Percolation Test Report for Stormwater Disposal

Lot. 40 No. 136 Narrabeen Park Parade

Mona Vale NSW 2103

Submitted To
Metricon Pty. Ltd. (NSW)
Level 4, Building E, 32 Lexington Drive
Baulkham Hills NSW 2153

Site Number
130018

Date
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Author
Nicholas Leong

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Document Revision History

Date	Rev	Author	Approved by	Comments
23-Jan-20	A	Nicholas Leong	Scott Emmett	First Edition

List of Appendices

APPENDIX A: Percolation Test Results

APPENDIX B: Site Classification Report

REFERENCED STANDARDS:

AS 1726-2017, Geotechnical site investigations, Standards Australia, Sydney, Retrieved from SAI Global

AS 4897-2008, The design, installation and operation of underground petroleum storage systems, Standards Australia, Sydney, Retrieved from SAI Global

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1 Introduction

This report discusses the field investigation carried out on 22nd January 2020 for the purposes of determining on-site percolation rates of the insitu soils at a depth of 1.00 metres.

2 Investigation

2.1 Fieldwork

The fieldwork was carried out on 22nd January 2020 by hand augering test bores at the approximate locations as shown on the attached plan to a depth of 1.00 metres.

After soaking the bore holes with 20 litres of water, the holes were then charged with water and the time taken for the water to fall a measured distance was recorded. The permeability rate was then calculated as:

Mean Coefficient of Permeability (km) in terms of m/day

3 Findings

3.1 Fieldwork

Previous investigation conducted by Intrax Consulting engineers revealed that the existing soil profile consisted of CLAY trace gravel (Ref.: 130018-GEO-Site Classification Report[A], 14th August 2019). Please refer to the attached report for detailed descriptions.

3.2 Percolation Test Results

The percolation test results are shown in the table below. The mean coefficient of permeability (km) was determined by measuring the fall in height of water over the total test time of 300 seconds for Boreholes 1, 2 and 3.

Borehole No.	Percolation Rate (cm/hour)	Mean coefficient of Permeability (m/day)
1	12 cm/hr	0.8198 m/day
2	36 cm/hr	0.9912 m/day
3	36 cm/hr	0.9851 m/day

4 Design Percolation Value and Delineation

After reviewing the soil profiles in the field and the laboratory test results, it was found that the site under consideration cannot be delineated into areas in terms of design percolation / Km values.

It is recommended that a design percolation rate of 12 cm/hr or a corresponding permeability rate of 0.8198 m/day be adopted in this instance.

5 Conclusion

Based on the testing to date, the soils encountered on-site require, an alternative method for storm water disposal.

The adopted figures in Section 4 place a high factor of safety to ensure that, post development, the infiltration/permeability rates can be maintained in the long term. Note it is recommended that any soakage pit installation adopt an overflow to kerb and channel due to the low percolation rates.

Appendix A

Percolation Test Results

1		DEPTH OF TEST HOLE (mm) =	1000

Head versus Percolation Rate For Site 1

time (sec)	depth (mm)	flow rate (mm/min)
0:00:15	30	
0:00:30	50	
0:00:45	70	
0:01:00	85	
0:01:15	95	
0:01:30	100	
0:01:45	103	
0:02:00	105	
0:02:30	106	
0:03:00	107	
0:04:00	108	
0:05:00	110	

2		DEPTH OF TEST HOLE (mm) =	900

Head versus Percolation Rate For Site 2

time (sec)	depth (mm)	flow rate (mm/min)
0:00:15	40	
0:00:30	65	
0:00:45	85	
0:01:00	100	
0:01:15	110	
0:01:30	115	
0:01:45	120	
0:02:00	122	
0:02:30	125	
0:03:00	125	
0:04:00	125	
0:05:00	125	

3		DEPTH OF TEST HOLE (mm) =	900

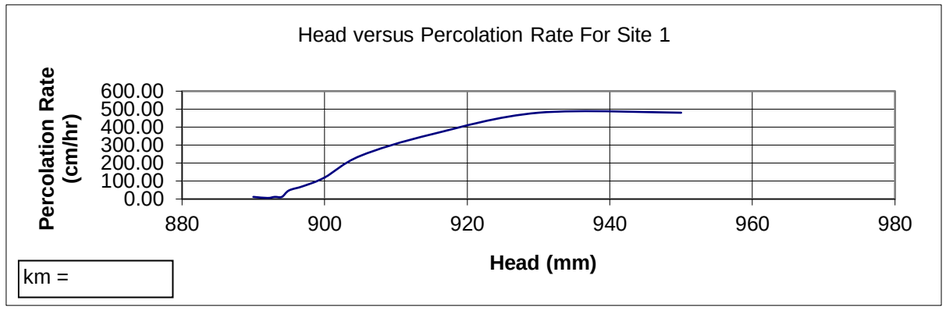
Head versus Percolation Rate For Site 3

time (sec)	depth (mm)	flow rate (mm/min)
0:00:15	35	
0:00:30	60	
0:00:45	80	
0:01:00	95	
0:01:15	105	
0:01:30	110	
0:01:45	115	
0:02:00	117	
0:02:30	120	
0:03:00	120	
0:04:00	120	
0:05:00	120	

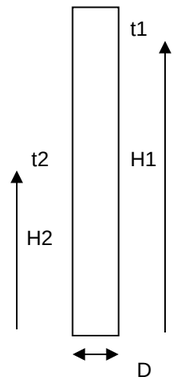
1 DEPTH OF TEST HOLE (mm) = 1000

Head versus Percolation Rate For Site 1

time (sec)	depth (mm)	Head (mm)	flow rate (mm/min)	flow rate (cm/hour)
0:00:15	30	970		
0:00:30	50	950	80.00	480.00
0:00:45	70	930	80.00	480.00
0:01:00	85	915	60.00	360.00
0:01:15	95	905	40.00	240.00
0:01:30	100	900	20.00	120.00
0:01:45	103	897	12.00	72.00
0:02:00	105	895	8.00	48.00
0:02:30	106	894	2.00	12.00
0:03:00	107	893	2.00	12.00
0:04:00	108	892	1.00	6.00
0:05:00	110	890	2.00	12.00



Km = PI().D / 11 (t2 - t1). In(H1/H2)
D= 11 (cm)
t2 = 300 (sec)
t1 = 15 (sec)
H2 = 89 (cm)
H1 = 97 (cm)

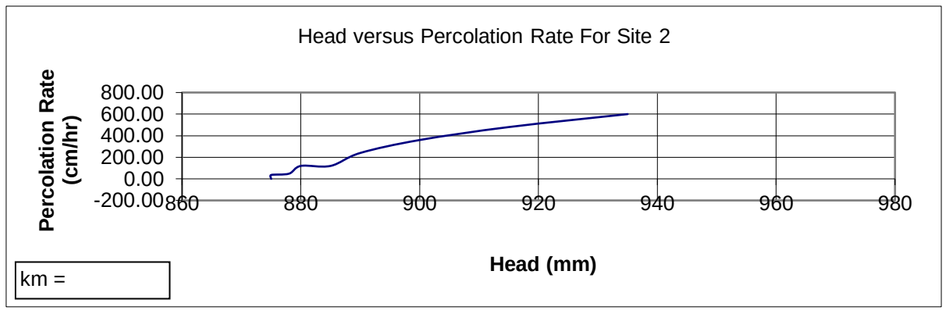


1 **Km - 0.000949 (cm/sec)**
Km - 0.819773 (m/day)

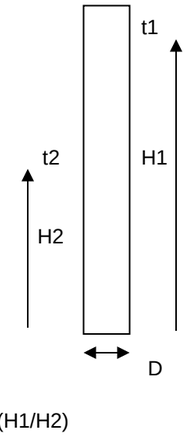
2 DEPTH OF TEST HOLE (mm) = 900

Head versus Percolation Rate For Site 2

time (sec)	depth (mm)	Head (mm)	flow rate (mm/min)	flow rate (cm/hour)
0:00:15	40	960		
0:00:30	65	935	100.00	600.00
0:00:45	85	915	80.00	480.00
0:01:00	100	900	60.00	360.00
0:01:15	110	890	40.00	240.00
0:01:30	115	885	20.00	120.00
0:01:45	120	880	20.00	120.00
0:02:00	122	878	8.00	48.00
0:02:30	125	875	6.00	36.00
0:03:00	125	875	0.00	0.00
0:04:00	125	875	0.00	0.00
0:05:00	125	875	0.00	0.00



Km = PI().D / 11 (t2 - t1). In(H1/H2)
D= 11 (cm)
t2 = 300 (sec)
t1 = 15 (sec)
H2 = 77.5 (cm)
H1 = 86 (cm)

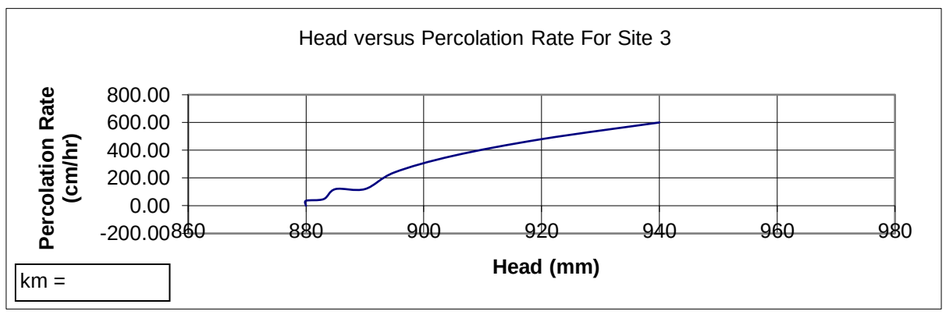


2 **Km - 0.001147 (cm/sec)**
Km - 0.991155 (m/day)

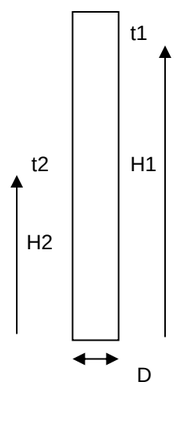
3 DEPTH OF TEST HOLE (mm) = 900

Head versus Percolation Rate For Site 3

time (sec)	depth (mm)	Head (mm)	flow rate (mm/min)	flow rate (cm/hour)
0:00:15	35	965		
0:00:30	60	940	100.00	600.00
0:00:45	80	920	80.00	480.00
0:01:00	95	905	60.00	360.00
0:01:15	105	895	40.00	240.00
0:01:30	110	890	20.00	120.00
0:01:45	115	885	20.00	120.00
0:02:00	117	883	8.00	48.00
0:02:30	120	880	6.00	36.00
0:03:00	120	880	0.00	0.00
0:04:00	120	880	0.00	0.00
0:05:00	120	880	0.00	0.00



Km = PI().D / 11 (t2 - t1). In(H1/H2)
D= 11 (cm)
t2 = 300 (sec)
t1 = 15 (sec)
H2 = 78 (cm)
H1 = 86.5 (cm)



3 **Km - 0.00114 (cm/sec)**
Km - 0.985119 (m/day)

Appendix B

Site Classification Report

Site Classification

AS2870-2011 Residential Slabs and Footings

Date:	14/8/2019
Date of Fieldwork:	12/8/2019
Site Number:	130018
Site Address:	Lot. 40, No. 136, Narrabeen Park Parade, Mona Vale, Nsw, 2103
Client:	Metricon Homes Pty Ltd - NSW

Summary of Assessment Results

Site Classification:	**"P"** in accordance with AS2870-2011
Climatic Zone:	**"1"** in accordance with AS2870-2011
Wind Rating:	**"N3"** in accordance with AS4055-2012

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Document Revision History

Date	Rev	Engineer	Comments
14/08/2019	A	Aruna Welgama	First Edition

1 Introduction

Intrax Consulting Engineers Pty Ltd (Intrax) have been engaged by the client to conduct an investigation of the surface and subsurface conditions at **Lot. 40, No. 136, Narrabeen Park Parade, Mona Vale, Nsw, 2103** as depicted on the cover page with a view to reporting on the Site Classification for a proposed residential dwelling.

2 Site Classification

2.1 Site Geology

The available Geological Survey Maps showed the site to be underlain by **Triassic Aged Sedimentary Deposits**. The subsurface profile encountered in the boreholes is considered to be consistent with the geological map indications.

2.2 Field Investigation

Three(3) boreholes were advanced using a **Hand Auger** to the depths indicated on the borehole logs (refer to Appendix B). These boreholes were positioned as indicated on the site plan (refer to Appendix A) along with details of the existing surface conditions such as slope, trees, and existing buildings. Disturbed materials obtained from augering boreholes were logged in accordance with AS1726-2016 and then classified in accordance with AS2870-2011.

A guide to the existing/natural soil profile consisted of:

FILL – CLAY overlying the naturally occurring:

CLAY

Full details of the observed subsurface material and conditions have been recorded on the borehole logs and presented in Appendix B.

2.2.1 In-situ Testing

Testing was carried out in accordance with Australian Standard AS 1289, 'Methods of Testing Soil for Engineering Purposes' and included:

- 2 Dynamic Cone penetration test (DCP)

Test results are included on the logs of the bores.

2.3 Site Classification in Accordance With AS2870-2011

In accordance with AS2870-2011 "Residential Slabs and Footings Construction" a site classification of **Class "P"** is applicable to this site **due to fill and abnormal moisture conditions – trees and existing building on site and trees on adjacent sites.**

In the absence of the fill material, the designing engineer should recognise that the natural soils encountered on this site result in a **"Class M"** site classification applying to this site.

Based on the findings of this investigation, the soil profile combined with this writer's local knowledge and experience, the characteristic surface movement (Ys) on this site, under normal condition, has been estimated to be in the range of **20mm to 40mm**.

Should a more detailed investigation (by others) with relevance to the reactivity of the soils in the local area be available, Intrax should be provided with this documentation. It is a condition of this report that any information the client may have with regards to the site and its history be provided to Intrax. This may lead to Intrax reviewing the above classification and conducting a more detailed geotechnical investigation with regards to the additional information. This report is not a detailed geotechnical investigation. It partially complies with the requirements of AS2870-2011 and is limited to the items required under Clause 2.2.2(a). Should a more rigorous assessment be required, Intrax can provide a Geotechnical Investigation of the site upon request.

2.3.1 Additional Notes Relating to This Site Classification

This investigation is based on a limited geotechnical assessment. Should the subsurface conditions encountered during construction vary from those described above, Intrax must be advised of these variations to provide comment or inspect the site where necessary. The use of standard footings as presented in AS2870-2011 is only applicable to building with a loading and a construction style similar that of a residential dwelling as described in section 3.1 of AS2870-2011.

In accordance with Clause 2.5.2 of AS2870 where the site cut exceeds 500mm a second site investigation is recommended. As such;

- **Where the cut depth is >500mm and < 1000mm the relevant design engineer may choose to design for a reduced crack zone from first principles**
- **Where the cut depth is in excess of 1000mm a second soil must be carried out to confirm the effects of the cut on the site classification"**

2.4 Wind Rating

At the time of our site visit an investigation of this site and the surrounding terrain was conducted to determine the Wind Classification Design Speed. The maximum design gust wind speed for this site is **50 m/s** based on wind speed calculations (Vh) for use in ultimate limit state design only calculated in accordance with the limitations as in AS4055 Section 1.2.

The Wind Rating for this site has been assessed as **N3**.

3 Founding Recommendations

Based on the site classification of the site, engineer designs in accordance with AS2870-2011 Section 4 can be adopted. An engineer designed footing system designed by engineering principles founded on natural material is recommended for this site. We recommend that the designing engineer refer to AS2870 - 2011 to ensure design compliance to this document, especially Sections 1.3 “Performance of Footing Systems and Design Considerations.”

Alternatively, deeper foundations can be adopted as follows:

To prevent differential settlement of the structure consideration should be given to the use of bored piers/screw piles or driven piles where these are founded within the natural occurring undisturbed CLAY.

Bored Piers should be founded into the CLAY which has an allowable end bearing pressure as indicated on Table 1.

AS a guide any bored piers founded deeper than 1800mm from the existing surface the extent of the bored pier founded greater than this depth may adopt a skin friction of 15kPa for any clay soils.

The pile design should be conducted by engineering principles, adopting the principle of effective stress. Negative skin friction should be adopted for the upper filling material.

The exact depth required to achieve the capacity will need to be analysed by the piling contractor and the current piling codes.

3.1 Allowable Bearing Pressures

The following allowable bearing pressures can be adopted for the soils listed in the table below. These bearing pressures apply where typically the embedment is a minimum of 100mm into the specified material.

Table 1: Allowable Bearing Pressures

Soil Type	Indicative Founding Depth (mm)	Maximum Allowable Bearing Capacity (kPa)
Uncontrolled Fill[1]	N/A	N/A
Natural Clay[2]	100mm into layer	120
Natural Clay[2]	300mm into layer	150
Natural Clay[2]	600mm into layer	250

[1] **Uncontrolled Fill** - Any FILLING that does not meet the requirements of AS2870-2011 Clause 2.5.3(b). This clause allows up to 0.8m of uncontrolled SAND FILL and up to 0.4m of uncontrolled CLAY FILL without impacting on the above site classification following that all foundations are founded on the natural soils through the filling.

[2] **Natural Material** – All-natural material given allowable bearing capacities denotes strength at optimum moisture conditions. The potential presence of perched groundwater in soils may lead to construction difficulties during wet weather. Please refer to Section 4.2 for site specific difficulties.

4 Construction Techniques and Difficulties

4.1 General

1. All loose surface fill, all roots and all organic material are to be removed from the building platform.

2. Notwithstanding the recommendations made in this report, wherever footings are close to any excavations or easements, that part of the footing must be deepened so that the projection from the underside of the footing to the bottom of the excavations makes an angle not exceeding 30 degrees in sandy soils and 45 degrees in clayey soils (This angle is measured from the horizontal). Steeper angles are not recommended unless sufficient testing and investigation has been carried out to indicate otherwise or the foundations are founded in competent rock.

3. It is recommended a second soil test be undertaken if the site is cut more than 400mm for CLAY sites. Where it is proposed to FILL the site a second soil test will be required should > 400mm of CLAY FILL be proposed or >800mm SAND FILL be proposed. It is recommended that any FILLING placed meet the requirements of CONTROLLED FILL as this will minimise the impact of the FILLING on the current classification of the site.

4. The Plumber shall lay waste pipes below ground surface at minimum grade. Risers are to be staked firmly.

5. Care shall be taken with surface drainage of the allotment from the start of construction and must be well drained so that water cannot pond beside or adjacent to footings. The drainage system shall be completed by the finish of construction of the house in accordance with AS2870-2011 Clause 5.5.3 (a).

6. Proper site drainage is very important in reactive sites such as this site. It is therefore recommended that the ground surface immediately next to the perimeter footings be graded away or site drainage issues be addressed. Should you the client require detailed design for specific site drainage plans please do not hesitate to contact Intrax Consulting Engineers.

7. Any filling placed across the site to assist in levelling prior to slab construction should conform with the requirement for either Controlled fill (Clause 2.5.3) or Rolled fill (Clause 6.4.2) AS 2870-2011. These clauses are as follows. If it cannot be confirmed that the fill is Controlled Fill or Rolled Fill then the reader should refer to item (c).

   A. Controlled Fill - Fill that will be required to support structures or associated pavements, or for which engineering properties are to be controlled AS2870-2011. Refer Clause 2.5.3, Clause 2.5.3(a)(c) - (Ie: where a specification has been provided on the type, quality and compaction requirements for filling at a site and the earthworks have been deemed compliant with the specification)

   B. Intrax has the express right to deem FILL uncontrolled where it cannot be clearly demonstrated that fill has been placed under the above conditions. That is to say that it is a requirement of the developer/builder to demonstrate fill placement has been placed in the appropriate layer thicknesses.

   C. Rolled Fill - Rolled Fill consists of material compacted in layers by repeated rolling with an excavator or similar equipment. The depth of rolled fill shall not exceed 0.6metres compacted in layers not more than 0.3m thick for sand material or 0.3m compacted in layers not more than 0.15m thick for other material AS2870-2011 Cl6.4.2(b)

   D. Where the nature of the fill cannot be confirmed, this office must undertake an assessment of the fill or be supplied with a suitable compaction report or geotechnical assessment of the fill to undertake an appropriate design for the site if the fill is to be utilised as a foundation.

8. We advise that it is possible that some sites may still have the presence of isolated areas of original organic material that may not have been fully removed during the sub division earthworks development stage. Intrax will make every effort to identify organic material within the soil profile, however due to the limitation on the number of boreholes for each site investigation, it is possible that some of these pockets may escape identification. Intrax does not take responsibility for isolated organic material that lies in areas outside our borehole locations, to the extent that these pockets could affect the design or construction of the footing system.

4.2 Site Specific

- **This site contains significant trees which may affect the foundations of the proposed residence. Remove existing trees and tree roots/material over the proposed building area. Any soft or loose material that does not respond to compaction should be excavated to achieve a firm working base. Fill holes with suitable fill compacted in 150mm (maximum) layers.**
- **An engineer designed footing system in accordance with AS2870 2011 is recommended for this site taking into consideration the effect of the trees in relation to the final house siting.**
- **Demolition of the existing structure is likely to leave isolated pockets of fill and or disturbed ground conditions. Where there is local disturbance the proposed foundations must extend a minimum of 100mm below the level of disturbance into either of the naturally occurring materials as identified in Section 2 of this report. Note alternatively the disturbed material may be controlled and subsequently adopted as a founding material (refer definitions on controlled FILL).**

5 Conditions of Use of This Report

5.1 Report Limitations

1. The recommendations in this report are based on the following:

   a) Information about the site & its history, proposed site treatment and building type conveyed to us by the client and or their agent

   b) Professional judgments and opinions using the most recent information in soil testing practice that is available to us.

   c) The location of our test sites and the information gained from this and other investigations.

2. Should the client or their agent neglect to supply us with correct or relevant information, including information about previous buildings, trees or past activities on the site, or should changes be made to the building type, size and or/position, this report may be made obsolete, irrelevant or unsuitable. In such cases, Intrax will not accept any liability for the consequences and Intrax reserves the right to make an additional charge if more testing or a change to the report is necessary.

3. The recommendations made in this report may need to be reviewed should any site works disturb any soil 200mm below the proposed founding depth.

4. The descriptions of the soils encountered in the boreholes follow those outlined in AS1726-2017; Geotechnical Site Investigations. Colour descriptions can vary with soil moisture content and individual interpretation.

5. If the site conditions at the time of construction differ from those described in this report then Intrax must be contacted so a site inspection can be carried out prior to any footing being poured. The owner/builder will be responsible for any fees associated with this additional work.

6. This report assumes that the soil profiles observed in the boreholes are representative of the entire site. If the soil profile and site conditions appear to differ substantially from those reported herein, then Intrax should be contacted immediately and this report may need to be reviewed and amended where appropriate. The owner/builder will be responsible for any fees associated with this additional work.

7. The user of this report must take into account the following limitations. Soil and drilling depths are given to a tolerance of +/- 200mm. Where spot levels or a feature survey have been undertaken, levels are given a tolerance of +/- 200mm.

8. It must be understood and a condition of acceptance of this report is that whilst every effort is made to identify fill material across the site, difficulties exist in determining fill material, in particular, for example, well compacted site or area derived fill, when utilising a small diameter auger. Consequently, Intrax emphasises that we will not be responsible for any financial losses, consequential or otherwise, that may occur as a result of not accurately determining the fill profile across the site.

9. Intrax's assessment of flooding is based on Government/Council planning and GIS data available at the time of this investigation. Intrax has not made a site specific assessment based on height or hydrological data with reference to the future flood risk at the property. Intrax does not guarantee that this site is free from flooding as further detailed investigation may be required.

   a) This report does not assess the potential for landslide, undermining or aggressive soils.

5.2 Variations to This Report

It is neither economically feasible nor practical to determine every subsurface feature on the site. Studies have shown that a large number of boreholes leads to only a slight increase in probability of detecting hidden site features (such as a filled well or cellar) in the foundation soils. As such, any variations, or discrepancies in soil type, colour, or horizon depth must be reported to the Engineer immediately so that their potential influence on the footings may be assessed.

5.3 Loss or Damages

Subject to the limitations of this report as expressed in Section 5.1, Intrax Consulting Engineers Pty Ltd will not accept liability for loss or damage, consequential or otherwise, based on the recommendations of this report, other than for the cost of re-assessment. This site classification assessment should not be considered a comprehensive analysis of the subject site. Should a more detailed geotechnical assessment be required Intrax Consulting Engineers Pty Ltd can provide such a report. Please contact Intrax Consulting Engineers Pty Ltd to discuss this further.

Should you have any questions regarding this report please do not hesitate to contact the Intrax Site Classification Division on 03 8371 0100.

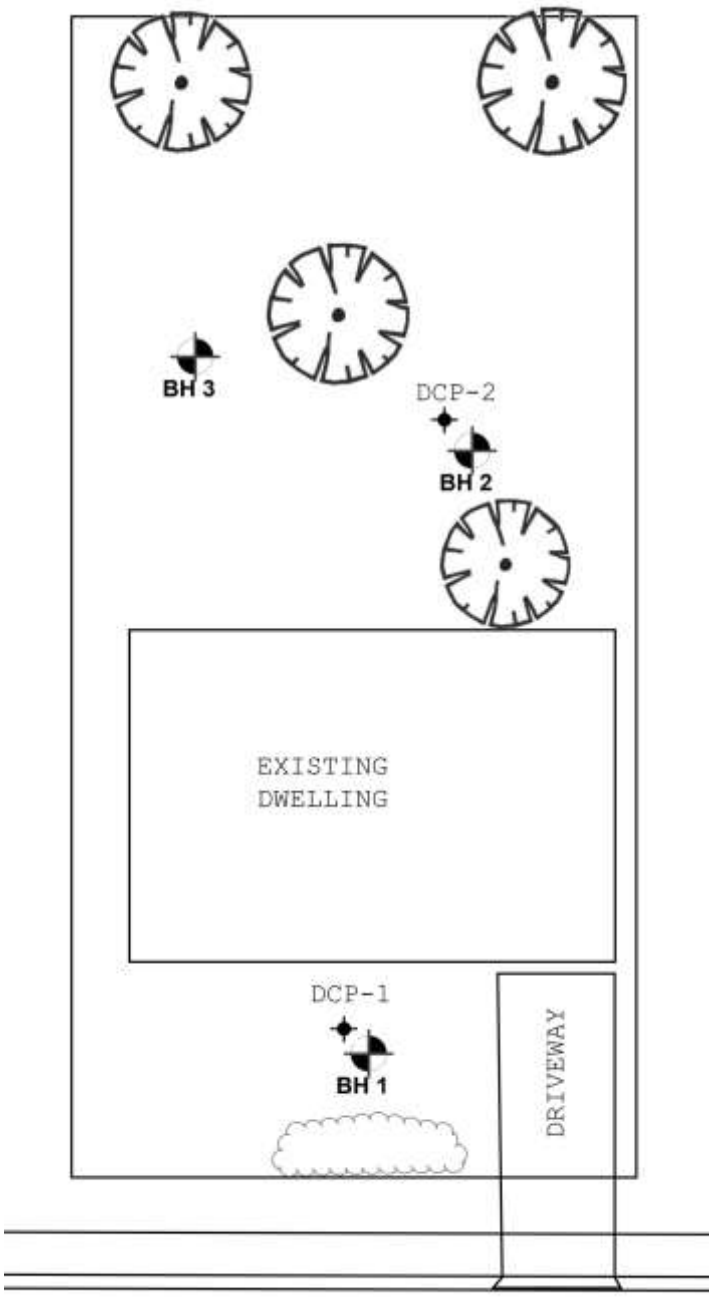
For and on behalf of Intrax Consulting Engineers Pty Ltd

Aruna Welgama (M.Eng)

Geotechnical Engineer

Appendix A
Site Plan

Site Plan



NOT TO SCALE

Appendix B
Borehole Logs & DCP Test Results

Borehole Logs

Site Address:	Lot. 40, No. 136, Narrabeen Park Parade, Mona Vale, Nsw, 2103						HAND AUGER	HAND AUGER	HAND AUGER
Horizon	**USC**	**Soil Type**	**Moisture**	**Density/ Consistency/ Strength**	**Plasticity**	**Description**	**Borehole 1**	**Borehole 2**	**Borehole 3**
EXISTING SURFACE LEVEL							0	0	0
UNCONTROLLED FILL	CI	silty CLAY trace sand gravel	Moist, Near Plastic Limit	Stiff	Medium Plasticity	dark grey brown mottled black orange , root material.	0 - 600	0 - 800	0 - 800
A	CH	CLAY trace gravel	Moist, Wet Of Plastic Limit	Stiff	High Plasticity	pale grey brown mottled orange , root material.	600 - 1200	800 - 1200	800 - 1200
Intrax HOUSING				**Intrax ID #:**		130018	REFUSAL ON STIFF CLAY	REFUSAL ON STIFF CLAY	REFUSAL ON STIFF CLAY
				Date of Fieldwork		12/08/2019	Groundwater Not Encountered	Groundwater Not Encountered	Groundwater Not Encountered

Dynamic Cone Penetration (DCP) Test Result

Test Method: AS1289.6.3.2-1997 (Reconfirmed 2013)

Date of Fieldwork: 12/8/2019

Site Number: 130018

Site Address: Lot. 40, No. 136, Narrabeen Park Parade, Mona Vale, Nsw, 2103

Test Number	**DCP – 1**	**DCP - 2**	**DCP – 3**
Ground Water	Nil	Nil	Nil
Depth (mm)	**Number of Blow/100mm**		
0 – 100	3	3	
100 – 200	4	2	
200 – 300	3	3	
300 – 400	3	2	
400 – 500	4	3	
500 – 600	5	3	
600 – 700	5	3	
700 – 800	6	4	
800 – 900		4	
900 – 1000		5	
1000 – 1100		6	
1100 – 1200		7	
1200 – 1300		7	
1300 – 1400		8	
1400 – 1500		9	
1500 – 1600			
1600 - 1700			
1700 – 1800			
1800 – 1900			
1900 - 2000			

Notes

Refusal: more than 20 blows / 0.10m