopting good soil erosion and sedimentation control practices, including:

- plan for soil and water management concurrently with engineering design and in advance of any earthworks
- minimise the area and duration of soil exposure
- stockpile stripped topsoil for re-use and protect from erosion

- control stormwater runoff by diverting stormwater from denuded areas, minimising slope gradients, lengths and runoff velocities
- trap soil and water pollutants using silt traps, sediment basins, perimeter banks, silt fences and nutrient traps as appropriate, and
- quick rehabilitation of denuded areas.

4.3 Footings

4.3.1 Shallow footings

Shallow footings such as raft slabs, strip or pad footings could be used on the site provided they were designed to accommodate the surface movement expected to occur in moderately reactive clays. Footings founded on hard, residual silty and gravely clay soils on the site can be proportioned for an allowable bearing pressure of 200kPa. Footings founded on distinctly weathered, low strength siltstone or sandstone can be proportioned for an allowable bearing pressure of 600kPa. Footings founded on controlled compacted fill may be proportioned for maximum allowable bearing capacity of 150kPa.

Alluvial sandy silt and silty sand encountered in test pits TP1 and TP2 near the gully on the southern part of the site may be difficult to compact and therefore would not be suitable for shallow foundations. If shallow foundations are preferred a nominal 0.5m layer of controlled fill could be placed and compacted to the specification set out in Section 4.1 to provide a suitable working platform. Alternatively sandy silt and silty sand soils could be excavated until suitable founding material is exposed.

The footing excavation should be trimmed and cleaned prior to pouring to remove any loosened or softened material. Exposed clays may fret and soften on exposure and therefore, concrete should be poured within 24 hours of footing excavation, or else a blinding layer of concrete used to protect the base. Should softening of the exposed soils occur, the affected material should be over excavated and backfilled to design footing level by a layer of mass concrete.

4.3.2 Deep footings

Heavily loaded structures or structures to be founded below alluvial soils should be supported on piles founded on distinctly weathered sandstone or better. Bored piles would be suitable.

The suggested design values for bored piles are shown in Table 4.1.

Table 4.1 Design values for bored piles

Stratum	Depth Below Natural Ground	Allowable Shaft Adhesion (kPa)[(1)]	Serviceability End Bearing Pressure (kPa)[(2)]
Siltstone – distinctly weathered, low strength (Class V)	1.6m to 3.5m	40	700
Sandstone – distinctly weathered, low to medium strength (Class V)	0.8m to 1.0m	60	1000

[(1)] AS2159-1995 requires that the contribution of the pile shaft from ground surface to 1.5 pile diameters or 1m (whichever greater) shall be ignored. Assumes a clean socket with roughness category of R2 or better as defined by Walker and Pells (1998).

[(2)] Assumes minimum embedment depth of 1 × pile diameter into the founding stratum.

The recommended foundation design parameters given above have been based on the research findings documented in Pells, PJN et al. (1998), 'Foundations on Sandstone and Shale in the Sydney Region', Australian Geomechanics Journal, December 1998. Allowable bearing capacities are based on a limiting settlement of 1% of the pile diameter and shaft adhesion values include a FOS of 2.5.

4.3.3 Further work

The footing recommendations are based upon a limited test pit investigation. Improvement in founding conditions may be expected with greater depth of excavation in rock. A drilling investigation with rock coring and testing is recommended if significant rock sockets and/or higher strength founding conditions are required.

Further advice should also be sought where footings with substantial vibrating loads are anticipated (e.g. punch presses, large reciprocating engines etc)

4.4 Pavements

4.4.1 Design Subgrade Conditions

Pavement design should be based on the CBR of materials forming the top 300mm of subgrade and with regard to traffic loads and volumes.

The subgrade conditions beneath access roads and car parking areas are likely to consist of silty clays on the northwest part of the site and silty sands and sandy silts on the south part of the site.

Based on the CBR test results and provided subgrade preparation is carried out in accordance with Section 4.2, we recommend that the design of flexible pavements for the car park and driveway areas on the northwest part of the site be based on a CBR of 2%. For concrete or rigid pavement design, an equivalent modulus of subgrade reaction of 18kPa/mm may be adopted.

On the southern part of the site alluvial silty soils are unlikely to provide a suitable subgrade for pavements. These materials may need to be excavated and replaced with imported

materials. If imported materials are to be used in subgrade preparation, additional sampling and testing would be required to confirm CBR design values.

4.4.2 Subgrade preparation

Following stripping, the exposed subgrade materials should be proof rolled to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with approved select material or stabilised using lime.

The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade fill should be compacted to minimum density ratio of 100% Standard Maximum Dry Density at a moisture content in the range of ±2% of the Optimum Moisture Content. The CBR of the top 300mm of subgrade material should not be less than the CBR value adopted for the pavement design.

5. Limitations

This report should be read in conjunction with the appended “Limitations of Geotechnical Site Investigation”, which provide important information regarding geotechnical investigations and assessments. Any changes to the scope of development of this site, or significant variation in subsurface conditions from those anticipated should be reported to PB for reassessment.

Figures

Client: WIPS Management
Project: Geotechnical Investigation
Location: HEZ Development

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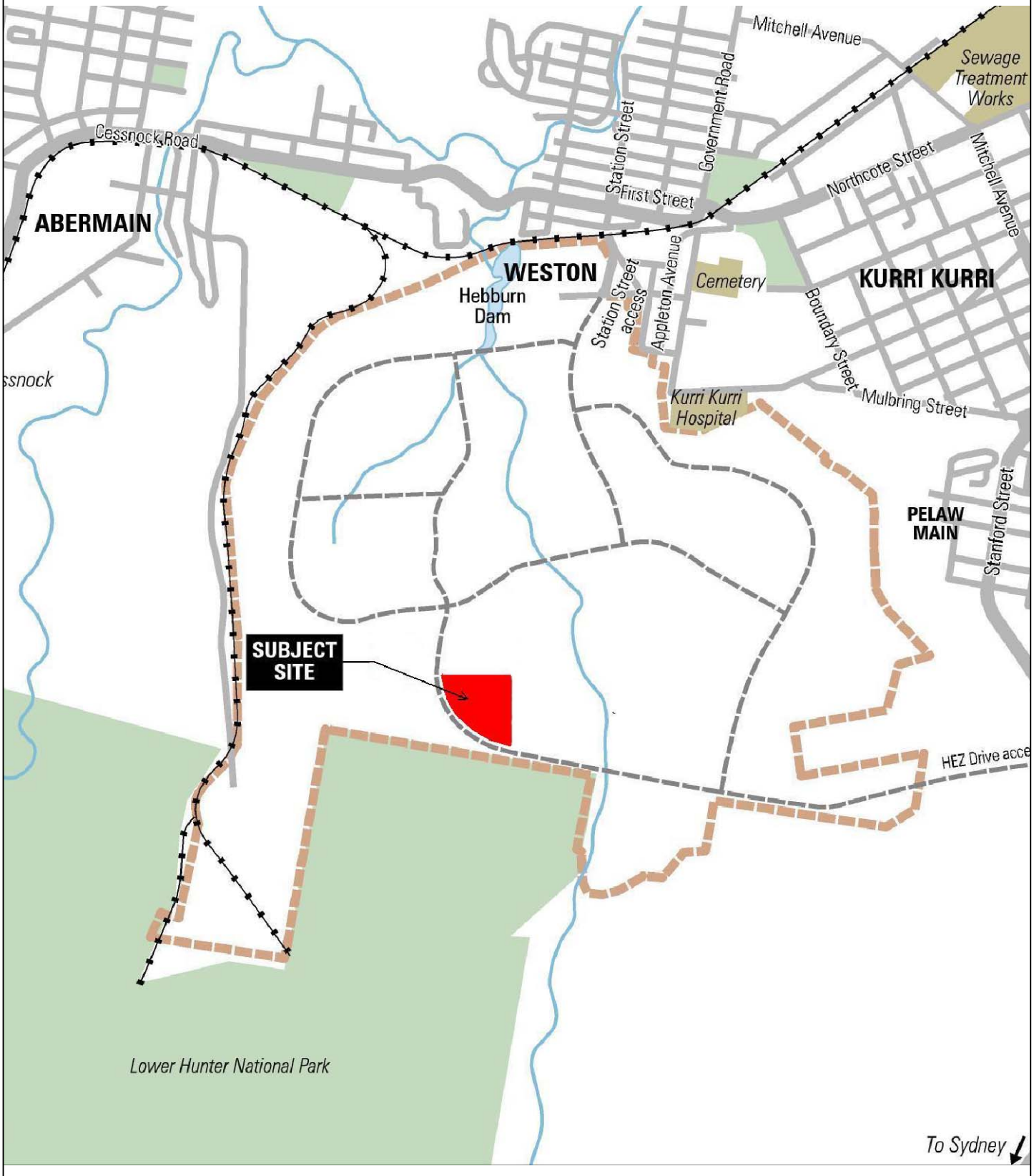


Site Plan
Figure 1

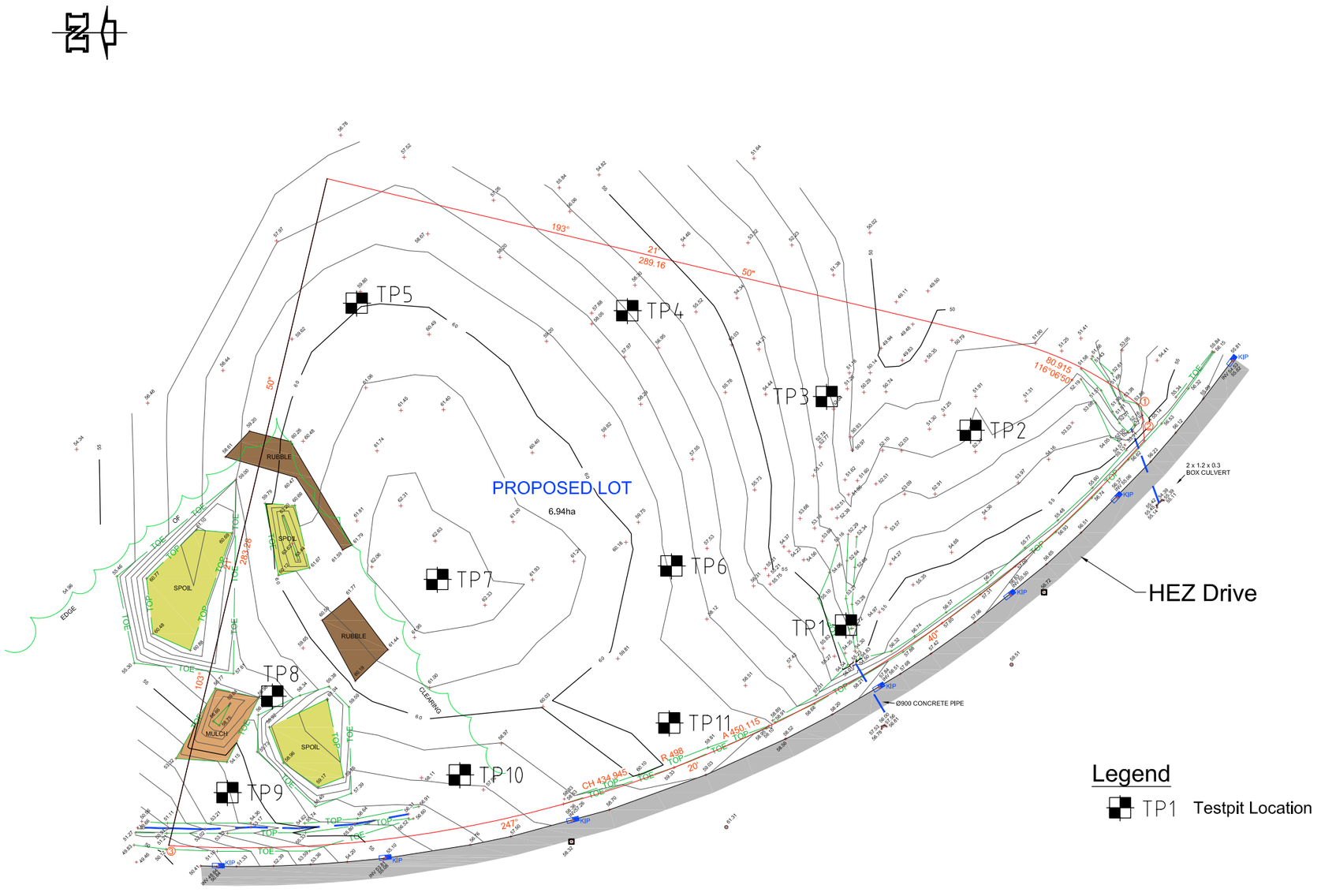
REPORT: 2122647a\PR_0358
CAD REFERENCE: J:\2122647a_Walltech\09_Drafting\001\ACAD\DRAWINGS\PR_0358\figure 1.dwg

Client: WIPS Management
Project: Geotechnical Investigation
Location: HEZ Development

PARSONS BRINCKERHOFF

0 50 100 m

Scale 1: 2000



Legend

TP1 Testpit Location

Testpit Location Plan
Figure 2

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Appendix A

Limitation of geotechnical investigations

LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

Scope of Services

This geotechnical site assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Parsons Brinckerhoff (PB) ("scope of services"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, PB has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, PB has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. PB will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to PB.

Geotechnical Investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the Client and expressly for purposes indicated by the Client or his representative. Use by any other persons for any purpose, or by the Client for a different purpose, might result in problems. The Client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This Geotechnical Report is Based on Project-specific Factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed; or
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

The Limitations of Site Investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface

profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface Conditions are Time Dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept appraised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid Misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/Profile Logs Should Not Be Separated from the Engineering Report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters. Canberra 1987.

Geotechnical Involvement During Construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. PB assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of PB or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

PB will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Appendix B

Test pit logs and explanatory notes

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP 1

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 341946.35 N 1364743.33**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					SP	TOPSOIL, Sandy SILT, low plasticity, grey brown, trace root fibres	MC<PL			ALLUVIAL
	0.30				SP	Sandy SILT, low plasticity, grey, fine grained sand, trace fine rounded gravel				
	1.00 1				SM	Silty SAND, fine, brown speckled orange	D			Cemented
	1.70				SM	Silty SAND, fine grained, grey mottled orange, with fine to coarse rounded gravel and cobbles				Very hard scraping on gravel Possibly RESIDUAL
	2									
	2.50					SANDSTONE, fine grained, orange brown, interbedded with SILTSTONE, grey, extremely weathered, extremely low to low strength				Thinly laminated
						END OF TEST PIT AT 2.70 m				No Refusal

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP10

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 341884.53 N 1364903.45**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					SW	FILL: Sandy GRAVEL, fine to coarse, grey, fine to coarse grained sand	D			FILL
	0.30				ML	TOPSOIL: Sandy SILT, low plasticity, brown	MC<PL			Cemented
	0.50				CL	Silty CLAY, medium plastcicty, red brown with fine to coarse sub-angular to angular gravel	MC~PL		>600 >600 >600	RESIDUAL SOIL
	1		B							
	1.10				CL	Silty CLAY, low plasticity, pale gray mottled red	MC<PL			
	1.40					SILTSTONE, pale grey mottled red/orange, extremely to distinctly weathered, extremely low to medium strength				
						END OF TEST PIT AT 1.90 m				Bucket refusal on inferred medium strength rock
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP11

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 341905.9 N 1364816.62**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Gravelly Sandy SILT, low plasticity, pale grey, fine sand, fine grained to medium grained gravels, trace root fibres	MC<PL			TOPSOIL
	0.40		B		CL	Silty CLAY, medium plasticity, brown mottled red/orange	MC~PL		>600 >600 >600	RESIDUAL SOIL
	0.90				CL	Silty CLAY, low plasticity, pale grey, mottled orange	MC<PL		>600 >600 >600	Some joints approximately 100mm spacing
	1									
	1.10					SILTSTONE, grey orange, distinctly weathered, very low to low strength, becoming pale grey mottled orange, interbedded with SANDSTONE, extremely weathered, very low strength				
	2									
						END OF TEST PIT AT 2.17 m				No Refusal

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP2

SHEET 1 OF 2

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 342026.92 N 1364691.61**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Sandy SILT, low plasticity, grey, with root fibres	MC<PL			ALLUVIAL
	0.20		D		ML	Sandy SILT, low plasticity, fine grained sand, grey				Cemented
	0.50		D		ML	Sandy Clayey SILT, low plasticity, grey, trace fine to medium rounded to sub-rounded gravel, fine grained sand			>600 >600 >600	
	1 1.10				SM	Silty SAND, fine grained, yellow brown, trace fine to medium sub-round to round gravel, some cementing	D			
	2.00 2				SM	As above, but with fine to medium subrounded to rounded gravel				"with" sub-rounded to rounded gravels
	2.30				CH	Sandy Clay, medium plasticity, yellow brown, fine grained sand	MC<PL			RESIDUAL

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP2

SHEET 2 OF 2

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 342026.92 N 1364691.61**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY VS S F ST VST / FB VL L MD D VD H	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					CH	Sandy Clay, medium plasticity, yellow brown, fine grained sand *(continued)*	MC<PL			
	3.28					SILTSTONE, brown, distinctly weathered, high strength				Bucket refusal on inferred high strength siltstone
						END OF TEST PIT AT 3.30 m				
	4									
	5									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP3

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 342041 N 1364751.21**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Sandy SILT, low plasticity, grey brown, fine grained sand, trace root fibres				
	0.30				ML	Sandy SILT, low plasticity, pale grey, fine grained sand				
	0.60		D		ML	Silty CLAY, medium plasticity, brown mottled red, trace fine to medium sub-angular gravel, interbedded with extremely to distinctly weathered siltstone			>600 >600 >600	RESIDUAL SOIL
	0.85					SILTSTONE, pale grey mottled orange, extremely to distinctly weathered, extremely low to very low strength, with medium to high strength bands, interbedded with SANDSTONE and ironstone bands				
	1									
	1.30					As above, but distinctly weathered, medium to high strength with low strength bands				Some joints of approximately 0.1m
						END OF TEST PIT AT 1.60 m				Bucket refusal on inferred high strength rock
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP4

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 342076.66 N 1364833.7**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Gravelly Sandy SILT, low plasticity, grey, fine to medium gravels, trace root fibres	MC<PL			
	0.30				CL	Gravelly CLAY, medium plastcity, grey brown and red, fine to coarse angular to sub-angular gravels, with fine grained sand	MC<PL		>600 >600 >600	RESIDUAL SOIL
	0.50					SANDSTONE, fine grained, grey and red/orange, distinctly weathered, medium strength, with extremely low to very low strength bands				Joints approximately 30 to 100mm
	0.75					As above, but medium to high strength, light grey				
						END OF TEST PIT AT 0.85 m				Refusal on medium to high strength SANDSTONE
	1									
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP5

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 342079.93 N 1364945.9**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Sandy SILT, low plasticity, grey, with fine to coarse gravel, trace root fibres	MC<PL			
	0.20				CL	Gravelly CLAY, medium plasticity, red brown, fine to coarse, sub-angular to angular gravel				RESIDUAL SOIL
	0.50					SANDSTONE, fine grained, red brown, distinctly weathered, medium to high strength			>600 >600 >600	Highly fractured approximately 30mm spacing
	0.97 1		D			As above, but distinctly to slightly weathered, grey orange, medium to high strength				Few joints approximately 100-300mm
						END OF TEST PIT AT 1.02 m				Bucket refusal on inferred high strength rock
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP6

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**
Excavation Method:	**Excavator**	Surface RL:	
		Co-ords:	**E 341970.93 N 1364815.63**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	TOPSOIL: Sandy SILT, low plasticity, brown, fine grained sand with fine to medium gravel, trace root fibres	MC<PL			
	0.35		D		CL	Silty CLAY, low to medium plasticity, red brown	MC<PL		>600 >600 >600	RESIDUAL SOIL
	0.50				CL	Silty CLAY, low plasticity, pale grey mottled red, with extremely weathered, extremely low strength SILTSTONE bands				
	1									
	1.20					SILTSTONE, pale grey mottled red, distinctly weathered, very low to medium strength, interbedded SANDSTONE, fine grained, distinctly weathered, very low to medium strength				medium to high strength bands Fractured approximately 30 to 100mm
	2									
						END OF TEST PIT AT 2.20 m				Bucket refusal on inferred medium to high strength rock

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP7

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 341965.49 N 1364912.65**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					ML	Gravelly Sandy SILT, low plasticity, brown, trace root fibres	MC>PL			
	0.25		D		CH	Silty CLAY, medium to high plasticity, red brown, trace fine to coarse angular to sub angular gravel	MC~PL		>600 >600 >600	RESIDUAL SOIL
	0.60				CH	Gravelly CLAY, high plasticity, grey mottled red, fine to coarse sub-angular to angular gravel	MC<PL			
	1.00 1					SILSTONE, grey and red, distinctly weathered, medium to high strength, interbedded with silty clay and very low to low strength SILSTONE				
						END OF TEST PIT AT 1.60 m				Bucket refusal on inferred high strength SILTSTONE
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP8

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**
Excavation Method:	**Excavator**	Surface RL:	
		Co-ords:	**E 341917.23 N 1364981.1**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					SM	FILL: Silty SAND, fine grained, brown with wood fragments	D			Old mulch
	0.15				SM	TOPSOIL: Silty SAND, fine, grained brown, trace fine to medium gravel	D			TOPSOIL
	0.25				CL	Silty CLAY, medium plasticity, red brown, trace fine gravel sand and fine sub-angular gravel	MC<PL		>600 >600 >600	RESIDUAL SOIL becoming extremely weathered rock
	0.45					SANDSTONE, fine grained, red brown, distinctly weathered, medium to high strength				SANDSTONE bedding fractures approximately 50mm joints approximately 100 to 300mm
	0.70					SANDSTONE, fine, pale grey, distinctly weathered, low to medium strength				
	1					END OF TEST PIT AT 0.80 m				Bucket refusal on inferred medium to high strength rock
	2									

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

TEST PIT ENGINEERING LOG

TEST PIT NO.

TP9

SHEET 1 OF 1

Client:	**WIPS Management**	Date Commenced:	**05/04/06**
Project:	**Geotech Investigation for HEZ Warehouse**	Date Completed:	**05/04/06**
Test Pit Location:	**See site plan**	Recorded By:	**AJF**
Project Number:	**2122647A**	Log Checked By:	**JNA**

Excavation Method: **Excavator**

Surface RL:

Co-ords: **E 341877.33 N 1364999.75**

Test Pit Information				Field Material Description						
1	2	3	4	5	6	7	8	9	10	11
WATER	RL(m) / DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	HAND PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
					SP	FILL: Silty SAND, fine grained grey/orange	M			
	0.50				ML	Sandy SILT, low plasticity, grey fine grained sand, with tree roots	MC<PL			
	0.90				CL	Silty CLAY, low to medium plasticity, grey mottled orange	MC>PL		550 570	RESIDUAL SOIL
	1		B							
	1.30					SILTSTONE, grey, red and brown bedded red, distinctly weathered, very low to low strength, interbedded with IRONSTONE clay and fined grained SANDSTONE				Poorly developed thin laminations interbedded SANDSTONE, fine
	2					END OF TEST PIT AT 2.50 m				Bucket refusal on inferred medium strength rock

This test pit log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

PARSONS BRINCKERHOFF

Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{total length considered}}$$

$$\text{TCR (\%)} = \frac{\text{length of core recovered}}{\text{length of core run}}$$

ROCK STRENGTH

Rock strength is described using AS1726 and ISRM - Commission on Standardisation of Laboratory and Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index", as follows:

Term	Symbol	Point Load Index $Is_{(50)}$ (MPa)
Extremely Low	EL	<0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	>10

● Diametral Point Load Index test

■ Axial Point Load Index test

ROCK MATERIAL WEATHERING

Rock weathering is described using the following abbreviation and definitions used in AS1726:

Abbreviation	Term
RS	Residual soil
XW	Extremely weathered
DW	Distinctly weathered
SW	Slightly weathered
FR	Fresh

DEGREE OF FRACTURING

Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm – 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm – 100 mm with occasional shorter and longer sections.
Slightly Fractured:	Core lengths are generally 300 mm – 1,000 mm with occasional longer sections and occasional sections of 100 mm – 300 mm.
Unbroken:	The core does not contain any fracture.

DEGREE OF DEVELOPMENT OF BEDDING

Massive	No obvious development of bedding - rock appears homogeneous
Poorly Developed	Bedding is barely obvious as faint mineralogical layering or grain size banding, but bedding planes are poorly defined.
Well Developed	Bedding is apparent in outcrops or drill core as distinct layers or lines marked by mineralogical or grain size layering.
Very Well Developed	is often marked by a distinct colour banding as well as by mineralogical or grain size layering.

DEFECT DESCRIPTION

Type:	
B	Bedding
BP	Bed Parting
F	Fault
C	Cleavage
J	Joint
S	Shear Zone
CS	Clay Seam

Planarity	Description
P	Planar
Un	Undulating
St	Stepped
Ir	Irregular

Roughness	Description
Sm	Smooth
R	Rough
Sk	Slickensided
Fe	Ironstained

The inclination if defects are measured from perpendicular to the core axis.

WATER

Water level at date shown

◁ **Partial water loss**

▷ **Water inflow**

◀ **Complete water loss**

NFGWO **No Free Groundwater Observed**
The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

Graphic Symbols for Soils & Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicate mixed materials such as clayey sand.

Soil Symbols

Main components


CLAY


SILT


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


PEAT

Minor Components


Clayey


Silty


Sandy


Gravelly

Other


FILL


BITUMEN


CONCRETE

Rock Symbols

Sedimentary Rocks


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


LAMINITE


COAL


LIMESTONE


CONGLOMERATE

Igneous Rocks


GRANITE


BASALT


UNDIFFERENTIATED IGNEOUS

Metamorphic Rocks


SLATE, PHYLLITE, SCHIST


GNEISS

QUARTZITE

NFGWE No Free Groundwater Encountered: The borehole/test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

Appendix C

Laboratory results

Aggregates for Engineering Purposes

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Proposed HEZ Warehouse	**Sample No.**	9354
Location:	HEZ	**Depth:**	0.35 - 0.8m
Source:	TP 6	**Report No.**	5

Sieve Size (mm)	% Passing	Specification
200		
75		
63		
53		
37.5		
26.5		
19		
13.2		
9.5		
6.7		
4.75		
2.36		
1.18		
0.600		
0.425		
0.300		
0.150		
0.075		
Sample History		
Method		

ATTERBERG LIMITS			Procedures
Liquid Limit	%		
Plastic Limit	%		
Plasticity Index	%		
Linear Shrinkage	%	15.0	E
Mould Length	mm	250.06	
Crumbling / Curling		Curling	
Sample History			L
Sample Preparation			H,I

(A) AS 1289.3.1 . 1 Liquid Limit - Standard Method
(B) AS 1289.3.1 . 2 Liquid Limit - Subsidiary Method
(C) AS 1289.3.2 . 1 Plastic Limit - Standard Method
(D) AS 1289.3.3 . 1 Plasticity Index - Standard Method
(E) AS 1289.3.4 . 1 Linear Shrinkage - Standard Method
(F) AS 1289.3.6 . 1 Washed
(G) AS 1289.3.6 . 1 Dry Sieved
(H) OVEN DRIED
(I) DRY SIEVED
(J) RTA T201
(K) Sampled from Stockpile in accordance with AS 1141.3.1-6.9.5
(L) Sampled By Others
(m) Air Dried

SOILS DESCRIPTION / USC

Silty CLAY , red brown

Comments:

Date Sampled: 6/4/06

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025

Authorised Signatory: _____

Damian Wilson

Date: _____

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NATA LABORATORY No. 1731

Aggregates for Engineering Purposes

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Proposed HEZ Warehouse	**Sample No.**	9353
Location:	HEZ	**Depth:**	0.6 - 0.75m
Source:	TP 3	**Report No.**	4

Sieve Size (mm)	% Passing	Specification
200		
75		
63		
53		
37.5		
26.5		
19		
13.2		
9.5		
6.7		
4.75		
2.36		
1.18		
0.600		
0.425		
0.300		
0.150		
0.075		
Sample History		
Method		

ATTERBERG LIMITS			Procedures
Liquid Limit	%		
Plastic Limit	%		
Plasticity Index	%		
Linear Shrinkage	%	12.5	E
Mould Length	mm	250.08	
Crumbling / Curling		Curling	
Sample History			L
Sample Preparation			H,I

(A) AS 1289.3.1 . 1 Liquid Limit - Standard Method
(B) AS 1289.3.1 . 2 Liquid Limit - Subsidiary Method
(C) AS 1289.3.2 . 1 Plastic Limit - Standard Method
(D) AS 1289.3.3 . 1 Plasticity Index - Standard Method
(E) AS 1289.3.4 . 1 Linear Shrinkage - Standard Method
(F) AS 1289.3.6 . 1 Washed
(G) AS 1289.3.6 . 1 Dry Sieved
(H) OVEN DRIED
(I) DRY SIEVED
(J) RTA T201
(K) Sampled from Stockpile in accordance with AS 1141.3.1-6.9.5
(L) Sampled By Others
(m) Air Dried

SOILS DESCRIPTION / USC

Silty CLAY , orange brown

Comments:

Date Sampled: 6/4/06

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Authorised Signatory: _____

Damian Wilson

Date: _____

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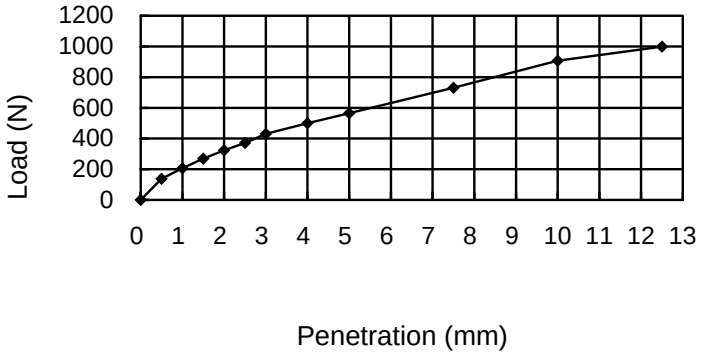
NATA LABORATORY No. 1731

California Bearing Ratio Report

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Proposed HEZ Warehouse	**Report No.**	3
Location:	HEZ		



Sample Information

Date Sampled:	06/04/06	Date Tested:	12/04/06	Sample No.	9352
Soil Description:	Silty CLAY , red				
Source Location:	TP 11, 0.4 - 0.9m				

Compaction and Placement Data

Compaction Used		Standard	Dry Density			
Maximum Dry Density	t/m^3	1.62	Before Soaking	1.60 t/m^3	99.5	% Comp.
Optimum Moisture Content	%	19.6	After Soaking	1.55 t/m^3	95.5	% Comp.
No. of Layers		3	Moisture Content			
Blows per Layer		53	At Compaction	%	20.5	
Drop of Rammer	mm	300	After Soaking	%	26.0	
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)	%	27.0	
Surcharge Used	kg	4.5	After Penetration (Entire Depth)	%	25.5	
Substitution +19mm Sieve		No	Swell After 4 Days Soaking	%	0.2	

California Bearing Ratio

CBR (Soaked) = 3.0 % at 2.5 mm Penetration

Procedures Used

A,C

AS 1289.6.1.1 DETERMINATION OF THE CALIFORNIA BEARING RATIO OF A SOIL - Standard Laboratory Method.

A. AS 1289 5.1.1 Determination of The Dry Density/Moisture Relation of a Soil Using Standard Compaction - Standard Method.

B. AS 1289 5 2.1 Determination of The Dry Density/Moisture Relation of a Soil Using Modified Compaction - Standard Method.

C. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Oven Drying Method (Standard Method).

D. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Microwave - Oven Drying Method (Subsidiary Method).

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

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Authorised Signatory: .....
Damian Wilson

Date: .....

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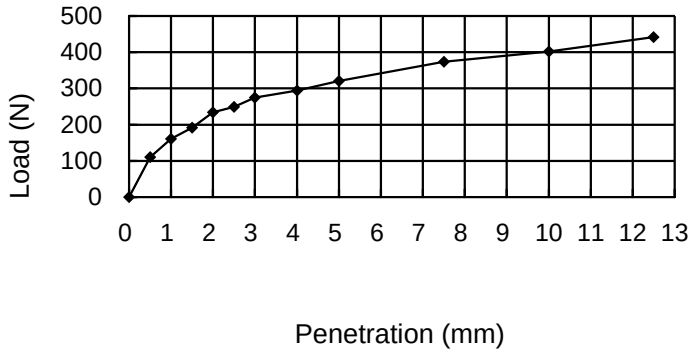
NATA LABORATORY No. 1731

California Bearing Ratio Report

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Proposed HEZ Warehouse	**Report No.**	2
Location:	HEZ		



Sample Information

Date Sampled:	06/04/06	Date Tested:	12/04/06	Sample No.	9351
Soil Description:	Silty CLAY , red brown				
Source Location:	TP 10, 0.5 - 1.1m				

Compaction and Placement Data

Compaction Used		Standard	Dry Density			
Maximum Dry Density	t/m^3	1.65	Before Soaking	1.65 t/m^3	100.0	% Comp.
Optimum Moisture Content	%	19.6	After Soaking	1.62 t/m^3	98.5	% Comp.
No. of Layers		3	Moisture Content			
Blows per Layer		53	At Compaction		%	19.5
Drop of Rammer	mm	300	After Soaking		%	22.5
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)		%	25.5
Surcharge Used	kg	4.5	After Penetration (Entire Depth)		%	22.0
Substitution +19mm Sieve		No	Swell After 4 Days Soaking		%	1.4

California Bearing Ratio

CBR (Soaked) = 2.0 % at 2.5 mm Penetration

Procedures Used

A,C

AS 1289.6.1.1 DETERMINATION OF THE CALIFORNIA BEARING RATIO OF A SOIL - Standard Laboratory Method.

A. AS 1289 5.1.1 Determination of The Dry Density/Moisture Relation of a Soil Using Standard Compaction - Standard Method.

B. AS 1289 5 2.1 Determination of The Dry Density/Moisture Relation of a Soil Using Modified Compaction - Standard Method.

C. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Oven Drying Method (Standard Method).

D. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Microwave - Oven Drying Method (Subsidiary Method).

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Accredited for compliance with ISO/IEC 17025

Authorised Signatory: .....
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Date: .....

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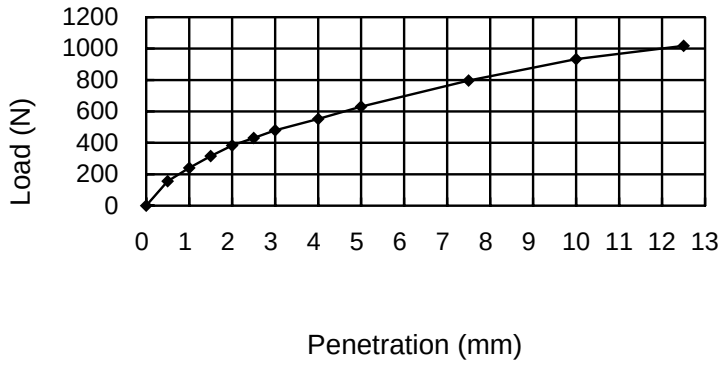
NATA LABORATORY No. 1731

California Bearing Ratio Report

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Proposed HEZ Warehouse	**Report No.**	1
Location:	HEZ		



Sample Information

Date Sampled:	06/04/06	Date Tested:	12/04/06	Sample No.	9350
Soil Description:	Silty CLAY , brown grey				
Source Location:	TP 9, 1.0 - 1.3m				

Compaction and Placement Data

Compaction Used		Standard	Dry Density			
Maximum Dry Density	t/m^3	1.76	Before Soaking	1.77 t/m^3	100.5	% Comp.
Optimum Moisture Content	%	16.0	After Soaking	1.79 t/m^3	101.5	% Comp.
No. of Layers		3	Moisture Content			
Blows per Layer		53	At Compaction		%	15.5
Drop of Rammer	mm	300	After Soaking		%	18.0
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)		%	18.0
Surcharge Used	kg	4.5	After Penetration (Entire Depth)		%	18.0
Substitution +19mm Sieve		No	Swell After 4 Days Soaking		%	0.5

California Bearing Ratio

CBR (Soaked) = 3.5 % at 2.5 mm Penetration

Procedures Used A,C

AS 1289.6.1.1 DETERMINATION OF THE CALIFORNIA BEARING RATIO OF A SOIL - Standard Laboratory Method.

A. AS 1289 5.1.1 Determination of The Dry Density/Moisture Relation of a Soil Using Standard Compaction - Standard Method.

B. AS 1289 5 2.1 Determination of The Dry Density/Moisture Relation of a Soil Using Modified Compaction - Standard Method.

C. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Oven Drying Method (Standard Method).

D. AS 1289 2.1.1 Determination of The Moisture Content of a Soil - Microwave - Oven Drying Method (Subsidiary Method).

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NATA LABORATORY No. 1731

Aggregates for Engineering Purposes

Client:	WIPS Management	**Job No.**	2122647A
Project:	Geotechnical Investigation for Prposed HEZ Warehouse	**Sample No.**	9355
Location:	HEZ	**Depth:**	0.25 -0.4m
Source:	TP 7	**Report No.**	6

Sieve Size (mm)	% Passing	Specification
200		
75		
63		
53		
37.5		
26.5		
19		
13.2		
9.5		
6.7		
4.75		
2.36		
1.18		
0.600		
0.425		
0.300		
0.150		
0.075		
Sample History		
Method		

ATTERBERG LIMITS			Procedures
Liquid Limit	%		
Plastic Limit	%		
Plasticity Index	%		
Linear Shrinkage	%	9.5	E
Mould Length	mm	249.98	
Crumbling / Curling		Curling	
Sample History			L
Sample Preparation			H,I

(A) AS 1289.3.1 . 1 Liquid Limit - Standard Method
(B) AS 1289.3.1 . 2 Liquid Limit - Subsidiary Method
(C) AS 1289.3.2 . 1 Plastic Limit - Standard Method
(D) AS 1289.3.3 . 1 Plasticity Index - Standard Method
(E) AS 1289.3.4 . 1 Linear Shrinkage - Standard Method
(F) AS 1289.3.6 . 1 Washed
(G) AS 1289.3.6 . 1 Dry Sieved
(H) OVEN DRIED
(I) DRY SIEVED
(J) RTA T201
(K) Sampled from Stockpile in accordance with AS 1141.3.1-6.9.5
(L) Sampled By Others
(m) Air Dried

SOILS DESCRIPTION / USC

Silty CLAY , red brown

Comments:

Date Sampled: 6/4/06

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