

Department of Communications,  
Climate Action and Environment



**Environmental  
Monitoring Services at the  
Former Mining Areas of  
Silvermines (Co. Tipperary)  
and Avoca (Co. Wicklow)**

**Avoca Data Report**

Round 2  
September 2018



**CDM  
Smith**



# Document Control Sheet

<b>Client</b>		Department of Communications, Climate Action and Environment		
<b>Project</b>		Environmental Monitoring of Former Mining Areas of Silvermines and Avoca (2018-2020)		
<b>Project No:</b>		118174		
<b>Report</b>		Data Report for the Former Mining Area of Avoca – September 2018		
<b>Document Reference:</b>		118174/40/DG/12A		
<b>Version</b>	<b>Author</b>	<b>Checked</b>	<b>Reviewed</b>	<b>Date</b>
1	Project Team	R O'Carroll	R L Olsen	November 2018



# Table of Contents

<b>Section 1</b>	<b>Objectives and Scope .....</b>	<b>1</b>
<b>Section 2</b>	<b>Groundwater Monitoring Summary .....</b>	<b>2</b>
<b>Section 3</b>	<b>Surface Water Monitoring Summary.....</b>	<b>3</b>

## Appendices

<b>Appendix A Physico-chemical Field Data</b>
<b>Appendix B Surface Water Flow Measurements</b>
<b>Appendix C Groundwater Level Data/ Measurements</b>
<b>Appendix D Photographs</b>
<b>Appendix E Chain of Custody Records</b>
<b>Appendix F Certificates of Analysis and Laboratory Analytical Data</b>
<b>Appendix G Standard Reference Material Certificates</b>
<b>Appendix H Field Data Sheets and Logbook Notes</b>

## Section 1 Objectives and Scope

The Department of Communications, Climate Action and Environment (the Department) appointed CDM Smith Ireland Ltd (CDM Smith) to undertake a programme of environmental monitoring at the closed mine sites of Silvermines and Avoca, commencing in 2018.

The scope of the monitoring programme is defined in the *Environmental Monitoring of Former Mining Areas of Silvermines and Avoca Monitoring Plan*, (Document Ref: 118174/40/DG/01, dated February 2018) and sampling activities were performed in accordance with the programme and procedures set out therein.

This Data Report for the Avoca Mining Area contains all field observations and laboratory analytical results collected during the September 2018 round of monitoring. It is a stand-alone document but is intended to be read in conjunction with an Environmental Monitoring Report, to be issued in November 2018.

The report contains the data and information in appendices as follows:

- **Appendix A:** All physico-chemical field analyses (pH, DO, conductivity, ORP, temperature) collected in the field in Excel spreadsheets;
- **Appendix B:** All surface water flow measurements;
- **Appendix C:** All groundwater level measurements and downloads from data loggers in Excel spreadsheets;
- **Appendix D:** All relevant digital photographs contained on a CD;
- **Appendix E:** Chain of custody records;
- **Appendix F:** Certificates of Analysis laboratory report and laboratory analytical data;
- **Appendix G:** Standard reference material certificates; and
- **Appendix H:** Copies of field data sheets and logbook notes.



## Section 2 Groundwater Monitoring Summary

Seven groundwater wells were sampled on 6 and 7 September 2018. No sample was obtained from monitoring well SG104 due to the borehole being dry.

A clean Grundfos pump and dedicated tubing were lowered to midway along the well screen and samples were collected after field parameters were stabilised according to the low flow sampling method. The only exceptions were for GW1/05 and GW2/05. A blockage exists in GW1/05 and GW2/05 which prevents low flow sampling from being conducted. The samples were collected after greater than 3 volumes of the well had been purged and the field parameters had stabilised. Stabilisation of parameters was the primary requirement with respect to sampling time. If the field parameters had stabilised after 1.5 volumes of the well had been purged the sample was also taken.

Physico-chemical field data are summarised in **Appendix A** and analytical data are contained in **Appendix F**. Groundwater levels were measured at all monitoring wells using a portable electronic water level recorder. Automatic groundwater recorders are installed in six wells and data were downloaded. Groundwater level data are contained in **Appendix C**.

In accordance with the QA/QC Protocols set out in the Monitoring Plan, one duplicate groundwater sample and one decontamination blank were collected. The latter was obtained by sampling deionised water that was pumped through the groundwater pump after decontamination. One certified standard reference material containing known concentrations of the 18 metals was shipped blind to ALS laboratory (SRM certificate is contained in **Appendix G**).

## Section 3 Surface Water Monitoring Summary

Nineteen surface water locations were sampled between 4 and 5 September 2018. No sample could be obtained from Ballygahan Adit and because it was not discharging at the time of sampling. Photographs of each sampling site are contained in **Appendix D**. Field parameter measurements were also collected at each location. Physico-chemical field data are summarised in **Appendix A** and analytical data are contained in **Appendix F**.

Flow was measured at 10 locations using various methods depending upon the quantity of flow to be measured and any safety concerns. Additionally, data were obtained from the EPA for the existing automatic recorders at Whites Bridge (EPA station 10044) and Wicklow County Council Maintenance Yard (EPA Station 10045). Surface water flow data and measurement methodologies are contained in **Appendix B**.

In accordance with the Monitoring Plan, two duplicate surface water samples and one decontamination blank sample were collected. The latter was collected by sampling deionised water that was poured over the sampling equipment after the equipment had been decontaminated. One certified standard reference material containing known concentrations of the 18 metals was shipped blind to ALS laboratory (SRM certificate is contained in **Appendix G**).

## Appendix A

---

### Physico-Chemical Field Data

Excel files are also on attached CD



**Table A-1 Avoca Physico-chemical Field Data Round 2 (2018) - Groundwater**

Sample ID	Date Sampled	pH (field)	Temperature (field)	Specific Conductance @ deg.C (field)	Dissolved Oxygen 1 (field)	Dissolved Oxygen 2 (field)	ORP (Field)
		pH Units	°C	mS/cm	% Sat	mg/l O <sub>2</sub>	mV
MWDA1	13/09/2018	2.80	13.0	1.672	3.0	0.30	410
MWDA2	13/09/2018	3.73	12.0	1.625	2.1	0.22	240
MWPF1	06/09/2018	4.59	11.0	1.400	29.7	3.28	304
MWET1	06/09/2018	3.31	12.1	2.455	3.1	0.43	316
MWET2	06/09/2018	6.06	11.5	3.291	1.6	0.17	24.8
GW1/05	07/09/2018	3.61	11.1	1.678	39.5	4.93	413
GW2/05	06/09/2018	3.52	12.1	1.420	62.6	6.66	337
SG104	06/09/2018	-	-	-	-	-	-

Notes:

SG104 - No sample obtainable due to dry borehole

Table A-2 Avoca Physico-chemical Field Data Round 2 (2018) - Surface Water

Sample ID	Date Sampled	pH (field)	Temperature (field)	Specific Conductance @ deg.C (field)	Dissolved Oxygen 1 (field)	Dissolved Oxygen 2 (field)	ORP (Field)
		pH Units	°C	mS/cm	% Sat	mg/l O <sub>2</sub>	mV
Cronebane Intermediate Adit	04/09/2018	3.41	10.4	1095	5	0.55	349
Cronebane Shallow Adit	04/09/2018	2.61	10.5	4160	12.5	1.35	496
Deep Adit	04/09/2018	3.14	11.1	1552	52.3	5.7	428.2
Deep Adit Confluence	04/09/2018	3.1	11.3	1555	76.4	8.34	443
Road Adit	04/09/2018	3.77	12.9	1268	34.4	3.64	339.8
Road Adit Confluence	04/09/2018	3.79	12.8	1269	87.3	9.2	353.2
US Tigroney West (Drainage)	04/09/2018						
850 Adit (portal)	04/09/2018	2.89	10.8	1342	91.1	10.05	514
Ballygahan Adit	05/09/2018	n/a	n/a	n/a	n/a	n/a	n/a
Site T1	05/09/2018	6.97	14.9	77.6	105	10.63	192
US Whites Bridge	05/09/2018	6.69	13.8	68.6	94.9	9.84	204
Whites Bridge	05/09/2018	6.44	15	74.1	106	10.8	211
Whites Bridge GS	05/09/2018	6.21	14.3	84	104	10.69	213
DS Deep Adit	05/09/2018	6.17	14.4	80.4	108.7	11.09	188
DS Millrace	05/09/2018	6.2	14.1	81.7	103	10.59	193
US Ballygahan Adit	05/09/2018	5.93	13.5	86.3	107	11.1	203
US Road Adit	05/09/2018	5.81	13	91	107.2	11.29	202
WCC Main. Yard GS	05/09/2018	5.65	12.8	127	106	11.2	196
Site T5	05/09/2018	5.86	12.5	113.9	101.4	10.85	179
Avoca Bridge	05/09/2018	6	11.7	100	97.9	10.59	151

Notes:

Ballygahan Adit - No flow on 05 September 2018

## Appendix B

---

# Surface Water Flow Measurements

Excel files are also on attached CD



**Table B-1 Avoca Surface Water Flow Measurements - Round 2 (2018)**

Site Name	Flow m <sup>3</sup> /s	Flow l/s	Date	Method	Notes
Site T1 (Avoca River)	1.68	1676	05/09/2018	Flow meter	Flow recorded at 16:30
US Whites Bridge	1.16	1160	05/09/2018	Calculated	Flow recorded at 16:00
Whites Bridge	1.16	1160	05/09/2018	Calculated	Flow recorded at 15:45
White's Bridge GS	1.18	1180	05/09/2018	Automatic recorder (Data from EPA)	Flow recorded at 13:30
DS Deep Adit	1.18	1184	05/09/2018	Calculated	Flow recorded at 14:20
DS Millrace	1.19	1188	05/09/2018	Calculated	Flow recorded at 14:00
US Ballygahan Adit	1.28	1280	05/09/2018	Calculated	Flow recorded at 12:40
US Road Adit	1.28	1282	05/09/2018	Calculated	Flow recorded at 12:00
Wicklow Co Co. Maintenance Yard GS	1.29	1290	05/09/2018	Calculated	Flow recorded at 11:45
Site T5	1.18	1185	05/09/2018	Flow meter	Flow recorded at 10:45
Avoca Bridge	1.02	1023	05/09/2018	Float Method, with depth profile using wading staff	Flow recorded at 8:45
850 Adit	0.00	1.2	04/09/2018	Flow Meter - Marsh McBirney	-
Deep Adit	0.01	8.5	04/09/2018	Flow Meter - Marsh McBirney	-
Deep Adit Confluence	0.00	3.9	04/09/2018	Flume	Upstream Gauge - 0.25 ft on 4 inch flume, capturing 95% of flow.
Road Adit	0.02	16.8	04/09/2018	Flow Meter - Marsh McBirney	Upstream Gauge - 0.22 m.
Road Adit Confluence	0.01	7.9	04/09/2018	Flow Meter - Marsh McBirney	-
Cronebane Intermediate Adit	0.002	2.2	04/09/2018	Flume	Upstream Gauge - 0.19 ft on 4 inch flume, capturing 95% of flow.
Cronebane Shallow Adit	0.000	0.1	04/09/2018	Bucket and stop watch	-
US Tigroney West (Drainage Channel)	-	-	04/09/2018	No Flow	-
Vale View	-	-	05/09/2018	No Flow	Recorded at 16:00

## Appendix C

# Groundwater Level Data/ Measurements

Excel files are also on attached CD

**Table C-1 Avoca Groundwater Level Measurements Round 2 (2018)**

<b>Borehole Identifier:</b>	<b>MWDA1</b>	<b>MWDA2</b>	<b>MWET1</b>	<b>MWET2</b>	<b>MWPF1</b>	<b>GW1/05</b>	<b>GW2/05</b>	<b>SG104</b>
<b>Top of Casing Elevation (mOD):</b>	32.79	32.62	33.39	33.37	31.49	30.80	30.95	58.17
<b>Date:</b>	13/09/2018	13/09/2018	06/09/2018	06/09/2018	06/09/2018	07/09/2018	06/09/2018	07/09/2018
<b>Time:</b>	15:00	14:45	14:10	15:30	10:00	09:15	17:15	11:00
<b>Depth to Groundwater (m bTOC):</b>	6.29	6.40	7.63	7.54	4.83	5.74	5.59	-
<b>Groundwater Elevation (m OD):</b>	26.51	26.23	25.76	25.83	26.66	25.07	25.37	-

**Notes:**

m is metres

OD is Ordnance Datum

bTOC is below top of casing



## Appendix D

### Photographs

Appendix is on attached CD as .jpg files

## Appendix E

---

### Chain of Custody Records



Email: [hawardencustomerservices@alsglobal.com](mailto:hawardencustomerservices@alsglobal.com)

[illegible]





# ALS HAWARDEN CHAIN OF CUSTODY FORM

Address: Units 7-8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US

Phone: 01244 528 777 Couriers: 0845 900 3800

Email: hawardencustomerservices@alsglobal.com

CLIENT: CDM Smith	CONTACT NAME: LAURA FOLEY	Date samples despatched: 6.9.18	@mis Schedule: YES / NO	Sheet ..... of .....
ADDRESS: 15 Wentworth, Eblana Villas, Dublin 2, D02A611	CONTACT E-MAIL: Laura.Foley@cdmsmith.com	Sampler: Laura Foley		
PROJECT LOCATION: AVOCA	CONTACT PHONE: 086 3913232	ALS Quote Number: 49153 (Ver-3)	Turnaround - please tick 7 day turnaround <input checked="" type="checkbox"/> 5 day turnaround <input type="checkbox"/> 4 day turnaround <input type="checkbox"/> 3 day turnaround <input type="checkbox"/> Other (please specify):	Report format Standard <input type="checkbox"/> Cross Tab <input type="checkbox"/> NG <input type="checkbox"/> AGS <input type="checkbox"/> Equis <input type="checkbox"/> Other (please specify):
PROJECT REFERENCE: 118174	ADDITIONAL CONTACTS: Avoca W' Shee 085 834 248 2584	PO Number (If required): 118174		
<b>MATRIX INFORMATION:</b> Please note that matrix specification is a mandatory field. Please select appropriate reference code: Soils(S), Gas(G), Product(P), Sludge(SL), Unspecified Solid (UNS). <b>WATER MATRICES:</b> Ground Water (GW), Surface Water (SW), Drinking Water (DW), Land Leachate (LE), Prepared Leachate (PL), Untreated Sewage (US), Treated Sewage (TS), Trade Effluent (TE), Saline Water (SA), Process Water (PR), Recreational Water (RE) and Unspecified Liquid (UNL).		Known Hazards:	Third party invoicing details (if applicable):	

SAMPLE INFORMATION					SUITE/ANALYSIS REQUIRED										Additional Information
DATE / TIME OF SAMPLING	SAMPLE ID	DEPTH IN METRES (TOP)	DEPTH IN METRES (BASE)	MATRIX: Please refer to key above											Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis
5.9.18	Avoca Bridge T5			SW											
	WCC Plant Yard														
	US of Road Adit														
	US Ballygahan Adit														
	Whites Bridge														
	Whites Bridge GS														
	DS Deep Adit														
	DS Mill Race														
	US Whites Bridge														
	T1														
⑦	AVSD01.11														
⑦	AVSD02.11														
	AVAB02.11														
TOTAL															

Water only No TOL or Co





## ALS HAWARDEN CHAIN OF CUSTODY FORM

**Address:** Units 7-8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US

**Phone:** 01244 528 777      **Couriers:** 0845 900 3800

Email: [hawardencustomerservices@alsglobal.com](mailto:hawardencustomerservices@alsglobal.com)

CLIENT: <b>CDM Smith</b>		CONTACT NAME: <b>Laura Foley</b>		Date samples despatched: <b>7.9.18.</b>		@mis Schedule: YES / NO		Sheet .....1.....			
ADDRESS: <b>15 Westworth, Eblana</b>		CONTACT E-MAIL: <b>Laura.Foley@</b>		Sampler: <b>Laura Foley</b>				of .....1.....			
PROJECT LOCATION: <b>Villas, Dublin 2, D02 A611</b>		CONTACT PHONE: <b>cdm.smith.com</b>		ALS Quote Number: <b>49153 (Ver 3)</b>				Report format			
PROJECT REFERENCE: <b>118174</b>		ADDITIONAL CONTACTS: <b>086 3913232</b> <b>Auro O' Shea 085 834 2584</b>		PO Number (If required): <b>118174_R2.</b>		Turnaround - please tick		Standard <input type="checkbox"/>			
MATRIX INFORMATION:		Known Hazards:		Third party invoicing details (if applicable):		7 day turnaround <input type="checkbox"/>		Cross Tab <input type="checkbox"/>			
Please note that matrix specification is a mandatory field. Please select appropriate reference code: Soils(S), Gas(G), Product(P), Sludge(SL), Unspecified Solid (UNS).						5 day turnaround <input type="checkbox"/>		NG <input type="checkbox"/>			
WATER MATRICES:						4 day turnaround <input type="checkbox"/>		AGS <input type="checkbox"/>			
Ground Water (GW), Surface Water (SW), Drinking Water (DW), Land Leachate (LE), Prepared Leachate (PL), Untreated Sewage (US), Treated Sewage (TS), Trade Effluent (TE), Saline Water (SA), Process Water (PR), Recreational Water (RE) and Unspecified Liquid (UNL).						3 day turnaround <input type="checkbox"/>		Equis <input type="checkbox"/>			
						Other (please specify):		Other (please specify):			
SAMPLE INFORMATION					SUITE/ANALYSIS REQUIRED					Additional Information	
DATE / TIME OF SAMPLING	SAMPLE ID	DEPTH IN METRES (TOP)	DEPTH IN METRES (BASE)	MATRIX: Please refer to key above							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis
6.9.18	HWPF 1			SW	}	As per quote 49153 (Ver 3),					No TOC or Cd analysis
↓	HWDA 1					but <u>no</u> TOC or Cd					
	MWDA2										
	MWET1					analysis please					
	MWET2.										
	GW2 /05										
	AVDBO1.11										
?	AVSRO1.11			PR							
TOTAL											





## ALS HAWARDEN CHAIN OF CUSTODY FORM

**Address:** Units 7-8 Hawarden Business Park, Manor Road, Hawarden,  
Deeside, CH5 3US

**Phone:** 01244 528 777      **Couriers:** 0845 900 3800

**Email:** [hawardencustomerservices@alsglobal.com](mailto:hawardencustomerservices@alsglobal.com)

[illegible]





## ALS HAWARDEN CHAIN OF CUSTODY FORM

**Address:** Units 7-8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US

**Phone:** 01244 528 777      **Couriers:** 0845 900 3800

**Email:** [hawardencustomerservices@alsglobal.com](mailto:hawardencustomerservices@alsglobal.com)

CLIENT: <b>CO4 Smith</b>		CONTACT NAME: <b>Laura Foley</b>	Date samples despatched: <b>14.9.18</b>	Sheet ..... 1 ..... of ..... 1 .....
ADDRESS: <b>15 Westworth, Eblana, Villas, Dublin 2, DO2 1611</b>		CONTACT E-MAIL: <b>Laura.Foley@admsmith.com</b>	Sampler: <b>Laura Foley - Auto 0'</b>	
PROJECT LOCATION: <b>Silvermuck Avoca</b>		CONTACT PHONE: <b>086 391 3232</b>	ALS Quote Number: <b>49153 (Ver 3)</b>	@mis Schedule: YES / NO Turnaround - please tick 7 day turnaround <input type="checkbox"/> 5 day turnaround <input type="checkbox"/> 4 day turnaround <input type="checkbox"/> 3 day turnaround <input checked="" type="checkbox"/> Other (please specify):
PROJECT REFERENCE: <b>118174</b>		ADDITIONAL CONTACTS: <b>Auto 0' Dha. 085 834 2584</b>	PO Number (If required): <b>118174 - 2.3.0</b>	
MATRIX INFORMATION: Please note that matrix specification is a mandatory field. Please select appropriate reference code: Soils(S), Gas(G), Product(P), Sludge(SL), Unspecified Solid (UNS). WATER MATRICES: Ground Water (GW), Surface Water (SW), Drinking Water (DW), Land Leachate (LE), Prepared Leachate (PL), Untreated Sewage (US), Treated Sewage (TS), Trade Effluent (TE), Saline Water (SA), Process Water (PR), Recreational Water (RE) and Unspecified Liquid (UNL).		Known Hazards:	Third party invoicing details (if applicable):	Report format Standard <input type="checkbox"/> Cross Tab <input type="checkbox"/> NG <input type="checkbox"/> AGS <input type="checkbox"/> Equis <input type="checkbox"/> Other (please specify):

[illegible]

## Appendix F

# Certificates of Analysis and Laboratory Analytical Data

Excel files are also on attached CD

**Table F-1 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Organic Carbon, Total	Ammoniacal Nitrogen as N	pH	Sulphate	Aluminium (diss.filt)	Antimony (diss.filt)	Arsenic (diss.filt)
		Units	mg/l	mg/l	pH Units	mg/l	µg/l	µg/l	µg/l
180317-36	850 Adit	04/09/2018	-	<0.2	2.93	859	60200	<6	7.2
180315-112	AVOCA BRIDGE	05/09/2018	3.1	<0.2	6.43	6.3	212	<1	<0.5
180317-36	Cronebane Inter Adit	04/09/2018	-	0.32	2.98	683	53500	<6	23.4
180317-36	Cronebane Shallow Adit	04/09/2018	-	0.529	2.76	1370	132000	<6	78.7
180317-36	Deep Adit	04/09/2018	-	<0.2	3.45	215	15800	<6	<3
180317-36	Deep Adit Conf	04/09/2018	-	<0.2	3.17	563	49100	<6	4.44
	Drainage Channel (Tigroney west	04/09/2018							
180315-112	DS DEEP ADIT	05/09/2018	4.25	<0.2	5.35	14.6	515	<1	<0.5
180315-112	DS MILLRACE	05/09/2018	4.39	<0.2	6.27	7.6	328	<1	<0.5
180317-36	Road Adit	04/09/2018	-	5.27	4.34	1280	10500	<11	12.4
180317-36	Road Adit Conf	04/09/2018	-	5.16	4.23	1250	10600	<6	10.8
180315-112	SITE T1	05/09/2018	3.62	<0.2	6.51	2.9	114	<1	<0.5
180315-112	SITE T5	05/09/2018	<3	<0.2	6.32	8.6	243	<1	<0.5
180315-112	US BALLYGAHAN ADIT	05/09/2018	<3	<0.2	6.46	5.3	186	<1	<0.5
180315-112	US ROAD ADIT	05/09/2018	3.15	<0.2	6.42	6.1	247	<1	<0.5
180317-36	US Tigroney West	04/09/2018	-	<0.2	3.91	154	6250	<1	1.74
180315-112	US WHITES BRIDGE	05/09/2018	3.89	<0.2	6.62	2.1	110	<1	<0.5
	Vale View	05/09/2018							
180315-112	WCC MAIN. YARD GS	05/09/2018	4.11	<0.2	5.75	22.9	337	<1	0.602
180315-112	WHITES BRIDGE	05/09/2018	3.13	<0.2	6.59	<2	119	<1	0.501
180315-112	WHITES BRIDGE GS	05/09/2018	3.22	<0.2	6.43	6.6	337	<1	<0.5



**Table F-1 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Barium (diss.filt)	Cadmium (diss.filt)	Calcium (diss.filt)	Chromium (diss.filt)	Cobalt (diss.filt)	Copper (diss.filt)	Iron (diss.filt)
		Units	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	mg/l
180317-36	850 Adit	04/09/2018	10	90.8	-	<6	96.7	6050	17.2
180315-112	AVOCA BRIDGE	05/09/2018	6.28	0.279	3.9	<1	<0.5	10.3	0.201
180317-36	Cronebane Inter Adit	04/09/2018	7.22	104	-	<6	94.6	9250	61.3
180317-36	Cronebane Shallow Adit	04/09/2018	4.87	155	-	<6	138	>6240	88.5
180317-36	Deep Adit	04/09/2018	20.3	21	-	<6	15.5	790	4.56
180317-36	Deep Adit Conf	04/09/2018	12	60.3	-	<6	62.7	5180	10.7
	Drainage Channel (Tigroney west	04/09/2018							
180315-112	DS DEEP ADIT	05/09/2018	5.82	1.25	2.5	<1	1.46	76.6	0.0659
180315-112	DS MILLRACE	05/09/2018	5.98	0.587	2.5	<1	0.653	30.1	0.096
180317-36	Road Adit	04/09/2018	16.3	7	-	<11	130	298	134
180317-36	Road Adit Conf	04/09/2018	14.6	5.85	-	<6	122	267	128
180315-112	SITE T1	05/09/2018	7.79	0.15	2.76	<1	<0.5	1.22	0.0745
180315-112	SITE T5	05/09/2018	7.71	0.296	4.2	<1	0.699	11.9	0.414
180315-112	US BALLYGAHAN ADIT	05/09/2018	6.19	0.194	3.94	<1	<0.5	8.25	0.114
180315-112	US ROAD ADIT	05/09/2018	6.08	0.28	3.99	<1	<0.5	14.3	0.135
180317-36	US Tigroney West	04/09/2018	12.3	6.77	-	<1	8.71	934	1.1
180315-112	US WHITES BRIDGE	05/09/2018	6.45	0.146	2.7	<1	<0.5	0.734	0.0799
	Vale View	05/09/2018							
180315-112	WCC MAIN. YARD GS	05/09/2018	6.15	0.478	6.72	<1	2.81	17.5	2.34
180315-112	WHITES BRIDGE	05/09/2018	6.24	0.152	4.36	<1	<0.5	0.625	0.13
180315-112	WHITES BRIDGE GS	05/09/2018	7.16	0.412	3.88	<1	<0.5	17.4	0.109



**Table F-1 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Lead (diss.filt)	Manganese (diss.filt)	Molybdenum (diss.filt)	Nickel (diss.filt)	Vanadium (diss.filt)	Zinc (diss.filt)
		Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
180317-36	850 Adit	04/09/2018	904	3070	<18	36.2	<6	30000
180315-112	AVOCA BRIDGE	05/09/2018	4.01	43.3	<3	0.992	<1	77
180317-36	Cronebane Inter Adit	04/09/2018	1090	2120	<18	41.6	<6	29800
180317-36	Cronebane Shallow Adit	04/09/2018	683	3200	<18	60	<6	>31200
180317-36	Deep Adit	04/09/2018	869	872	<18	7.52	<6	7000
180317-36	Deep Adit Conf	04/09/2018	705	2120	<18	24.2	<6	19800
	Drainage Channel (Tigroney west	04/09/2018						
180315-112	DS DEEP ADIT	05/09/2018	9.75	70.2	<3	1.46	<1	388
180315-112	DS MILLRACE	05/09/2018	5.68	45.6	<3	0.983	<1	175
180317-36	Road Adit	04/09/2018	240	11300	<33	57.7	<11	8890
180317-36	Road Adit Conf	04/09/2018	233	10800	<18	50.9	<6	8050
180315-112	SITE T1	05/09/2018	4.96	29.9	<3	1.04	<1	33.5
180315-112	SITE T5	05/09/2018	4.34	65.1	<3	0.998	<1	98.4
180315-112	US BALLYGAHAN ADIT	05/09/2018	3.35	35.5	<3	0.795	<1	52.6
180315-112	US ROAD ADIT	05/09/2018	3.8	42.1	<3	0.935	<1	74.2
180317-36	US Tigroney West	04/09/2018	306	653	<3	5.12	<1	2110
180315-112	US WHITES BRIDGE	05/09/2018	3.14	28.3	<3	0.793	<1	29.8
	Vale View	05/09/2018						
180315-112	WCC MAIN. YARD GS	05/09/2018	7.18	237	<3	1.84	<1	250
180315-112	WHITES BRIDGE	05/09/2018	3.44	32.1	<3	0.784	<1	35.3
180315-112	WHITES BRIDGE GS	05/09/2018	3.71	41.1	<3	0.798	<1	121

**Table F-2 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Ammoniacal Nitrogen as N	pH	Sulphate	Aluminium (diss.filt)	Antimony (diss.filt)	Arsenic (diss.filt)	Barium (diss.filt)
		Units	mg/l	pH Units	mg/l	µg/l	µg/l	µg/l	µg/l
180908-181	GW1/05	04/09/2018	<2	3.76	1090	60500	<6	<3	4.31
180908-179	GW2/05	05/09/2018	<0.2	3.99	857	42700	<1	0.836	1.35
18349768	MWDA2	04/09/2018	0.265	3.57	1010	28300	<6	<3	<1.2
18349767	MWDA1	04/09/2018	0.434	3.1	913	70300	<6	4.27	<1.2
180908-179	MWET1	04/09/2018	0.981	3.76	1690	170000	<6	4.19	4.32
180908-179	MWET2	04/09/2018	0.254	5.99	2060	<60	<6	6.22	10.9
180908-179	MWPF1	04/09/2018	<0.2	5.39	27.6	241	<1	<0.5	7.36

**Table F-2 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Cadmium (diss.filt)	Chromium (diss.filt)	Cobalt (diss.filt)	Copper (diss.filt)	Iron (diss.filt)	Lead (diss.filt)	Manganese (diss.filt)
		Units	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l
180908-181	GW1/05	04/09/2018	22	<6	102	7160	1.78	15.9	4690
180908-179	GW2/05	05/09/2018	14.3	1.17	75.4	5870	0.198	0.553	3880
18349768	MWDA2	04/09/2018	79	<6	214	2370	109	2.71	11600
18349767	MWDA1	04/09/2018	69.2	<6	93	2620	19.4	48.1	4360
180908-179	MWET1	04/09/2018	30.6	9.59	259	10600	107	87.6	9510
180908-179	MWET2	04/09/2018	1.66	<6	108	<1.8	89.3	<1.2	30200
180908-179	MWPF1	04/09/2018	0.348	<1	<0.5	36.2	0.0219	<0.2	19.5

**Table F-2 Avoca Laboratory Analytical Data R2 (2018) -  
Surface Water**

SDG	Sample Description	Date Sampled	Molybdenum (diss.filt)	Nickel (diss.filt)	Vanadium (diss.filt)	Zinc (diss.filt)
		Units	µg/l	µg/l	µg/l	µg/l
180908-181	GW1/05	04/09/2018	<18	47.4	<6	7980
180908-179	GW2/05	05/09/2018	3.99	35.7	<1	6720
18349768	MWDA2	04/09/2018	<18	96.1	<6	<17.6
18349767	MWDA1	04/09/2018	<18	43.2	<6	37700
180908-179	MWET1	04/09/2018	<18	123	<6	11200
180908-179	MWET2	04/09/2018	<18	12.8	<6	4830
180908-179	MWPF1	04/09/2018	<3	0.516	<1	37.8

**Table F-3 Avoca Laboratory Analytical Data Round 2 (2018) -  
Field QA/QC**

SDG	Sample Description	Date Sampled	Aluminium (diss.filt)	Antimony (diss.filt)	Arsenic (diss.filt)	Barium (diss.filt)	Cadmium (diss.filt)	Chromium (diss.filt)
		Units	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
180908-179	AVSR01.11	04/09/2018	1570	323	584	1930	739	429
180908-179	AVDB01.11	05/09/2018	17.6	<1	<0.5	<0.2	<0.08	<1
180908-181	AVGD01.11	04/09/2018	63600	<6	<3	4.62	22.6	<6
18349770	SMDB02.11	04/09/2018	<10	<1	<0.5	0.224	<0.08	<1
18349769	SMSD03.11	04/09/2018	<10	<1	<0.5	37.8	<0.08	<1

**Table F-3 Avoca Laboratory Analytical Data Round 2 (2018) -  
Field QA/QC**

SDG	Sample Description	Date Sampled	Cobalt (diss.filt)	Copper (diss.filt)	Iron (diss.filt)	Lead (diss.filt)	Manganese (diss.filt)	Molybdenum (diss.filt)
		Units	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l
180908-179	AVSR01.11	04/09/2018	487	437	2.49	597	193	102
180908-179	AVDB01.11	05/09/2018	<0.5	1.43	0.0435	0.344	3.32	<3
180908-181	AVGD01.11	04/09/2018	105	7360	2.22	19.7	4850	<18
18349770	SMDB02.11	04/09/2018	<0.5	<0.3	<0.019	0.298	<3	<3
18349769	SMSD03.11	04/09/2018	<0.5	<0.3	<0.019	<0.2	<3	<3

**Table F-3 Avoca Laboratory Analytical Data Round 2 (2018) -  
Field QA/QC**

SDG	Sample Description	Date Sampled	Nickel (diss.filt)	Vanadium (diss.filt)	Zinc (diss.filt)
		Units	µg/l	µg/l	µg/l
180908-179	AVSR01.11	04/09/2018	446	1360	1800
180908-179	AVDB01.11	05/09/2018	<0.4	<1	2.45
180908-181	AVGD01.11	04/09/2018	48.6	<6	8210
18349770	SMDB02.11	04/09/2018	<0.4	<1	2.17
18349769	SMSD03.11	04/09/2018	<0.4	<1	<1



Unit 7-8 Hawarden Business Park  
Manor Road (off Manor Lane)  
Hawarden  
Deeside  
CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CDM Smith  
15 Wentworth  
Elbana Villas  
Dublin  
Dublin 2  
D02 WK10

**Attention:** Laura Foley

## CERTIFICATE OF ANALYSIS

<b>Date:</b>	13 September 2018
<b>Customer:</b>	D_CDMSMITH_DUB
<b>Sample Delivery Group (SDG):</b>	180906-116
<b>Your Reference:</b>	118174
<b>Location:</b>	Avoca
<b>Report No:</b>	472332

We received 12 samples on Thursday September 06, 2018 and 12 of these samples were scheduled for analysis which was completed on Thursday September 13, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

**Sonia McWhan**

Operations Manager







## CERTIFICATE OF ANALYSIS

Validated

SDG: 180906-116  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 472332  
Superseded Report:

### Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
18273274	850 ADIT			04/09/2018
18273277	AVSR02.11			04/09/2018
18273276	CRONEBANE INTER ADIT			04/09/2018
18273275	CRONEBANE SHALLOW ADIT			04/09/2018
18273272	DEEP ADIT			04/09/2018
18273273	DEEP ADIT CONF.			04/09/2018
18273270	ROAD ADIT			04/09/2018
18273271	ROAD ADIT CONF.			04/09/2018
18273281	SMSDB01.11			30/08/2018
18273280	SMVDB01.11			04/09/2018
18273278	WB01.11			04/09/2018
18273279	WB02.11			04/09/2018

#### Maximum Sample/Coolbox Temperature (°C) :

13.2

#### ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.











## CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180906-116  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174

**Report Number:** 472332  
**Superseded Report:**

### Table of Results - Appendix

Method No	Reference	Description
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180906-116  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 472332  
Superseded Report:

## Test Completion Dates

Lab Sample No(s)	18273274	18273277	18273276	18273275	18273272	18273273	18273270	18273271	18273281	18273280
Customer Sample Ref.	850 ADIT	AVSR02.11	CRONEBANE INTER ADIT	CRONEBANE SHALL OW ADIT	DEEP ADIT	DEEP ADIT CONF.	ROAD ADIT	ROAD ADIT CONF.	SMSDB01.11	SMVDB01.11
AGS Ref.										
Depth										
Type	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen	12-Sep-2018		12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018		
Anions by Kone (w)	08-Sep-2018		08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018		
Dissolved Metals by ICP-MS	11-Sep-2018	11-Sep-2018	11-Sep-2018	13-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018
pH Value	12-Sep-2018		12-Sep-2018	12-Sep-2018	12-Sep-2018	13-Sep-2018	13-Sep-2018	12-Sep-2018		

Lab Sample No(s)	18273278	18273279
Customer Sample Ref.	WB01.11	WB02.11
AGS Ref.		
Depth		
Type	Surface Water	Surface Water
Dissolved Metals by ICP-MS	11-Sep-2018	11-Sep-2018



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180906-116  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 472332  
Superseded Report:

## ASSOCIATED AQC DATA

### Ammoniacal Nitrogen

Component	Method Code	QC 1815	QC 1831
Ammoniacal Nitrogen as N	TM099	<b>99.6</b> 95.98 : 104.95	<b>100.4</b> 95.98 : 104.95

### Anions by Kone (w)

Component	Method Code	QC 1815
Chloride	TM184	92.93 : 115.43
Phosphate (Ortho as PO4)	TM184	96.40 : 108.40
Sulphate (soluble)	TM184	<b>104.0</b> 90.53 : 113.03
TON as NO3	TM184	96.26 : 111.21

### Dissolved Metals by ICP-MS

Component	Method Code	QC 1859	QC 1895	QC 1857
Aluminium	TM152	<b>98.0</b> 90.09 : 112.69	<b>95.0</b> 90.09 : 112.69	<b>102.67</b> 94.19 : 114.31
Antimony	TM152	<b>110.67</b> 81.00 : 119.70	<b>113.17</b> 81.00 : 119.70	<b>103.5</b> 79.80 : 122.00
Arsenic	TM152	<b>101.67</b> 90.67 : 112.97	<b>101.67</b> 90.67 : 112.97	<b>106.5</b> 90.42 : 111.32
Barium	TM152	<b>103.83</b> 84.74 : 117.25	<b>106.33</b> 84.74 : 117.25	<b>105.0</b> 90.79 : 113.16
Beryllium	TM152	<b>99.0</b> 88.27 : 113.27	<b>97.83</b> 88.27 : 113.27	<b>105.0</b> 93.25 : 120.04
Bismuth	TM152	<b>100.33</b> 86.72 : 115.61	<b>104.5</b> 86.72 : 115.61	<b>102.17</b> 94.65 : 117.05
Borate	TM152			<b>103.7</b> 88.00 : 112.00
Boron	TM152	<b>96.0</b> 82.81 : 116.65	<b>94.67</b> 82.81 : 116.65	<b>104.0</b> 86.68 : 117.67
Cadmium	TM152	<b>101.67</b> 90.28 : 114.48	<b>103.0</b> 90.28 : 114.48	<b>103.33</b> 94.60 : 112.40
Calcium	TM152			<b>100.8</b> 88.64 : 126.35
Chromium	TM152	<b>97.67</b> 89.50 : 108.80	<b>98.0</b> 89.50 : 108.80	<b>102.0</b> 93.28 : 110.91
Cobalt	TM152	<b>97.67</b> 89.66 : 112.39	<b>97.33</b> 89.66 : 112.39	<b>101.67</b> 84.39 : 114.26
Copper	TM152	<b>98.33</b> 88.45 : 117.93	<b>98.17</b> 88.45 : 117.93	<b>103.83</b> 88.86 : 118.72
Iron	TM152			<b>102.67</b> 92.00 : 113.00
Lead	TM152	<b>99.17</b> 89.25 : 115.12	<b>101.67</b> 89.25 : 115.12	<b>100.5</b> 89.25 : 115.12





# CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180906-116  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174

**Report Number:** 472332  
**Superseded Report:**

## Dissolved Metals by ICP-MS

		QC 1859	QC 1895	QC 1857
Lithium	TM152	<b>97.67</b> 88.50 : 116.05	<b>97.5</b> 88.50 : 116.05	<b>103.17</b> 89.26 : 119.04
Magnesium	TM152			<b>100.0</b> 86.35 : 113.36
Manganese	TM152	<b>97.67</b> 91.63 : 112.33	<b>95.0</b> 91.63 : 112.33	<b>102.83</b> 94.24 : 112.74
Molybdenum	TM152	<b>97.5</b> 86.94 : 106.49	<b>98.67</b> 86.94 : 106.49	<b>100.83</b> 87.00 : 108.89
Nickel	TM152	<b>98.83</b> 89.60 : 117.38	<b>98.67</b> 89.60 : 117.38	<b>103.17</b> 92.11 : 110.56
Niobium	TM152	96.38 : 128.85	96.38 : 128.85	
Phosphorus	TM152	<b>99.0</b> 90.43 : 111.75	<b>97.67</b> 90.43 : 111.75	<b>101.33</b> 90.52 : 115.47
Potassium	TM152			<b>99.73</b> 90.23 : 109.87
Selenium	TM152	<b>103.33</b> 88.22 : 113.50	<b>103.67</b> 88.22 : 113.50	<b>104.83</b> 88.44 : 113.86
Silver	TM152	<b>98.0</b> 91.29 : 113.29	<b>99.17</b> 91.29 : 113.29	<b>102.5</b> 87.04 : 107.38
Sodium	TM152			<b>99.2</b> 92.68 : 108.68
Strontium	TM152	<b>99.0</b> 91.27 : 106.32	<b>100.33</b> 91.27 : 106.32	<b>102.33</b> 90.72 : 114.82
Tellurium	TM152	<b>96.5</b> 81.16 : 111.23	<b>97.67</b> 81.16 : 111.23	<b>99.67</b> 90.72 : 112.62
Thallium	TM152	<b>88.83</b> 81.70 : 117.09	<b>86.5</b> 81.70 : 117.09	<b>103.0</b> 86.08 : 122.48
Tin	TM152			<b>103.67</b> 91.00 : 109.00
Titanium	TM152	<b>101.67</b> 89.62 : 110.62	<b>97.33</b> 89.62 : 110.62	<b>103.5</b> 92.82 : 118.92
Tungsten	TM152	<b>99.17</b> 88.98 : 114.68	<b>104.33</b> 88.98 : 114.68	<b>100.67</b> 78.12 : 132.82
Uranium	TM152	<b>99.0</b> 92.30 : 116.90	<b>104.67</b> 92.30 : 116.90	<b>103.17</b> 90.58 : 113.28
Vanadium	TM152	<b>101.17</b> 88.22 : 118.55	<b>102.17</b> 88.22 : 118.55	<b>101.0</b> 88.43 : 114.30
Zinc	TM152	<b>99.67</b> 89.30 : 115.44	<b>99.33</b> 89.30 : 115.44	<b>106.67</b> 86.52 : 115.27
Zirconium	TM152	85.51 : 109.42	85.51 : 109.42	

## pH Value

Component	Method Code	QC 1812	QC 1861
pH	TM256	<b>101.35</b> 99.20 : 102.14	<b>100.94</b> 99.19 : 102.43

**CERTIFICATE OF ANALYSIS****SDG:** 180906-116  
**Location:** Avoca**Client Reference:** 118174  
**Order Number:** 118174**Report Number:** 472332  
**Superseded Report:**

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis .

The figure detailed is the percentage recovery result for the AQC .

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control .



# CERTIFICATE OF ANALYSIS

SDG:	180906-116	Client Reference:	118174	Report Number:	472332
Location:	Avoca	Order Number:	118174	Superseded Report:	

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH<sub>4</sub> by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

## General

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

## Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

## Asbestos

### Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

### Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

**Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.**

**The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.**



Unit 7-8 Hawarden Business Park  
Manor Road (off Manor Lane)  
Hawarden  
Deeside  
CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CDM Smith  
15 Wentworth  
Elbana Villas  
Dublin  
Dublin 2  
D02 WK10

**Attention:** Laura Foley

## CERTIFICATE OF ANALYSIS

<b>Date:</b>	17 October 2018
<b>Customer:</b>	D_CDMSMITH_DUB
<b>Sample Delivery Group (SDG):</b>	180907-101
<b>Your Reference:</b>	118174
<b>Location:</b>	Avoca
<b>Report No:</b>	477149

**This report has been revised and directly supersedes 472045 in its entirety.**

We received 14 samples on Friday September 07, 2018 and 14 of these samples were scheduled for analysis which was completed on Wednesday September 12, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

**Sonia McWhan**

Operations Manager





## CERTIFICATE OF ANALYSIS

Validated

SDG: 180907-101  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 477149  
Superseded Report: 472045

### Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
18282259	AVDB02.11			05/09/2018
18282246	AVOCA Bridge			05/09/2018
18282257	AVSD01.11			05/09/2018
18282258	AVSD02.11			05/09/2018
18282253	DS Deep Adit			05/09/2018
18282254	DS Mill Race			05/09/2018
18282256	T1			05/09/2018
18282247	T5			05/09/2018
18282250	US Ballygahan Adit			05/09/2018
18282249	US of Road Adit			05/09/2018
18282255	US Whites Bridge			05/09/2018
18282248	WCC Main Yard			05/09/2018
18282251	Whites Bridge			05/09/2018
18282252	Whites Bridge GS			05/09/2018

#### Maximum Sample/Coolbox Temperature (°C) :

12

#### ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.

## CERTIFICATE OF ANALYSIS













## CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180907-101  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174

**Report Number:** 477149  
**Superseded Report:** 472045

### Table of Results - Appendix

Method No	Reference	Description
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180907-101  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 477149  
Superseded Report: 472045

## Test Completion Dates

Lab Sample No(s)  
Customer Sample Ref.

AGS Ref.  
Depth  
Type

18282259	18282246	18282257	18282258	18282253	18282254	18282256	18282247	18282250	18282249
AVDB02.11	AVOCA Bridge	AVSD01.11	AVSD02.11	DS Deep Adit	DS Mill Race	T1	T5	US Ballygahan A dit	US of Road Adit
Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen	12-Sep-2018			12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018	12-Sep-2018
Anions by Kone (w)	08-Sep-2018			08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018	08-Sep-2018
Dissolved Metals by ICP-MS	10-Sep-2018	10-Sep-2018	10-Sep-2018	10-Sep-2018	10-Sep-2018	10-Sep-2018	11-Sep-2018	10-Sep-2018	10-Sep-2018
pH Value	11-Sep-2018			11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018
Total Organic and Inorganic Carbon	11-Sep-2018			11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018	11-Sep-2018

Lab Sample No(s)  
Customer Sample Ref.

AGS Ref.  
Depth  
Type

18282255	18282248	18282251	18282252
US Whites Bridg e	WCC Main Yard	Whites Bridge	Whites Bridge G S
Surface Water	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen	12-Sep-2018	12-Sep-2018	12-Sep-2018
Anions by Kone (w)	08-Sep-2018	08-Sep-2018	08-Sep-2018
Dissolved Metals by ICP-MS	10-Sep-2018	10-Sep-2018	10-Sep-2018
pH Value	11-Sep-2018	11-Sep-2018	11-Sep-2018
Total Organic and Inorganic Carbon	11-Sep-2018	11-Sep-2018	11-Sep-2018



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180907-101  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 477149  
Superseded Report: 472045

## ASSOCIATED AQC DATA

### Ammoniacal Nitrogen

Component	Method Code	QC 1855	QC 1861	QC 1878
Ammoniacal Nitrogen as N	TM099	<b>101.6</b> 95.98 : 104.95	<b>102.0</b> 95.98 : 104.95	<b>102.0</b> 95.98 : 104.95

### Anions by Kone (w)

Component	Method Code	QC 1888
Chloride	TM184	92.93 : 115.43
Phosphate (Ortho as PO4)	TM184	96.40 : 108.40
Sulphate (soluble)	TM184	<b>102.4</b> 90.53 : 113.03
TON as NO3	TM184	96.26 : 111.21

### Dissolved Metals by ICP-MS

Component	Method Code	QC 1801	QC 1849
Aluminium	TM152	<b>99.0</b> 90.09 : 112.69	<b>100.67</b> 94.19 : 114.31
Antimony	TM152	<b>113.33</b> 81.00 : 119.70	<b>102.33</b> 79.80 : 122.00
Arsenic	TM152	<b>101.17</b> 90.67 : 112.97	<b>99.83</b> 90.42 : 111.32
Barium	TM152	<b>105.0</b> 84.74 : 117.25	<b>99.5</b> 90.79 : 113.16
Beryllium	TM152	<b>100.83</b> 88.27 : 113.27	<b>102.67</b> 93.25 : 120.04
Bismuth	TM152	<b>102.17</b> 86.72 : 115.61	<b>100.33</b> 94.65 : 117.05
Borate	TM152		<b>101.85</b> 88.00 : 112.00
Boron	TM152	<b>98.67</b> 82.81 : 116.65	<b>102.0</b> 86.68 : 117.67
Cadmium	TM152	<b>103.17</b> 90.28 : 114.48	<b>101.67</b> 94.60 : 112.40
Calcium	TM152		<b>98.67</b> 88.64 : 126.35
Chromium	TM152	<b>100.33</b> 89.50 : 108.80	<b>99.5</b> 93.28 : 110.91
Cobalt	TM152	<b>99.67</b> 89.66 : 112.39	<b>99.33</b> 84.39 : 114.26
Copper	TM152	<b>100.17</b> 88.45 : 117.93	<b>99.67</b> 88.86 : 118.72
Iron	TM152		<b>100.0</b> 92.00 : 113.00
Lead	TM152	<b>103.67</b> 89.25 : 115.12	<b>96.83</b> 89.25 : 115.12



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180907-101  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 477149  
Superseded Report: 472045

## Dissolved Metals by ICP-MS

		QC 1801	QC 1849
Lithium	TM152	<b>99.33</b> 88.50 : 116.05	<b>103.33</b> 89.26 : 119.04
Magnesium	TM152		<b>98.13</b> 86.35 : 113.36
Manganese	TM152	<b>99.83</b> 91.63 : 112.33	<b>100.5</b> 94.24 : 112.74
Molybdenum	TM152	<b>100.33</b> 86.94 : 106.49	<b>98.83</b> 87.00 : 108.89
Nickel	TM152	<b>100.5</b> 89.60 : 117.38	<b>100.17</b> 92.11 : 110.56
Niobium	TM152	96.38 : 128.85	
Phosphorus	TM152	<b>100.17</b> 90.43 : 111.75	<b>99.0</b> 90.52 : 115.47
Potassium	TM152		<b>98.13</b> 90.23 : 109.87
Selenium	TM152	<b>102.83</b> 88.22 : 113.50	<b>100.5</b> 88.44 : 113.86
Silver	TM152	<b>101.5</b> 91.29 : 113.29	<b>100.17</b> 87.04 : 107.38
Sodium	TM152		<b>98.13</b> 92.68 : 108.68
Strontium	TM152	<b>100.33</b> 91.27 : 106.32	<b>101.67</b> 90.72 : 114.82
Tellurium	TM152	<b>97.17</b> 81.16 : 111.23	<b>97.33</b> 90.72 : 112.62
Thallium	TM152	<b>89.17</b> 81.70 : 117.09	<b>94.83</b> 86.08 : 122.48
Tin	TM152		<b>101.0</b> 91.00 : 109.00
Titanium	TM152	<b>99.67</b> 89.62 : 110.62	<b>99.67</b> 92.82 : 118.92
Tungsten	TM152	<b>104.33</b> 88.98 : 114.68	<b>99.67</b> 78.12 : 132.82
Uranium	TM152	<b>104.5</b> 92.30 : 116.90	<b>99.33</b> 90.58 : 113.28
Vanadium	TM152	<b>105.83</b> 88.22 : 118.55	<b>98.0</b> 88.43 : 114.30
Zinc	TM152	<b>101.33</b> 89.30 : 115.44	<b>101.67</b> 86.52 : 115.27
Zirconium	TM152	85.51 : 109.42	

## pH Value

Component	Method Code	QC 1845
pH	TM256	<b>100.4</b> 99.20 : 102.14

## Total Organic and Inorganic Carbon



## CERTIFICATE OF ANALYSIS

Validated

SDG: 180907-101  
Location: Avoca

Client Reference: 118174  
Order Number: 118174

Report Number: 477149  
Superseded Report: 472045

### Total Organic and Inorganic Carbon

Component	Method Code	QC 1864	QC 1805	QC 1803
Total Organic Carbon	TM090	<b>101.67</b> 97.97 : 110.17	<b>101.5</b> 97.97 : 110.17	<b>101.67</b> 97.97 : 110.17

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



# CERTIFICATE OF ANALYSIS

<b>SDG:</b>	180907-101	<b>Client Reference:</b>	118174	<b>Report Number:</b>	477149
<b>Location:</b>	Avoca	<b>Order Number:</b>	118174	<b>Superseded Report:</b>	472045

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH<sub>4</sub> by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

## General

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

## Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

## Asbestos

### Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

### Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

**Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.**

**The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.**





Unit 7-8 Hawarden Business Park  
Manor Road (off Manor Lane)  
Hawarden  
Deeside  
CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CDM Smith  
15 Wentworth  
Elbana Villas  
Dublin  
Dublin 2  
D02 WK10

**Attention:** Laura Foley

## CERTIFICATE OF ANALYSIS

<b>Date:</b>	18 September 2018
<b>Customer:</b>	D_CDMSMITH_DUB
<b>Sample Delivery Group (SDG):</b>	180908-181
<b>Your Reference:</b>	118174
<b>Location:</b>	Avoca
<b>Report No:</b>	472797

**This report has been revised and directly supersedes 472389 in its entirety.**

We received 2 samples on Saturday September 08, 2018 and 2 of these samples were scheduled for analysis which was completed on Thursday September 13, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

**Sonia McWhan**

Operations Manager





# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: Avoca

Client Reference: 118174  
Order Number: 118174-R2

Report Number: 472797  
Superseded Report: 472389

## Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
18291861	AVGD01.11			07/09/2018
18291860	GW1/05			07/09/2018

Maximum Sample/Coolbox Temperature (°C) : 14.2

### ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.



# CERTIFICATE OF ANALYSIS

Validated

SDG:	180908-181	Client Reference:	118174	Report Number:	472797
Location:	Avoca	Order Number:	118174-R2	Superseded Report:	472389

<b>Results Legend</b>  <div> <div>X</div> Test         </div> <div> <div>N</div> No Determination Possible         </div> Sample Types - S - Soil/Solid UNS - Unspecified Solid GW - Ground Water SW - Surface Water LE - Land Leachate PL - Prepared Leachate PR - Process Water SA - Saline Water TE - Trade Effluent TS - Treated Sewage US - Untreated Sewage RE - Recreational Water DW - Drinking Water Non-regulatory UNL - Unspecified Liquid SL - Sludge G - Gas OTH - Other	Lab Sample No(s)		18291861	18291860
	Customer Sample Reference		AVGD01.11	GM1/05
	AGS Reference			
	Depth (m)			
	Container		HNO3 Filtered (ALE204)	H2SO4 (ALE244)
	Sample Type		PW	SW
			500ml Plastic (ALE208)	
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 1		X
Anions by Kone (w)	All	NDPs: 0 Tests: 1	X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2	X	X
pH Value	All	NDPs: 0 Tests: 1	X	
Total Organic and Inorganic Carbon	All	NDPs: 0 Tests: 1		X



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: Avoca

Client Reference: 118174  
Order Number: 118174-R2

Report Number: 472797  
Superseded Report: 472389

Results Legend			Customer Sample Ref.	AVGD01.11	GW1/05			
#	ISO17025 accredited.		Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	Process Water (PR) 07/09/2018  08/09/2018 180908-181 18291861	Surface Water (SW) 07/09/2018  08/09/2018 180908-181 18291860			
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&5@	Sample deviation (see appendix)							
d	Dilution Applied							
Component	LOD/Units	Method						
Organic Carbon, Total	<3 mg/l	TM090			<3			
					#			
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099			<0.2			
					# d1.0			
Aluminium (diss.filt)	<10 µg/l	TM152			60500			
					# d19.0106			
Antimony (diss.filt)	<1 µg/l	TM152			<6			
					d6.0			
Arsenic (diss.filt)	<0.5 µg/l	TM152			<3			
					# d6.0			
Barium (diss.filt)	<0.2 µg/l	TM152			4.31			
					# d6.0			
Cadmium (diss.filt)	<0.08 µg/l	TM152			22			
					# d6.0			
Chromium (diss.filt)	<1 µg/l	TM152			<6			
					# d6.0			
Cobalt (diss.filt)	<0.5 µg/l	TM152			102			
					# d6.0			
Copper (diss.filt)	<0.3 µg/l	TM152			7160			
					# d19.0106			
Lead (diss.filt)	<0.2 µg/l	TM152			15.9			
					# d6.0			
Manganese (diss.filt)	<3 µg/l	TM152			4690			
					# d6.0			
Molybdenum (diss.filt)	<3 µg/l	TM152			<18			
					# d6.0			
Nickel (diss.filt)	<0.4 µg/l	TM152			47.4			
					# d6.0			
Vanadium (diss.filt)	<1 µg/l	TM152			<6			
					# d6.0			
Zinc (diss.filt)	<1 µg/l	TM152			7980			
					# d6.0			
Calcium (Dis.Filt)	<0.2 mg/l	TM152			142			
					# d6.0			
Iron (Dis.Filt)	<0.019 mg/l	TM152			1.78			
					# d6.0			
Sulphate	<2 mg/l	TM184			1090			
					# d5.0			
pH	<1 pH Units	TM256			3.76			
					#			
Aluminium (diss.filt)	<10 µg/l	TM152		63600				
				d19.5575				
Antimony (diss.filt)	<1 µg/l	TM152		<6				
				d6.0				
Arsenic (diss.filt)	<0.5 µg/l	TM152		<3				
				d6.0				
Barium (diss.filt)	<0.2 µg/l	TM152		4.62				
				d6.0				
Cadmium (diss.filt)	<0.08 µg/l	TM152		22.6				
				d6.0				
Chromium (diss.filt)	<1 µg/l	TM152		<6				
				d6.0				
Cobalt (diss.filt)	<0.5 µg/l	TM152		105				
				d6.0				
Copper (diss.filt)	<0.3 µg/l	TM152		7360				
				d19.5575				
Lead (diss.filt)	<0.2 µg/l	TM152		19.7				
				d6.0				
Manganese (diss.filt)	<3 µg/l	TM152		4850				
				d6.0				
Molybdenum (diss.filt)	<3 µg/l	TM152		<18				
				d6.0				
Nickel (diss.filt)	<0.4 µg/l	TM152		48.6				
				d6.0				







# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: Avoca

Client Reference: 118174  
Order Number: 118174-R2

Report Number: 472797  
Superseded Report: 472389

## Table of Results - Appendix

Method No	Reference	Description
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: Avoca

Client Reference: 118174  
Order Number: 118174-R2

Report Number: 472797  
Superseded Report: 472389

## Test Completion Dates

Lab Sample No(s)	18291861	18291860
Customer Sample Ref.	AVGD01.11	GW1/05
AGS Ref.		
Depth		
Type	Process	Surface Water
Ammoniacal Nitrogen		12-Sep-2018
Anions by Kone (w)		13-Sep-2018
Dissolved Metals by ICP-MS	13-Sep-2018	13-Sep-2018
pH Value		13-Sep-2018
Total Organic and Inorganic Carbon		13-Sep-2018



## CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: AvocaClient Reference: 118174  
Order Number: 118174-R2Report Number: 472797  
Superseded Report: 472389

## ASSOCIATED AQC DATA

## Ammoniacal Nitrogen

Component	Method Code	QC 1867
Ammoniacal Nitrogen as N	TM099	<b>99.2</b> 95.98 : 104.95

## Anions by Kone (w)

Component	Method Code	QC 1881
Chloride	TM184	<b>105.0</b> 92.93 : 115.43
Phosphate (Ortho as PO <sub>4</sub> )	TM184	96.40 : 108.40
Sulphate (soluble)	TM184	<b>102.8</b> 90.53 : 113.03
TON as NO <sub>3</sub>	TM184	96.26 : 111.21

## Dissolved Metals by ICP-MS

Component	Method Code	QC 1859
Aluminium	TM152	<b>101.33</b> 94.19 : 114.31
Antimony	TM152	<b>101.5</b> 79.80 : 122.00
Arsenic	TM152	<b>99.0</b> 90.42 : 111.32
Barium	TM152	<b>99.33</b> 90.79 : 113.16
Beryllium	TM152	<b>105.0</b> 93.25 : 120.04
Bismuth	TM152	<b>99.0</b> 94.65 : 117.05
Borate	TM152	<b>103.7</b> 88.00 : 112.00
Boron	TM152	<b>103.67</b> 86.68 : 117.67
Cadmium	TM152	<b>101.17</b> 94.60 : 112.40
Chromium	TM152	<b>99.17</b> 93.28 : 110.91
Cobalt	TM152	<b>98.33</b> 84.39 : 114.26
Copper	TM152	<b>99.0</b> 88.86 : 118.72
Lead	TM152	<b>96.67</b> 89.25 : 115.12
Lithium	TM152	<b>102.83</b> 89.26 : 119.04
Manganese	TM152	<b>100.17</b> 94.24 : 112.74



## CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-181  
Location: AvocaClient Reference: 118174  
Order Number: 118174-R2Report Number: 472797  
Superseded Report: 472389

## Dissolved Metals by ICP-MS

		QC 1859
Molybdenum	TM152	<b>97.67</b> 87.00 : 108.89
Nickel	TM152	<b>99.17</b> 92.11 : 110.56
Phosphorus	TM152	<b>100.33</b> 90.52 : 115.47
Selenium	TM152	<b>99.5</b> 88.44 : 113.86
Silver	TM152	<b>98.67</b> 87.04 : 107.38
Strontium	TM152	<b>99.33</b> 90.72 : 114.82
Tellurium	TM152	<b>95.83</b> 90.72 : 112.62
Thallium	TM152	<b>94.83</b> 86.08 : 122.48
Titanium	TM152	<b>99.67</b> 92.82 : 118.92
Tungsten	TM152	<b>98.5</b> 78.12 : 132.82
Uranium	TM152	<b>99.0</b> 90.58 : 113.28
Vanadium	TM152	<b>98.17</b> 88.43 : 114.30
Zinc	TM152	<b>100.0</b> 86.52 : 115.27

## pH Value

Component	Method Code	QC 1847
pH	TM256	<b>101.08</b> 99.73 : 102.16

## Total Organic and Inorganic Carbon

Component	Method Code	QC 1872
Total Organic Carbon	TM090	<b>104.83</b> 97.97 : 110.17

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



# CERTIFICATE OF ANALYSIS

<b>SDG:</b>	180908-181	<b>Client Reference:</b>	118174	<b>Report Number:</b>	472797
<b>Location:</b>	Avoca	<b>Order Number:</b>	118174-R2	<b>Superseded Report:</b>	472389

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH<sub>4</sub> by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

## General

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

## Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

## Asbestos

### Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

### Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

**Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.**

**The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.**





Unit 7-8 Hawarden Business Park  
Manor Road (off Manor Lane)  
Hawarden  
Deeside  
CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CDM Smith  
15 Wentworth  
Elbana Villas  
Dublin  
Dublin 2  
D02 WK10

**Attention:** Laura Foley

## CERTIFICATE OF ANALYSIS

<b>Date:</b>	17 October 2018
<b>Customer:</b>	D_CDMSMITH_DUB
<b>Sample Delivery Group (SDG):</b>	180908-179
<b>Your Reference:</b>	118174
<b>Location:</b>	Avoca
<b>Report No:</b>	477153

**This report has been revised and directly supersedes 472803 in its entirety.**

We received 7 samples on Saturday September 08, 2018 and 7 of these samples were scheduled for analysis which was completed on Tuesday September 18, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

**Sonia McWhan**

Operations Manager





## CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-179  
Location: Avoca

Client Reference: 118174  
Order Number: 118174--R2

Report Number: 477153  
Superseded Report: 472803

### Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
18291738	AVDB01.11			06/09/2018
18291739	AVSR01.11			06/09/2018
18291741	GW2-05			06/09/2018
18291737	MWDA1			06/09/2018
18291742	MWET1			06/09/2018
18291743	MWET2			06/09/2018
18291736	MWPF1			06/09/2018

#### Maximum Sample/Coolbox Temperature (°C) :

##### ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

**14.2**

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

**Only received samples which have had analysis scheduled will be shown on the following pages.**



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-179  
Location: Avoca

Client Reference: 118174  
Order Number: 118174--R2

Report Number: 477153  
Superseded Report: 472803

## Results Legend

**X** Test

**N** No Determination Possible

## Sample Types -

S - Soil/Solid  
UNS - Unspecified Solid  
GW - Ground Water  
SW - Surface Water  
LE - Land Leachate  
PL - Prepared Leachate  
PR - Process Water  
SA - Saline Water  
TE - Trade Effluent  
TS - Treated Sewage  
US - Untreated Sewage  
RE - Recreational Water  
DW - Drinking Water  
Non-regulatory  
UNL - Unspecified Liquid  
SL - Sludge  
G - Gas  
OTH - Other

Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container	Sample Type
18291736	MM/PF1			<div> <div> HNO3 Filtered (ALE204)</div> <div> H2SO4 (ALE244)</div> <div> 500ml Plastic (ALE208)</div> <div> HNO3 Filtered (ALE204)</div> <div> H2SO4 (ALE244)</div> </div>	SW
18291743	MM/ET2			<div> <div> HNO3 Filtered (ALE208)</div> <div> H2SO4 (ALE244)</div> </div>	SW
18291742	MM/ET1			<div> <div> 500ml Plastic (ALE208)</div> <div> HNO3 Filtered (ALE204)</div> <div> H2SO4 (ALE244)</div> </div>	SW
18291741	GW2-05			<div> <div> 500ml Plastic (ALE208)</div> <div> HNO3 Filtered (ALE204)</div> <div> H2SO4 (ALE244)</div> </div>	SW
18291739	AVSR01.11			<div> <div> 500ml Plastic (ALE208)</div> <div> HNO3 Filtered (ALE204)</div> </div>	SW
18291738	AVDB01.11			<div> <div> HNO3 Filtered (ALE204)</div> </div>	PW
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 4			
Anions by Kone (w)	All	NDPs: 0 Tests: 4			
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6			
pH Value	All	NDPs: 0 Tests: 4			



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-179  
Location: Avoca

Client Reference: 118174  
Order Number: 118174--R2

Report Number: 477153  
Superseded Report: 472803

Results Legend		Customer Sample Ref.	AVDB01.11	AVSR01.11	GW2-05	MWET1	MWET2	MWPF1
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	Process Water (PR) 06/09/2018 08/09/2018 180908-179 18291738	Process Water (PR) 06/09/2018 08/09/2018 180908-179 18291739	Surface Water (SW) 06/09/2018 08/09/2018 180908-179 18291741	Surface Water (SW) 06/09/2018 08/09/2018 180908-179 18291742	Surface Water (SW) 06/09/2018 08/09/2018 180908-179 18291743	Surface Water (SW) 06/09/2018 08/09/2018 180908-179 18291736
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&5@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099			<0.2	0.981	0.254	<0.2
					#	#	#	#
Aluminium (diss.filt)	<10 µg/l	TM152			42700	170000	<60	241
					#	#	#	#
Antimony (diss.filt)	<1 µg/l	TM152			<1	<6	<6	<1
Arsenic (diss.filt)	<0.5 µg/l	TM152			0.836	4.19	6.22	<0.5
					#	#	#	#
Barium (diss.filt)	<0.2 µg/l	TM152			1.35	4.32	10.9	7.36
					#	#	#	#
Cadmium (diss.filt)	<0.08 µg/l	TM152			14.3	30.6	1.66	0.348
					#	#	#	#
Chromium (diss.filt)	<1 µg/l	TM152			1.17	9.59	<6	<1
					#	#	#	#
Cobalt (diss.filt)	<0.5 µg/l	TM152			75.4	259	108	<0.5
					#	#	#	#
Copper (diss.filt)	<0.3 µg/l	TM152			5870	10600	<1.8	36.2
					#	#	#	#
Lead (diss.filt)	<0.2 µg/l	TM152			0.553	87.6	<1.2	<0.2
					#	#	#	#
Manganese (diss.filt)	<3 µg/l	TM152			3880	9510	30200	19.5
					#	#	#	#
Molybdenum (diss.filt)	<3 µg/l	TM152			3.99	<18	<18	<3
					#	#	#	#
Nickel (diss.filt)	<0.4 µg/l	TM152			35.7	123	12.8	0.516
					#	#	#	#
Vanadium (diss.filt)	<1 µg/l	TM152			<1	<6	<6	<1
					#	#	#	#
Zinc (diss.filt)	<1 µg/l	TM152			6720	11200	4830	37.8
					#	#	#	#
Iron (Dis.Filt)	<0.019 mg/l	TM152			0.198	107	89.3	0.0219
					#	#	#	#
Sulphate	<2 mg/l	TM184			857	1690	2060	27.6
					#	#	#	#
pH	<1 pH Units	TM256			3.99	3.76	5.99	5.39
					#	#	#	#
Aluminium (diss.filt)	<10 µg/l	TM152	17.6	1570				
Antimony (diss.filt)	<1 µg/l	TM152	<1	323				
Arsenic (diss.filt)	<0.5 µg/l	TM152	<0.5	584				
Barium (diss.filt)	<0.2 µg/l	TM152	<0.2	1930				
Cadmium (diss.filt)	<0.08 µg/l	TM152	<0.08	739				
Chromium (diss.filt)	<1 µg/l	TM152	<1	429				
Cobalt (diss.filt)	<0.5 µg/l	TM152	<0.5	487				
Copper (diss.filt)	<0.3 µg/l	TM152	1.43	437				
Lead (diss.filt)	<0.2 µg/l	TM152	0.344	597				
Manganese (diss.filt)	<3 µg/l	TM152	3.32	193				
Molybdenum (diss.filt)	<3 µg/l	TM152	<3	102				
Nickel (diss.filt)	<0.4 µg/l	TM152	<0.4	446				
Vanadium (diss.filt)	<1 µg/l	TM152	<1	1360				
Zinc (diss.filt)	<1 µg/l	TM152	2.45	1800				
Iron (Dis.Filt)	<0.019 mg/l	TM152	0.0435	2.49				



## CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180908-179  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174--R2

**Report Number:** 477153  
**Superseded Report:** 472803

### Table of Results - Appendix

Method No	Reference	Description
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



## CERTIFICATE OF ANALYSIS

SDG: 180908-179  
Location: AvocaClient Reference: 118174  
Order Number: 118174--R2Report Number: 477153  
Superseded Report: 472803

## Test Completion Dates

Lab Sample No(s)	18291738	18291739	18291741	18291742	18291743	18291736
Customer Sample Ref.	AVDB01.11	AVSR01.11	GW2-05	MWET1	MWET2	MWPF1
AGS Ref.						
Depth						
Type	Process Water	Process Water	Surface Water	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen			14-Sep-2018	14-Sep-2018	14-Sep-2018	14-Sep-2018
Anions by Kone (w)			13-Sep-2018	17-Sep-2018	17-Sep-2018	17-Sep-2018
Dissolved Metals by ICP-MS	17-Sep-2018	18-Sep-2018	18-Sep-2018	18-Sep-2018	18-Sep-2018	17-Sep-2018
pH Value			14-Sep-2018	14-Sep-2018	14-Sep-2018	14-Sep-2018





# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-179  
Location: Avoca

Client Reference: 118174  
Order Number: 118174--R2

Report Number: 477153  
Superseded Report: 472803

## ASSOCIATED AQC DATA

### Ammoniacal Nitrogen

Component	Method Code	QC 1837	QC 1839
Ammoniacal Nitrogen as N	TM099	<b>98.0</b> 95.98 : 104.95	<b>97.2</b> 95.98 : 104.95

### Anions by Kone (w)

Component	Method Code	QC 1881	QC 1887
Chloride	TM184	<b>105.0</b> 92.93 : 115.43	<b>101.0</b> 92.93 : 115.43
Phosphate (Ortho as PO4)	TM184	96.40 : 108.40	96.40 : 108.40
Sulphate (soluble)	TM184	<b>102.8</b> 90.53 : 113.03	<b>100.8</b> 90.53 : 113.03
TON as NO3	TM184	96.26 : 111.21	<b>98.0</b> 96.26 : 111.21

### Dissolved Metals by ICP-MS

Component	Method Code	QC 1867	QC 1896	QC 1842
Aluminium	TM152	<b>104.0</b> 94.19 : 114.31	<b>106.67</b> 94.19 : 114.31	<b>104.0</b> 94.19 : 114.31
Antimony	TM152	<b>106.0</b> 79.80 : 122.00	<b>106.67</b> 79.80 : 122.00	<b>106.5</b> 79.80 : 122.00
Arsenic	TM152	<b>102.0</b> 90.42 : 111.32	<b>102.5</b> 90.42 : 111.32	<b>103.0</b> 90.42 : 111.32
Barium	TM152	<b>105.5</b> 90.79 : 113.16	<b>105.83</b> 90.79 : 113.16	<b>106.0</b> 90.79 : 113.16
Beryllium	TM152	<b>110.0</b> 93.25 : 120.04	<b>110.83</b> 93.25 : 120.04	<b>104.33</b> 93.25 : 120.04
Bismuth	TM152	<b>105.67</b> 94.65 : 117.05	<b>108.17</b> 94.65 : 117.05	<b>108.5</b> 94.65 : 117.05
Borate	TM152	<b>108.02</b> 88.00 : 112.00	<b>111.11</b> 88.00 : 112.00	<b>103.7</b> 88.00 : 112.00
Boron	TM152	<b>108.0</b> 86.68 : 117.67	<b>111.0</b> 86.68 : 117.67	<b>103.67</b> 86.68 : 117.67
Cadmium	TM152	<b>106.5</b> 94.60 : 112.40	<b>106.67</b> 94.60 : 112.40	<b>104.83</b> 94.60 : 112.40
Calcium	TM152		<b>105.6</b> 88.64 : 126.35	
Chromium	TM152	<b>104.0</b> 93.28 : 110.91	<b>106.33</b> 93.28 : 110.91	<b>105.67</b> 93.28 : 110.91
Cobalt	TM152	<b>101.5</b> 84.39 : 114.26	<b>104.33</b> 84.39 : 114.26	<b>105.17</b> 84.39 : 114.26
Copper	TM152	<b>104.33</b> 88.86 : 118.72	<b>107.67</b> 88.86 : 118.72	<b>107.67</b> 88.86 : 118.72
Iron	TM152		<b>106.67</b> 92.00 : 113.00	
Lead	TM152	<b>101.83</b> 89.25 : 115.12	<b>103.83</b> 89.25 : 115.12	<b>104.5</b> 89.25 : 115.12



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180908-179  
Location: Avoca

Client Reference: 118174  
Order Number: 118174--R2

Report Number: 477153  
Superseded Report: 472803

## Dissolved Metals by ICP-MS

		QC 1867	QC 1896	QC 1842
Lithium	TM152	<b>104.5</b> 89.26 : 119.04	<b>111.33</b> 89.26 : 119.04	<b>103.67</b> 89.26 : 119.04
Magnesium	TM152		<b>103.2</b> 86.35 : 113.36	
Manganese	TM152	<b>102.67</b> 94.24 : 112.74	<b>107.5</b> 94.24 : 112.74	<b>106.17</b> 94.24 : 112.74
Molybdenum	TM152	<b>104.5</b> 87.00 : 108.89	<b>103.67</b> 87.00 : 108.89	<b>105.17</b> 87.00 : 108.89
Nickel	TM152	<b>104.33</b> 92.11 : 110.56	<b>107.67</b> 92.11 : 110.56	<b>105.83</b> 92.11 : 110.56
Phosphorus	TM152	<b>100.67</b> 90.52 : 115.47	<b>105.67</b> 90.52 : 115.47	<b>104.0</b> 90.52 : 115.47
Potassium	TM152		<b>105.33</b> 90.23 : 109.87	
Selenium	TM152	<b>102.83</b> 88.44 : 113.86	<b>102.5</b> 88.44 : 113.86	<b>101.67</b> 88.44 : 113.86
Silver	TM152	<b>104.83</b> 87.04 : 107.38	<b>105.0</b> 87.04 : 107.38	<b>104.33</b> 87.04 : 107.38
Sodium	TM152		<b>104.0</b> 92.68 : 108.68	
Strontium	TM152	<b>101.33</b> 90.72 : 114.82	<b>104.33</b> 90.72 : 114.82	<b>104.0</b> 90.72 : 114.82
Tellurium	TM152	<b>100.83</b> 90.72 : 112.62	<b>103.5</b> 90.72 : 112.62	<b>102.33</b> 90.72 : 112.62
Thallium	TM152	<b>102.83</b> 86.08 : 122.48	<b>109.5</b> 86.08 : 122.48	<b>105.83</b> 86.08 : 122.48
Tin	TM152		<b>106.0</b> 91.00 : 109.00	
Titanium	TM152	<b>105.83</b> 92.82 : 118.92	<b>106.0</b> 92.82 : 118.92	<b>106.0</b> 92.82 : 118.92
Tungsten	TM152	<b>105.5</b> 78.12 : 132.82	<b>107.83</b> 78.12 : 132.82	<b>105.5</b> 78.12 : 132.82
Uranium	TM152	<b>105.67</b> 90.58 : 113.28	<b>107.67</b> 90.58 : 113.28	<b>105.5</b> 90.58 : 113.28
Vanadium	TM152	<b>105.0</b> 88.43 : 114.30	<b>106.33</b> 88.43 : 114.30	<b>107.67</b> 88.43 : 114.30
Zinc	TM152	<b>106.67</b> 86.52 : 115.27	<b>107.67</b> 86.52 : 115.27	<b>107.67</b> 86.52 : 115.27

## pH Value

Component	Method Code	QC 1879
pH	TM256	<b>100.81</b> 99.19 : 102.43

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis .

The figure detailed is the percentage recovery result for the AQC .

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control .



# CERTIFICATE OF ANALYSIS

<b>SDG:</b>	180908-179	<b>Client Reference:</b>	118174	<b>Report Number:</b>	477153
<b>Location:</b>	Avoca	<b>Order Number:</b>	118174--R2	<b>Superseded Report:</b>	472803

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH<sub>4</sub> by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

## General

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

## Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

## Asbestos

### Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

### Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

**Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.**

**The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.**



Unit 7-8 Hawarden Business Park  
Manor Road (off Manor Lane)  
Hawarden  
Deeside  
CH5 3US

Tel: (01244) 528700

Fax: (01244) 528701

email: hawardencustomerservices@alsglobal.com

Website: www.alsenvironmental.co.uk

CDM Smith  
15 Wentworth  
Elbana Villas  
Dublin  
Dublin 2  
D02 WK10

**Attention:** Laura Foley

## CERTIFICATE OF ANALYSIS

<b>Date:</b>	24 September 2018
<b>Customer:</b>	D_CDMSMITH_DUB
<b>Sample Delivery Group (SDG):</b>	180918-53
<b>Your Reference:</b>	118174
<b>Location:</b>	Avoca
<b>Report No:</b>	473772

We received 10 samples on Tuesday September 18, 2018 and 10 of these samples were scheduled for analysis which was completed on Monday September 24, 2018. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Approved By:

**Sonia McWhan**

Operations Manager





## CERTIFICATE OF ANALYSIS

Validated

SDG: 180918-53  
Location: Avoca

Client Reference: 118174  
Order Number: 118174.2.3.0

Report Number: 473772  
Superseded Report:

### Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
18349767	MWDA1			13/09/2018
18349768	MWDA2			13/09/2018
18349770	SMDB02.11			13/09/2018
18349769	SMSD03.11			13/09/2018
18349761	SW1-SM			13/09/2018
18349763	SW3-SM			13/09/2018
18349765	SW5-SM			13/09/2018
18349766	SW6-SM			13/09/2018
18349764	SW4-SM-GA			13/09/2018
18349762	SW2-SM-SOUTH			13/09/2018

#### Maximum Sample/Coolbox Temperature (°C) :

18.2

#### ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.









# CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180918-53  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174.2.3.0

**Report Number:** 473772  
**Superseded Report:**

Results Legend		Customer Sample Ref.	MWDA1	MWDA2	SMD802.11	SMSD03.11	SW1-SM	SW3-SM
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sample Time Date Received SDG Ref Lab Sample No.(s) AGS Reference						
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&+5@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
Organic Carbon, Total	<3 mg/l	TM090					<3	<3
							#	#
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	0.434	0.265			<0.2	<0.2
			#	#			#	#
Aluminium (diss.filt)	<10 µg/l	TM152	70300	28300			<10	<10
			#	#			#	#
Antimony (diss.filt)	<1 µg/l	TM152	<6	<6			<1	<1
Arsenic (diss.filt)	<0.5 µg/l	TM152	4.27	<3			0.71	<0.5
			#	#			#	#
Barium (diss.filt)	<0.2 µg/l	TM152	<1.2	<1.2			37.5	34
			#	#			#	#
Cadmium (diss.filt)	<0.08 µg/l	TM152	69.2	79			<0.08	<0.08
			#	#			#	#
Chromium (diss.filt)	<1 µg/l	TM152	<6	<6			<1	<1
			#	#			#	#
Cobalt (diss.filt)	<0.5 µg/l	TM152	93	214			<0.5	<0.5
			#	#			#	#
Copper (diss.filt)	<0.3 µg/l	TM152	2620	2370			<0.3	<0.3
			#	#			#	#
Lead (diss.filt)	<0.2 µg/l	TM152	48.1	2.71			<0.2	0.421
			#	#			#	#
Manganese (diss.filt)	<3 µg/l	TM152	4360	11600			<3	<3
			#	#			#	#
Molybdenum (diss.filt)	<3 µg/l	TM152	<18	<18			<3	<3
			#	#			#	#
Nickel (diss.filt)	<0.4 µg/l	TM152	43.2	96.1			<0.4	<0.4
			#	#			#	#
Vanadium (diss.filt)	<1 µg/l	TM152	<6	<6			<1	<1
			#	#			#	#
Zinc (diss.filt)	<1 µg/l	TM152	37700	<17.6			<1	30.8
			#	#			#	#
Calcium (Dis.Filt)	<0.2 mg/l	TM152					12.2	12.4
							#	#
Iron (Dis.Filt)	<0.019 mg/l	TM152	19.4	109			<0.019	<0.019
			#	#			#	#
Sulphate	<2 mg/l	TM184	913	1010			11.7	9.6
			#	#			#	#
pH	<1 pH Units	TM256	3.1	3.57			7.6	7.72
			#	#			#	#
Aluminium (diss.filt)	<10 µg/l	TM152			<10	<10		
Antimony (diss.filt)	<1 µg/l	TM152			<1	<1		
Arsenic (diss.filt)	<0.5 µg/l	TM152			<0.5	<0.5		
Barium (diss.filt)	<0.2 µg/l	TM152			0.224	37.8		
Cadmium (diss.filt)	<0.08 µg/l	TM152			<0.08	<0.08		
Chromium (diss.filt)	<1 µg/l	TM152			<1	<1		
Cobalt (diss.filt)	<0.5 µg/l	TM152			<0.5	<0.5		
Copper (diss.filt)	<0.3 µg/l	TM152			<0.3	<0.3		
Lead (diss.filt)	<0.2 µg/l	TM152			0.298	<0.2		
Manganese (diss.filt)	<3 µg/l	TM152			<3	<3		
Molybdenum (diss.filt)	<3 µg/l	TM152			<3	<3		
Nickel (diss.filt)	<0.4 µg/l	TM152			<0.4	<0.4		
Vanadium (diss.filt)	<1 µg/l	TM152			<1	<1		







## CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180918-53  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174.2.3.0

**Report Number:** 473772  
**Superseded Report:**

### Table of Results - Appendix

Method No	Reference	Description
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180918-53  
Location: Avoca

Client Reference: 118174  
Order Number: 118174.2.3.0

Report Number: 473772  
Superseded Report:

## Test Completion Dates

Lab Sample No(s)  
Customer Sample Ref.

AGS Ref.  
Depth  
Type

	18349767	18349768	18349770	18349769	18349761	18349763	18349765	18349766	18349764	18349762
	MWDA1	MWDA2	SMDB02.11	SMSD03.11	SW1-SM	SW3-SM	SW5-SM	SW6-SM	SW4-SM-GA	SW2-SM-SOUTH
	Ground Water	Ground Water	Process Water	Process Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen	21-Sep-2018	21-Sep-2018			21-Sep-2018	21-Sep-2018	21-Sep-2018	21-Sep-2018	21-Sep-2018	21-Sep-2018
Anions by Kone (w)	20-Sep-2018	20-Sep-2018			20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018
Dissolved Metals by ICP-MS	24-Sep-2018	22-Sep-2018	24-Sep-2018	22-Sep-2018	22-Sep-2018	22-Sep-2018	22-Sep-2018	22-Sep-2018	22-Sep-2018	22-Sep-2018
pH Value	20-Sep-2018	20-Sep-2018			20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018	20-Sep-2018
Total Organic and Inorganic Carbon					21-Sep-2018	21-Sep-2018	21-Sep-2018	21-Sep-2018	21-Sep-2018	



# CERTIFICATE OF ANALYSIS

Validated

SDG: 180918-53  
Location: Avoca

Client Reference: 118174  
Order Number: 118174.2.3.0

Report Number: 473772  
Superseded Report:

## ASSOCIATED AQC DATA

### Ammoniacal Nitrogen

Component	Method Code	QC 1820	QC 1826
Ammoniacal Nitrogen as N	TM099	<b>101.6</b> 95.98 : 104.95	<b>100.4</b> 95.98 : 104.95

### Anions by Kone (w)

Component	Method Code	QC 1808
Chloride	TM184	92.93 : 115.43
Phosphate (Ortho as PO4)	TM184	96.40 : 108.40
Sulphate (soluble)	TM184	<b>104.4</b> 90.53 : 113.03
TON as NO3	TM184	96.26 : 111.21

### Dissolved Metals by ICP-MS

Component	Method Code	QC 1862	QC 1844	QC 1861	QC 1824
Aluminium	TM152	<b>100.67</b> 94.19 : 114.31	<b>102.33</b> 94.19 : 114.31	<b>101.33</b> 94.19 : 114.31	<b>103.67</b> 94.19 : 114.31
Antimony	TM152	<b>102.67</b> 79.80 : 122.00	<b>101.5</b> 79.80 : 122.00	<b>101.5</b> 79.80 : 122.00	<b>102.5</b> 79.80 : 122.00
Arsenic	TM152	<b>101.0</b> 90.42 : 111.32	<b>101.0</b> 90.42 : 111.32	<b>100.5</b> 90.42 : 111.32	<b>102.0</b> 90.42 : 111.32
Barium	TM152	<b>102.0</b> 90.79 : 113.16	<b>101.33</b> 90.79 : 113.16	<b>101.83</b> 90.79 : 113.16	<b>101.17</b> 90.79 : 113.16
Beryllium	TM152	<b>102.17</b> 93.25 : 120.04	<b>106.0</b> 93.25 : 120.04	<b>102.5</b> 93.25 : 120.04	<b>104.83</b> 93.25 : 120.04
Bismuth	TM152	<b>102.67</b> 94.65 : 117.05	<b>103.5</b> 94.65 : 117.05	<b>101.0</b> 94.65 : 117.05	<b>105.5</b> 94.65 : 117.05
Borate	TM152	<b>103.09</b> 88.00 : 112.00	<b>103.09</b> 88.00 : 112.00	<b>102.47</b> 88.00 : 112.00	<b>103.09</b> 88.00 : 112.00
Boron	TM152	<b>103.0</b> 86.68 : 117.67	<b>103.0</b> 86.68 : 117.67	<b>102.33</b> 86.68 : 117.67	<b>103.0</b> 86.68 : 117.67
Cadmium	TM152	<b>103.67</b> 94.60 : 112.40	<b>103.67</b> 94.60 : 112.40	<b>102.67</b> 94.60 : 112.40	<b>103.33</b> 94.60 : 112.40
Chromium	TM152	<b>101.67</b> 93.28 : 110.91	<b>102.67</b> 93.28 : 110.91	<b>101.0</b> 93.28 : 110.91	<b>105.67</b> 93.28 : 110.91
Cobalt	TM152	<b>102.0</b> 84.39 : 114.26	<b>103.0</b> 84.39 : 114.26	<b>101.83</b> 84.39 : 114.26	<b>103.67</b> 84.39 : 114.26
Copper	TM152	<b>101.67</b> 88.86 : 118.72	<b>103.17</b> 88.86 : 118.72	<b>102.17</b> 88.86 : 118.72	<b>103.67</b> 88.86 : 118.72
Lead	TM152	<b>104.17</b> 89.25 : 115.12	<b>102.67</b> 89.25 : 115.12	<b>102.67</b> 89.25 : 115.12	<b>105.17</b> 89.25 : 115.12
Lithium	TM152	<b>102.0</b> 89.26 : 119.04	<b>104.67</b> 89.26 : 119.04	<b>101.67</b> 89.26 : 119.04	<b>103.5</b> 89.26 : 119.04
Manganese	TM152	<b>101.5</b> 94.24 : 112.74	<b>102.5</b> 94.24 : 112.74	<b>100.5</b> 94.24 : 112.74	<b>103.0</b> 94.24 : 112.74



# CERTIFICATE OF ANALYSIS

Validated

**SDG:** 180918-53  
**Location:** Avoca

**Client Reference:** 118174  
**Order Number:** 118174.2.3.0

**Report Number:** 473772  
**Superseded Report:**

## Dissolved Metals by ICP-MS

		QC 1862	QC 1844	QC 1861	QC 1824
Molybdenum	TM152	<b>101.5</b> 87.00 : 108.89	<b>100.0</b> 87.00 : 108.89	<b>100.5</b> 87.00 : 108.89	<b>101.0</b> 87.00 : 108.89
Nickel	TM152	<b>102.0</b> 92.11 : 110.56	<b>103.67</b> 92.11 : 110.56	<b>103.0</b> 92.11 : 110.56	<b>103.33</b> 92.11 : 110.56
Niobium	TM152		88.00 : 112.00	88.00 : 112.00	
Phosphorus	TM152	<b>100.83</b> 90.52 : 115.47	<b>101.33</b> 90.52 : 115.47	<b>100.17</b> 90.52 : 115.47	<b>101.0</b> 90.52 : 115.47
Selenium	TM152	<b>101.5</b> 88.44 : 113.86	<b>101.5</b> 88.44 : 113.86	<b>100.67</b> 88.44 : 113.86	<b>103.0</b> 88.44 : 113.86
Silver	TM152	<b>102.67</b> 87.04 : 107.38	<b>101.0</b> 87.04 : 107.38	<b>100.83</b> 87.04 : 107.38	<b>102.17</b> 87.04 : 107.38
Strontium	TM152	<b>101.33</b> 90.72 : 114.82	<b>101.0</b> 90.72 : 114.82	<b>101.0</b> 90.72 : 114.82	<b>100.0</b> 90.72 : 114.82
Tellurium	TM152	<b>98.17</b> 90.72 : 112.62	<b>98.0</b> 90.72 : 112.62	<b>97.5</b> 90.72 : 112.62	<b>98.17</b> 90.72 : 112.62
Thallium	TM152	<b>101.0</b> 86.08 : 122.48	<b>99.33</b> 86.08 : 122.48	<b>98.83</b> 86.08 : 122.48	<b>102.83</b> 86.08 : 122.48
Titanium	TM152	<b>100.5</b> 92.82 : 118.92	<b>100.0</b> 92.82 : 118.92	<b>99.17</b> 92.82 : 118.92	<b>101.83</b> 92.82 : 118.92
Tungsten	TM152	<b>104.67</b> 78.12 : 132.82	<b>102.5</b> 78.12 : 132.82	<b>101.67</b> 78.12 : 132.82	<b>103.5</b> 78.12 : 132.82
Uranium	TM152	<b>102.67</b> 90.58 : 113.28	<b>101.67</b> 90.58 : 113.28	<b>101.33</b> 90.58 : 113.28	<b>104.33</b> 90.58 : 113.28
Vanadium	TM152	<b>104.0</b> 88.43 : 114.30	<b>99.0</b> 88.43 : 114.30	<b>100.67</b> 88.43 : 114.30	<b>101.83</b> 88.43 : 114.30
Zinc	TM152	<b>106.0</b> 86.52 : 115.27	<b>106.33</b> 86.52 : 115.27	<b>105.67</b> 86.52 : 115.27	<b>107.67</b> 86.52 : 115.27
Zirconium	TM152		88.00 : 112.00	88.00 : 112.00	

## pH Value

Component	Method Code	QC 1843
pH	TM256	<b>100.4</b> 99.73 : 102.16

## Total Organic and Inorganic Carbon

Component	Method Code	QC 1879
Total Organic Carbon	TM090	<b>98.83</b> 95.80 : 111.10

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis .

The figure detailed is the percentage recovery result for the AQC .

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control .





# CERTIFICATE OF ANALYSIS

SDG:	180918-53	Client Reference:	118174	Report Number:	473772
Location:	Avoca	Order Number:	118174.2.3.0	Superseded Report:	

## Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH<sub>4</sub> by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

## General

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

## Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

## Asbestos

### Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

### Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

**Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.**

**The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.**

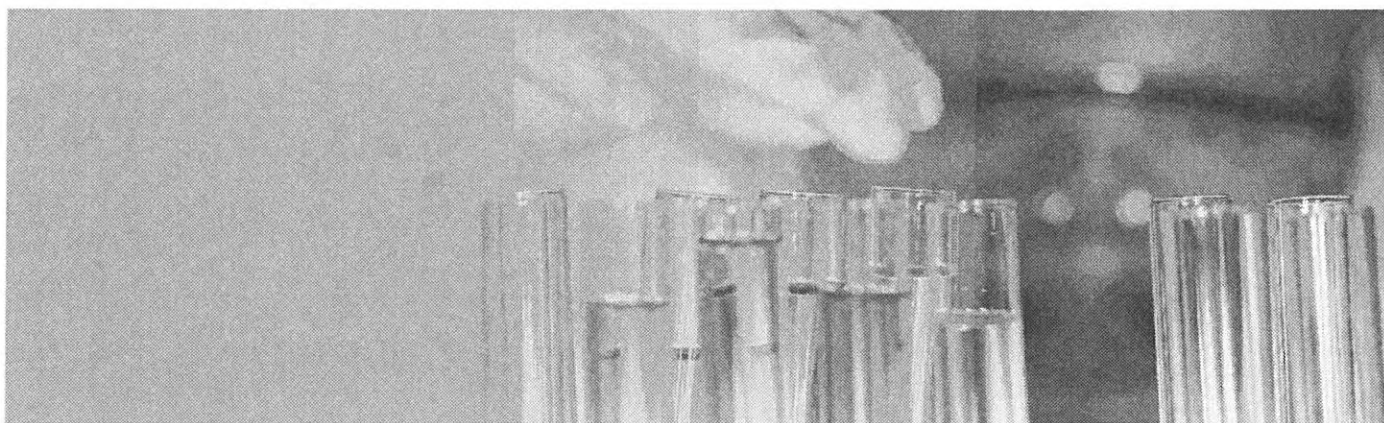
## Appendix G

---

### Standard Reference Material Certificates

# Quality Control

## Instructions and Data Package



**Customer Number: F655907**

**Focus Scientific Solutions Ltd  
Unit 12, Block 3  
City North Business Campus  
Ireland  
Stamullen, Co.Meath,**



A Waters Company

# Quality Control Sample Dilution Instructions

**This section contains the preparation instructions for all  
samples that you have ordered.**

**If you have any questions concerning the Instructions listed in  
this portion of your Data Package please feel free to call ERA's  
Technical Staff at 1-800-372-0122.**





A Waters Company



## Instructions for Catalog # 740 Ready-to-Use Trace Metals

Revision 041608

### Description:

- This standard is packaged in a 500 mL polyethylene bottle containing approximately 500 mL of standard.
- This standard is preserved with approximately 0.15%(v/v) nitric acid.
- The standard should be stored at  $4 \pm 2^\circ\text{C}$ .
- This product is intended to be used as a quality control check of the entire analytical process for the analytes/matrix included in the standard.
- The standard contains the following analytes in the concentration ranges shown:

Aluminum.....	200 – 4000 µg/L	Lead .....	70 – 3000 µg/L
Antimony.....	95 – 900 µg/L	Manganese.....	70 – 4000 µg/L
Arsenic .....	70 – 900 µg/L	Molybdenum.....	60 – 600 µg/L
Barium.....	100 – 2500 µg/L	Nickel.....	80 – 3000 µg/L
Beryllium.....	8 – 900 µg/L	Selenium.....	90 – 2000 µg/L
Boron .....	800 – 2000 µg/L	Silver.....	26 – 600 µg/L
Cadmium .....	8 – 750 µg/L	Strontium.....	30 – 300 µg/L
Chromium.....	17 – 1000 µg/L	Thallium .....	60 – 900 µg/L
Cobalt.....	28 – 1000 µg/L	Vanadium .....	55 – 2000 µg/L
Copper.....	40 – 900 µg/L	Zinc.....	100 – 2000 µg/L
Iron.....	200 – 4000 µg/L		

### Helpful Hints:

- While it is technically not necessary to digest this standard prior to analysis, digestion should be performed if this is your normal procedure.
- For some methods (primarily colorimetric methods), pH adjustment or preparatory extraction may be required to remove any interferences before analysis.

### Instructions:

1. Shake the Ready-to-Use Trace Metals bottle prior to opening.
2. Remove aliquots and analyze by your normal procedures.

### Safety:

ERA products may be hazardous and are intended for use by professional laboratory personnel trained in the competent handling of such materials. Responsibility for the safe use of these products rests entirely with the buyer and/or user. Material Safety Data Sheets (MSDS) for all ERA products are available by calling 1-800-372-0122.



A Waters Company

# **Data Pack™ Certification Sheet(s)**

**The data contained in this section of the Data Pack™ contains  
all of the certification sheets for the quality control samples that  
you have ordered.**

**If you have any questions concerning the data listed in this  
portion of your Data Pack™ please feel free to call ERA's  
Technical Staff at 1-800-372-0122.**







A Waters Company

## Certificate of Analysis

Lot No. P273-740B

Catalog No. 740

Issue Date: July 16, 2018

Revision Date: Original

## Ready-to-Use WasteWatR™ Trace Metals

Product use instructions are included as part of the certification packet and are paginated separately from this Certificate of Analysis. Please reference the product use instructions for catalog #740 revision 041608.

### Certification

Parameter	Certified Value <sup>1</sup> (µg/l)	Uncertainty <sup>2</sup>	QC PALs™ <sup>3</sup> (µg/l)	PT PALs™ <sup>4</sup> (µg/l)
aluminum	1540	0.454%	1350 - 1740	1270 - 1770
antimony	314	0.712%	273 - 345	246 - 371
arsenic	644	0.646%	563 - 708	543 - 737
barium	2140	0.496%	1950 - 2310	1820 - 2460
beryllium	253	0.538%	228 - 276	215 - 291
boron	967	3.93%	864 - 1090	822 - 1110
cadmium	738	0.458%	656 - 790	627 - 849
chromium	436	0.470%	397 - 475	371 - 501
cobalt	493	0.458%	460 - 547	419 - 567
copper	423	3.41%	384 - 461	360 - 486
iron	2490	0.454%	2260 - 2760	2120 - 2860
lead	592	0.460%	536 - 651	503 - 681
manganese	210	1.24%	195 - 231	178 - 242
molybdenum	104	0.452%	93.4 - 112	84.1 - 123
nickel	449	2.70%	408 - 489	390 - 512
selenium	154	0.456%	135 - 171	131 - 177
silver	929	0.456%	832 - 1020	790 - 1070
strontium	55.7	1.44%	50.5 - 61.3	47.3 - 64.1
thallium	419	1.42%	369 - 465	342 - 488
vanadium	1440	0.456%	1310 - 1540	1220 - 1660
zinc	1780	0.456%	1610 - 1960	1510 - 2050

### Analytical Verification

Parameter	Mean (µg/l)	Round Robin Data <sup>5</sup> Recovery (%)	n	NIST Traceability SRM Number	Recovery (%)
aluminum	1540	100%	182	SRM 3101a	100%
antimony	305	97.3%	183	SRM 3102a	98.8%
arsenic	616	95.7%	195	SRM 3103a	98.8%
barium	2100	98.0%	183	SRM 3104a	96.4%
beryllium	247	97.6%	175	SRM 3105a	103%
boron	957	98.9%	138	SRM 3107	98.3%
cadmium	719	97.4%	203	SRM 3108	99.6%
chromium	434	99.7%	201	SRM 3112a	101%
cobalt	506	103%	168	SRM 3113	101%
copper	419	99.1%	212	SRM 3114	99.0%
iron	2500	100%	178	SRM 3126a	101%
lead	590	99.6%	204	SRM 3128	99.3%
manganese	204	97.1%	196	SRM 3132	97.4%
molybdenum	102	97.8%	174	SRM 3134	99.0%
nickel	449	100%	200	SRM 3136	99.8%
selenium	147	95.8%	194	SRM 3149	98.3%
silver	911	98.1%	184	SRM 3151	102%
strontium	54.3	97.5%	110	SRM 3153a	101%
thallium	411	98.0%	171	SRM 3158	101%
vanadium	1400	97.2%	169	SRM 3165	101%
zinc	1760	98.5%	203	SRM 3168a	96.1%

Please see footnotes on back





1. The **Certified Values** are the actual "made-to" concentrations confirmed by ERA analytical verification.
2. The stated **Uncertainty** is the total propagated uncertainty at the 95% confidence interval. The uncertainty is based on the preparation and internal analytical verification of the product by ERA, multiplied by a coverage factor which is equal to the Student t factor at a 95% confidence interval at n-1 degrees of freedom. The uncertainty applies to the product as supplied and does not take into account any required or optional dilution and/or preparations the laboratory may perform while using this product.
3. The **QC Performance Acceptance Limits (QC PALs™)** are based on actual historical data collected in ERA's Proficiency Testing program. The **QC PALs™** reflect any inherent biases in the methods used to establish the limits and closely approximate a 95% confidence interval of the performance that experienced laboratories should achieve using accepted environmental methods. Use the **QC PALs™** to realistically evaluate your performance against your peers.
4. The **PT Performance Acceptance Limits (PT PALs™)** are calculated using the regression equations and fixed acceptance criteria specified in the NELAC proficiency testing requirements. Use the **PT PALs™** when analyzing this QC standard alongside USEPA and NELAC compliant PT standards. Please note that many PT study acceptance limits are concentration dependent (some non-linearly) and, therefore, the acceptance limits of this QC standard and any PT standard may differ relative to their difference in concentrations.
5. The **Analytical Verification** data include the mean value, percent recovery and number of data points reported by the laboratories in our Proficiency Testing study compared to the Certified Values. In addition, where NIST Standard Reference Materials (SRMs) are available, each analyte has been analytically traced to the NIST SRM listed.

$$\text{Traceability Recovery (\%)} = [(\% \text{ recovery certified standard}) / (\% \text{ recovery NIST SRM})] * 100$$

The traceability data shown were compiled by analyzing the ERA standards or their associated stock solutions against the applicable NIST SRMs.

6. This standard **expires 10/2018**. The certified values are monitored and purchasers will be notified of any significant changes resulting in recertification or withdrawal of this certified reference material during the period of validity of this certificate.

If you have any questions or need technical assistance, please call ERA technical assistance at 1-800-372-0122 or email to [info@eraqc.com](mailto:info@eraqc.com).

Certifying Officer: Brian Miller



Issuing Date 19-Jul-2016

Revision Date 07-Apr-2016

Revision Number 1

This safety data sheet was created pursuant to the requirements of 29 CFR 1910.1200

## 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

### Product identifier

**Product Name** Trace Metals, Ready-to-Use WasteWatR™  
**Product Number** 740  
**Synonyms** None

### Recommended use of the chemical and restrictions on use

**Recommended Use** Laboratory use only  
**Uses advised against** No information available

### Details of the supplier of the safety data sheet

**Supplier** ERA, A Waters Company  
**Supplier Address** 16341 Table Mountain Parkway, Golden, CO 80403 USA  
**Non-Emergency Telephone Number** +1-303-431-8454  
**E-mail address** sdsinfo@eraqc.com

### Emergency telephone number

**Company Emergency Phone Number** In case of EMERGENCY call CHEMTREC Day or Night  
 Within USA and Canada: 800-424-9300  
 International Call Collect: +1-703-527-3887

## 2. HAZARDS IDENTIFICATION

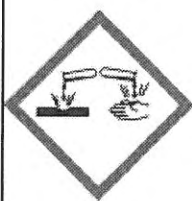
### Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1

### GHS Label elements, including precautionary statements

#### Emergency Overview

<b>Signal word</b>	<b>Danger</b>
<b>Hazard Statements</b> Causes severe skin burns and eye damage	
	
<b>Appearance</b> Clear, colorless	<b>Physical state</b> Liquid
<b>Odor</b> Odorless	

**Precautionary Statements - Prevention**

Do not breathe dust/fume/gas/mist/vapors/spray  
Wash face, hands and any exposed skin thoroughly after handling  
Wear protective gloves/protective clothing/eye protection/face protection

**Precautionary Statements - Response**

Immediately call a POISON CENTER or doctor/physician  
Specific treatment (see supplemental first aid instructions on this label)

**Eyes**

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing  
Immediately call a POISON CENTER or doctor/physician

**Skin**

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower  
Wash contaminated clothing before reuse

**Inhalation**

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing  
Immediately call a POISON CENTER or doctor/physician

**Ingestion**

IF SWALLOWED: Rinse mouth. DO NOT induce vomiting

**Precautionary Statements - Storage**

Store locked up

**Precautionary Statements - Disposal**

Dispose of contents/container to an approved waste disposal plant

**Hazards not otherwise classified (HNOC)**

Not applicable

**Unknown Toxicity**

0 % of the mixture consists of ingredient(s) of unknown toxicity

**Other information**

No information available

**Interactions with Other Chemicals**

No information available.

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

Note: only the components contributing to the product's GHS hazard classification are listed in this section.

Chemical Name	CAS No	Weight-%
Nitric Acid	7697-37-2	0.21

**4. FIRST AID MEASURES****First aid measures****General Advice**

Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

---

<b>Eye contact</b>	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention/advice.
<b>Skin contact</b>	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Seek immediate medical attention/advice.
<b>Inhalation</b>	Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If breathing is difficult, (trained personnel should) give oxygen. Delayed pulmonary edema may occur. Get medical attention immediately if symptoms occur.
<b>Ingestion</b>	Do NOT induce vomiting. Rinse mouth immediately and drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.
<b>Self-protection of the first aider</b>	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Use personal protective equipment as required. Wear personal protective clothing (see section 8).

**Most important symptoms and effects, both acute and delayed**

**Most Important Symptoms and Effects**      Burning sensation.

**Indication of any immediate medical attention and special treatment needed**

**Notes to Physician**      Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure.

## 5. FIRE-FIGHTING MEASURES

### Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

### Unsuitable extinguishing media

CAUTION: Use of water spray when fighting fire may be inefficient.

### Specific hazards arising from the chemical

The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating gases and vapors.

#### Uniform Fire Code

Corrosive: Other--Liquid

### Hazardous Combustion Products

Carbon oxides.

### Explosion Data

Sensitivity to Mechanical Impact No.

Sensitivity to Static Discharge No.

### Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

## 6. ACCIDENTAL RELEASE MEASURES

### Personal precautions, protective equipment and emergency procedures

#### Personal precautions

Attention! Corrosive material. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

#### Other Information

Refer to protective measures listed in Sections 7 and 8.

### Environmental precautions

#### Environmental precautions

Refer to protective measures listed in Sections 7 and 8. Prevent further leakage or spillage if safe to do so. Should not be released into the environment. Do not allow to enter into soil/subsoil. Prevent product from entering drains.

### Methods and material for containment and cleaning up

#### Methods for containment

Prevent further leakage or spillage if safe to do so.

#### Methods for cleaning up

Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

## 7. HANDLING AND STORAGE

### Precautions for safe handling

#### Handling

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. In case of insufficient ventilation, wear suitable respiratory equipment. Use only with adequate ventilation and in closed systems. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.

### Conditions for safe storage, including any incompatibilities

#### Storage

Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture. Store locked up. Keep out of the reach of children. Store away from other materials.

#### Incompatible Products

Acids. Bases. Oxidizing agent.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### Control parameters

#### Exposure Guidelines

This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric Acid 7697-37-2	STEL: 4 ppm TWA: 2 ppm	TWA: 2 ppm TWA: 5 mg/m <sup>3</sup> (vacated) TWA: 2 ppm (vacated) TWA: 5 mg/m <sup>3</sup> (vacated) STEL: 4 ppm (vacated) STEL: 10 mg/m <sup>3</sup>	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m <sup>3</sup> STEL: 4 ppm STEL: 10 mg/m <sup>3</sup>

### Appropriate engineering controls

#### Engineering Measures

Showers  
Eyewash stations  
Ventilation systems

### Individual protection measures, such as personal protective equipment

#### Eye/face protection

Face protection shield.

#### Skin and body protection

Wear protective gloves and protective clothing. Long sleeved clothing. Chemical resistant apron. Impervious gloves.

#### Respiratory protection

No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

#### Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. Take off contaminated clothing and wash before reuse.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Physical and Chemical Properties**

Physical state	Liquid		
Appearance	Clear, colorless	Odor	Odorless
Color	No information available	Odor Threshold	No information available

<u>Property</u>	<u>Values</u>	<u>Remarks</u>	<u>Method</u>
pH	1.5		
Melting / freezing point	no data available	None known	
Boiling point / boiling range	no data available	None known	
Flash Point	no data available	None known	
Evaporation Rate	no data available	None known	
Flammability (solid, gas)	no data available	None known	
Flammability Limit in Air			
Upper flammability limit	no data available		
Lower flammability limit	no data available		
Vapor pressure	no data available	None known	
Vapor density	no data available	None known	
Specific Gravity	1		
Water Solubility	Soluble in water		
Solubility in other solvents	no data available	None known	
Partition coefficient: n-octanol/water	no data available	None known	
Autoignition temperature	no data available	None known	
Decomposition temperature	no data available	None known	
Kinematic viscosity	no data available	None known	
Dynamic viscosity	no data available	None known	
Explosive properties	no data available		
Oxidizing properties	no data available		

**Other Information**

Softening Point	no data available
VOC Content (%)	no data available
Particle Size	no data available
Particle Size Distribution	

**10. STABILITY AND REACTIVITY****Reactivity**

no data available.

**Chemical stability**

Stable under recommended storage conditions.

**Possibility of Hazardous Reactions**

None under normal processing.

**Hazardous Polymerization**

Hazardous polymerization does not occur.

**Conditions to avoid**

Exposure to air or moisture over prolonged periods.

**Incompatible materials**

Acids. Bases. Oxidizing agent.

**Hazardous Decomposition Products**

Carbon oxides.

**11. TOXICOLOGICAL INFORMATION**



**Information on likely routes of exposure****Product Information**

<b>Inhalation</b>	Specific test data for the substance or mixture is not available. Corrosive by inhalation. (based on components). Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Inhaled corrosive substances can lead to a toxic edema of the lungs. Pulmonary edema can be fatal. May cause irritation of respiratory tract.
<b>Eye contact</b>	Specific test data for the substance or mixture is not available. Causes burns. (based on components). Corrosive to the eyes and may cause severe damage including blindness. Causes serious eye damage. May cause irreversible damage to eyes.
<b>Skin contact</b>	Specific test data for the substance or mixture is not available. May cause irritation. Prolonged contact may cause redness and irritation.
<b>Ingestion</b>	Specific test data for the substance or mixture is not available. Causes burns. (based on components). Ingestion causes burns of the upper digestive and respiratory tracts. May cause severe burning pain in the mouth and stomach with vomiting and diarrhea of dark blood. Blood pressure may decrease. Brownish or yellowish stains may be seen around the mouth. Swelling of the throat may cause shortness of breath and choking. May cause lung damage if swallowed. May be fatal if swallowed and enters airways. Ingestion may cause irritation to mucous membranes. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

**Component Information**

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Nitric Acid 7697-37-2	-	-	= 67 ppm ( Rat ) 4 h = 130 mg/m <sup>3</sup> ( Rat ) 4 h

**Information on toxicological effects**

**Symptoms** Erythema (skin redness). Burning. May cause blindness. Coughing and/ or wheezing.

**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

**Sensitization** No information available.

**Carcinogenicity** The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Nitric Acid 7697-37-2		Group 1 Group 2A		X

**Reproductive toxicity** No information available.

**STOT - single exposure** No information available.

**STOT - repeated exposure** No information available.

**Chronic Toxicity** Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen.

**Target Organ Effects** Respiratory system. Eyes. Skin. Gastrointestinal tract (GI).

Aspiration Hazard No information available.

**Numerical measures of toxicity Product Information**

The following values are calculated based on chapter 3.1 of the GHS document  
Not applicable

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

Harmful to aquatic life.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Nitric Acid 7697-37-2		96h LC50: = 72 mg/L (Gambusia affinis)		

**Persistence and Degradability**

No information available.

**Bioaccumulation**

Chemical Name	Log Pow
Nitric Acid 7697-37-2	-2.3

**Other adverse effects**

No information available.

## 13. DISPOSAL CONSIDERATIONS

**Waste treatment methods**

**Disposal methods** This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261).

**Contaminated Packaging** Dispose of contents/containers in accordance with local regulations.

**US EPA Waste Number** D002 D006 D010 U217 P120

**California Hazardous Waste Codes** 791

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste
Nitric Acid 7697-37-2	Toxic Corrosive Ignitable

## 14. TRANSPORT INFORMATION

**DOT**  
**Proper Shipping Name** Not regulated  
**Hazard Class** NON REGULATED  
N/A

**TDG** Not regulated

<u>MEX</u>	Not regulated
<u>ICAO</u>	Not regulated
<u>IATA</u>	Not regulated
Proper Shipping Name	NON REGULATED
<u>IMDG/IMO</u>	Not regulated
<u>RID</u>	Not regulated
<u>ADR</u>	Not regulated
<u>ADN</u>	Not regulated

## 15. REGULATORY INFORMATION

### International Inventories

TSCA	Complies
DSL	All components are listed either on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

### US Federal Regulations

#### SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical Name	CAS No	Weight-%	SARA 313 - Threshold Values %
Nitric Acid - 7697-37-2	7697-37-2	0.21	1.0

#### SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

#### CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Nitric Acid 7697-37-2	1000 lb			X

#### CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Nitric Acid 7697-37-2	1000 lb	1000 lb	RQ 1000 lb final RQ RQ 454 kg final RQ

### US State Regulations

**California Proposition 65**

This product contains the following Proposition 65 chemicals.

**U.S. State Right-to-Know Regulations**

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
Water 7732-18-5			X		
Nitric Acid 7697-37-2	X	X	X	X	X
Aluminum Nitrate Nonahydrate 7784-27-2	X		X	X	X
Ferric Nitrate 10421-48-4	X	X	X	X	X
Barium Nitrate 10022-31-8	X	X	X	X	X
Boric Acid 10043-35-3	X				X
Zinc Nitrate Hexahydrate 10196-18-6	X		X	X	X
Manganese Nitrate Tetrahydrate 10377-66-9	X		X	X	X
Nickel Nitrate Hexahydrate 13138-45-9	X	X	X	X	X
Vanadium Pentoxide 1314-62-1	X	X	X	X	X
Lead Nitrate 10099-74-8	X	X	X	X	X
Cobalt Acetate 71-48-7	X		X	X	X
Silver Nitrate 7761-88-8	X	X	X	X	X
Selenium 7782-49-2	X	X	X	X	X
Cadmium 7440-43-9	X	X	X	X	X
Copper 7440-50-8	X	X	X	X	X
Ammonium Dichromate 7789-09-5	X	X	X	X	X
Antimony 7440-36-0	X	X	X	X	X
Arsenic 7440-38-2	X	X	X	X	X
Thallium Nitrate 10102-45-1	X	X	X	X	X
Ammonium Molybdate 13106-76-8	X			X	
Strontium Nitrate 10042-76-9	X	X	X	X	X
Beryllium Acetate, Basic 19049-40-2	X		X	X	X

**International Regulations**

Component	Carcinogen Status	Exposure Limits
Nitric Acid 7697-37-2 ( 0.21 )		Mexico: TWA 2 ppm Mexico: TWA 5 mg/m <sup>3</sup> Mexico: STEL 4 ppm Mexico: STEL 10 mg/m <sup>3</sup>

**Canada****WHMIS Hazard Class**

Not determined

**16. OTHER INFORMATION**

<b>NFPA</b>	<b>Health Hazards</b> 3	<b>Flammability</b> 0	<b>Instability</b> 0	<b>Physical and Chemical Hazards -</b>
<b>HMIS</b>	<b>Health Hazards</b> 3	<b>Flammability</b> 0	<b>Physical Hazard</b> 0	<b>Personal Protection</b>
				X

<b>Prepared By</b>	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
<b>Issuing Date</b>	19-Jul-2016
<b>Revision Date</b>	07-Apr-2016
<b>Revision Note</b>	No information available

**Disclaimer**

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text



The supplier identified below generated this SDS using the UL SDS template. UL did not test, certify, or approve the substance described in this SDS, and all information in this SDS was provided by the supplier or was reproduced from publically available regulatory data sources. UL makes no representations or warranties regarding the completeness or accuracy of the information in this SDS and disclaims all liability in connection with the use of this information or the substance described in this SDS. The layout, appearance and format of this SDS is © 2014 UL LLC. All rights reserved

**End of Safety Data Sheet**

## Appendix H

---

### Field Data Sheets and Logbook Notes

## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and Avoca

Site Name: T1 Avoca River after confluence w/ R Avonbeg

Date: 5.9.18

Time: 16:30

Flow Meter Used: Marsh McBreeny

Left Bank: 4.10

Right Bank: 15.55

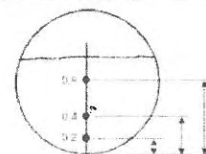
## Notes

Stream Flow Conditions (muddy, clear, debris etc):

Clear water, low flow.  
Algae on rocky boulders right bank.

Weather Conditions (i.e. temperature, wind, precipitation):

Dry, warm, clear.

Figure 1-2 (1, 2, 4, 5) Velocity  
Positions

	Distance from IP (m)	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
1	0	—	10	0						
2	0.35	0.35	14	0.01						
3	0.95	0.70	19	0.05						
4	2.15	1.2	32	0.21						
5	2.55	0.4	25	0.15						
6	3.55	1.0	31	0.12						
7	4.55	"	46	0.29						
8	5.55	"	40	0.45						
9	6.55	"	58	0.50						
10	7.55	"	51	0.44						
11	8.85	1.3	46	0.51				Boulder at 7.0m.		
12	10.25	1.4	37	0.50						

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$



## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and Avoca

	Distance from IP	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
13	11.05	0.8	38	0.37						
14	12.05	1m	11	0.39				3 Boulder - width protruding from surface		1.25m
15	13.25	1.2	12	0.07				width of flowing area 30m		
16										
17								28.5m		RS.
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$

## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and AvocaSite Name: Avoca BridgeDate: 05 Sept 2018Time: 09:00Flow Meter Used: Marsh Mc BirneyLeft Bank: B-9M 4.0mRight Bank: 19.5m

## Notes

Stream Flow Conditions (muddy, clear, debris etc):

Nice glide, very little debris & algae growth; brown sediment on river bed; Very rocky

Weather Conditions (i.e. temperature, wind, precipitation):

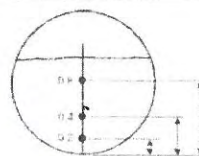
Day, cool, clear sky, still, no rain in previous 24hrs.\*NB\* At all locations, the FPA has varied widely, to do with fluid dynamics \*

Figure 1-2 (2, 3, 5) Velocity Positions

	Distance from IP (m)	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
1	0	✓	5	✓	0					
2	1cm	✓	12	0.13 (1.3)						
3	1	✓	24	0.11				+ mound of boulders ca. 1m upstream of 6m * Substrate comprised of boulders, cobbles. Very little silt + sand.	None is reaching surface of water.	
4	1	✓	32	0.20						
5	1		58	0.10						
6	1		64	0.2				(jumping between 0.2 and 0.3 due to character of flow dynamics)		
7			44	0.19						
8			38 30					Depth taken @ boulder. Even with FPA values are highly variable. ranging (-0.14 to 0.46)		
9			62							
10			62							
11			60							
12			62							

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used (V0.2+V0.8)/2

\*Flow dynamics are too changeable ∴ not possible to measure flow with Marsh Mc Birney.\*

\*2 values for each reading!! 1) FPA: 0.13 @ 5m.  
2) RC



## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and Avoca

	Distance from IP	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
13			72							
14			68							
15			44							
16			56							
17			34							
18			40							
19			23							
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$

## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and AvocaSite Name: T5 Coach Yard for Access

Date:

Time:

Flow Meter Used:

Left Bank: 20m 20cm / 2.2m.Right Bank: 0m.

## Notes

Stream Flow Conditions (muddy, clear, debris etc):

High sediment load!! photos taken. No algal growth. Fluffy brown sedimentation on bed. Mostly small stones + pebbles on bed.

Weather Conditions (i.e. temperature, wind, precipitation):

white foam on surface. Sunny, clear sky, cool, breezy. No precip. in previous 24 hrs

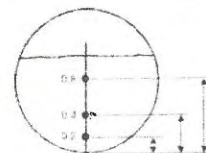


Figure 1-2 (1, 2, 3, 5) Velocity Positions

	Distance from IP	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
20.2m	1	20	4	/	0					
20m	2	20	5	/	0					
19m	3	1m	13	0.03	/					
18m	4	1m	12	0.04	/					
17.5m	5	1.3	14	0.08	/			*Large Rock @ 17m*	17.3m; and	16.5m
16.5m	6	0.8	23	0.06	/					
16m	7	0.5	12	0.12	/					
14.7m	8	1.3	44	0.13	/			*Large boulder breaking water @ 15m*		
14m	9	0.7	44	0.15						
13m	10	1.0	41	0.10						
12m	11	1.0	41	/	/			*Large rock immediately u/s of 12m		
12.3m	12	0.3	42	0.15	/			∴ velocity decreased.		

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$



## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and Avoca

	Distance from IP	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
13	1m		40	0.14						
14	1m		41	0.12						
15	1m		30	0.08						
16	1m		43	0.12						
17	1m		48	0.18						
18	1m		43	0.18						
19	1m		52	0.18						
20	1m		44	0.17						
21	1m		46	0.22						
22	1m		65	0.18						
23	1m		72	0.18						
24	1m		74	0.18						
25										
26										
27										
28										
29										
30										

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$

## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and Avoca

Site Name: 850 Adit AOS LF

Date: 4.09.18

Time: 13.10pm

Flow Meter Used: Marsh Mc Birney

Left Bank: 7.0m 2.05m

Right Bank: 0.80m

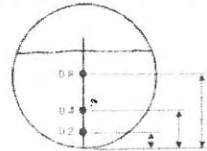
## Notes

Stream Flow Conditions (muddy, clear, debris etc):

Adit orange precipitate on adit bed  
and water

Weather Conditions (i.e. temperature, wind, precipitation):

warm, dry, sunny

Figure 1-2 (2, 3, 5) Velocity  
Positions

	Distance from IP (cm)	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
2.07	0	0	6		0.0					
1.85	20	0.2	6		0.02					
1.65	40	0.2	7.5		0.03					
1.55	50	0.1	8		0.01					
1.45	60	0.1	7.5		0.01					
1.35	70	0.1	8		0.04					
1.25	80	0.1	8		0.07					
1.15	90	0.1	7					0.035		
1.05	100	0.1	7		0.02					
0.85	120	0.20	9	0.3						
0.8	125	0.05	10		0.1					

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$



## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and AvocaSite Name: ROAD Adit ConfluenceDate: 04 Sept 18Time: 10:30Flow Meter Used: Marsh MS BirneyLeft Bank: 50 cm 10.5mRight Bank: 100 cm 1m

## Notes

Stream Flow Conditions (muddy, clear, debris etc):

"Glade" area, undisturbed, not planted, no vegetation  
even-hanging

Weather Conditions (i.e. temperature, wind, precipitation):

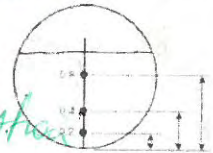
Dry, sunny, breezy, mild.

Figure 1-2 (2, 4, 5) Velocity Positions

	Distance from IP (cm)	Width (m)	Total Depth (cm)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
1	0	-	12	0.16	/					
2	10	0.1	13	0.22	/					
3	20	0.1	12	0.16	/					
4	30	0.1	10	0.12	/					
5	40	0.1	10	0.16	/					
6	50	0.1	8	/	0.11					
7	60	0.1	5	/	0.01					
8										
9	5	-	12	0.24	/					
10	15	/	13	0.17	/					
11										
12										

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$



## Open Channel Flow Profiling Form

CDM  
SmithProject: Environmental Monitoring of Former  
Mining Areas of Silvermines and AvocaSite Name: Deep AditDate: 04-Sept-18Time: 12:10Flow Meter Used: Marsh M<sup>2</sup> Kiney

\*NB: Always use

Left Bank: 60 cmRight Bank: 150 cm

## Notes

Stream Flow Conditions (muddy, clear, debris etc):

Riffle on surface, fast flowing but OK. No area found with glide.

Weather Conditions (i.e. temperature, wind, precipitation):

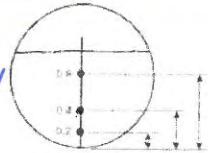


Figure 1-2 (2, 3, 5) Velocity Positions

	Distance from IP (m)	Width (m)	Total Depth (cm) (m)	Velocity (m/s)				Comments	From Bridge	
				V0.6	V0.9	V0.2	V0.8		Depth to water (m)	Depth to bottom (m)
(@ 60cm)	1	0.1	0.03	0.17						
(@ 70cm)	2	0.1	0.05	0.33						
80cm	3	0.1	0.06	0.21	0.23					
90cm	4	0.1	0.05	0.22						
(1m)	5	0.1	0.05	0.26						
1.01m	6	0.1	0.04	0.25						
1.2m	7	0.1	0.06	0.25						
1.3m	8	0.1	0.05	0.13						
1.4m	9	0.1	0.02	0.06						
1.5m	10	0.1	0.005	0.0						
	11									
@ 65cm	12	0.05	0.05	0.24						
@ 75cm	13	0.05	0.06	0.44						

## Notes:

- V0.6: Average velocity for a stream at depths between 0.09 and 0.75 metres. Multiply the total depth by 0.4 and set the sensor at this depth from the bottom (or 0.6 times the total depth from the water surface).
- V0.9: If the depth is less than 0.09m – place the sensor in the water until it's just submerged and multiply the velocity by 0.9.
- Two point (V0.2 and V0.8): For depths over 0.75 metres the two point method is used  $(V0.2 + V0.8)/2$

# LOW FLOW GROUNDWATER SAMPLING SHEET

CDM  
Smith

Project: Environmental Monitoring of Former Mining Areas of Silvermines  
and Avoca

Site Name: MWDA1	Site Code: MWDA1		
Date: 13 Sept 2018	Sample Depth (metres bTOC)	Target: 11m	Actual:
Initial Static Water Level (metres bTOC): 6.285	Purging/Sampling Device:		
Well diameter (mm):	Purge start time: 15:32		
Well depth (metres):	Sample collection time:		
Well Volume:	Sample Number:		
Print Sampler Name: Aes + LF	Samplers Signature: Aes + LF		
Comments: Water initially light sandy brown in colour. An obstruction was encountered @ ca. 11m & tubing is pushed.			

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
0	6.285			12.8	2.86	1608	44.5	4.18	291	0 litres
15:37 - + 5	6.27			13.0	2.84	1642	6.5	0.69	344	1.7 litres
15:42 - + 10	6.29			13.0	2.79	1699	3.0	0.29	386	3.5 litres
15:47 - + 15	6.285			13.4	2.79	1693	2.2	0.23	405	5.0 litres
15:52 - + 20	6.295			13.0	2.79	1695	3.6	0.37	410	6.5 litres
15:58 - + 26	6.29			13.0	2.80	1672	3.0	0.30	410	7.5 litres

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.



# LOW FLOW GROUNDWATER SAMPLING SHEET

CDM  
Smith

Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

Site Name: <u>MWDA 2</u>		Site Code: <u>MWDA 2</u>	
Date: <u>13 Sept 2018</u>		Sample Depth (metres bTOC)	Target: <u>24.9m</u> Actual:
Initial Static Water Level (metres bTOC): <u>6.395m</u>		Purging/Sampling Device:	
Well diameter (mm):		Purge start time: <u>14:54</u>	
Well depth (metres):		Sample collection time: <u>15:27</u>	
Well Volume:		Sample Number:	
Print Sampler Name: <u>ABS + LF</u>		Samplers Signature: <u>ABS + LF</u>	
Comments:			

Time elapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
14:59 - 0				13.0	3.4	1616	22.4	2.28	273	
15:04 - 45	6.38m			11.8	3.75	1637	6.1	0.63	233	3 litres
15:09 - 10	6.45m			11.8	3.72	1635	3.0	0.33	236	5 litres
15:14 - 15	6.445m			12.0	3.74	1638	2.5	0.26	236	6.5 litres
15:19 - 20	6.455m			12.0	3.74	1632	2.4	0.25	239	7.2 litres
	6.46m			12.0	3.73	1625	2.1	0.22	240	8.0 litres

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

# LOW FLOW GROUNDWATER SAMPLING SHEET

CDM  
Smith

Project: Environmental Monitoring of Former Mining Areas of Silvermines  
and Avoca

Site Name:	MWDA 1			Site Code:	MWDA1			
Date:	06.09.18			Sample Depth (metres bTOC)	Target:	11	Actual:	11
Initial Static Water Level (metres bTOC):	6.39			Purging/Sampling Device:	Wasp			
Well diameter (mm):				Purge start time:	13.13			
Well depth (metres):				Sample collection time:	13.45			
Well Volume:				Sample Number:				
Print Sampler Name:				Samplers Signature:	LF & AOS			
Comments:	Was raining MID; Overcast							

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
0				12.3	2.80	1676	41.3	3.87	430	
5	6.40			12.4	2.79	"	5.4	0.58	433	3L
10	6.398			12.6	2.78	1693	3.6	0.36	436	5L
15	6.40			11	2.79	1688	2.4	0.25	436	7.25
32-19	6.40			11	2.79	1691	2.2	0.22	436	7.75 @ 13.13 (logged)
37-24	6.40			12.7	"	1688	1.9	0.20	435	9.75
42-29	6.40			12.9	2.79	1688	2.2	0.24	437	12.25 (12.50)

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

# LOW FLOW GROUNDWATER SAMPLING SHEET

Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

CDM  
Smith

\*logged under MWDA1 before  
3 readings. Then logged under MWDA2.

Site Name: MWDA 2	Site Code: MWDA2		
Date: 06.09.18	Sample Depth (metres bTOC)	Target: 3	Actual: 3
Initial Static Water Level (metres bTOC): 6.495	Purging/Sampling Device: Wasp		
Well diameter (mm):	Purge start time: 12.16		
Well depth (metres):	Sample collection time:		
Well Volume:	Sample Number:		
Print Sampler Name:	Samplers Signature: LF - AOS		
Comments: Raining, wet, overcast, dull.			

length  
of tubing.  
Also check  
previous site  
sheets to confirm  
change  
tubing  
next round.

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
1				11.1	3.75	1637	10.5	1.14	279	
21 5	6.59			12.1	3.78	1638	9.0	0.96	265	1.3 litres
26 10	6.58			11.3	3.78	1640	4.7	0.50	262	4.2 litres
31 15	6.57			11.4	3.77	1632	26.2	1.20	263	1.1 litres (+1) empty
36 20	6.57			11.8	3.73	1618	6.6	0.69	269	+ 3.2 = 12 litres @ 3-2
41 25	6.54			11.6	3.73	1603	2.2	0.24	272	26.0 = 14.80 litres
46 30	6.55			11.8	3.69	1579	2.0	0.21	278	@ 7.2 (11.2 = 16 litres)

logged  
empty  
logged  
under  
MWDA2

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

# LOW FLOW GROUNDWATER SAMPLING SHEET

CDM  
Smith

Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

Site Name: <u>GW2-05</u>		Site Code: <u>GW2-05</u>	
Date: <u>06 Sept 2018</u>	Sample Depth (metres bTOC)	Target:	Actual:
Initial Static Water Level (metres bTOC): <u>5.735m</u>	Purging/Sampling Device:		
Well diameter (mm):	Purge start time: <u>17:15</u>		
Well depth (metres): <u>5.51m / 6.51m</u>	Sample collection time: <u>17:36</u>		
Well Volume:	Sample Number:		
Print Sampler Name: <u>Aos + LF</u>	Samplers Signature: <u>[Signature]</u>		
Comments: <u>dry, overcast, mild.</u> <u>* Turbid, brown, clay-like water. A lot of silt. *</u>			

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
0	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
2	5.74m			12.6	3.66	1427	74.2	7.81	298	3 litres purged.
11	5.735m			12.2	3.53	1420	65.6	6.88	308	6 litres purged.
14	5.735m			12.3	3.53	1422	62.7	6.68	318	7 litres purged.
17	5.735m			12.2	3.52	1420	65.9	7.03	329	8 litres.
19	5.74			12.1	3.52	1420	62.6	6.66	337	9 litres.

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

6.51  
5.73  
0.78 m



**CDM  
Smith**

Site Name: GW1 / 05.	Site Code:		
Date: 07 Sept 2018.	Sample Depth (metres bTOC)	Target: 25.3.	Actual:
Initial Static Water Level (metres bTOC): 5.585m.	Purging/Sampling Device: Bailen		
Well diameter (mm): 50mm	Purge start time: 09:15.		
Well depth (metres):	Sample collection time: 09:55		
Well Volume:	Sample Number:		
Print Sampler Name: AOS + LF	Samplers Signature: [Signature]		
Comments: Bright, dry, sunny, mild / cool.			

[illegible]

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.



# LOW FLOW GROUNDWATER SAMPLING SHEET



Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

Site Name: MWPF I.		Site Code:	
Date: 06.09.2018	Sample Depth (metres bTOC)	Target: 4.7.7.7	Actual: 6
Initial Static Water Level (metres bTOC): 4.83	Purging/Sampling Device: Wave pump		
Well diameter (mm):	Purge start time: 10.42		
Well depth (metres):	Sample collection time: 11.20		
Well Volume:	Sample Number:		
Print Sampler Name: LF - AUS	Samplers Signature:		
Comments: Overcast - spitting rain			

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
0				10.6	4.95	138	35.0	3.76	257	
5	4.835			10.9	4.12	"	29.4	3.24	299	3.5L
10	4.84			11.0	4.29	"	28.1	3.09	296	5.2L
15	4.845			11.3	4.48	"	28.3	3.12	293	6.75 (+ 6.75 Jumper)
20	4.845			10.8	4.43	139	28.8	3.19	301	8.75 (+2L)
25	4.845			10.9	4.50	"	"	3.18	302	10.75 (+2L)
30	"			"	4.55	140	29.1	3.20	303	12.75 (+2L)
35	"			11.0	4.59	"	29.7	3.28	304	14.5L (+2L)

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

# LOW FLOW GROUNDWATER SAMPLING SHEET



Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

Site Name: <b>MW ET 1</b>	Site Code: <b>MWET1</b>		
Date: <b>06.09.18</b>	Sample Depth (metres bTOC)	Target: <b>9.6</b>	Actual: <b>9.6</b>
Initial Static Water Level (metres bTOC): <b>7.63</b>	Purging/Sampling Device: <b>Wasp</b>		
Well diameter (mm):	Purge start time: <b>14.35</b>		
Well depth (metres):	Sample collection time: <b>15.02</b>		
Well Volume:	Sample Number:		
Print Sampler Name: <b>IF. AOD</b>	Samplers Signature: <b>[Signature]</b>		
Comments: <b>Wet, mild evening. Rain this morning</b> <span style="float: right;"><b>Water very turbid bring up ↑ sediment lead start of purging</b></span>			

Time elapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
0				11.0	3.77	2412	13.2	1.22	290	
45 + 10	7.635			11.3	3.30	2475	2.1	0.33	321	0.5 litres
50 + 15	7.64			11.7	3.30	2465	4.1	0.45	321	7 litres
55 + 20	7.64			11.8	3.30	2459	3.6	0.41	319	7.2 litres
60 + 25	7.645			12.1	3.31	2455	3.9	0.43	316	7.8

- Notes:
- Collect readings at 5 to 10 minute intervals.
  - The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
  - Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.

# LOW FLOW GROUNDWATER SAMPLING SHEET

Project: Environmental Monitoring of Former Mining Areas of Silvermines and Avoca

\*NB\* Data logger needs to be removed in order to fit pump in well. *holding*  
*Bring*  
*merch?*

CDM  
Smith

Site Name: MWET2	Site Code: MWET2		
Date: 06 Sept 2018	Sample Depth (metres bTOC)	Target: 19m	Actual: 19
Initial Static Water Level (metres bTOC): 7.545m	Purging/Sampling Device: WASP		
Well diameter (mm):	Purge start time: 15:38		
Well depth (metres):	Sample collection time:		
Well Volume:	Sample Number:		
Print Sampler Name: LOS + LF	Samplers Signature:		
Comments: Cloudy, overcast, mild. Raining this morning.			

Time lapsed (mins)	Water Level (m bTOC)	Drawdown (m)	Flow Rate (ml/min)	Temp. (°C)	pH	Cond. (µs/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	ORP (mV)	Comments
	< 0.1 m			±3 (°C)	±0.1	±3 %		±10 %	±10 %	
0			2500ml/min	11.0	4.40	3029	28.1	2.88	202	logged
15:42-5	7.91			11.2	5.78	3254	8.4	0.98	71.6	2.5L
47-10	7.95			11.4	5.94	3280	3.2	0.33	45.6	5L
52-15	7.97			11.6	6.00	3289	2.4	0.24	35.9	6.5L
57-20	7.96			11.4	6.04	3294	1.8	0.20	30.2	8.5L - jumped
02-25	7.925			11.5	6.05	3295	1.8	0.19	28.1	+ 1.8L = ? 10.3L
07-30	7.94			11.5	6.06	3291	1.6	0.17	24.8	4L = 13.5L

## Notes:

- Collect readings at 5 to 10 minute intervals.
- The well is considered stabilised and ready for sampling when the indicator parameters have stabilised for three consecutive readings.
- Flow rate should not exceed 500 ml/minute during purging or 250 ml/minute during sampling.



Avoca Sampling R2 2018.  
Day 1 4-09-18.

~~0-7~~

9.15: Onsite LFE AOS  
Weather: Dry, sunny, warm.

9.30 YSI calibration.

	Target	Actual.
pH 4	177 $\pm$ 50	143
pH 7	0 $\pm$ 50	-23.5
Sp. cond	4.6-5.4	4.92
ORP	0 $\pm$ 50	26.5
O <sub>2</sub> mg/L	pass/fail	pass: Calibrated.

9.45. Road Adit ✓ Have photo.

X : ~~(20268)~~ <sup>(b)</sup> → 19858. ( $\pm$  4m)  
Y : → 81512

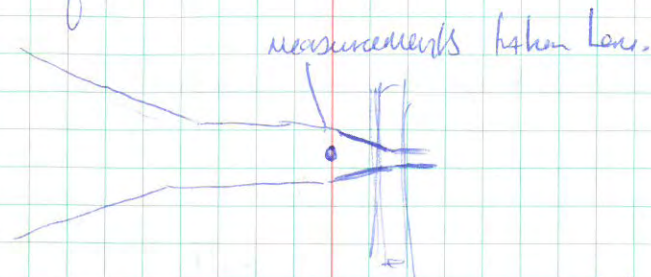
Photo & sample taken.

Depth of water in existing plume:  
21; 22; 23.

YSI parameters:

°C: 12.9 DO%: 34.4 ORP 339.8.  
pH: ~~3.64~~ <sup>105</sup> 3.77 DO mg/L 3.64 SPC: 1268.

(~~Depth~~ of water in existing plume: ✓)



10.30 Road Adit Conf. - photo neg'd.

X: 19942  
Y: 81513

Photo taken  
Sample taken.

YSI parameters

°C	12.8	DO mg/L	9.20
pH	3.79	SPC	1269
DO %	87.3	ORP	353.2

Flow: Marsh McBierny-  
see flow sheet.

No discharge visible w/o of  
flow measurement.



11:30 DEEP ADIT CONF. - photo req'd.  
1420  
X: ~~19850~~ (+/- 4m) X: 19896  
Y: ~~(82123)~~ Y: 81986

Photo taken and sample

YSI parameters:

°C	11.3	DO mg/L	8.34
pH	3.10	SPC	1555
DO%	76.4	ORP	443

Flow: Plume used due to unsuitable conditions for Marsh Mc Bierny

Front Reading: 0.25  
Back Reading: 0.10

Percentage Capture: 95%

11:50 Deep Adit. - photo req'd.

X: 19850  
Y: 82123

photo taken @ ca. 11:20; Sample taken @ 11:30

YSI parameters:  
°C: 11.1  
pH: 3.14  
DO%: 52.3  
DO mg/L: 5.70  
SPC: 1552  
ORP: 428.2  
Flow: Marsh Mc Bierny \* See flow sheet \*

12:45 850 Adit - KMC photo

X: inside 850 adit entrance  
Y: N/S of sump (before flow gauge)

Photo taken and grab sample collected upgradient of sump / flow gauge

YSI parameters:

°C	10.8°C	DO mg/L	10.05
pH	2.89	SPC	1342
DO%	91.1	ORP	514

Flow measured N/S of sump by Marsh Mc Bierny → see flow sheet.

1:55

W/S Tigermey Westphoto  
neg'd.

1 (Runoff from east Avoca trench)

X: 19957 (+/- 5m)

Y: 82175

Photo taken.

No flow.

Red staining observed

2:10pm Conebare Shallow Adit

have photo

X: 20268 (+/- 3m)

Y: 82646

Photo taken and sample collected

V. low flow.

YSI parameters

°C 10.5

pH 2.61

DO% 12.5

DOmg/L 1.35

SPC 4160

ORP 496

ca. 90% capture.

- 1) 12.7 seconds: 1 litre through flume.
- 2) 13.1 seconds: 1 litre " "
- 3) 12.8 second: " " " "

Spigot used due to insufficient flow for flume &

photo  
neg'd.15:20 Conebare Inter Adit

X: 20320 (+/- 3m)

Y: 82749

Photo taken and sample collected

YSI parameters

°C 10.4

pH 3.41

DO% 5.0

DOmg/L 0.55

SPC 1095

ORP 349

Flow measured w/ Flume  
Front (L/s) 1.90 ~95%  
Back (L/s) 0.07 capture.



16.15 BW SRM collected  
Sample ID: AVSR02.11  
Lot no.: P273-7408,  
ERA Trace Metals

16.30 Water Blanks Collected

Sample IDs:

WB01.11 (Filtered)

WB02.11 (Unfiltered)

Deionised water:

Batch no. 804- 6252

Manfact. Date: 10.04.2018.

Offsite @ 17.00.

Samples packed and checked  
against coc.

Samples collected from hotel  
reception on 05.09.18.

105 Sept 2018

Avoca Sampling R2 2018 Day 2.

8.30 on-site AF & AOS.

Weather: Dry, clear, cold

YSI Calibration:

	Expected	Actual.
pH 4	177 $\pm$ 60	141
pH 7	0 $\pm$ 50	-233
3p cond.	46-5.4	Calibrated @ 4.8g
O <sub>2</sub>	pass/fail	Calibrated <input checked="" type="checkbox"/> pass

8.45 Avoca Bridge.

x 20370

y 79928

Sample collected  
Photo taken. (C)

x composite samples collected from  
4 equidistant locations across  
the river.

\* Flow Marsh Mc Bierney - see flow  
sheet.

YSI parameter

°C	11.7	Dong IL	10.59
pH	6.0	SPC	100
DO%	97.9	ORP	151

\* Marsh Mc Bierney attempted  
but velocities highly variable  
(-0.22  $\rightarrow$  +0.58) using fixed  
point method, due to fluid  
dynamics  $\therefore$  float method used.



# Float method details

Total river width (measured w/ tape across river) = 15.5m.

River depth (measured by wading)

Left bank

1m

2

3

4

5

6

7

8

9

10

11

12

13

14

15

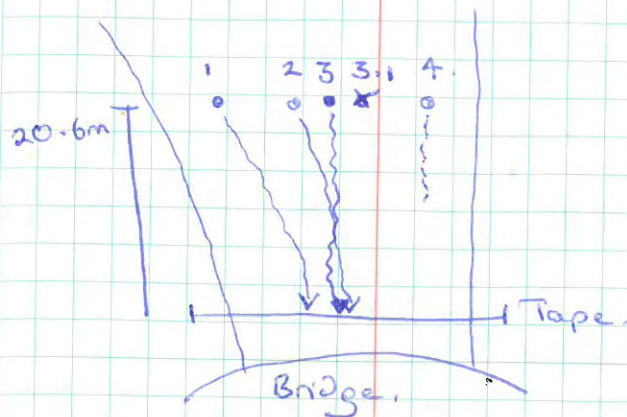
15.5 (right bank)

Orange 1. <sup>1st</sup> seeds

Time: 2:24.14

Crossed tape @ 7.20

Stream



Orange 2 <sup>seeds</sup>

Time: 1:56.72 minutes

Crossed tape @ 10.5m

Orange 3

Time: 1mi 57.91 seconds

Crossed @ 10.20m

Orange 3.1

Time: 1mi 47.89 sec.

Crossed @ 10.7m

Orange 4

Time: 2mi 15.87 seconds

Crossed tape @ 15.6m

2  
10:45: T5.

YSI parameters.

°C : 12.5

pH : 5.86

DO % : 101.4

DO mg/L : 10.85

SpC : 113.9

ORP : 179

X : 19970 (+/- 4m)

Y : 81110

Sample collected + photo taken (✓)

Flow measured using  
Marsh McBerny → see flow sheet

3  
11:45 Wicklow co. w. yard

Samples collected + photo taken.

Flow → not taken here.

to be received from WCC

Main Vard Gauging Station

X : 19942

Y : 81440

\*Composite samples collected from  
4 equidistant points across  
the river \*

\*NB 3: Composite samples collected  
from 4 equidistant points across  
the river

YSI parameters.

°C : 12.8

pH : 5.65

DO : 106

DO mg/L : 11.2

SpC : 127

ORP : 196

4  
12:00 upstream of Road Ait

X : 19939 (+/- 3m)

Y : 81532

Sample taken (composite  
4 equidistant points across river)

Photo taken.

YSI parameters:

°C : 13.0

pH : 5.81

DO % : 107.2

DO mg/L : 11.29

SpC : 91.6

ORP : 202.

Flow from Wicklow w. w.  
gauge station.

Duplicate collected:

AVSD01.11



1<sup>5</sup> 12:40: U.S. Ballygahan Adit

X: 19936

Y: 81633

- photo taken + sample collected.
- No flow measurement required.
- Sample not composite due to strong current and water depth. Grab sample taken from flowing water body.

YSI parameters:

°C : 13.5

pH : 5.93

DO% : 107

DO mg/L : 11.1

SPC : 86.3

ORP : 203

1<sup>6</sup> 14:00 D/S Millrace

X: 20013

Y: 81790

Photo taken and composite grab sample collected

YSI parameters

°C : 14.1

pH : 6.20

DO% : 105

DO mg/L : 10.59

SPC : 81.7

ORP : 193

Flow not required

1<sup>7</sup> 14:20 D/S Deep Adit

X: 319951

Y: 181,922

- photo taken + <sup>→ composite</sup> sample collected

- No flow measurement required

YSI parameters

°C : 14.4

pH : 6.17

DO% : 108.7

DO mg/L : 11.09

SPC : 80.4

ORP : 188

15.15 Whites Bridge Gauging station

X 19842 ( $\pm 3m$ )

Y 82018

Photo taken and grab sample  
Composite from 4 equidistant  
points across the river channel  
taken.

YSI parameters

$^{\circ}C$  14.3

$DO mg/L$  10.69

pH 6.21

DPC 84.0

$O_2\%$  104

ORP 213

(logged under "Whites Bridge")

EPA stopp gauge @ 2.95 (see photo)  
y 29.5cm.

\*IB\* 4 number (2) of seeps  
I'd on the way to Whites  
Bridge GS.

→ Photo + GPS coordinates taken:

X: 19873 ( $\pm 5m$ ) : Seep 1  
Y: 82002

750 - 1000 ml/sec flow estimation  
(usual)

X: 19878 ( $\pm 5m$ ) Seep 2  
Y: 82001

250 - 500 ml/sec flow estimation  
(usual)

flowing over a wider  
area.

15.45 Whites bridge

X 19773 ( $\pm 3m$ )

Y 82066

Photo taken + composite sample  
collected @ 4 equidistant points  
across river, wading

YSI parameters

$^{\circ}C$  15

$DO mg/L$  10.8

pH 6.44

SPC 74.1

$DO\%$  106

ORP 211



10.00 Upstream of Whites Bridge

X: 19584 (+/- 4m)

Y: 82389

Composite sample & photo taken.

YSI parameters:

°C 13.8

DO % 94.9

pH 6.69

" mg/L 9.84

SPC 68.6

ORP 204.

Vale view 2nd dy - no flow

16.30 I1 Avoca River.

X: 19580 (+/- 4m)

Y: 82396

YSI parameters:

°C 14.9

DO mg/L: 10.63

pH 6.97

SPC: 77.6

DO % 105

ORP 192

Photo taken & composite sample collected.

Duplicate sw sample collected  
ID: AVSD 02.11

Flow measured w/ flow meter  
(Marsh McBirney) → see flow sheet

17.30 Surface water decan blank sample collected

Sample ID: AVDB 02.11

Decan sample collected from sampling DI water from the decontaminated surface water sampling cup

DI water: Lennox

Batch No.: 804-6252

Date of manufacture: 10-04-18.

18.00: offsite

Samples packed and checked against coc

Avoca Day 3 6.9.18

1 Samples left hotel reception.

9.30 Onsite LF, ABS

Weather: Overcast, drizzle

9.45 USI calibration

	Target	Actual	
pH 4	177 $\pm$ 50	142	✓
pH 7	0 $\pm$ 50	-25.1	✓
APC	4.6 - 5.4	4.93	✓
ORP	0 $\pm$ 50	24.5	✓
O <sub>2</sub>	press/fail Calibrated	Calibrated.	✓

10.00 HWPF 1

DTW: 4.829

Instantaneous values:

4.83m

10.3 °C

4.8V

Data downloaded.

Purge start time: 10.42

Spl. collection time:

Warning:

Difference Date / time

OTT orpheus Mini (10.08.2018

16.01.30) < > PC (06.09.2018

10:26:30)

Batteries dead in logger and  
were replaced before possible to  
connect

11.00 SW standard ref material  
sample collected

Sample ID: AUSR 01.11

Lot no. 7273-7403

ERA trace metals

11.45 MWD 12

DTW: 6.495m

Instantaneous values:

m 6.521

°C 11.2

V 4.3

(value updated)

calibrated by

above)

Warning

\* Difference time / date:

OTT 06.09.2018 10.32.26

PC 06.09.2018 11.51.14

Tried to update time; will  
check tomorrow if worked.



Batteries @ 4.3V

Batteries charged.

Data Downloaded

Purge start time: 12:16

Sample collection time:

### 13:00 MWDA 1.

DTW: 6.39m

Instantaneous values:

6.408m (up DTW w/ above)

12.0 °C

4.3V

OTT software time warning:

OTT: 11:12 AM, PC: 12:26 PM

Attempted to correct time → will check tomorrow if correct.

Purge start time: 13:16

Sample collection time:

### 14:10 MWET 1

DTW: ~~6.535m~~ 7.63m.

Purge start time: 14:35

Sample collected @: 15:02.

### 15:30 MWET 2

DTW: 7.535

Purge start time: 15:38

Sample collection time:

GW Down blank collected @ 16:30  
→ 20 L of potable water pumped through waste pump, followed by 20 L of DI water  
↳ Sample collected directly from pump, not filtered

Sample I.D.: AVDB01.11

DI water: kemox

Batch no. 804-6252

Manufactured: 10.04.2018

### 17:30 MWET 1 Datalogger Download

DIF time / date warning

OTT 6/9/18 16:16:39 PC 6/9/18

17:36

→ corrected



Duplicate sample taken

ID: SMSDO3.11

\* Animal Access and Batching on  
left bank \*

11.15 Offsite:

15.00 Final surface water

Decon blank collected

ID: SMABO2.11

↳ Collected by sampling DI water  
from the decontaminated sampling  
cup

DI water: Lenox

Batch no: 804-6252

Date of manufacture 10.04.18.

14.40 Avoca wells MWDA1 and  
MWDA2 resampled as label  
on 1<sup>st</sup> sample set incorrect.

Data downloaded from both  
wells before sampling.

14.45 MWDA2 (rhe as facing)  
DTW: 6.395m.

Purge start time: 14.54

Sample collection time: 15.27

15.00 MWDA1 (rhe as facing)  
DTW: 6.285m

Purge start time: 15.32.

Sample collection:

### Instantaneous Data

7.65m

10.4 °C

4.3 V

Data downloaded (from 1/3/18)  
and batteries changed.

17.45 HWET2 Data Download  
Batteries dead Batteries replaced  
to allow data download.

### Instantaneous values.

7.568 m

10.3 °C

4.8 V (new batteries)

Time Date Warning

OTT 5.9.18 14.01 PC 6.9.18 17.54

Data downloaded from 1.3.18  
and batteries changed.

17.15 GW2-05

DTW: 5.735m

TD: 6.51m

Sampled w/ bailer.

Purge start time: 17.15

Sample collection time: 17.36

Samples packed and  
checked against COC

18.35 Offsite



Avoca Day 4 07.09.18

8.45 onsite LF, AOS

Weather: Clear, mild, dry

9.00 YSI Cal.

	Expected values	Actual
pH 7	0 +/- 50	-23.3
pH 4	177 +/- 50	143
sp. cond	4.6-5.4	4.91
O <sub>2</sub>	Pass	pass/calibrated

9.15 GW1 - O5

DTW: 5.585

TD: 27.275

Purge start time: 9.15

Sample collection time: 9.55.

Sampled w/ boiler.

Groundwater duplicate sample collected

Sample ID: AVG001.11.

11.00 am SG104.

Well dry @ 25.7m.

Samples packed and checked against COC.

Oppsite @ 11.30 and samples dropped to AHS / Aramex in Belly boughol w. Dustin

