Infiltration Basin Sediment Analysis
Earnshaw Street, Golden Beach

Prepared for:
Yolanda Burt
Transport and Infrastructure Policy
Regional Strategy and Planning
Sunshine Coast Council

Report Number: J000196-002-R-Rev0

March 2016

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1.0 INTRODUCTION

Core Consultants Pty Ltd (Core) was requested by Sunshine Coast Council (SCC) (Yolanda Burt) to undertake a sediment sampling and analysis program of sediments contained within an infiltration basin located at Earnshaw Street, Golden Beach. The aim of the sampling and analysis program was to determine if the sediments contained any potential contaminants of concern and the extent to which any potentially contaminated sediment had infiltrated within the subsurface soil profile. The location of the site is shown on Plate 1.

2.0 SITE DESCRIPTION

The infiltration basin is located at the junction of Earnshaw Street and The Esplanade, Golden Beach. The site is owned and maintained by Sunshine Coast Council and is surrounded by parkland and recreational facilities with Pumicestone Passage located approximately 10 metres to the east. The infiltration basin is vegetated with a mixture of typical wetland species both native and introduced grasses and reeds.

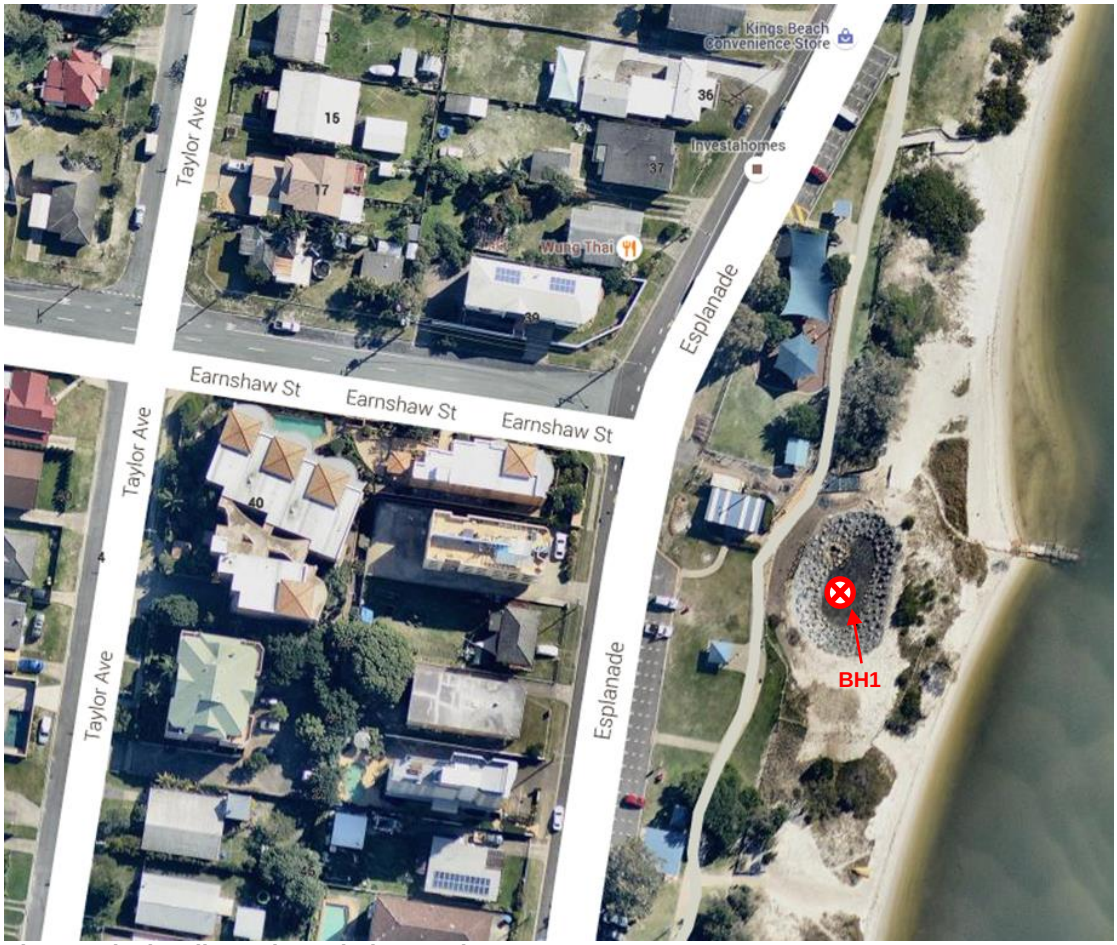


Plate 1: Site locality and Borehole Location.

3.0 INVESTIGATION METHODOLOGY

3.1 Field Investigation

For the purpose of this investigation Core undertook one borehole within the infiltration basin to identify subsurface conditions at the site (refer Plate 1).

The borehole was undertaken using a combination of hand held piston corer and hand augering to recover soil samples to a depth of 0.75 m below ground level (m BGL). The fieldwork was carried out by an experienced environmental scientist from Core on 4 March 2016. The approximate location of the borehole was recorded using a hand-held GPS unit with a differential correction signal, having an accuracy of ± 3 m. Borehole coordinates are presented on the borehole report and accompanying photographs in Appendix A. Subsurface conditions are discussed in Section 4.1.

Sediment samples were collected in accordance with Australian Standards. These procedures include decontamination, sample handling, sample storage and chain of custody documentation. Sediment samples were collected at the following depth intervals;

- Surface 0.0 – 0.05 m BGL
- 0.05 to 0.2 m BGL and
- 0.4 to 0.5 m BGL

The selected samples were submitted for laboratory analysis for the following chemical compounds:

- Total Recoverable Hydrocarbons (TRH), Benzene Toluene Ethylbenzene Xylenes and Naphthalene (BTEXN), Total Nitrogen, Total Phosphorous, and Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Zinc and Mercury);
- E.Coli plus Faecal Coliforms;
- Particle Size Distribution (PSD) analysis (via Sieve and Hydrometer).

Laboratory analysis was conducted by Eurofins/MGT. Eurofins/MGT are National Association of Testing Authorities (NATA) accredited for the tests conducted.

4.0 RESULTS OF THE INVESTIGATION

4.1 Subsurface Conditions

The subsurface soil profile encountered within the infiltration basin generally consisted of:

- Organic Clay Silt: comprising very dark grey, very soft, low plasticity, clayey silt with abundant organics to depths of 0.05 m BGL; overlying
- Geo-fabric; overlying
- Sand: generally comprising grey, wet, medium dense, predominantly fine to medium grained sand to depth of investigation (0.75 m BGL)

No visual or olfactory evidence of contamination was observed within the sediment profiles during drilling/coring (Refer Appendix A).

It should be noted that very low to negligible levels of fine sediment was observed within the underlying sand material (most likely a result of the geo-fabric). This is further supported and confirmed by the results of the particle size distribution testing which are presented in Appendix B.

4.2 Sediment Contamination Analytical Results

Samples analysed for the contamination suite of parameters generally recorded concentrations below the laboratory level of reporting (LOR) except for BH1 (0.0-0.05 m BGL) where concentrations of TRH fractions C16-C34 (120mg/kg) and C34-C40 at (140 mg/kg) were observed slightly above their levels of reporting at 100 mg/kg.

In addition, concentrations of arsenic, chromium, copper, lead, nickel and zinc were observed above the laboratory LOR in BH1 (0.0-0.05 m BGL) with the concentration recorded for zinc (340 mg/kg) at a level which would likely exceed the NEPM 2013 Environmental Investigation Limits for Urban Residential and Public Open Space. It should be noted that the EIL's adopted for comparative purposes are considered conservative and site specific EIL's should be developed. The remaining samples BH1 (0.05-0.2 m BGL) and BH1 (0.4-0.5 m BGL) generally returned metals concentrations below the laboratory LOR for the parameters analysed.

High levels of total nitrogen and phosphorus were recorded in BH1 (0.0-0.05 m BGL) with concentrations of 3200 mg/kg and 1000 mg/kg respectively while the samples from the lower soil profile were below the laboratory LOR. High total nitrogen and phosphorus concentrations would be expected in a constructed wetland environment such as the infiltration basin.

From a contamination perspective the above results suggest that the surface sediments within the infiltration basin pose a low risk to the surrounding environment, while the sediments from the lower soil profile do not indicate a potential contamination risk to surrounding environment or human health. These findings are considered typical of an infiltration or sediment basin scenario, as such, the infiltration basin is operating as it should in trapping the sediments, particular matter and potential contaminants from the water column.

Laboratory certificates of analysis are presented in Appendix C.

4.3 Pathogens

The results of pathogen analysis of the samples analysed indicated that E. Coli concentrations within the upper soil profile BH1 (0.0-0.05 m BGL) and BH1 (0.05-0.2 m BGL) were generally found to be above the laboratory LOR with concentrations of 45 MPN/g (Most Probable Number/gram) and 20 MPN/g respectively. While concentrations of thermotolerant coliforms were found to range from 45 MPN/g to >16,000 MPN/g with the highest concentrations being recorded in the surface sample BH1 (0.0-0.5 m BGL).

The above results of the pathogen analysis suggest that the surface sediments within the infiltration basin, if released, could pose a potential risk to the surrounding environment and human health.

Laboratory certificates of analysis are presented in Appendix C.

It is worth noting for comparative purposes that the ANZECC Guidelines Section 5.2 (Recreational Waters Secondary Contact) criteria for thermotolerant coliforms lists the following concentration criteria; *secondary contact should not exceed 1000 organisms/100 ml*.

5.0 CONCLUSION

Based on the results of this sediment analysis assessment there appears to be an indication of historical or current contamination impact on the surface sediments within the infiltration basin, while the underlying sediments generally indicate little or no contamination impact. On the basis of these findings and from a contamination perspective, the surface sediments within the infiltration would be considered to pose a low risk to the surrounding environment and human health. However, results of pathogen analysis indicate that surface sediments could potentially pose a risk to the environment and human health if released.

It is recommended that Council develop and implement a regular (6 monthly) maintenance program for the removal and appropriate disposal of the surface sediments from within the infiltration basin to a licensed landfill facility.

6.0 LIMITATIONS

Should you require any further information please contact the undersigned. We draw your attention to the document, Limitations, which is included in Appendix D.

Core Consultants Pty Ltd

Yours sincerely,

Lyndon Gordon BSc (EnvSc (Hons)) MEIANZ CEnvP
Senior Environmental Scientist

Josh Mitchell BSc (EnvSc) MEIANZ CEnvP CPSS
Associate

LG/JM/lg

A.B.N. 75 603 384 050

APPENDIX A

Borehole Log Report

core consultants

clarity • commitment • passion

REPORT OF BOREHOLE: BH1

CLIENT:	SCC Infiltration Basin	POSITION:	E. 512096 N. 7033997	DRILL RIG:	Hand Auger		
PROJECT:	Sedimnet Analysis			DRILLER:	LG		
LOCATION:	Earnshaw St, Golden Beach	INCLINATION:-90°		LOGGED:	LG	DATE:	11/03/2016
JOB NO:	J000196	HOLE DIA: 100 mm	DEPTH: 1.0 m	CHECKED:	JM	DATE:	12/03/2016

Depth	Bagged Sample	USCS	Description	Moisture	Observations
0.05	BH1 0.0-0.05 m	OL	Clay Silt - very dark grey, very soft, low plasticity, abundant organics	w	0A abundant organics
0.2	BH1 0.05-0.2 m	SP	Sand - grey, wet, medium dense, fine to medium grained sand, trace silt/clay	W	0A
0.75	BH1 0.4-0.5 m				
			Cave in at 0.75 m bgl		
			End of hole at 0.75 m bgl. Refusal		

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

 FILL

 GRAVEL (GP or GW)

 SAND (SP or SW)

 SILT (ML or MH)

 CLAY (CL, CI or CH)

 ORGANIC SOILS (OL or OH or Pt)

 COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

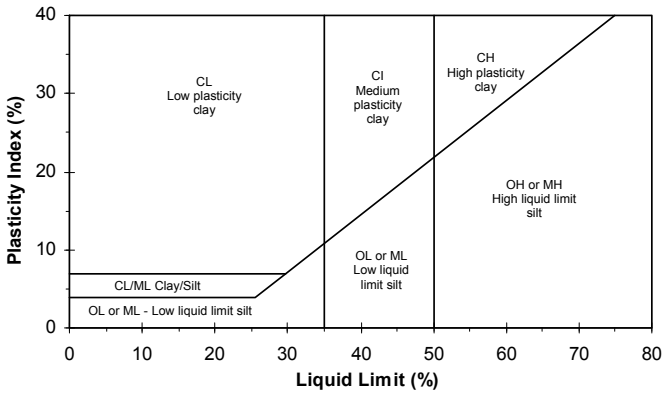
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, (Amdt1 – 1994 and Amdt2 – 1994), Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

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

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.

APPENDIX B

Particle Size Distribution; Certificates of Analysis

Particle Size Distribution

- Australian Standard sieves

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 38310 | **Sample N°: 1** | **Date Received: 9/3/16** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Eurofins - MGT Environmental**	Project Name:	**Ref: 491942**
Client Contact:	**Eurofins Report**	SESL Quote N°:	
Client Job N°:		Sample Name:	**B16-Ma06763 (BH0.05-0.2)**
Client Order N°:	**B16-026-491942**	Description:	**Soil**
Address:	**PO Box 276 Oakleigh VIC 3166**	Test Type:	**PSA_AS**

SUMMARY

Analysed by SESL Australia NATA #15633

No commentary requested.

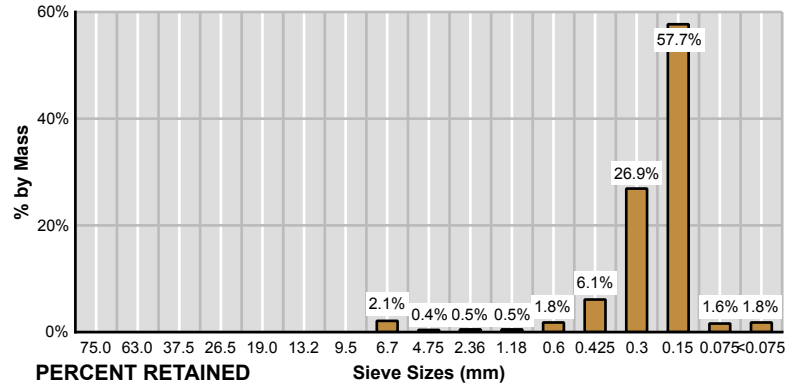
D VALUES

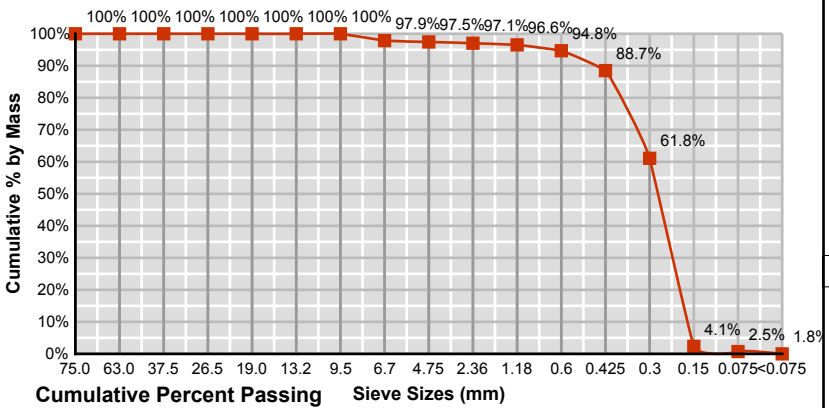
D_{95}:	0.65
D_{90}:	0.46
D_{85}:	0.41
D_{60}:	0.30
D_{50}:	0.27
D_{15}:	0.18
D_{10}:	0.17
D_5:	0.15

PERFORMANCE FACTORS

Gradation Index (D_{90}/D_{10}):	2.80
Coefficient of Uniformity: (D_{60}/D_{10})	1.79

PARTICLE SIZE DISTRIBUTION GRAPH





PARTICLE SIZE ANALYSIS

Sieve (mm)	Fraction	% Retained by mass	% Passing by mass
75.0	Cobbles	0	100
63.0	Very Coarse Gravel	0	100
37.5	Coarse Gravel	0	100
26.5	Coarse Gravel	0	100
19.0	Medium Gravel	0	100
13.2	Medium Gravel	0	100
9.5	Medium Gravel	0	100
6.7	Fine Gravel	2.06	97.94
4.75	Fine Gravel	0.42	97.52
2.36	Fine Gravel	0.47	97.05
1.18	Very Coarse Sand	0.45	96.6
0.6	Medium Sand	1.76	94.84
0.425	Medium Sand	6.14	88.7
0.3	Medium Sand	26.89	61.81
0.15	Fine Sand	57.68	4.13
0.075	Fine Sand	1.64	2.49
FINE PARTICLES (Hydrometer calculated)			
0.02	Very Fine Sand	0	1.84
0.002	Silt	0.92	0.92
<0.002	Clay	0.92	N/A

Consultant:
Andrew Jacovides

Authorised Signatory:
Kelly Lee

Date Report Generated
21/03/2016

Method Reference: SESL PM 0001 : Particle Size Analysis

Particle Size Distribution

- Australian Standard sieves

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 38310 | **Sample N°: 2** | **Date Received: 9/3/16** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Eurofins - MGT Environmental**	Project Name:	**Ref: 491942**
Client Contact:	**Eurofins Report**	SESL Quote N°:	
Client Job N°:		Sample Name:	**B16-Ma06764 (BH1 0.4-0.5)**
Client Order N°:	**B16-026-491942**	Description:	**Soil**
Address:	**PO Box 276 Oakleigh VIC 3166**	Test Type:	**PSA_AS**

SUMMARY

Analysed by SESL Australia NATA #15633

No commentary requested.

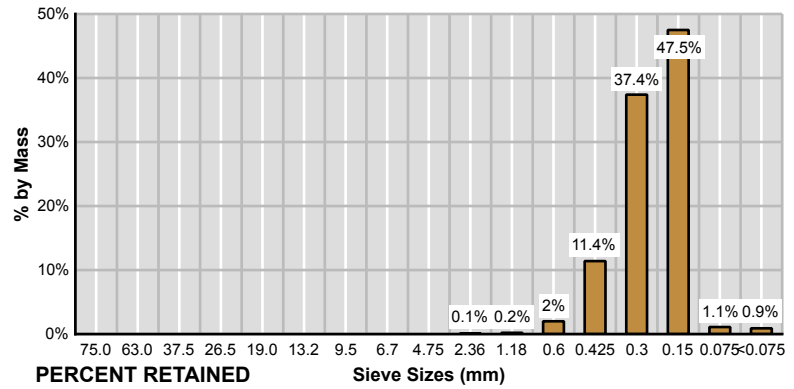
D VALUES

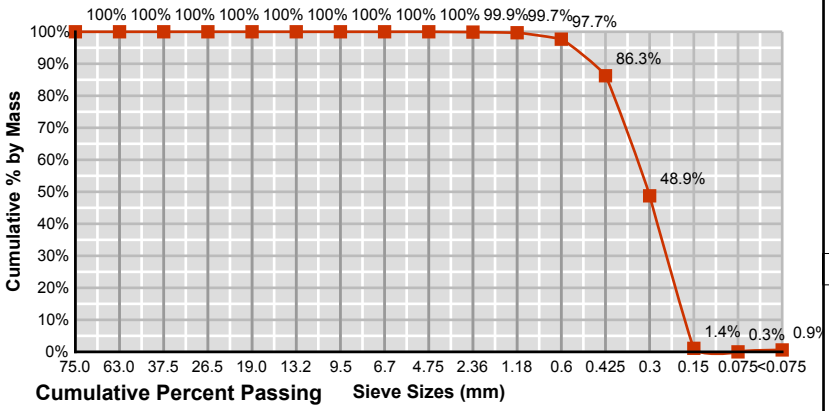
D_{95}:	0.56
D_{90}:	0.48
D_{85}:	0.42
D_{60}:	0.34
D_{50}:	0.30
D_{15}:	0.19
D_{10}:	0.18
D_5:	0.16

PERFORMANCE FACTORS

Gradation Index (D_{90}/D_{10}):	2.72
Coefficient of Uniformity: (D_{60}/D_{10})	1.90

PARTICLE SIZE DISTRIBUTION GRAPH





PARTICLE SIZE ANALYSIS

Sieve (mm)	Fraction	% Retained by mass	% Passing by mass
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63.0	Very Coarse Gravel	0	100
37.5	Coarse Gravel	0	100
26.5	Coarse Gravel	0	100
19.0	Medium Gravel	0	100
13.2	Medium Gravel	0	100
9.5	Medium Gravel	0	100
6.7	Fine Gravel	0	100
4.75	Fine Gravel	0.01	99.99
2.36	Fine Gravel	0.1	99.89
1.18	Very Coarse Sand	0.15	99.74
0.6	Medium Sand	2.03	97.71
0.425	Medium Sand	11.43	86.28
0.3	Medium Sand	37.39	48.89
0.15	Fine Sand	47.53	1.36
0.075	Fine Sand	1.06	0.31
FINE PARTICLES (Hydrometer calculated)			
0.02	Very Fine Sand	0	0.93
0.002	Silt	0.93	0
<0.002	Clay	0	N/A

Consultant: Andrew Jacovides

Authorised Signatory: Kelly Lee

Date Report Generated 21/03/2016

Method Reference: SESL PM 0001 : Particle Size Analysis

APPENDIX C

Laboratory Certificates of Analysis and Chain of Custody Documentation

eurofins | mgt

Certificate of Analysis

Core Consultants Pty Ltd
55 Kingford Smith Parade
Maroochydore
QLD 4558

NATA Accredited
Accreditation Number 1261
Site Number 20794 & 14271

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Josh Mitchell**

Report **491942-S**
Project name INFILTRATION BASIN
Project ID J000196
Received Date Mar 07, 2016

Client Sample ID			M01 **BH1 0.0-0.05**	M01 **BH1 0.05-0.2**	M01 **BH1 0.4-0.5**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B16-Ma06762**	**B16-Ma06763**	**B16-Ma06764**
Date Sampled			**Mar 04, 2016**	**Mar 04, 2016**	**Mar 04, 2016**
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	20	mg/kg	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	91	< 50	< 50
TRH C29-C36	50	mg/kg	130	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	220	< 50	< 50
BTEX					
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	55	54	115
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene N02	0.5	mg/kg	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	120	< 100	< 100
TRH >C34-C40	100	mg/kg	140	< 100	< 100
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
TRH C6-C10 less BTEX (F1) N04	20	mg/kg	< 20	< 20	< 20
TRH >C10-C16 less Naphthalene (F2) N01	50	mg/kg	< 50	< 50	< 50
Nitrate & Nitrite (as N)	5	mg/kg	< 5	< 5	< 5
Total Kjeldahl Nitrogen (as N)	10	mg/kg	3200	< 10	< 10
Total Nitrogen (as N)	10	mg/kg	3200	< 10	< 10
Phosphorus	5	mg/kg	1000	< 100	< 100
% Moisture	1	%	75	18	18
Particle Size Distribution by Sieve and Hydrometer			-	see attached	see attached
Heavy Metals					
Arsenic	2	mg/kg	9.4	< 2	< 2
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	34	< 5	< 5
Copper	5	mg/kg	44	< 5	< 5
Lead	5	mg/kg	35	< 5	< 5

Client Sample ID			[M01]BH1 0.0-0.05	[M01]BH1 0.05-0.2	[M01]BH1 0.4-0.5
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B16-Ma06762**	**B16-Ma06763**	**B16-Ma06764**
Date Sampled			**Mar 04, 2016**	**Mar 04, 2016**	**Mar 04, 2016**
Test/Reference	LOR	Unit			
Heavy Metals					
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	17	< 5	< 5
Zinc	5	mg/kg	340	5.3	< 5
Pathogens					
E.coli	1	MPN/g	45	20	<10
Thermotolerant Coliforms	1	MPN/g	[M10]>16000	[M10]700	[M10]45

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B6			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Mar 10, 2016	14 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
BTEX	Melbourne	Mar 09, 2016	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Mar 09, 2016	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Mar 10, 2016	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Metals M8	Melbourne	Mar 09, 2016	28 Day
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N)	Melbourne	Mar 10, 2016	28 Day
- Method: APHA 4500-NO3/NO2 Nitrate-Nitrite Nitrogen by FIA			
Total Kjeldahl Nitrogen (as N)	Melbourne	Mar 10, 2016	28 Day
- Method: APHA 4500 TKN			
Phosphorus	Melbourne	Mar 11, 2016	180 Day
- Method: USEPA 6010			
E.coli	Melbourne	Mar 11, 2016	72 Hour
- Method: LTM-MIC-6621			
Thermotolerant Coliforms	Melbourne	Mar 11, 2016	72 Hour
- Method: Inhouse: Thermotolerant Coliforms in Soil by MPN*			
% Moisture	Melbourne	Mar 08, 2016	14 Day
- Method: LTM-GEN-7080 Moisture			

eurofins | mgt

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NATA # 1261
Site # 1254 & 14271

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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Company Name: Core Consultants Pty Ltd
Address: 55 Kingford Smith Parade
Maroochydore
QLD 4558

Project Name: INFILTRATION BASIN
Project ID: J000196

Order No.:
Report #: 491942
Phone: 07 5475 5900
Fax:

Received: Mar 7, 2016 3:30 PM
Due: Mar 14, 2016
Priority: 5 Day
Contact Name: Josh Mitchell

Eurofins | mgt Client Manager: Ryan Gilbert

Sample Detail					E.coli	Particle Size Distribution by Sieve and Hydrometer	Phosphorus	Thermotolerant Coliforms	Total Nitrogen Set (as N)	Moisture Set	Eurofins | mgt Suite B6
Laboratory where analysis is conducted											
Melbourne Laboratory - NATA Site # 1254 & 14271					X		X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
External Laboratory						X					
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
BH1 0.0-0.05	Mar 04, 2016		Soil	B16-Ma06762	X		X	X	X	X	X
BH1 0.05-0.2	Mar 04, 2016		Soil	B16-Ma06763	X	X	X	X	X	X	X
BH1 0.4-0.5	Mar 04, 2016		Soil	B16-Ma06764	X	X	X	X	X	X	X

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (Eurofins | mgt uses NATA accredited in-house method LTM-GEN-7010)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/kg	< 5			5	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	78			70-130	Pass	
TRH C10-C14	%	90			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	88			70-130	Pass	
Toluene	%	77			70-130	Pass	
Ethylbenzene	%	76			70-130	Pass	
m&p-Xylenes	%	75			70-130	Pass	
Xylenes - Total	%	75			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	91			70-130	Pass	
TRH C6-C10	%	71			70-130	Pass	
TRH >C10-C16	%	88			70-130	Pass	
LCS - % Recovery							
Nitrate & Nitrite (as N)	%	107			70-130	Pass	
LCS - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heavy Metals									
Arsenic			%	88			80-120	Pass	
Cadmium			%	88			80-120	Pass	
Chromium			%	93			80-120	Pass	
Copper			%	88			80-120	Pass	
Lead			%	93			80-120	Pass	
Mercury			%	112			75-125	Pass	
Nickel			%	94			80-120	Pass	
Zinc			%	93			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	B16-Ma07108	NCP	%	78			70-130	Pass	
TRH C10-C14	M16-Ma04835	NCP	%	89			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	B16-Ma07108	NCP	%	84			70-130	Pass	
Toluene	B16-Ma07108	NCP	%	80			70-130	Pass	
Ethylbenzene	B16-Ma07108	NCP	%	81			70-130	Pass	
m&p-Xylenes	B16-Ma07108	NCP	%	83			70-130	Pass	
o-Xylene	B16-Ma07108	NCP	%	80			70-130	Pass	
Xylenes - Total	B16-Ma07108	NCP	%	82			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	B16-Ma07108	NCP	%	71			70-130	Pass	
TRH C6-C10	B16-Ma07108	NCP	%	71			70-130	Pass	
TRH >C10-C16	M16-Ma04835	NCP	%	87			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	B16-Ma06762	CP	%	100			75-125	Pass	
Cadmium	B16-Ma06762	CP	%	91			75-125	Pass	
Chromium	B16-Ma06762	CP	%	96			75-125	Pass	
Copper	B16-Ma06762	CP	%	103			75-125	Pass	
Lead	B16-Ma06762	CP	%	96			75-125	Pass	
Mercury	B16-Ma06762	CP	%	104			70-130	Pass	
Nickel	B16-Ma06762	CP	%	94			75-125	Pass	
Zinc	B16-Ma06762	CP	%	91			75-125	Pass	
Spike - % Recovery									
				Result 1					
Nitrate & Nitrite (as N)	B16-Ma06763	CP	%	89			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	B16-Ma07117	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M16-Ma04804	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M16-Ma04804	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M16-Ma04804	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	B16-Ma07117	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	B16-Ma07117	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	B16-Ma07117	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	B16-Ma07117	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	

Duplicate									
BTEX				Result 1	Result 2	RPD			
o-Xylene	B16-Ma07117	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	B16-Ma07117	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	B16-Ma07117	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	B16-Ma07117	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M16-Ma04804	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M16-Ma04804	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M16-Ma04804	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Nitrate & Nitrite (as N)	B16-Ma06762	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	B16-Ma06762	CP	mg/kg	9.4	15	43	30%	Fail	Q15
Cadmium	B16-Ma06762	CP	mg/kg	< 0.4	0.7	83	30%	Fail	Q15
Chromium	B16-Ma06762	CP	mg/kg	34	34	1.0	30%	Pass	
Copper	B16-Ma06762	CP	mg/kg	44	45	<1	30%	Pass	
Lead	B16-Ma06762	CP	mg/kg	35	34	4.0	30%	Pass	
Mercury	B16-Ma06762	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	B16-Ma06762	CP	mg/kg	17	17	3.0	30%	Pass	
Zinc	B16-Ma06762	CP	mg/kg	340	350	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B16-Ma06764	CP	%	18	18	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
M01	Microbiological Testing performed outside the recommended holding time
M10	NATA accreditation does not cover the performance of this service in soil matrices
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Ryan Gilbert	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Ian Bolch	Senior Analyst-Microbiology (VIC)
Mele Singh	Senior Analyst-Organic (VIC)

Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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NATA # 1261 Site # 20794

Company Name: Core Consultants Pty Ltd
Address: 55 Kingford Smith Parade
Maroochydore
QLD 4558

Project Name: INFILTRATION BASIN
Project ID: J000196

Order No.:
Report #: 491942
Phone: 07 5475 5900
Fax:

Received: Mar 7, 2016 3:30 PM
Due: Mar 14, 2016
Priority: 5 Day
Contact Name: Josh Mitchell

Eurofins | mgt Client Manager: Ryan Gilbert

Sample Detail					E.coli	Particle Size Distribution by Sieve and Hydrometer	Phosphorus	Thermotolerant Coliforms	Total Nitrogen Set (as N)	Moisture Set	Eurofins | mgt Suite B6
Laboratory where analysis is conducted											
Melbourne Laboratory - NATA Site # 1254 & 14271					X		X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
External Laboratory						X					
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
BH1 0.0-0.05	Mar 04, 2016		Soil	B16-Ma06762	X		X	X	X	X	X
BH1 0.05-0.2	Mar 04, 2016		Soil	B16-Ma06763	X	X	X	X	X	X	X
BH1 0.4-0.5	Mar 04, 2016		Soil	B16-Ma06764	X	X	X	X	X	X	X

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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Sample Receipt Advice

Company name:	**Core Consultants Pty Ltd**
Contact name:	Josh Mitchell
Project name:	INFILTRATION BASIN
Project ID:	J000196
COC number:	TR-01
Turn around time:	5 Day
Date/Time received:	Mar 7, 2016 3:30 PM
Eurofins | mgt reference:	**491942**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ryan Gilbert on Phone : or by e.mail: Ryangilbert@eurofins.com

Results will be delivered electronically via e.mail to Josh Mitchell - jmitchell@coreconsult.com.au.

TEST REQUEST FORM

Eurofins | MGT
Unit 1/21 Smallwood Place, QLD 4172
Phone: 3902 4600

Order No.: TR-01
Job No.: J000196
Job Name: Infiltration Basin
C.O.C. No.: TR-01 Quotation No. #150417COR
Sampled By: Lyndon Gordon Contact Name: Lyndon 0404 0503 26
Email Report to: lgordon@coreconsult.com.au; jmitchell@coreconsult.com.au
Prior Storage:

SAMPLE ID	Sample Depth (m)	Media	No. of Bags	No. of Bottles	SAMPLE DATE	Suite B6 - TRH/BTEXN/8 Metals	MIC6 - E.Coli plus Faecal Coliforms	Total Nitrogen	Total Phorphorus	PSD Analysis (Sieve and Hydrometer)											Remarks and or Other Details
BH1	0.0-0.0.05	Soil	1	1	4/03/2016	X	X	X	X												
BH1	0.05 - 0.2	Soil	1	1	4/03/2016	X	X	X	X	X											
BH1	0.4 - 0.5	Soil	1	1	4/03/2016	X	X	X	X	X											

Checked by:
Date Sent:

Date Received By Eurofins: R. Gow
7-3-16 3.30 pm
11.6°C ice

Parkual
491942

core consultants pty ltd
55 Kingsford Smith Parade
Maroochydore QLD 4558
Phone: 5475 5900

APPENDIX D

Limitations

LIMITATIONS

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