

Our Ref: 217505_LET_001.docx

10 January 2018

Oberon Council
137-139 Oberon Street
Oberon NSW 2787

Attention: Vicki McKinnon – Development Control Assistant

ENVIRONMENTAL MONITORING OF OBERON WASTE FACILITY

Geolyse has completed scheduled environmental monitoring per the requirements of Environment Protection Licence (EPL) 20289 at Oberon Waste Facility, located at 364 – 372 Lowes Mount Road, Oberon.

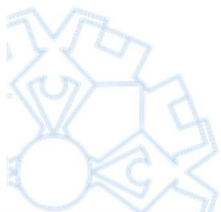
Groundwater Levels

Groundwater was gauged at six (6) groundwater monitoring wells across the site. Groundwater gauging data is included in **Table 1** (attached), and elevations are shown on **Figure 1**.

Groundwater monitoring locations BH1D, BH3D, BH4D and BH6D, were not scheduled to be monitored during this bi-annual monitoring event.

Observations were as follows:

- Depths to groundwater ranged from 2.71 metres below ground level (mbgl) at BH3S, to 4.43 mbgl at BH4S.
- Corresponding groundwater elevations ranged from 1,101.72 metres Australian Height Datum (AHD) at BH4S to 1,109.84 mAHD at BH2, indicating a groundwater flow direction to the north-west.
- Groundwater monitoring locations BH1S and BH6S were dry during gauging. Groundwater at monitoring location BH4S did not recharge following purging and no sample could be collected.



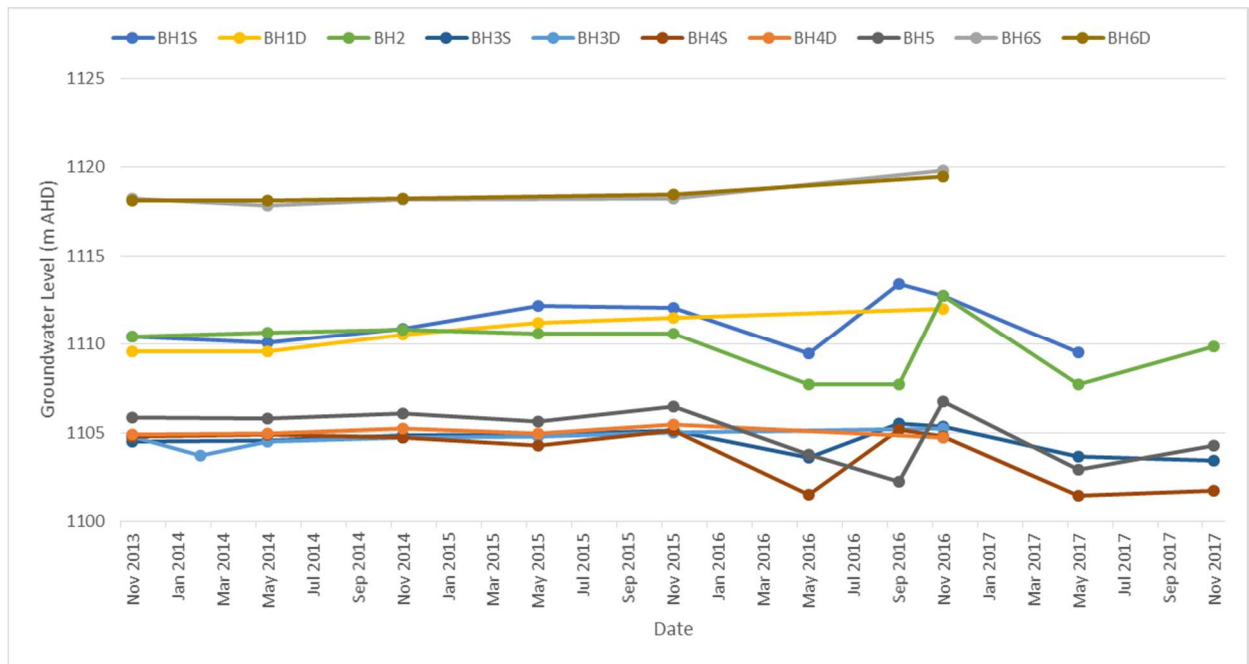


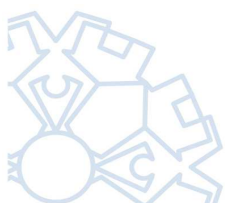
Figure 1: Oberon Waste Facility – Groundwater Elevations

Groundwater Quality

Groundwater samples were able to be collected from monitoring locations BH1S, BH2 and BH5. 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 5.9 at BH2 to 7.1 at BH3S. Groundwater pH at BH2 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 470 $\mu\text{S}/\text{cm}$ at BH2 to 1,200 $\mu\text{S}/\text{cm}$ at BH3S.
- Total dissolved solids (TDS) concentrations were recorded to range from 300 mg/L at BH2 to 660 mg/L at BH5. TDS concentrations were below the livestock watering ‘loss of production’ tolerance limit for the most susceptible livestock category, poultry (3000 mg/L – ANZECC & ARMCANZ, 2000).
- Total alkalinity in groundwater ranged from 56 mg/L at BH2 to 460 mg/L at BH5. The total alkalinity at BH5 was higher than the guideline hardness value for potential fouling of waters (350 mg/L).





- Groundwater chloride concentrations ranged from 32 mg/L at BH3S to 69 mg/L at BH2. All concentrations were below the guideline value for protection of moderately sensitive crops (350 mg/L).
- Sulfate concentrations in groundwater ranged from below the laboratory limit of reporting (LOR) of 1 mg/L at BH2, to 160 mg/L at BH5.
- Calcium concentrations ranged from 1.4 mg/L at BH2 to 12 mg/L at BH5.
- Magnesium concentrations ranged from 16 mg/L at BH3S to 74 mg/L at BH5.
- Potassium concentrations ranged from 0.3 mg/L at BH2 to 0.9 mg/L at BH5.
- Concentrations of sodium ranged from 16 mg/L at BH2, to 170 mg/L at BH5. Sodium concentrations were below the guideline level for irrigation to moderately sensitive crops (< 230 mg/L).
- The concentration of total organic carbon (TOC) ranged from 1.0 mg/L at BH2, to 7.3 mg/L at BH5.
- Ammonia concentrations in groundwater ranged from 0.02 mgN/L at BH3S and BH5, to 0.04 mgN/L at BH2.
- Nitrate concentrations ranged from below the laboratory LOR of 0.05 mgN/L at BH3S to 17 mgN/L at BH2.
- Concentrations of total phosphorus ranged from 0.06 mg/L at BH5, to 1.7 mg/L at BH3S. Total phosphorus concentrations were above the guideline level for long-term irrigation to prevent algal growth in irrigation water (< 0.05 mg/L).

Surface Water Quality

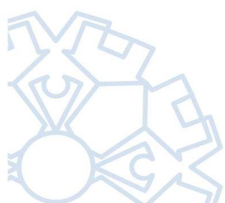
A surface water discharge event occurred on 4 December 2017 from the surface storage pond dam located to the west of the facility and a sample was collected. The sample was couriered to SGS Laboratories in Alexandria, NSW, who are NATA accredited to perform the scheduled analysis. Results of analysis are included in **Table 3** (attached), and laboratory certificates have also been appended to this letter.

Surface water quality has been assessed by comparison to criteria (where available) provided in the site Environment Protection Licence 20289 (November 2013) '*Limit Conditions - L2.4 Water and/or Land Concentration Limits*'.

- Laboratory measured pH was recorded to be 6.9, and was within the limit condition range (6.5 to 8.5 pH units).
- Electrical conductivity (EC) was recorded to be 400 μ S/cm.
- The concentration of oil & grease in the surface water discharge was recorded to be 10 mg/L, equivalent to (but not exceeding) the limit condition concentration (< 10 mg/L).
- Total suspended solids (TSS) were recorded to be 46 mg/L in the surface water sample, below the limit condition concentration (< 50 mg/L).

Summary

Groundwater monitoring is scheduled to continue biannually. The next monitoring event will occur in May 2018 and will include the groundwater monitoring points installed in the deeper aquifer.



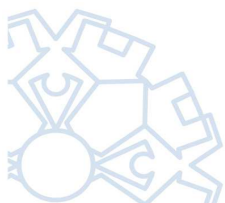
Please do not hesitate to contact us with any questions or comments you may have regarding this report.

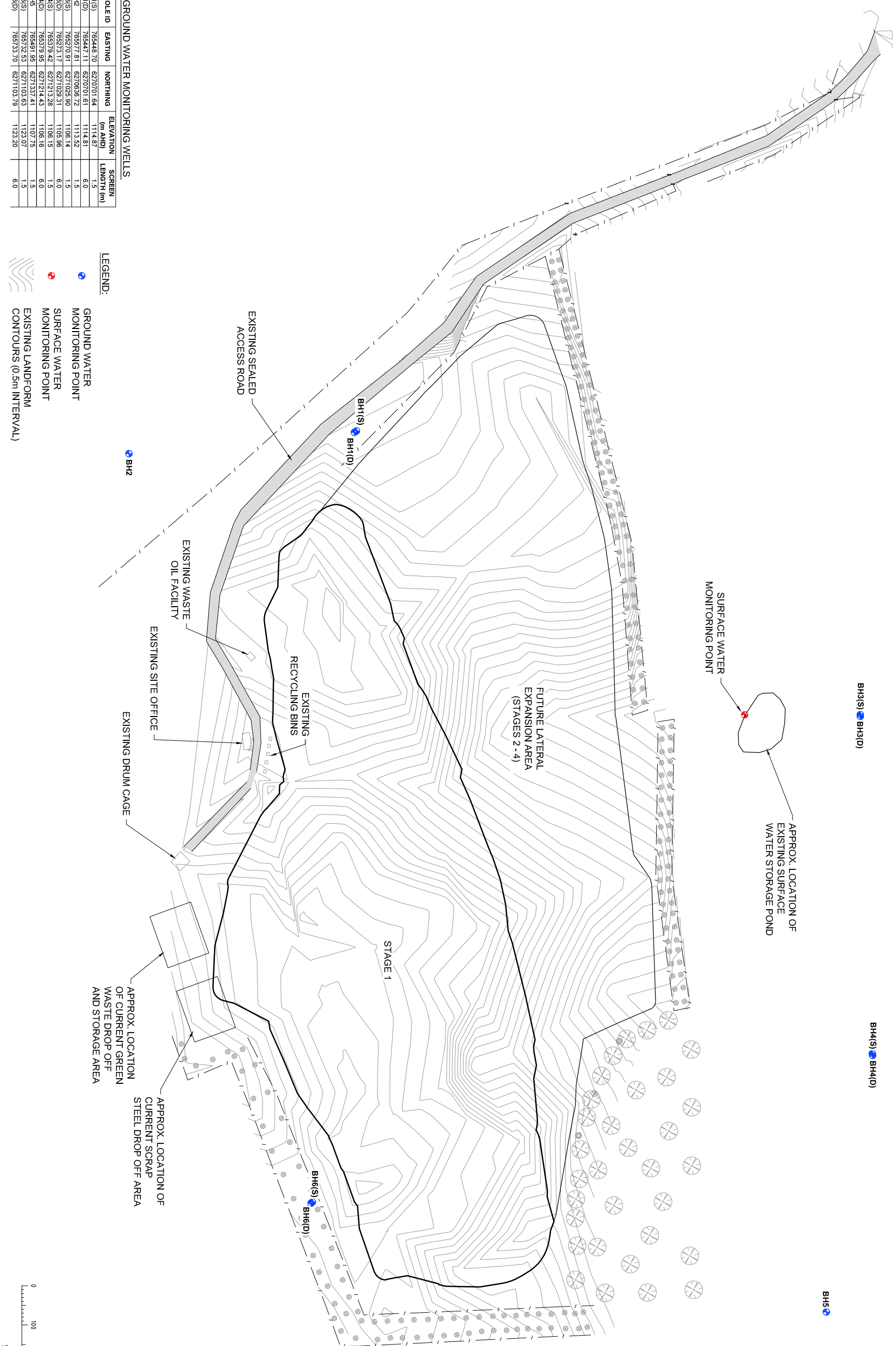
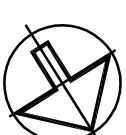
Yours faithfully
Geolyse Pty Ltd



BRENDAN STUART
Environmental Scientist

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

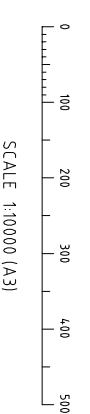




GROUND WATER MONITORING WELLS

BOREHOLE ID	EASTING	NORTHING	ELEVATION (m AHD)	SCREEN LENGTH (m)
BH1(S)	705448.70	6270701.84	1114.87	1.5
BH1(D)	705447.11	6270701.81	1114.81	6.0
BH2	705577.81	6270636.72	1113.52	1.5
BH3(S)	705270.91	6271023.90	1106.14	1.5
BH3(D)	705273.17	6271023.31	1105.96	6.0
BH4(S)	705379.42	6271213.28	1106.15	1.5
BH4(D)	705379.95	6271214.43	1106.16	6.0
BH5	705491.95	6271337.41	1107.75	1.5
BH6(S)	705732.53	6271103.83	1123.07	1.5
BH6(D)	705733.70	6271103.79	1123.20	6.0

- LEGEND:**
- + GROUND WATER MONITORING POINT
 - + SURFACE WATER MONITORING POINT
 - EXISTING LANDFORM CONTOURS (0.5m INTERVAL)



ORANGE
 154 PERSEY STREET
 P.O. BOX 7863
 ORANGE, NSW 2800
 Ph. (02) 6393 5000
 Fx. (02) 6393 5950
 orange@geolyse.com
 www.geolyse.com

No	DATE	DRAWING CHECK	APPROVED BY	DETAILS
A	02/05/13	LP	KH	DRAFT
B	16/05/13	LP	KH	ISSUED
C	01/10/14	MY	MH	UPDATE PIEZO BH3(D) DATA

PROJECT

**OBERON LANDFILL EXTENSION
 LANDFILL ENVIRONMENTAL MANAGEMENT PLAN**

FILE REFERENCE: 211129_AOC_EV02_EV02.dwg

APPROVAL AUTHORITY

**OBERON COUNCIL
 ENVIRONMENT
 PROTECTION AUTHORITY**

CLIENT

OBERON COUNCIL

DRAWING

**EXPANSION STAGES AND
 MONITORING POINTS**

PROJECT NUMBER: 211129
 DRAWING NUMBER: 05C_EV02
 SOURCE: INTERNAL
 REV: C

TABLE A2 - EPL 20289 OBERON WASTE FACILITY- GROUNDWATER GAUGING RESULTS

Ground Water Levels: 13-Nov-17

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)
BH1S	-	-	1114.87	13/11/2017	5.50	1109.37	5.50	1109.37	0.00
BH1D	-	-	1114.81	13/11/2017	WLNLM	-	26.50	1088.31	N/A
BH2	-	-	1113.52	13/11/2017	3.68	1109.84	5.80	1107.72	2.12
BH3S	-	-	1106.14	13/11/2017	2.71	1103.43	5.00	1101.14	2.29
BH3D	-	-	1105.96	13/11/2017	WLNLM	-	26.60	1079.36	N/A
BH4S	-	-	1106.15	13/11/2017	4.43	1101.72	4.80	1101.35	0.37
BH4D	-	-	1106.16	13/11/2017	WLNLM	-	50.50	1055.66	N/A
BH5	-	-	1107.75	13/11/2017	3.47	1104.28	5.50	1102.25	2.03
BH6S	-	-	1123.07	13/11/2017	5.87	1117.20	5.87	1117.20	0.00
BH6D	-	-	1123.20	13/11/2017	WLNLM	-	27.00	1096.20	N/A

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.
- WLNLM: *Water Level Not Measured*



Date	BH1S		BH1D		BH2		BH3S		BH3D		BH4S		BH4D		BH5		BH6S		BH6D	
	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)
19-Nov-13	4.41	1110.46	5.20	1109.61	3.06	1110.46	1.63	1104.51	1.18	1104.78	1.40	1104.75	1.27	1104.89	1.89	1105.86	4.83	1118.24	5.06	1118.14
25-Feb-14	-	-	-	-	-	-	-	-	2.28	1103.68	-	-	-	-	-	-	-	-	-	-
12-May-14	4.80	1110.07	5.20	1109.61	2.85	1110.67	1.58	1104.56	1.48	1104.48	1.26	1104.89	1.23	1104.93	1.97	1105.78	5.20	1117.87	5.07	1118.13
5-Nov-14	3.99	1110.88	4.28	1110.53	2.72	1110.80	1.31	1104.83	1.24	1104.72	1.43	1104.72	0.92	1105.24	1.66	1106.09	4.90	1118.17	4.94	1118.26
6-May-15	2.67	1112.20	3.58	1111.23	2.90	1110.62	1.27	1104.87	1.18	1104.78	1.91	1104.24	1.21	1104.95	2.11	1105.64	5.87	WLNLM	WLNLM	WLNLM
23-Nov-15	2.82	1112.05	3.33	1111.48	2.90	1110.62	1.04	1105.10	0.94	1105.02	1.05	1105.10	0.70	1105.46	1.30	1106.45	4.83	1118.24	4.73	1118.47
19-May-16	5.42	1109.45	WLNLM		5.80	1107.72	2.55	1103.59	WLNLM		4.65	1101.50	WLNLM		3.97	1103.78	5.87	WLNLM	WLNLM	WLNLM
5-Sep-16	1.46	1113.41	WLNLM		5.80	1107.72	0.61	1105.53	WLNLM		0.97	1105.18	WLNLM		5.50	1102.25	5.87	WLNLM	WLNLM	WLNLM
7-Nov-16	2.14	1112.73	2.80	1112.01	0.74	1112.78	0.82	1105.32	0.76	1105.20	1.35	1104.80	1.45	1104.71	0.99	1106.76	3.22	1119.85	3.72	1119.48
17-May-17	5.37	1109.50	WLNLM		5.80	1107.72	2.51	1103.63	WLNLM		4.73	1101.42	WLNLM		4.87	1102.88	5.87	WLNLM	WLNLM	WLNLM
13-Nov-17	5.50		WLNLM		3.68	1109.84	2.71	1103.43	WLNLM		4.43	1101.72	WLNLM		3.47	1104.28	5.87	WLNLM	WLNLM	WLNLM

**TABLE 2: OBERON WASTE FACILITY - RESULTS OF LABORATORY ANALYSIS
Q4 2017**



Group	Analyte	LOR	Units	Criteria	Sample ID	BH2	BH3(S)	BH5	SW1
					Sample Date	13/11/2017	13/11/2017	13/11/2017	5/12/2017
Physical Parameters	pH (Lab)	-	No unit	6.5 - 8.5	PS	5.9	6.7	7.1	6.9
	Electrical Conductivity (Lab)	2	µS/cm	4478		470	590	1200	400
	Oil & Grease	5	mg/L	10		-	-	-	10
	Total Suspended Solids	5	mg/L	50		-	-	-	46
	Total Dissolved Solids	10	mg/L	-		300	360	660	-
Alkalinity	Total Alkalinity as CaCO3	5	mg/L	350		56	250	460	-
Anions	Chloride	1	mg/L	350		69	32	36	-
	Sulfate (SO4)	1	mg/L	-		< 1	10	160	-
Cations	Calcium (Ca)	0.2	mg/L	1000		1.4	5.1	12	-
	Magnesium (Mg)	0.1	mg/L	-		39	16	74	-
	Potassium (K)	0.1	mg/L	-		0.3	0.5	0.9	-
	Sodium (Na)	0.5	mg/L	230		16	100	170	-
Forms of Carbon	Total Organic Carbon	0.2	mg/L	-		1	4.9	7.3	-
Nutrients	Ammonia (NH3) as N	0.01	mg/L	-		0.04	0.02	0.02	-
	Nitrate (NO3) as N	0.05	mg/L	-		-	< 0.05	-	-
	Nitrate (NO3) as N	0.005	mg/L	-		17	-	3	-
	Nitrite (NO2) as N	0.005	mg/L	-		< 0.005	< 0.005	< 0.005	-
	Total Phosphorus	0.02	mg/L	0.05		0.69	1.7	0.06	-

mg/L milligrams 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 and/or *NSW EPA Environment Protection Licence 20289 'Limit Conditions - L2.4 Water and/or Land Concentration Limits'*, 2013

 within criteria
 criteria exceeded

CLIENT DETAILS

Contact **Brendan Stuart**
 Client **GEOLYSE PTY LIMITED**
 Address **PO BOX 1963
 NSW 2800**

Telephone **61 2 68841525**
 Facsimile **(Not specified)**
 Email **bstuart@geolyse.com**

Project **217505 - Oberon WF**
 Order Number **(Not specified)**
 Samples **3**

LABORATORY DETAILS

Manager **Huong Crawford**
 Laboratory **SGS Alexandria Environmental**
 Address **Unit 16, 33 Maddox St
 Alexandria NSW 2015**

Telephone **+61 2 8594 0400**
 Facsimile **+61 2 8594 0499**
 Email **au.environmental.sydney@sgs.com**

SGS Reference **SE172656 R0**
 Date Received **16 Nov 2017**
 Date Reported **23 Nov 2017**

COMMENTS

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

Ion Chromatography - The Limit of Reporting (LOR) has been raised for NO3-N due to high conductivity of the sample requiring dilution.

SIGNATORIES



Dong Liang
 Metals/Inorganics Team Leader



Huong Crawford
 Production Manager



Kamrul Ahsan
 Senior Chemist



Shane McDermott
 Inorganic/Metals Chemist

Parameter	Units	LOR	SE172656.001	SE172656.002	SE172656.003
Sample Number			SE172656.001	SE172656.002	SE172656.003
Sample Matrix			Water	Water	Water
Sample Date			13 Nov 2017	13 Nov 2017	13 Nov 2017
Sample Name			BH2	BH3(S)	BH5

Anions by Ion Chromatography in Water Method: AN245 Tested: 17/11/2017

Chloride	mg/L	1	69	32	36
Nitrate Nitrogen, NO3-N	mg/L	0.005	17	<0.050†	3.0
Sulfate, SO4	mg/L	1	<1.0	10	160

Alkalinity Method: AN135 Tested: 17/11/2017

Total Alkalinity as CaCO3	mg/L	5	56	250	460
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Total Dissolved Solids (TDS) in water Method: AN113 Tested: 21/11/2017

Total Dissolved Solids Dried at 175-185°C	mg/L	10	300	360	660
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Forms of Carbon Method: AN190 Tested: 22/11/2017

Total Organic Carbon as NPOC	mg/L	0.2	1.0	4.9	7.3
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pH in water Method: AN101 Tested: 17/11/2017

pH**	No unit	-	5.9	6.7	7.1
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Conductivity and TDS by Calculation - Water Method: AN106 Tested: 17/11/2017

Conductivity @ 25 C	µS/cm	2	470	590	1200
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Parameter	Units	LOR	SE172656.001	SE172656.002	SE172656.003
Sample Number			SE172656.001	SE172656.002	SE172656.003
Sample Matrix			Water	Water	Water
Sample Date			13 Nov 2017	13 Nov 2017	13 Nov 2017
Sample Name			BH2	BH3(S)	BH5

Ammonia Nitrogen by Discrete Analyser (Aquakem) Method: AN291 Tested: 20/11/2017

Ammonia Nitrogen, NH ₃ as N	mg/L	0.01	0.04	0.02	0.02
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Nitrite in Water Method: AN277 Tested: 20/11/2017

Nitrite Nitrogen, NO ₂ as N	mg/L	0.005	<0.005	<0.005	<0.005
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Total Phosphorus by Kjeldahl Digestion DA in Water Method: AN279/AN293(Sydney only) Tested: 21/11/2017

Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	0.69	1.7	0.06
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Metals in Water (Dissolved) by ICPOES Method: AN320 Tested: 21/11/2017

Calcium, Ca	mg/L	0.2	1.4	5.1	12
Magnesium, Mg	mg/L	0.1	39	16	74
Potassium, K	mg/L	0.1	0.3	0.5	0.9
Sodium, Na	mg/L	0.5	16	100	170

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
Total Alkalinity as CaCO3	LB136716	mg/L	5	<5	0 - 4%	97%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Ammonia Nitrogen, NH ₃ as N	LB136751	mg/L	0.01	<0.01	6 - 71%	108%

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery
Chloride	LB136719	mg/L	1	<0.05	0 - 1%	95%	
Nitrate Nitrogen, NO ₃ -N	LB136719	mg/L	0.005	<0.005	1%	96%	100%
Sulfate, SO ₄	LB136719	mg/L	1	<1.0	0 - 1%	93%	

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB136692	µS/cm	2	<2	1%	100%

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	LB136971	mg/L	0.2	<0.2	1%	97%	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	LB136868	mg/L	0.2	<0.2	2 - 3%	95%	106%
Magnesium, Mg	LB136868	mg/L	0.1	<0.1	1 - 2%	95%	
Potassium, K	LB136868	mg/L	0.1	<0.1	2 - 6%	93%	123%
Sodium, Na	LB136868	mg/L	0.5	<0.5	1 - 6%	98%	89%

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.

Nitrite in Water Method: ME-(AU)-[ENV]AN277

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Nitrite Nitrogen, NO2 as N	LB136751	mg/L	0.005	<0.005	100%

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

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH**	LB136692	No unit	-	1 - 3%	99%

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	LB136828	mg/L	10	<10	5%	98%

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)	LB136855	mg/L	0.02	<0.02	22%	108%	108%

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.
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.
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 CO ₂ 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 O ₂ /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, NO ₂ , NO ₃ and SO ₄ 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
AN277/WC250.312	Nitrite ions, when reacted with a reagent containing sulphanilamide and N-(1-naphthyl)-ethylenediamine dihydrochloride produce a highly coloured azo dye that is measured photometrically at 540nm.
AN279/AN293(Sydney)	The sample is digested with Sulphuric acid, K ₂ SO ₄ and CuSO ₄ . All forms of phosphorus are converted into orthophosphate. The digest is cooled and placed on the discrete analyser for colorimetric analysis.
AN291	Ammonia in solution reacts with hypochlorite ions from Sodium Dichloroisocyanate, and salicylate in the presence of Sodium Nitroprusside to form indophenol blue and measured at 670 nm by Discrete Analyser.
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

METHODOLOGY SUMMARY

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
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples 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 calculated 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 criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

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CLIENT DETAILS

Contact **Brendan Stuart**
 Client **GEOLYSE PTY LIMITED**
 Address **PO BOX 1963
 NSW 2800**

Telephone **61 2 68841525**
 Facsimile **(Not specified)**
 Email **bstuart@geolyse.com**

Project **217505 - Oberson WF**
 Order Number **(Not specified)**
 Samples **1**

LABORATORY DETAILS

Manager **Huong Crawford**
 Laboratory **SGS Alexandria Environmental**
 Address **Unit 16, 33 Maddox St
 Alexandria NSW 2015**

Telephone **+61 2 8594 0400**
 Facsimile **+61 2 8594 0499**
 Email **au.environmental.sydney@sgs.com**

SGS Reference **SE173460 R0**
 Date Received **07 Dec 2017**
 Date Reported **08 Dec 2017**

COMMENTS

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

SIGNATORIES



Dong Liang
Metals/Inorganics Team Leader

Sample Number SE173460.001
 Sample Matrix Water
 Sample Date 05 Dec 2017
 Sample Name SW1

Parameter	Units	LOR
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pH in water Method: AN101 Tested: 8/12/2017

pH**	No unit	-	6.9
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Conductivity and TDS by Calculation - Water Method: AN106 Tested: 8/12/2017

Conductivity @ 25 C	µS/cm	2	400
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Oil and Grease in Water Method: AN185 Tested: 8/12/2017

Oil and Grease	mg/L	5	10
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Total and Volatile Suspended Solids (TSS / VSS) Method: AN114 Tested: 8/12/2017

Total Suspended Solids Dried at 103-105°C	mg/L	5	46
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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.

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

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity @ 25 C	LB138226	µS/cm	2	<2	0%	103%

Oil and Grease in Water Method: ME-(AU)-[ENV]AN185

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Oil and Grease	LB138160	mg/L	5	<5	105%

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

Parameter	QC Reference	Units	LOR	LCS %Recovery
pH**	LB138226	No unit	-	99%

Total and Volatile Suspended Solids (TSS / VSS) Method: ME-(AU)-[ENV]AN114

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Total Suspended Solids Dried at 103-105°C	LB138202	mg/L	5	<5	97%

METHOD

METHODOLOGY SUMMARY

AN101

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AN106

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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

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 APHA 5520 B. Internal Reference AN185

FOOTNOTES

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