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Report on
Geotechnical Investigation at
5531 West Swan Road, West Swan WA

For
Hyqualty Group

Reference: GI83221PG_Rev0
Date: 05 February 2021

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TABLES

APPENDICES

1.0 INTRODUCTION

Perth Geotechnics (PG) has carried out a geotechnical investigation at 5531 West Swan Road, West Swan WA in order to provide a site classification report in accordance with AS2870-2011. The project was engaged by Mr. Steven Shen on behalf of Hyqualty Group (the client).

The proposed development at the site will be a shed and 8 nos. transportable single storey buildings.

This report has to read or implement in full. No partial implementation of this report is allowed. It should be noted that our investigation is not includes environmental and acid sulphate assessment.

The geotechnical investigation consisted of a desktop study, site investigation, site classification, drainage recommendation, earthworks recommendation, bearing capacity, site sub-soil class assignment and earthquake hazard factor.

2.0 OBJECTIVES

The objectives of the investigation are following:

- Desktop study and available information.
- The factual data (field test results), including borehole logs as per AS1726.
- Interpretation of the subsurface conditions across the site.
- Groundwater table information if it is encountered.
- Site classification in accordance with AS2870-2011,
- Recommendation on stormwater drainage.
- Recommendations on remedial works including earthworks, site preparations and compaction requirements.
- Earthquake classifications as per AS1170.
- Recommendation on the type of foundation.
- Recommendation on bearing capacity of site soil.

3.0 DESKTOP STUDY

3.1 Site History

A review of Landgate Information and aerial photography of the site indicates that the site is situated in a farmland area.

3.2 Site Geology

A review of Environmental Geological Western Australia survey Map of Perth 1:50,000 (sheet 2034II and Part of 2034III and 2134III) revealed that the site is consisted of Pebbly Silt- strong brown silt with common, fine to occasionally coarse grained, sub rounded laterite quartz, heavily weathered granite pebble, some fine to medium grained quartz sand, of alluvial origin, Guildford formation (Qpa).

Environmental Geological map of Perth also revealed that the site soil has low permeability, low corrosion potential, medium to high slope stability, medium to high bearing capacity. Near surface water table, prone to flooding, differential settlement of foundations may occur, unless built on columns or concrete rafts above 1 m or compacted sand, dispersive in places.

3.3 Ground water

Groundwater table was not observed at any of the borehole up to the investigation depth of 2.0 m below ground level.

A review of the 'Online Perth Groundwater Atlas' of the Department of Water was carried out for this site. "Perth Groundwater Atlas" revealed that natural surface elevation is 15.5 m AHD and annual average groundwater table at 13.0 m AHD. That means depth of the groundwater table is approximately 2.5 m AHD from the ground level. The groundwater level contours are estimated based on the recorded groundwater levels measured in May of 2003 (end of summer). Therefore, accuracy of the data may vary.

4.0 SITE INVESTIVATION

The geotechnical site investigation was undertaken on 20 January 2021 in the full-time presence of two geotechnical engineers from PG. The site investigation comprised of following:

- Site walkover and taking photograph.
- Excavation of eight (8) boreholes (BH1 to BH8) by hand auger up to a depth of 2.5 m or refusal.
- Logging of the site soil profile as per AS1726.
- Conducting eight (8) Dynamic Cone Penetrometer (DCP1 to DCP8) tests adjacent to boreholes to a depth of 1.0 m or refusal.
- Conducting two (2) Field Permeability Test (FPT1 and FPT2) by Guelph permeameter.
- Recording of the locations of BH, DCP and FPT by handheld GPS.

A site plan showing the locations of the borehole, DCP and Field Permeability Tests are provided in Appendix A.

4.1 Site Description

The site is situated at 5531 West Swan Road, West Swan WA. The proposed development is located at rear side of the existing house. There is an existing house and a medium size shed which will remain and a small size shed will be demolished. The existing house floor level is approximately 1.0 m higher than existing ground level. There are some small to medium size trees at the size. The site is covered by grasses and site level is found flat to gentle slope from northern and eastern to southern and western side. The site level is found flat to slope from southern to northern side. The site photograph was taken during the field investigation are shown in Appendix D.

4.2 Bore Hole Logs

Eight (8) Bore Holes (BH1 to BH8) were conducted at the site by using a hand auger up to a depth of 2.5 m or refusal.

Boreholes BH1 to BH8 revealed similar soil profile and consists of Sand- fine to medium grained, dark grey, grey, pale brown, dry, loose to very dense with few rootlets and few gravels to a depth between 0.1 m and 0.3 m overlying Silty Sand/ Clayey Sand- fine to medium grained, pale brown, yellowish brown, grey, reddish brown, brown, pale grey, white, dry, dense to very dense, low plasticity to a depth between 0.25 m and 0.5 m overlying Sandy Clay- medium to high plasticity, grey mottled yellowish brown, grey, pale brown, yellowish brown, yellow, orange, grey, yellowish brown mottled red, slightly moist to moist, very stiff to hard, fine grained sand to a depth between 1.8 m and 2.0 m. Groundwater table was not observed at any of the borehole up to the investigation depth.

BH1 to BH8 were terminated at a depth of 2.0 m, 2.0 m, 1.8 m, 2.0 m, 1.9 m, 2.0 m, 1.9 m and 2.0 m respectively due to hand auger refusal. Bore Hole logs are attached in Appendix B to this report.

4.3 Dynamic Cone Penetrometers (DCP) Test

Eight (8) Dynamic Cone Penetrometer tests (DCP1 to DCP8) were conducted adjacent to borehole locations. All DCP tests were conducted to a depth of 1.0 m or refusal. The tests were conducted in accordance with test method AS1289.6.3.2, Ref Table 6.4.6.1 (A) & (B) HB 160-2006. DCP tests revealed that the site is in loose to very dense and very stiff to hard condition.

Based on the Dynamic Cone Penetrometer test results, the foundation material is not capable of supporting an allowable bearing pressure of 100 kPa in its current condition.

The DCP test certificates are attached to this report in Appendix B.

4.4 Field Permeability Test

Two (2) Field permeability tests (FPT1 and FPT2) were conducting by using guelph permeameter as per ASTM D 5126 – 90 at two locations. The tests were conducted at a depth of 0.5 m below ground level (bgl). The Guelph Permeameter is a constant head device that operates on the Mariotte siphon principle. It provides a straightforward way of determining the field saturated hydraulic conductivity, matrix flux potential and the soil sorptivity in the field.

Permeability test report is presented in Appendix B and summary are presented in Table 1.

Table 1. Summary of Field Permeability Test Results

Permeability Test ID	Co-ordinates (GDA94)		Permeability Rate		Soil Description	Test Depth (m)
	Easting	Northing	cm/sec	m/day		
FPT1	404 201	6 475 855	7.3×10^{-4}	0.63	Sandy Clay	0.5
FPT2	404 188	6 475 889	8.5×10^{-4}	0.73	Sandy Clay	0.5

The coefficient of permeability or hydraulic conductivity of the site is varying from 0.63 to 0.73 m/day.

5.0 LABORATORY TEST

Laboratory tests were conducted at Western Geotechnical Laboratory WA, a NATA accredited laboratory located at Welshpool WA. The following laboratory tests were undertaken:

- Percent Fines (% Fines) (Test Method: AS 1289 3.6.1)
- Atterberg Limits Test or PI test (Test Method AS1289. 3.9.2, 3.2.1, 3.3.1, 3.4.1)

Laboratory test revealed that site is consisted of highly reactive clay. The laboratory test results are presented in Table 2 and test certificates are included in Appendix C.

Table 2. Summary of Laboratory Test Data

Soil Properties	Soil Sample from BH4 (0.3 m to 0.75 m)	Soil Sample from BH4 (0.8 m to 1.5 m)
Fines < 75µm (%)	69	73
Atterberg Limit Test		
Liquid Limit (%)	42	52
Plastic Limit (%)	17	17
Plasticity Index (%)	25	35
Linear Shrinkage (%)	12.0	9.0

6.0 SITE CLASSIFICATION

6.1 Site Classification

Based on the subsurface, surrounding site condition during the investigation and laboratory test results, the site is classified with a Site Classification of **'H1'** (characteristic surface movement of 40< Ys ≤ 60 mm) in accordance with the definitions provided in Australian Standard AS2870 - 2011, by conducting the remedial measures or site preparation as describe at Section 6.2.

The site can be reclassified to **'M'** classification by conducting the remedial measures or site preparation as describe at *Section 6.2.* The characteristic surface movement can be considered up to (20< Ys ≤ 40 mm) in accordance with the definitions provided in Australian Standard AS2870 -2011. The soil suction change of 2.5 m is considering in this case.

The site can be reclassified to **'S'** classification by conducting the remedial measures or site preparation as describe at *Section 6.2.* The characteristic surface movement can be considered up to (0< Ys ≤ 20 mm) in accordance with the definitions provided in Australian Standard AS2870 -2011. The soil suction change of 2.5 m is considering in this case.

General definition of 'Site Class' is shown in Table 3 (Source: AS 2870-2011).

Table 3. General Definition of Site Class

Site Class	Soil Description	Characteristic Surface Movement (mm)
A	Most SAND and ROCK sites with little or no ground movement due to moisture content variation	little or no ground movement
S	Slightly reactive clayey or silty SAND, which will cause slight ground movement due to moisture content variation	0< Ys ≤ 20
M	Moderately reactive clayey or silty soil which will cause moderate ground movement due to moisture content variation	20< Ys ≤ 40
H1	Highly reactive clayey or silty soil which will cause high ground moved due to moisture content variation	40< Ys ≤ 60
H2	Highly reactive clayey or silty soil which will cause high ground moved due to moisture content variation	60< Ys ≤ 75
E	Extremely reactive clayey or silty soil which will cause extreme ground movement due to moisture content variation	Ys >75

P	Problematic sites, sites consisted of soft soils, soft clay or silt or loose sand; landfills, mine subsidence, collapsing soils, very reactive soils, subjected to erosion and sites which cannot be classified as A to E.	-

6.2 Site Preparation

- The earthworks should be carried out in a controlled manner in accordance with the recommendations given in Australian Standard AS 3798, *"Guidelines on earthworks for commercial and residential developments".*
- Clear uncontrolled fill, grasses, building rubbles, paved materials, tree with tree roots, demolition debris, soft clay materials or other deleterious material.
- **For Site class 'M'**, prepare sand pad of **700 mm** over reactive clay and compact as per AS 3798.
- **For Site class 'S'**, prepare sand pad of **1200 mm** over reactive clay and compact as per AS 3798.
- Compact the exposed cleaned surface with a required number of passes of a heavy vibratory roller to a dense state (95% of MMDD in accordance with AS1289.5.2.1 or an equivalent minimum DCP blow count of 4 per 100 mm or an equivalent minimum PSP blow count of 8 for 150-450 mm, 9 PSP blows for 450-750 mm and 10 PSP blows for 750-1050 mm.
- The material at compaction should be moisture conditioned within -1% to +2% of its optimum moisture content.
- The type of fill material used, and the depth of fill may also affect the site classification.
- Retaining wall will be required to retain the filling sand and if the level difference is 0.5 m or as per City of Swan requirements.
- The Owner needs attention regarding the CSIRO publication in Building Technology File Number 18 from "Guide to Home Owners on Foundation Maintenance and Footing Performance".
- *It is highly recommended that during the course of construction to verify site preparation and compaction prior to pouring of concrete checked by a geotechnical engineer.*

6.3 Structural Fill

Suitable materials for structural fill shall be a clean imported sand fill. The fill material at compaction should comprise sand that is free from oversized material (i.e. material > 50 mm in any dimension), less than 5% fines (material passing 0.075 mm sieve), foreign material, organic material or other deleterious material. It should also be free from industrial waste, solid waste, or construction and demolition debris.

7.0 SITE SUBSOIL CLASS AND EARTHQUAKE HAZARD FACTOR

The site sub-soil class may be classified as Class Ce - Shallow soil. This is based on the geotechnical investigation and is in accordance with the definitions provided in AS1170.4-2007, Structural design actions Part 4: Earthquake actions in Australia.

The design criteria required for a structure in consideration of the risk of being subjected to earthquake loads is provided in AS1170.4-2007. The Hazard Factor (z) for Perth is 0.09. This is based on Figure 3.2(D) which provides the hazard factor for Western Australia.

8.0 STORMWATER DRAINAGE

The site investigation revealed that the site comprises of sand/silty sand/clayey sand overlying sandy clay up to the maximum investigation depth of 2.0 m. Groundwater table was not observed at any of the borehole up to the investigation depth. It is found from field permeability test that the coefficient of permeability or hydraulic conductivity of the site is varying from 0.63 to 0.73 m/day.

Onsite disposal of stormwater via soakwell is not appropriate for this site. We recommend to disposal of stormwater or roof runoff to offsite of the property or to the council drainage system via a site-specific drainage system. The drainage system has to fulfil the requirements of City of Swan.

9.0 BEARING CAPACITY

Strip and pad footings should generally be a feasible foundation option for the proposed building structure.

Based on the inferred state of natural soils as presented in Section 4.2 and DCP test results as presented in Section 4.3, it can be concluded that the ground has not sufficient bearing capacity to support pad or strip shallow foundations for the proposed building structure.

PG has estimated that the foundation material that is prepared following the recommended remedial earthworks/site preparation presented in Section 6.2, will be capable of withstanding an allowable bearing pressure of 100 kPa.

10.0 WIND CLASSIFICATION

N2 (as per Australian Std. AS 4055-2012), Wind Region = A, Terrain Category = TC2, Topographic Class = T0, Shielding Class = NS.

11.0 SUMMARY AND RECOMMENDATION

As part of the building process the site is to be prepared in accordance with the recommendations given in Australian Standard AS 3798-2007, “Guidelines on earthworks for commercial and residential developments”. Further site works are required to prepare the site prior to construction in the form of compaction using proof rolling as part of the site preparation.

Based on the subsurface, surrounding site condition during the investigation and laboratory test results, the site is classified with a Site Classification of **‘H1’** (characteristic surface movement of 40< Ys ≤ 60 mm) in accordance with the definitions provided in Australian Standard AS2870 - 2011, by conducting the remedial measures or site preparation as describe at Section 6.2.

The site can be reclassified to **‘M’** classification by conducting the remedial measures or site preparation as describe at *Section 6.2.* The characteristic surface movement can be considered up to (20< Ys ≤ 40 mm) in accordance with the definitions provided in Australian Standard AS2870 -2011. The soil suction change of 2.5 m is considering in this case.

The site can be reclassified to **‘S’** classification by conducting the remedial measures or site preparation as describe at *Section 6.2.* The characteristic surface movement can be considered up to (0< Ys ≤ 20 mm) in accordance with the definitions provided in Australian Standard AS2870 -2011. The soil suction change of 2.5 m is considering in this case.

Onsite disposal of stormwater via soakwell is not appropriate for this site. We recommend to disposal of stormwater or roof runoff to offsite of the property or to the council drainage system via a site-specific drainage system. The drainage system has to fulfil the requirements of City of Swan.

Strip and pad footings should generally be a feasible foundation option for the proposed building structure. Based on the inferred state of natural soils as presented in Section 4.2 and DCP test results as presented in Section 4.3, it can be concluded that the ground has not sufficient bearing capacity to support pad or strip shallow foundations for the proposed building structure. PG has estimated that the foundation material that is prepared following the recommended remedial earthworks/site preparation presented in Section 6.2, will be capable of withstanding an allowable bearing pressure of 100 kPa.

It is highly recommended that during the course of construction to verify site preparation and compaction prior to pouring of concrete checked by a geotechnical engineer.

12.0 LIMITATION

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

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

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

13.0 REFERENCES

Australian Standard AS1170.4-2007, "Earthquake Actions in Australia".

Australian Standard AS 1726-1993, "Geotechnical Site Investigations".

Australian Standard AS 2870-2011, "Residential Slabs and Footings".

Australian Standard AS 3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments".

Geological Survey of Western Australia. 1:50,000 Environmental Geology Series Map, Perth sheet.

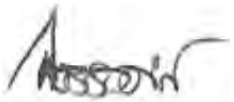
Standards Australia, Hand Book HB 160-2006 "Soil Testing".

Perth Ground Atlas onlineversion, https://maps.water.wa.gov.au/#/webmap/gwm, Department of Environment, WA (browsed 05 February 2020).

14.0 CLOSURE

This letter presents our report on a geotechnical site classification carried out at the above site. If you have any questions related to the report or we can be of further assistance, please do not hesitate to contact Perth geotechnics or the undersigned.

For and on behalf of Perth Geotechnics.



Mohammad Amzad Hossain
B Eng. (Civil), MIEAust, MAGS, MIEB
Sr Geotechnical Engineer

Perth Geotechnics

APPENDIX – A

SITE PLAN AND LAYOUT PLAN

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Project: Geotechnical Investigation **Location:** 5531 West Swan Road, West Swan WA		**Site Plan:** Bore Hole (BH), Dynamic Cone Penetrometer (DCP) and Field Permeability Test (FPT) Locations
Client: Hyqualty Group		
Reference: GI83221PG	**Scale:** N.T.S.	**Drawing No:** 83221_Rev0
Date: 04/02/2021	**Drawn By:** MH	

PROPOSED PLAN

LOCATION OF THE LOG

APPROXIMATELY CAR PARK AREA
SUBJECT TO THE FINAL TRAFFIC REPORT

TYPICAL AT AREA

停车场位置

POSSIBLE ENTRY AND EXIT.
SUBJECT TO THE FINAL TRAFFIC REPORT
出入口位置

PLANT NURSERY AND FRUIT PICKING AREA

种植区域

APPROXIMATELY LOCATION OF THE TRANSPORTABLE/SEA CONTAINER TYPE SINGLE BUILDING(TOTAL 8):
EACH BUILDING CONSISTS:
TWO MASTER BEDROOM
SINGLE LIVING ROOM
SINGLE KITCHEN WITH DINNING
BALCONY DECKING AREA

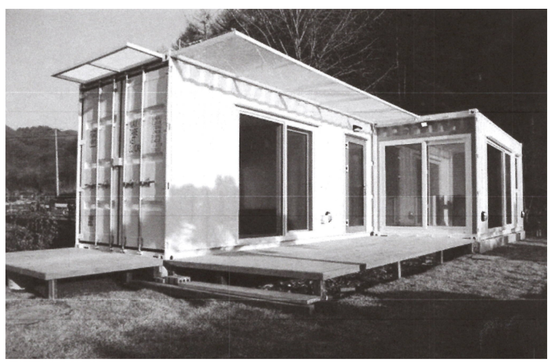
TYPICAL AT LOCATIONS

住宅房屋区域含：
2主卧 1客厅 1厨房 1饭厅
共计8栋

EXISTING BUILDING TO BE KEPT
SOME EXTENSION AND MODIFICATION MAY BE REQUIRED SUBJECTS TO THE FINAL ARCHITECTURAL DRAWING.

保留现有房屋， 扩建室外凉棚，室内改建

POSSIBLE EXTENSION NEW VERANDAH
扩建室外凉棚



EXAMPLE OF THE BUILDING

NOTE:
LEVELS ARE ARBITRARY
ASSUMED DATUM 50.00m
NAIL IN BITUMEN

WARNING!
BOUNDARY RE-ESTABLISHMENT SURVEY REQUIRED TO CONFIRM LOT BOUNDARY POSITION AND DIMENSIONS

SERVICE LEGEND

DRAINAGE
SIDE ENTRY PIT
STORM WATER MANHOLE
DRAINAGE PIPE

ELECTRICITY
POWER DOME
POWER PIT
POWER POLE
LIGHT POLE
STEEL WIRE ANCHOR
STAY POLE
POWER LINE

GAS
GAS MANHOLE
GAS MARKER
GAS METER
GAS VALVE
GAS LINE

SEWER
SEWER MANHOLE
SEWER INSPECTION OPENING
SEWER LINE

COMMUNICATIONS
COMMUNICATIONS PIT
COMMUNICATIONS MARKER
COMMUNICATIONS LINE

WATER
FIRE HYDRANT
STOP VALVE
WATER TAP
WATER MARKER
WATER METER
WATER PIPE

UNDEFINED
UNDEFINED SERVICE MARKER
UNDEFINED MANHOLE
UNDEFINED SERVICE

SURVEY
DATUM
PEG FOUND

STRUCTURES
BUILDING
RETAINING WALL
ROAD CENTRE LINE

SERVICE RECORDS

SERVICE \ STATUS	LOCATED	ONLY SIGHTED	OBSTRUCTION	NOT AVAILABLE
WATER				✓
SEWER				✓
GAS				✓
TEL/COMM	✓			
POWER U/G				✓
O/H	✓			

REV	DATE	BY	DESCR.
0	18.12.20	PP	ISSUED FOR USE
A	16.12.20	MK	ISSUED FOR REVIEW

TITLE:

FEATURE AND CONTOUR SURVEY
5531 WEST SWAN ROAD
WEST SWAN

CLIENT: Rechitects Architecture and Design

LOT NUMBER: 9
PLAN/DIA: D55984
CERT/TITLE: 1526/77

SITE SURVEY ONLY. The in formation shown on this drawing is current at the date of survey. Boundary information, Easements ETC. to be verified from the Certificeate of Title, Plan/Diagram or a boundary Repeg. Boundary position approximate only. Location of boundary pegs or fences in relation to the boundary lines are not guaranteed. Sewer, drainage may vary from the Schematic representation, clearances to be checked on site. Service information to be confirmed with the relevant authorities. For underground services ring "DIAL BEFORE YOU DIG" for confirmation.

HORIZ. DATUM: LOCAL GRID
VERT. DATUM: ARBITRARY

SCALE @A1: 1:400
0 5 10 15 20

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DOC NUMBER: 201130-170898-6249-MK-FS-1

FILE REFERENCE: NA

SURVEYED	DATE	DRAFTED	DATE	REVIEWED	DATE
MK	30.11.2020	MK	16.12.2020	PP	18.12.2020

Perth Geotechnics

APPENDIX – B

BORE HOLE LOGS, DCP & FIELD PERMEABILITY TEST CERTIFICATES

BORE HOLE LOG

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH1
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 203	**Equipment Type**	Hand Auger
Northing:	6 475 845	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**SAND**- fine to medium grained, pale brown, grey, with few gravels up to 10 mm (TOPSOIL)	D	L-MD	
	0.3				SC		**Clayey SAND**- fine to medium grained, reddish brown, brown, grey, low plasticity	D	D	
	0.6				Cl		**Sandy CLAY**- medium plasticity, grey, pale brown, fine grained sand	SM	VSt	
	0.8									
1.0										
	1.3				Cl		**Sandy CLAY**- medium to high plasticity, grey, pale grey, fine grained sand	SM	VSt	
2.0							**Terminated at a depth of 2.0 m due to hand auger refusal**			
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
= **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

BORE HOLE LOG

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH2
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 186	**Equipment Type**	Hand Auger
Northing:	6 475 853	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
	0.2				SP		**SAND**- fine to medium grained, pale brown, grey, with few gravels up to 10 mm (TOPSOIL)	D	L	
	0.4				SM		**Silty SAND**- fine to medium grained, grey, pale brown, low plasticity	D		
	0.75				Cl		**Sandy CLAY**- medium to high plasticity, grey mottled yellowish brown, fine grained sand	SM		
1.0					Cl		**Sandy CLAY**- medium to high plasticity, yellowish brown, yellow, orange, fine grained sand	M	VSt-H	
2.0							**Terminated at a depth of 2.0 m due to hand auger refusal**			
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

BORE HOLE LOG

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH3
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 168	**Equipment Type**	Hand Auger
Northing:	6 475 870	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**SAND**- fine to medium grained, pale brown, grey, with few gravels up to 10 mm (TOPSOIL)	D	L-VD	
	0.25									
	0.4				SM		**Silty SAND**- fine to medium grained, pale grey, white, low plasticity	D	VD	
					Cl		**Sandy CLAY**- medium to high plasticity, grey mottled yellowish brown, fine grained sand	SM	VSt-H	
	0.8									
1.0										
	1.8						**Terminated at a depth of 1.8 m due to hand auger refusal**			
2.0										
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

BORE HOLE LOG

Perth Geotechnics
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Tel: 08 6396 2675; M: 0430 130 677
PO Box 165, Gosnells WA 6990
E: info@perthgeotechnics.com.au
www.perthgeotechnics.com.au

Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH4
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 205	**Equipment Type**	Hand Auger
Northing:	6 475 864	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
	0.1				SP		**SAND**- fine to medium grained, dark grey, grey, with few rootlets (TOPSOIL)	D	L	
	0.3				SC		**Clayey SAND**- fine to medium grained, reddish brown, brown, low plasticity	D	D-VD	
			B1		CI		**Sandy CLAY**- medium to high plasticity, yellowish brown, yellow, orange, fine grained sand	SM	VSt-H	
	0.8				CH		**Sandy CLAY**- high plasticity, yellowish brown, dark grey, yellow, fine grained sand	SM	VSt	
1.0			B2							
	1.5									
2.0							**Terminated at a depth of 2.0 m due to hand auger refusal**			
3.0										
4.0										
5.0										

Remarks:
Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
= Water Table

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH5
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 180	**Equipment Type**	Hand Auger
Northing:	6 475 884	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
	0.1				SP		**SAND**- fine to medium grained, dark grey, grey, with few rootlets (TOPSOIL)	D	MD	
	0.3				SC		**Clayey SAND**- fine to medium grained, reddish brown, brown, low plasticity	D	VD	
					CI		**Sandy CLAY**- medium to high plasticity, yellowish brown, yellow, orange, fine grained sand	SM	VSt-H	
	0.8				CH		**Sandy CLAY**- high plasticity, yellowish brown, orange, yellow, fine grained sand	SM	VSt	
1.0										
	1.9						**Terminated at a depth of 1.9 m due to hand auger refusal**			
2.0										
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH6
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 204	**Equipment Type**	Hand Auger
Northing:	6 475 895	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
	0.15				SP		**SAND**- fine to medium grained, dark grey, grey, with few rootlets (TOPSOIL)	D	D	
	0.35				SC		**Clayey SAND**- fine to medium grained, reddish brown, brown, low plasticity	D	VD	
	0.8				CI		**Sandy CLAY**- medium to high plasticity, yellowish brown, yellow, orange, fine grained sand	SM	H	
1.0					CH		**Sandy CLAY**- high plasticity, yellowish brown mottled red, yellow, orange, fine grained sand	SM	VSt	
2.0							**Terminated at a depth of 2.0 m due to hand auger refusal**			
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH7
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 176	**Equipment Type**	Hand Auger
Northing:	6 475 895	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
					SP		**SAND**- fine to medium grained, dark grey, grey, with few rootlets (TOPSOIL)	D	D-VD	
	0.25				SC		**Clayey SAND**- fine to medium grained, pale brown, yellowish brown, grey, low plasticity	D	VD	
	0.5				CI		**Sandy CLAY**- medium to high plasticity, yellowish brown, brown, grey, fine grained sand	SM	VSt-H	
	0.9				CH		**Sandy CLAY**- high plasticity, yellowish brown, grey, dark grey, pale brown, fine grained sand	SM	VSt	
1.0										
	1.9						**Terminated at a depth of 1.9 m due to hand auger refusal**			
2.0										
3.0										
4.0										
5.0										

Remarks:

Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
▽ = **Water Table**

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

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Reference:	GI83221PG	**Client:**	Hyqualty Group
Project:	Geotechnical Investigation	**Test Pit ID:**	BH8
Location:	5531 West Swan Road, West Swan WA	**Date Commenced:**	20/01/2021
Easting:	50 404 189	**Equipment Type**	Hand Auger
Northing:	6 475 908	**Logged By:**	MH
Sampling Type:	B - Bulk Sample	**Checked By:**	SI

Scale (m)	Depth (m)	GWT (m)	Sampling Type/Depth	Graphic Log	UCS Symbol	Sample ID	Soil Description	Moisture Condition	Density	Remarks/Field observations
	0.1				SP		**SAND**- fine to medium grained, dark grey, grey, with few rootlets (TOPSOIL)	D	VD	
					SC		**Clayey SAND**- fine to medium grained, pale brown, brown, grey, low plasticity	D	VD	
	0.5				Cl		**Sandy CLAY**- medium to high plasticity, yellowish brown, yellow, orange, fine grained sand	SM	VSt-H	
1.0										
	1.2				CH		**Sandy CLAY**- high plasticity, yellowish brown, orange, yellow, fine grained sand		VSt	
2.0							**Terminated at a depth of 2.0 m due to hand auger refusal**			
3.0										
4.0										
5.0										

Remarks:
Sampling Type:
B - Bulk Sample (/Disturbed),
U - Undisturbed Sample

Moisture Condition:
D - Dry, **M** - Moist, **W** - Wet
SM- Slightly Moist
= Water Table

Density:
VL = Very Loose, **L** = Loose,
MD = Medium Dense
D = Dense, **VD** = Very Dense

VS = Very Soft
F = Firm
St = Stiff

VSt = Very Stiff
H = Hard
R = Refusal

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DYNAMIC CONE PENETROMETER (DCP)
TEST CERTIFICATE

(AS 1289.6.3.2)
Correlation of Sand Density - Table 6.4.6.1 (A) & (B) HB 160-2006

Client	Hyqualty Group	Project	Geotechnical Investigation
Reference	GI83221PG	Location	5531 West Swan Road, West Swan WA
Date Tested	20/01/2021	Tested By	MH/SI

References:	DCP1	DCP2	DCP3	DCP4	DCP5
Depth below ground level test commenced	**Penetration Resistance - Blows/100mm**				
0-100	2	4	2	2	3
100-200	3	6	10	4	10
200-300	4	12	16	15	13
300-400	6	20	21	13	16
400-500	6	20	20	11	14
500-600	8	11	14	12	11
600-700	8	12	12	10	10
700-800	7	12	11	9	9
800-900	8	10	10	9	9
900-1000	8	9	10	8	7
Depth below ground level test commenced					
0-100	L	D	L	L	MD
100-200	MD	D	VD	D	VD
200-300	D	VD	VD	VD	VD
300-400	D	VD	VD	H	H
400-500	D	H	H	H	H
500-600	D	H	H	H	H
600-700	VSt	H	H	VSt	VSt
700-800	VSt	H	H	VSt	VSt
800-900	VSt	VSt	VSt	VSt	VSt
900-1000	VSt	VSt	VSt	VSt	VSt

Remarks:

Table A: H = Hard >10, VSt = Very Stiff, 5 – 10, St = Stiff, 3 – 4, F = Firm, 1 – 2, VS = Very Soft < 1

Table B: VD = Very Dense > 8, D = Dense, 4 – 8, MD = Medium Dense, 2 – 3, L = Loose, 1 – 2, VL = Very Loose < 1

Perth Geotechnics

DYNAMIC CONE PENETROMETER (DCP)
TEST CERTIFICATE

(AS 1289.6.3.2)
Correlation of Sand Density - Table 6.4.6.1 (A) & (B) HB 160-2006

Client	Hyqualty Group	Project	Geotechnical Investigation
Reference	GI83221PG	Location	5531 West Swan Road, West Swan WA
Date Tested	20/01/2021	Tested By	MH/SI

References:	DCP6	DCP7	DCP8	DCP9	DCP10
Depth below ground level test commenced	**Penetration Resistance - Blows/100mm**				
0-100	4	5	13		
100-200	12	14	20		
200-300	13	16	18		
300-400	14	14	17		
400-500	12	13	15		
500-600	12	12	13		
600-700	12	12	11		
700-800	11	10	10		
800-900	10	10	10		
900-1000	9	9	9		
Depth below ground level test commenced					
0-100	D	D	VD		
100-200	VD	VD	VD		
200-300	VD	VD	VD		
300-400	VD	VD	VD		
400-500	H	VD	VD		
500-600	H	H	H		
600-700	H	H	H		
700-800	H	VSt	VSt		
800-900	VSt	VSt	VSt		
900-1000	VSt	VSt	VSt		

Remarks:

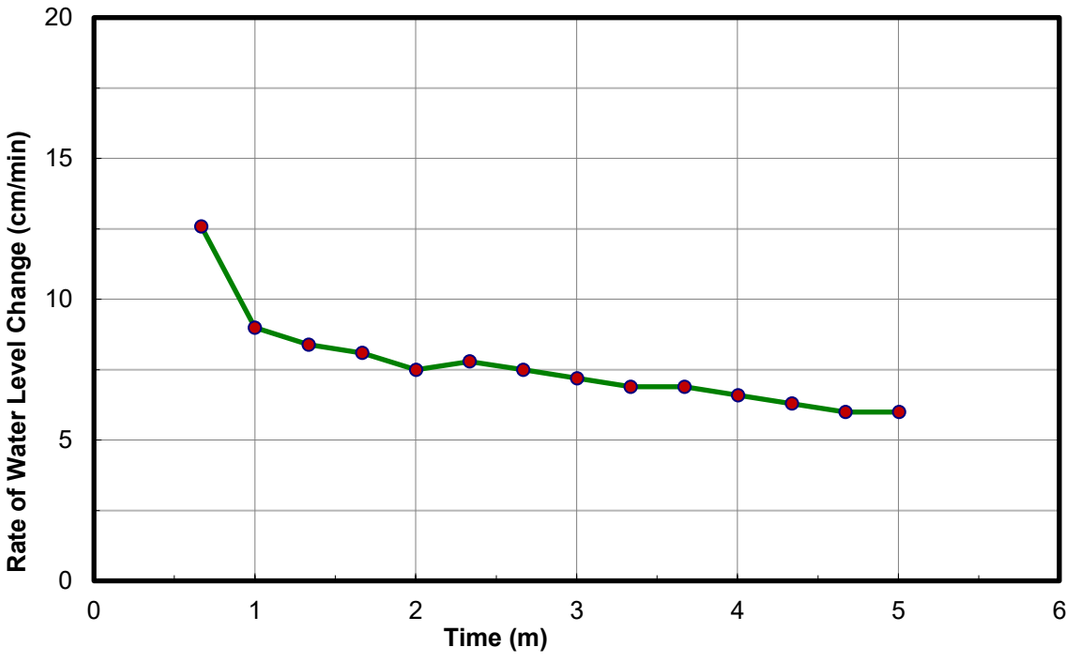
Table A: H = Hard >10, VSt = Very Stiff, 5 – 10, St = Stiff, 3 – 4, F = Firm, 1 – 2, VS = Very Soft < 1

Table B: VD = Very Dense > 8, D = Dense, 4 – 8, MD = Medium Dense, 2 – 3, L = Loose, 1 – 2, VL = Very Loose < 1

PERTH GEOTECHNICS

Test ID	FPT1	Reference	GI83221PG
Project	Geotechnical Investigation	Client	Hyqualty Group
Location	5531 West Swan Road, West Swan WA	Soil Type	Sandy Clay
Co-ordinates	Easting: 50 404 201 / Northing: 6 475 855	Test Depth	500 mm from surface
Instrument Name	Guelph Permeameter	Date Tested	20/01/2021

PERMEABILITY TEST CERTIFICATES
(ASTM D 5126-90)



Water Hydraulic conductivity K_{fs}: **7.3E-04** **cm/sec**

6.3E-01 **m/day**

Tested By: *Mohammad Amzad Hossain* Date: 4/02/2021

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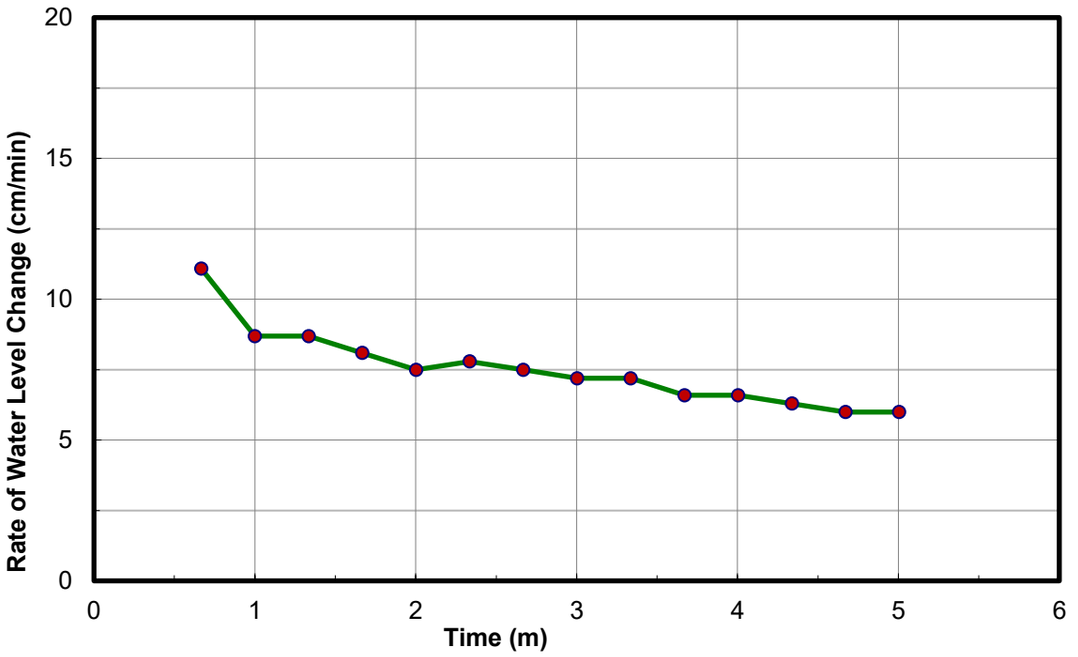
PERTH GEOTECHNICS

Test ID	FPT2	Reference	GI83221PG
Project	Geotechnical Investigation	Client	Hyqualty Group
Location	5531 West Swan Road, West Swan WA	Soil Type	Sandy Clay
Co-ordinates	Easting: 50 404 188 / Northing: 6 475 889	Test Depth	500 mm from surface
Instrument Name	Guelph Permeameter	Date Tested	20/01/2021

PERMEABILITY TEST CERTIFICATES
(ASTM D 5126-90)



Water Hydraulic conductivity K_{fs}: **8.5E-04** **cm/sec**

7.3E-01 **m/day**

Tested By: *Mohammad Amzad Hossain* Date: 4/02/2021

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APPENDIX – C

LABORATORY TEST CERTIFICATES

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

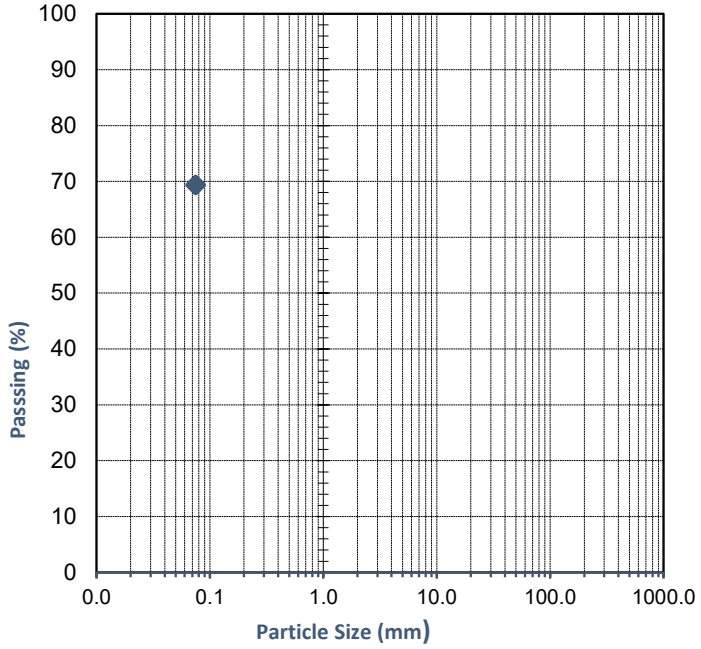
TEST REPORT - AS 1289.3.9.2, 3.2.1, 3.3.2, 3.4.1 & 3.6.1

Client:	Perth Geotechnics	*Ticket No.*	S2346
Client Address:	PO Box 165, Gosnells	*Report No.*	WG21/1901_1_PSDPI
Project:	Material Assessment	*Sample No.*	WG21/1901
Location:	5513 West Swan Road, West Swan	*Date Sampled:*	Not specified
Sample Identification:	BH4 0.3-0.75m	*Date Tested:*	22/1 - 25/1/2021

Sampling Method: **Sampled by Client, Tested as Received**

TEST RESULTS - Particle Size Distribution of Soil

Sieve Size (mm)	Percent Passing Sieve (%)
125.0	
75.0	
53.0	
37.5	
19.0	
9.5	
4.75	
2.36	
1.18	
0.600	
0.425	
0.300	
0.150	
0.075	69



TEST RESULTS - Consistency Limits (Casagrande)

AS 1289.3.9.2	AS 1289.3.2.1	AS 1289.3.3.2	AS 1289.3.4.1		
Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Linear Shrinkage (%)	Mould Length (mm)	Condition of Dry Specimen:
42	17	25	12	250	Cracked, Curled

Method of Preparation: Dry Sieved **History of Sample:** Oven Dried <50°C

Comments: Clients request for the % fines of material passing 0.075mm only.

Approved Signatory: EBullen

Name: Erin Bullen

Date: 25-Jan-21

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

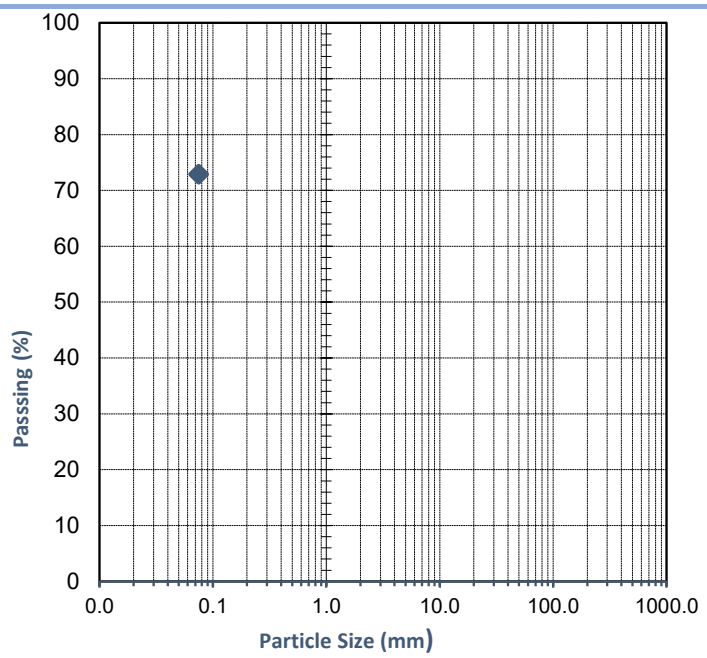
TEST REPORT - AS 1289.3.9.2, 3.2.1, 3.3.2, 3.4.1 & 3.6.1

Client:	Perth Geotechnics	*Ticket No.*	S2346
Client Address:	PO Box 165, Gosnells	*Report No.*	WG21/1902_1_PSDPI
Project:	Material Assessment	*Sample No.*	WG21/1902
Location:	5513 West Swan Road, West Swan	*Date Sampled:*	Not specified
Sample Identification:	BH4 0.8-1.5m	*Date Tested:*	22/1-25/1/2021

Sampling Method: **Sampled by Client, Tested as Received**

TEST RESULTS - Particle Size Distribution of Soil

Sieve Size (mm)	Percent Passing Sieve (%)
125.0	
75.0	
53.0	
37.5	
19.0	
9.5	
4.75	
2.36	
1.18	
0.600	
0.425	
0.300	
0.150	
0.075	73



TEST RESULTS - Consistency Limits (Casagrande)

AS 1289.3.9.2	AS 1289.3.2.1	AS 1289.3.3.2	AS 1289.3.4.1		
Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Linear Shrinkage (%)	Mould Length (mm)	Condition of Dry Specimen:
52	17	35	9	250	Cracked, Curled

Method of Preparation: Dry Sieved **History of Sample:** Oven Dried <50°C

Comments: Clients request for the % fines of material passing 0.075mm only.

Approved Signatory:

Name: Erin Bullen

Date: 25-Jan-21

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599
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APPENDIX – D

SITE PHOTOGRAPH

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Photo 01: Site is looking from southern-west to northern-east side

Photo 02: Site is looking from eastern to western side

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Photo 03: Bore Hole location (BH4), subsurface probing by Hand Auger

Photo 04: Soil from Bore Hole (BH4)

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Photo 05: Conducting Dynamic Cone Penetrometer (DCP) Test at location DCP3

Photo 06: Conducting Field Permeability Test (FPT) at location FPT2