Report on

GEOTECHNICAL STUDY
PROPOSED RESIDENTIAL SUBDIVISION
VARIOUS RURAL LOTS
HENLEY BROOK

Submitted to:
Progress Developments
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J1501139 004 R Rev0

11 September 2019

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FIGURE

APPENDICES

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics Pty Ltd's (Galt's) geotechnical study for the proposed residential subdivision of 13 rural lots in Henley Brook ("the site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The rural lots are as follows:

- Lot 24 Starflower Place
- Lot 602 Lord Street
- Lot 19 Diane Place
- Lots 29, 39, 45, 55, 109 and 115 Brooklands Drive
- Lots 204, 224, 286 and 292 Park Street

The lots are all occupied with a house and shed/s with open pasture and spreads of mature trees. Lot 45 Brooklands Drive has a track around its perimeter.

The surface elevation generally ranges from about RL 37 m AHD in the west falling gradually to RL 31 m AHD in the northeast, with localised higher areas in the south and south-east.

We understand that the lots are to be subdivided into residential lots with associated public open space, access roads, service etc. We expect that some bulk filling and low retaining walls will be required to form level lots and facilitate drainage.

3. PROJECT OBJECTIVES

The objectives of this study were to:

- assess subsurface soil and groundwater conditions across the site;
- provide recommendations on suitable footing systems for the proposed development;
- provide a site classification(s) in accordance with AS 2870-2011 "Residential Slabs and Footings";
- provide recommendations and geotechnical design parameters for earth retaining structures;
- recommend appropriate site preparation procedures including compaction criteria;
- assess the hydraulic conductivity of the soils at the site for potential on-site disposal of stormwater by infiltration; and
- provide a subgrade California bearing ratio (CBR) value for pavement thickness design by others.

4. FIELDWORK

Fieldwork was carried out on 19 and 20 August 2019 and comprised:

- cone penetration tests (CPTs) at 4 locations extending to depths of 6.2 m in each instance;
- excavation of test pits at 19 locations extending to depths of between 1.2 m to 2.5 m;
- drilling of hand augered boreholes at 8 locations, to a depth of 1.0 m in each instance;
- infiltration tests using the 'inverse auger hole' technique in each hand auger borehole, at depths of between 0.88 m and 0.97 m;
- Perth sand penetrometer (PSP) tests adjacent to hand auger boreholes and test pits, extending to a depth of 1.05 m in each instance.

General

A geotechnical engineer from Galt selected and positioned the test locations, observed the CPTs, drilled the hand augered boreholes, observed the test pitting, logged the materials encountered in the boreholes and test pits, carried out the penetrometer and infiltration testing and collected the samples for laboratory testing.

The approximate test locations are shown on Figure 1, Site and Location Plan. Photographs of the site taken during the fieldwork are presented in Appendix A. Details of the tests are presented in Table 1: Summary of Tests.

Table 1: Summary of Tests

Test Name	Test Depth (m)[1]	Depth to Groundwater (m)	Stratigraphy
CPT01	6.2	2.0	TOPSOIL: SAND overlying SAND with localised layers of iron cemented sand ("coffee rock")
CPT02	6.2	Dry to 5.3	
CPT03	6.2	4.5	
CPT04	6.2	Dry to 3.1	
TP01	2.5	2.4	
TP03	2.0	GNE	
TP04	1.9	GNE	
TP05	2.5	2.3	
TP06	1.5	1.4	
TP07	1.6	1.4	
TP08	1.8	1.6	
TP09	1.5	1.2	
TP10	2.4	1.9	
TP11	1.8	GNE	
TP12	1.3	1.2	
TP13	1.2	0.7	
TP14	1.6	GNE	
TP15	1.6	1.6	
TP16	2.0	GNE	
TP17	1.7	GNE	
TP18	1.7	1.6	
TP19	1.3	1.0	
TP20	1.3	1.0	
HA01/IT01	1.0	GNE	
HA02/IT02	1.0	GNE	
HA03/IT03	1.0	GNE	
HA04/IT04	1.0	GNE	
HA05/IT05	1.0	GNE	
HA06/IT06	1.0	GNE	
HA07/IT07	1.0	GNE	
HA08/IT08	1.0	GNE	

Notes:
1. TP02 was not excavated due to access constraints – replaced with a hand auger borehole
2. "Dry to 5.3 m"- indicates hole collapse to recorded depth after removal of the CPT probe.
3. GNE - Groundwater not encountered
4. Thin layers of sand and sandy gravel fill were encountered in TP08 & TP14.

Cone Penetration Tests

Cone penetration tests (CPTs) were undertaken using a 22-tonne track-truck CPT rig supplied and operated by Probedrill Pty Ltd. The testing was undertaken in accordance with AS 1289.6.5.1. The results of the CPTs are presented in Appendix B, along with a method of interpretation proposed by Robertson et al. (1986)[1].

Test Pits

Test pits were excavated using an 8 tonne, JCB 3CX tractor mounted backhoe equipped with a 0.45 m toothed bucket. The backhoe was supplied and operated by ANH Contracting. Test pit reports are presented in Appendix C, along with a method of soil description and a list of explanatory notes and abbreviations used in the reports. A photograph of the spoil recovered from each test pit is included on each report.

Hand Augered Boreholes

Hand augered boreholes were drilled using an 80 mm nominal diameter hand auger. Hand augered borehole reports are presented in Appendix C.

Infiltration Tests

Infiltration tests were undertaken in the boreholes using the inverse auger hole method described by Cocks[2]. The results of the infiltration testing are presented in Appendix D and are summarised in Table 2: Summary of Infiltration Test Results.

Table 2: Summary of Infiltration Test Results

Test Location	Test Depth (m)	Stratigraphy	Minimum Unsaturated Hydraulic Conductivity[1], k (m/day)		
			Test 1	Test 2	Test 3
IT01	0.95	TOPSOIL: SAND overlying SAND	12.1	8.6	9.0
IT02	0.92		9.8	10.2	10.2
IT03	0.97		7.0	8.9	8.9
IT04	0.9		9.5	8.8	6.5
IT05	0.92		7.2	7.8	8.0
IT06	0.92		12.2	11.6	14.4
IT07	0.93		5.1	5.0	4.6
IT08	0.88		14.6	>15	>15

Note: Permeabilities above 15 m/day are not reported due to the inaccuracy of the method in highly permeable material.

Perth Sand Penetrometer (PSP) Tests

Perth sand penetrometer (PSP) tests were undertaken in accordance with AS 1289.6.3.3, except to a greater depth than the 0.45 m specified by the code. Furthermore, PSP blow counts are also reported per 0.15 m penetration rather than per 0.3 m. PSP test results are presented in Appendix E.

[1] Robertson, P.K., Campanella, R.G., Gillespie, D. and Grief, J. (1986) "Use of Piezometer Cone Data".

[2] Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114.

5. LABORATORY TESTING

Laboratory testing was carried out by Western Geotechnical and Laboratory Services (WGLS) in their NATA accredited laboratory. Testing comprised:

- particle size distribution on 2 samples; and
- organic content on 1 sample.

The laboratory test results are presented in Appendix F including the test methods followed and are summarised in Table 3.

Table 3: Summary of Laboratory Test Results

Test Location	Sample Depth (m)	% Gravel	% Sand	% Fines	% Organics
TP06	0.0-0.3	1	93	6	6.1
TP06	1.5-1.7	-	97	3	-

6. SITE CONDITIONS

6.1 Geology

The Perth sheet of the 1:50,000 scale Environmental Geology series map indicates that most of the lots are underlain by Pebbly Silt of the Guildford Formation. However, Bassendean Sand is also shown on the southern part of Lots 286 and 292 Park Street.

Our investigation found the site is underlain by Bassendean Sand to the full depth of investigation (1.2 m to 6.2 m deep). The only exceptions were isolated iron cemented layers and areas of fill. No Pebbly Silt was noted.

6.2 Subsurface Conditions

The subsurface conditions are broadly consistent across the site and the typical soil profile may be summarised as:

- TOPSOIL: Organic SAND/SAND (SP-SM): fine to coarse grained, sub-angular to sub-rounded, dark grey, trace to with fines, with organics (up to 6%) to depth of typically 0.1 m to 0.2 m (up to about 0.3); overlying

- SAND (SP): fine to coarse grained, sub-angular to sub-rounded, dark grey/grey/off-white, generally very loose to loose to depths of up to 1.5 m becoming medium dense to dense to the maximum investigated depth of 6.2 m.

Notes

1. Soil conditions below 2.0 m depth are inferred from CPT data using Robertson, P.K., Campanella, R.G., Gillespie, D. and Grieg, J. (1986) “Use of Piezometer Cone Data”.
2. “Coffee rock” (iron indurated sand) is present from 1.4 m to 1.7 m depth varying in thickness in TP01, TP03, TP05, TP14, TP15 & TP18
3. Thin layers of FILL SAND noted in TP08 and TP14. It is possible that there are areas of deeper fill, including localised informal landfill on some lots.
4. Small stockpiles of waste materials and garden refuse were noted in places.

6.3 Groundwater

The Perth Groundwater Atlas (1997) shows the historical maximum groundwater level to fall from about RL 36 m AHD in the west to RL 31 m AHD in the east. Over most of the site, the historical maximum groundwater level is close to the existing ground level.

Groundwater was noted in most test holes at depths ranging from 0.7 m to 4.5 m.

We expect that the groundwater levels have been lowered due to the construction of drains in the area. We recommend that a hydrogeologist is appointed to draft an urban water management plan and confirm the design groundwater elevations across the site.

7. GEOTECHNICAL ASSESSMENT

7.1 Site Classification

We consider that the site is geotechnically capable of supporting the proposed development.

We have assessed the site in accordance with AS 2870-2011 "Residential Slabs and Footings". We consider that a site classification of "Class A" is appropriate for the site, provided:

- our site preparation recommendations outlined in Section 7.2 are undertaken; and
- the surface level is at least 0.5 m above the design maximum groundwater elevation.

We note that AS 2870 is limited to single to double storey residential structures with a maximum bearing pressure of 100 kPa for shallow footings.

7.2 Site Preparation

The site preparation measures outlined below are aimed at preparation of the site prior to construction of the buildings/structures, including on-ground slabs, shallow footings, retaining walls and pavements. Landscaped areas do not require this preparation.

- Demolish existing structures and pavements and remove all debris including uncontrolled fill and buried structures (services, soakwells, footings etc.) for disposal off-site.
- Remove vegetation, including grubbing out of all roots. Where mature trees are present, deep excavation may be required to remove the root systems. The holes formed must be backfilled in controlled layers with approved compacted fill.
- Strip and stockpile topsoil for potential re-use (refer to Section 7.4) or disposal off site.
- Excavate where required using safely batted slopes as outlined in Section 7.5.
- Moisture condition and compact the exposed ground to the density specified in Section 7.3 to a depth of at least 0.9 m.
- Any areas of loose ground or unsuitable material must be removed and replaced with approved fill as outlined in Section 7.4.
- Where fill is used to build up levels, use approved fill (see Section 7.4), placed and compacted in layers of no greater than 0.3 m loose thickness. Each layer must be compacted to achieve the density specified in Section 7.3.
- Excavate for pad and strip footings and compact the exposed bases to the density specified in Section 7.3 to a depth of at least 0.9 m below the underside of all footings and slabs. Over excavation and replacement with approved compacted fill is required for any zone not achieving the density specified in Section 7.3.

Notes
1. Given the significant depth of loose sand we note that additional effort (possibly involving impact rolling or over-excavation and replacement) may be required to ensure that the required compaction is achieved at depth.
2. Compaction within 1 m of the groundwater table may be difficult and would likely require dewatering or other mitigating measures (depending on the time of year the earthworks are carried out) to ensure that adequate compaction is achieved.

7.3 Compaction

Approved granular fill and *in situ* sand must be compacted using suitable compaction equipment to achieve a dry density ratio (DDR) of at least 95% MMDD (maximum modified dry density) as determined in accordance with AS 1289.5.2.1 at a moisture content within 2% of optimum moisture content (OMC).

Where clean sand (<5% gravel, <5% fines) is used as fill, a Perth sand penetrometer (PSP) may be used for compaction control in accordance with AS 1289.6.3.3. The following minimum PSP blow counts may be assumed to correlate to a dry density ratio of 95% MMDD:

- Depth range 0 m to 0.15 m: SET.
- Depth range 0.15 m to 0.45 m: 8 blows.
- Depth range 0.45 m to 0.75 m: 10 blows.
- Depth range 0.75 m to 1.05 m: 12 blows (or 6 blows for depth range 0.75 m to 0.9 m).

If difficulties are experienced recording the required blow counts, a PSP correlation should be carried out to determine the PSP blow count correlating to a DDR of 95% MMDD.

Over-excavation and replacement of loose materials must be done where the minimum dry density ratio cannot be achieved.

Fill must be placed in horizontal layers of not greater than 300 mm loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Care will need to be taken when compacting in the vicinity of existing structures. This is particularly important if vibratory compaction is being carried out. Tynan (1973[3] provides guidance on the selection of compaction equipment for use adjacent to structures.

Large compaction equipment (self-propelled vibrating rollers, etc.) must not be used within 2 m behind retaining walls. Hand compaction plant (e.g. plate compactors) must be used.

Testing

After compaction, verify that the required density has been achieved by testing to a minimum depth of 0.9 m:

- on compacted subgrades and on each lift of fill at a rate of 1 test per 500 m^3 or 1 test per 2,500 m^2 whichever is greater;
- at each spread footing location;
- at 5 m centres below on-ground slabs; and
- at 10 m centres on pavement subgrades.

[3] Tynan (1973) Ground Vibration and Damage Effects on Buildings, Australia Road Research Board, Special Report No. 11.

7.4 Approved Fill

Imported granular fill must comply with the material requirements as stated in AS 3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments".

Generally, the *in situ* sand at the site is suitable for re-use as inert structural fill. Sand fill containing oversize (>100 mm) or putrescible demolition rubble or rubbish is not suitable for re-use as structural fill. Given that demolition and removal of the existing structures will occur, there may also be pockets of debris present across the site.

Any organic-rich sand (greater than 2% organics by weight) or sand containing significant proportions of fines (greater than 5% of material less than 0.075 mm in size by weight) must not be used. Where permeable fill is required, the maximum fines content should be 5%.

Topsoil and sand fill containing significant amounts of organics must either be:

- removed and disposed off-site;
- re-used in non-structural areas; or
- blended with site-derived or imported clean sand for re-use as fill (subject to trials noted below).

We consider that the in-situ topsoil sand is generally suitable for re-use as granular fill provided that the material is screened to remove large organics, and then blended with site-derived or imported clean sand (with less than 5% fines and less than 1% organics by weight) to produce a suitable, free draining, structural fill. Field trials of proposed blends must be undertaken to assess the suitability of the blended material against both the structural fill and civil engineering/drainage requirements.

We can provide further advice on this if required.

Where doubt exists, a geotechnical engineer must be engaged to inspect and approve the use of potential fill materials.

7.5 Excavations and Slopes

Based on the soil profile encountered, we consider that excavations at the site can be readily achieved to a depth of at least 2 m using conventional earthmoving equipment (i.e. 5 tonne excavator or greater in size). The possible presence of obstructions such as buried services, cemented layers (coffee rock), large roots, etc must be taken into account when selecting excavation equipment.

Excavations in sand are particularly prone to instability unless support is provided. Care must be exercised in such excavations and appropriate safety measures adopted where necessary, particularly in the vicinity of existing buildings, structures and infrastructure.

Dewatering will be required to facilitate excavation within 1 m of the groundwater table. Refer to Section 7.7 for further details.

Where groundwater is at least 1 m below the toe of the slope, we recommend batter angles no steeper than 1V:2H for temporary slopes and 1V:3H for permanent slopes where no external restraint is provided to the slope (suitable for slope heights up to 2 m with no surcharge at the crest of the slope). Even at these slope angles, rilling and erosion of the slope may occur. Where steeper slopes are required, temporary or permanent slope retention must be employed.

Temporary slopes of 1V:2H require the following:

- No surcharges (machinery, stockpiles, etc.) near the crest of the slope.
- A maximum slope height of 2 m in the absence of any further geotechnical advice and/or slope stability analysis.

A geotechnical engineer must be consulted where there is any doubt regarding the stability or safety of unsupported excavations.

7.6 Shallow Footings

We consider that residential single and double storey buildings may be supported on shallow footings founded on the in-situ sand and sand fill provided that the site preparation procedures in Section 7.2 are undertaken. Footings should be designed in accordance with the standard designs presented for a "Class A" site in AS 2870-2011 with a maximum allowable bearing pressure of 100 kPa. For footings of up to 2 m in plan, founded at a minimum 0.5 m embedment, the estimated settlement is expected to be less than 5 mm.

7.7 Dewatering

Groundwater was encountered in most test holes at depths ranging from 0.7 m to 4.5 m. The need and extent of dewatering required will depend on the depth of excavation required and the time of year that earthworks are undertaken. We recommend that that earthworks are conducted during late summer when groundwater levels can be expected to be at their seasonal low.

Dewatering assessments should be carried out where dewatering is likely to be required.

7.8 Retaining Structures

Retaining structures may be designed in accordance with AS 4678-2002 "Earth-Retaining Structures". Approved granular fill that conforms to the requirements outlined in Section 7.4 must be used for gravity retaining wall backfill. The following parameters are appropriate for approved granular fill that is compacted to the requirements of Section 7.3.

- Angle of internal friction, $\phi = 34°$
- Coefficient of active earth pressure $K_a = 0.28$
- Coefficient of passive earth pressure $K_p = 3.54$
- At rest coefficient of earth pressure $K_o = 0.44$
- Bulk unit weight: 18 kN/m^3 above the water table

Compaction plant can augment the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise compaction pressures.

It is important to note that some ground movement is to be expected behind any soil retaining system, including gravity retaining walls.

7.9 Stormwater Disposal

The results of the infiltration tests are presented in Appendix E. The results show that the minimum unsaturated hydraulic conductivity ranges from 4.6 m/day to 14.6 m/day. We note that the tests were carried out close to the surface and above the groundwater level.

We consider that sands at the site are suitable for on-site disposal of stormwater by infiltration using soakwells / soakage basins assuming that the site preparation requirements outlined in Section 7.2 have been carried out and provided that the bases of the soakwells /basins are in permeable sand at least 0.2 m above the maximum groundwater level.

Notwithstanding the results of the infiltration testing, we recommend a design value of hydraulic conductivity (k) not greater than 5 m/day for the in-situ sand above the design groundwater level to allow for the variability in materials and reduced hydraulic conductivity as a consequence of:

- densification of sand during site preparation works;
- natural variation in sands; and
- clogging of the sand around soakwells and soakage basins over time with fines.

We note that this is an unsaturated hydraulic conductivity value and assumes that groundwater will be at least 0.2 m below the base of soakwells / basins. The groundwater level during the wetter months may adversely affect the performance of any soakwells / basins.

The hydraulic conductivity of any imported fill must be assessed prior to placement.

Soakwells should be placed outside a line of 1V:2H extending below the edge of the nearest footing, subject to local council regulations. Discharge from soakwells has been known to promote densification of loose sandy soils, leading to settlements of footings and slabs. Soakwells should be carefully wrapped with geotextile to prevent migration of sand and fines into the soakwell.

7.10 Pavement Subgrades

Where the site preparation measures outline in Section 7.2 have been carried out, flexible pavement thickness design may be undertaken assuming a subgrade design California bearing ratio (CBR) of 10%.

8. CLOSURE

We draw your attention to Appendix G of this report, "Understanding Your Report". The information provided within is intended to inform you as to what your realistic expectations of this report should be. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing.

GALT GEOTECHNICS PTY LTD

Rick Piovesan CPEng

Geotechnical Engineer

Piravin Anandacoomaraswamy

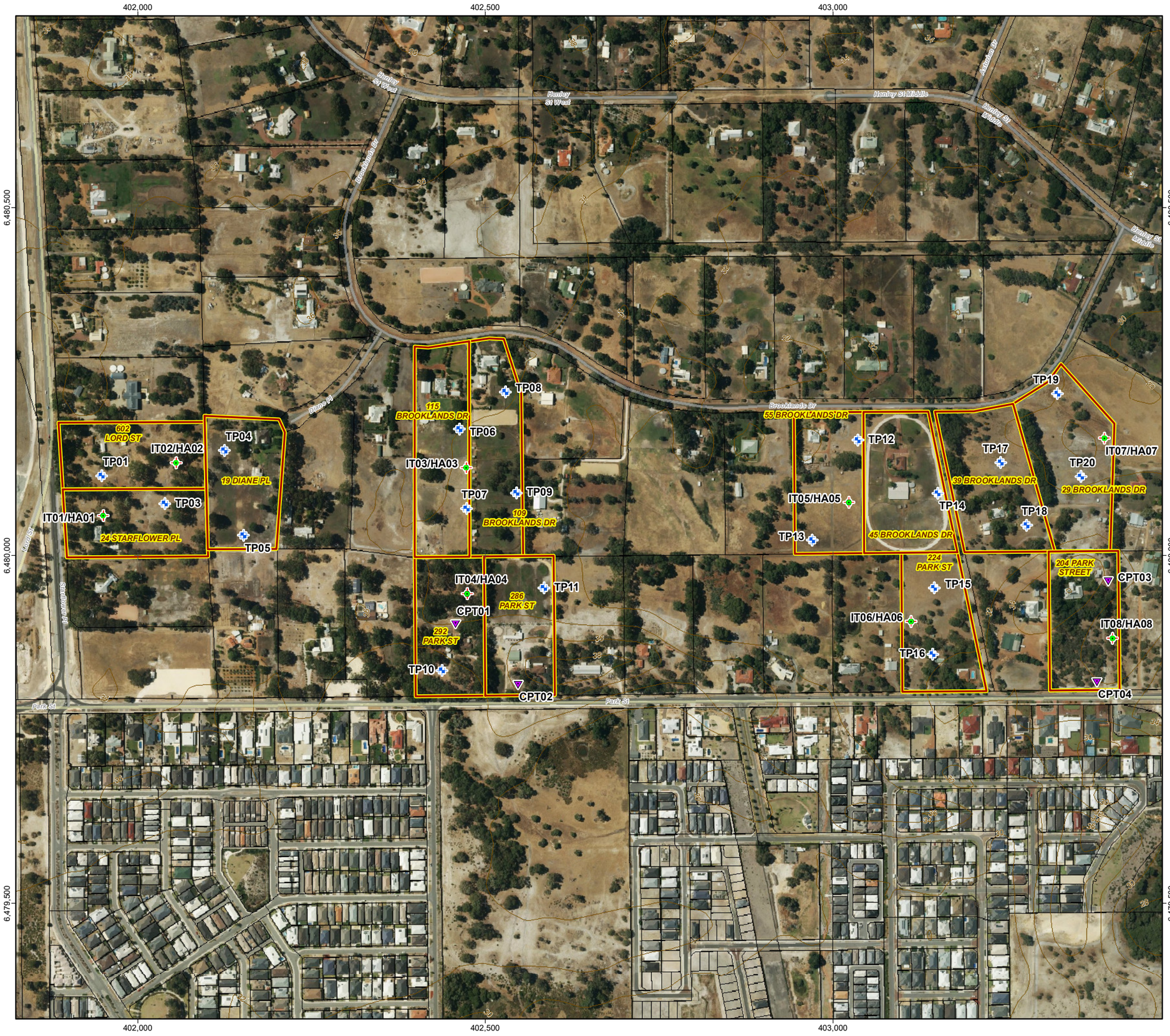
Graduate Geotechnical Engineer

\\galtgeo.local\OsbornePark\Data\Jobs\2015\J1501139 - Progress DD Various Henley Brook\03 Correspondence\J1501139 004 R Rev0.docx

Figure

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017

ABN: 64 625 054 729



Legend

- Site Boundary
- Cone Penetration Test
- Hand Auger Borehole / Infiltration Test
- Test Pit

N

0 80 160 240 320 400
Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:5,500	(A3)
DRAWN	CED	
DATE DRAWN	22/08/2019	
CHECKED	RP	
DATE CHECKED	3/09/2019	
PROJECTION	GDA 1994 MGA Zone 50	

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CLIENT	**PROGRESS DEVELOPMENTS**
PROJECT	HENLEY BROOK RESIDENTIAL SUBDIVISION
LOCATION	HENLEY BROOK - VARIOUS LOTS
TITLE	SITE & LOCATION PLAN

Job No	Fig No	Rev
J1501139	FIGURE 1	**A**

Appendix A: Site Photographs

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50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Photograph 1: Area around test pit TP01 (602 Lord Street)

Photograph 2: Area around test pit TP03 (24 Starflower Place)

Photograph 3: Area around test pit TP07 (115 Brooklands Drive)

Photograph 4: Area around test pit TP09 (109 Brooklands Drive)

Photograph 5: Typical mature trees and localised waste dumps (292 Park Street)

Photograph 6: Area around test pit TP10 (292 Park Street)

Photograph 7: Area around test pit TP11 (286 Park Street)

Photograph 8: Area around test pit TP15 (224 Park Street)

Photograph 9: Area around test pit TP20 (29 Brooklands Drive)

Photograph 10: Area around hand augered borehole HA05 (255 Brooklands Drive)

Appendix B: Cone Penetration Test Results

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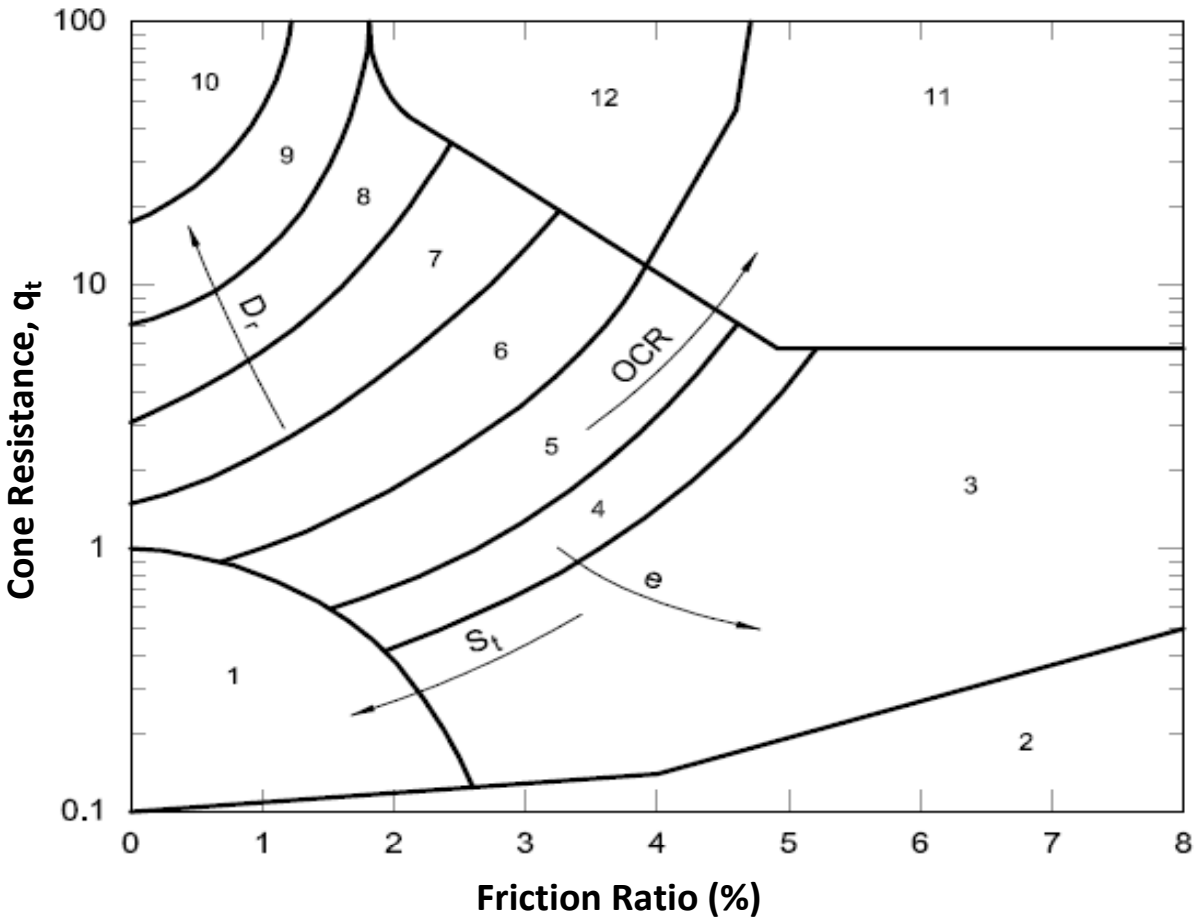
ABN: 64 625 054 729



DEFINITIONS

q_t : Cone tip resistance corrected for pore water pressure
S_t : Sensitivity
e : Void ratio
D_r : Relative density
OCR : Overconsolidation ratio
OC : Overconsolidated

SOIL BEHAVIOUR TYPE ZONES

1. Sensitive fine grained
2. Organic material
3. Clay
4. Silty clay to clay
5. Clayey silt to silty clay
6. Sandy silt to clayey silt
7. Silty sand to sandy silt
8. Sand to silty sand
9. Sand
10. Gravelly sand to sand
11. Very stiff fine grained material (OC/cemented)
12. Sand to clayey sand (OC/cemented)

NOTES

A. Some overlap in type zones is expected
B. Local correlations are preferred and may indicate soil type boundaries that are different from those shown above

Reference: Robertson, P.K., Campanella, R.G., Gillespie, D. and Grieg, J. (1986) "Use of Piezometer Cone Data". Proceedings of the ASCE Speciality Conference In Situ '86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp 1263-80, American Society of Civil Engineers (ASCE)

Galt GEOTECHNICS

CONE PENETRATION TESTING (CPT) SOIL TYPE INTERPRETATION

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Progress Developments Pty Ltd

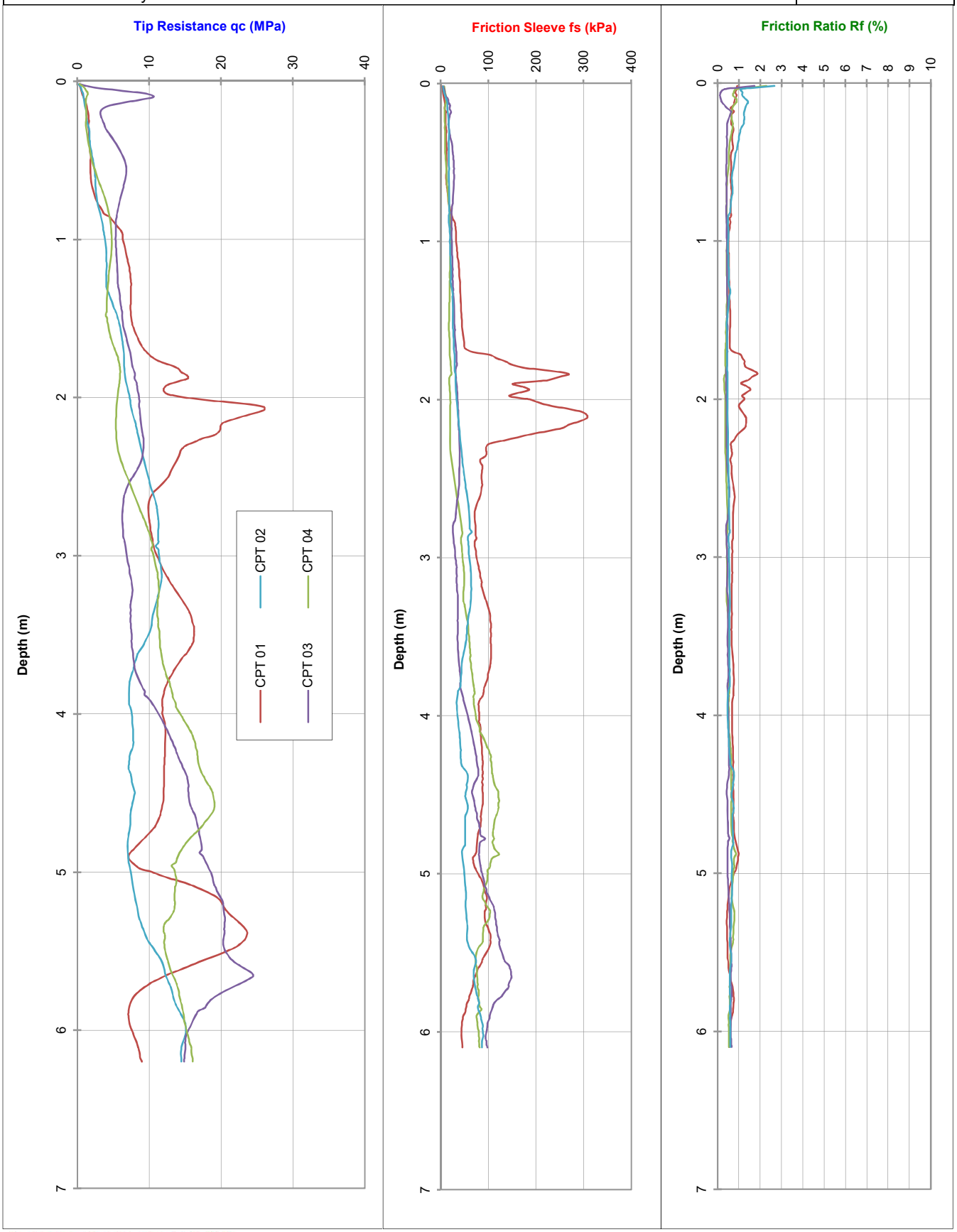
Job No.: J1501139

PROJECT: Residential Subdivision

Date/s: 19-08-19

LOCATION: Henley Brook

ALL DATA



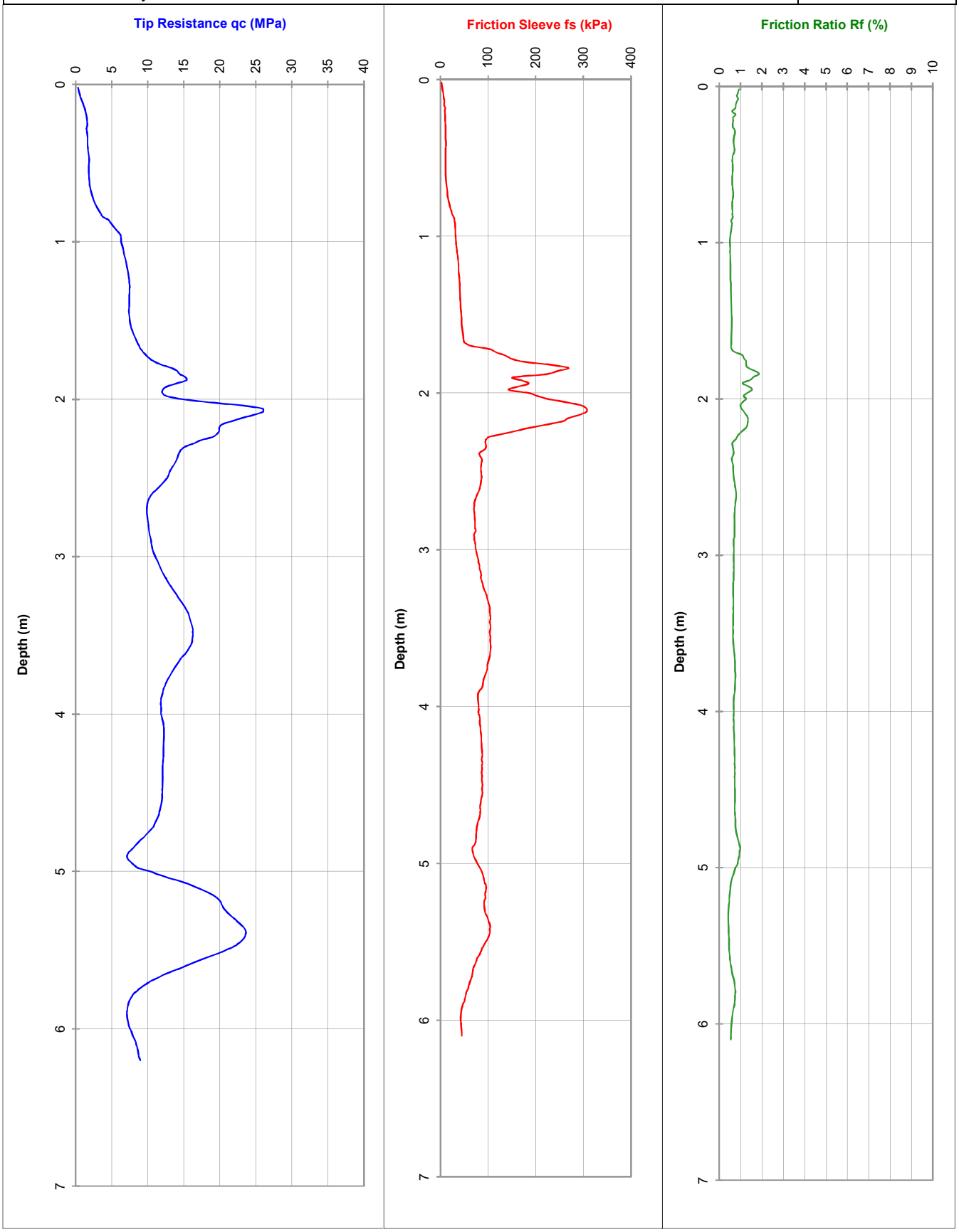
PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999
and IRTP 2001 for friction reducer

Rig Type: 22 Tonne Track Truck

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT:	Progress Developments Pty Ltd	Job No.: J1501139	Probe I.D
PROJECT:	Residential Subdivision	RL (m):	**CPT 01**
LOCATION:	Henley Brook	Co-ords:	19-Aug-19



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. Water (m): 2

Dummy probe to (m):

Refusal:

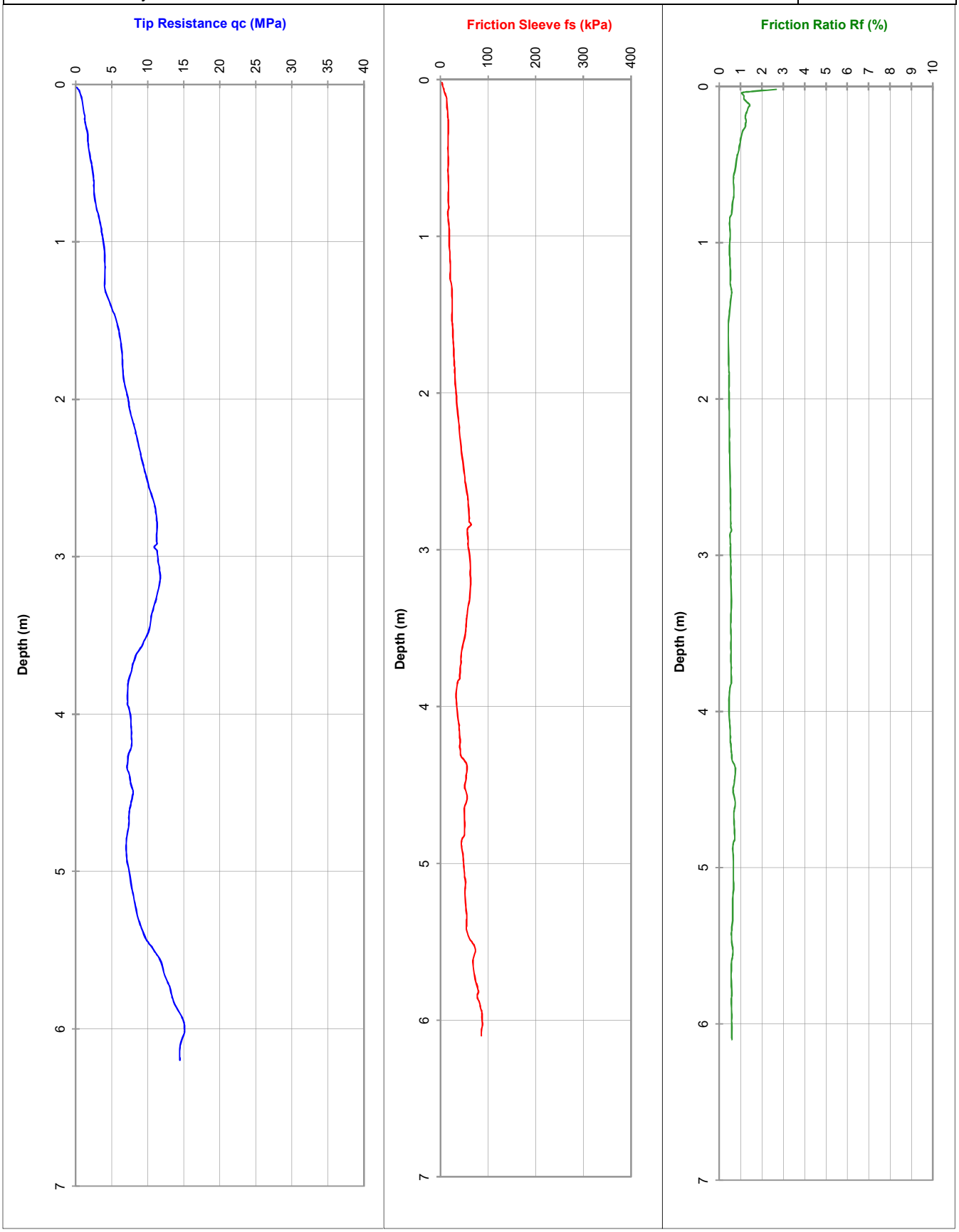
Cone I.D.: EC20

File: GL1145TT

Rig Type: 22 Tonne Track Truck

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Progress Developments Pty Ltd	Job No.: J1501139	Probe I.D
PROJECT: Residential Subdivision	RL (m):	**CPT 02**
LOCATION: Henley Brook	Co-ords:	19-Aug-19



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. Water (m): Dry to 5.3

Dummy probe to (m):

Refusal:

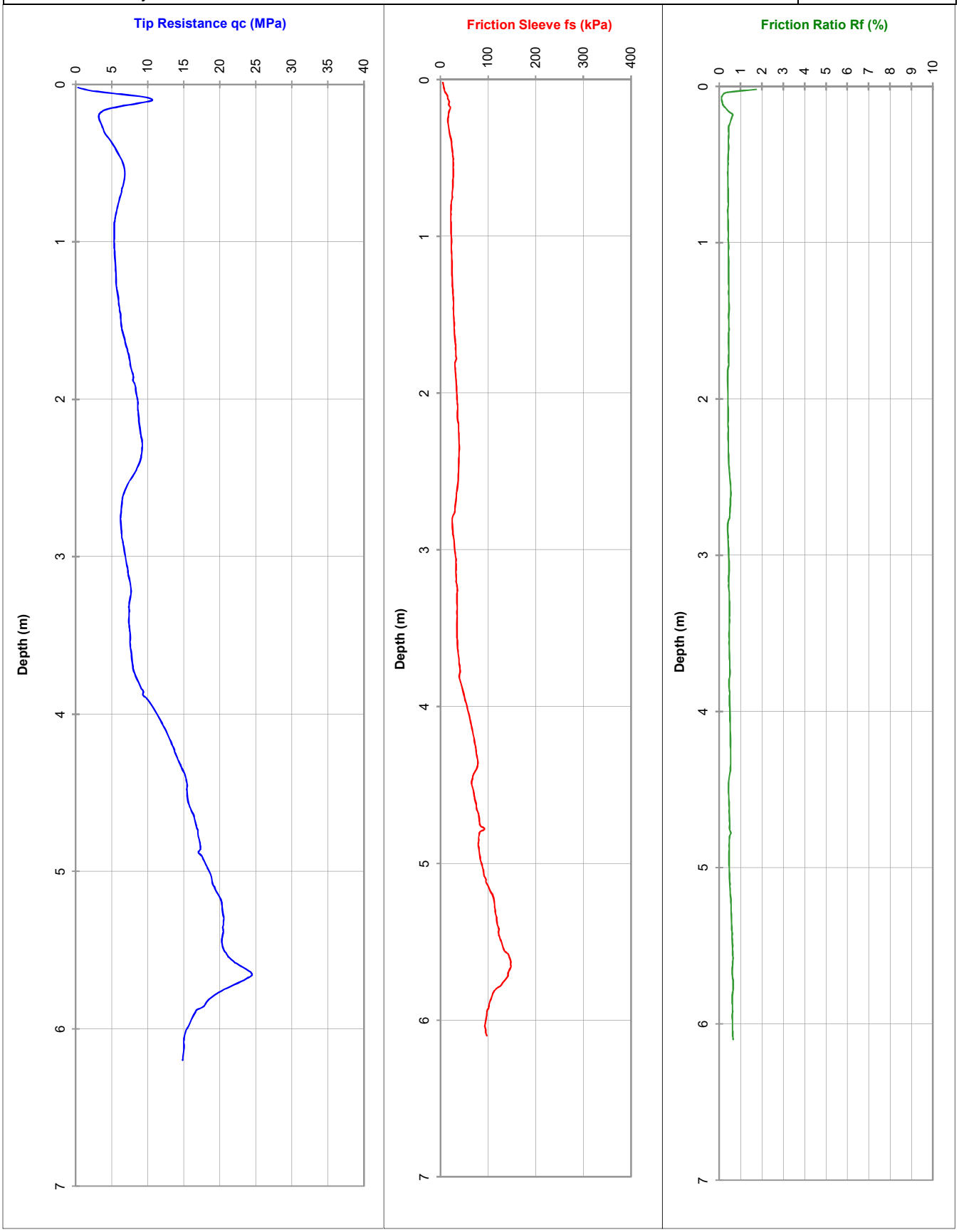
Cone I.D.: EC20

File: GL1148TT

Rig Type: 22 Tonne Track Truck

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT:	Progress Developments Pty Ltd	Job No.: J1501139	Probe I.D
PROJECT:	Residential Subdivision	RL (m):	**CPT 03**
LOCATION:	Henley Brook	Co-ords:	19-Aug-19



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. Water (m): 4.5

Dummy probe to (m):

Refusal:

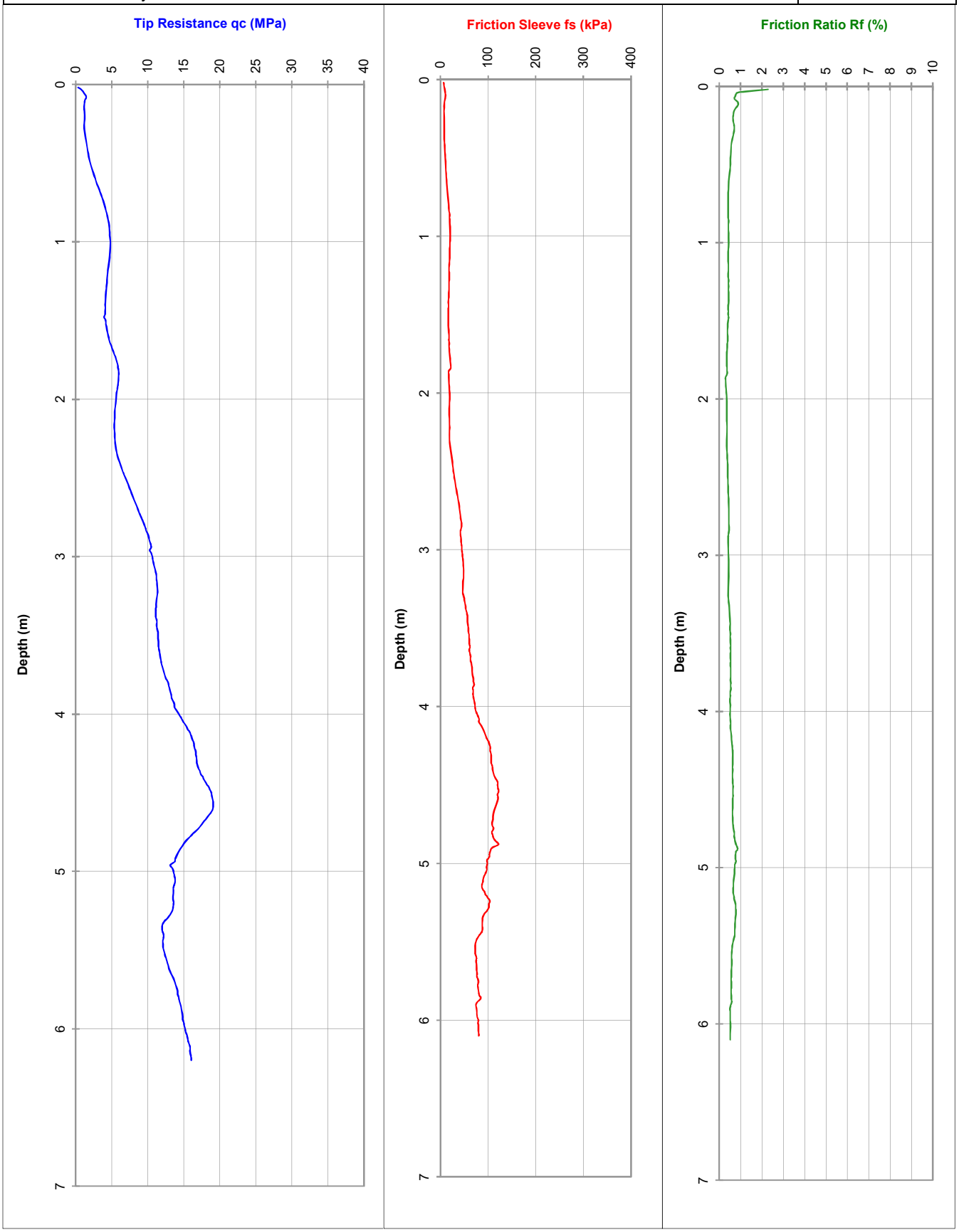
Cone I.D.: EC20

File: GL1147TT

Rig Type: 22 Tonne Track Truck

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT:	Progress Developments Pty Ltd	Job No.: J1501139	Probe I.D
PROJECT:	Residential Subdivision	RL (m):	**CPT 04**
LOCATION:	Henley Brook	Co-ords:	19-Aug-19



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. Water (m): Dry to 3.1

Dummy probe to (m):

Refusal:

Cone I.D.: EC20

File: GL1146TT

Rig Type: 22 Tonne Track Truck

Appendix C: Test Pit and Borehole Reports

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

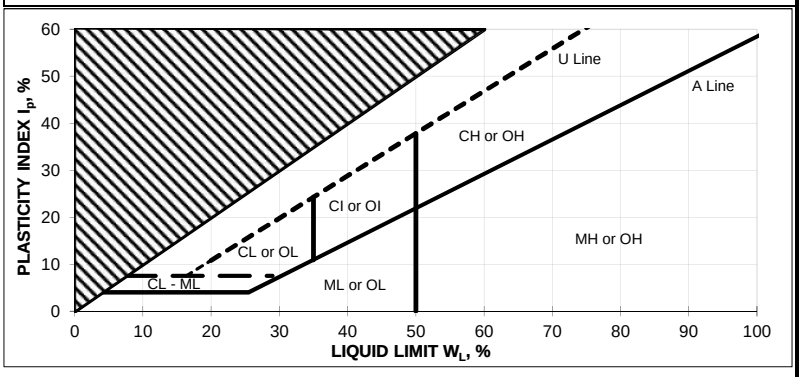
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name		**Particle Size (mm)**
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION		
Symbol	**Term**	**Description**
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	**Term**
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	**Description**
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	**Term**	**Undrained Shear Strength (kPa)**
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	**Organic Content % of dry mass**
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	**Term**	**Density Index (%)**
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

TEST PIT: TP01

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	D - M	VL - L	
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey to off-white, trace fines		L	
			1.0									
	F		1.5						Well cemented, dark brown, with fines (coffee rock)			
	E								Off-white, no cementation, trace fines	M		
			2.0						Pale brown, no cementation, trace fines			
			2.5						Hole terminated at 2.50 m Colllapse Groundwater encountered at 2.4 m	W		

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP03

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, grey to off-white, trace fines		L	
			0.5									
			1.0					SP		M		
					B(TP03-1) S-TP03-1				Pale brown			
			1.5						Well cemented, dark brown, with fines (coffee rock)			
	F-H								Pale brown, no cementation			
			2.0						Hole terminated at 2.00 m Colllapse Groundwater not encountered			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP04

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines	M	MD	
			0.5									
			1.0					SP				
			1.5						Brown, trace fines	M - W		
			2.0						Hole terminated at 1.90 m Colllapse Groundwater not encountered			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP05

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0		B(TP05-1)			SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	M	L	
			0.5						SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines			
			1.0									
			1.5					SP	Well cemented, dark brown, with fines (coffee rock)		MD	
									Bbrown/pale brown, no cementation			
			2.0							M - W		
										W		
			2.5						Hole terminated at 2.50 m Colllapse Groundwater encountered at 2.3 m			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP06

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace to some fines, organics (6%)	M	L	
									SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines			
			0.5								MD - D	
								SP	Dark grey to brown, trace fines			
			1.0							W		
			1.5						Hole terminated at 1.50 m Colllapse Groundwater encountered at 1.4 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP07

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey to grey, trace fines	M	L	
			0.5									
								SP	Brown, trace fines			
			1.0							M - W	MD	
			1.5						Off-white, trace fines	W		
									Hole terminated at 1.60 m Colllapse Groundwater encountered at 1.4 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP08

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	FILL: TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
								SP	FILL: SAND, fine to coarse grained, sub-angular to sub-rounded, brown, trace rootlets, trace fines			
			0.5						SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines	M	MD - D	
									Off-white, trace fines			
			1.0					SP	Dark grey, trace fines	M - W		
			1.5							W		
			2.0						Hole terminated at 1.80 m Colllapse Groundwater encountered at 1.6 m			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP09

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	M	MD	
			0.5		B(TP09-1)			SP	SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines			
			1.0							W		
			1.5						Hole terminated at 1.50 m Colllapse Groundwater encountered at 1.2 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP10

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace organics/rootlets, trace fines			
									SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines		VL	
			0.5							M	L	
									Grey to off-white, trace fines			
			1.0					SP				
			1.5							M - W		
		▼	2.0							W		
			2.5						Hole terminated at 2.40 m Colllapse Groundwater encountered at 1.9 m			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP11

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, off-white, trace fines	D - M	L	
			0.5									
			1.0					SP			MD	
			1.5						Pale yellow to orange, trace fines	M		
			2.0						Hole terminated at 1.80 m Colllapse Groundwater not encountered			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP12

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			Trace rootlets in TP wall up to 800 mm depth
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines	M	L	
		▼	1.0							W		
			1.5						Hole terminated at 1.30 m Colllapse Groundwater encountered at 1.2 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP13

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, trace fines	M		
			0.5		B(TP13-1)			SP			L	
										W		
			1.0						Off-white, trace fines			
									Hole terminated at 1.20 m Collapse Groundwater encountered at 0.7 m			
			1.5									
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP14

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	FILL: TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	M	L	
									FILL: Sandy GRAVEL, fine to medium grained, orange brown, 40-50% fine to coarse grained sand, trace fines			
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines			
			1.0									
			1.5						Cemented, with fines, dark brown (coffee rock)	W		
									Hole terminated at 1.60 m Collapse Groundwater not encountered			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP15

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines	M	L	
			1.0									
										M - W		
	F	▼	1.5						Becoming well cemented sand, with fines, dark brown (coffee rock)	W		
									Hole terminated at 1.60 m Colllapse Groundwater encountered at 1.6 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP16

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	M	L	Roots in TP wall up to 1.2 m depth (approximately 5-20 mm thick)
			0.5						SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines		MD	
			1.0		B(TP16-1)			SP				
			1.5							M - W		
			2.0						Hole terminated at 2.00 m Colllapse Groundwater not encountered			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP17

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines	M	L	
			0.5					SP				
			1.0									
			1.5							M - W		
									Hole terminated at 1.70 m Colllapse Groundwater not encountered			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP18

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines	M	L	
			0.5					SP			MD	
			1.0									
		▼	1.5						Well cemented sand, dark brown, with fines (coffee rock)	M - W		
									Pale brown, no cementation	W		
			2.0						Hole terminated at 1.70 m Colllapse Groundwater encountered at 1.6 m			
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP19

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines	M	VL - L	
			0.5					SP				
			1.0							W		
			1.5						Hole terminated at 1.30 m Colllapse Groundwater encountered at 1 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

TEST PIT: TP20

Sheet 1 OF 1

Job Number:	J1501139	**Contractor:**	ANH Contracting	**Date:**	19/08/2019
Client:	Progress Developments	**Machine:**	JCB 3CX	**Logged:**	PA
Project:	Proposed Residential Subdivision	**Operator:**	Neil	**Checked Date:**	03/09/2019
Location:	Various Rural Lots, Henley Brook	**Bucket:**	450 mm toothed	**Checked By:**	RP

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
BH	E	▼	0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			Tree log in TP wall at 0.4 m depth (approximately 600 mm long, 100 mm thick)
								SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale grey to off-white, trace fines	M	L	
			0.5									
			1.0							W		
			1.5						Hole terminated at 1.30 m Colllapse Groundwater encountered at 1 m			
			2.0									
			2.5									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA01

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
HA	E		0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, brown, trace fines Becoming pale grey	M	L - MD	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA02

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
HA	E								SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey to grey, trace fines			
			0.5					SP	Becoming off-white	M	L	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA03

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
									SAND: fine to coarse grained, sub-angular to sub-rounded, grey for 100 mm becoming off-white, trace fines	D - M		
			0.5					SP	Brown	M	L - MD	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA04

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	M	L	
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines	M - W		
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA05

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics			
HA	E		0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey to grey	M	L	
										W	VL	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA06

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	E		0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey, trace fines, trace organics	D - M	L	
			0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, grey, trace fines			
									Off-white	M		
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA07

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey to brown, trace fines, trace organics			
HA	E		0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, off-white becoming pale yellow at depth	M W	L	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

HAND AUGER BOREHOLE: HA08

Sheet 1 OF 1

Job Number: J1501139
Client: Progress Developments
Project: Proposed Residential Subdivision
Location: Various Rural Lots, Henley Brook

Operator:
Inclination: -90°

Date: 20/08/2019
Logged: PA
Checked Date: 03/09/2019
Checked By: RP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0					SP	TOPSOIL: SAND, fine to coarse grained, sub-angular to sub-rounded, dark grey , trace fines, trace organics			
HA	E		0.5					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, off-white, trace fines	M	VL - L	
			1.0						Hole terminated at 1.00 m Target depth Groundwater not encountered			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

Appendix D: Infiltration Test Results

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT01/HA01
Test Depth:	0.95 m

Spreadsheet author:	ORW	17-Oct-09

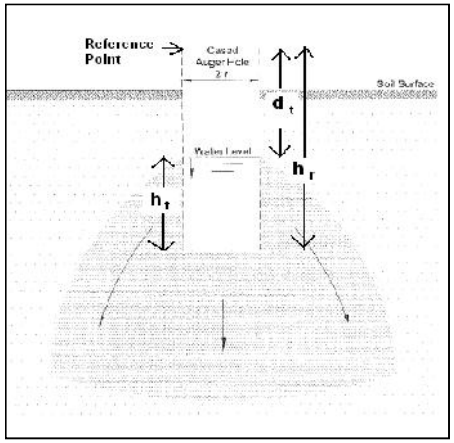
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.22	0.91		
20	0.5	0.63	4.0E-04	34.7
40	0.595	0.535	2.9E-04	25.0
60	0.66	0.47	2.4E-04	20.7
80	0.715	0.415	2.1E-04	18.4
100	0.76	0.37	1.9E-04	16.8
120	0.79	0.34	1.8E-04	15.3
140	0.81	0.32	1.6E-04	13.9
160	0.83	0.3	1.5E-04	12.9
180	0.85	0.28	1.4E-04	12.1
		AVERAGE	2.2E-04	18.9

Test 2

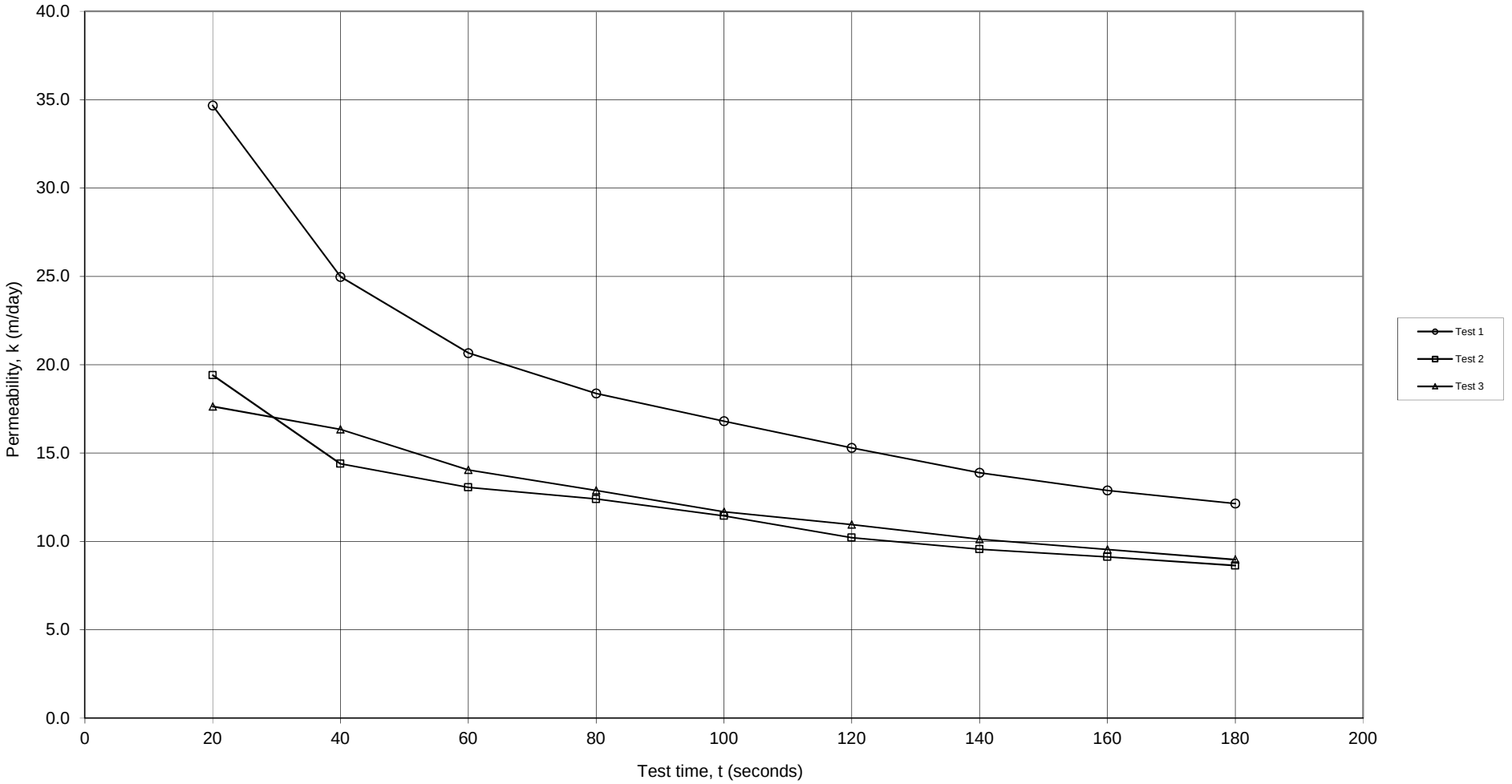
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.49	0.64		
20	0.61	0.52	2.2E-04	19.4
40	0.66	0.47	1.7E-04	14.4
60	0.71	0.42	1.5E-04	13.1
80	0.755	0.375	1.4E-04	12.4
100	0.785	0.345	1.3E-04	11.4
120	0.8	0.33	1.2E-04	10.2
140	0.82	0.31	1.1E-04	9.6
160	0.84	0.29	1.1E-04	9.1
180	0.855	0.275	1.0E-04	8.6
		AVERAGE	1.4E-04	12.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.73		
20	0.525	0.605	2.0E-04	17.6
40	0.615	0.515	1.9E-04	16.3
60	0.665	0.465	1.6E-04	14.0
80	0.71	0.42	1.5E-04	12.9
100	0.74	0.39	1.4E-04	11.7
120	0.77	0.36	1.3E-04	10.9
140	0.79	0.34	1.2E-04	10.1
160	0.81	0.32	1.1E-04	9.6
180	0.825	0.305	1.0E-04	9.0
		AVERAGE	1.4E-04	12.5

Permeability by Inverse Auger Hole Method

IT01/HA01



Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT02/HA02
Test Depth:	0.92 m

Spreadsheet author:	ORW	17-Oct-09

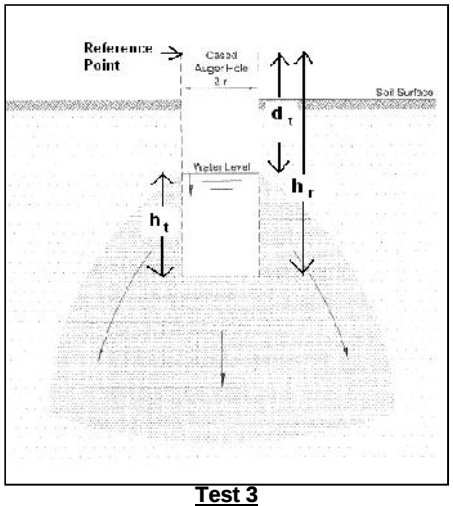
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, p101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

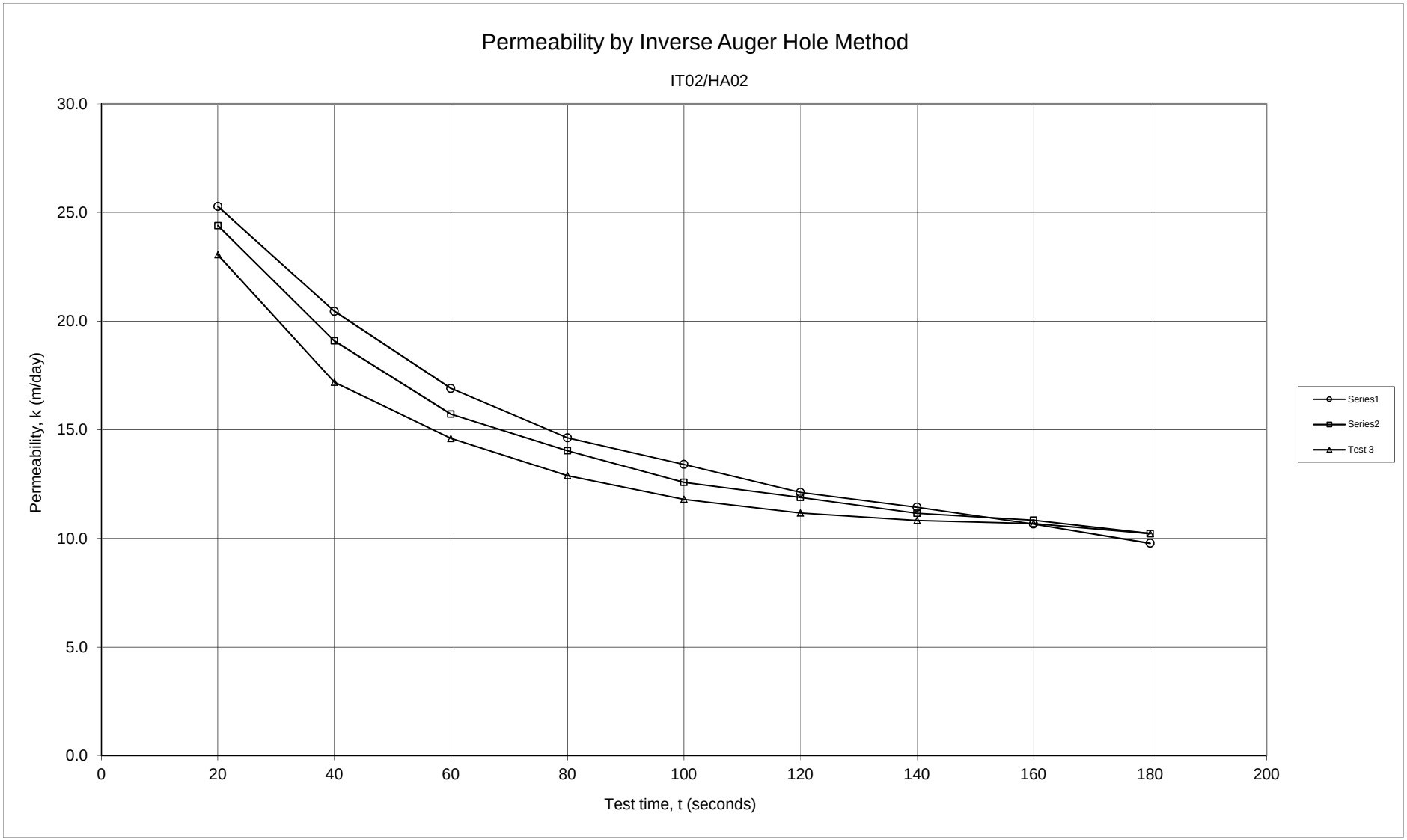
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.28	0.85		
20	0.48	0.65	2.9E-04	25.3
40	0.58	0.55	2.4E-04	20.5
60	0.635	0.495	2.0E-04	16.9
80	0.675	0.455	1.7E-04	14.6
100	0.715	0.415	1.6E-04	13.4
120	0.74	0.39	1.4E-04	12.1
140	0.77	0.36	1.3E-04	11.4
160	0.79	0.34	1.2E-04	10.7
180	0.8	0.33	1.1E-04	9.8
		AVERAGE	1.7E-04	15.0

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.23	0.9		
20	0.435	0.695	2.8E-04	24.4
40	0.53	0.6	2.2E-04	19.1
60	0.585	0.545	1.8E-04	15.7
80	0.635	0.495	1.6E-04	14.0
100	0.67	0.46	1.5E-04	12.6
120	0.71	0.42	1.4E-04	11.9
140	0.74	0.39	1.3E-04	11.2
160	0.775	0.355	1.3E-04	10.8
180	0.795	0.335	1.2E-04	10.2
		AVERAGE	1.7E-04	14.4

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.23	0.9		
20	0.425	0.705	2.7E-04	23.1
40	0.505	0.625	2.0E-04	17.2
60	0.565	0.565	1.7E-04	14.6
80	0.61	0.52	1.5E-04	12.9
100	0.65	0.48	1.4E-04	11.8
120	0.69	0.44	1.3E-04	11.2
140	0.73	0.4	1.3E-04	10.8
160	0.77	0.36	1.2E-04	10.7
180	0.795	0.335	1.2E-04	10.2
		AVERAGE	1.6E-04	13.6


Permeability by Inverse Auger Hole Method
IT02/HA02
Permeability, k (m/day)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Series1
Series2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT03/HA03
Test Depth:	0.97 m

Spreadsheet author:	ORW	17-Oct-09

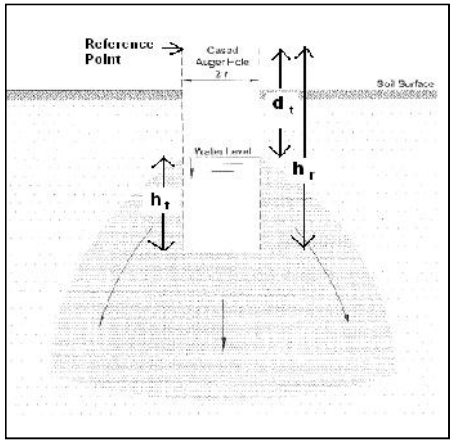
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

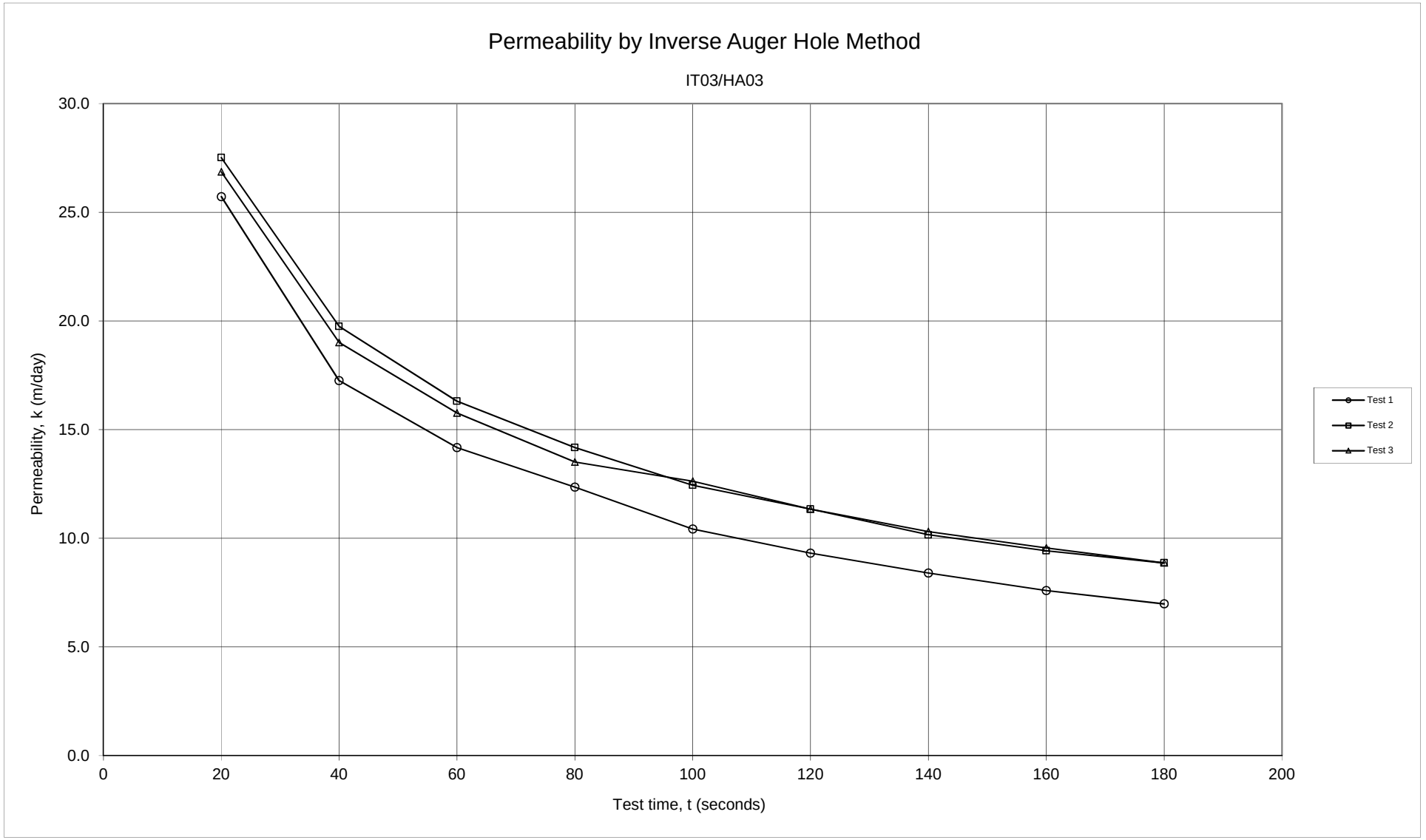
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.25	0.88		
20	0.46	0.67	3.0E-04	25.7
40	0.52	0.61	2.0E-04	17.3
60	0.57	0.56	1.6E-04	14.2
80	0.61	0.52	1.4E-04	12.4
100	0.625	0.505	1.2E-04	10.4
120	0.645	0.485	1.1E-04	9.3
140	0.66	0.47	9.7E-05	8.4
160	0.67	0.46	8.8E-05	7.6
180	0.68	0.45	8.1E-05	7.0
		AVERAGE	1.4E-04	12.5

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.18	0.95		
20	0.42	0.71	3.2E-04	27.5
40	0.505	0.625	2.3E-04	19.7
60	0.565	0.565	1.9E-04	16.3
80	0.61	0.52	1.6E-04	14.2
100	0.64	0.49	1.4E-04	12.4
120	0.67	0.46	1.3E-04	11.3
140	0.685	0.445	1.2E-04	10.2
160	0.705	0.425	1.1E-04	9.4
180	0.725	0.405	1.0E-04	8.9
		AVERAGE	1.7E-04	14.4

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.18	0.95		
20	0.415	0.715	3.1E-04	26.9
40	0.495	0.635	2.2E-04	19.0
60	0.555	0.575	1.8E-04	15.8
80	0.595	0.535	1.6E-04	13.5
100	0.645	0.485	1.5E-04	12.6
120	0.67	0.46	1.3E-04	11.3
140	0.69	0.44	1.2E-04	10.3
160	0.71	0.42	1.1E-04	9.6
180	0.725	0.405	1.0E-04	8.9
		AVERAGE	1.6E-04	14.2


Permeability by Inverse Auger Hole Method
IT03/HA03
Permeability, k (m/day)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT04/HA04
Test Depth:	0.90 m

Spreadsheet author:	ORW	17-Oct-09

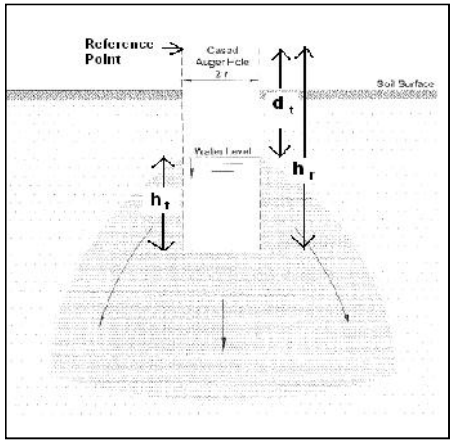
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

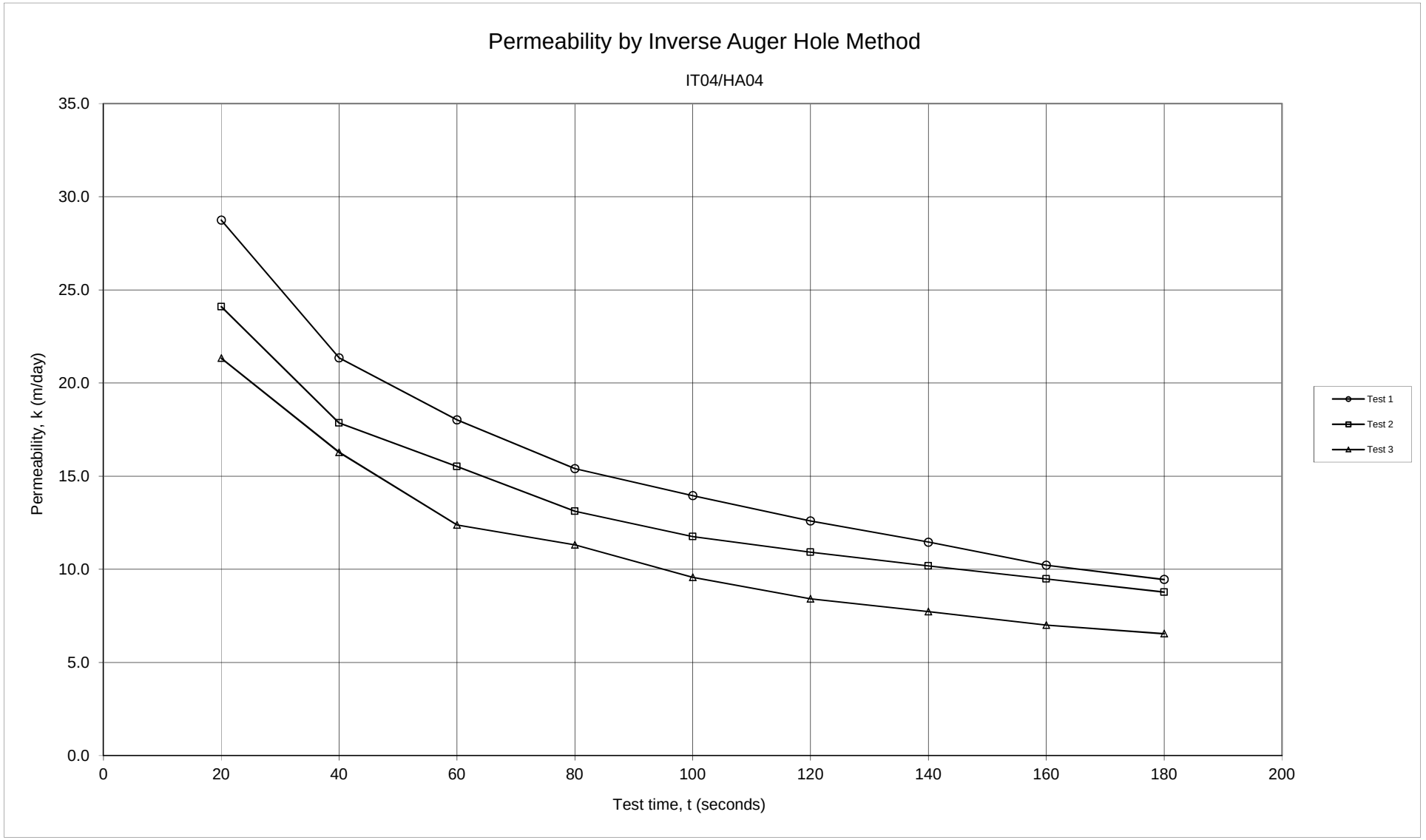
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.45	0.68		
20	0.63	0.5	3.3E-04	28.7
40	0.7	0.43	2.5E-04	21.4
60	0.75	0.38	2.1E-04	18.0
80	0.78	0.35	1.8E-04	15.4
100	0.81	0.32	1.6E-04	13.9
120	0.83	0.3	1.5E-04	12.6
140	0.845	0.285	1.3E-04	11.5
160	0.85	0.28	1.2E-04	10.2
180	0.86	0.27	1.1E-04	9.5
		AVERAGE	1.8E-04	15.7

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.47	0.66		
20	0.62	0.51	2.8E-04	24.1
40	0.68	0.45	2.1E-04	17.9
60	0.73	0.4	1.8E-04	15.5
80	0.755	0.375	1.5E-04	13.1
100	0.78	0.35	1.4E-04	11.8
120	0.805	0.325	1.3E-04	10.9
140	0.825	0.305	1.2E-04	10.2
160	0.84	0.29	1.1E-04	9.5
180	0.85	0.28	1.0E-04	8.8
		AVERAGE	1.6E-04	13.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.24	0.89		
20	0.42	0.71	2.5E-04	21.3
40	0.5	0.63	1.9E-04	16.3
60	0.53	0.6	1.4E-04	12.4
80	0.58	0.55	1.3E-04	11.3
100	0.595	0.535	1.1E-04	9.6
120	0.61	0.52	9.7E-05	8.4
140	0.63	0.5	9.0E-05	7.7
160	0.64	0.49	8.1E-05	7.0
180	0.655	0.475	7.6E-05	6.5
		AVERAGE	1.3E-04	11.2


Permeability by Inverse Auger Hole Method
IT04/HA04
Permeability, k (m/day)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT05/HA05
Test Depth:	0.92 m

Spreadsheet author:	ORW	17-Oct-09

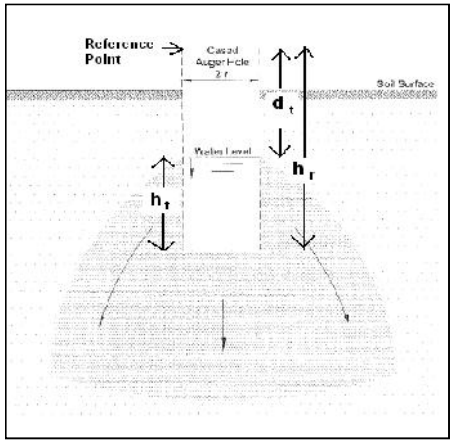
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

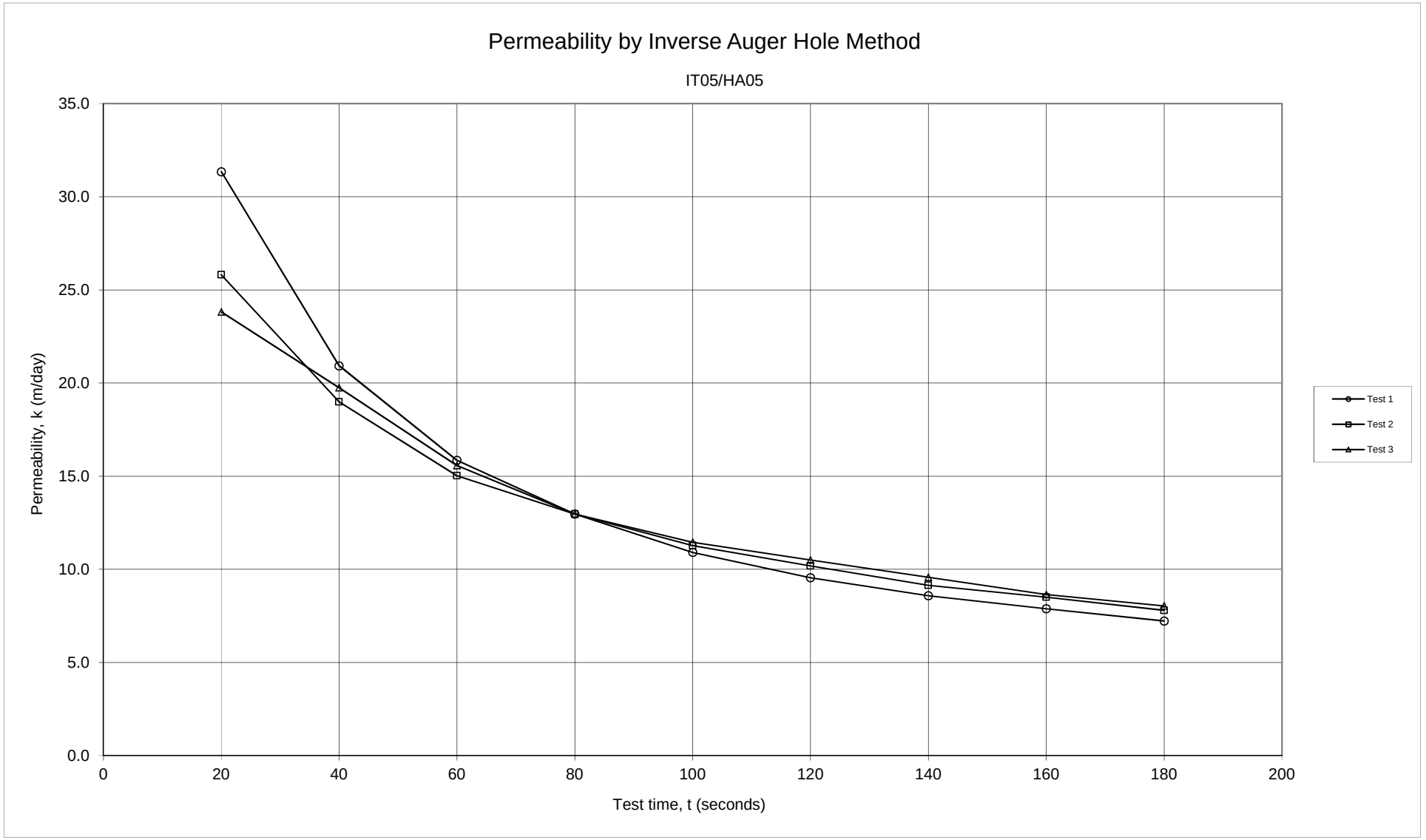
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.21	0.92		
20	0.47	0.66	3.6E-04	31.3
40	0.54	0.59	2.4E-04	20.9
60	0.575	0.555	1.8E-04	15.9
80	0.6	0.53	1.5E-04	13.0
100	0.615	0.515	1.3E-04	10.9
120	0.63	0.5	1.1E-04	9.5
140	0.645	0.485	9.9E-05	8.6
160	0.66	0.47	9.1E-05	7.9
180	0.67	0.46	8.4E-05	7.2
		AVERAGE	1.6E-04	13.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.21	0.92		
20	0.43	0.7	3.0E-04	25.8
40	0.515	0.615	2.2E-04	19.0
60	0.56	0.57	1.7E-04	15.0
80	0.6	0.53	1.5E-04	13.0
100	0.625	0.505	1.3E-04	11.3
120	0.65	0.48	1.2E-04	10.2
140	0.665	0.465	1.1E-04	9.1
160	0.685	0.445	9.8E-05	8.5
180	0.695	0.435	9.0E-05	7.8
		AVERAGE	1.5E-04	13.3

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.21	0.92		
20	0.415	0.715	2.8E-04	23.8
40	0.525	0.605	2.3E-04	19.7
60	0.57	0.56	1.8E-04	15.6
80	0.6	0.53	1.5E-04	13.0
100	0.63	0.5	1.3E-04	11.5
120	0.66	0.47	1.2E-04	10.5
140	0.68	0.45	1.1E-04	9.6
160	0.69	0.44	1.0E-04	8.6
180	0.705	0.425	9.3E-05	8.0
		AVERAGE	1.5E-04	13.4


Permeability by Inverse Auger Hole Method
IT05/HA05
Permeability, k (m/day)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

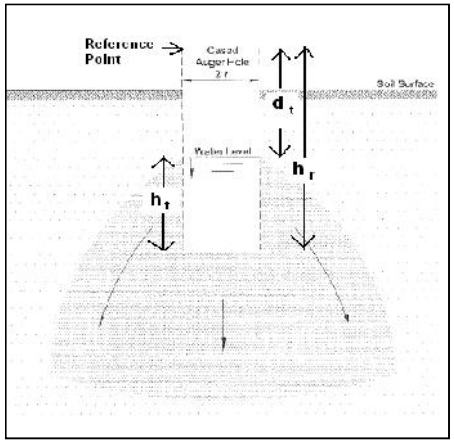
Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT06/HA06
Test Depth:	0.92 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m

Test 1

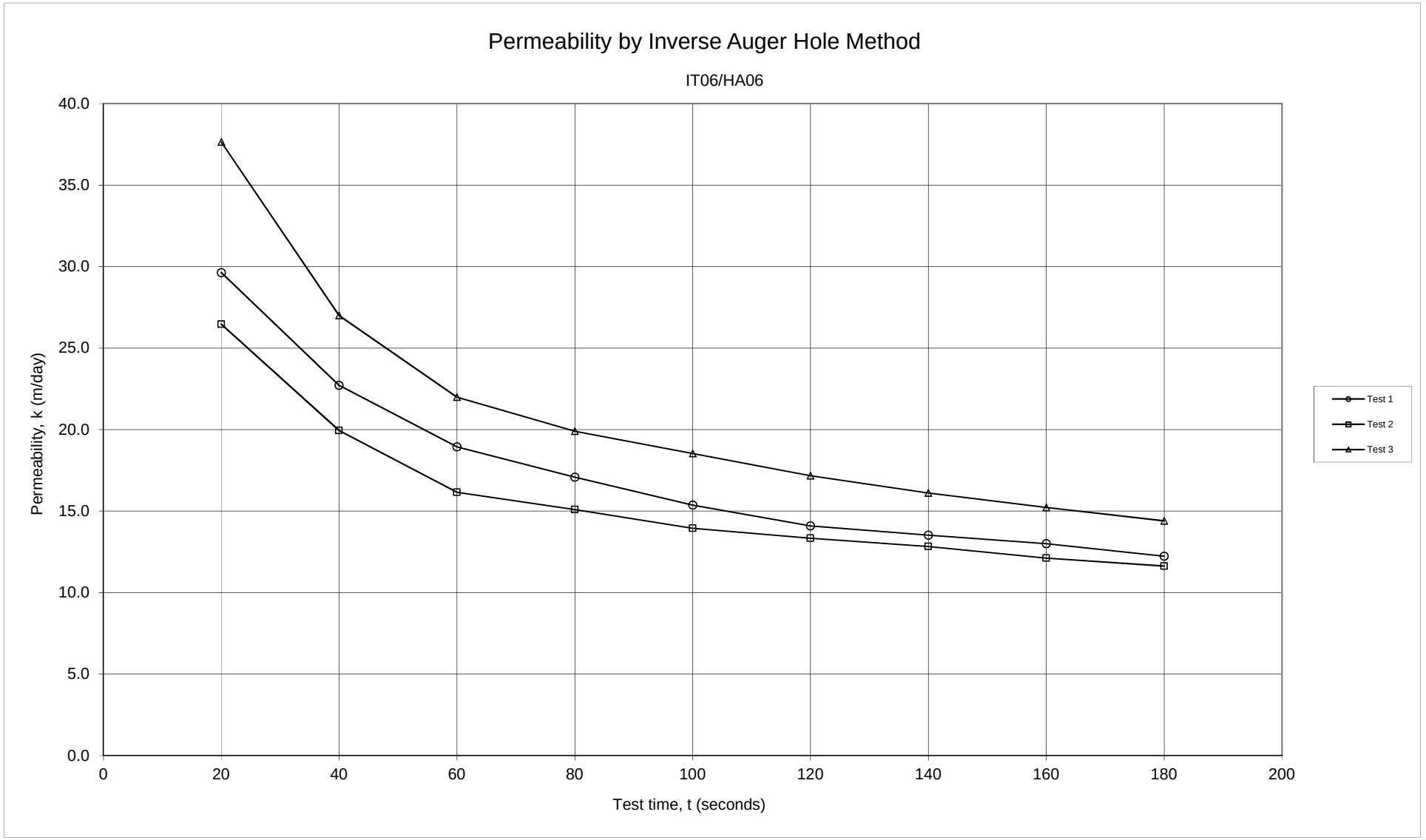
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.43	0.7		
20	0.62	0.51	3.4E-04	29.6
40	0.7	0.43	2.6E-04	22.7
60	0.75	0.38	2.2E-04	18.9
80	0.795	0.335	2.0E-04	17.1
100	0.825	0.305	1.8E-04	15.4
120	0.85	0.28	1.6E-04	14.1
140	0.88	0.25	1.6E-04	13.5
160	0.905	0.225	1.5E-04	13.0
180	0.92	0.21	1.4E-04	12.2
		AVERAGE	2.0E-04	17.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.44	0.69		
20	0.61	0.52	3.1E-04	26.5
40	0.68	0.45	2.3E-04	19.9
60	0.72	0.41	1.9E-04	16.2
80	0.77	0.36	1.7E-04	15.1
100	0.805	0.325	1.6E-04	13.9
120	0.84	0.29	1.5E-04	13.3
140	0.87	0.26	1.5E-04	12.8
160	0.89	0.24	1.4E-04	12.1
180	0.91	0.22	1.3E-04	11.6
		AVERAGE	1.8E-04	15.7

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.25	0.88		
20	0.54	0.59	4.4E-04	37.6
40	0.635	0.495	3.1E-04	27.0
60	0.695	0.435	2.5E-04	22.0
80	0.755	0.375	2.3E-04	19.9
100	0.805	0.325	2.1E-04	18.5
120	0.84	0.29	2.0E-04	17.2
140	0.87	0.26	1.9E-04	16.1
160	0.895	0.235	1.8E-04	15.2
180	0.915	0.215	1.7E-04	14.4
		AVERAGE	2.4E-04	20.9


Permeability by Inverse Auger Hole Method
IT06/HA06
Permeability, k (m/day)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT07/HA07
Test Depth:	0.93 m

Spreadsheet author:	ORW	17-Oct-09

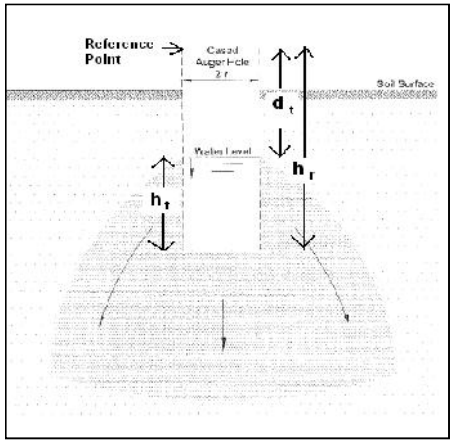
$$K = 1.15r\,\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

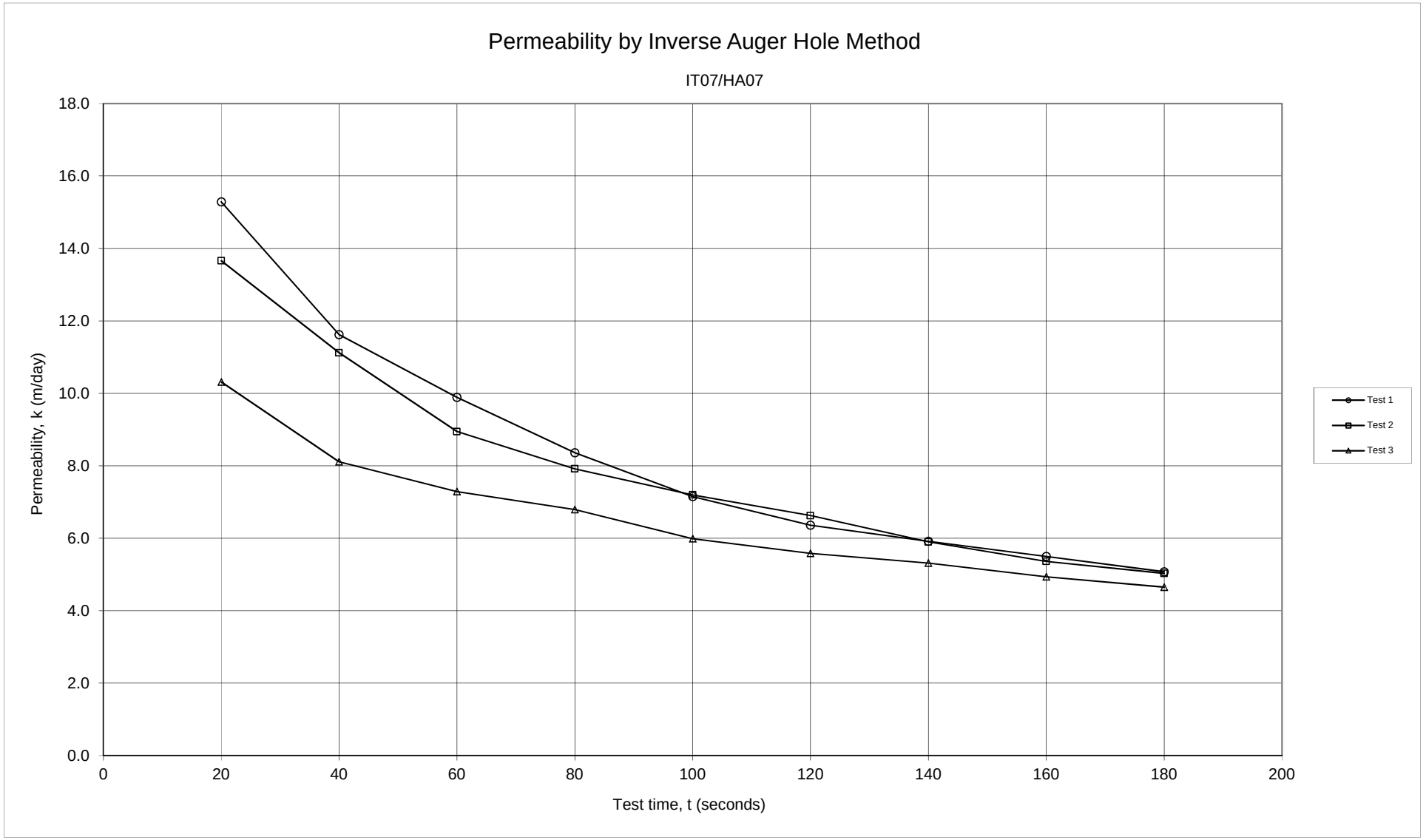
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.26	0.87		
20	0.39	0.74	1.8E-04	15.3
40	0.45	0.68	1.3E-04	11.6
60	0.495	0.635	1.1E-04	9.9
80	0.52	0.61	9.7E-05	8.4
100	0.535	0.595	8.3E-05	7.2
120	0.55	0.58	7.4E-05	6.4
140	0.57	0.56	6.8E-05	5.9
160	0.585	0.545	6.4E-05	5.5
180	0.595	0.535	5.9E-05	5.1
		AVERAGE	9.7E-05	8.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.2	0.93		
20	0.325	0.805	1.6E-04	13.7
40	0.395	0.735	1.3E-04	11.1
60	0.43	0.7	1.0E-04	8.9
80	0.465	0.665	9.2E-05	7.9
100	0.495	0.635	8.3E-05	7.2
120	0.52	0.61	7.7E-05	6.6
140	0.53	0.6	6.8E-05	5.9
160	0.54	0.59	6.2E-05	5.4
180	0.555	0.575	5.8E-05	5.0
		AVERAGE	9.2E-05	8.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.21	0.92		
20	0.305	0.825	1.2E-04	10.3
40	0.355	0.775	9.4E-05	8.1
60	0.4	0.73	8.4E-05	7.3
80	0.44	0.69	7.9E-05	6.8
100	0.46	0.67	6.9E-05	6.0
120	0.485	0.645	6.5E-05	5.6
140	0.51	0.62	6.2E-05	5.3
160	0.525	0.605	5.7E-05	4.9
180	0.54	0.59	5.4E-05	4.6
		AVERAGE	7.6E-05	6.6


Permeability by Inverse Auger Hole Method
IT07/HA07
Permeability, k (m/day)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1501139
Client:	Progress Developments
Location:	Various Lots
	Henley Brook
Calc by:	PA
BH Name:	IT08/HA08
Test Depth:	0.88 m

Spreadsheet author:	ORW	17-Oct-09

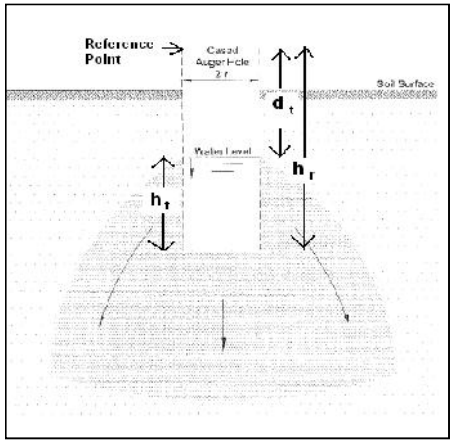
$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Permeability		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	1.13	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
h_0	h_t at t=0		m



Test 1

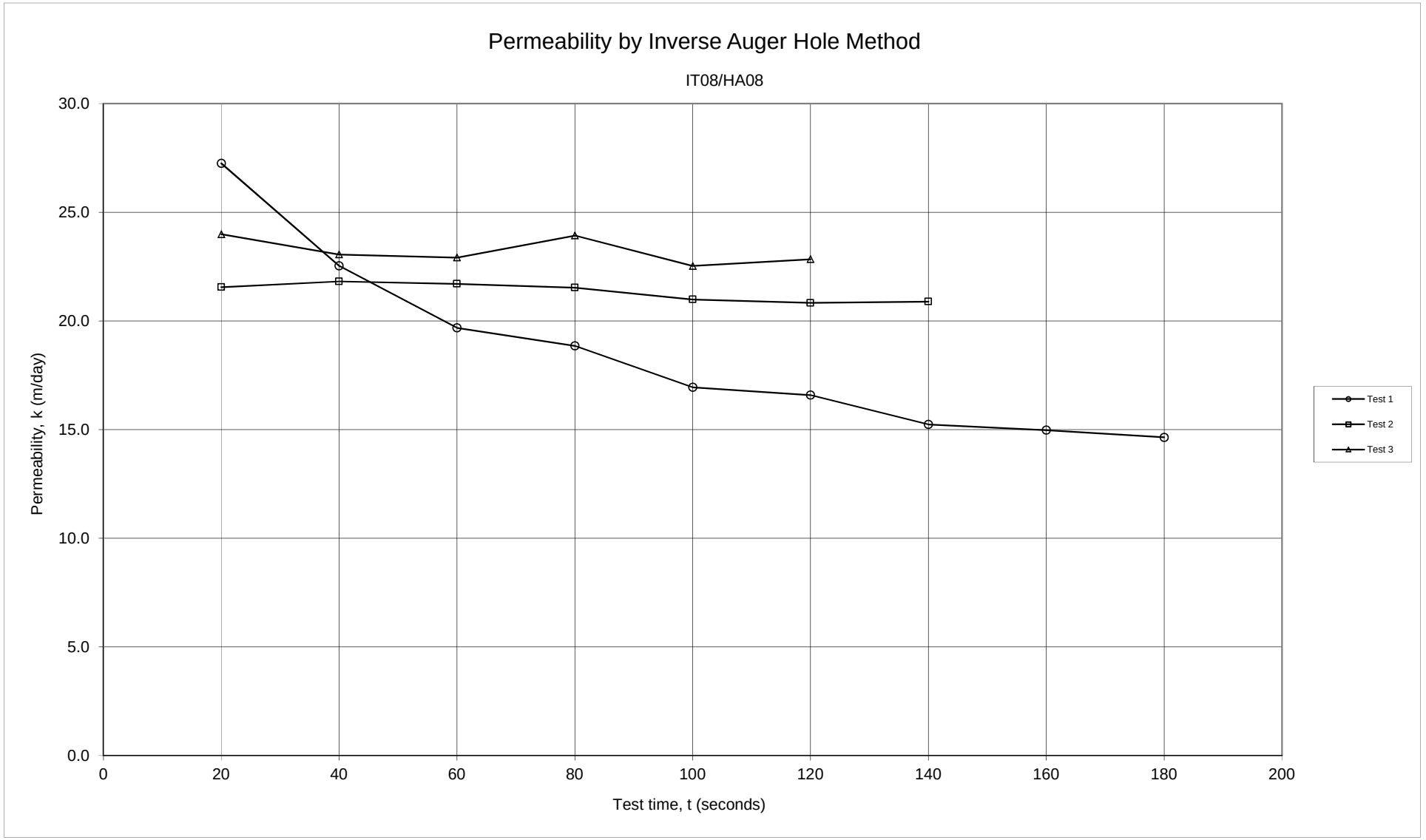
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.56	0.57		
20	0.705	0.425	3.2E-04	27.3
40	0.78	0.35	2.6E-04	22.5
60	0.83	0.3	2.3E-04	19.7
80	0.88	0.25	2.2E-04	18.9
100	0.905	0.225	2.0E-04	17.0
120	0.94	0.19	1.9E-04	16.6
140	0.955	0.175	1.8E-04	15.2
160	0.98	0.15	1.7E-04	15.0
180	1	0.13	1.7E-04	14.6
		AVERAGE	2.1E-04	18.5

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.6	0.53		
20	0.71	0.42	2.5E-04	21.6
40	0.8	0.33	2.5E-04	21.8
60	0.87	0.26	2.5E-04	21.7
80	0.925	0.205	2.5E-04	21.5
100	0.965	0.165	2.4E-04	21.0
120	1	0.13	2.4E-04	20.8
140	1.03	0.1	2.4E-04	20.9
		AVERAGE	2.5E-04	21.3

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.65	0.48		
20	0.76	0.37	2.8E-04	24.0
40	0.84	0.29	2.7E-04	23.1
60	0.905	0.225	2.7E-04	22.9
80	0.965	0.165	2.8E-04	23.9
100	0.995	0.135	2.6E-04	22.5
120	1.03	0.1	2.6E-04	22.8
		AVERAGE	2.7E-04	23.2


Permeability by Inverse Auger Hole Method
IT08/HA08
Permeability, k (m/day)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Appendix E: Perth Sand Penetrometer Test Results

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PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client: Progress Developments
Project: Proposed Residential Subdivison
Location: Various Lots, Henley Brook
Job No: J1501139
Date: 19 & 20 August 2019
Engineer: PA

Test No:						
Location:	TP01	TP04	TP05	TP06	TP07	TP08
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**					
0-150	SET	SET	SET	SET	SET	SET
150-300	2	3	2	3	2	4
300-450	1	4	2	3	3	3
450-600	2	4	2	5	3	5
600-750	1	4	3	7	4	5
750-900	2	4	4	9	4	5
900-1050	3	5	5	12	5	6

Test No:						
Location:	TP09	TP10	TP11	TP12	TP13	TP16
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**					
0-150	SET	SET	SET	SET	SET	SET
150-300	4	1	2	2	4	1
300-450	5	1	3	2	3	2
450-600	4	3	3	3	3	3
600-750	4	3	4	3	2	3
750-900	4	3	4	3	2	5
900-1050	4	4	4	3	3	7

Test No:						
Location:	TP17	TP18	TP19	TP20	HA01/IT01	HA02/IT02
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**					
0-150	SET	SET	SET	SET	SET	SET
150-300	2	2	1	3	4	1
300-450	2	2	3	3	4	3
450-600	3	3	2	3	4	4
600-750	3	4	1	3	5	4
750-900	3	4	1	2	5	3
900-1050	4	4	2	3	6	4

Test No:						
Location:	HA03/IT03	HA04/IT04	HA05/IT05	HA06/IT06	HA07/IT07	HA08/IT08
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**					
0-150	SET	SET	SET	SET	SET	SET
150-300	2	2	3	2	4	0
300-450	4	3	2	2	4	1
450-600	4	3	2	2	3	2
600-750	5	3	2	3	2	2
750-900	5	3	1	3	2	1
900-1050	6	4	1	3	3	2

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

Appendix F: Laboratory Test Certificates

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

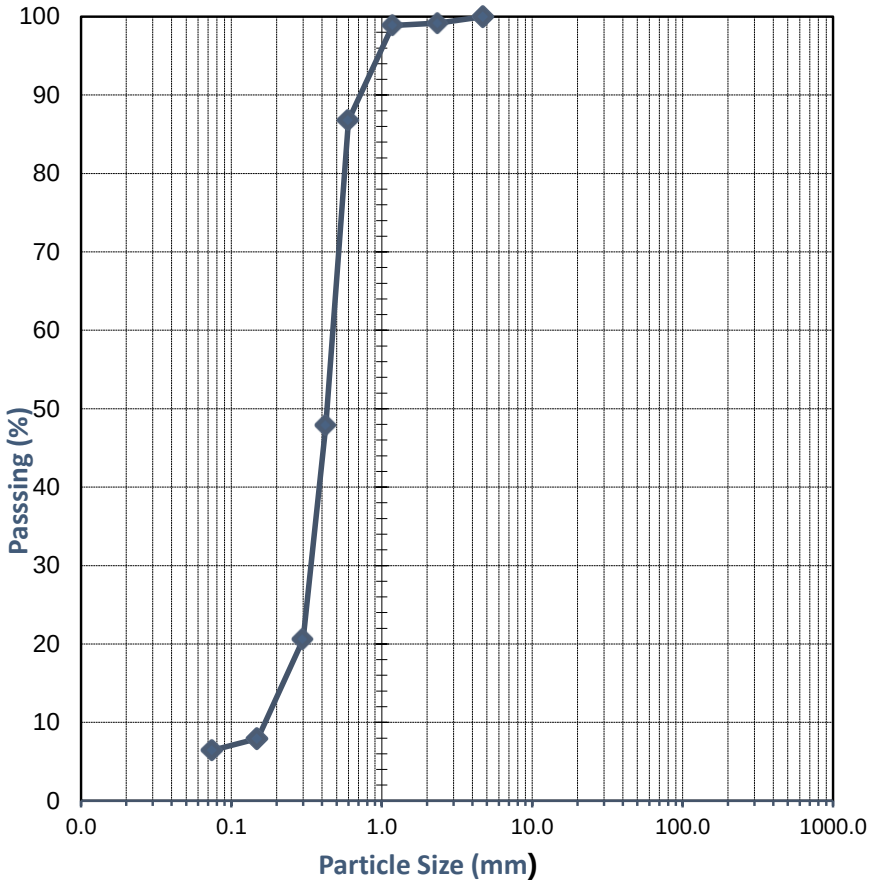
TEST REPORT - AS 1289.3.6.1

Client:	Progress Developments	*Ticket No.*	S299
Client Address:	-	*Report No.*	WG19/2454_1_PSD
Project:	Proposed Residential Subdivsion	*Sample No.*	WG19/2454
Location:	Henley Brook	*Date Sampled:*	Not Specified
Sample Identification:	TP05 0.0-0.3m	*Date Tested:*	23-08-2019

TEST RESULTS - Particle Size Distribution of Soil

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

Sieve Size (mm)	Percent Passing Sieve
75.0	
53.0	
37.5	
19.0	
9.5	
4.75	100
2.36	99
1.18	99
0.600	87
0.425	48
0.300	21
0.150	8
0.075	6



Comments:

Approved Signatory:

Name: Brooke Elliott
Function: Quality Manager
Date: 24-August-2019

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

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Progress Developments	*Ticket No.*	S299
Client Address:	-	*Report No.*	WG19/2454_1_ORG
Project:	Proposed Residential Subdivsion	*Sample No.*	WG19/2454
Location:	Henley Brook	*Date Sampled:*	Not Specified
Sample Identification:	See Below	*Date Tested:*	23-08-2019

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS - CO

Furnace Temperature (°): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG19/2454	TP05 0.0-0.3m	93.9	6.1

Comments:

Approved Signatory:

Name: Brooke Elliott

Function: Quality Manager

Date: 24-August-2019

NATA WORLD RECOGNISED ACCREDITATION

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

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

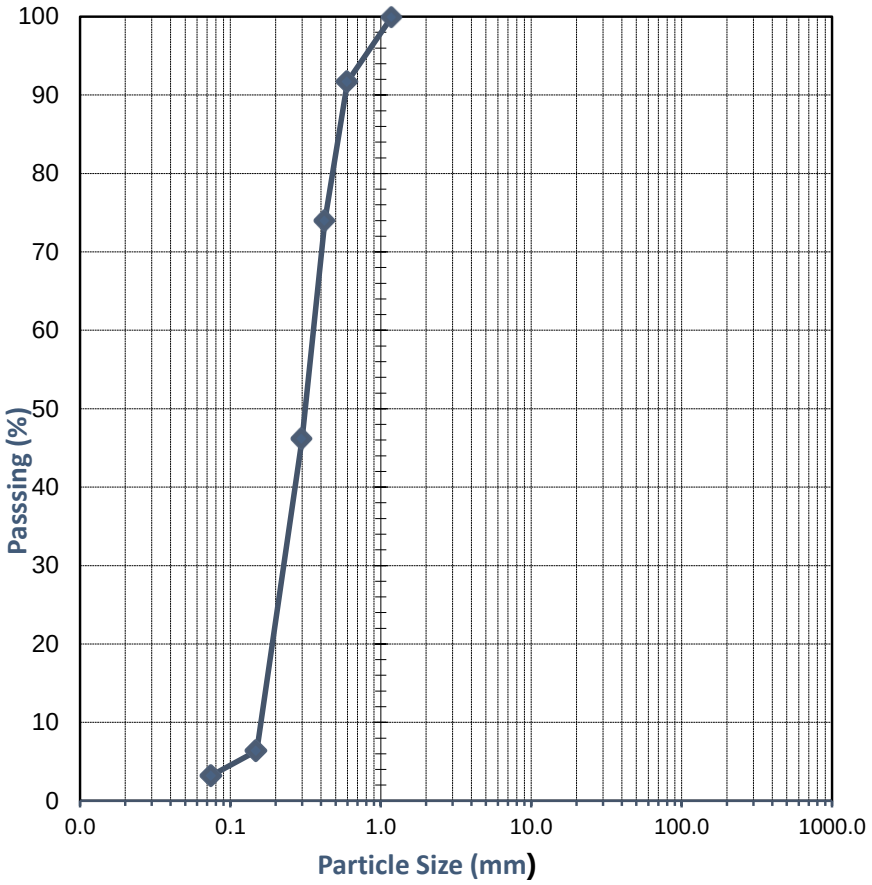
TEST REPORT - AS 1289.3.6.1

Client:	Progress Developments	*Ticket No.*	S299
Client Address:	-	*Report No.*	WG19/2455_1_PSD
Project:	Proposed Residential Subdivsion	*Sample No.*	WG19/2455
Location:	Henley Brook	*Date Sampled:*	Not Specified
Sample Identification:	TP03 1.5-1.7m	*Date Tested:*	23-08-2019

TEST RESULTS - Particle Size Distribution of Soil

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

Sieve Size (mm)	Percent Passing Sieve
75.0	
53.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	92
0.425	74
0.300	46
0.150	6
0.075	3



Comments:

Approved Signatory:

Name: Brooke Elliott
Function: Quality Manager
Date: 24-August-2019

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

Appendix G: Understanding Your Report

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UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev3

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.