Mr Elias, Mr Maltese and Mr Petro

C/- AE Design Partnership

Preliminary Onsite Wastewater Assessment:
Lot 2 Sec 4 DP2954
1111-1141 Elizabeth Drive, Cecil Park, NSW

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1706121JR03V04
September 2018

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is provide a preliminary onsite wastewater assessment report in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Mr Elias, Mr Maltese and Mr Petro C/- AE Design Partnership (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

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Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

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Author(s)	Reviewer(s)	Project Manager	Signature
Daniel O'Sullivan	Andrew Norris Gray Taylor	Gray Taylor	

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All enquiries regarding this project are to be directed to the Project Manager.

CONTENTS

1 Overview

1.1 Background

Martens & Associates (MA) has prepared this preliminary onsite wastewater assessment to support a development application (DA) to Fairfield City Council (FCC) for a commercial subdivision at 1111-1141 Elizabeth Drive, Cecil Park, NSW ('the site'), being Lot 2, Sec 4, DP 2954. This report provides a preliminary assessment of on-site wastewater management requirements and land capability.

1.2 Objectives

The objectives of this report include:

- Assessment of the suitability of soil at the site to accommodate effluent irrigation.
- Identification of areas which are unsuitable for irrigation (including buffer setbacks).
- Identification of wastewater management systems most appropriate for the proposed development.
- Prepare a preliminary wastewater management solution for future lots.

1.3 Development Proposal

We understand from a brief by the client and a concept layout that the development will include site subdivision for commercial lots consisting of a new mixed-use highway service centre and associated internal access roads. Proposed development site plan is provided in Attachment A.

1.4 Relevant Planning Controls and Design Principles

The assessment is prepared in accordance with the following guidelines and design principles:

- Department of Environment and Conservation (2004) Environmental Guidelines – Use of Effluent by Irrigation
- Australian/ New Zealand Standard 1547 (2012) - *On site domestic wastewater management*

- Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998) - *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households.*

- Fairfield City Council (2011) – *On-site Sewage Management System and Greywater Re-use Policy*

2 Site Description

2.1 Summary

A summarised site description is provided in Table 1. A site contour survey plan is provided in Attachment A.

Table 1: Site description summary.

Item	Description / Detail
Site address and Lot/DP	1111-1141 Elizabeth Drive, Cecil Park, NSW (Lot 2 Sec 4 DP 2954).
Approximate area[2]	7.38 ha (Project Surveyors, 2017)
Local Government Area (LGA)[1]	Fairfield City Council (FCC).
Current zoning and land use	The site is not currently zoned for rural residential use.
Proposed land use	Commercial subdivision.
Site description	Rural residential lot with cleared pastoral land, dwelling and multiple sheds and stockpiles.
Surrounding land uses	Low density residential to the north, cleared pastoral land and tree cover to the east and south, new housing development being constructed to the west.
Topography	Located within slightly undulating terrain. Site elevation ranges from approximately 117 m AHD at street level on the south of the site to approximately 100 m AHD at the northern site boundary (Project Surveyors, 2017).
Expected geology	The Penrith *1:100,000 Geological Series Sheet 9030* (1991) describes site geology as Bringelly Shale consisting of shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff. The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Luddenham variety consisting of shallow dark podzolic soils or massive earthy clays on crests; moderately deep red podzoic soils on upper slopes; moderately deep yellow podzoic soils and praire soils on lower slopes and drainage lines.
Environmental receptors	Site drainage is via overland flow to a tributary of Ropes Creek along the north western site boundary. Ropes Creek is located approximately 3 km to the east of the site.

2.2 Sub-Surface Conditions

A geotechnical investigation was completed by Martens and Associates on 12 January, 2018 which involved the excavation of nine boreholes (BH101 – BH109) using a hydraulic auger to a maximum depth of 4.3 m below ground level (mbgl). Borehole testing locations are shown on the site testing plan in Attachment A and detailed borehole logs are provided in Attachment B.

The natural soil and rock profile of is generally comprised of:

- Unit A Topsoil - Silt Loam: Low liquid limit, light brown, trace clay and organic material ranging between 0.0 – 0.5 mBGL.
- Unit B Subsoil - Silty Clay: Medium plasticity, brown / red-brown, trace claystone gravels ranging from 0.0 – 1.6 mBGL.
- Unit C Bedrock - Shale: Brown, inferred very low strength, distinctly weathered, ranging from 0.7 - 2.3 mBGL.

Fill, comprising inferred firm silt loam / silty clay, was encountered in BH101 and BH102 up to approximately 0.7 mBGL and expected to be present in the southern portion. This fill is considered to be "uncontrolled" and has likely been placed for previous development and / or landscaping purposes and sourced from the site.

Table 2: Summary of soil depths.

Borehole Identification	Depth of Layer (mBGL)		
	Silt loam (Unit A)	Silty clay (Unit B)	Shale (Unit C)
BH101	0 – 0.5[3]	0.5 – 1.3[1]	1.3 – 3.3[2]
BH102	-	0.0 – 1.1[1, 3]	1.1 – 2.0[2]
BH103	0 – 0.3	0.3 – 1.0[1]	1.0 – 2.3[2]
BH104	0 – 0.3	0.3 – 0.8[1]	0.8 – 1.1[2]
BH105	0 – 0.3	0.3 – 0.7[1]	0.7 – 1.4[2]
BH106	0 – 0.3	0.3 – 1.0[1]	1.0 – 1.9[2]
BH107	0 – 0.3	0.3 – 0.9[1]	0.9 – 1.6[2]
BH108	0 – 0.5	0.5 - 4.3	-
BH109	0 – 0.1	0.1 – 1.6[1]	1.6 – 1.8[2]

Notes:
[1] V-bit refusal on inferred extremely weathered shale.
[2] TC refusal on inferred highly weathered shale.
[3] Fill material.

Encountered conditions are described in more detail in the borehole logs (Attachment B).

Table 3: Summary of typical soil horizon characteristics

Layer	Agricultural Classification	Soil Permeability Category [1]
Silty Loam	SiL	3a
Silty Clay	SiC	5b

Notes:
[1] In accordance with Table 8 of NSW Department of Local Government *et al*. (NSW DLG, 1998).

2.2.1 Hydrogeological Assessment

A review of the NSW Department of Primary Industries Water (DPIW) real time groundwater bore database revealed that there is no bore located within 500 m of the site.

Groundwater inflow was not encountered during drilling of BH101 to BH107 and BH109 to 3.3 mBGL.

Groundwater inflow was observed during drilling of BH108 at approximately 3.0 mBGL and excavation spoil below this depth, up to investigation termination depth of 4.30 mBGL (top of weathered rock), was encountered in a wet condition. Water is considered to be associated with the nearby drainage depression and small dam.

Should further information on permeant site groundwater levels be required, additional investigation would need to be carried out (i.e. installation of groundwater monitoring bores).

2.3 Climate Data

The nearest rainfall station with adequate data is at Horsley Park Equestrian Centre (Horsley Park, rain station 067119, rainfall 1997 – present) and nearest station with evaporation records is Badgerys Creek (station 067068, 1967-1984). These stations are considered generally representative of the site. A comparison of median rainfall and evaporation is provided in Table 4.

Table 4: Comparison of rainfall and Class A Pan evaporation data for the site.

Month	Median Monthly Rainfall (mm)	Median Monthly Class A Pan Evaporation (mm)	Rainfall Surplus Rainfall – Evap. (mm)
January	64.2	182.9	-118.7
February	93.3	151.2	-57.9
March	57.3	136.4	-79.1

Month	Median Monthly Rainfall (mm)	Median Monthly Class A Pan Evaporation (mm)	Rainfall Surplus Rainfall – Evap. (mm)
April	61.6	99	-37.4
May	27.7	65.1	-37.4
June	54.5	51	3.5
July	30.4	58.9	-28.5
August	26.7	89.9	-63.2
September	22.1	120	-97.9
October	48.4	142.6	-94.2
November	57.2	168	-110.8
December	61.4	201.5	-140.1
Annual	**604.8**	**1466.5**	**-861.7**

The comparison shows a rainfall to evaporation deficit of -861.7 mm per year.

3 Wastewater Assessment

3.1 Individual Lot Wastewater Management Solution

A typical onsite wastewater treatment system for each lot would consist of a secondary sewage treatment system and an irrigation system designed in accordance with AS/NZS 1547 (2012) *On-site domestic wastewater management* standard.

The sewage treatment system should, where possible generally be located to allow gravity drainage of sewage and treat effluent to the standard shown in Table 5.

Table 5: Assumed secondary treatment standards.

Parameter	Secondary Standard
BOD_5 (mg/L)	30
Suspended Solids (mg/L)	30
Faecal Coliforms (CFU/100mL)	30
Total Phosphorus (mg/L)	10
Total Nitrogen (mg/L)	25

3.2 Soil Capability Assessment

3.2.1 Overview

Nine (9) boreholes were excavated on the site. The boreholes were located to characterise site soil characteristics. Attachment B provides full borehole log sheets. These showed a generally consistent soil profile across the site. All boreholes undertaken have also been logged in accordance with soil agricultural classification scheme for wastewater purposes.

3.2.2 Soil Permeability

Evaluation of soil permeability has been conducted using AS/NZS 1547 (2012) and the Department of Local Government *et al.* (1998) texture / structure analyses technique. Suitability of topsoil / subsoil for effluent irrigation is determined using this classification technique. Design Irrigation Rates (DIR) are determined based on topsoil / subsoil texture and structure (Table 6).

Table 6: Design irrigation rates (AS/NZS 1547, 2012) and permeability classifications (DLG *et al*. 1998).

Soil Texture	Agricultural Classification	Design Irrigation Rate (mm/day)	DLG et al. (1998) Classification	Suitability Class
Silt Loam (Topsoil)	SiL	3.5	3 a	Minor limitation
Silty Clay (Subsoil)	SiC	3.0	5 b	Moderate limitation

With respect to permeability, the silty clay subsoil is a moderate limitation for sub-surface effluent irrigation/application. This limitation will be addressed in water and nutrient balance assessment (Section 3.6).

Design irrigation rate (DIR) is addressed by adopting AS/NZS1547/2012. Soils are sufficiently permeable to assimilate applied wastewater without allowing excessive leaching to lower soil profiles or deep groundwater, thus maximising the potential for effluent evapo-transpiration and nutrient assimilation.

3.3 Preliminary Land Capability Assessment for On-site Effluent Re-use

Suitability for on-site effluent re-use in proposed irrigation areas is assessed according to Tables 4 and 6 of the NSW Department of Local Government *et al.* (NSW DLG, 1998) and summarised in Table 7.

Table 7: Site suitability for on-site effluent management systems, according to NSW Department of Local Government et al. (1998).

Feature	Details of Irrigation Areas	Limitation Rating
Flood potential[1]	Majority of the site is above the 1 in 20 year flood levels	Minor
Sun and wind exposure	High	Minor
Slope (%)[1]	< 10 %	Minor
Landform[1]	Convex and concave side slopes	Minor
Erosion potential[1]	No signs present	Minor
Site drainage[1]	Good	Minor
Fill	Fill present	Moderate
Rock outcrop	<10%	Minor

Feature	Details of Irrigation Areas	Limitation Rating
Geology	No major discontinuities	Minor
Depth to bedrock (m)	Generally >1.0 m	Minor
Depth to water table (m)	>1.0 m	Minor
Soil permeability category	3a, 5b	Minor/Moderate
Coarse fragments (%)	Generally 0 – 20%	Minor

Notes:
[1] These are major and moderate limitations associated with areas on the site impacted by flooding (i.e. within and adjacent to drainage channels along northwest and northeast boundaries). However as there is no proposed development within these areas they don't pose any limitation to effluent disposal.

The limitation posed by flooding potential has been assessed by GHD in the request for Secretary's Environmental Assessment Requirements (SEARs) for state significant development prepared by AE Design Partnership, November, 2017. AE stated that further investigations into flooding are to be conducted as part of the subsequent EIS process. It is anticipated that all effluent disposal areas can be located outside of flood impacted areas.

Moderate limitation posed by fill material and soil permeability category will be addressed in water and nutrient balance assessment (Section 3.6). Limitations posed by soil permeability have been discussed in Section 3.2.

Additionally, the fill material is consistent with natural site material and will not cause excessively slow drainage nor allow preferential or unacceptably rapid drainage.

3.4 Buffer Setbacks for Effluent Reuse Area

Irrigation field areas are located with buffers in accordance with DLG *et al.* (1998), with recommended buffers summarised in Table 8.

Table 8: Adopted buffer setbacks in accordance with DLG *et.al* (1998).

Site feature	Recommended setback range (m)
Drainage channels and farm dams	40
Site boundaries, and roads	3/6[1]
Dwellings and buildings	3/6[1] or 15[2]

Notes:
[1] x/y buffer distance downslope/upslope of feature respectively.
[2] Buffer distance of 15m if a surface irrigation system is used.

These buffer setbacks shall be used for subdivision and future commercial building design purposes.

3.5 Equivalent Population (EP) and Effluent Area

When considering the overall sewage management solution assessment of sewage generation rates is essential. Table 9 provides initial guidance on likely sewage generation rates based on Table A1 of the Water Services Association of Australia Sewerage Code (2002) guidelines.

When calculating litres per day for each commercial lot no detailed development plans were available therefore it was assumed that 70 % of the site would be hardstand (commercial building and car parking) with 30 % of the site used as landscaped areas. Of the 70 % of construction area it is assumed that 35 % will include the commercial building itself and 35 % will include car parking. Therefore, building size and EP calculations have been based on an area 35 % of the total proposed lot area.

Average dry weather flows into a sewer from domestic, commercial and industrial sources is defined as 180 L/d/EP (WSA, 2002).

Table 9: Design wastewater loads.

Intended Use	Classification [1]	Lot	Equivalent Population (EP) per hectare[1]	Lot Size (m^2) [2]	Building Footprint (BF) [3]	EP per BF [4]	Litres per day [5]
Commercial	Local commercial	1	75	3,021	1057	8.1	1427
		2	75	3,540	1239	9.3	1673
		3	75	2,372	830	6.2	1121
		4	75	4,047	1416	10.6	1912
		5	75	3,762	1317	9.9	1778
		6	75	4,267	1493	11.2	2016
		7	75	5,056	1770	13.3	2389
		8	75	4,448	1557	11.7	2102
		9	75	2,701	945	7.9	1276

Intended Use	Classification [1]	Lot	Equivalent Population (EP) per hectare[1]	Lot Size (m^2) [2]	Building Footprint (BF) [3]	EP per BF [4]	Litres per day [5]
		10	75	2,460	861	8.0	1162
		11	75	2,482	869	7.7	1173
		12	75	2,430	851	6.1	1148
		13	75	2,576	902	6.2	1217
		14	75	2,256	790	5.9	1066

Notes:
[1] Based on Water Services Association of Australia Sewerage Code (2002) guidelines.
[2] Subdivision layout – drawing number DA04 (25/7/18).
[3] 35 % of total site area.
[4] (BF/10,000) x 75
[5] BF x 180 L/d/EP

3.6 Effluent Application Rates for Sub-Surface Irrigation

Soil properties and corresponding recommended design irrigation rates (DIRs) according to AS/NZS 1547 (2012) for site soils are given in Table 10. These are based on site investigations and assumptions of soil properties based on our experience in similar soil environments.

Table 10: DIR and soil properties for site soils.

Soil Category	Depth (m) [1]	Texture	Structure	Indicative Permeability (K_{sat}) (m/d)	Design Irrigation Rate (DIR) (mm/day)
Topsoil	0.0 – 0.3	SiL	Moderately Structured	1.5 – 3.0	3.5
Subsoil	0.3 – 1.4	SiC	Moderately Structured	0.06 – 0.12	3
			Adopted design irrigation rate		**3.0**

Notes:
[1] Depth of soil horizons varies across the site.

3.7 Soil, Water and Nutrient Modelling Summary

To refine the preliminary effluent application design developed using the soil hydraulics methodology of AS / NZS 1547 (2012) a water and nutrient budget has been prepared for each lot. Modelling has been based on anticipated flow rates (Table 10).

Water balance analysis used local climate data and the monthly water balance modelling methodology adopted by DEC (2004) and DLG *et al.* (1998). This method allows for assessment of a range of effluent application rates to determine the required wet-weather storage. Assessment was completed to calculate irrigation area for no wet weather storage, and 7 days wet weather storage.

Results of this analysis are presented in Table 11. Final need for wet-weather storage shall be determined based on the developed site effluent irrigation solution and available areas for effluent irrigation.

Analysis of nutrient assimilation and uptake by vegetation and soil (p-sorption) has been undertaken using a monthly nutrient balance.

Through iterative modelling the minimum area required for the management of effluent nutrients has been determined. The results of this analysis (Table 11) conclude that nutrient assimilation capacity of vegetation shall not be the limiting factor for the design of effluent management solutions on the site. Analysis calculations can be provided upon request.

Table 11: Modelling summary: area required for sustainable irrigation per litres / day.

Lot	Area Required (m^2) AS/NZS 1547: 2012	Area Required (m^2) Water Balance (no storage[1])	Area Required (m^2) Water Balance (7 days storage[2])	Area Required (m^2) Nitrogen Uptake	Area Required (m^2) Phosphorus Saturation	Adopted Design Area (m^2) with no wet weather storage
1	476	1058	813	651	787	**1058**
2	558	1240	950	763	922	**1240**
3	374	830	640	511	618	**830**
4	637	1420	1090	872	1054	**1420**
5	593	1320	1010	811	980	**1320**
6	672	1500	1150	920	1112	**1500**
7	796	1770	1360	1090	1317	**1770**
8	701	1560	1200	959	1159	**1560**

Lot	Area Required (m^2) AS/NZS 1547: 2012	Area Required (m^2) Water Balance (no storage[1])	Area Required (m^2) Water Balance (7 days storage[2])	Area Required (m^2) Nitrogen Uptake	Area Required (m^2) Phosphorus Saturation	Adopted Design Area (m^2) with no wet weather storage
9	426	957	724	582	704	**957**
10	387	861	666	530	641	**861**
11	391	867	665	535	647	**867**
12	383	850	661	524	633	**850**
13	406	901	694	556	671	**901**
14	355	788	609	486	588	**788**

Notes:
[1] Area where no wet weather storage is required.
[2] Area where 7 days weather storage is required.

3.8 Soil, Water and Nutrient Modelling Summary

The minimum area required for irrigation is dictated by water balance no dwelling results and equates to approximately 35% of the lot area plus necessary boundary and other setbacks and buffers. Given the expected development will have carparks and buildings covering 70% of each lot it is not feasible to have an onsite wastewater treatment system on each lot. Therefore a wastewater treatment pump out system is recommended.

4 Recommendations for Onsite Wastewater Management

Findings of the onsite wastewater assessment concluded that, in absence of reticulated sewage services, a pumpout system is the most suitable compliant wastewater management solution to service the proposed commercial lots.

It is likely that Sydney Water will provide reticulated sewer to the area within the next 2-4 years. Our client's preference is to pump out wastewater effluent from the proposed individual lots until a reticulated sewerage system connection becomes available. This is considered to be in accordance with Fairfield City Council (2018) and is also the most economical solution.

4.1 Correspondence with Fairfield City Council

Mr Sarid Dashti of Fairfield City Council (03/05/2018) confirmed that FCC assesses sites on an individual basis and will consider the use of pump-out where an onsite effluent management system will not be possible, as is the case on this site.

4.2 Minimum Onsite Wastewater Management Requirements

4.2.1 Developer Advice

The developer advised that onsite wastewater treatment systems were not the preferred option for the subdivision. Their preference, due to the nature of the proposed commercial development and intended lot use was a separate pump out system for each lot.

The site constraints assessment confirms that an onsite wastewater management system for the commercial lots related wastewater would not be feasible, due to insufficient site area being available with respect to recommended buffers and intended lot usage.

4.2.2 Commercial Lots

All related wastewater (staff and visitor toilets, hand basins and staff kitchen facilities) are to be connected to the proposed onsite wastewater management system.

A pump-out system is proposed for each commercial lot with the following components as a minimum:

- An appropriately sized commercial grease trap where required.

- A septic tank located adjacent to the approved building. A summary of septic tank sizes are shown in Table 12.
- New effluent collection well with capacity shown in Table 12. This shall provide approximately 8 days capacity.
- New 50 mm Camlock fitting to allow pump-out tanker access. Camlock to be connected to the effluent collection well via a PVC or PE main. Where the connecting main is not covered by suitable 300 mm of soil, mechanical protection will need to be provided.
- Camlock to include marker post with reflector to prevent damage.
- Collection well to be fitted with float, alarm and communications system to advise operator when system at 75% capacity.

Table 12: Design summary: Septic tank and collection well sizes.

Lot	Lot Size (m^2)	Litres per day	Minimum Septic Tank Size (L) [1]	Minimum Collection Well Size (L) [2]
1	3,084	1457	3007	11658
2	3,540	1673	3223	13382
3	2,372	1121	2671	8966
4	4,047	1912	3462	15298
5	3,762	1778	3328	14220
6	4,267	2016	3566	16130
7	5,056	2389	3939	19112
8	4,448	2102	3652	16814
9	3,020	1427	2977	11416
10	3,030	1432	2982	11454
11	2,948	1393	2943	11143

Lot	Lot Size (m²)	Litres per day	Minimum Septic Tank Size (L) [1]	Minimum Collection Well Size (L) [2]
12	2,316	1094	2644	8754
13	2,374	1122	2672	8974
14	2,261	1068	2618	8546

Notes:
[1] Septic tank size = 1550 (sludge allowance - NSW Health, 2001) 1 days flow
[2] Collection well size = 8 days capacity

4.3 System Maintenance Requirements

General wastewater management system requirements for each lot are as follows:

- Collection wells are sized to require weekly pump-out by pump-out tanker. There are local pump-out contractors available to service the site on a regular basis.
- Septic tank well is to be regularly inspected and periodically (typically 5 – 10 years) pumped out to tanker to remove accumulated solids by pumpout tanker.
- All system pumps, alarms, floats and controls to be periodically maintained in conjunction with the septic tank and effluent collection well.

5 Conclusions and Additional Works

5.1 Additional Works at Detailed Design

Additional works at detailed design include the following as a minimum:

- An onsite wastewater management report will be required for each lot in conjunction with Development Applications to construct commercial buildings. Report shall provide details of the following:
    - Confirmation of building size and use to assess an appropriate wastewater generation assessment.
    - Treatment system specification, septic tank volume calculation, wastewater transfer systems and required pump out design.

Prior to the installation of the sewage management system approval from Council is required under S68 of the Local Government Act. Further approval to operate is required prior to system commissioning.

5.2 General Conclusions

The wastewater management assessment shows that the site is capable of being used for proposed commercial subdivision, provided recommendations given in this report are adhered to in design and construction of the future onsite wastewater management systems.

6 References

http://www.bom.gov.au

Australian / New Zealand Standard 1547 (2012), *On-site domestic wastewater management*

Australian Bureau of Statistics – *Census (2011) community profile for NSW*

Australian and New Zealand Environment and Conservation Council (1999) *Effluent Management Guidelines for Dairy Processing in Australia*.

Fairfield City Council (2002) – *On-site Sewage Management Strategy*

NSW Department of Environment and Conservation (2004) *Environmental Guidelines – Use of Effluent by Irrigation*

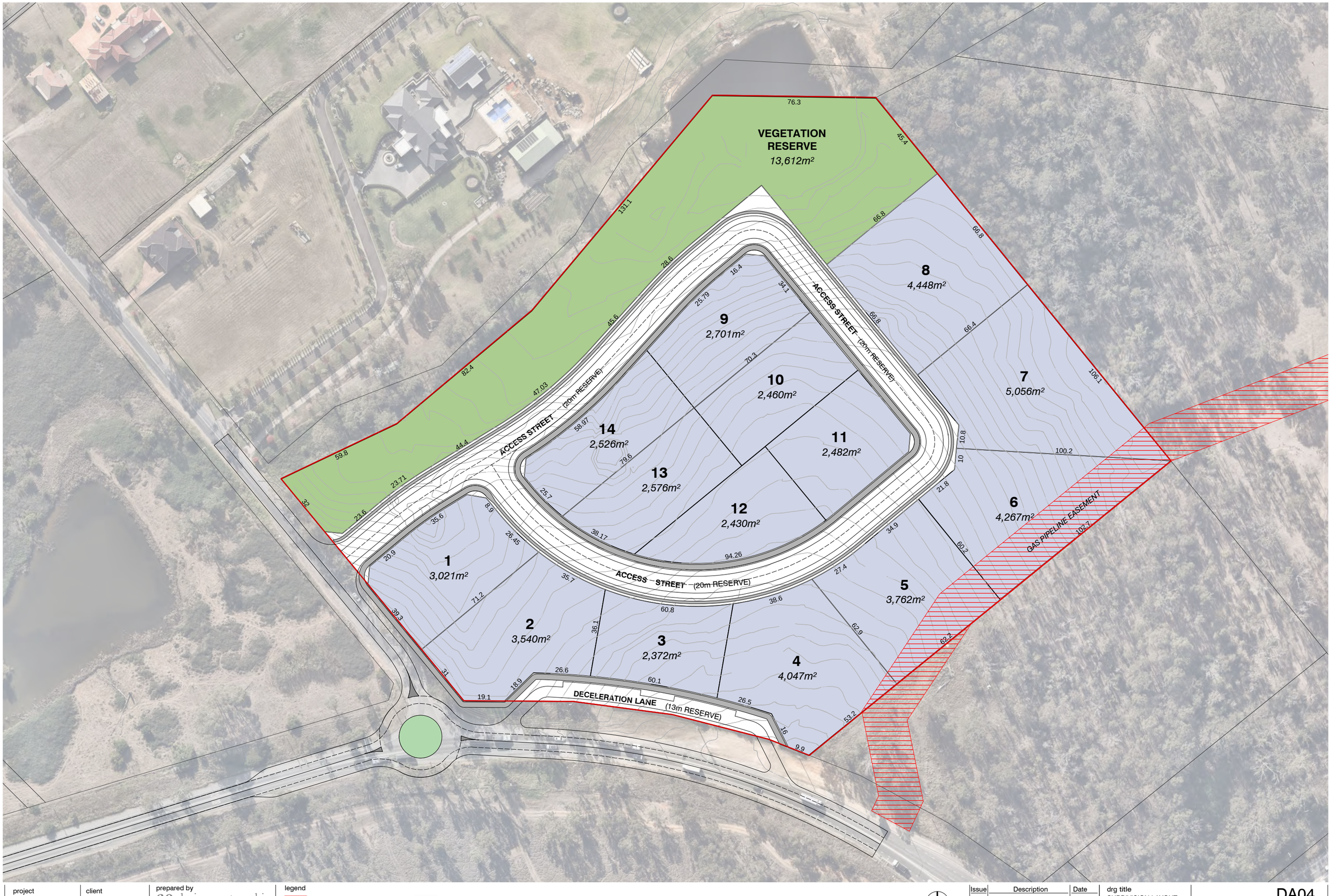
NSW Health (2001) *Septic Tank and Collection Well Accreditation Guideline*

Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998), *Environment and Health Protection Guidelines - On-site Sewage Management for Single Households*

NSW Department of Primary Industries, Wollongong Port Hacking 1:100,000 Geological Series (1985)

Water Services Association of Australia (2002) *Sewage Code of Australia Part 1: Planning and Design.*

7 Attachment A – Site Plans



project
1111-1141
Elizabeth Drive
Cecil Park

client
Elizabeth Drive
Pty Ltd

prepared by
ae design partnership
architecture urban design planning
Nominated Architect
Director N R Dickson # 7061
ABN 85 162 968 103

legend
- Site Boundary
- Cadastre
- Countours (0.5m intervals)
- Lot
- Vegetation Reserve
- Gas Pipeline Easement
- Indicative Footpath/Cycleway (2.5m wide)

1:1,500 @ A3

Issue	Description	Date
DA	DA Package	30/07/18

drg title
SUBDIVISION LAYOUT

drawn SB
checked RD

drg no. DA04

date 25/07/2018
issue A

8 Attachment B – Borehole Logs

CLIENT	Mr Elias & Mr Maltese & Mr Petro.	COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH101**
PROJECT	Prelim. Salinity & Geotechnical Investigation	LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT	4WD ute-mounted drill rig	EASTING		RL SURFACE	114 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 3.30 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				114.00				ML	FILL: Silt LOAM, low liquid limit, light brown, with fine grained gravels, inferred firm, moderate structure.		F	FILL
				0.50								
	M		0.5	113.50	P6121/101/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, some grey bands, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
			1.0		P6121/101/1.0/S/1 D 1.00 m							
	H			*1.30*								
AD/T		Not Encountered		112.70					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.30: V-bit refusal.
	L		1.5		P6121/101/1.5/R/1 D 1.50 m							
			2.0		P6121/101/2.0/R/1 D 2.00 m							
	M		2.5		P6121/101/2.5/R/1 D 2.50 m							
				3.00								
	H		3.0	111.00	P6121/101/3.0/R/1 D 3.00 m				Inferred low strength.			
				3.30					Hole Terminated at 3.30 m			3.30: TC-bit refusal on inferred low to medium strength claystone.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH102**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	113.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.00 m depth	NORTHING		ASPECT	N	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0.5	113.50	P6121/102/0.1/S/1 D 0.10 m			CL-CI	FILL: Silty CLAY, low to medium plasticity, light brown, grey and red-brown, with fine to medium grained gravels, inferred firm, moderate structure.	D	F	FILL
					P6121/102/0.5/S/1 D 0.50 m							
				0.70								
	M		1.0	112.80	P6121/102/1.0/S/1 D 1.00 m			CI	Silty CLAY, medium plasticity, red-brown, with grey bands, trace claystone gravels, inferred stiff to very stiff, moderate structure.		St - VSt	RESIDUAL SOIL
				1.10								
AD/T	L		1.5	112.40	P6121/102/1.5/R/1 D 1.50 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.10: V-bit refusal.
				1.80								
	H		2.0	111.70					Inferred low strength.			
				2.00					Hole Terminated at 2.00 m			2.00: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH103**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.30 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00				ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
				106.70				CI	Silty CLAY, medium plasticity, red-brown, with brown and grey bands, trace claystone gravels, inferred stiff to very stiff, moderate structure.			RESIDUAL SOIL
	M		0.5		P6121/103/0.5/S/1 D 0.50 m					D	St - VSt	
					P6121/103/0.9/S/1 D 0.90 m							
			1.0	*1.00*								
AD/T	L			106.00					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.00: V-bit refusal.
			1.5		P6121/103/1.5/R/1 D 1.50 m							
				1.70								
				105.30					Inferred low strength.			
	H		2.0		P6121/103/2.0/R/1 D 2.00 m							
				2.30								
									Hole Terminated at 2.30 m			2.30: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH104**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	110 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.10 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				110.00								
AD/V	L	Not Encountered			P6121/104/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
				109.70				CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D		RESIDUAL SOIL
AD/V	L-M		0.5		P6121/104/0.5/S/1 D 0.50 m						St - VSt	
				0.80								
AD/T	M			109.20					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.80: V-bit refusal.
			1.0	*1.10*	P6121/104/1.0/R/1 D 1.00 m							
									Hole Terminated at 1.10 m			1.10: TC-bit refusal on inferred low to medium strength claystone.
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH105**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.40 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00	P6121/105/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30 106.70								
	L-M		0.5		P6121/105/0.5/S/1 D 0.50 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
	M-H			*0.70* 106.30								
AD/T	L		1.0		P6121/105/1.0/R/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.70: V-bit refusal.
	M			*1.40*	P6121/105/1.3/R/1 D 1.30 m				Hole Terminated at 1.40 m			1.40: TC-bit refusal on inferred low to medium strength claystone.
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH106**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	107 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.90 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	107.00	P6121/106/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30								
				106.70				CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.			RESIDUAL SOIL
	L-M		0.5		P6121/106/0.5/S/1 D 0.50 m					D	St - VSt	
				1.00								
AD/T	M		1.0	106.00	P6121/106/1.0/S/1 D 1.00 m				CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.00: V-bit refusal.
			1.5		P6121/106/1.5/R/1 D 1.50 m							
				1.90								
			2.0						Hole Terminated at 1.90 m			1.90: TC-bit refusal on inferred low to medium strength claystone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH107**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	104 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.60 m depth	NORTHING		ASPECT	NE	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	104.00	P6121/107/0.1/S/1 D 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit, light brown, with clay, inferred firm, moderate structure.		F	TOPSOIL
				0.30 103.70				CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred stiff to very stiff, moderate structure.	D	St - VSt	RESIDUAL SOIL
	L-M		0.5		P6121/107/0.5/S/1 D 0.50 m							
				0.90 103.10					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 0.90: V-bit refusal.
AD/T	M		1.0		P6121/107/1.0/R/1 D 1.00 m							
			1.5	*1.60*	P6121/107/1.5/R/1 D 1.50 m				Hole Terminated at 1.60 m			1.60: TC-bit refusal on inferred low to medium strength claystone.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH108**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	105.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.30 m depth	NORTHING		ASPECT	NW	SLOPE <5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V			0	105.50	P6121/108/0.1/S/1 0.10 m			ML	TOPSOIL: Silt LOAM, low liquid limit,brown, with clay, organic material, inferred firm, moderate structure.		S - F	TOPSOIL
				0.50								
	L		0.5	105.00	P6121/108/0.5/S/1 0.50 m			CL-CI	Silty CLAY, low to medium plasticity, dark brown, with red bands, inferred firm to stiff, moderate structure.	D / M		RESIDUAL SOIL
			1.0		P6121/108/1.0/S/1 1.00 m						F - St	
				1.50								
			1.5	104.00	P6121/108/1.5/S/1 1.50 m			CI-CH	Medium CLAY, medium to high plasticity, brown and red-brown, with fine grained claystone gravels, inferred stiff, moderate structure.			
			2.0		P6121/108/2.0/S/1 2.00 m					M		
			2.5		P6121/108/2.5/S/1 2.50 m							
	L-M	Water inflow.	3.0								St	
			3.5							W		
			4.0									
				4.30								
			4.5						Hole Terminated at 4.30 m			4.30: V-bit refusal on inferred very low strength claystone.

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CLIENT	Mr Elias & Mr Maltese & Mr Petro.		COMMENCED	12/01/2018	COMPLETED	12/01/2018	**REF BH109**
PROJECT	Prelim. Salinity & Geotechnical Investigation		LOGGED	DO	CHECKED	HN/RE	Sheet 1 OF 1
SITE	1111 - 1141 Elizabeth Drive, Cecil Park , NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1706121
EQUIPMENT		4WD ute-mounted drill rig	EASTING		RL SURFACE	100.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.80 m depth	NORTHING		ASPECT	NW	SLOPE <10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	100.50 ***0.10***				CL-CI	TOPSOIL: Silty CLAY, low to medium plasticity, brown and grey, inferred soft to firm, moderate structure.		S - F	TOPSOIL
				100.40	P6121/109/0.1/S/1 0.10 m			CI	Silty CLAY, medium plasticity, brown and red-brown, trace claystone gravels, inferred firm to stiff, moderate structure.			RESIDUAL SOIL
	L-M		0.5		P6121/109/0.5/S/1 0.50 m						F - St	
				1.00						D		
			1.0	99.50 *1.10*	P6121/109/1.0/S/1 1.00 m			CI	Medium CLAY, medium plasticity, red-brown with grey bands, with fine grained claystone gravels, inferred stiff to very stiff, moderate structure.			
	M										St - VSt	
			1.5		P6121/109/1.5/S/1 1.50 m							
				1.60								
AD/T				98.90					CLAYSTONE, brown, inferred very low strength, distinctly weathered.			WEATHERED ROCK 1.60: V-bit refusal.
				1.80					Hole Terminated at 1.80 m			1.80: TC-bit refusal on inferred low to medium strength claystone.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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