Report on

GEOTECHNICAL STUDY
PROPOSED MIXED-USE DEVELOPMENT
CORNER READ STREET & COUNCIL AVENUE
ROCKINGHAM

Submitted to:
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J1702030 002 R Rev2

24 August 2018

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1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics Pty Ltd's (Galt's) geotechnical study for the proposed mixed-use development at the corner of Read Street and Council Avenue, Rockingham (the "site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

The study was authorised by Alex Drake-Brockman of Arise Developments in an email dated 24 July 2018.

This revised report includes changes based on comments by the City of Rockingham, and supersedes our previous report, J702030 002 R Rev2, dated 23 August 2018.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Based on the supplied information, the site is irregular in shape and approximately 1.24 hectares in size. The site is bounded by Council Avenue to the north, Read Street to the west, Sepia Court to the east and residential lots to the south.

The provided development plan indicates that the site is relatively flat with a surface elevation between RL 4.4 m and RL 5 m AHD.

There is a light to moderate coverage of vegetation, comprising of grasses, low shrubs and grass trees.

Based on the provided concept drawings, we understand the development will comprise:

- several retail-type tenancies / showrooms along the western / southern boundaries,
- a gym and café in the north west corner;
- a petrol station in the north east corner; and
- car parking and access roads over the remainder of the site (mainly the east and southern portions).

We assume that the buildings will typically be masonry or tilt-up concrete construction, founded on slab on-ground or shallow foundations.

We understand the only significant excavations are likely to be for the buried tanks at the service station, which we assume will extend to around 4 m depth.

3. PREVIOUS STUDIES

Galt Environmental carried out an environmental study for the site in January 2018 (report reference: J1702030 001 R Rev1, dated 12 February 2018).

The study included the drilling of 10 boreholes across the site to depths of between 1 m and 6 m, with boreholes logged in accordance with AS1726-2017.

The subsurface conditions were found to comprise sand to depth at all test locations (up to 6 m depth). Groundwater was encountered at depths of between 2.7m and 4.1 m across the site.

The findings of the environmental report have been used to supplement the findings of the current geotechnical study.

4. PROJECT OBJECTIVES

The objectives of the current study were to:

- assess subsurface soil and groundwater conditions across the site;
- provide recommendations on suitable footing systems for the proposed development;
- provide allowable bearing pressure and settlement estimates for shallow foundations;
- 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;
- provide recommendations on the tank installation and backfilling;
- assess the appropriate site subsoil class for the site in accordance with AS 1170.4-2007;
- recommend appropriate site preparation procedures including compaction criteria;
- assess the permeability 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.

5. FIELDWORK

The fieldwork was carried out on 30 July 2018 and comprised:

- a walkover and inspection of the site;
- cone penetration tests (CPTs) at 6 locations (CPT01 to CPT06), extending to depths of between 6.2 m and 8.2 m;
- drilling of hand auger boreholes at 3 locations (HA01 to HA03), extending to depths of between 1.8 m and 2.0 m;
- Perth sand penetrometer (PSP) testing adjacent to each hand auger borehole, extending to 0.9 m; and
- infiltration tests using the 'inverse auger hole' technique in each borehole, conducted at depths of between 0.75 m to 0.80 m.

General

Test locations were selected and positioned by a geotechnical engineer from Galt.

The geotechnical engineer conducted the walkover and inspection of the site, observed the CPTs, drilled the hand auger boreholes, logged the materials encountered in each borehole, and performed the penetrometer and infiltration tests.

The approximate test locations are shown on Figure 1, Site and Location Plan. Photographs of the site taken during the study are presented in Appendix A, Site Photographs.

Details of the tests are presented in Table 1: Summary of Tests.

Table 1: Summary of Tests

Test Name	Test Depth (m)	Approximate Depth to Groundwater (m)[1]	Reason for Termination	Stratigraphy[2]
CPT01	8.2	2.8	Target Depth	SAND
CPT02	8.2	2.8	Target Depth	
CPT03	6.2	2.6	Target Depth	
CPT04	8.2	2.8	Target Depth	
CPT05	6.2	2.9	Target Depth	
CPT06	6.2	2.8	Target Depth	
HA01	2.0	GNE[1]	Target Depth	
HA02	1.8	GNE	Refusal	
HA03	2.0	GNE	Target Depth	

Notes: 1. Groundwater not encountered

2. Stratigraphy below 2.0 m is inferred from CPT data using the Robertson et al. (1986) CPT interpretation method

Site Walkover

A site walkover was conducted to inspect the general condition of the site. We note that the exteriors of adjacent structures/houses and pavements appear to be in good condition with no obvious signs of settlement related damage (i.e. cracking).

A Water Corporation sewer manhole was observed in the centre of site. This is noted on DBYD information.

A Western Power substation is present in the north eastern corner of the site.

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, Cone Penetration Test Results, along with a method of interpretation proposed by Robertson et al. (1986)[1].

Hand Auger Boreholes

Summary hand auger borehole reports are presented in Appendix C, along with a list of notes, abbreviations and the method of soil description used on the reports. Photographs of the spoil recovered from the boreholes are included on each borehole report.

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 150 mm penetration rather than per 300 mm. PSP test results are presented in Appendix D, Perth Sand Penetrometer Test Results.

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

Infiltration Tests

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

Table 2: Summary of Infiltration Test Results

Test Location	Description	Pipe Embedment (m)	Minimum Unsaturated Permeability, k (m/day)		
			Test 1	Test 2	Test 3
HA01	SAND	0.72	12.9	11.6	10.4
HA02		0.85	>15	>15	>15
HA03		0.80	13.8	12.2	11.3

Notes: 1. The minimum permeabilities shown are typically recorded towards the end of the test, with pressure head varying between about 0.2 m and 0.4 m.
2. Permeabilities greater than 15 m/day are not shown due to the inaccuracies of the test method in highly permeable soils.

6. SITE CONDITIONS

6.1 Geology

The Rockingham sheet of the 1:50,000 scale Environmental Geology series map indicates that the area is underlain by Safety Bay Sand described as:

- SAND - *Calcareous sand, white, fine to medium grained, sub-rounded quartz and shell debris, of eolian origin*.

The results of our investigation are in line with the geological mapping of the area.

6.2 Subsurface Conditions

The subsurface conditions across the site are generally consistent and can be summarised as:

- SAND (SP): fine to medium grained, sub-angular to sub-rounded, generally dark grey at surface becoming pale yellow to white with depth, trace organics within the top 0.2 m, trace fines, generally medium dense at surface, becoming dense to very dense below around 1.0 m depth, localised loose to medium dense zones to 2 m depth and between 4.5 m and 5.5 m depth, present from surface to maximum investigated depth (8.2 m).

Notes: 1. Soil conditions below 2.0 m depth are inferred from CPT data using the Robertson et al. (1986) CPT interpretation method.

6.3 Groundwater

The Perth Groundwater Atlas (1997) shows the maximum groundwater level to be around RL 2.9 m AHD. This is about 2 m to 3 m below the current ground surface and around 2 m above the base of the proposed fuel tanks.

Groundwater was encountered in all CPT holes after extraction of the probe at depths ranging from 2.6 m to 2.9 m below surface level. Based on the provided design drawings, this correlate to a groundwater elevation of approximately RL 2 m AHD.

[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.

Given that installation of buried tanks will require excavation to around 4 m depth (around RL 1 m AHD), dewatering will be required to facilitate installation of the underground storage tanks.

7. GEOTECHNICAL ASSESSMENT

7.1 Site Classification

We consider that the site is geotechnically capable of supporting the proposed mixed-use 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 that the site preparation measures given in Section 7.3 are adopted.

Note: Footing and slab details provided in AS2870-2011 are limited to single and double storey residential buildings with a maximum bearing pressure of 100 kPa.

7.2 Site Subsoil Classification

We have assessed the site subsoil classification in accordance with AS 1170.4-2007 "Earthquake Actions in Australia". We consider that a site subsoil class of "C_e" is appropriate for the site. This is based on the expected depth to bedrock being less than 45 m.

7.3 Site Preparation

The site preparation measures outlined below are aimed at preparation of the site prior to construction of structures including on-ground slabs, shallow footings, retaining walls and pavement subgrades.

General

- Remove all vegetation and any deleterious materials encountered on site;
- Strip topsoil and stockpile for possible later treatment and re-use as fill, landscaping or disposal off-site. On average, we expect a 100 mm strip should be adequate, however all roots and organics must be removed.
- Stockpile suitable excavated material for potential re-use as fill (see Section 7.5).
- Moisture condition and compact the exposed base of the excavation to the density specified in Section 7.4 to a minimum depth of 0.9 m.
- Any areas of loose sand or unsuitable material must be removed and replaced with approved fill as outlined in Section 7.5. **Note**: There are localised areas where loose-medium sand is present to 2 m depth.
- Where fill is required to build up levels, use approved fill (see Section7.5), placed and compacted in layers of no greater than 300 mm loose thickness. Each layer must be placed and compacted to achieve the minimum density specified in Section 7.4.
- Excavate for pad and strip footings and compact the base to the minimum density specified in Section 7.4 to a depth of 0.9 m below the footings.

Underground Storage Tanks

- Dewater around the perimeter of the excavation to a minimum of 1 m below excavation levels. We consider that dewatering spears may be used to dewater the in-situ sand (see Section 7.9)
- Excavate to the required depth, battering slopes as specified in Section 7.7 and stockpile material for potential re-use (see Section 7.5). Where battering is not possible (due to proximity of other structures, buried services, etc), install temporary retaining walls / shoring (Section 7.8).

- Compact the exposed base of the excavation to the density specified in Section 7.4 to a minimum depth of 0.9 m below the excavation.
- Install tanks, including backfill to the manufacturer's specification below, to the sides and above the tanks.
- Where further fill is required to build up levels, only use approved fill outlined in Section 7.5, placed and compacted in layers of no greater than 300 mm of loose thickness.
- Any areas of loose sand or unsuitable material must be removed and replaced with approved fill as outlined in Section 7.5.

7.4 Compaction

Approved granular fill and the *in situ* sand must be compacted using suitable compaction equipment to achieve a dry density ratio 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, a Perth sand penetrometer (PSP) may be used for compaction control. We consider that the following blow counts to correspond to a dry density ratio of 95% MMDD:

- 0-150 mm: SET
- 150-450 mm: 8
- 450-750 mm: 10
- 750-1050 mm: 12 (or 750-900 mm: 6)

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

- be done on site;
- use the nuclear density gauge (NDG) to determine density at a minimum of 5 points with varying density to a depth of 300 mm below surface;
- use a calibrated PSP to determine the PSP blow count from 150 mm to 450 mm at each of the NDG test points; and
- be plotted on a chart of PSP blow count vs DDR.

Over-excavation and replacement of loose materials may be required 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.

Compaction Testing

After compaction, verify that the required level of compaction has been achieved by testing at the base of excavation and through the full depth of any fill and to a minimum depth of 0.9 m. The frequency of testing should be as follows:

- on each lift of fill at the rate of 1 test per 500 m3 or at least 2 tests per layer (4 tests per layer below the building footprint), whichever is greater;
- at each spread footing location;
- at 5 m centres along strip footings and retaining wall footings (where present); and
- at 10 m centres below on-ground slabs and pavements.

Compaction Vibrations

Care will need to be taken when compacting in the vicinity of existing services and structures. This is particularly important if vibratory compaction is being carried out. Tynan (1973)[3] provides assistance with the selection of compaction equipment for use adjacent to services. Of particular concern are the adjacent residential properties along the eastern and southern boundaries.

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

7.5 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 present at the site is suitable for re-use as inert structural fill.

Topsoil sand can potentially be re-used as structural fill provided it is screened of any coarse organics and blended with clean sand fill to meet the organic and permeability requirements. The proportion of clean sand required would depend on the outcomes of field permeability trials to assess a suitable blend ratio. We can provide further assistance with this process if required.

Any organic-rich sand (greater than 2% organics by weight), sand containing significant proportions of fines (greater than 5% of material less than 0.075 mm in size by weight), or rock particles greater than 100 mm diameter must not be used.

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

7.6 Shallow Footings

We consider that the proposed building may be founded on shallow footings founded within the *in situ* sand. Table 3 and Table 4 provide allowable bearing pressure and estimated settlements for pad footings and strip footings at embedment depths of 0.5 m and 1.0 m, respectively. These values are based on the assumption that the site preparation procedures in Section 7.3 are followed.

Table 3: Pad Footing Allowable Bearing Pressures and Estimated Settlements

Minimum Footing Embedment (m)	Minimum Footing Dimension (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5	200	<5
	1.0	220	<5
	2.0	250	5-10
	3.0	250	10-15
1.0	1.0	200	<5
	2.0	240	<5
	3.0	250	10-15
	4.0	250	10-15

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

Table 4: Strip Footing Allowable Bearing Pressures and Estimated Settlements

Minimum Footing Embedment (m)	Footing Width (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5	180	<5
	1.0	200	5-10
	2.0	220	10-15
	3.0	230	15-20
1.0	1.0	200	<5
	2.0	220	5-10
	2.0	230	15-20
	4.0	240	20-25

Allowable bearing pressures for footings of intermediate plan dimensions to those tabulated can be interpolated. Footings that have a plan dimension either smaller or larger than those covered by tables above will need to be considered individually along with other embedment depths. Footings carrying significant eccentric loading, such as below retaining walls, must be assessed separately.

An allowable working bearing pressure of 250 kPa is considered to be an upper limit for footings to limit total and differential settlements as well as the risk of long-term creep settlement which may occur under high bearing pressures.

The settlement of the proposed structure will depend upon a number of factors including the applied pressures, footings size and base preparation. The estimates of settlement provided above assume that the site preparation measures in Section 7.3 have been completed. The estimated settlements are for the working bearing pressure values shown. Differential settlements of up to half of the total estimated settlement values are likely between footings of similar sizes, loads and elevations. About 70% of the settlement is expected to occur during construction.

The estimated settlements indicated in the above tables do not include interaction effects from footings founded near other footings (i.e. groups of footings). Interaction effects will need to be considered if the spacing between adjacent footings is smaller than the dimension of the footings (i.e. the centre-to-centre spacing between footings is less than twice the width of the footings). This could act to double the nominated settlements, dependent on the footing configuration. Where an assessment of footing groups is required, a more detailed numerical analysis would need to be undertaken (we can complete this, if required).

All prepared footing excavations must be carefully assessed by a competent person prior to blinding.

7.7 Excavations and Slopes

Based on the soil profile encountered, we consider that excavation of the sandy material will be readily achieved to a depth of at least 5 m using conventional earthmoving equipment (i.e. with a 15 tonne or larger excavator with a toothed bucket). The possible presence of obstructions such as buried services and moderately cemented sand layers must be taken into account when selecting excavation equipment.

Excavations in sand are prone to instability, particularly at or below the groundwater level.

Where groundwater is at least 1 m below the toe of the slope, excavations must be battered at slopes no steeper than 1V:2H for temporary 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 erosion and rilling may occur. Where steeper slopes are required, temporary or permanent slope retention must be employed.

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

- The groundwater is at least 1.0 m below the base of the excavation.
- The maximum slope height is 2 m without specific advice and slope stability analysis
- Surcharges (such as structures, plant and soil stockpiles) must not be placed at or close to the crest of unsupported excavations.

Excavations extending below groundwater will require the groundwater to be drawn down at least 1 m below the maximum depth of excavation prior to excavation commencing (see Section 7.9).

The stability of open excavations must be carefully assessed by the contractor during construction. A geotechnical engineer must be consulted where there is any doubt regarding the stability or safety of unsupported excavations.

7.8 Retaining Structures

Retaining structures above the groundwater level may be designed in accordance with AS 4678-2002 "Earth-Retaining Structures". For the design of retaining structures, the parameters in Table 5 are considered appropriate.

Table 5: Retaining Structures Design Parameters

Soil Type	Bulk Density (t/m^3)	Angle of Internal Friction (deg.)	Wall Friction = 0°		Wall Friction = 0.5Φ	
			Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p	Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p
Medium dense SAND (0.0 m to 1.0m depth)	17	34	0.28	3.5	0.25	5.7
Dense or well compacted SAND (1.0 m to 4,0 m depth)	18	36	0.26	3.9	0.22	6.5

Notes:
1. Earth pressure coefficients are provided in this table for conditions of zero friction between the wall and the soil and with wall friction of 0.5Φ'.
2. A horizontal ground surface behind the wall has been assumed.
3. The retaining wall designer should make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction.

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.

7.9 Dewatering

We note that where excavations extend below about RL 3.0 m AHD, groundwater seepage into excavations may be expected depending on the time of the year. Based on the current groundwater levels recorded (~RL 2.0 m AHD) and the proposed tank levels (~RL 1.0 m AHD) dewatering will be necessary to enable excavation and placement of the tanks.

We consider that dewatering should be possible using groundwater spears as are conventionally used in the Perth metropolitan area. We note the following:

- A dewatering licence may be required depending on the duration and rate of dewatering.
- A dewatering licence may require a dewatering study and dewatering management plan to be done to characterise the dewatering effluent.

- Disposal of dewatering effluent will be required. Usually, an infiltration basin is used, however this relies on having adequate open area of the site (or nearby) to form the infiltration basin.

We can provide further advice and carry out the dewatering study if required.

7.10 Buoyancy

The structural designers must take into account potential buoyancy on the fuel tanks. A design groundwater level of at least RL 3.0 m AHD (historical maximum groundwater elevation) must be allowed by the designer for the tank installation. Dewatering may need to continue to at least partway through construction until sufficient load is in place to resist buoyancy. We can provide further advice if required.

7.11 Stormwater Disposal

Groundwater was encountered during the investigation at depths of between about 2.6 m and 2.9 m. The Perth Groundwater Atlas (1997) shows the historical maximum groundwater level to be around RL 2.9 m AHD. This is around 2.0 m below the current ground surface.

We consider that the site is suitable for the disposal of stormwater by infiltration (i.e soak wells, storm water cells, etc), provided that the infiltration system is founded a minimum of 0.3 m above the maximum groundwater level (i.e. founded at or above RL 3.2 m AHD).

We recommend a design permeability (k) not greater than 6 m/day. This is to allow for the variability in materials and reduced permeability as a consequence of:

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

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

Where soakwells are founded close to (within 0.3 m) or below the maximum groundwater level a reduced design permeability will be applicable during wetter times of the year. This must be taken into consideration by the civil designer.

7.12 Pavement Design

A subgrade California bearing ratio (CBR) of 12% may be assumed for pavement thickness design constructed on top of at least 0.5 m of compacted *in situ* sand or imported sand fill. This CBR value assumes that the site preparation requirements outlined in Section 7.3 have been carried out on the pavement subgrade.

8. CLOSURE

We draw your attention to Appendix F 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

Paul Woodroof CPEng

Geotechnical Engineer

Kieran Harris

Geotechnical Engineer

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Figures

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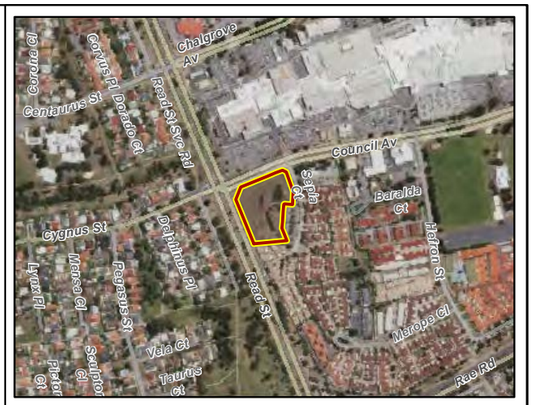

Legend

- Site Boundary
- Cone Penetration Test
- Hand Auger Borehole / Permeability Test

N

0 10 20 30 40 50
Meters

SCALE	1:750	(A3)
DRAWN	CED	
DATE DRAWN	24/07/2018	
CHECKED	KH	
DATE CHECKED	02/08/2018	
PROJECTION	GDA 1994 MGA Zone 50	

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CLIENT	**ARISE DEVELOPMENTS**
PROJECT	ROCKINGHAM COMMERCIAL CENTRE
LOCATION	COUNCIL AVENUE 2 SEPIA COURT
TITLE	SITE & LOCATION PLAN
Job No	J1702030
Fig No	FIGURE 1
Rev	**A**

Appendix A: Site Photographs

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

Photograph 1: CPT01 in progress

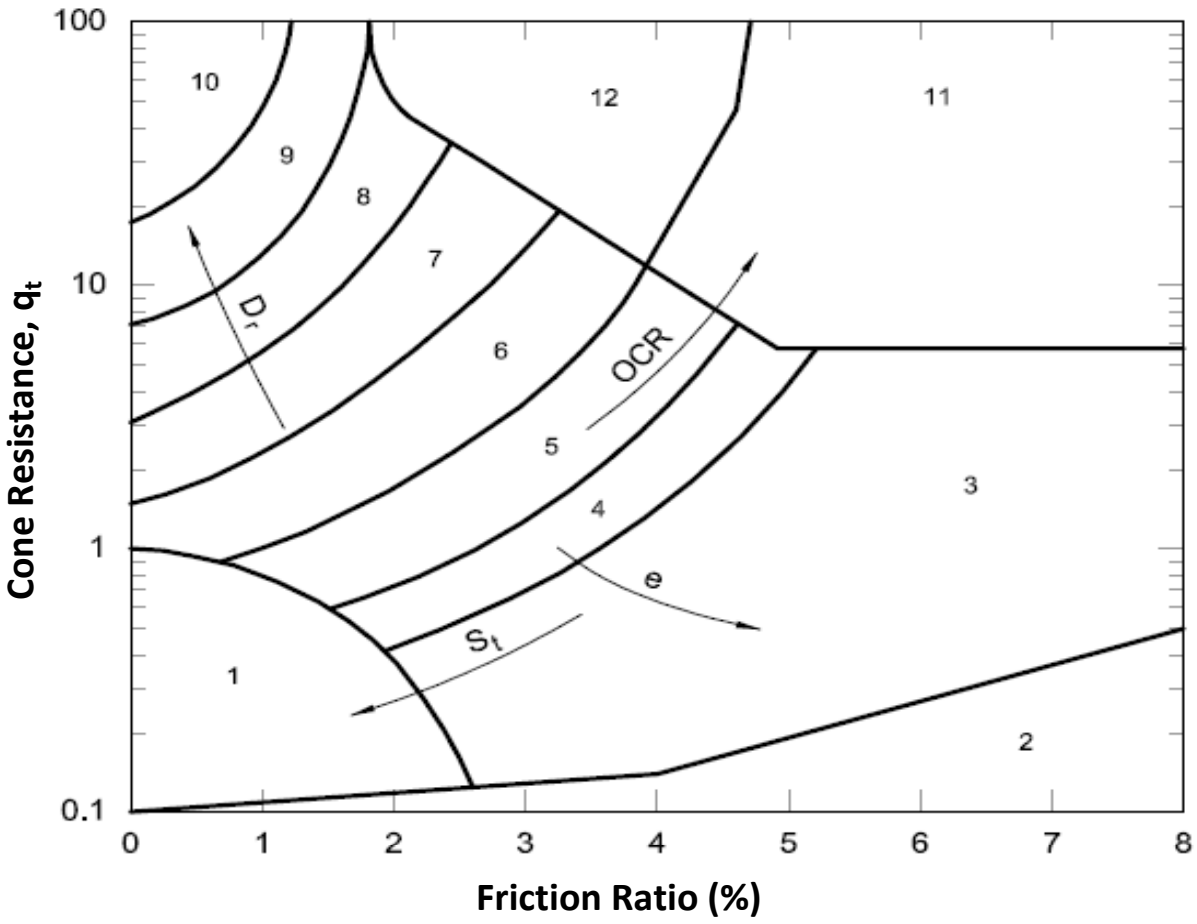
Photograph 2: Water Corporation sewer manhole in the centre of the site

Photograph 3: South along Read Street

Photograph 4: View south east showing vegetation and existing residences

Appendix B: Cone Penetration Test Results

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

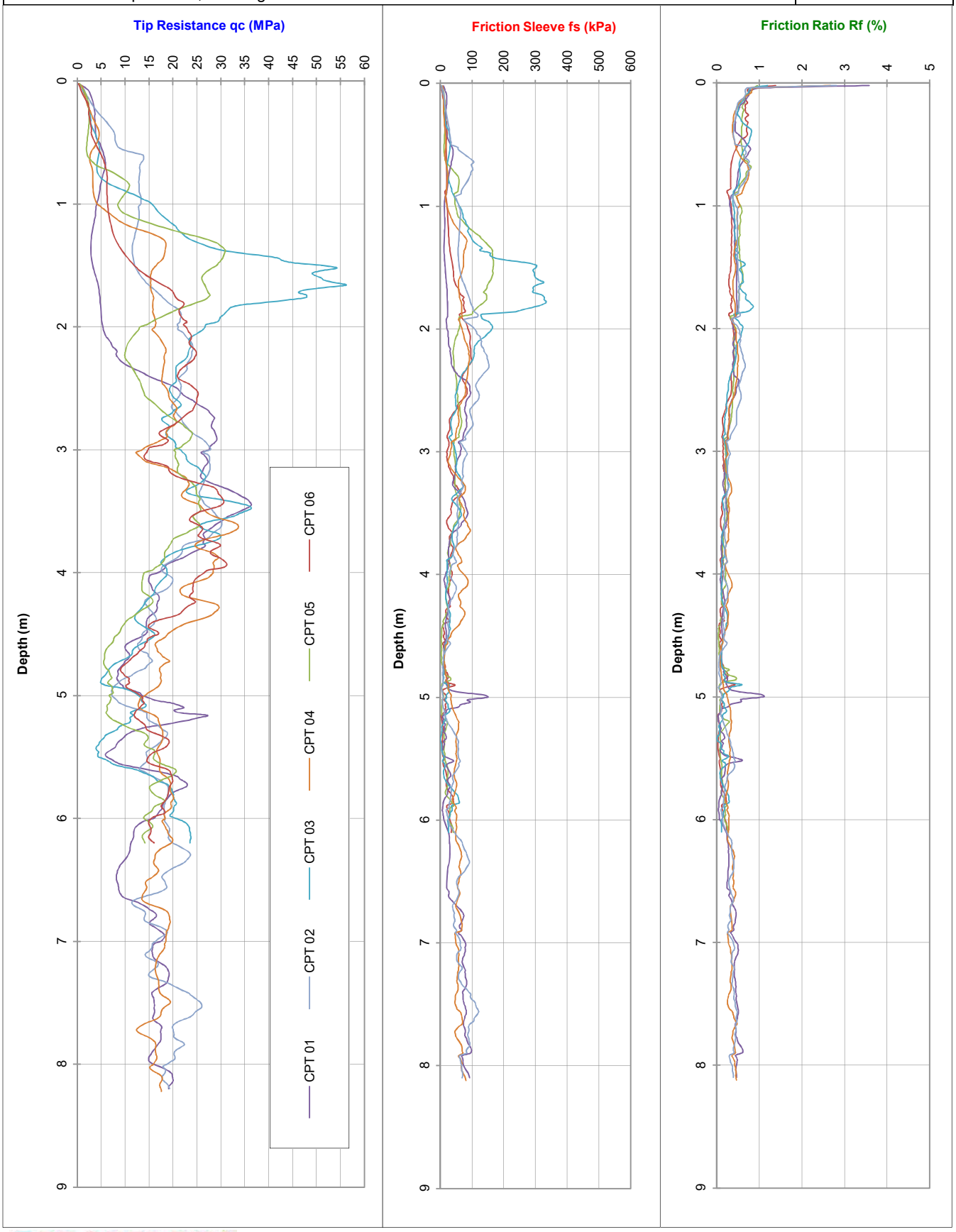
Galt GEOTECHNICS

CONE PENETRATION TESTING (CPT) SOIL TYPE INTERPRETATION

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments
Job No.: J1702030
PROJECT: Proposed Mixed Use Development
Date/s: 30/07/2018
LOCATION: 2 Sepia Court, Rockingham

ALL DATA



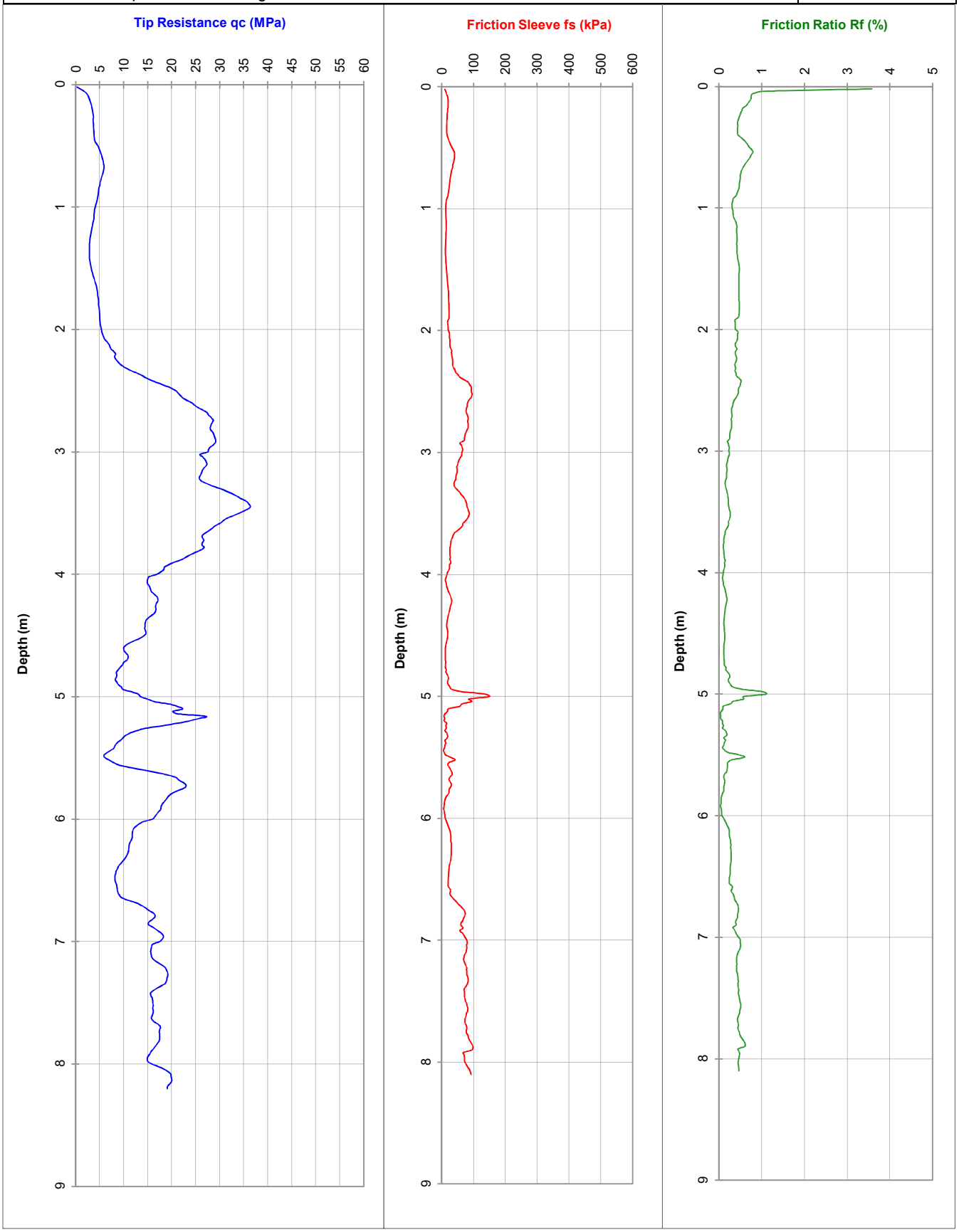
PROBEDRILL GEOTECHNICAL SURVEY

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

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 01**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.8

Dummy probe to (m):

Refusal:

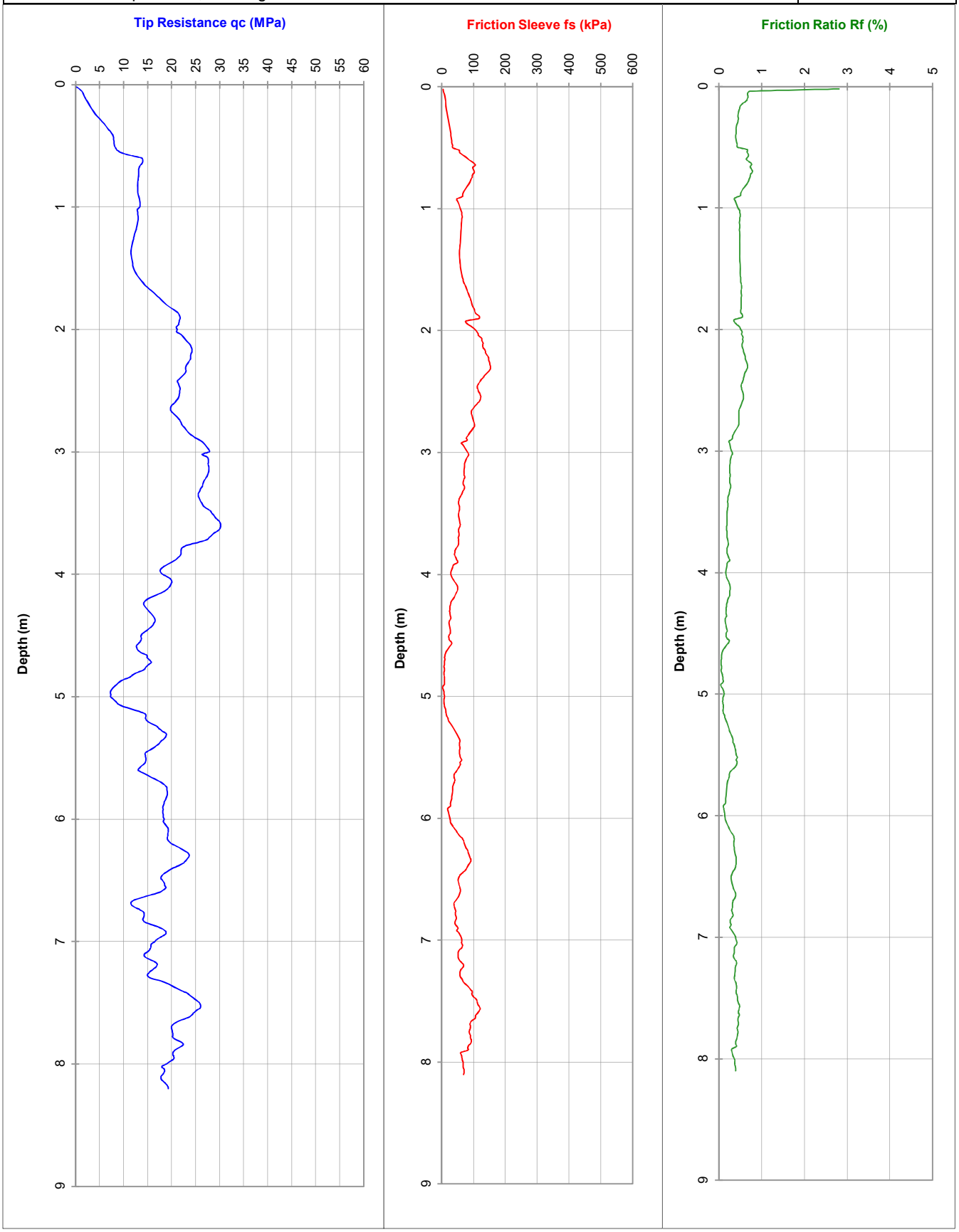
Cone I.D.: ECF68GM

File: GL0925TT

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 02**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.8

Dummy probe to (m):

Refusal:

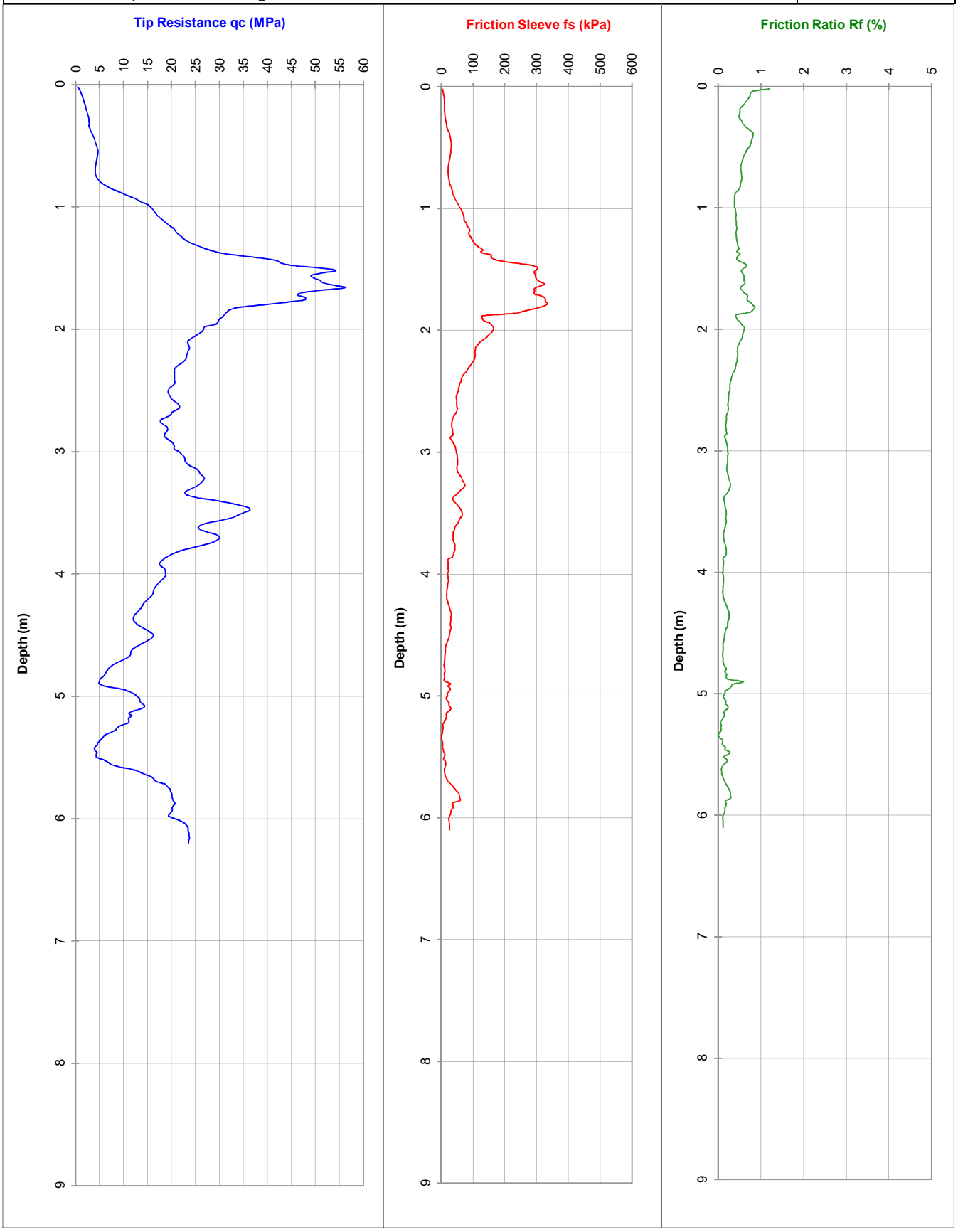
Cone I.D.: ECF68GM

File: GL0928TT

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 03**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.6

Dummy probe to (m):

Refusal:

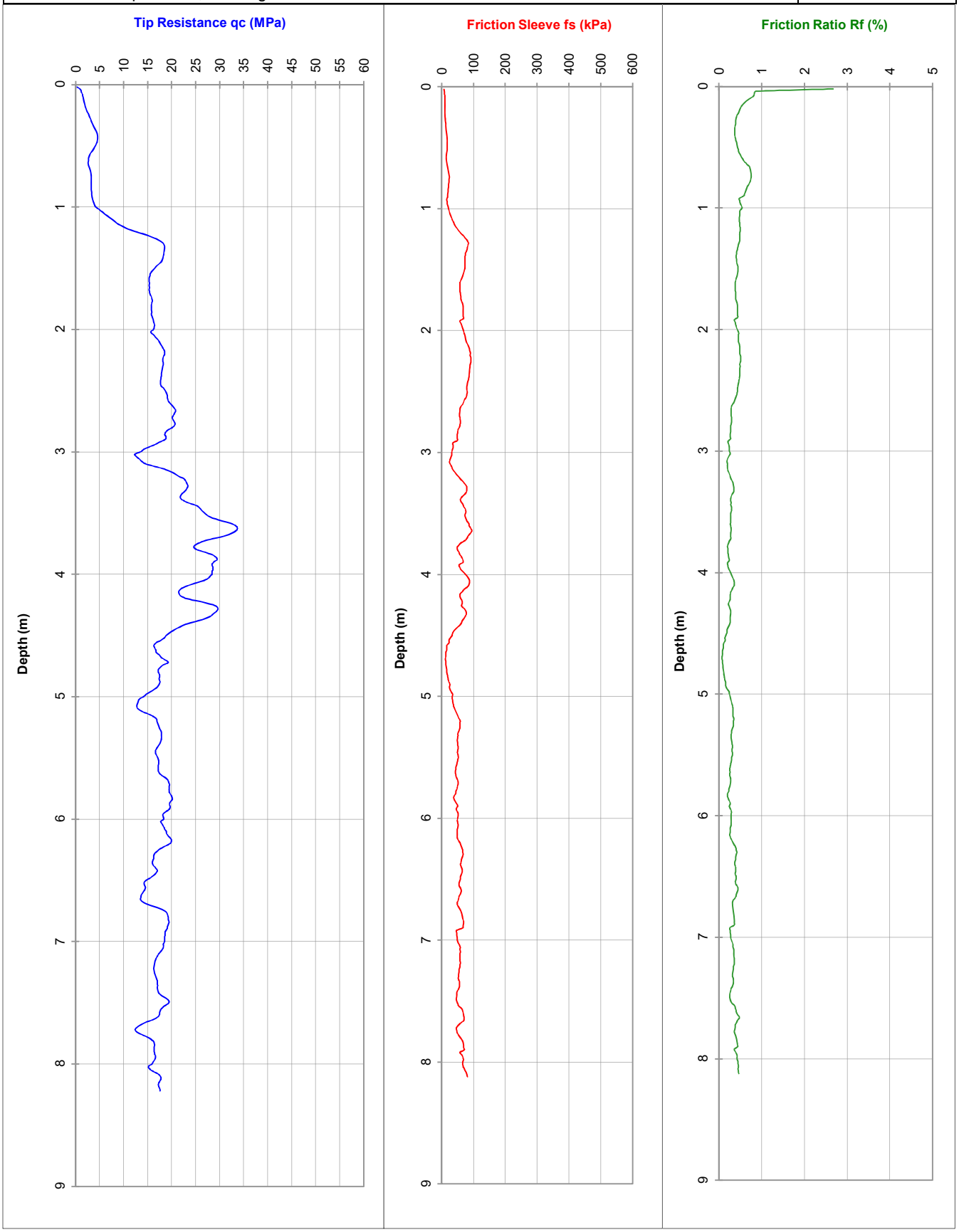
Cone I.D.: ECF68GM

File: GL0926TT

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 04**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.8

Dummy probe to (m):

Refusal:

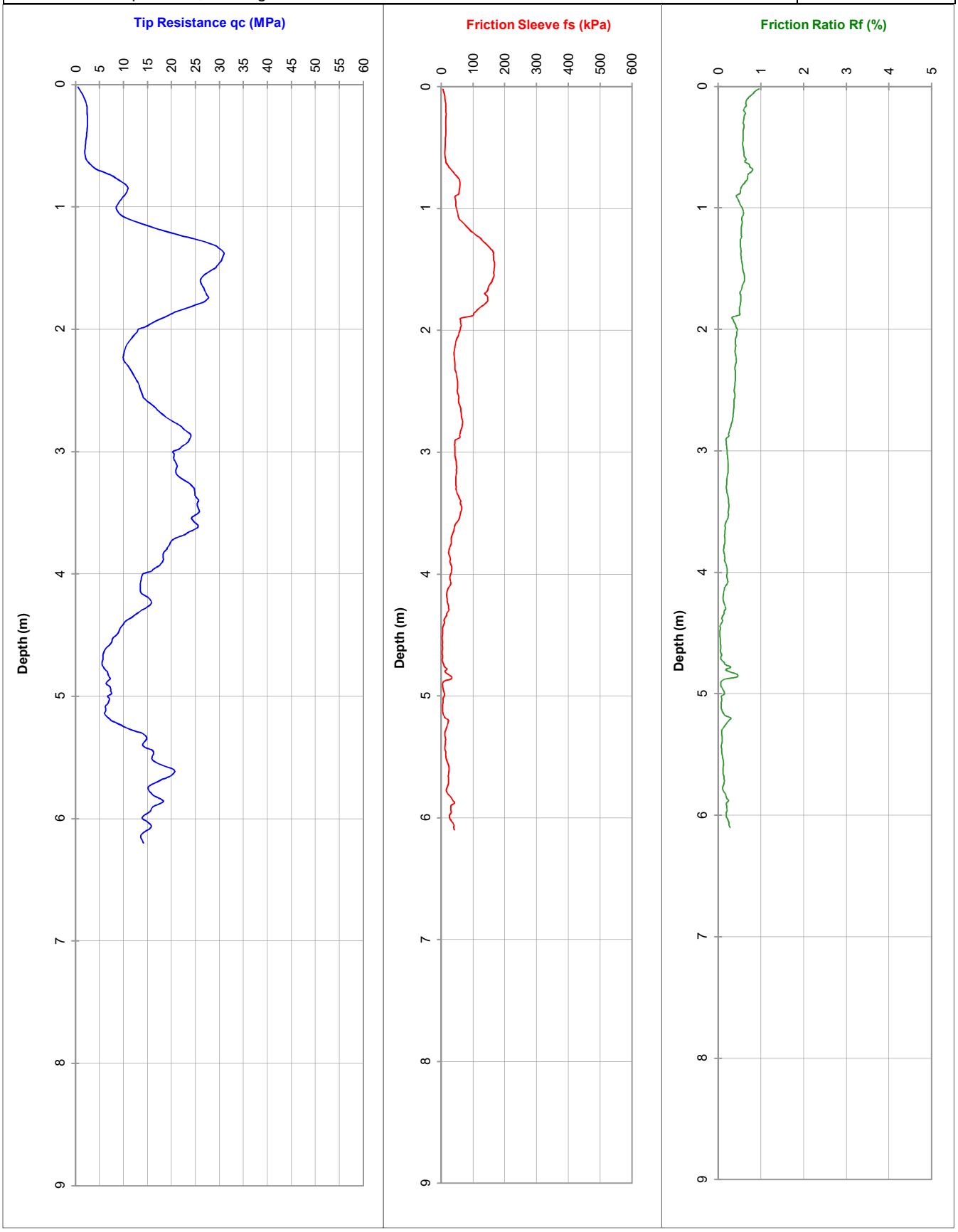
Cone I.D.: ECF68GM

File: GL0927TT

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 05**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.9

Dummy probe to (m):

Refusal:

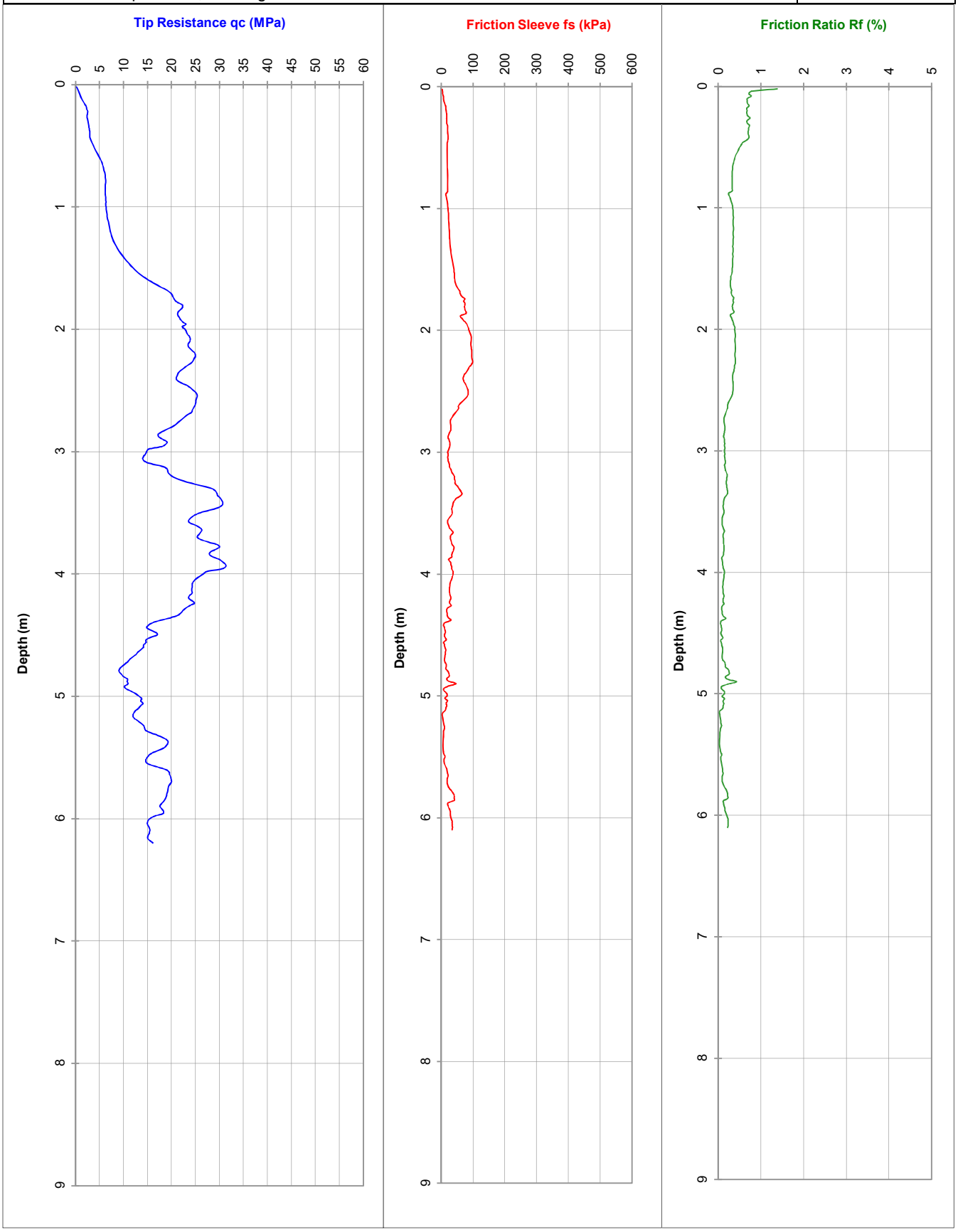
Cone I.D.: ECF68GM

File: GL0924TT

Rig: 22 tonne Truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Arise Developments	Job No.: J1702030	Probe I.D
PROJECT: Proposed Mixed Use Development	RL (m):	**CPT 06**
LOCATION: 2 Sepia Court, Rockingham	Co-ords:	30-Jul-18



PROBEDRILL GEOTECHNICAL SURVEY

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

Approx. Water (m): 2.8

Dummy probe to (m):

Refusal:

Cone I.D.: ECF68GM

File: GL0923TT

Rig: 22 tonne Truck (Track-Truck)

Appendix C: Summary Hand Auger 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 & UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) 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%.

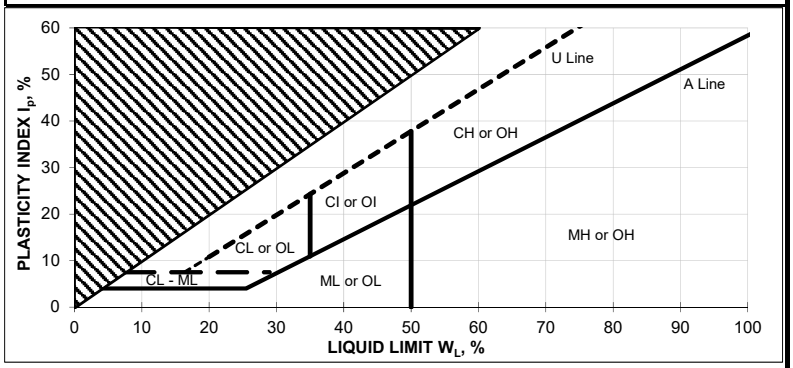
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

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

SUMMARY BOREHOLE REPORT

Job Number:	J1702030	**Date Performed:**	30/07/2018
Client:	Arise Developments	**Excavated using:**	80mm Hand Auger
Project:	Proposed Mixed-use Commercial Development	**Logged By:**	KH
Location:	Cnr Read St & Council Ave Rockingham		

HA01

Test Depth (m)	Stratigraphy
0.0 – 2.0	SAND (SP): fine to medium grained, sub-angular to sub-rounded, dark grey at surface becoming pale yellow to white below 0.6 m, trace organics top 0.2 m, trace fines, moist, medium dense to dense.

End of borehole at 2.0 m
Target Depth
Groundwater not encountered

HA01 spoil

SUMMARY BOREHOLE REPORT

HA02

Test Depth (m)	Stratigraphy
0.0 – 1.8	SAND (SP): fine to medium grained, sub-angular to sub-rounded, grey at surface becoming pale yellow to white below 0.3 m, trace organics top 0.2 m, trace fines, moist, dense.
End of borehole at 1.8 m Refusal on inferred tree root Groundwater not encountered	

HA02 spoil

SUMMARY BOREHOLE REPORT

HA03

Test Depth (m)	Stratigraphy
0.0 – 2.0	SAND (SP): fine to medium grained, sub-angular to sub-rounded, dark grey at surface becoming pale yellow to white below 0.3 m, trace organics top 0.2 m, trace fines, moist, medium dense.
End of borehole at 2.0 m Target depth Groundwater not encountered	

HA03 spoil

Appendix D: Perth Sand Penetrometer Test Results

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

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client:	Arise Development	**Job No:**	J1702030
Project:	Proposed Multi-Use Commercial	**Date:**	30/07/2018
Location:	Cnr Read St and Council Ave	**Engineer:**	KH

Location:	HA01	HA02	HA03			
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**					
0-150	SET	SET	SET			
150-300	4	5	2			
300-450	5	6	2			
450-600	5	3	2			
600-750	6	6	3			
750-900	5	7	5			

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 E: 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

Spreadsheet author:	ORW	17-Oct-09

Job No:	J1702030
Client:	Arise Developments
Location:	Cnr Read St & Council Ave, Rockingham
Calc by:	KH
BH Name:	HA01
Test Depth:	0.78 m

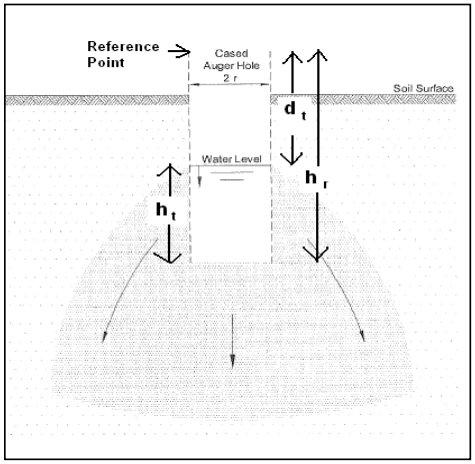
$$K = 1.15r\frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

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	0.78	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

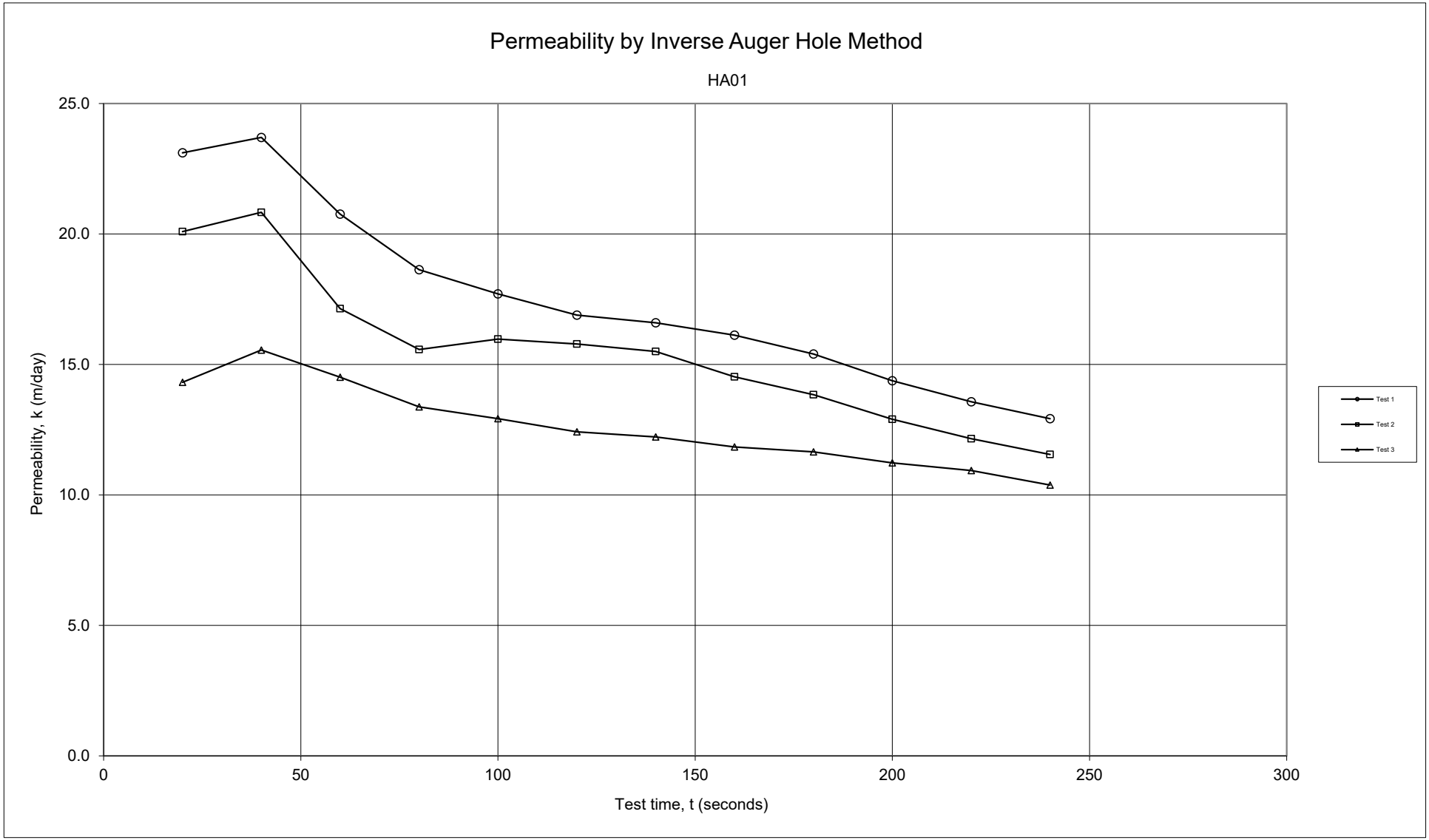
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.78		
20	0.17	0.61	2.7E-04	23.1
40	0.31	0.47	2.7E-04	23.7
60	0.38	0.4	2.4E-04	20.8
80	0.43	0.35	2.2E-04	18.6
100	0.48	0.3	2.0E-04	17.7
120	0.52	0.26	2.0E-04	16.9
140	0.56	0.22	1.9E-04	16.6
160	0.59	0.19	1.9E-04	16.1
180	0.61	0.17	1.8E-04	15.4
200	0.62	0.16	1.7E-04	14.4
220	0.63	0.15	1.6E-04	13.6
240	0.64	0.14	1.5E-04	12.9
		AVERAGE	2.0E-04	17.5

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.78		
20	0.15	0.63	2.3E-04	20.1
40	0.28	0.5	2.4E-04	20.8
60	0.33	0.45	2.0E-04	17.1
80	0.38	0.4	1.8E-04	15.6
100	0.45	0.33	1.8E-04	16.0
120	0.5	0.28	1.8E-04	15.8
140	0.54	0.24	1.8E-04	15.5
160	0.56	0.22	1.7E-04	14.5
180	0.58	0.2	1.6E-04	13.8
200	0.59	0.19	1.5E-04	12.9
220	0.6	0.18	1.4E-04	12.2
240	0.61	0.17	1.3E-04	11.6
		AVERAGE	1.8E-04	15.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.78		
20	0.11	0.67	1.7E-04	14.3
40	0.22	0.56	1.8E-04	15.6
60	0.29	0.49	1.7E-04	14.5
80	0.34	0.44	1.5E-04	13.4
100	0.39	0.39	1.5E-04	12.9
120	0.43	0.35	1.4E-04	12.4
140	0.47	0.31	1.4E-04	12.2
160	0.5	0.28	1.4E-04	11.8
180	0.53	0.25	1.3E-04	11.7
200	0.55	0.23	1.3E-04	11.2
220	0.57	0.21	1.3E-04	10.9
240	0.58	0.2	1.2E-04	10.4
		AVERAGE	1.5E-04	1.3E+01


Permeability by Inverse Auger Hole Method
HA01
Permeability, k (m/day)
25.0
20.0
15.0
10.0
5.0
0.0
0
50
100
150
200
250
300
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

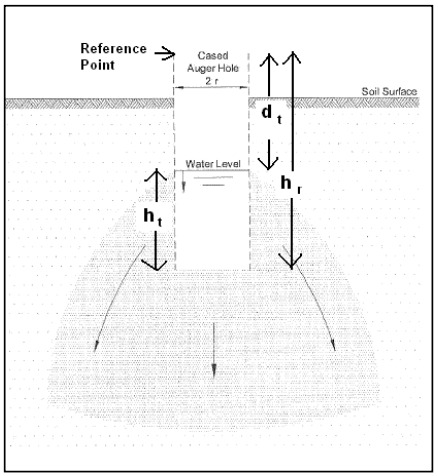
Galt Geotechnics

Job No:	J1702030
Client:	Arise Developments
Location:	Cnr Read St & Council Ave, Rockingham
Calc by:	KH
BH Name:	HA02
Test Depth:	0.81 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	0.81	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

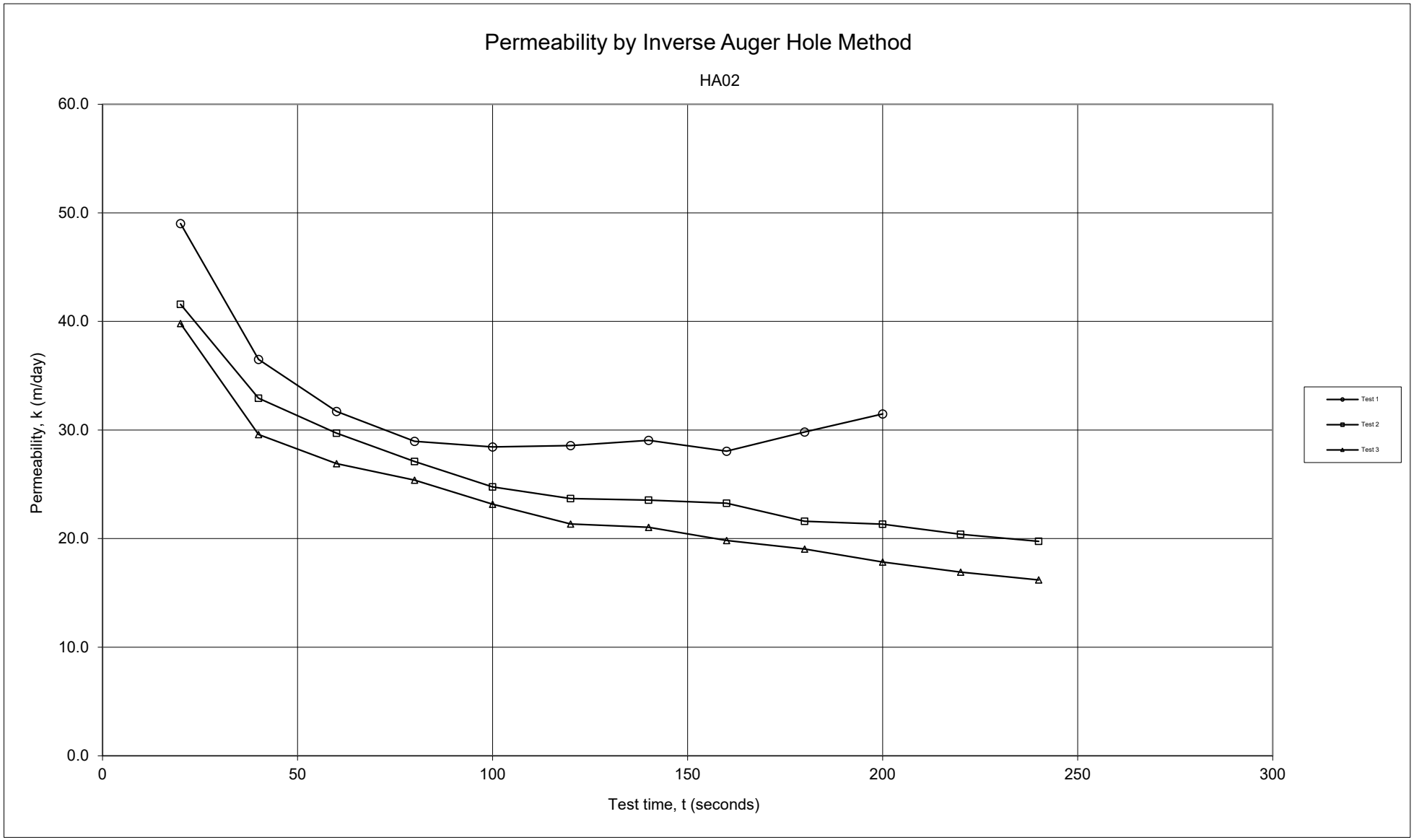
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.81		
20	0.33	0.48	5.7E-04	49.0
40	0.44	0.37	4.2E-04	36.5
60	0.52	0.29	3.7E-04	31.7
80	0.58	0.23	3.4E-04	29.0
100	0.64	0.17	3.3E-04	28.4
120	0.69	0.12	3.3E-04	28.6
140	0.73	0.08	3.4E-04	29.1
160	0.75	0.06	3.2E-04	28.1
180	0.78	0.03	3.5E-04	29.8
200	0.8	0.01	3.6E-04	31.5
220	Dry			
240				
		AVERAGE	3.7E-04	32.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.81		
20	0.29	0.52	4.8E-04	41.6
40	0.41	0.4	3.8E-04	32.9
60	0.5	0.31	3.4E-04	29.7
80	0.56	0.25	3.1E-04	27.1
100	0.6	0.21	2.9E-04	24.8
120	0.64	0.17	2.7E-04	23.7
140	0.68	0.13	2.7E-04	23.5
160	0.71	0.1	2.7E-04	23.3
180	0.72	0.09	2.5E-04	21.6
200	0.74	0.07	2.5E-04	21.3
220	0.75	0.06	2.4E-04	20.4
240	0.76	0.05	2.3E-04	19.7
		AVERAGE	3.0E-04	25.8

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.81		
20	0.28	0.53	4.6E-04	39.8
40	0.38	0.43	3.4E-04	29.6
60	0.47	0.34	3.1E-04	26.9
80	0.54	0.27	2.9E-04	25.4
100	0.58	0.23	2.7E-04	23.2
120	0.61	0.2	2.5E-04	21.4
140	0.65	0.16	2.4E-04	21.1
160	0.67	0.14	2.3E-04	19.8
180	0.69	0.12	2.2E-04	19.0
200	0.7	0.11	2.1E-04	17.8
220	0.71	0.1	2.0E-04	16.9
240	0.72	0.09	1.9E-04	16.2
		AVERAGE	2.7E-04	23.1


Permeability by Inverse Auger Hole Method
HA02
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Permeability, k (m/day)
0
50
100
150
200
250
300
Test time, t (seconds)
Test 1
Test 2
Test 3

Permeability Calculation - Inverse Auger Hole Method

Galt Geotechnics

Job No:	J1702030
Client:	Arise Developments
Location:	Cnr Read St & Council Ave, Rockingham
Calc by:	KH
BH Name:	HA03
Test Depth:	0.76 m

Spreadsheet author:	ORW	17-Oct-09

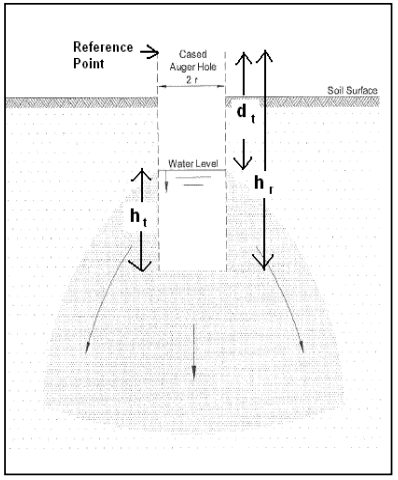
$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

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	0.76	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

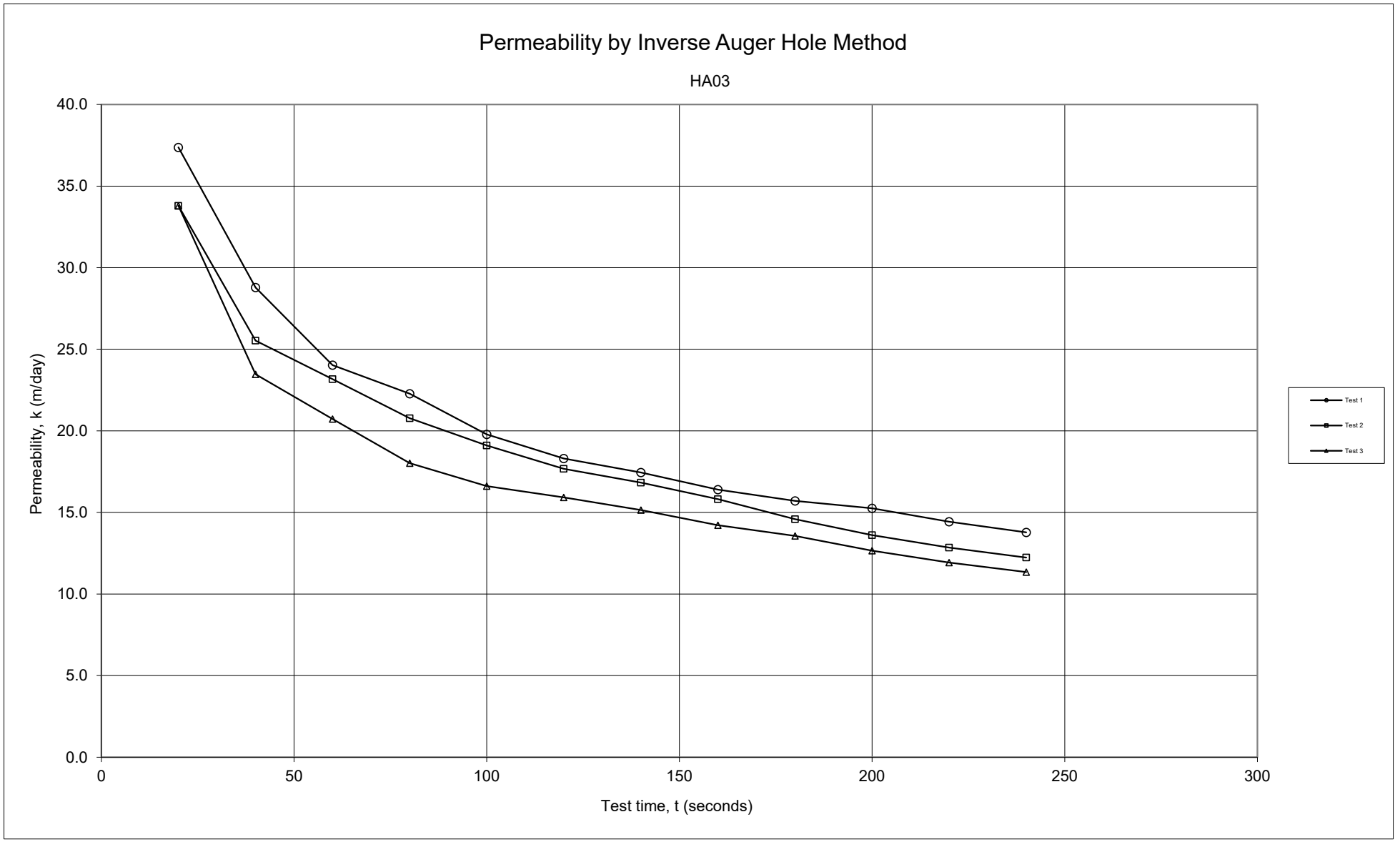
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.76		
20	0.25	0.51	4.3E-04	37.4
40	0.35	0.41	3.3E-04	28.8
60	0.41	0.35	2.8E-04	24.0
80	0.47	0.29	2.6E-04	22.3
100	0.5	0.26	2.3E-04	19.8
120	0.53	0.23	2.1E-04	18.3
140	0.56	0.2	2.0E-04	17.4
160	0.58	0.18	1.9E-04	16.4
180	0.6	0.16	1.8E-04	15.7
200	0.62	0.14	1.8E-04	15.3
220	0.63	0.13	1.7E-04	14.4
240	0.64	0.12	1.6E-04	13.8
		AVERAGE	2.3E-04	20.3

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.76		
20	0.23	0.53	3.9E-04	33.8
40	0.32	0.44	3.0E-04	25.5
60	0.4	0.36	2.7E-04	23.2
80	0.45	0.31	2.4E-04	20.8
100	0.49	0.27	2.2E-04	19.1
120	0.52	0.24	2.0E-04	17.7
140	0.55	0.21	1.9E-04	16.8
160	0.57	0.19	1.8E-04	15.8
180	0.58	0.18	1.7E-04	14.6
200	0.59	0.17	1.6E-04	13.6
220	0.6	0.16	1.5E-04	12.8
240	0.61	0.15	1.4E-04	12.2
		AVERAGE	2.2E-04	18.8

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0	0.76		
20	0.23	0.53	3.9E-04	33.8
40	0.3	0.46	2.7E-04	23.5
60	0.37	0.39	2.4E-04	20.7
80	0.41	0.35	2.1E-04	18.0
100	0.45	0.31	1.9E-04	16.6
120	0.49	0.27	1.8E-04	15.9
140	0.52	0.24	1.8E-04	15.1
160	0.54	0.22	1.6E-04	14.2
180	0.56	0.2	1.6E-04	13.6
200	0.57	0.19	1.5E-04	12.7
220	0.58	0.18	1.4E-04	11.9
240	0.59	0.17	1.3E-04	11.3
		AVERAGE	2.0E-04	17.3


Permeability by Inverse Auger Hole Method
HA03
Permeability, k (m/day)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
50
100
150
200
250
300
Test time, t (seconds)
Test 1
Test 2
Test 3

Appendix F: Understanding Your Report

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

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.

O:\Administration\Standard Forms and Documents\PMP11-Rev3 Understanding your Report.docx

Our Ref: CW1039400:SJL
Contact: Scott Lambie

31 August 2018

Cardno (WA) Pty Ltd
ABN 77 009 119 000

11 Harvest Terrace
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Australia

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www.cardno.com

Property Development Solutions
Unit 9, 69 Hay Street
SUBIACO EAST WA 6008

Attention: Geoff Loxton

Dear Geoff

REVIEW OF RESPONSIBLE AUTHORITY RESPONSE
PROPOSED HEALTH STUDIO, RESTAURANT, SHOWROOMS & CONVENIENCE STORE
LOT 301 READ STREET, ROCKINGHAM

As instructed, Cardno's Traffic and Transport Planning team has undertaken a review of the responsible authority responses for the proposed development of a Health Studio, Restaurant, Showrooms and Convenience Store located at Lot 301 Read Street Rockingham, in the context of current best-practice and statutory guidelines. Our responses are presented below.

CITY OF ROCKINGHAM

1. ***Austroads' Guide to Road Design Part 4 – Intersections and Crossings (General) recommends that an access driveway should not be located within the functional area of an intersection. The upstream functional area is defined as the length of which vehicles are manoeuvring to execute either a right or left-turn movement at an intersection. The proposed access driveway off Council Avenue is located within the upstream functional area of Read Street/Council Avenue intersection and therefore is not supported.***

   Cardno has undertaken an assessment of the access location against AustRoads guidelines and believes that the proposed access point is acceptable in its proposed location. The planned access is a "left in left out" configuration that intersects with Council Avenue within the left turn lane exiting onto Read Street. This access will be predominately used by drivers wishing to head south onto Read Street and by heavy vehicles / service vehicles leaving the site after deliveries (which would be undertaken well outside of peak traffic hours). While the configuration is less than ideal and is by AustRoads definition, within the functional area for right turning vehicles within Council Avenue, the lane in which the planned access intersects will not contain any traffic undertaking a through or right turn movement. This is a situation created by the design of the of the Council Avenue / Read Street intersection, with the left westbound lane within Council Avenue being a trapped lane over its entire length.

   While AustRoads guidelines suggest access points in this location should be avoided where possible, it does not state that they can't be located within this zone when appropriate. This planned access is critical to the operation of the convenience store / service station. These types of service sites are typically located on prominent intersection corners and as a consequence, inevitably have their development accesses located within the functional area of the adjacent intersection. Numerous examples of such can be seen within the wider metropolitan area. Based on these numerous precedents, it is felt that it would not be unreasonable to allow the planned access at its proposed location.

2. ***The internal road network may not be adequate to accommodate for commercial vehicles and therefore a swept path analysis is required to be provided to demonstrate commercial vehicle manoeuvrability.***

   Swept path drawings have been prepared for the City's assessment.

3. ***MRWA's Supplement to Austroads' Guide to Road Design Part 4 recommends that the location of a bus stop should be at least 30m from the Tangent Point (TP) when it is located after an intersection (i.e. from Sepia Court) and therefore the proposal location is not supported.*** –

   Cardno understands that the proponent is prepared to negotiate with the Public Transport Authority (PTA) to relocate the bus stop east of Sepia court. Should the PTA support the proposal, the concerns raised with regard to the current bus stop location will no longer be relevant. It is therefore suggested by Cardno that any issues in relation to the existing bus stop and its location be conditioned within the approval, that the developer liaise with the PTA to relocate the bus stop to the satisfaction of the Public Transport Authority.

4. ***A queue analysis is required to demonstrate that the provided queueing space within the petrol station is adequate to accommodate for the expected peak demand, otherwise the design is required to be amended.***

   It is Cardno's view that the City has not provided sufficient evidence of potential queuing / congestion of traffic on Council Avenue as a result of the convenience store / fuel service station's location within the development. There is no suggestion within the Riley Traffic Impact Assessment report or the design of the site in Cardno's view that creates the nexus for a queue analysis to be undertaken. When referring to the WAPC guidelines for individual developments, there is certainly no specific requirement for this type of analysis to be undertaken.

5. ***Define the vehicle priorities at intersections within the site by means of pavement marking and/or signage (eg. give way sign).***

   Cardno considers that this level of detail could be appropriately conditioned at this approval stage, however Cardno has been requested to provide recommendations for line marking and signage suitable for the control of traffic within the site and will provide a sketch in due course.

6. ***The City has the following comments regarding the Transport Impact Assessment (TIA, prepared by Riley Consulting, dated 18th July 2018)***

   Cardno recommends that appropriate amendments to the Riley TIA be undertaken to correct a number of minor errors / omissions. It is however Cardno's view that the minor errors and omissions are themselves, of no material importance to the findings / recommendations contained within the traffic report or the operation of the proposed site.

7. ***Austroads' Guide to Road Design Part 4 – Intersections and Crossings (General) recommends a minimum 70m left turn auxiliary lane for the site access instead of 60m as nominated in the report. Please amend report accordingly.***

   Cardno has undertaken an assessment of the required design criteria for auxiliary left turn indented pockets within AustRoads Part 4A. AustRoads typically uses a design speed criteria of either 10km per hour above the posted speed limit or the 85 percentile speed for an existing road. As Read Street is speed zoned at 70km/h, when using a design speed of 80km/h, a diverge / deceleration length of 45m is required, with an additional 30m entry tapper – totalling 75m. However, when considering the 85 percentile speed for Read Street (around 74km/h) an auxiliary left turn indented pocket length of 70m would be considered appropriate. The existing unused bus bay that exists within Read Street, which the development will utilise, is able to accommodate a 70m long auxiliary lane without significant modification and therefore the proposal should be considered compliant.

8. ***The cycle time for the signalised intersection at Read Street/Council Avenue seems a bit low (i.e. 70 seconds for weekday PM and 90 seconds for Saturday peak). Please check and confirm that these cycle time reflects the actual operation at the intersection by comparing it to SCATS data. Different cycle time is likely to change the intersection analysis results.***

   Cardno have requested appropriate SCATS data from Main Roads WA to allow checking of the existing cycle times and will confirm this as soon as practicable.

DEPARTMENT OF PLANNING

1. ***The proposal is not in accordance with the Commission's Regional Roads (Vehicular Access) Policy D.C. 5.1, which seeks to minimise the number of new crossovers onto regional roads and rationalise existing access arrangements. The Policy states: 'Where alternative access is or could be made available from side streets, no access shall be permitted to the regional road'. Read Street is classified as a Category 1 control of access road per Plan Number SP 694/4. As such, no access is supported from the site to Read Street.***

   While it is noted that Policy D.C 5.1 s 3.3.2 does state that no access from regional roads shall be permitted unless under special circumstances, s 3.3.4 of the same policy does allow for the provision of regional road access for large traffic generating developments such as shopping centres and recreation centres. Given that the proposed development has a primary focus of both commercial retail and recreation (gymnasium and café), it would be reasonable to suggest that the proposal meets the criteria for approval on these grounds.

   The access off Read Street is critical to allow the entry of vehicles originating from the north of the site. The only full access intersection that could cater for these vehicles is that of Council Avenue and Sepia Court. Sepia Court is a local access street ending in a cul-de-sac and that currently services mainly residential developments and a child care centre. Forcing the majority of the development traffic, including the heavy servicing vehicles, would lead to a deterioration of safety within Sepia Court and impact the streets current users. By allowing the prosed access off Read Street into the development, There will be a negligible effect on traffic flow due to the provision of the proposed left turn pocket, the planned access is consistent with other nearby developments fronting Read Street which have been provided direct access, results in no change in the character or operation of Read Street and no significant alterations to the configuration of Read Street will be required. Given this, it is Cardno's view that the proposed access meets the criteria within Policy D.C 5.1 to allow for discretionary approval of the Read Street access.

2. ***WAPC Transport Impact Assessment Guidelines states that assessment years should be undertaken 10 years after full opening of the development (not the year of full opening or post development as shown). Traffic Impact Assessment is to be updated accordingly.***

   Cardno is of the view that the traffic impact for the development can be assessed for the required 10 year horizon, using appropriately factored traffic growth figures and that this can be conditioned within the approval process to the satisfaction of the Department of Planning.

PUBLIC TRANSPORT AUTHORITY

1. ***The PTA does not support the proposed relocation of bus stop 21234. There are 6 Transperth bus routes that are assigned to this bus stop and given that services are designed to connect with trains at Rockingham Station this can result in multiple services arriving at bus stop 21234 simultaneously. The proposed bus stop position does not accommodate this and would result in bus services causing conflict and blocking the Council Avenue - Sepia Court intersection.***

   Cardno has undertaken an assessment of the existing bus stop location and have found that it is currently creating safety and congestion issues due to its close proximity to the Council Avenue and Read Street intersection. It is Cardno's view that there would be community benefit if the PTA was agreeable to a relocation of the bus stop to a point east of the Sepia Court intersection. This alternative location would result in moving the stop closer to the Council Avenue underpass that links directly to Rockingham City Shopping Centre and therefore would provide significant safety improvements for the public wishing to access the bus stop.

   It is noted that the elevation of the Council Avenue carriageway, designed to accommodate the underpass, results in a noteworthy height difference between the carriageway and parts of the adjacent verge and existing Council Avenue shared path, however these issues can be overcome with suitable retaining of the bus stop pad area and accessible path links to the Council Avenue shared path being provided. As the proponent is willing to work with the Public Transport Authority on relocating the bus stop to this possible location, Cardno considers it appropriate that any concerns relating to the bus stop location be appropriately conditioned requiring the developer to liaise with the Public Transport Authority in order to relocate the bus stop, to the satisfaction of the Public Transport Authority.

Should you wish to discuss any of the above please contact the undersigned or Jacob Martin.

Yours sincerely

Scott Lambie
Team Leader - Traffic Engineering
for Cardno
Direct Line: +61 8 6461 0750
Email: scott.lambie@cardno.com.au

Government of **Western Australia**
Development Assessment Panels

LG Ref: 20.2018.201.1
DAP Ref: DAP/18/01463
Enquiries: (08) 6551 9919

Mr Peter Simpson
PTS Town Planning Pty Ltd
PO Box 538
Inglewood WA 6932

Dear Mr Simpson

METRO SOUTH-WEST JDAP - CITY OF ROCKINGHAM - DAP APPLICATION - 20.2018.201.1 - DETERMINATION

Property Location:	Lot 301 (2-6) Council Avenue, Rockingham
Application Details:	Proposed Health Studio, Restaurant, Showrooms and Convenience Store

Thank you for your Form 1 Development Assessment Panel (DAP) application and plans submitted to the City of Rockingham on 20 July 2018 for the above-mentioned development.

This application was considered by the Metro South-West JDAP at its meeting held on 28 November 2018, where in accordance with the provisions of the City of Rockingham Town Planning Scheme No. 2, it was resolved to **refuse** the application as per the attached notice of determination.

Please be advised that there is a right of review by the State Administrative Tribunal in accordance with Part 14 of the *Planning and Development Act 2005*. Such an application must be made within 28 days of the determination, in accordance with the *State Administrative Tribunal Act 2004*.

Should you have any queries with respect to the reasons for refusal, please contact Mr David Bonovic on behalf of the City of Rockingham on 9528 0374.

Yours sincerely,

DAP Secretariat

30 November 2018

Encl. DAP Determination Notice
Refused Plans

Cc: Mr David Bonovic
City of Rockingham

Government of **Western Australia**
Development Assessment Panels

Planning and Development Act 2005

City of Rockingham Town Planning Scheme No. 2

Metro South-West Joint Development Assessment Panel

Determination on Development Assessment Panel Application for Planning Approval

Property Location: Lot 301 (2-6) Council Avenue, Rockingham
Application Details: Proposed Health Studio, Restaurant, Showrooms and Convenience Store

In accordance with regulation 8 of the *Planning and Development (Development Assessment Panels) Regulations 2011*, the above application for planning approval was **refused** on 28 November 2018, subject to the following:

Refuse DAP Application reference DAP/18/01463 and accompanying plans

- Cover Page, Drawing No.A000, dated 30.08.18;
- Perspectives, Drawing No.A001, A002, A003, dated 30.08.18;
- Site Survey, Drawing No.A004, dated 30.08.18;
- Site Plan, Drawing No.A005, dated 30.08.18;
- Ground Floor Plan, Drawing No.A006, dated 19.07.18;
- Roof Plan, Drawing No.A007, dated 30.08.18;
- Site Access & Activation, Drawing No.A008, dated 30.08.18;
- Elevations, Drawing No.A009, A010, dated 30.08.18;
- Sections, Drawing No.A011, dated 30.08.18;
- Materials, Drawing No.A012, A013, dated 30.08.18;
- Signage Location Plan, Drawing No.A014, dated 30.08.18;
- Signage Elevation, Drawing No.A015, A016, dated 30.08.18

in accordance with Clause 68 of the *Planning and Development (Local Planning Schemes) Regulations 2015* and the provisions of 68(2)(b) of the deemed provisions of the City of Rockingham Town Planning Scheme No.2, subject to the following reasons as follows:

Reasons

1. The development fails to satisfy objectives (f) and (h) of the Primary Centre City Zone under the City's Town Planning Scheme No.2 as the development does not provide a contiguous, activated street front development along Council Avenue, Read Street and Sepia Court and does not provide for a variety of vibrant land-uses more consistent with proximity to transit and the City Centre area.

2. The development application does not satisfy Clause 67 (b), (h), (m) and (t) of the *Planning and Development (Local Planning Schemes) Regulations 2015 (Schedule 2 – Deemed Provisions)* with the development being contrary to:

   b&h. The development provisions, principles and vision for the Rockingham Strategic Regional Centre Activity Centre Plan;

m. The development provisions for Local Planning Policy 3.2.12 - Development Policy Plan: Southern Gateway and Rockingham Station Sectors relating to height, scale and appearance of the development and is considered to result in an impoverished design outcome, non-compatible with the surrounding development context.

t. The proposed Council Avenue vehicular access which is located within the functional area of the Council Avenue and Read Street intersection will lead to vehicle manoeuvring that will compromise traffic safety.

3. The development does not provide for a minimum building height of three (3) storeys as required by clause 5.4 'Building Heights and Prominent Sites' of *Planning Policy 3.2.12 - Development Policy Plan: Southern Gateway and Rockingham Station Sectors*.

4. The development does not provide for significant elements that acknowledge arrival upon a Gateway Location as required by Clause 8.1.3 Gateway Locations of *Planning Policy - 3.2.12 Development Policy Plan: Southern Gateway and Rockingham Station Sectors.*

5. The development does not comply with clause 8.1.5 'Planning and Design Principles' and does not satisfy objective 8.1.2 of *Planning Policy 3.2.12 - Development Policy Plan: Southern Gateway and Rockingham Station Sectors* as the development does not provide for visually distinctive buildings to reinforce the townscape structure and add legibility to the access and movement network.

6. The development does not comply with Clause 6.1.5.3 'Required Elements' and does not satisfy objectives 1, 3 and 4 of Clause 6.1.5 'Council Avenue Sub Precinct - Supplementary Design Guidelines of *Planning Policy 3.2.12 Development Policy Plan: Southern Gateway and Rockingham Station Sectors* as the development fails to*:*

   a. To provide for a contiguous, activated street front built form to Council Avenue;
   b. To provide for identifiable landmark on the corner of Council Avenue and Read Street which consists of high quality buildings; and
   c. To provide for shop front activation along Read Street and shop front activation along Sepia Court.

7. The proposed Pylon Sign and Convenience Store Roof Sign will result in signage that is not considered to be appropriate for its location as required by Clause 3(a) of *Planning Policy 3.3.1 - Control of Advertisements.*

ROCKINGHAM CENTRAL MIXED-USE DEVELOPMENT

CNR COUNCIL AVENUE & READ STREET, ROCKINGHAM WA

DRAWING LIST

NO.	SHEET TITLE	VISION	STATUS	DATE
A000	COVER PAGE	B	DA	30/08/18
A001	PERSPECTIVES	B	DA	30/08/18
A002	PERSPECTIVES	B	DA	30/08/18
A003	PERSPECTIVES	B	DA	30/08/18
A004	SITE SURVEY	B	DA	30/08/18
A005	SITE PLAN	B	DA	30/08/18
A006	SITE ACCESS & ACTIVATION	B	DA	30/08/18
A007	FLOOR PLAN	B	DA	30/08/18
A008	ROOF PLAN	B	DA	30/08/18
A009	SECTIONS	B	DA	30/08/18
A010	ELEVATIONS	B	DA	30/08/18
A011	ELEVATIONS	B	DA	30/08/18
A012	MATERIALS	B	DA	30/08/18
A013	MATERIALS	B	DA	30/08/18
A014	SIGNAGE PLAN	B	DA	30/08/18
A015	SIGNAGE ELEVATIONS	B	DA	30/08/18
A016	SIGNAGE ELEVATIONS	B	DA	30/08/18
A017	SIGNAGE SCHEDULE	B	DA	30/08/18

AREA

TENANCY NUMBER	TENANCY TYPE	GFA	NLA
TENANCY 1	CONVENIENCE STORE		210m²
TENANCY 2	SHOWROOM		2,193m²
TENANCY 3	SHOWROOM		940m²
TENANCY 4	SHOWROOM		940m²
TENANCY 5	SHOOWROOM		510m²
TENANCY 6	CAFE		166m²
TENANCY 7	GYM		301m²
	TOTAL	**5,965m²**	**5,260m²**

TOTAL PARKING PROVIDED **106 + 6 BROWSER BAYS**

USE	AREA (NLA)	PARKING RATIOS		PARKING PROVIDED	
		MIN	MAX	MIN	MAX
GYM	301m²	1:20	1:15	16	21
SHOWROOM	4,583m²	1:80	1:60	58	77
CAFE	166m²	1:8	1:6	21	28
CONVENIENCE STORE	210m²	1:22	1:17	10	13
TOTAL	**5,260m²**			**105**	**139**

BICYCLE PARKING PROVIDED **20 BAYS**

PARKING RATIO (MIN)		PARKING PROVIDED	
LONG-TERM	SHORT-TERM	LONG-TERM	SHORT TERM
1:400	1:200	1	2
1:750	1:1000	7	5
1:250	1:150	2	3
		10	**10**

ROCKINGHAM CENTRAL

COVER PAGE
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

Project Number: 43917
Drawing Number: A000
Revision: B
Date: 30/08/2018

Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT
ASSESSMENT PANEL

REFUSED

28-Nov-2018

1. VIEW FROM COUNCIL AVE LOOKING EAST

ROCKINGHAM CENTRAL

PERSPECTIVES
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

Project Number: 43917
Drawing Number: A001
Revision: B
Date: 30/08/2018

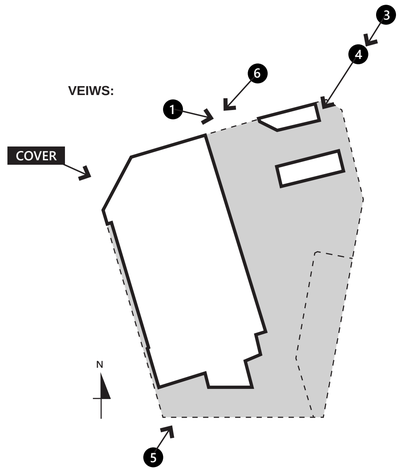
Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018



2. AERIAL FROM NORTH EAST

3. VIEW FROM CNR COUNCIL AVE AND SEPIA CT

ROCKINGHAM CENTRAL

PERSPECTIVES
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

Project Number: 43917
Drawing Number: A002
Revision: B
Date: 30/08/2018

Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

4. VIEW FROM READ STREET

5. VIEW FROM COUNCIL AVE

ROCKINGHAM CENTRAL

PERSPECTIVES
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

Project Number: 43917
Drawing Number: A003
Revision: B
Date: 30/08/2018

Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

ROCKINGHAM CENTRAL

SITE SURVEY
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

North:

Project Number:	43917
Drawing Number:	A004
Revision:	B
Date:	30/08/2018

Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

MIXED-USE DEVELOPMENT

LOT 301, NO. 2, CNR COUNCIL AVENUE AND READ STREET

FFL 4.80

COUNCIL AVE

READ ST

PIA CT

RELOCATED BUS STOP

EXISTING BUS STOP

EXISTING TRANSFORMER

PUBLIC SEATING AREA, REFER TO LANDSCAPE PLAN FOR DETAILS

EXISTING FENCE TO BE DEMOLISHED

PROPOSED PLAYGROUND WITH CANOPY ABOVE REFER TO LANDSCAPE PLAN FOR DETAILS

CONVENIENCE STORE

FFL 4.80

AWNING ABOVE

building sign

BIKE

PLAY GROUND

canopy over

100 SETBACK

50 SETBACK

125 SETBACK

GIVE WAY

FILL POINT

RL4.70

RL4.50

RL4.76

RL4.65

RL4.60

AIR AND WATER

UNDERGROUND OIL/WATER SEPARATION UNIT

service station directional sign

TREE TO BE DEMOLISHED

LANDSCAPING, REFER TO LANDSCAPE PLAN FOR DETAILS

2m HIGH BRICK WALL

EXISTING RESIDENTIAL

LOADING AREA

pylon sign

1.3m LOG/WIRE FENCE

LANDSCAPING, REFER TO LANDSCAPE PLAN FOR DETAILS

LOADING / SERVICE ROUTE

ROCKINGHAM CENTRAL	SITE PLAN **ROCKINGHAM CENTRAL**	**Status:** DEVELOPMENT APPLICATION **Path:** P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package	**Scale:** 1:250 @ A1	**North:**	**Project Number:** 43917 **Drawing Number:** A005 **Revision:** B **Date:** 30/08/2018	Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

ROCKINGHAM CENTRAL	GROUND FLOOR **ROCKINGHAM CENTRAL**	**Status:** DEVELOPMENT APPLICATION **Path:** P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package	**Scale:** 1:250 @ A1	**North:**	**Project Number:** 43917 **Drawing Number:** A006 **Revision:** A **Date:** 19/7/2018

Hames Sharley

Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

ROCKINGHAM CENTRAL

ROOF PLAN
ROCKINGHAM CENTRAL

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: 1:250 @ A1

North:

Project Number: 43917
Drawing Number: A007
Revision: B
Date: 30/08/2018

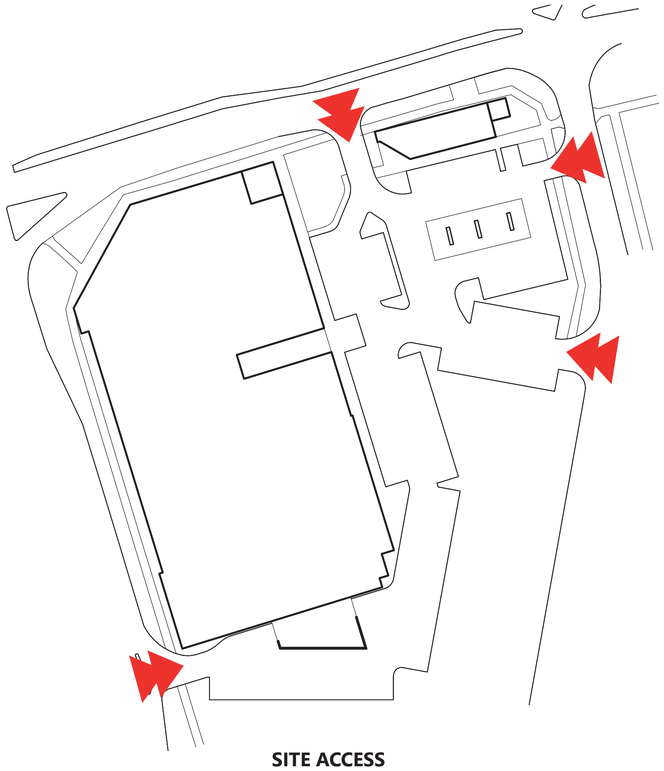
Hames Sharley

Amended Plan - 03 September 2018

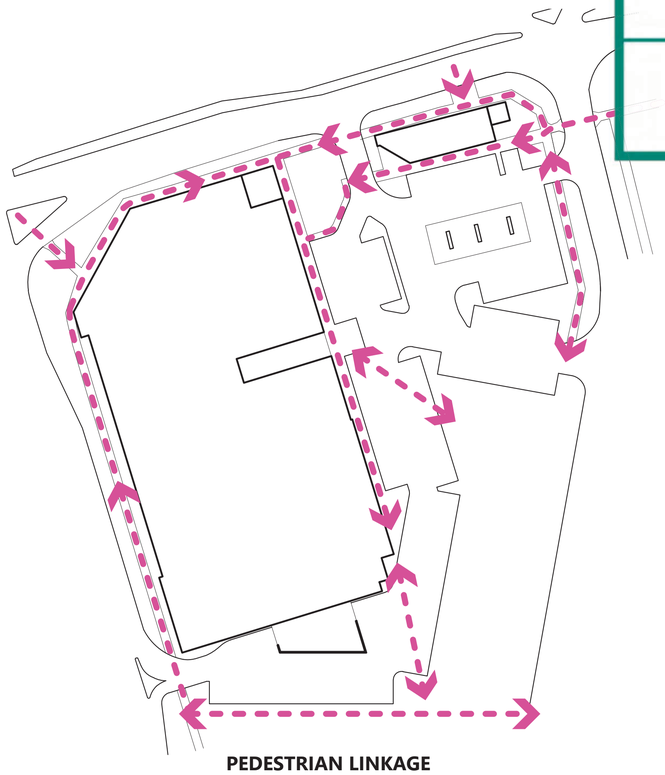
DEVELOPMENT ASSESSMENT PANEL

REFUSED

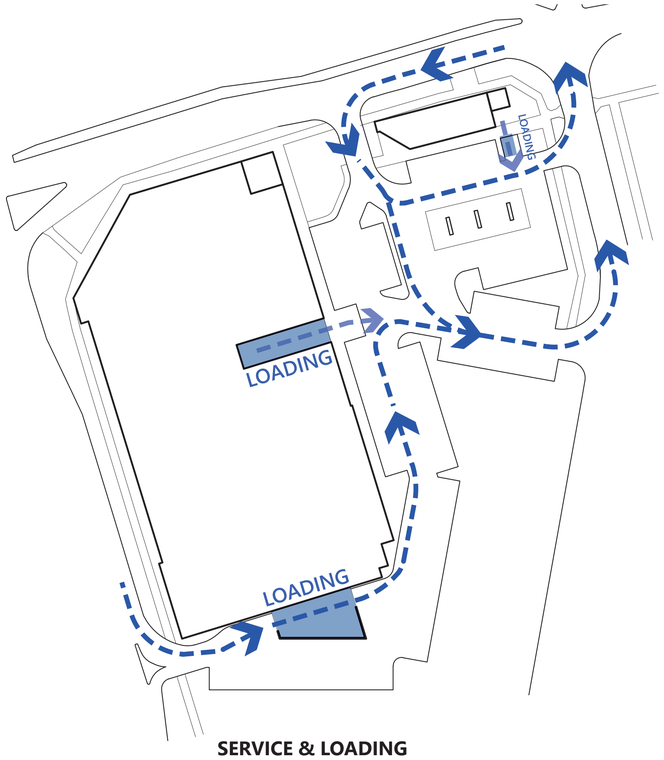
28-Nov-2018



SITE ACCESS



PEDESTRIAN LINKAGE



SERVICE & LOADING STRAGETY

FRONTAGE ACTIVATION

ROCKINGHAM CENTRAL

SITE ACCESS & ACTIVATION
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: NTS

North:

Project Number: 43917
Drawing Number: A008
Revision: B
Date: 30/08/2018

Hames Sharley

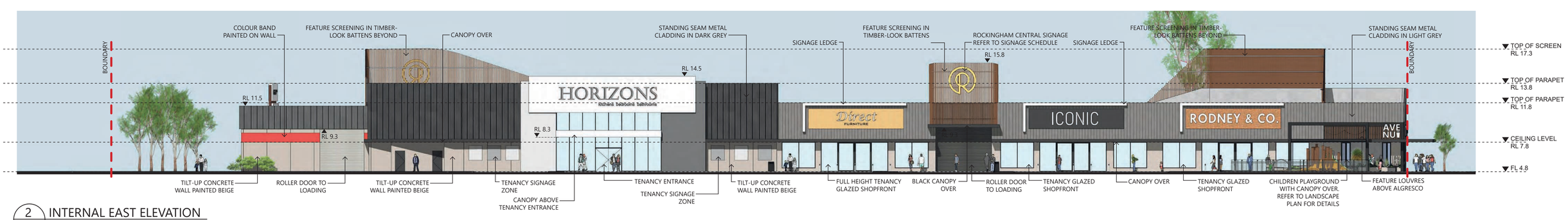
Amended Plan - 03 September 2018

DEVELOPMENT ASSESSMENT PANEL

REFUSED

28-Nov-2018

1 SEPIA CT ELEVATION



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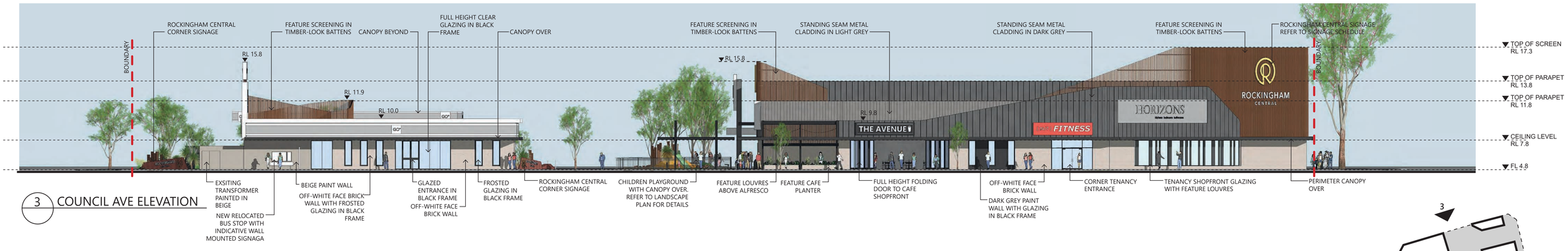
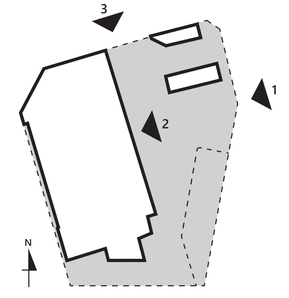


3 COUNCIL AVE ELEVATION



ROCKINGHAM CENTRAL

ELEVATIONS
ROCKINGHAM CENTRAL DEVELOPMENT

Status: DEVELOPMENT APPLICATION
Path: P:\43917 Rockingham Central\03 Production\05 Presentation Master files\DA Package

Scale: 1:200 @ A1

Project Number: 43917
Drawing Number: A009
Revision: B
Date: 30/08/2018

Hames Sharley