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Our Ref: 217500_LET_007.docx

4 November 2019

Lithgow City Council
PO Box 19,
180 Mort Street
Lithgow NSW 2790

Attention: Nigel Campbell, Waste & Recycling Coordinator

ENVIRONMENTAL MONITORING OF PORTLAND WASTE DISPOSAL DEPOT

Premise has completed annual groundwater monitoring at Portland Waste Disposal Depot, located off the Portland Cullen Bullen Road, approximately 2 km north of Portland, NSW.

Groundwater Levels

Groundwater was gauged at six (6) groundwater monitoring wells across the site. Groundwater gauging data is included in **Table 1** (attached), and elevation trends are shown on **Figure 1**. No groundwater was recorded in monitoring stations MP1 and MP3. Observations were as follows:

- Depths to groundwater ranged from 0.87 metres below ground level (mbgl) at MP9, to 25.93 mbgl at MP5. Corrected groundwater elevations ranged from 904.03 metres Australian Height Datum (mAHD) at MP9, to 912.07 mAHD at MP5.
- Inference of groundwater elevations, calculated from available survey data from installed groundwater monitoring wells, indicates a flow direction to the north-west.

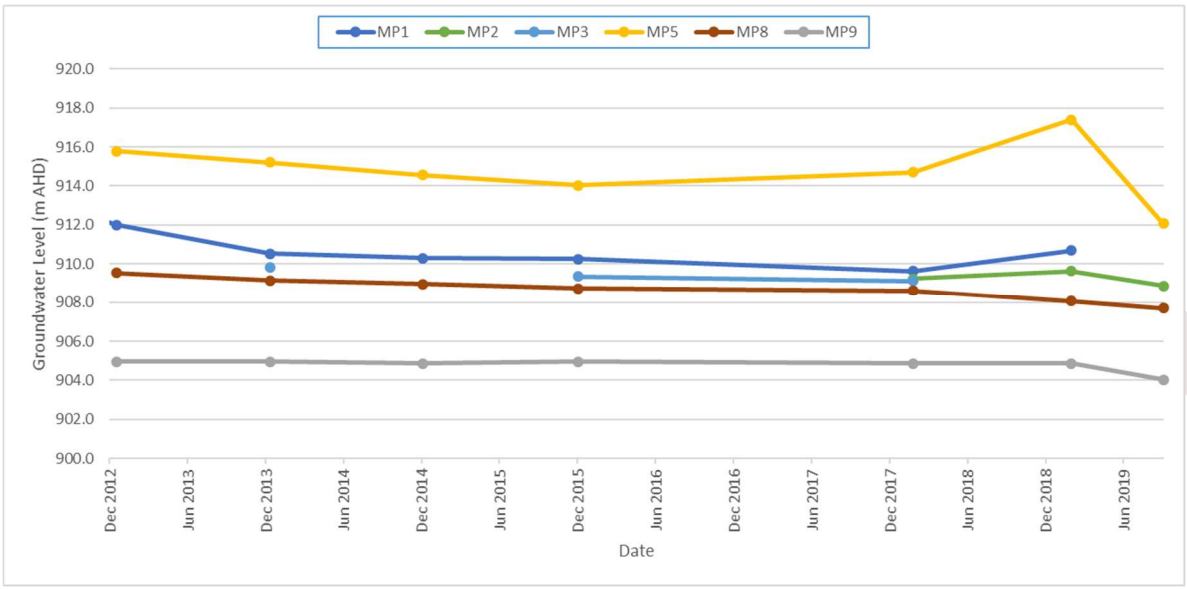


Figure 1: Portland Waste Disposal Depot – Groundwater Elevations

Groundwater Quality

Groundwater samples were able to be collected from wells MP5, MP8 and MP9. Groundwater at monitoring location MP2 did not recharge following purging and no sample could be collected. Samples were couriered to SGS Laboratories in Alexandria, NSW, who are NATA accredited to perform the scheduled analysis. Results of analysis are included in **Table 2** (attached), and laboratory certificates have also been appended to this letter.

Groundwater quality has been assessed by comparison to criteria (where available) adopted from Australian and New Zealand Environment and Conservation Council (ANZECC) Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* 2000 – Primary Industries: Water quality for irrigation and general water use.

- Laboratory measured pH ranged from 6.7 at MP8 to 6.9 at MP5 and MP9. Groundwater was within the guideline range considered suitable for pumping, irrigation and stock watering (6.0 to 8.5 pH units).
- Electrical conductivity (EC) ranged from 1700 µS/cm at piezometer MP5 to 3100 µS/cm at piezometers MP8 and MP9.
- Total dissolved solid (TDS) concentrations ranged from 1000 mg/L at piezometer MP5 to 1900 mg/L at piezometers MP8 and MP9, and identify the surface water did not exceed the livestock watering 'loss of production' TDS tolerance limit for the most sensitive livestock category, poultry (3,000 mg/L, ANZECC & ARMCANZ, 2000).
- Total alkalinity in groundwater ranged from 480 mg/L at MP5 to 640 mg/L at MP9. Groundwater alkalinity at MP5, MP8 and MP9 was above the guideline hardness value for potential fouling of waters (350 mg/L).
- Groundwater chloride concentrations ranged from 100 mg/L at MP5 to 360 mg/L at MP8. The chloride concentration recorded at MP8 exceeded the guideline value for protection of moderately sensitive crops (350 mg/L).
- Fluoride concentrations in groundwater ranged from 0.21 mg/L at MP8, to 0.25 mg/L at MP5. All concentrations were below the guideline value of 1 mg/L for long term irrigation use (up to 100 years).
- Sulfate concentrations in groundwater ranged from 520 mg/L at MP5 to 1100 mg/L at MP8 and MP9.
- Calcium concentrations ranged from 210 mg/L at MP5 to 350 mg/L at MP8.
- Magnesium concentrations ranged from 86 mg/L at MP5 to 210 mg/L at MP9.
- Potassium concentrations ranged from 8.0 mg/L at MP9 to 10 mg/L at MP5.
- Concentrations of sodium ranged from 96 mg/L at MP5 to 220 mg/L at MP8. Sodium concentrations in groundwater samples did not exceed the guideline level for irrigation to moderately sensitive crops (<230 mg/L).
- Total organic carbon (TOC) in groundwater ranged from 1.7 mg/L at MP9 to 4.2 mg/L at MP5.
- Ammonia concentrations in groundwater ranged from 0.031 mgN/L at MP9 to 0.15 mgN/L at MP5.
- Nitrate concentrations ranged from below the laboratory limit of reporting (LOR) of 0.025 mgN/L at MP8 and MP9, to 0.084 mgN/L at MP5.
- Iron concentrations ranged from 0.037 mg/L at MP9 to 0.81 mg/L at MP1. The iron concentration recorded in the groundwater samples collected from MP5 and MP8 exceeded the long-term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.

- Manganese concentrations ranged from 0.66 mg/L at MP9 to 4.8 mg/L at MP8. Manganese concentrations at all locations exceeded the long-term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.
- Total phenols were below the laboratory LOR of 0.01 mg/L at all groundwater monitoring points.
- Organochlorine pesticides were below respective laboratory LORs at all groundwater monitoring points.

Surface Water Discharge Monitoring

The surface water monitoring point SW1 was inspected in September 2019. No discharge was occurring at the time of inspection, and no evidence of discharge(s) having occurred prior was apparent.

The next routine monitoring for groundwater is scheduled for September 2020. Surface water monitoring is required to take place any calendar month when a surface water discharge is recorded at an interval of not less than once every 6 months.

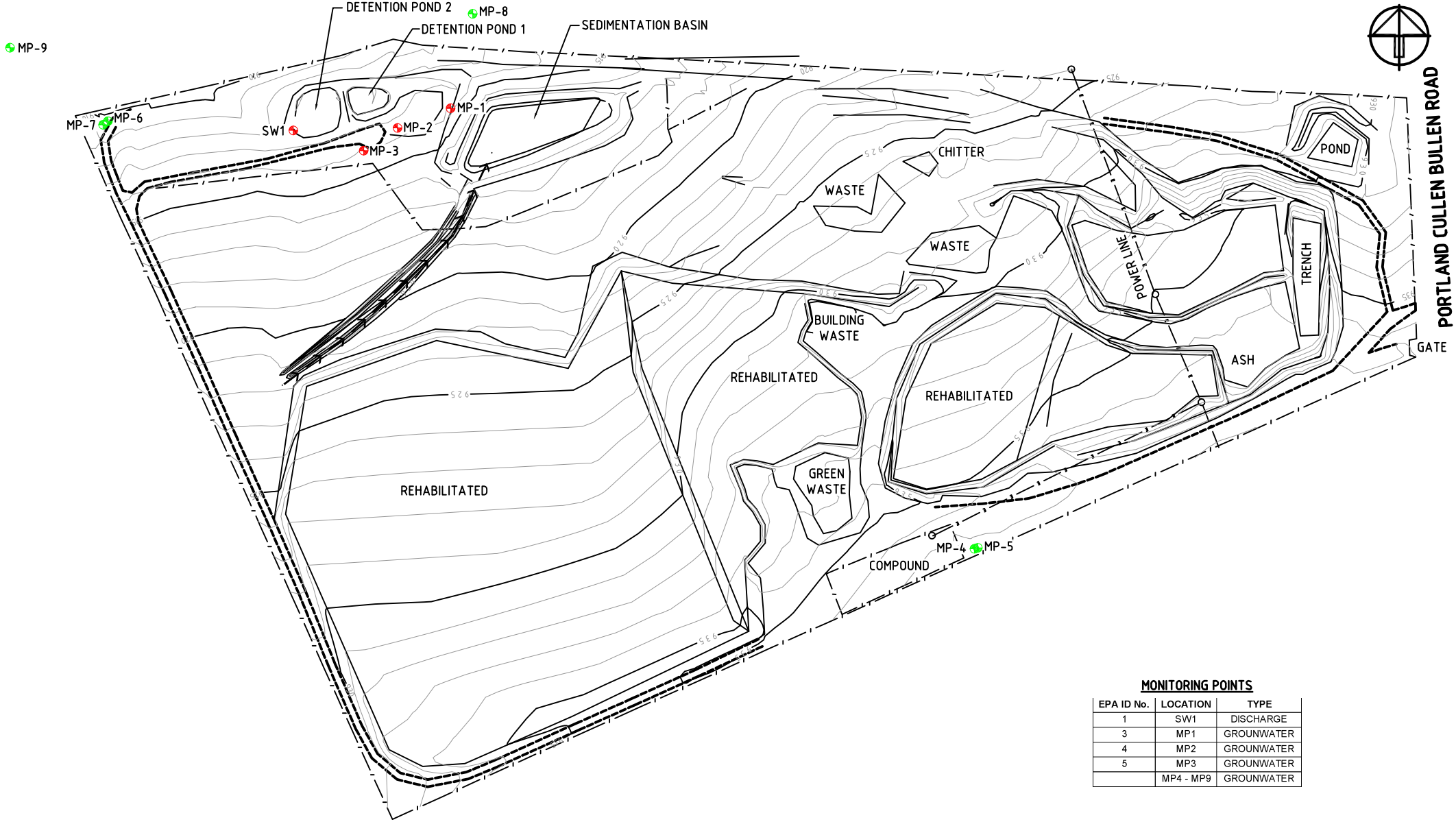
Please do not hesitate to contact us with any questions or comments you may have regarding this report.

Yours faithfully

Premise Australia Pty Ltd

BRENDAN STUART
Environmental Scientist

No. of Attachments – 4: Environmental Monitoring Point Locations
Table 1 – Groundwater Level Measurements
Table 2 – Results of Laboratory Analyses – September 2019
SGS Laboratories Analytical Reports – September 2019



MONITORING POINTS

EPA ID No.	LOCATION	TYPE
1	SW1	DISCHARGE
3	MP1	GROUNWATER
4	MP2	GROUNWATER
5	MP3	GROUNWATER
	MP4 - MP9	GROUNWATER

LEGEND:

- EPA MONITORING POINT
- ADDITIONAL MONITORING POINT

0 20 40 60 80 100

APPROX. SCALE

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ORANGE, NSW 2800
Ph. (02) 6362 1055
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No	DATE	DRAFTING CHECK	PM CHECK	DETAILS
A	15/09/08	-	-	ISSUED TO CLIENT
B	11/05/11	LRP	AGB	ISSUED TO CLIENT
C	01/11/12	MDH	KBF	ISSUED TO CLIENT

PROJECT: PORTLAND WASTE DISPOSAL DEPOT

FILE REFERENCE: O:\Projects\202334_01B_EV01.dwg

APPROVAL AUTHORITY: ENVIRONMENTAL PROTECTION AUTHORITY EPL: 10936

CLIENT: LITHGOW CITY COUNCIL, 180 MORT STREET, LITHGOW NSW 2790

DRAWING: ENVIRONMENTAL MONITORING POINTS

PROJECT NUMBER: 202334 DRAWING NUMBER: 01C_EV01 REV. C

SOURCE: CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD. CONSULTING LAND, ENGINEERING AND MINING SURVEYORS

TABLE 1: PORTLAND WASTE DISPOSAL DEPOT - GROUNDWATER LEVEL RESULTS

Ground Water Levels: 02-Sep-19

Piezometer Details:

	Ground Elev (mAHD)	Stickup (m)	Elevation Top PVC (mAHD)	Date	Measured (m)	GWL (mAHD)	Well Depth (m)	Well Base (mAHD)	Water Column (m)
MP1	913.700	0.40	914.100	02/09/2019	NMWL	-	6.0	908.09	nil
MP2	913.600	0.20	913.800	02/09/2019	4.92	908.88	5.0	908.80	0.08
MP3	914.200	0.60	914.800	02/09/2019	NMWL	-	5.8	909.00	nil
MP5	937.200	0.80	938.000	02/09/2019	25.93	912.07	61.3	876.70	35.37
MP8	911.800	0.50	912.300	02/09/2019	4.61	907.69	21.5	890.79	16.90
MP9	903.800	1.10	904.900	02/09/2019	0.87	904.03	16.7	888.20	15.83

Definitions:

Stickup:	Height of piezometer pipe above ground surface.
Ground Elev:	Actual elevation of ground at the piezometer relative to an arbitrary datum. All ground elevations are measured to the same datum, hence Piezo GWLs are relative to each other.
GWL:	Actual elevation of groundwater at the piezometer relative to an arbitrary datum.
NMWL:	No Measured Water Level
Measured:	Depth of groundwater measured from the top of the piezometer pipe.

	MP1		**MP2**		**MP3**		**MP5**		**MP8**		**MP9**	
Date	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)
01-Jun-10	4.21	909.89	NMWL		NMWL		30.20	907.80	4.48	907.82	0.00	904.90
15-Dec-10	1.23	912.87	NMWL		NMWL		27.37	910.63	3.44	908.86	-0.05	904.95
29-Jun-11	1.30	912.80	NMWL		5.65	909.15	25.67	912.33	3.62	908.68	-0.05	904.95
27-Jul-11	1.57	912.53	NMWL		NMWL		NMWL		NMWL		NMWL	
06-Dec-11	1.14	912.96	3.85	909.95	NMWL		25.40	912.60	Bore Damaged		-0.05	904.95
13-Jun-12	0.70	913.40	NMWL		4.48	910.32	NMWL		NMWL		NMWL	
16-Dec-12	2.09	912.01	NMWL		NMWL		22.22	915.78	2.77	909.53	-0.05	904.95
11-Dec-13	3.57	910.53	NMWL		4.98	909.82	22.79	915.21	3.16	909.14	-0.05	904.95
04-Dec-14	3.80	910.30	NMWL		NMWL		23.43	914.57	3.33	908.97	0.05	904.85
03-Dec-15	3.84	910.26	NMWL		5.45	909.35	23.97	914.03	3.57	908.73	-0.05	904.95
24-Jan-18	4.46	909.64	4.56	909.24	5.68	909.12	23.30	914.70	3.68	908.62	0.05	904.85
30-Jan-19	3.40	910.70	4.18	909.62	NMWL		20.61	917.39	4.23	908.07	0.05	904.85
02-Sep-19	NMWL		4.92	908.88	NMWL		25.93	912.07	4.61	907.69	0.87	904.03

TABLE 2: PORTLAND WASTE DISPOSAL DEPOT - RESULTS OF LABORATORY ANALYSIS
SEPTEMBER 2019

				Sample ID	MP-5	MP-8	MP-9
				Sample Date	02/09/2019	02/09/2019	02/09/2019
Group	**Analyte**	**LOR**	**Units**	**Criteria**	PS	PS	PS
Physical Parameters	pH (Lab)	0	No unit	6.0 - 8.5	**6.9**	**6.7**	**6.9**
	Total Dissolved Solids	2	mg/L	-	**1000**	**1900**	**1900**
	Electrical Conductivity (Lab)	2	µS/cm	4478	**1700**	**3100**	**3100**
Alkalinity	Bicarbonate Alkalinity as CaCO3	5	mg/L	-	**480**	**590**	**640**
	Carbonate Alkalinity as CaCO3	1	mg/L	-	< 1	< 1	< 1
	Hydroxide Alkalinity as CaCO3	5	mg/L	-	< 5	< 5	< 5
	Phenolphthalein Alkalinity as CaCO3	5	mg/L	-	< 5	< 5	< 5
	Total Alkalinity as CaCO3	5	mg/L	350	**480**	**590**	**640**
Anions	Chloride	0.05	mg/L	350	**100**	**360**	**330**
	Fluoride	0.1	mg/L	1	**0.25**	**0.21**	**0.23**
	Sulfate (SO4)	1	mg/L	-	**520**	**1100**	**1100**
Cations	Calcium (Ca)	0.1	mg/L	1000	**210**	**350**	**340**
	Magnesium (Mg)	0.1	mg/L	-	**86**	**180**	**210**
	Potassium (K)	0.2	mg/L	-	**10**	**9.7**	**8**
	Sodium (Na)	0.1	mg/L	230	**96**	**220**	**210**
Forms of Carbon	Total Organic Carbon	0.2	mg/L	-	**4.2**	**3**	**1.7**
Nutrients	Ammonia (NH3) as N	0.005	mg/L	-	**0.15**	**0.078**	**0.031**
	Nitrate (NO3) as N	0.005	mg/L	-	**0.084**	-	-
	Nitrate (NO3) as N	0.025	mg/L	-	-	< 0.025	< 0.025
Trace Metals	Iron (Fe)	0.005	mg/L	0.2	**0.81**	**0.68**	**0.037**
	Manganese (Mn)	0.001	mg/L	0.2	**0.81**	**4.8**	**0.66**
Phenolics	Total Phenols	0.01	mg/L	-	< 0.01	< 0.01	< 0.01

TABLE 2: PORTLAND WASTE DISPOSAL DEPOT - RESULTS OF LABORATORY ANALYSIS
SEPTEMBER 2019

				Sample ID	MP-5	MP-8	MP-9
				Sample Date	02/09/2019	02/09/2019	02/09/2019
Group	**Analyte**	**LOR**	**Units**	**Criteria**	PS	PS	PS
OC Pesticides	Aldrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Alpha BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Alpha Chlordane	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Alpha Endosulfan	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Beta BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Beta Endosulfan	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Delta BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Dieldrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Endosulfan sulphate	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Endrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Endrin aldehyde	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Endrin ketone	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Heptachlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Heptachlor epoxide	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Hexachlorobenzene (HCB)	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Lindane (gamma BHC)	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Methoxychlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	p,p'-DDD	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	p,p'-DDE	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	p,p'-DDT	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	o,p'-DDD	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	o,p'-DDT	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	o,p'-DDE	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Gamma Chlordane	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	trans-Nonachlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Isodrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1
	Mirex	0.1	µg/L	-	< 0.1	< 0.1	< 0.1

mg/L	milligrams per litre
µg/L	micrograms per litre
µS/cm	microsiemens per centimetre
LOR	limit of reporting
PS	primary sample
Criteria	Criteria adopted from *Australian and New Zealand Environment and Conservation Council (ANZECC) Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Australian and New Zealand Guidelines for Fresh and Marine Water Quality* - 'Primary Industries: Water quality for irrigation and general water use', 2000
	within criteria
	criteria exceeded

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Brendan Stuart	Manager	Huong Crawford
Client	PREMISE	Laboratory	SGS Alexandria Environmental
Address	LEVEL 1 100 BRUNSWICK STREET FORTITUDE VALLEY QLD 4006	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	61 2 6939 5000	Telephone	+61 2 8594 0400
Facsimile	(Not specified)	Facsimile	+61 2 8594 0499
Email	Brendan.stuart@premise.com.au	Email	au.environmental.sydney@sgs.com
Project	**217501 - Portland GD**	SGS Reference	**SE197257 R0**
Order Number	(Not specified)	Date Received	04 Sep 2019
Samples	3	Date Reported	11 Sep 2019

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

Anions - Ion Chromatography - The Limit of Reporting (LOR) has been raised due to high conductivity of the sample requiring dilution.

SIGNATORIES

Bennet Lo
Senior Organic Chemist/Metals Chemis

Dong Liang
Metals/Inorganics Team Leader

Ly Kim Ha
Organic Section Head

Shane McDermott
Inorganic/Metals Chemist

Parameter	Units	LOR	Sample Number: SE197257.001 Sample Matrix: Water Sample Date: 02 Sep 2019 Sample Name: MP-5	SE197257.002 Water 02 Sep 2019 MP-8	SE197257.003 Water 02 Sep 2019 MP-9
OC Pesticides in Water Method: AN420 Tested: 5/9/2019					
Hexachlorobenzene (HCB)	µg/L	0.1	<0.1	<0.1	<0.1
Alpha BHC	µg/L	0.1	<0.1	<0.1	<0.1
Lindane (gamma BHC)	µg/L	0.1	<0.1	<0.1	<0.1
Heptachlor	µg/L	0.1	<0.1	<0.1	<0.1
Aldrin	µg/L	0.1	<0.1	<0.1	<0.1
Beta BHC	µg/L	0.1	<0.1	<0.1	<0.1
Delta BHC	µg/L	0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	µg/L	0.1	<0.1	<0.1	<0.1
o,p'-DDE	µg/L	0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	µg/L	0.1	<0.1	<0.1	<0.1
Gamma Chlordane	µg/L	0.1	<0.1	<0.1	<0.1
Alpha Chlordane	µg/L	0.1	<0.1	<0.1	<0.1
trans-Nonachlor	µg/L	0.1	<0.1	<0.1	<0.1
p,p'-DDE	µg/L	0.1	<0.1	<0.1	<0.1
Dieldrin	µg/L	0.1	<0.1	<0.1	<0.1
Endrin	µg/L	0.1	<0.1	<0.1	<0.1
o,p'-DDD	µg/L	0.1	<0.1	<0.1	<0.1
o,p'-DDT	µg/L	0.1	<0.1	<0.1	<0.1
Beta Endosulfan	µg/L	0.1	<0.1	<0.1	<0.1
p,p'-DDD	µg/L	0.1	<0.1	<0.1	<0.1
p,p'-DDT	µg/L	0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	µg/L	0.1	<0.1	<0.1	<0.1
Endrin aldehyde	µg/L	0.1	<0.1	<0.1	<0.1
Methoxychlor	µg/L	0.1	<0.1	<0.1	<0.1
Endrin ketone	µg/L	0.1	<0.1	<0.1	<0.1
Isodrin	µg/L	0.1	<0.1	<0.1	<0.1
Mirex	µg/L	0.1	<0.1	<0.1	<0.1
Surrogates					
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	**68**	**79**	**78**
Total Phenolics in Water Method: AN289 Tested: 9/9/2019					
Total Phenols	mg/L	0.01	<0.01	<0.01	<0.01
Anions by Ion Chromatography in Water Method: AN245 Tested: 6/9/2019					
Fluoride	mg/L	0.1	**0.25**	**0.21**	**0.23**
Chloride	mg/L	0.05	**100**	**360**	**330**
Nitrate Nitrogen, NO3-N	mg/L	0.005	**0.084**	<0.025↑	<0.025↑
Sulfate, SO4	mg/L	1	**520**	**1100**	**1100**
Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 6/9/2019					
Ammonia Nitrogen, NH_3 as N	mg/L	0.005	**0.15**	**0.078**	**0.031**

Parameter	Units	LOR	Sample Number: SE197257.001 Sample Matrix: Water Sample Date: 02 Sep 2019 Sample Name: MP-5	Sample Number: SE197257.002 Sample Matrix: Water Sample Date: 02 Sep 2019 Sample Name: MP-8	Sample Number: SE197257.003 Sample Matrix: Water Sample Date: 02 Sep 2019 Sample Name: MP-9
pH in water Method: AN101 Tested: 6/9/2019					
pH**	No unit	-	**6.9**	**6.7**	**6.9**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 6/9/2019					
Conductivity @ 25 C	µS/cm	2	**1700**	**3100**	**3100**
Total Dissolved Solids (by calculation)	mg/L	2	**1000**	**1900**	**1900**
Alkalinity Method: AN135 Tested: 6/9/2019					
Bicarbonate Alkalinity as CaCO3	mg/L	5	**480**	**590**	**640**
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1
Hydroxide Alkalinity as CaCO3	mg/L	5	<5	<5	<5
Phenolphthalein Alkalinity as CaCO3*	mg/L	5	<5	<5	<5
Total Alkalinity as CaCO3	mg/L	5	**480**	**590**	**640**
Forms of Carbon Method: AN190 Tested: 9/9/2019					
Total Organic Carbon as NPOC	mg/L	0.2	**4.2**	**3.0**	**1.7**
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 6/9/2019					
Calcium, Ca	mg/L	0.1	**210**	**350**	**340**
Magnesium, Mg	mg/L	0.1	**86**	**180**	**210**
Potassium, K	mg/L	0.2	**10**	**9.7**	**8.0**
Sodium, Na	mg/L	0.1	**96**	**220**	**210**
Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 9/9/2019					
Iron, Fe	µg/L	5	**810**	**680**	**37**
Manganese, Mn	µg/L	1	**810**	**4800**	**660**

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Alkalinity Method: ME-(AU)-[ENV]AN135

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Bicarbonate Alkalinity as CaCO3	LB182667	mg/L	5	<5	3%	NA
Carbonate Alkalinity as CaCO3	LB182667	mg/L	1	<1	0%	NA
Hydroxide Alkalinity as CaCO3	LB182667	mg/L	5	<5		
Total Alkalinity as CaCO3	LB182667	mg/L	5	<5	3%	102%

Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: ME-(AU)-[ENV]AN291

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Ammonia Nitrogen, NH_3 as N	LB182600	mg/L	0.005	0.007	2%	103%	102%

Anions by Ion Chromatography in Water Method: ME-(AU)-[ENV]AN245

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Fluoride	LB182649	mg/L	0.1	<0.10		98%
Chloride	LB182649	mg/L	0.05	<0.05		101%
Nitrate Nitrogen, NO3-N	LB182649	mg/L	0.005	<0.005		98%
Sulfate, SO4	LB182649	mg/L	1	<1.0	1%	101%

Conductivity and TDS by Calculation - Water Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB182648	µS/cm	2	<2	0 - 1%	105%
Total Dissolved Solids (by calculation)	LB182648	mg/L	2	<2	0 - 1%	106%

Forms of Carbon Method: ME-(AU)-[ENV]AN190

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Organic Carbon as NPOC	LB182690	mg/L	0.2	<0.2	2%	92%	97%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Metals in Water (Dissolved) by ICPOES Method: ME-(AU)-[ENV]AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Calcium, Ca	LB182643	mg/L	0.1	<0.1	0%	97%
Magnesium, Mg	LB182643	mg/L	0.1	<0.1	0%	99%
Potassium, K	LB182643	mg/L	0.2	<0.2		95%
Sodium, Na	LB182643	mg/L	0.1	<0.1		87%

OC Pesticides in Water Method: ME-(AU)-[ENV]AN420

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Hexachlorobenzene (HCB)	LB182525	µg/L	0.1	<0.1	NA
Alpha BHC	LB182525	µg/L	0.1	<0.1	NA
Lindane (gamma BHC)	LB182525	µg/L	0.1	<0.1	NA
Heptachlor	LB182525	µg/L	0.1	<0.1	104%
Aldrin	LB182525	µg/L	0.1	<0.1	82%
Beta BHC	LB182525	µg/L	0.1	<0.1	NA
Delta BHC	LB182525	µg/L	0.1	<0.1	107%
Heptachlor epoxide	LB182525	µg/L	0.1	<0.1	NA
o,p'-DDE	LB182525	µg/L	0.1	<0.1	NA
Alpha Endosulfan	LB182525	µg/L	0.1	<0.1	NA
Gamma Chlordane	LB182525	µg/L	0.1	<0.1	NA
Alpha Chlordane	LB182525	µg/L	0.1	<0.1	NA
trans-Nonachlor	LB182525	µg/L	0.1	<0.1	NA
p,p'-DDE	LB182525	µg/L	0.1	<0.1	NA
Dieldrin	LB182525	µg/L	0.1	<0.1	108%
Endrin	LB182525	µg/L	0.1	<0.1	108%
o,p'-DDD	LB182525	µg/L	0.1	<0.1	NA
o,p'-DDT	LB182525	µg/L	0.1	<0.1	NA
Beta Endosulfan	LB182525	µg/L	0.1	<0.1	NA
p,p'-DDD	LB182525	µg/L	0.1	<0.1	NA
p,p'-DDT	LB182525	µg/L	0.1	<0.1	85%
Endosulfan sulphate	LB182525	µg/L	0.1	<0.1	NA
Endrin aldehyde	LB182525	µg/L	0.1	<0.1	NA
Methoxychlor	LB182525	µg/L	0.1	<0.1	NA
Endrin ketone	LB182525	µg/L	0.1	<0.1	NA
Isodrin	LB182525	µg/L	0.1	<0.1	NA
Mirex	LB182525	µg/L	0.1	<0.1	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB182525	%	-	74%	77%

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

pH in water **Method: ME-(AU)-[ENV]AN101**

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH**	LB182648	No unit	-	0%	101%

Total Phenolics in Water **Method: ME-(AU)-[ENV]AN289**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Phenols	LB182704	mg/L	0.01	<0.01	0%	92%

Trace Metals (Dissolved) in Water by ICPMS **Method: ME-(AU)-[ENV]AN318**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Iron, Fe	LB182680	µg/L	5	<5	114%
Manganese, Mn	LB182680	µg/L	1	<1	106%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN020	Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
AN106	Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
AN135	Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
AN190	TOC and DOC in Water: A homogenised micro portion of sample is injected into a heated reaction chamber packed with an oxidative catalyst that converts organic carbon to carbon dioxide. The CO2 is measured using a non-dispersive infrared detector. The process is fully automated in a commercially available analyser. If required a sugar value can be calculated from the TOC result. Reference APHA 5310 B.
AN190	Chemical oxygen demand can be calculated/estimated based on the O2/C relation as 2.67*NPOC (TOC). This is an estimate only and the factor will vary with sample matrix so results should be interpreted with caution.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
AN289	Analysis of Total Phenols in Soil Sediment and Water: Steam distillable phenols react with 4-aminoantipyrine at pH 7.9±0.1 in the presence of potassium ferricyanide to form a coloured antipyrine dye analysed by Discrete Analyser. Reference APHA 5530 B/D.
AN291	Ammonia in solution reacts with hypochlorite ions from Sodium Dichloroisocyanuate, and salicylate in the presence of Sodium Nitroprusside to form indophenol blue and measured at 670 nm by Discrete Analyser.
AN318	Determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN420	SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).
Calculation	Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported . APHA4500CO2 D.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
		NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au.pv.sgsvr/en-gb/environment.