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Our Ref: 217500_LET_009.docx

16 December 2019

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

Attention: Nigel Campbell, Waste & Recycling Coordinator

ENVIRONMENTAL MONITORING OF LITHGOW SOLID WASTE FACILITY

Premise has completed scheduled groundwater and accumulated landfill gas monitoring at Lithgow Solid Waste Facility, located off Geordie Street, Lithgow on 19 November 2019. Leachate discharge monitoring from point LW1 was also conducted.

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 MB1, MB6, MB11 and MB13. Observations were as follows:

- Depths to groundwater ranged from 3.36 metres below ground level (mbgl) at MB14, to 14.25 mbgl at MB6B. Corrected groundwater elevations ranged from 897.21 metres Australian Height Datum (mAHD) at MB14, to 932.79 mAHD at MB6B.
- Inference of groundwater elevations, calculated from available survey data from installed groundwater monitoring wells indicate a flow direction to the south-west.

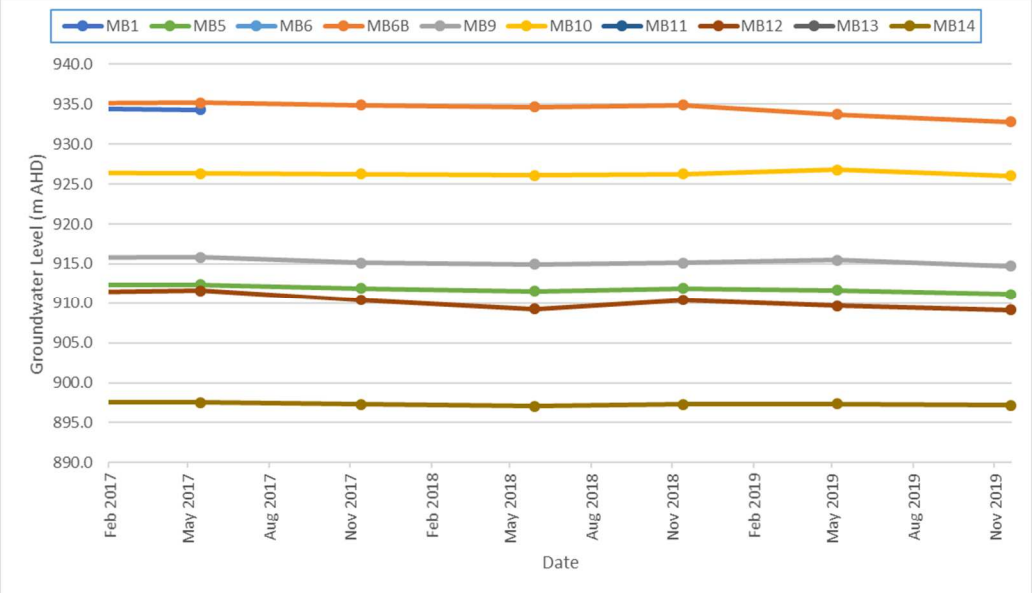


Figure 1: Lithgow Solid Waste Facility – Groundwater Elevations

Groundwater Quality

Groundwater samples were able to be collected from wells MB5, MB6B, MB9, MB10, MB12 and MB14. The monitoring well casing at location MB6B is bent at approximately 2.0 mbgl and was sampled by Hydrasleeve® sampling equipment, while other monitoring wells were sampled using bailers. 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 5.2 at MB12 to 7.0 at MB14. pH of groundwater at MB12 was below the guideline range considered suitable for pumping, irrigation and stock watering (6.0 to 8.5 pH units).
- Electrical conductivity (EC) ranged from 220 µS/cm at piezometer MB10 to 1300 µS/cm at piezometer MB6B.
- Total dissolved solids (TDS) ranged from 92 mg/L at MB10 to 630 mg/L at MB12. TDS concentrations were below the livestock watering 'loss of production' tolerance limit for the most susceptible livestock category, poultry (3,000 mg/L – ANZECC & ARMCANZ, 2000).
- The chemical oxygen demand (COD) of groundwater samples ranged from below the laboratory limit of reporting (LOR) of 10 mg/L at MB10 and MB14, to 39 mg/L at MB6B.
- Total alkalinity in groundwater ranged from 38 mg/L at MB12 to 350 mg/L at MB6B. Alkalinity of groundwater did not exceed the guideline hardness value for potential fouling of waters (350 mg/L).
- Groundwater chloride concentrations ranged from 20 mg/L at MB10 to 230 mg/L at MB12. All concentrations were below the guideline value for protection of moderately sensitive crops (350 mg/L).
- Fluoride concentrations in groundwater were all below the laboratory LOR of 0.1 mg/L. 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 16 mg/L at MB10 to 89 mg/L at MB12.
- Calcium concentrations ranged from 13 mg/L at MB10 to 92 mg/L at MB14.
- Magnesium concentrations ranged from 9.7 mg/L at MB10 to 64 mg/L at MB6B.
- Potassium concentrations ranged from 2.9 mg/L at MB10 to 36 mg/L at MB5.
- Concentrations of sodium ranged from 9.8 mg/L at MB10 to 84 mg/L at MB5. Sodium concentrations were below the guideline level for irrigation to moderately sensitive crops (<230 mg/L).
- Ammonia concentrations in groundwater ranged from 0.22 mgN/L at MB14 to 3.2 mgN/L at MB12.
- Nitrate concentrations ranged from below the laboratory LOR of 0.005 mgN/L at MB6B, MB9, MB12 and MB14, to 3.9 mgN/L at MB5.
- Phosphorus concentrations in groundwater ranged from below the laboratory LOR of 0.02 mg/L at MB12 and MB14, to 0.48 mg/L at MB6B. Phosphorus concentrations at MB5 and MB6B were above the guideline value of 0.05 mg/L for long term irrigation use (up to 100 years).

- Aluminium concentrations in groundwater were recorded at below the laboratory LOR of 0.005 mg/L with the exception of MB12, which recorded a concentration of 0.44 mg/L. Aluminium concentrations in groundwater were below the long-term (up to 100 years) irrigation guideline concentration of 5 mg/L.
- Hexavalent chromium and total chromium concentrations were below the respective laboratory LORs of 0.004 mg/L and 0.001 mg/L. Concentrations of total chromium were lower than the long-term (up to 100 years) irrigation guideline concentration of 0.1 mg/L.
- Iron concentrations ranged from 0.001 mg/L at MB6B to 41 mg/L at MB12. Iron concentrations at MB9, MB10, MB12 and MB14 exceeded the long-term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.
- Manganese concentrations ranged from 0.083 mg/L at MB14 to 3.6 mg/L at MB6B. Manganese concentrations at locations MB5, MB6B, MB9 and MB12 the long-term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.
- Total organic carbon (TOC) in groundwater ranged from 1.0 mg/L at MB10 to 7.4 mg/L at MB6B.
- Total phenols were at or below the laboratory LOR of 0.01 mg/L at all groundwater monitoring points.
- Organochlorine pesticides and organophosphorus pesticides were below respective laboratory LORs at all groundwater monitoring points.
- Total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH) were below respective laboratory LORs at all groundwater monitoring points, with the exception of TPH C6-C9 fraction and TRH C6-C10 fraction at MB12 (both recorded at 130µg/L).

Leachate

The leachate sample collected from LW1 was couriered to SGS Laboratories in Alexandria, NSW, who are NATA accredited to perform the scheduled analysis. Results of analysis are included in **Table 3** (attached), and laboratory certificates have also been appended to this letter.

Leachate 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 was slightly alkaline, recorded at 6.7, noted to be near-neutral.
- Electrical conductivity (EC) was recorded to be 1,000 µS/cm. The corresponding total dissolved solids (TDS) concentration was calculated to be 670 mg/L, below the livestock watering 'loss of production' tolerance limit for the most susceptible livestock category, poultry (3,000 mg/L – ANZECC & ARMCANZ, 2000).
- The chemical oxygen demand (COD) was recorded to be 12 mg/L.
- The biochemical oxygen demand (BOD) was recorded to be less than the laboratory LOR of 5 mg/L. High COD relative to BOD may be indicative of the presence of non-biodegradable organic matter (e.g. oils, humic substances, organic polymers).
- Total alkalinity was recorded at 99 mg/L, which was below the guideline hardness value for potential fouling of waters (350 mg/L).
- The recorded chloride concentration was 220 mg/L, and below the guideline value for protection of moderately sensitive crops (350 mg/L).

- The fluoride concentration of leachate was recorded to be 0.17 mg/L, below the guideline value of 1 mg/L for long term irrigation use (up to 100 years).
- The leachate sulphate concentration was recorded to be 23 mg/L.
- Calcium in leachate was recorded to be 52 mg/L.
- Magnesium in leachate was recorded to be 18 mg/L.
- Potassium in leachate was recorded to be 16 mg/L.
- Sodium in leachate was recorded to be 100 mg/L. The sodium concentration was below the guideline level for irrigation to moderately sensitive crops (230 mg/L).
- Total organic carbon (TOC) was recorded at 4.3 mg/L.
- The ammonia concentration of leachate was recorded to be 0.18 mgN/L.
- The nitrate concentration of leachate was recorded to be 0.46 mgN/L.
- Iron in leachate was recorded to be 0.7 mg/L, and above the long term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.
- Manganese in leachate was recorded to be 0.78 mg/L, and above the long term (up to 100 years) irrigation guideline concentration of 0.2 mg/L.
- Total phenolics in leachate were recorded at equivalent to the laboratory LOR of 0.01 mg/L.

Accumulated Landfill Gas Monitoring

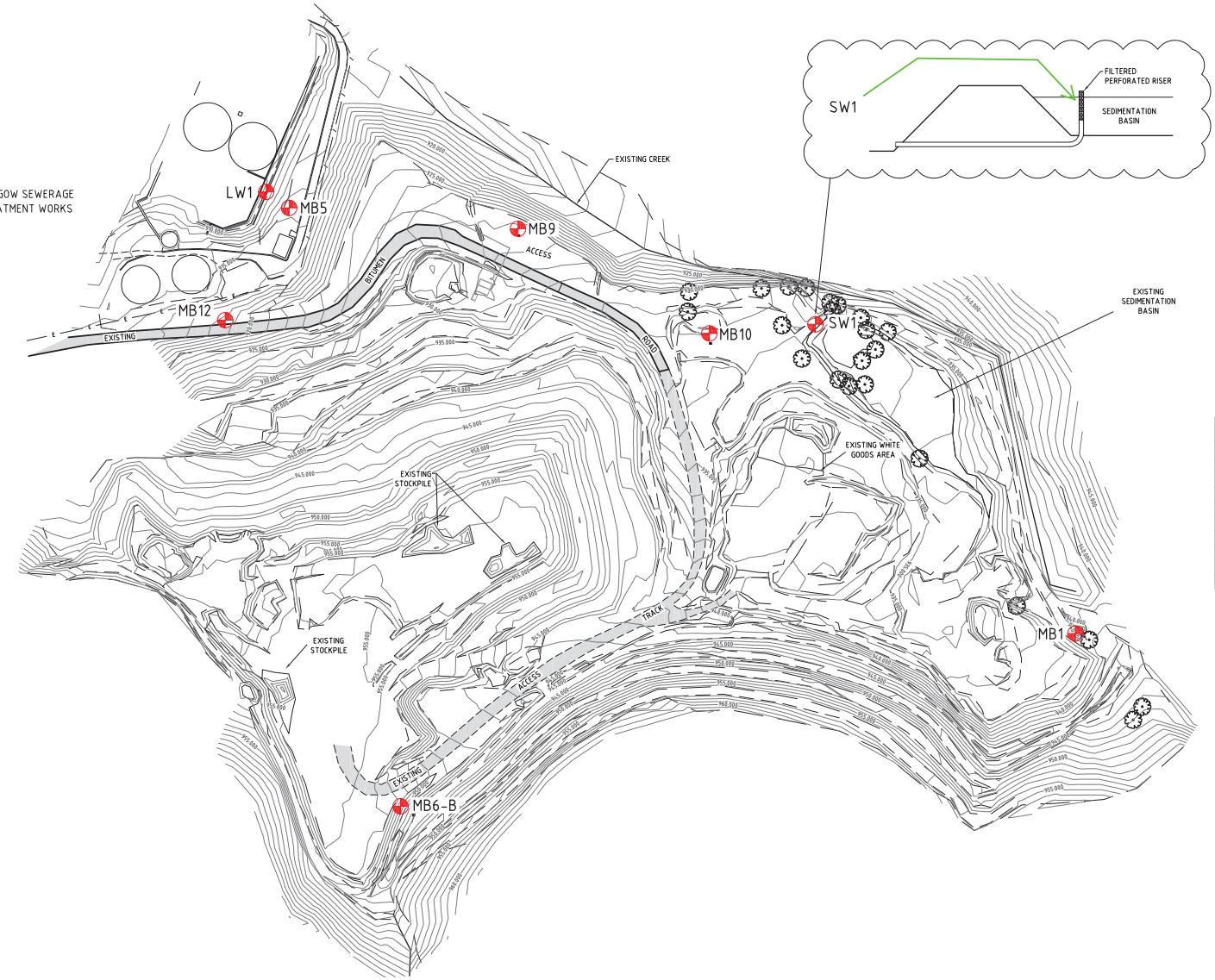
Gas concentrations in buildings and sheds within the required monitoring distance of 250 metres of filled areas were all below the respective threshold concentration of 1.25 % (v/v) during the monthly monitoring rounds conducted in June 2019 to November 2019. Results of gas monitoring are included in **Table 4** (attached)

The next routine monitoring for groundwater, leachate and accumulated landfill gas is scheduled for May 2020. Surface water monitoring is required to take place any calendar month when a surface water discharge is recorded. 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 – 5: Environmental Monitoring Point Locations
Table 1 – Groundwater Level Measurements
Table 2 – Results of Laboratory Analyses (Groundwater) – November 2019
Table 3 – Results of Laboratory Analyses (Leachate) – November 2019
Table 4 – Accumulated Landfill Gas Monitoring
SGS Laboratories Analytical Reports – November 2019



EPA MONITORING POINTS

EPA ID No.	LOCATION	TYPE
1	MB1	GROUNDWATER
2	MB5	GROUNDWATER
3	MB6-B	GROUNDWATER
4	MB9	GROUNDWATER
5	MB10	GROUNDWATER
6	SW1	AMBIENT WATER
7	MB12	GROUNDWATER
8	MB14	GROUNDWATER
9	LW1	LEACHATE
10		LANDFILL GAS

NOTES:

1. THIS PLAN IS PREPARED FROM A FIELD SURVEY FOR THE PURPOSE OF DESIGNING NEW CONSTRUCTIONS ON THE LAND AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.
2. VISIBLE SERVICES HAVE BEEN LOCATED ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, THE RELEVANT AUTHORITIES SHOULD BE CONTACTED FOR LOCATION OF FURTHER UNDERGROUND SERVICES AND DETAILED LOCATIONS OF ALL SERVICES.
3. CONTOUR INTERVAL 1m.
4. THESE NOTES ARE AN INTEGRAL PART OF THIS PLAN.

LEGEND:

- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING TRACK
- EXISTING ELECTRICITY
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING ACCESS ROAD

SCALE 1:1500(A1)
0 10 20 40 60 80 100
SCALE 1:3000(A3)
0 10 20 40 60 80 100

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No	DATE	DRAFTING CHECK	PM CHECK	DETAILS
A	27/06/11	LP	AB	WORKING DRAFT
B	28/09/11	LP	AB	EPL VARIATION

PROJECT
LITHGOW SOLID WASTE FACILITY
LANDFILL ENVIRONMENTAL MANAGEMENT PLAN
FILE REFERENCE: O:\Projects\211109\Out\Cad\Lithgow\211109_01B_EV01-EV09.dwg

APPROVAL AUTHORITY
ENVIRONMENTAL PROTECTION AUTHORITY
EPL : 6004

CLIENT
CITY OF LITHGOW COUNCIL

DRAWING
ENVIRONMENTAL MONITORING POINTS
PROJECT NUMBER: 211109
DRAWING NUMBER: 01B_EV04
REV. B
SOURCE: CRAVEN, ELLISTON & HAYES (LITHGOW) PTY. LTD. (DRAWING No. E668-10, DATED 19/04/2010)

Premise

TABLE 1: LITHGOW SOLID WASTE FACILITY - GROUNDWATER LEVEL RESULTS

Ground Water Levels: 13-Nov-18

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)
MB1	939.790	0.86	940.650	13/11/2018	NMWL	-	6.5	934.15	nil
MB5	914.940	0.80	915.740	13/11/2018	3.80	911.94	9.8	905.94	6.00
MB6	945.820	0.85	946.670	13/11/2018	NMWL	-	-	-	nil
MB6B	946.290	0.75	947.040	13/11/2018	12.15	934.89	19.3	927.74	7.15
MB9	928.260	0.69	928.950	13/11/2018	13.84	915.11	17.1	911.85	3.26
MB10	932.180	0.73	932.910	13/11/2018	6.63	926.28	13.7	919.21	7.07
MB11	915.010	0.67	915.680	13/11/2018	NMWL	-	17.9	897.82	nil
MB12	918.330	0.76	919.090	13/11/2018	8.70	910.39	22.3	896.84	13.55
MB13	914.980	0.70	915.680	13/11/2018	NMWL	-	39.4	876.28	nil
MB14	899.790	0.78	900.570	13/11/2018	3.29	897.28	17.7	882.87	14.41

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.

Measured: Depth of groundwater measured from the top of the piezometer pipe.

	MB1		**MB5**		**MB6**		**MB6B**		**MB9**		**MB10**		**MB11**		**MB12**		**MB13**		**MB14**	
Date	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)	Measured	GWL (mAHD)
25-Oct-11	NMWL		3.20	912.54	NMWL		9.92	937.12	12.62	916.33	5.77	927.14	NMWL		8.69	910.40	NMWL		2.80	897.77
08-Feb-12	5.85	934.80	3.26	912.48	NMWL		4.68	942.36	12.71	916.24	5.83	927.08	6.87	908.81	8.77	910.32	6.89	908.79	NMWL	
15-Mar-12	3.11	937.54	2.29	913.45	NMWL		7.82	939.22	11.56	917.39	5.51	927.40	6.08	909.60	7.95	911.14	6.11	909.57	2.64	897.93
24-Apr-12	NMWL		2.55	913.19	NMWL		7.47	939.57	12.10	916.85	5.78	927.13	NMWL		8.24	910.85	NMWL		2.67	897.90
31-May-12	5.55	935.10	3.07	912.67	NMWL		9.71	937.33	12.73	916.22	6.04	926.87	NMWL		8.43	910.66	NMWL		2.64	897.93
30-Oct-12	NMWL		3.29	912.45	NMWL		14.64	932.40	13.33	915.62	6.19	926.72	6.83	908.85	8.90	910.19	6.87	908.81	3.11	897.46
17-Apr-13	5.81	934.84	2.87	912.87	NMWL		13.55	933.49	12.80	916.15	6.10	926.81	NMWL		8.50	910.59	NMWL		2.91	897.66
23-Oct-13	NMWL		3.44	912.30	NMWL		13.97	933.07	13.60	915.35	6.35	926.56	NMWL		9.01	910.08	NMWL		3.09	897.48
02-Apr-14	4.90	935.75	3.98	911.76	NMWL		11.00	936.04	13.66	915.29	5.75	927.16	NMWL		9.04	910.05	NMWL		3.20	897.37
02-Jun-14	NMWL		3.96	911.78	NMWL		NMWL		NMWL		NMWL		NMWL		NMWL		NMWL		NMWL	
21-Oct-14	NMWL		3.81	911.93	NMWL		11.41	935.63	13.13	915.82	6.01	926.90	NMWL		8.89	910.20	NMWL		2.97	897.60
21-Apr-15	NMWL		3.56	912.18	NMWL		14.98	932.06	13.19	915.76	6.26	926.65	NMWL		9.06	910.03	NMWL		3.27	897.30
13-Oct-15	NMWL		3.34	912.40	NMWL		12.18	934.86	13.30	915.65	6.30	926.61	NMWL		8.35	910.74	NMWL		3.06	897.51
15-May-17	6.36	934.30	3.37	912.38	NMWL		11.88	935.16	13.09	915.86	6.58	926.34	NMWL		7.45	911.64	NMWL		3.05	897.52
13-Nov-17	NMWL		3.80	911.94	NMWL		12.15	934.89	13.84	915.11	6.63	926.28	NMWL		8.70	910.39	NMWL		3.29	897.28
29-May-18	NMWL		4.19	911.55	NMWL		12.38	934.66	13.99	914.96	6.83	926.08	NMWL		9.84	909.25	NMWL		3.50	897.07
13-Nov-18	NMWL		3.80	911.94	NMWL		12.15	934.89	13.84	915.11	6.63	926.28	NMWL		8.70	910.39	NMWL		3.29	897.28
06-May-19	NMWL		4.05	911.69	NMWL		13.31	933.73	13.48	915.47	6.13	926.78	NMWL		9.45	909.64	NMWL		3.20	897.37
19-Nov-19	NMWL		4.58	911.16	NMWL		14.25	932.79	14.21	914.74	6.86	926.05	NMWL		9.95	909.14	NMWL		3.36	897.21

TABLE 2: LITHGOW SOLID WASTE FACILITY - RESULTS OF LABORATORY ANALYSIS **GROUNDWATER**
NOVEMBER 2019

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				Sample ID	MB5	MB9	MB10	MB12	MB14	MB6B
				Sample Date	19/11/2019	19/11/2019	19/11/2019	19/11/2019	19/11/2019	19/11/2019
Group	**Analyte**	**LOR**	**Units**	**Criteria**	PS	PS	PS	PS	PS	PS
Physical Parameters	pH (Lab)	0	No unit	6.0 - 8.5	**6.4**	**6.1**	**6**	**5.2**	**7**	**6.3**
	Electrical Conductivity (Lab)	2	µS/cm	4478	**1100**	**440**	**220**	**1100**	**770**	**1300**
	Total Dissolved Solids	10	mg/L	-	**550**	**210**	**92**	**630**	**390**	**630**
	Chemical Oxygen Demand	10	mg/L	-	**23**	**13**	< 10	**18**	< 10	**39**
Alkalinity	Bicarbonate Alkalinity as CaCO3	5	mg/L	-	**160**	**120**	**55**	**38**	**290**	**350**
	Total Alkalinity as CaCO3	5	mg/L	350	**160**	**120**	**55**	**38**	**290**	**350**
Anions	Chloride	0.05	mg/L	350	**190**	**58**	**20**	**230**	**33**	**170**
	Fluoride	0.1	mg/L	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Sulfate (SO4)	1	mg/L	-	**20**	**18**	**16**	**89**	**47**	**32**
Cations	Calcium (Ca)	0.1	mg/L	1000	**55**	**24**	**13**	**34**	**92**	**74**
	Magnesium (Mg)	0.1	mg/L	-	**18**	**15**	**9.7**	**25**	**29**	**64**
	Potassium (K)	0.2	mg/L	-	**36**	**9.9**	**2.9**	**9.7**	**8.8**	**14**
	Sodium (Na)	0.1	mg/L	230	**84**	**33**	**9.8**	**79**	**19**	**68**
Forms of Carbon	Total Organic Carbon	0.2	mg/L	-	**5.6**	**2.6**	**1**	**4.7**	**3.4**	**7.4**
Nutrients	Ammonia (NH3) as N	0.005	mg/L	-	**2.2**	**2.7**	**0.22**	**3.2**	**0.22**	**0.84**
	Nitrate (NO3) as N	0.005	mg/L	-	**3.9**	< 0.005	**0.13**	< 0.005	< 0.005	< 0.005
	Total Phosphorus	0.02	mg/L	0.05	**0.16**	**0.05**	**0.05**	< 0.02	< 0.02	**0.48**
Trace Metals	Chromium (Cr)	0.001	mg/L	-	**0.003**	**0.003**	< 0.001	< 0.001	< 0.001	**0.005**
	Aluminium (Al)	0.005	mg/L	5	< 0.005	< 0.005	< 0.005	**0.44**	< 0.005	< 0.005
	Iron (Fe)	0.005	mg/L	0.2	**0.016**	**7.8**	**0.73**	**41**	**1.1**	**0.01**
	Manganese (Mn)	0.001	mg/L	0.2	**0.96**	**1.3**	**0.13**	**2.2**	**0.083**	**3.6**
	Hexavalent Chromium (Cr-VI)	0.004	mg/L	0.1	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Phenolics	Total Phenols	0.01	mg/L	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
OC Pesticides	Aldrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Alpha BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Alpha Chlordane	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Alpha Endosulfan	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Beta BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Beta Endosulfan	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Delta BHC	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Dieldrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Endosulfan sulphate	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Endrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Endrin aldehyde	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Endrin ketone	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Heptachlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Heptachlor epoxide	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Hexachlorobenzene (HCB)	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Lindane (gamma BHC)	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Methoxychlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	p,p'-DDD	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	p,p'-DDE	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	p,p'-DDT	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	o,p'-DDD	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	o,p'-DDT	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	o,p'-DDE	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Gamma Chlordane	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	trans-Nonachlor	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Isodrin	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Mirex	0.1	µg/L	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
OP Pesticides	Azinphos-methyl	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Bromophos Ethyl	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Chlorpyrifos (Chlorpyrifos Ethyl)	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Diazinon (Dimpylate)	0.5	µg/L	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
	Dichlorvos	0.5	µg/L	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
	Dimethoate	0.5	µg/L	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
	Ethion	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Fenitrothion	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Malathion	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Parathion-ethyl (Parathion)	0.2	µg/L	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Methidathion	0.5	µg/L	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total Petroleum Hydrocarbons	TRH C6-C9	40	µg/L	-	< 40	< 40	< 40	**130**	< 40	< 40
	TRH C10-C14	50	µg/L	-	< 50	< 50	< 50	< 50	< 50	< 50
	TRH C15-C28	200	µg/L	-	< 200	< 200	< 200	< 200	< 200	< 200
	TRH C29-C36	200	µg/L	-	< 200	< 200	< 200	< 200	< 200	< 200
	TRH C10-C36	450	µg/L	-	< 450	< 450	< 450	< 450	< 450	< 450
	TRH C37-C40	200	µg/L	-	< 200	< 200	< 200	< 200	< 200	< 200
Total Recoverable Hydrocarbons	TRH C6-C10	50	µg/L	-	< 50	< 50	< 50	**130**	< 50	< 50
	TRH C6-C10 minus BTEX (F1)	50	µg/L	-	< 50	< 50	< 50	**130**	< 50	< 50
	TRH >C10-C16	60	µg/L	-	< 60	< 60	< 60	< 60	< 60	< 60
	TRH >C10-C16 minus Naphthalene (F2)	60	µg/L	-	< 60	< 60	< 60	< 60	< 60	< 60
	TRH >C16-C34 (F3)	500	µg/L	-	< 500	< 500	< 500	< 500	< 500	< 500
	TRH >C34-C40 (F4)	500	µg/L	-	< 500	< 500	< 500	< 500	< 500	< 500
	TRH C10-C40	650	µg/L	-	< 650	< 650	< 650	< 650	< 650	< 650
BTEXN Analytes	Benzene (F0)	0.5	µg/L	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

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

TABLE 3: LITHGOW SOLID WASTE FACILITY - RESULTS OF LABORATORY ANALYSIS **LEACHATE**
NOVEMBER 2019

				Sample ID	LW1
				Sample Date	19/11/2019
Group	**Analyte**	**LOR**	**Units**	**Criteria**	PS
Physical Parameters	pH (Lab)	0	No unit	6.0 - 8.5	**6.7**
	Electrical Conductivity (Lab)	2	µS/cm	4478	**1000**
	Chemical Oxygen Demand	10	mg/L	-	**12**
	Biochemical Oxygen Demand (BOD5)	5	mg/L	-	< 5
Alkalinity	Bicarbonate Alkalinity as CaCO3	5	mg/L	-	**99**
	Total Alkalinity as CaCO3	5	mg/L	350	**99**
Anions	Chloride	1	mg/L	350	**220**
	Fluoride	0.1	mg/L	1	**0.17**
	Sulfate (SO4)	1	mg/L	-	**23**
Cations	Calcium (Ca)	0.1	mg/L	1000	**52**
	Magnesium (Mg)	0.1	mg/L	-	**18**
	Potassium (K)	0.2	mg/L	-	**16**
	Sodium (Na)	0.1	mg/L	230	**100**
Forms of Carbon	Total Organic Carbon	0.2	mg/L	-	**4.3**
Nutrients	Ammonia (NH3) as N	0.01	mg/L	-	**0.18**
	Nitrate (NO3) as N	0.005	mg/L	-	**0.46**
	Total Kjeldahl Nitrogen	0.05	mg/L	-	**0.57**
Trace Metals	Iron (Fe)	0.005	mg/L	0.2	**0.7**
	Manganese (Mn)	0.001	mg/L	0.2	**0.78**
Phenolics	Total Phenols	0.01	mg/L	-	**0.01**

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

TABLE 4: LITHGOW SOLID WASTE FACILITY - ACCUMULATED LANDFILL GAS MONITORING
METHANE (as %, v/v)

		Date	30/01/2019	19/02/2019	28/03/2019	04/04/2019	06/05/2019	06/06/2019	10/07/2019	19/08/2019	02/09/2019	09/10/2019	19/11/2019
Location	**LOR**	**Units**											
Site Shed	0.005	%	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Weighbridge	0.005	%	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Office (STP)	0.005	%	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Green Shed (STP)	0.005	%	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Pump Room (STP)	0.005	%	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

LOR limit of reporting

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	**217500-Lithgow SWF**	SGS Reference	**SE200192 R0**
Order Number	(Not specified)	Date Received	21 Nov 2019
Samples	6	Date Reported	02 Dec 2019

COMMENTS

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

SIGNATORIES

Akheeqar BENIAMEEN
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Shane MCDERMOTT
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Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name SE200192.001 Water 19 Nov 2019 MB5	SE200192.002 Water 19 Nov 2019 MB6B	SE200192.003 Water 19 Nov 2019 MB9	SE200192.004 Water 19 Nov 2019 MB10
Volatile Petroleum Hydrocarbons in Water Method: AN433 Tested: 26/11/2019						
TRH C6-C10	µg/L	50	<50	<50	<50	<50
TRH C6-C9	µg/L	40	<40	<40	<40	<40
Surrogates						
d4-1,2-dichloroethane (Surrogate)	%	-	**101**	**108**	**105**	**108**
d8-toluene (Surrogate)	%	-	**100**	**102**	**103**	**105**
Bromofluorobenzene (Surrogate)	%	-	**92**	**96**	**95**	**97**
VPH F Bands						
Benzene (F0)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	<50	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403 Tested: 21/11/2019						
TRH C10-C14	µg/L	50	<50	<50	<50	<50
TRH C15-C28	µg/L	200	<200	<200	<200	<200
TRH C29-C36	µg/L	200	<200	<200	<200	<200
TRH C37-C40	µg/L	200	<200	<200	<200	<200
TRH C10-C36	µg/L	450	<450	<450	<450	<450
TRH C10-C40	µg/L	650	<650	<650	<650	<650
TRH F Bands						
TRH >C10-C16	µg/L	60	<60	<60	<60	<60
TRH >C10-C16 - Naphthalene (F2)	µg/L	60	<60	<60	<60	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500	<500	<500
OC Pesticides in Water Method: AN420 Tested: 21/11/2019						
Hexachlorobenzene (HCB)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Lindane (gamma BHC)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Gamma Chlordane	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Endrin	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDD	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Endrin ketone	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	µg/L	0.1	<0.1	<0.1	<0.1	<0.1
Mirex	µg/L	0.1	<0.1	<0.1	<0.1	<0.1

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE200192.001 Water 19 Nov 2019 MB5	SE200192.002 Water 19 Nov 2019 MB6B	SE200192.003 Water 19 Nov 2019 MB9	SE200192.004 Water 19 Nov 2019 MB10
OC Pesticides in Water Method: AN420 Tested: 21/11/2019 (continued)							
Surrogates							
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-		**45**	**40**	**33**	**47**
OP Pesticides in Water Method: AN420 Tested: 21/11/2019							
Dichlorvos	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Dimethoate	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate)	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Fenitrothion	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Malathion	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Bromophos Ethyl	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Methidathion	µg/L	0.5		<0.5	<0.5	<0.5	<0.5
Ethion	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Azinphos-methyl	µg/L	0.2		<0.2	<0.2	<0.2	<0.2
Surrogates							
2-fluorobiphenyl (Surrogate)	%	-		**56**	**46**	**40**	**42**
d14-p-terphenyl (Surrogate)	%	-		**80**	**64**	**54**	**58**
Total Phenolics in Water Method: AN289 Tested: 25/11/2019							
Total Phenols	mg/L	0.01		<0.01	<0.01	<0.01	<0.01
Anions by Ion Chromatography in Water Method: AN245 Tested: 22/11/2019							
Fluoride	mg/L	0.1		<0.10	<0.10	<0.10	<0.10
Chloride	mg/L	0.05		**190**	**170**	**58**	**20**
Nitrate Nitrogen, NO3-N	mg/L	0.005		**3.9**	<0.005	<0.005	**0.13**
Sulfate, SO4	mg/L	1		**20**	**32**	**18**	**16**
Alkalinity Method: AN135 Tested: 22/11/2019							
Bicarbonate Alkalinity as CaCO3	mg/L	5		**160**	**350**	**120**	**55**
Total Alkalinity as CaCO3	mg/L	5		**160**	**350**	**120**	**55**

Parameter	Units	LOR	Sample Number: SE200192.001 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB5	SE200192.002 Water 19 Nov 2019 MB6B	SE200192.003 Water 19 Nov 2019 MB9	SE200192.004 Water 19 Nov 2019 MB10
Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 22/11/2019						
Ammonia Nitrogen, NH_3 as N	mg/L	0.005	**2.2**	**0.84**	**2.7**	**0.22**
Total Phosphorus by Kjeldahl Digestion DA in Water Method: AN279/AN293(Sydney only) Tested: 22/11/2019						
Total Phosphorus (Kjeldahl Digestion) as P	mg/L	0.02	**0.16**	**0.48**	**0.05**	**0.05**
pH in water Method: AN101 Tested: 21/11/2019						
pH**	No unit	-	**6.4**	**6.3**	**6.1**	**6.0**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 21/11/2019						
Conductivity @ 25 C	µS/cm	2	**1100**	**1300**	**440**	**220**
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 26/11/2019						
Total Dissolved Solids Dried at 175-185°C	mg/L	10	**550**	**630**	**210**	**92**
COD in Water Method: AN179/AN181 Tested: 27/11/2019						
Chemical Oxygen Demand	mg/L	10	**23**	**39**	**13**	<10

Parameter	Units	LOR	Sample Number: SE200192.001 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB5	SE200192.002 Water 19 Nov 2019 MB6B	SE200192.003 Water 19 Nov 2019 MB9	SE200192.004 Water 19 Nov 2019 MB10
Forms of Carbon Method: AN190 Tested: 25/11/2019						
Total Organic Carbon as NPOC	mg/L	0.2	**5.6**	**7.4**	**2.6**	**1.0**
Hexavalent Chromium in water by Discrete Analyser Method: AN283 Tested: 22/11/2019						
Hexavalent Chromium, Cr6+	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 22/11/2019						
Calcium, Ca	mg/L	0.1	**55**	**74**	**24**	**13**
Magnesium, Mg	mg/L	0.1	**18**	**64**	**15**	**9.7**
Potassium, K	mg/L	0.2	**36**	**14**	**9.9**	**2.9**
Sodium, Na	mg/L	0.1	**84**	**68**	**33**	**9.8**
Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 22/11/2019						
Aluminium, Al	µg/L	5	<5	<5	<5	<5
Iron, Fe	µg/L	5	**16**	**10**	**7800**	**730**
Manganese, Mn	µg/L	1	**960**	**3600**	**1300**	**130**
Trace Metals (Total) in Water by ICPMS Method: AN022/AN318 Tested: 22/11/2019						
Total Chromium	µg/L	1	**3**	**5**	**3**	<1

Parameter	Units	LOR	Sample Number: SE200192.005 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB12	Sample Number: SE200192.006 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB14
Volatile Petroleum Hydrocarbons in Water Method: AN433 Tested: 26/11/2019				
TRH C6-C10	µg/L	50	**130**	<50
TRH C6-C9	µg/L	40	**130**	<40
Surrogates				
d4-1,2-dichloroethane (Surrogate)	%	-	**108**	**112**
d8-toluene (Surrogate)	%	-	**104**	**108**
Bromofluorobenzene (Surrogate)	%	-	**95**	**100**
VPH F Bands				
Benzene (F0)	µg/L	0.5	<0.5	<0.5
TRH C6-C10 minus BTEX (F1)	µg/L	50	**130**	<50
TRH (Total Recoverable Hydrocarbons) in Water Method: AN403 Tested: 21/11/2019				
TRH C10-C14	µg/L	50	<50	<50
TRH C15-C28	µg/L	200	<200	<200
TRH C29-C36	µg/L	200	<200	<200
TRH C37-C40	µg/L	200	<200	<200
TRH C10-C36	µg/L	450	<450	<450
TRH C10-C40	µg/L	650	<650	<650
TRH F Bands				
TRH >C10-C16	µg/L	60	<60	<60
TRH >C10-C16 - Naphthalene (F2)	µg/L	60	<60	<60
TRH >C16-C34 (F3)	µg/L	500	<500	<500
TRH >C34-C40 (F4)	µg/L	500	<500	<500
OC Pesticides in Water Method: AN420 Tested: 21/11/2019				
Hexachlorobenzene (HCB)	µg/L	0.1	<0.1	<0.1
Alpha BHC	µg/L	0.1	<0.1	<0.1
Lindane (gamma BHC)	µg/L	0.1	<0.1	<0.1
Heptachlor	µg/L	0.1	<0.1	<0.1
Aldrin	µg/L	0.1	<0.1	<0.1
Beta BHC	µg/L	0.1	<0.1	<0.1
Delta BHC	µg/L	0.1	<0.1	<0.1
Heptachlor epoxide	µg/L	0.1	<0.1	<0.1
o,p'-DDE	µg/L	0.1	<0.1	<0.1
Alpha Endosulfan	µg/L	0.1	<0.1	<0.1
Gamma Chlordane	µg/L	0.1	<0.1	<0.1
Alpha Chlordane	µg/L	0.1	<0.1	<0.1
trans-Nonachlor	µg/L	0.1	<0.1	<0.1
p,p'-DDE	µg/L	0.1	<0.1	<0.1
Dieldrin	µg/L	0.1	<0.1	<0.1
Endrin	µg/L	0.1	<0.1	<0.1
o,p'-DDD	µg/L	0.1	<0.1	<0.1
o,p'-DDT	µg/L	0.1	<0.1	<0.1
Beta Endosulfan	µg/L	0.1	<0.1	<0.1
p,p'-DDD	µg/L	0.1	<0.1	<0.1
p,p'-DDT	µg/L	0.1	<0.1	<0.1
Endosulfan sulphate	µg/L	0.1	<0.1	<0.1
Endrin aldehyde	µg/L	0.1	<0.1	<0.1
Methoxychlor	µg/L	0.1	<0.1	<0.1
Endrin ketone	µg/L	0.1	<0.1	<0.1
Isodrin	µg/L	0.1	<0.1	<0.1
Mirex	µg/L	0.1	<0.1	<0.1

Parameter	Units	LOR	Sample Number: SE200192.005 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB12	Sample Number: SE200192.006 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB14
OC Pesticides in Water Method: AN420 Tested: 21/11/2019 (continued)				
Surrogates				
Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	**87**	**80**
OP Pesticides in Water Method: AN420 Tested: 21/11/2019				
Dichlorvos	µg/L	0.5	<0.5	<0.5
Dimethoate	µg/L	0.5	<0.5	<0.5
Diazinon (Dimpylate)	µg/L	0.5	<0.5	<0.5
Fenitrothion	µg/L	0.2	<0.2	<0.2
Malathion	µg/L	0.2	<0.2	<0.2
Chlorpyrifos (Chlorpyrifos Ethyl)	µg/L	0.2	<0.2	<0.2
Parathion-ethyl (Parathion)	µg/L	0.2	<0.2	<0.2
Bromophos Ethyl	µg/L	0.2	<0.2	<0.2
Methidathion	µg/L	0.5	<0.5	<0.5
Ethion	µg/L	0.2	<0.2	<0.2
Azinphos-methyl	µg/L	0.2	<0.2	<0.2
Surrogates				
2-fluorobiphenyl (Surrogate)	%	-	**50**	**56**
d14-p-terphenyl (Surrogate)	%	-	**68**	**78**
Total Phenolics in Water Method: AN289 Tested: 25/11/2019				
Total Phenols	mg/L	0.01	<0.01	<0.01
Anions by Ion Chromatography in Water Method: AN245 Tested: 22/11/2019				
Fluoride	mg/L	0.1	<0.10	<0.10
Chloride	mg/L	0.05	**230**	**33**
Nitrate Nitrogen, NO3-N	mg/L	0.005	<0.005	<0.005
Sulfate, SO4	mg/L	1	**89**	**47**
Alkalinity Method: AN135 Tested: 22/11/2019				
Bicarbonate Alkalinity as CaCO3	mg/L	5	**38**	**290**
Total Alkalinity as CaCO3	mg/L	5	**38**	**290**

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE200192.005 Water 19 Nov 2019 MB12	SE200192.006 Water 19 Nov 2019 MB14
Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 22/11/2019					
Ammonia Nitrogen, NH_3 as N	mg/L	0.005		**3.2**	**0.22**
Total Phosphorus by Kjeldahl Digestion DA in Water Method: AN279/AN293(Sydney only) Tested: 22/11/2019					
Total Phosphorus (Kjeldahl Digestion) as P	mg/L	0.02		<0.02	<0.02
pH in water Method: AN101 Tested: 21/11/2019					
pH**	No unit	-		**5.2**	**7.0**
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 21/11/2019					
Conductivity @ 25 C	µS/cm	2		**1100**	**770**
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 26/11/2019					
Total Dissolved Solids Dried at 175-185°C	mg/L	10		**630**	**390**
COD in Water Method: AN179/AN181 Tested: 27/11/2019					
Chemical Oxygen Demand	mg/L	10		**18**	<10

Parameter	Units	LOR	Sample Number: SE200192.005 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB12	Sample Number: SE200192.006 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: MB14
Forms of Carbon Method: AN190 Tested: 25/11/2019				
Total Organic Carbon as NPOC	mg/L	0.2	**4.7**	**3.4**
Hexavalent Chromium in water by Discrete Analyser Method: AN283 Tested: 22/11/2019				
Hexavalent Chromium, Cr6+	mg/L	0.004	<0.004	<0.004
Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 22/11/2019				
Calcium, Ca	mg/L	0.1	**34**	**92**
Magnesium, Mg	mg/L	0.1	**25**	**29**
Potassium, K	mg/L	0.2	**9.7**	**8.8**
Sodium, Na	mg/L	0.1	**79**	**19**
Trace Metals (Dissolved) in Water by ICPMS Method: AN318 Tested: 22/11/2019				
Aluminium, Al	µg/L	5	**440**	<5
Iron, Fe	µg/L	5	**41000**	**1100**
Manganese, Mn	µg/L	1	**2200**	**83**
Trace Metals (Total) in Water by ICPMS Method: AN022/AN318 Tested: 22/11/2019				
Total Chromium	µg/L	1	<1	<1

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	LB188232	mg/L	5	<5	4%	NA
Total Alkalinity as CaCO3	LB188232	mg/L	5	<5	4%	112%

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	LB188208	mg/L	0.005	<0.005	1 - 4%	100%	100%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Fluoride	LB188213	mg/L	0.1	<0.10	1%	104%
Chloride	LB188213	mg/L	0.05	<0.05	0%	93%
Nitrate Nitrogen, NO3-N	LB188213	mg/L	0.005	<0.005	3%	98%
Sulfate, SO4	LB188213	mg/L	1	<1.0	0%	94%

COD in Water Method: ME-(AU)-[ENV]AN179/AN181

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chemical Oxygen Demand	LB188484	mg/L	10	<10	0%	83%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB188133	µS/cm	2	<2	0%	95%

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	LB188296	mg/L	0.2	<0.2	2%	92%	98%

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.

Hexavalent Chromium in water by Discrete Analyser Method: ME-(AU)-[ENV]AN283

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Hexavalent Chromium, Cr6+	LB188207	mg/L	0.004	<0.004	0%	104%	95%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Calcium, Ca	LB188190	mg/L	0.1	<0.1	0%	98%	85%
Magnesium, Mg	LB188190	mg/L	0.1	<0.1	1%	99%	
Potassium, K	LB188190	mg/L	0.2	<0.2	0%	92%	
Sodium, Na	LB188190	mg/L	0.1	<0.1	0%	99%	

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Hexachlorobenzene (HCB)	LB188160	µg/L	0.1	<0.1	NA
Alpha BHC	LB188160	µg/L	0.1	<0.1	NA
Lindane (gamma BHC)	LB188160	µg/L	0.1	<0.1	NA
Heptachlor	LB188160	µg/L	0.1	<0.1	90%
Aldrin	LB188160	µg/L	0.1	<0.1	75%
Beta BHC	LB188160	µg/L	0.1	<0.1	NA
Delta BHC	LB188160	µg/L	0.1	<0.1	100%
Heptachlor epoxide	LB188160	µg/L	0.1	<0.1	NA
o,p'-DDE	LB188160	µg/L	0.1	<0.1	NA
Alpha Endosulfan	LB188160	µg/L	0.1	<0.1	NA
Gamma Chlordane	LB188160	µg/L	0.1	<0.1	NA
Alpha Chlordane	LB188160	µg/L	0.1	<0.1	NA
trans-Nonachlor	LB188160	µg/L	0.1	<0.1	NA
p,p'-DDE	LB188160	µg/L	0.1	<0.1	NA
Dieldrin	LB188160	µg/L	0.1	<0.1	95%
Endrin	LB188160	µg/L	0.1	<0.1	90%
o,p'-DDD	LB188160	µg/L	0.1	<0.1	NA
o,p'-DDT	LB188160	µg/L	0.1	<0.1	NA
Beta Endosulfan	LB188160	µg/L	0.1	<0.1	NA
p,p'-DDD	LB188160	µg/L	0.1	<0.1	NA
p,p'-DDT	LB188160	µg/L	0.1	<0.1	70%
Endosulfan sulphate	LB188160	µg/L	0.1	<0.1	NA
Endrin aldehyde	LB188160	µg/L	0.1	<0.1	NA
Methoxychlor	LB188160	µg/L	0.1	<0.1	NA
Endrin ketone	LB188160	µg/L	0.1	<0.1	NA
Isodrin	LB188160	µg/L	0.1	<0.1	NA
Mirex	LB188160	µg/L	0.1	<0.1	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Tetrachloro-m-xylene (TCMX) (Surrogate)	LB188160	%	-	45%	59%

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.

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Dichlorvos	LB188160	µg/L	0.5	<0.5	91%
Dimethoate	LB188160	µg/L	0.5	<0.5	NA
Diazinon (Dimpylate)	LB188160	µg/L	0.5	<0.5	95%
Fenitrothion	LB188160	µg/L	0.2	<0.2	NA
Malathion	LB188160	µg/L	0.2	<0.2	NA
Chlorpyrifos (Chlorpyrifos Ethyl)	LB188160	µg/L	0.2	<0.2	98%
Parathion-ethyl (Parathion)	LB188160	µg/L	0.2	<0.2	NA
Bromophos Ethyl	LB188160	µg/L	0.2	<0.2	NA
Methidathion	LB188160	µg/L	0.5	<0.5	NA
Ethion	LB188160	µg/L	0.2	<0.2	93%
Azinphos-methyl	LB188160	µg/L	0.2	<0.2	NA

Surrogates

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
2-fluorobiphenyl (Surrogate)	LB188160	%	-	52%	60%
d14-p-terphenyl (Surrogate)	LB188160	%	-	68%	64%

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

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH**	LB188133	No unit	-	1%	100%

Total Dissolved Solids (TDS) in water **Method: ME-(AU)-[ENV]AN113**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Dissolved Solids Dried at 175-185°C	LB188403	mg/L	10	<10	2%	83%

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.

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery	MS %Recovery
Total Phenols	LB188302	mg/L	0.01	<0.01	95%	81%

Total Phosphorus by Kjeldahl Digestion DA in Water **Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Total Phosphorus (Kjeldahl Digestion) as P	LB188204	mg/L	0.02	<0.02	6%	105%	107%

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery	MS %Recovery
Aluminium, Al	LB188192	µg/L	5	<5	106%	103%
Iron, Fe	LB188192	µg/L	5	<5	115%	109%
Manganese, Mn	LB188192	µg/L	1	<1	112%	72%

Trace Metals (Total) in Water by ICPMS **Method: ME-(AU)-[ENV]AN022/AN318**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Chromium	LB188195	µg/L	1	<1	0%	NA

TRH (Total Recoverable Hydrocarbons) in Water **Method: ME-(AU)-[ENV]AN403**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH C10-C14	LB188160	µg/L	50	<50	81%
TRH C15-C28	LB188160	µg/L	200	<200	90%
TRH C29-C36	LB188160	µg/L	200	<200	92%
TRH C37-C40	LB188160	µg/L	200	<200	NA
TRH C10-C36	LB188160	µg/L	450	<450	NA
TRH C10-C40	LB188160	µg/L	650	<650	NA

TRH F Bands

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
TRH >C10-C16	LB188160	µg/L	60	<60	87%
TRH >C10-C16 - Naphthalene (F2)	LB188160	µg/L	60	<60	NA
TRH >C16-C34 (F3)	LB188160	µg/L	500	<500	98%
TRH >C34-C40 (F4)	LB188160	µg/L	500	<500	83%

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.

Volatile Petroleum Hydrocarbons in Water **Method: ME-(AU)-[ENV]AN433**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
TRH C6-C10	LB188414	µg/L	50	<50	0 - 21%	94%	92%
TRH C6-C9	LB188414	µg/L	40	<40	0 - 15%	95%	94%

Surrogates

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
d4-1,2-dichloroethane (Surrogate)	LB188414	%	-	96%	14 - 15%	96%	88%
d8-toluene (Surrogate)	LB188414	%	-	104%	5 - 18%	107%	90%
Bromofluorobenzene (Surrogate)	LB188414	%	-	93%	3 - 8%	110%	85%

VPH F Bands

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Benzene (F0)	LB188414	µg/L	0.5	<0.5	0%	NA	NA
TRH C6-C10 minus BTEX (F1)	LB188414	µg/L	50	<50	0 - 21%	92%	93%

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.
AN022	The water sample is digested with Nitric Acid and made up to the original volume similar to APHA3030E.
AN022/AN318	Following acid digestion of un filtered sample, determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
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.
AN113	Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
AN113	The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
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
AN181	Analysis of COD by Semi Closed Reflux: The sample is refluxed with strong acid and a known excess of oxidant. After digestion the unreduced oxidant is back titrated to determine the amount of oxidant consumed. The chemically oxidised matter is calculated in terms of oxygen equivalents. Reference APHA 5220 B.
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
AN279/AN293(Sydney)	The sample is digested with Sulphuric acid, K2SO4 and CuSO4. All forms of phosphorus are converted into orthophosphate. The digest is cooled and placed on the discrete analyser for colorimetric analysis.

METHOD	METHODOLOGY SUMMARY
AN283	Hexavalent Chromium via Aquakem DA: Soluble hexavalent chromium forms a red/violet colour with diphenylcarbazide in acidic solution. This procedure is very sensitive and nearly specific for Cr6+. If total chromium is also measured the trivalent form of chromium Cr3+ can be calculated from the difference (Total Cr - Cr6+). Reference APHA3500CrB.
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.
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). Where F2 is corrected for Naphthalene, the VOC data for Naphthalene is used.
AN403	Additionally, the volatile C6-C9/C6-C10 fractions may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Recoveerable Hydrocarbons - Silica (TRH-Silica) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents.
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependent on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
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).
AN433	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC`s are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
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.

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Brendan Stuart	Manager	Huong Crawford
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Project	**217500-Lithgow SWF**	SGS Reference	**SE200193 R0**
Order Number	(Not specified)	Date Received	21 Nov 2019
Samples	1	Date Reported	28 Nov 2019

COMMENTS

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

Total and Volatile Suspended Solids and Total Dissolvable Solids could not be tested due to insufficient sample .

SIGNATORIES

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Senior Chemist

Shane MCDERMOTT
Inorganic/Metals Chemist

Parameter	Units	LOR	Sample Number: SE200193.001 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: LW1
Total Phenolics in Water Method: AN289 Tested: 28/11/2019			
Total Phenols	mg/L	0.01	**0.01**
Anions by Ion Chromatography in Water Method: AN245 Tested: 22/11/2019			
Fluoride	mg/L	0.1	**0.17**
Chloride	mg/L	1	**220**
Nitrate Nitrogen, NO3-N	mg/L	0.005	**0.46**
Sulfate, SO4	mg/L	1	**23**
Alkalinity Method: AN135 Tested: 22/11/2019			
Bicarbonate Alkalinity as CaCO3	mg/L	5	**99**
Total Alkalinity as CaCO3	mg/L	5	**99**
TKN Kjeldahl Digestion by Discrete Analyser Method: AN281/AN292(Sydney only) Tested: 22/11/2019			
Total Kjeldahl Nitrogen	mg/L	0.05	**0.57**
Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 22/11/2019			
Ammonia Nitrogen, NH_3 as N	mg/L	0.01	**0.18**
pH in water Method: AN101 Tested: 22/11/2019			
pH**	No unit	-	**6.7**

Parameter	Units	LOR	Sample Number: SE200193.001 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: LW1
Conductivity and TDS by Calculation - Water Method: AN106 Tested: 22/11/2019			
Conductivity @ 25 C	µS/cm	2	**1000**
Total Dissolved Solids (TDS) in water Method: AN113 Tested: 26/11/2019			
Total Dissolved Solids Dried at 175-185°C	mg/L	10	IS
Total and Volatile Suspended Solids (TSS / VSS) Method: AN114 Tested: 26/11/2019			
Total Suspended Solids Dried at 103-105°C	mg/L	5	IS
Forms of Carbon Method: AN190 Tested: 26/11/2019			
Total Organic Carbon as NPOC	mg/L	0.2	**4.3**
BOD5 Method: AN183 Tested: 22/11/2019			
Biochemical Oxygen Demand (BOD5)	mg/L	5	<5
COD in Water Method: AN179/AN181 Tested: 27/11/2019			
Chemical Oxygen Demand	mg/L	10	**12**

Parameter	Units	LOR	Sample Number: SE200193.001 Sample Matrix: Water Sample Date: 19 Nov 2019 Sample Name: LW1
Oil and Grease in Water Method: AN185 Tested: 26/11/2019			
Oil and Grease	mg/L	5	IS
Metals in Water (Total) by ICPOES Method: AN022/AN320 Tested: 22/11/2019			
Total Calcium	mg/L	0.1	**52**
Total Magnesium	mg/L	0.1	**18**
Total Potassium	mg/L	0.2	**16**
Total Sodium	mg/L	0.1	**100**
Trace Metals (Total) in Water by ICPMS Method: AN022/AN318 Tested: 22/11/2019			
Total Iron	µg/L	5	**700**
Total Manganese	µg/L	1	**780**

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	LB188232	mg/L	5	<5	4%	NA
Total Alkalinity as CaCO3	LB188232	mg/L	5	<5	4%	112%

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	LB188208	mg/L	0.01	<0.01	1 - 4%	100%	100%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Fluoride	LB188213	mg/L	0.1	<0.10	1%	104%
Chloride	LB188213	mg/L	1	<0.05	0%	93%
Nitrate Nitrogen, NO3-N	LB188213	mg/L	0.005	<0.005	3%	98%
Sulfate, SO4	LB188213	mg/L	1	<1.0	0%	94%

BOD5 Method: ME-(AU)-[ENV]AN183

Parameter	QC Reference	Units	LOR	DUP %RPD
Biochemical Oxygen Demand (BOD5)	LB188263	mg/L	5	0%

COD in Water Method: ME-(AU)-[ENV]AN179/AN181

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chemical Oxygen Demand	LB188484	mg/L	10	<10	0%	83%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB188282	µS/cm	2	<2	0%	96%

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.

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery	MS %Recovery
Total Organic Carbon as NPOC	LB188407	mg/L	0.2	<0.2	92%	97%

Metals in Water (Total) by ICPOES Method: ME-(AU)-[ENV]AN022/AN320

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Calcium	LB188191	mg/L	0.1	<0.1	1%	99%
Total Magnesium	LB188191	mg/L	0.1	<0.1	1 - 2%	100%
Total Potassium	LB188191	mg/L	0.2	<0.2	1 - 5%	93%
Total Sodium	LB188191	mg/L	0.1	<0.1	1 - 5%	101%

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

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH**	LB188282	No unit	-	2%	100%

TKN Kjeldahl Digestion by Discrete Analyser Method: ME-(AU)-[ENV]AN281/AN292(Sydney only)

Parameter	QC Reference	Units	LOR	DUP %RPD	MS %Recovery
Total Kjeldahl Nitrogen	LB188204	mg/L	0.05	2%	106%

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

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Total Phenols	LB188621	mg/L	0.01	<0.01	98%

Trace Metals (Total) in Water by ICPMS Method: ME-(AU)-[ENV]AN022/AN318

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Iron	LB188195	µg/L	5	<5	1%	NA
Total Manganese	LB188195	µg/L	1	<1	1%	111%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN022	The water sample is digested with Nitric Acid and made up to the original volume similar to APHA3030E.
AN022/AN318	Following acid digestion of un filtered sample, determination of elements at trace level in waters by ICP-MS technique, in accordance with USEPA 6020A.
AN022/AN320	Total (acid soluble) Metals by ICP-OES: Samples are digested in nitric or nitric and hydrochloric acids prior to analysis 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.
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.
AN113	Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
AN113	The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
AN114	Total Suspended and Volatile Suspended Solids: The sample is homogenised by shaking and a known volume is filtered through a pre-weighed GF/C filter paper and washed well with deionised water. The filter paper is dried and reweighed. The TSS is the residue retained by the filter per unit volume of sample. Reference APHA 2540 D. Internal Reference AN114
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
AN181	Analysis of COD by Semi Closed Reflux: The sample is refluxed with strong acid and a known excess of oxidant. After digestion the unreduced oxidant is back titrated to determine the amount of oxidant consumed. The chemically oxidised matter is calculated in terms of oxygen equivalents. Reference APHA 5220 B.
AN183	BOD: Serial dilutions of the sample are firstly combined with various reagents to aid bacterial growth and the sample is incubated for 5 days at 20°C. The difference between the initial and final oxygen contents of the sample is the amount of oxygen consumed by the bacteria. This is related to the organic loading of the sample therefore cBOD is the measure of the digestibility or bioavailability of organic matter in the sample. Reference APHA 5210 B. Internal Reference AN183

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN185	Gravimetric Oil & Grease and Hydrocarbons: A known volume of sample is extracted using an organic solvent and the solvent layer with dissolved oils and greases is transferred to a pre-weighed beaker. The solvent is evaporated over low heating and the beaker reweighed. The concentration of oil and grease is determined by the increase in mass of the collection beaker per volume of sample extracted. O&G is suitable for lubricating oils and other high boiling point products but is not suitable for volatiles. Reference to APHA 5520 B and USEPA 1664 Revision B.. Internal Reference AN185
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
AN281	An unfiltered water or soil sample is first digested in a block digestor with sulfuric acid, K2SO4 and CuSO4. The ammonia produced following digestion is then measured colourimetrically using the Aquakem 250 Discrete Analyser. A portion of the digested sample is buffered to an alkaline pH, and interfering cations are complexed. The ammonia then reacts with salicylate and hypochlorite to give a blue colour whose absorbance is measured at 660nm and compared with calibration standards. This is proportional to the concentration of Total Kjeldahl Nitrogen in the original sample.
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.
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.
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.