

Appendix A.10.4

Groundwater Quality Monitoring Report

A.10.4 Groundwater Quality Monitoring Report

Galway County Council
N6 Galway City Ring Road
Groundwater Quality Monitoring
Report

GCOB-04.04.03_30.9.10_A.10.4

Issue 3 | 28 March 2025

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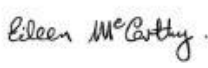
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1 Introduction

Arup was commissioned by Galway County Council to carry out groundwater quality sampling to investigate groundwater movement throughout the study area for the N6 Galway City Ring Road.

The aim of this work was to collect monthly groundwater quality data across the study area to identify groundwater flow paths and provide an indication of naturally occurring background concentrations for various groundwater quality parameters. The water quality results will also be used to determine the impact of the proposed N6 Galway City Ring Road on groundwater quality and thereby affect groundwater dependent ecosystems.

Arup carried out groundwater quality monitoring between February 2016 and April 2017 in boreholes and surface water locations within the study area for the N6 Galway City Ring Road. Another round of groundwater quality monitoring was completed between January 2024 and July 2024 to inform the hydrogeology assessment as part of the response to the request by ABP for further information in December 2023 where they requested Galway County Council to “*Update the Environmental Impact Assessment Report*” (EIAR) submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended).

This appendix presents the 2016-2017 data that was originally presented in the 2018 EIAR and also includes the new 2024 data.

This report comprises a factual report presenting the results of the monitoring. Although an extensive suite of analysis was carried out on the samples, the focus of this report is on the flow pathways and the identification of different groundwater types according to groundwater bodies.

2 Groundwater Monitoring Methodology

Between February 2016 to April 2017 Groundwater was sampled from 18 locations (16 monitoring wells, one supply well (GRC1/GRC2) and one spring (SW 2-4)) and surface water was sampled from three locations (one turlough (K31), and two surface water bodies (SW2-5 and Ballinafoyle lough)).

Between January 2024 to July 2024 groundwater quality samples were collected from 18 locations (15 monitoring wells, one supply well (GRC1/GRC2), one test well (TW101) and one spring (SW 2-4)) and surface water was sampled from three locations (one turlough (K31), and two surface water bodies (SW2-5 and Ballinafoyle lough)).

As noted in Appendix A.10.1B well number BH3/06, was excluded from the 2024 groundwater sampling program as the well condition had deteriorated and the water level was too low.

Field monitoring comprised of:

- Groundwater level
- Borehole depth
- Temperature
- pH
- Electrical conductivity

Analysis included:

- Physio-chemical parameters i.e. Total dissolved solids (TDS), Suspended Solids, Chemical Oxygen Demand, Biochemical oxygen demand (BOD), Electrical conductivity (EC) in the field and in the lab, pH in the field and in the lab, Field and lab temperature, Alkalinity, E. coli and Total Coliforms
- Major groundwater ions i.e. Nitrate, Phosphorus, Sulphate, Calcium, Magnesium, Potassium, Sodium, Ammonia, Chloride, Iron and Manganese
- A suite of metals i.e. Cadmium, Copper, Arsenic, Barium, Chromium, Chromium hexavalent in water, Nickel, Zinc, Lead, Mercury, Antimony, Molybdenum and Selenium and
- Total Petroleum Hydrocarbons (TPH) i.e. PRO Water, MTBE, BTEX, Extractable Hydrocarbons Water and Mineral Oil

Groundwater quality results are appended to this report.

2.1 Sampling Locations

The locations of sampling points are presented in **Figure 1** and summarised in **Table 1**.

Table 1: Groundwater and surface water sampling record

		2016										2017		2024			
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Dec	Feb	Apr	Jan	Feb	Mar	Jul
Groundwater	LQMW4	x								x	x				x		
	LQMW6	x	x	x	x	x	x	x	x						x		
	RP-2-01	x	x	x	x	x	x	x	x							x	
	RP-2-03	x	x	x	x	x	x	x	x							x	
	RP-2-05D	x	x	x	x	x	x	x	x							x	
	RP-2-05S	x	x	x	x	x	x	x	x							x	
	RC133	x	x	x	x	x	x	x	x	x	x				x		
	MW03	x	x	x	x	x	x	x	x						x		
	GRC1/GRC2 (supply well)									x	x			x			
	TW101 (trial well)																x
	BH3-48					x	x	x	x					x			x
	BH3-06							x	x								
	BH3-17							x	x					x			
	BH3-18									x	x			x			
	BH3-38									x	x			x			x
	BH3-41									x	x			x			
	BH3-42									x	x			x			x
	BH3-04									x	x			x			
Surface water	SW-2-4 (spring)	x	x	x	x										x		
	SW-2-5 (pond)	x	x	x	x	x								x			
	K31 (turlough)											x			x		
	Ballinafoyle Lough												x		x		

2.2 Borehole Sampling

Borehole sampling was carried out according to BS 6068-6.11:2009. Prior to sampling the groundwater level was measured using a manual dip meter (refer to Appendix A.10.3 of this updated EIAR for all groundwater level monitoring data). A submersible pump was lowered into the borehole, approximately 1m from the bottom. Groundwater level was measured again after the pump was inserted.

The pump flow was controlled using a flow meter. The dip meter was used to measure the water level in the borehole to ensure it did not drop below the pump during pumping.

A water quality Hanna probe was used to measure pH, Temperature and EC of extracted water. Measurements were recorded every five minutes. A sample was taken when three continuous measurements had the same value.

Samples from all locations were collected in plastic bottles provided by Complete Laboratory Solutions (CLS). The sampling method ensured there were little or no air bubbles in the sample before capping to minimise degradation of the sample.

3 Results and discussion

The water quality results are presented in **Annex A** to this updated Appendix A.10.4. A summary of the average groundwater and surface water quality results for selected field parameters and major ions are presented in Table 2. The samples are grouped according to groundwater body (GWB) and surface water or borehole sources.

The water quality results show a distinct signature difference between the granite and limestone groundwaters. Limestone and granite typically have significantly different signatures as the bedrock mineralogy influences the water chemistry. Limestone contains calcareous type water and contains higher concentrations of calcium and the alkalinity. The granite groundwater is non-calcareous (siliceous) type groundwater and contains typically lower calcium and alkalinity concentrations. These trends are observed in the study results as presented in **Figure 2** and Table 2 which show that the alkalinity and calcium, and consequently the EC, are notably higher in the limestone boreholes compared to the granite boreholes.

Within the limestone there is also evidence of different groundwater signatures. Lough Corrib Fen 1 (Menlough) has a distinctly lower EC, alkalinity and calcium compared to the other limestone GWBs. This is likely a reflection of the karst flow regime in the bedrock where faster travel times reduce the contact time that the water has with the limestone bedrock.

Similarly, the surface water bodies have a lower EC, alkalinity and calcium compared to the borehole samples. This is likely to be a reflection of the contribution from direct recharge and overland flow which contain lower ion content.

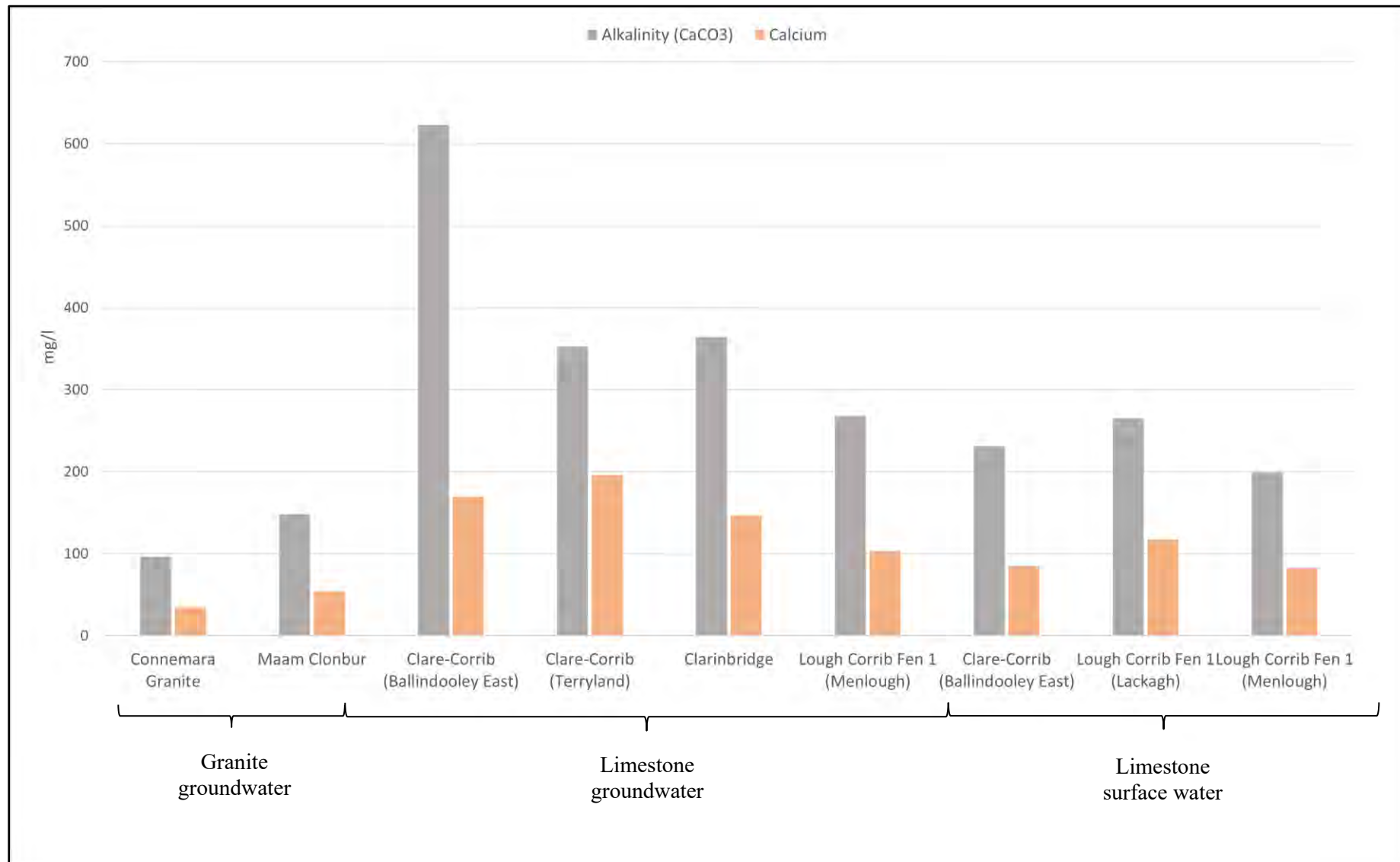
Figure 2: Average alkalinity and calcium concentrations in the granite and limestone groundwater and limestone surface water bodies

Table 2: Summary of average groundwater and surface water quality results

Geology			Granite		Limestone				Limestone		
Groundwater body			Connemara Granite	Maam Clonbur	Clare-Corrib (Ballindoooley East)	Clare-Corrib (Terryland)	Clarínbridge	Lough Corrib Fen 1 (Menlough)	Clare-Corrib (Ballindoooley East)	Lough Corrib Fen 1 (Lackagh)	Lough Corrib Fen 1 (Menlough)
Source of water			Ground water	Ground water	Ground water	Ground water	Ground water	Ground water	Surface water	Surface water	Surface water
Number of samples			6	5	18	31	+	20	2	6	7
EC*	EC (Field)	average	0.32	0.37	0.72	0.93	0.69	0.57	0.51	0.70	n/a
pH*	pH (Field)	average	7.11	6.92	7.76	7.20	7.49	7.71	7.30	7.32	n/a
Alkalinity	Alkalinity	average	96.50	148.68	623.17	352.74	364.26	268.05	231.00	265.33	198.86
Sulphate	Sulphate	average	10.51	16.77	29.50	105.08	21.98	14.73	11.20	50.08	18.74
Calcium	Calcium	average	35.00	54.00	169.74	196.08	147.00	103.55	85.50	117.50	82.97
Sodium	Sodium	average	14.83	18.00	26.36	55.19	24.50	14.98	20.50	15.13	13.80
Chloride	Chloride	average	22.63	29.38	32.23	50.68	33.68	23.57	35.20	25.07	24.40

*measured in the field

4 Conclusions

Arup carried out groundwater quality monitoring between February 2016 and April 2017 in boreholes and surface water locations within the study area for the N6 Galway City Ring Road. Another round of groundwater quality monitoring was completed between January 2024 and July 2024. Monitoring included field parameters and laboratory analysis for several parameters including physical parameters, inorganics, metals and hydrocarbons.

The results showed a distinct signature difference between the granite and limestone groundwaters and between the limestone groundwater and surface water bodies. The limestone groundwater contains notably higher calcium, alkalinity and EC concentrations compared to the granite groundwater and limestone surface water bodies. Furthermore, within the limestone Lough Corrib Fen 1 (Menlough) has a distinctly different groundwater signature compared to the other limestone groundwater bodies suggesting that a karst flow regime is likely in that GWB.

Annex A – Water quality results summary

Table A1: Granite Groundwater

		Groundwater body	Connemara Granite			Maam-Clonbur		
		Number of samples	6			5		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
TDS (gravimetric)	mg/l	n/a	655	58	234	311	151	224
Suspended Solids	mg/l	2	524	90	244	51	7	29
COD	mg/l	10	39	13	25	77	24	42
BOD	mg/l	1	4	4	4	0	0	0
EC (Field)	µS/cm	0.01	0.36	0.29	0.32	0.52	0.21	0.37
pH (Field)	pH Units	0.0	7.83	6.42	7	7.54	6.21	7
pH (Lab)	pH Units	0.0	7.2	5.6	7	6.8	6.4	7
Temperature (Field)	°C	n/a	15.3	10.2	12	17.8	8.3	13
Temperature (Lab)	°C	n/a	18.0	16.2	17	18.0	16.1	17
Alkalinity	mg/l CaCO ₃	10	160	22.2	97	201	78.7	149
E coli (Filtration) (Environmental Waters)	cfu/100ml	0	80	0	34	28	1	10
Coliforms (Filtration) (Environmental Waters)	cfu/100ml	0	280	0	67	40	1	16
Nitrate as NO ₃	mg/l	0.44	30.6	2.75	9	1.24	0.44	1
Phosphorus as PO ₄ -P	mg/l	0.01	0.047	0.014	0	0.025	0.013	0
Sulphate	mg/l	5.00	17.4	5.71	11	40.7	7.25	17

		Groundwater body	Connemara Granite			Maam-Clonbur		
		Number of samples	6			5		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Calcium	mg/l	0.69	54	7	35	71	32	54
Magnesium	mg/l	0.14	5	2	3	4	2	3
Potassium	mg/l	0.09	8	1	3	2	1	2
Sodium	mg/l	0.29	17	11	15	22	12	18
Ammonia as NH ₃ -N	mg/l	0.01	0.188	0.009	0	0.188	0.029	0
Chloride	mg/l	22.40	29	16.4	23	36.1	16.4	29
Iron	ug/l	10	3308	95	1885	2990	831	1693
Manganese	ug/l	5	822	129	523	738	264	444
PRO Water	ug/l	10	0	0	0	0	0	0
MTBE	ug/l	10	0	0	0	0	0	0
BTEX	ug/l	10	0	0	0	0	0	0
Extractable Hydrocarbons Water	ug/l	10	0	0	0	0	0	0
Mineral Oil		10	59	43	51	340.6	44	192
Cadmium	ug/l	0.09	1	1	1	0	0	0
Copper	ug/l	1.00	22	2	13	14	14	14
Arsenic	ug/l	0.50	3	1	2	1	0.8	1
Barium	ug/l	0.78	228	24	90	592	51	369
Chromium	ug/l	0.50	10	1	5	3	1	2
Chromium hexavalent in water	mg/l	0.00	0	0	0	0.005	0.005	0

		Groundwater body	Connemara Granite			Maam-Clonbur		
		Number of samples	6			5		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Nickel	ug/l	3.00	10	3	6	2	1	2
Zinc	ug/l	5.00	28	22	25	7	7	7
Lead	ug/l	0.12	29	29	29	8	4	6
Mercury	ug/l	0.04	0	0	0	0	0	0
Antimony as Sb	ug/l	1.20	0	0	0	0	0	0
Molybdenum	ug/l	3.00	3	3	3	1	1	1
Selenium	ug/l	0.80	1	0.8	1	1	0.6	1

Table A2: Limestone Groundwater

		Groundwater body	Clare-Corrib (Ballindooley East)			Clare-Corrib (Terryland)		
		Number of samples	18			31		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
TDS (gravimetric)	mg/l	n/a	453	109	334	968	32	457
Suspended Solids	mg/l	2	12963	8	876	2231	3	279
COD	mg/l	10	230	13	67	68	10	28
BOD	mg/l	1	9	3	6	3	3	3
EC (Field)	µS/cm	0.01	0.88	0.54	0.72	1.8	0.24	0.93
pH (Field)	pH Units	0.0	8.08	7.47	8	8.3	6.86	8
pH (Lab)	pH Units	0.0	7.7	6.9	7	8.1	6.8	7
Temperature (Field)	°C	n/a	18.8	4.9	12	16	9.6	12
Temperature (Lab)	°C	n/a	19.7	6.3	16	19.9	6.1	16
Alkalinity	mg/l CaCO ₃	10	5220	217	623	1000	45	353
E coli (Filtration) (Environmental Waters)	cfu/100ml	0	250	0	46	840	0	71
Coliforms (Filtration) (Environmental Waters)	cfu/100ml	0	250	0	46	840	0	69
Nitrate as NO ₃	mg/l	0.44	17.1	2.93	10	10.6	0	5
Phosphorus as PO ₄ -P	mg/l	0.01	0.019	0.012	0	0.091	0.011	0
Sulphate	mg/l	5.00	48.6	5.13	30	299	11	105
Calcium	mg/l	0.69	897	89	170	1196	40	196
Magnesium	mg/l	0.14	18.2	5	8	27.6	2	10
Potassium	mg/l	0.09	5	2	3	7	0.6	2

		Groundwater body	Clare-Corrib (Ballindooley East)			Clare-Corrib (Terryland)		
		Number of samples	18			31		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Sodium	mg/l	0.29	61	11	26	198	6	55
Ammonia as NH ₃ -N	mg/l	0.01	0.304	0.006	0	6.44	0.008	1
Chloride	mg/l	22.40	47.8	17.5	32	212	9.08	51
Iron	ug/l	10	2566	21	630	38043	5	3176
Manganese	ug/l	5	78	5	28	2298	3.07	455
PRO Water	ug/l	10	42	42	42	0	0	0
MTBE	ug/l	10	0	0	0	0	0	0
BTEX	ug/l	10	0	0	0	0	0	0
Extractable Hydrocarbons Water	ug/l	10	0	0	0	0	0	0
Mineral Oil		10	128	61	85	123	68	94
Cadmium	ug/l	0.09	0	0	0	4	0.7	2
Copper	ug/l	1.00	3	1	2	16	2	7
Arsenic	ug/l	0.50	0.5	0.5	1	4	0.8	2
Barium	ug/l	0.78	41	8	24	388	7	78
Chromium	ug/l	0.50	1	0.6	1	19	2	8
Chromium hexavalent in water	mg/l	0.00	0.013	0.009	0	0.006	0.003	0
Nickel	ug/l	3.00	4	2	3	35	1	7
Zinc	ug/l	5.00	22	12	17	122	24	73
Lead	ug/l	0.12	7	0.948	4	233	0.173	34

		Groundwater body	Clare-Corrib (Ballindooley East)			Clare-Corrib (Terryland)		
		Number of samples	18			31		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Mercury	ug/l	0.04	0	0	0	0	0	0
Antimony as Sb	ug/l	1.20	0.5	0.5	1	2	0.6	1
Molybdenum	ug/l	3.00	3	0.6	2	17.1	1	4
Selenium	ug/l	0.80	3.06	1	2	6.19	1	3

Table A3: Limestone Groundwater

		Groundwater Body	Clarinbridge			Lough Corrib Fen 1 (Menlough)		
		Number of samples	20			20		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
TDS (gravimetric)	mg/l	n/a	493	98	310	708	108	320
Suspended Solids	mg/l	2	2417	3	417	42	2	12
COD	mg/l	10	104	10	44	14	10	13
BOD	mg/l	1	10	2	4	0	0	0
EC (Field)	µS/cm	0.01	0.95	0.42	0.69	0.81	0.41	0.57
pH (Field)	pH Units	0.0	8.1	6.79	7	8.15	7.12	8
pH (Lab)	pH Units	0.0	8.1	6.9	7	7.5	6.7	7
Temperature (Field)	°C	n/a	13.9	7.7	12	13.6	8.5	11
Temperature (Lab)	°C	n/a	19.9	3.2	15	19.8	15.3	17
Alkalinity	mg/l CaCO ₃	10	818	221	364	395	130	268
E coli (Filtration) (Environmental Waters)	cfu/100ml	0	4560	0	294	89	0	32
Coliforms (Filtration) (Environmental Waters)	cfu/100ml	0	5700	0	378	89	0	32
Nitrate as NO ₃	mg/l	0.44	39.9	0.381	6	31.6	0.484	7
Phosphorus as PO ₄ -P	mg/l	0.01	0.201	0.012	0	0.1	0.011	0
Sulphate	mg/l	5.00	42.2	6.31	22	29.8	5.29	15
Calcium	mg/l	0.69	484	82	147	152	68.3	104
Magnesium	mg/l	0.14	23	2	7	6	2.1	4
Potassium	mg/l	0.09	23	1	6	2.22	0.9	2

		Groundwater Body	Clarinbridge			Lough Corrib Fen 1 (Menlough)		
		Number of samples	20			20		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Sodium	mg/l	0.29	70	9	25	18.3	11	15
Ammonia as NH ₃ -N	mg/l	0.01	0.98	0.008	0	0.025	0.006	0
Chloride	mg/l	22.40	94.1	14.4	34	29.5	15.3	24
Iron	ug/l	10	18361	12	2300	472	11	114
Manganese	ug/l	5	766	7	168	1002	2.77	192
PRO Water	ug/l	10	0	0	0	0	0	0
MTBE	ug/l	10	0	0	0	0	0	0
BTEX	ug/l	10	0	0	0	0	0	0
Extractable Hydrocarbons Water	ug/l	10	0	0	0	0	0	0
Mineral Oil		10	2207	9	427	30	27	29
Cadmium	ug/l	0.09	2	1	2	0	0	0
Copper	ug/l	1.00	21	1	8	2	1	2
Arsenic	ug/l	0.50	3	0.6	1	0.7	0.7	1
Barium	ug/l	0.78	110	12	43	17	5	10
Chromium	ug/l	0.50	14	0.5	6	3	0.5	2
Chromium hexavalent in water	mg/l	0.00	0.007	0.007	0	0.008	0.008	0
Nickel	ug/l	3.00	44	0.6	10	3	0.5	1
Zinc	ug/l	5.00	79	26	53	0	0	0
Lead	ug/l	0.12	21	4	11	3	0.26	2

		Groundwater Body	Clarinbridge			Lough Corrib Fen 1 (Menlough)		
		Number of samples	20			20		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average
Mercury	ug/l	0.04	0.2	0.2	0	0	0	0
Antimony as Sb	ug/l	1.20	1	0.6	1	0	0	0
Molybdenum	ug/l	3.00	5	0.6	2	1	1	1
Selenium	ug/l	0.80	4	1	2	3.19	1	2

Table A4: Limestone Surface Water

		Groundwater Body	Clare-Corrib (Ballindooley East)			Lough Corrib Fen 1 (Lackagh)			Lough Corrib Fen 1 (Menlough)		
		Number of samples	2			6			7		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average	Max	Min	Average
TDS (gravimetric)	mg/l	n/a	274	228	251	500	126	283	290	66	202
Suspended Solids	mg/l	2	12	2	7	38	2	12	7	7	7
COD	mg/l	10	39	16	28	32	23	28	10	10	10
BOD	mg/l	1	3	3	3	6	6	6	1	1	1
EC (Field)	µS/cm	0.01	0.51	0.51	0.51	0.698	0.698	0.70	0	0	0
pH (Field)	pH Units	0.0	7.63	6.96	7	7.32	7.32	7	0	0	0
pH (Lab)	pH Units	0.0	7.8	7.5	8	7.4	7	7	7.9	7.2	7
Temperature (Field)	°C	n/a	12.1	9.7	11	0	0	0	0	0	0
Temperature (Lab)	°C	n/a	18	16.4	17	19.6	15.3	17	17.9	16.1	17
Alkalinity	mg/l CaCO ₃	10	239	223	231	289	225	265	235	176	199
E coli (Filtration) (Environmental Waters)	cfu/100ml	0	2	0	1	98	0	61	68	28	49
Coliforms (Filtration) (Environmental Waters)	cfu/100ml	0	2	0	1	98	45	75	68	28	49
Nitrate as NO ₃	mg/l	0.44	0	0	0	4.43	0.713	3	8.22	3.37	6

		Groundwater Body	Clare-Corrib (Ballindooley East)			Lough Corrib Fen 1 (Lackagh)			Lough Corrib Fen 1 (Menlough)		
		Number of samples	2			6			7		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average	Max	Min	Average
Phosphorus as PO4-P	mg/l	0.01	0.034	0.034	0	0.031	0.012	0	0.057	0.02	0
Sulphate	mg/l	5.00	11.2	11.2	11	54.8	46.8	50	21.9	15.5	19
Calcium	mg/l	0.69	88	83	86	133	108	118	95.5	75	83
Magnesium	mg/l	0.14	3	3	3	4	3.3	4	3.32	2.7	3
Potassium	mg/l	0.09	2	2	2	2.07	1.51	2	2.99	2	2
Sodium	mg/l	0.29	29	12	21	16.7	14	15	16.3	10	14
Ammonia as NH3-N	mg/l	0.01	0.065	0.014	0	0.079	0.018	0	0.037	0.005	0
Chloride	mg/l	22.40	51.1	19.3	35	31.2	21.4	25	30.1	21	24
Iron	ug/l	10	100	53	77	434	45	186	88	34	61
Manganese	ug/l	5	9	9	9	9	3.56	6	1.7	1.7	2
PRO Water	ug/l	10	0	0	0	0	0	0	0	0	0
MTBE	ug/l	10	0	0	0	0	0	0	0	0	0
BTEX	ug/l	10	0	0	0	0	0	0	0	0	0
Extractable Hydrocarbons Water	ug/l	10	160	160	160	0	0	0	144	144	144
Mineral Oil		10	88	88	88	67	67	67	96.9	40	61
Cadmium	ug/l	0.09	0	0	0	0.097	0.097	0	0.023	0.023	0

		Groundwater Body	Clare-Corrib (Ballindooley East)			Lough Corrib Fen 1 (Lackagh)			Lough Corrib Fen 1 (Menlough)		
		Number of samples	2			6			7		
Parameter	Units	Detection limit	Max	Min	Average	Max	Min	Average	Max	Min	Average
Copper	ug/l	1.00	0	0	0	3	3	3	6	1	3
Arsenic	ug/l	0.50	0	0	0	0	0	0	0	0	0
Barium	ug/l	0.78	16	7	12	9	6	8	129	6	31
Chromium	ug/l	0.50	0	0	0	0.9	0.8	1	1	1	1
Chromium hexavalent in water	mg/l	0.00	0	0	0	0	0	0	0	0	0
Nickel	ug/l	3.00	0	0	0	2	1	2	1	1	1
Zinc	ug/l	5.00	0	0	0	0	0	0	0	0	0
Lead	ug/l	0.12	0	0	0	0	0	0	5	5	5
Mercury	ug/l	0.04	0.03	0.03	0	0	0	0	0	0	0
Antimony as Sb	ug/l	1.20	0	0	0	0	0	0	0	0	0
Molybdenum	ug/l	3.00	0.5	0.5	1	1	1	1	1	0.6	1
Selenium	ug/l	0.80	0	0	0	2.81	1.45	2.13	2.58	0.87	1.45

Annex B – Water quality results

A.10.4 Groundwater Quality Monitoring 2016 & 2017

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
Arup
50 Ringsend Road
Dublin 4

Report No. : 286056
Date of Receipt : 09/02/2016
Start Date of Analysis : 09/02/2016
Date of Report : 17/02/2016
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652521	LQMW4 9/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	18	mg/l
		COD	R	<10	mg/l
		pH	R	8.0	pH Units
		Alkalinity, total	R	93	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.024	mg/l
		Chloride	R	31.3	mg/l
		Nitrate as NO ₃	R	1.54	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	161	ug/l
		Potassium, total (in water)	S	0.6	mg/l
		Sulphate	R	28.1	mg/l
		TDS (gravimetric)	R	156	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Sodium, total (potable water)	S	14.2	mg/l
		Calcium, total (in water)	S	50.3	mg/l
		Magnesium, total (in water)	S	2.9	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652521	LQMW4 9/02/16	Good condition	08/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
Arup
50 Ringsend Road
Dublin 4

Report No. : 286197
Date of Receipt : 10/02/2016
Start Date of Analysis : 10/02/2016
Date of Report : 08/03/2016
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652787	LQMW6 10/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	211	mg/l
		COD	R	20	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	45	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.623	mg/l
		Phosphorus as PO ₄ -P	R	0.032	mg/l
		Chloride	R	30.8	mg/l
		Nitrate as NO ₃	R	4.31	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	7	ug/l
		Potassium, total (in water)	S	1.81	mg/l
		Sulphate	R	292	mg/l
		TDS (gravimetric)	R	149	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	200	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	200	cfu/100ml
		Sodium, total (potable water)	S	16.6	mg/l
		Calcium, total (in water)	S	252	mg/l
		Magnesium, total (in water)	S	4.7	mg/l



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652787	LQMW6 10/02/16	Good condition	09/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286057
 Date of Receipt : 09/02/2016
 Start Date of Analysis : 09/02/2016
 Date of Report : 17/02/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652522	MW03 9/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	324	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.054	mg/l
		Chloride	R	27	mg/l
		Nitrate as NO ₃	R	4	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	229	ug/l
		Potassium, total (in water)	S	1.28	mg/l
		Sulphate	R	5.92	mg/l
		TDS (gravimetric)	R	345	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	3	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	3	cfu/100ml
		Sodium, total (potable water)	S	17.3	mg/l
		Calcium, total (in water)	S	134	mg/l
		Magnesium, total (in water)	S	4.9	mg/l



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652522	MW03 9/02/16	Good condition	08/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
Arup
50 Ringsend Road
Dublin 4

Report No. : 286055
Date of Receipt : 09/02/2016
Start Date of Analysis : 09/02/2016
Date of Report : 17/02/2016
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652520	RC133 9/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	4	mg/l
		COD	R	<10	mg/l
		pH	R	7.5	pH Units
		Alkalinity, total	R	149	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.014	mg/l
		Phosphorus as PO ₄ -P	R	0.063	mg/l
		Chloride	R	24.7	mg/l
		Nitrate as NO ₃	R	4.32	mg/l
		Temperature	R	16.8 @ lab	C
		Iron, total	R	450	ug/l
		Potassium, total (in water)	S	1.57	mg/l
		Sulphate	R	9.95	mg/l
		TDS (gravimetric)	R	237	mg/l
		Manganese, total	R	1002	ug/l
		E coli (Filtration) (Environmental Waters)	R	38	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	38	cfu/100ml
		Sodium, total (potable water)	S	12.8	mg/l
		Calcium, total (in water)	S	68.3	mg/l
		Magnesium, total (in water)	S	2.1	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652520	RC133 9/02/16	Good condition	08/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286195
 Date of Receipt : 10/02/2016
 Start Date of Analysis : 10/02/2016
 Date of Report : 08/03/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652785	RP-2-01 10/02/16	BOD	R	3	mg/l
		Suspended Solids	R	12963	mg/l
		COD	R	230	mg/l
		pH	R	7.1	pH Units
		Alkalinity, total	R	5220	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.012	mg/l
		Chloride	R	31.2	mg/l
		Nitrate as NO ₃	R	17.1	mg/l
		Temperature	R	16.6 @ lab	C
		Iron, total	R	<10	ug/l
		Potassium, total (in water)	S	3.81	mg/l
		Sulphate	R	31.2	mg/l
		TDS (gravimetric)	R	247	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Sodium, total (potable water)	S	16.6	mg/l
		Calcium, total (in water)	S	897	mg/l
		Magnesium, total (in water)	S	18.2	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652785	RP-2-01 10/02/16	Good condition	09/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286198
 Date of Receipt : 10/02/2016
 Start Date of Analysis : 10/02/2016
 Date of Report : 08/03/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652788	RP-2-05S 10/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	1463	mg/l
		COD	R	68	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	1000	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.023	mg/l
		Chloride	R	212	mg/l
		Nitrate as NO ₃	R	10.6	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	<10	ug/l
		Potassium, total (in water)	S	4.76	mg/l
		Sulphate	R	170	mg/l
		TDS (gravimetric)	R	968	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	30	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	30	cfu/100ml
		Sodium, total (potable water)	S	198	mg/l
		Calcium, total (in water)	S	290	mg/l
		Magnesium, total (in water)	S	16.2	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652788	RP-2-05S 10/02/16	Good condition	09/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286196
 Date of Receipt : 10/02/2016
 Start Date of Analysis : 10/02/2016
 Date of Report : 08/03/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652786	RP-2-03 10/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	849	mg/l
		COD	R	32	mg/l
		pH	R	6.9	pH Units
		Alkalinity, total	R	1200	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	43.5	mg/l
		Nitrate as NO ₃	R	8.13	mg/l
		Temperature	R	16.8 @ lab	C
		Iron, total	R	2040	ug/l
		Potassium, total (in water)	S	4.39	mg/l
		Sulphate	R	32.3	mg/l
		TDS (gravimetric)	R	449	mg/l
		Manganese, total	R	78	ug/l
		E coli (Filtration) (Environmental Waters)	R	120	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	120	cfu/100ml
		Sodium, total (potable water)	S	40.2	mg/l
		Calcium, total (in water)	S	286	mg/l
		Magnesium, total (in water)	S	8.3	mg/l



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652786	RP-2-03 10/02/16	Good condition	09/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286199
 Date of Receipt : 10/02/2016
 Start Date of Analysis : 10/02/2016
 Date of Report : 08/03/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652789	RC-2-05D 10/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	59	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Alkalinity, total	R	252	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.011	mg/l
		Phosphorus as PO ₄ -P	R	0.022	mg/l
		Chloride	R	33.4	mg/l
		Nitrate as NO ₃	R	2.75	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	676	ug/l
		Potassium, total (in water)	S	1.88	mg/l
		Sulphate	R	18.1	mg/l
		TDS (gravimetric)	R	266	mg/l
		Manganese, total	R	31	ug/l
		E coli (Filtration) (Environmental Waters)	R	420	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	420	cfu/100ml
		Sodium, total (potable water)	S	16.5	mg/l
		Calcium, total (in water)	S	86.5	mg/l
		Magnesium, total (in water)	S	16.2	mg/l



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652789	RC-2-05D 10/02/16	Good condition	09/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
Arup
50 Ringsend Road
Dublin 4

Report No. : 286051
Date of Receipt : 09/02/2016
Start Date of Analysis : 09/02/2016
Date of Report : 17/02/2016
Order Number :
Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652516	SW-2-4 9/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total	R	176	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.057	mg/l
		Chloride	R	22.2	mg/l
		Nitrate as NO ₃	R	6.49	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	88	ug/l
		Potassium, total (in water)	S	2.28	mg/l
		Sulphate	R	18.7	mg/l
		TDS (gravimetric)	R	290	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	53	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	53	cfu/100ml
		Sodium, total (potable water)	S	13.4	mg/l
		Calcium, total (in water)	S	80	mg/l
		Magnesium, total (in water)	S	2.7	mg/l



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652516	SW-2-4 9/02/16	Good condition	08/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 286053
 Date of Receipt : 09/02/2016
 Start Date of Analysis : 09/02/2016
 Date of Report : 17/02/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
652518	SW-2-5 9/02/16	BOD	R	<1	mg/l
		Suspended Solids	R	2	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Alkalinity, total	R	258	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.031	mg/l
		Chloride	R	31.2	mg/l
		Nitrate as NO ₃	R	3.22	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	152	ug/l
		Potassium, total (in water)	S	1.78	mg/l
		Sulphate	R	52	mg/l
		TDS (gravimetric)	R	230	mg/l
		Manganese, total	R	<5	ug/l
		E coli (Filtration) (Environmental Waters)	R	98	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	98	cfu/100ml
		Sodium, total (potable water)	S	16.2	mg/l
		Calcium, total (in water)	S	115	mg/l
		Magnesium, total (in water)	S	3.4	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
652518	SW-2-5 9/02/16	Good condition	08/02/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 288418
 No.

Date of Receipt : 04/03/2016
 Start Date of Analysis : 04/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
657908	SW-2-5 2/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total (obsolete)	R	275	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.018	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	3	ug/l
		Chloride	R	27.4	mg/l
		Nitrate as NO ₃	R	2.99	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	45	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	1.45	ug/l
		Potassium, total (in water)	S	1.51	mg/l
		Sulphate	R	49.8	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	126	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.9	ug/l
		Nickel, total	R	2	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	45	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	45	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	132 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	14.2	mg/l
		Calcium, total (in water)	S	117	mg/l
		Lead, total (in water)	S	<6	ug/l
		Magnesium, total (in water)	S	3.3	mg/l
		Mercury, total (in water)	S	<0.10	ug/l
		Cadmium Total 10 days	S	0.097	ug/l
		Barium Total 10 days	S	7.90	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total	CLS 196 GC-GC-FID	No	No	Yes	No	No

Aliphatics C8-C44)						
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Cadmium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Barium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
657908	SW-2-5 2/03/16	Good condition	02/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 288415
 No.

Date of Receipt : 04/03/2016
 Start Date of Analysis : 04/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
657905	LQMW 6. 02/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	4	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total (obsolete)	R	260	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.622	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	2	ug/l
		Chloride	R	32.9	mg/l
		Nitrate as NO ₃	R	8	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	81	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	1.11	ug/l
		Potassium, total (in water)	S	2	mg/l
		Sulphate	R	299	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	733	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	211	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	8	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	88 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	20.2	mg/l
		Calcium, total (in water)	S	232	mg/l
		Lead, total (in water)	S	<6	ug/l
		Magnesium, total (in water)	S	4.7	mg/l
		Mercury, total (in water)	S	<0.10	ug/l
		Cadmium Total 10 days	S	<0.09	ug/l
		Barium Total 10 days	S	17.4	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

**Barbara Lee
 Environmental**

Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No

Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Cadmium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Barium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
657905	LQMW 6. 02/03/16	Good condition	02/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 289288
 Date of Receipt : 11/03/2016
 Start Date of Analysis : 11/03/2016
 Date of Report : 26/04/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
659759	MW03 09/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	22	mg/l
		COD	R	<10	mg/l
		pH	R	6.9	pH Units
		Alkalinity, total	R	316	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	2	ug/l
		Chloride	R	28.5	mg/l
		Nitrate as NO ₃	R	1.31	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	69	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	<0.80	ug/l
		Potassium, total (in water)	S	1.19	mg/l
		Sulphate	R	5.29	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0003	mg/l
		TDS (gravimetric)	R	389	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	8	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	1	ug/l
		Nickel, total	R	0.9	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	17	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	6	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	6	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	62 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	16.5	mg/l
		Calcium, total (in water)	S	131	mg/l
		Lead, total (in water)	S	<0.006	mg/l
		Magnesium, total (in water)	S	5	mg/l
		Mercury, total (in water)	S	<0.10	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, DSW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No

Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
659759	MW03 09/03/16	Good condition	09/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 289289
 No.

Date of Receipt : 11/03/2016
 Start Date of Analysis : 11/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
659761	RC133 09/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Alkalinity, total (obsolete)	R	130	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.025	mg/l
		Phosphorus as PO ₄ -P	R	0.047	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	25.3	mg/l
		Nitrate as NO ₃	R	3.72	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	15	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	<0.80	ug/l
		Potassium, total (in water)	S	1.63	mg/l
		Sulphate	R	14.2	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	189	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.5	ug/l
		Nickel, total	R	0.9	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	9	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	40	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	40	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	52 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	13.3	mg/l
		Calcium, total (in water)	S	72.5	mg/l
		Lead, total (in water)	S	<6	ug/l
		Magnesium, total (in water)	S	2.3	mg/l
		Mercury, total (in water)	S	<0.10	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

**Barbara Lee
 Environmental**

Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range)	CLS 147	Yes	No	Yes	No	No

and Lube Oil) by GC-FID						
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
659761	RC133 09/03/16	Good condition	09/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 289285
 No.

Date of Receipt : 11/03/2016
 Start Date of Analysis : 11/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
659756	RP-2-01 09/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	21	mg/l
		COD	R	16	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total (obsolete)	R	377	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	28.8	mg/l
		Nitrate as NO ₃	R	10.9	mg/l
		Temperature	R	16.5 @ lab	°C
		Iron, total	R	117	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	1.65	ug/l
		Potassium, total (in water)	S	2.9	mg/l
		Sulphate	R	29.4	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	0
		TDS (gravimetric)	R	310	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	10	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.9	ug/l
		Nickel, total	R	2	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	27	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	67	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	67	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	31 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	14.9	mg/l
		Calcium, total (in water)	S	169	mg/l
		Lead, total (in water)	S	7	ug/l
		Magnesium, total (in water)	S	7.9	mg/l
		Mercury, total (in water)	S	<0.10	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental

Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range)	CLS 147	Yes	No	Yes	No	No

and Lube Oil) by GC-FID						
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
659756	RP-2-01 09/03/16	Good condition	09/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 289290
 No.

Date of Receipt : 11/03/2016
 Start Date of Analysis : 11/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
659764	RP-2-05D 09/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	215	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Alkalinity, total (obsolete)	R	244	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	31	mg/l
		Nitrate as NO ₃	R	9.96	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	5	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	<0.80	ug/l
		Potassium, total (in water)	S	1.09	mg/l
		Sulphate	R	12	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	144	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	1	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	24	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	72 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	16.3	mg/l
		Calcium, total (in water)	S	141	mg/l
		Lead, total (in water)	S	7	ug/l
		Magnesium, total (in water)	S	13.1	mg/l
		Mercury, total (in water)	S	<0.10	ug/l

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Approved by:

Barbara Lee

**Barbara Lee
 Environmental**

Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range)	CLS 147	Yes	No	Yes	No	No

and Lube Oil) by GC-FID						
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
659764	RP-2-05D 09/03/16	Good condition	09/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 288416
 No.

Date of Receipt : 04/03/2016
 Start Date of Analysis : 04/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
657906	RP-2-05S 02/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	461	mg/l
		COD	R	29	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total (obsolete)	R	561	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.008	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	4	ug/l
		Chloride	R	111	mg/l
		Nitrate as NO ₃	R	8.9	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	1280	ug/l
		Lead, total (potable water)	S	0.008	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	3.61	ug/l
		Potassium, total (in water)	S	4.01	mg/l
		Sulphate	R	97.9	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	745	mg/l
		Arsenic, total	R	0.8	ug/l
		Manganese, total	R	52	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	5	ug/l
		Nickel, total	R	4	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	84 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	82	ug/l
		Sodium, total (potable water)	S	103	mg/l
		Calcium, total (in water)	S	166	mg/l
		Magnesium, total (in water)	S	11.5	mg/l
		Mercury, total (in water)	S	<0.10	ug/l
		Cadmium Total 10 days	S	0.70	ug/l
		Barium Total 10 days	S	158.0	ug/l

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Approved by:

Barbara Lee

Barbara Lee
Environmental

Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range)	CLS 147	Yes	No	Yes	No	No

and Lube Oil) by GC-FID						
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Cadmium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Barium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
657906	RP-2-05S 02/03/16	Good condition	02/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 289286
 No.

Date of Receipt : 11/03/2016
 Start Date of Analysis : 11/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
659757	RP-2-03 09/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	122	mg/l
		COD	R	16	mg/l
		pH	R	6.9	pH Units
		Alkalinity, total (obsolete)	R	272	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	1	ug/l
		Chloride	R	40.4	mg/l
		Nitrate as NO ₃	R	4.31	mg/l
		Temperature	R	16.6 @ lab	C
		Iron, total	R	53	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	1.65	ug/l
		Potassium, total (in water)	S	4.46	mg/l
		Sulphate	R	31.1	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	321	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.6	ug/l
		Nickel, total	R	3	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	41	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	35	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	35	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	58 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	67	ug/l
		Sodium, total (potable water)	S	14.9	mg/l
		Calcium, total (in water)	S	147	mg/l
		Lead, total (in water)	S	6	ug/l
		Magnesium, total (in water)	S	7.3	mg/l
		Mercury, total (in water)	S	<0.10	ug/l

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**Barbara Lee
 Environmental
 Scientist**

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Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No

Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
659757	RP-2-03 09/03/16	Good condition	09/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist

Arup
 50 Ringsend Road
 Dublin 4

Supplement to Report : 288417
 No.

Date of Receipt : 04/03/2016
 Start Date of Analysis : 04/03/2016
 Date of Report : 29/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
657907	SW-2-4 02/03/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total (obsolete)	R	203	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.037	mg/l
		Phosphorus as PO ₄ -P	R	0.042	mg/l
		Copper, total	R	3	ug/l
		Chloride	R	30.1	mg/l
		Nitrate as NO ₃	R	5.33	mg/l
		Temperature	R	16.6 @ lab	C
		Iron, total	R	34	ug/l
		Antimony, total as Sb (potable water)	S	<1.2	ug/l
		Selenium, total (potable water)	S	0.87	ug/l
		Potassium, total (in water)	S	2.12	mg/l
		Sulphate	R	21.9	mg/l
		Molybdenum, total (potable water)	S	<3.00	ug/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	66	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	1	ug/l
		Nickel, total	R	1	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	112 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<66	ug/l
		Sodium, total (potable water)	S	14.1	mg/l
		Calcium, total (in water)	S	81.7	mg/l
		Lead, total (in water)	S	<6	ug/l
		Magnesium, total (in water)	S	2.8	mg/l
		Mercury, total (in water)	S	<0.10	ug/l
		Cadmium Total 10 days	S	0.023	ug/l
		Barium Total 10 days	S	129.0	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited

**Barbara Lee
 Environmental
 Scientist**

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 It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total (obsolete)	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Antimony, total as Sb (potable water)	ICP-MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Selenium, total (potable water)	ICPMS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Potassium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Molybdenum, total (potable water)	ICP MS, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range)	CLS 147	Yes	No	Yes	No	No

and Lube Oil) by GC-FID						
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Sodium, total (potable water)	ICP AES, (Accredited in GW, SW, DW)	N/A	N/A	N/A	Yes	Yes
Calcium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Lead, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Magnesium, total (in water)	ICP OES, WAS049, (Accredited in GW, Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Cadmium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Barium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
657907	SW-2-4 02/03/16	Good condition	02/03/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291884
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666245	LQMW6. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	7	mg/l
		COD	R	<10	mg/l
		pH	R	6.9	pH Units
		Alkalinity, total	R	311	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	1.49	mg/l
		Phosphorus as PO ₄ -P	R	0.016	mg/l
		Chloride	R	35.2	mg/l
		Nitrate as NO ₃	R	6.6	mg/l
		Temperature	R	16.7 @ lab	C
		Sulphate	R	269	mg/l
		TDS (gravimetric)	R	745	mg/l
		E coli (Filtration) (Environmental Waters)	R	4	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	4	cfu/100ml
		Iron Total 10 days TAT10	S	87.1	ug/l
		Manganese Total 10 days TAT	S	220	ug/l
		Magnesium Total 10 days	S	8.04	mg/l
		Sodium Total 10 days	S	86.2	mg/l
		Potassium Total 10 days	S	3.52	mg/l
		Calcium Total 10 days	S	198	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666245	LQMW6. 06/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291887
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666248	MW03. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	7	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	361	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.011	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	28.6	mg/l
		Nitrate as NO ₃	R	2.27	mg/l
		Temperature	R	16.3 @ lab	C
		Sulphate	R	5.75	mg/l
		TDS (gravimetric)	R	360	mg/l
		E coli (Filtration) (Environmental Waters)	R	16	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	16	cfu/100ml
		Iron Total 10 days TAT10	S	53.4	ug/l
		Manganese Total 10 days TAT	S	3.11	ug/l
		Magnesium Total 10 days	S	5.56	mg/l
		Sodium Total 10 days	S	18.3	mg/l
		Potassium Total 10 days	S	1.08	mg/l
		Calcium Total 10 days	S	131	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666248	MW03. 06/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291888
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666249	RC133. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total	R	214	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.012	mg/l
		Phosphorus as PO ₄ -P	R	0.059	mg/l
		Chloride	R	26	mg/l
		Nitrate as NO ₃	R	5.28	mg/l
		Temperature	R	16.2 @ lab	C
		Sulphate	R	16.1	mg/l
		TDS (gravimetric)	R	225	mg/l
		E coli (Filtration) (Environmental Waters)	R	89	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	89	cfu/100ml
		Iron Total 10 days TAT10	S	33.7	ug/l
		Manganese Total 10 days TAT	S	2.77	ug/l
		Magnesium Total 10 days	S	2.66	mg/l
		Sodium Total 10 days	S	16.8	mg/l
		Potassium Total 10 days	S	1.87	mg/l
		Calcium Total 10 days	S	78.2	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666249	RC133. 06/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291875
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 05/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666230	RP-2-01. 07/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	128	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total	R	257	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	29.7	mg/l
		Nitrate as NO ₃	R	15.3	mg/l
		Temperature	R	16.3 @ lab	C
		Sulphate	R	27.8	mg/l
		TDS (gravimetric)	R	290	mg/l
		E coli (Filtration) (Environmental Waters)	R	14	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	14	cfu/100ml
		Iron Total 10 days TAT10	S	942	ug/l
		Manganese Total 10 days TAT	S	49.7	ug/l
		Magnesium Total 10 days	S	7.76	mg/l
		Sodium Total 10 days	S	18.5	mg/l
		Potassium Total 10 days	S	2.98	mg/l
		Calcium Total 10 days	S	129	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666230	RP-2-01. 07/04/16	Good condition	07/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291885
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666246	RP-2-05D. 07/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	11	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Alkalinity, total	R	205	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.049	mg/l
		Phosphorus as PO ₄ -P	R	0.012	mg/l
		Chloride	R	31.9	mg/l
		Nitrate as NO ₃	R	4.13	mg/l
		Temperature	R	16.5 @ lab	C
		Sulphate	R	13.7	mg/l
		TDS (gravimetric)	R	253	mg/l
		E coli (Filtration) (Environmental Waters)	R	11	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	11	cfu/100ml
		Iron Total 10 days TAT10	S	33.9	ug/l
		Manganese Total 10 days TAT	S	3.07	ug/l
		Magnesium Total 10 days	S	14.8	mg/l
		Sodium Total 10 days	S	19.1	mg/l
		Potassium Total 10 days	S	0.93	mg/l
		Calcium Total 10 days	S	94.6	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

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²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666246	RP-2-05D. 07/04/16	Good condition	07/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291886
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 27/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666247	RP-2-05S. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	2231	mg/l
		COD	R	45	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	700	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.025	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	113	mg/l
		Nitrate as NO ₃	R	7.48	mg/l
		Temperature	R	15.8 @ lab	C
		Iron, total	R	14010	ug/l
		Sulphate	R	104	mg/l
		TDS (gravimetric)	R	328	mg/l
		Manganese, total	R	2125	ug/l
		E coli (Filtration) (Environmental Waters)	R	17	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	17	cfu/100ml
		Magnesium Total 10 days	S	21.3	mg/l
		Sodium Total 10 days	S	176	mg/l
		Potassium Total 10 days	S	2.86	mg/l
		Calcium Total 10 days	S	548	mg/l



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666247	RP-2-05S. 07/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291883
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666244	RP-2-03. 07/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	81	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	299	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.025	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	47.8	mg/l
		Nitrate as NO ₃	R	9.12	mg/l
		Temperature	R	15.6 @ lab	C
		Sulphate	R	48.6	mg/l
		TDS (gravimetric)	R	391	mg/l
		E coli (Filtration) (Environmental Waters)	R	21	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	21	cfu/100ml
		Iron Total 10 days TAT10	S	299	ug/l
		Manganese Total 10 days TAT	S	39.3	ug/l
		Magnesium Total 10 days	S	5.07	mg/l
		Sodium Total 10 days	S	26.1	mg/l
		Potassium Total 10 days	S	2.24	mg/l
		Calcium Total 10 days	S	93.3	0



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666244	RP-2-03. 06/04/16	Good condition	07/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291889
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666250	SW-2-4. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Alkalinity, total	R	189	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.012	mg/l
		Phosphorus as PO ₄ -P	R	0.028	mg/l
		Chloride	R	26.1	mg/l
		Nitrate as NO ₃	R	4.17	mg/l
		Temperature	R	16.5 @ lab	C
		Sulphate	R	21.7	mg/l
		TDS (gravimetric)	R	225	mg/l
		E coli (Filtration) (Environmental Waters)	R	41	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	41	cfu/100ml
		Iron Total 10 days TAT10	S	59.7	ug/l
		Manganese Total 10 days TAT	S	1.7	ug/l
		Magnesium Total 10 days	S	3.0	mg/l
		Sodium Total 10 days	S	16.3	mg/l
		Potassium Total 10 days	S	2.23	mg/l
		Calcium Total 10 days	S	81.6	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666250	SW-2-4. 06/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 291890
 Date of Receipt : 08/04/2016
 Start Date of Analysis : 08/04/2016
 Date of Report : 06/05/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
666251	SW-2-5. 06/04/16	BOD	R	<1	mg/l
		Suspended Solids	R	2	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Alkalinity, total	R	225	mg/l CaCO ₃
		Ammonia as NH ₃ -N	R	0.03	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Chloride	R	25.7	mg/l
		Nitrate as NO ₃	R	2.46	mg/l
		Temperature	R	15.3 @ lab	C
		Sulphate	R	48.6	mg/l
		TDS (gravimetric)	R	145	mg/l
		E coli (Filtration) (Environmental Waters)	R	73	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	73	cfu/100ml
		Iron Total 10 days TAT10	S	54.7	ug/l
		Manganese Total 10 days TAT	S	3.56	ug/l
		Magnesium Total 10 days	S	3.78	mg/l
		Sodium Total 10 days	S	16.7	mg/l
		Potassium Total 10 days	S	1.66	mg/l
		Calcium Total 10 days	S	117	mg/l



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Alkalinity, total	CLS 54	No	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Iron Total 10 days TAT10	177, ICP-MS, (UKAS Accredited in DW, GW, SW and effluent.)	N/A	N/A	N/A	Yes	Yes
Manganese Total 10 days TAT	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
666251	SW-2-5. 06/04/16	Good condition	06/04/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294982
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674077	LQMW6. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	13	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH3-N	R	1.84	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	20.9	mg/l
		Nitrate as NO3	R	3.30	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	81	ug/l
		Sulphate	R	229	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	602	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	213	ug/l
		Zinc, total	R	67	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	4	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	24	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	12	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	12	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	154 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	328	mg/l CaCO3
		Lead Total	S	0.363	ug/l
		Magnesium Total 10 days	S	4.67	mg/l
		Potassium Total 10 days	S	2.71	mg/l
		Calcium Total 10 days	S	205	mg/l
		Molybdenum Total 5 days	S	17.1	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	<2.12	ug/l
		Sodium Total 10 days	S	25.3	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5	177, ICP-MS	N/A	N/A	N/A	Yes	No

days						
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674077	LQMW6. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294985
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674080	MW03. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Ammonia as NH3-N	R	0.021	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	24.9	mg/l
		Nitrate as NO3	R	3.11	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	11	ug/l
		Sulphate	R	<5	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	355	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	14	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	142 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	354	mg/l CaCO3
		Lead Total	S	<0.12	ug/l
		Magnesium Total 10 days	S	5.71	mg/l
		Potassium Total 10 days	S	1.13	mg/l
		Calcium Total 10 days	S	119	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	2.29	ug/l
		Sodium Total 10 days	S	16.2	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5	177, ICP-MS	N/A	N/A	N/A	Yes	No

days						
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674080	MW03. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294984
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674079	RC133. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	7	mg/l
		COD	R	<10	mg/l
		pH	R	7.5	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	0.082	mg/l
		Copper, total	R	1	ug/l
		Chloride	R	22	mg/l
		Nitrate as NO3	R	12.5	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	76	ug/l
		Sulphate	R	18.8	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	171	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	6	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	7	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	42	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	42	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	102 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	195	mg/l CaCO3
		Lead Total	S	0.26	ug/l
		Magnesium Total 10 days	S	2.6	mg/l
		Potassium Total 10 days	S	2.22	mg/l
		Calcium Total 10 days	S	82	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	3.19	ug/l
		Sodium Total 10 days	S	16.3	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674079	RC133. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294987
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 04/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674082	RP-2-01. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	85	mg/l
		COD	R	<10	mg/l
		pH	R	7.5	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	2	ug/l
		Chloride	R	28.3	mg/l
		Nitrate as NO3	R	13.4	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	2,566	ug/l
		Sulphate	R	22.2	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	232	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	19	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	1	ug/l
		Nickel, total	R	4	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	25	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	40	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	40	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	117 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	268	mg/l CaCO3
		Lead Total	S	0.948	ug/l
		Magnesium Total 10 days	S	7.19	mg/l
		Potassium Total 10 days	S	2.78	mg/l
		Calcium Total 10 days	S	96.1	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	2.97	ug/l
		Sodium Total 10 days	S	17.0	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental

Scientist

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674082	RP-2-01. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294979
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674074	RP-2-05D. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	3	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH ₃ -N	R	0.013	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	28.2	mg/l
		Nitrate as NO ₃	R	4.74	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	11	ug/l
		Sulphate	R	11.9	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	243	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	1	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	16	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	100	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	100	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	134 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	258	mg/l CaCO ₃
		Lead Total	S	0.173	ug/l
		Magnesium Total 10 days	S	13.4	mg/l
		Potassium Total 10 days	S	1.09	mg/l
		Calcium Total 10 days	S	90.1	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	2.53	ug/l
		Sodium Total 10 days	S	17.4	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5	177, ICP-MS	N/A	N/A	N/A	Yes	No

days						
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674074	RP-2-05D. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294981
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 12/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674076	RP-2-05S. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	1656	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH3-N	R	0.047	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	16	ug/l
		Chloride	R	30.6	mg/l
		Nitrate as NO3	R	8.75	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	38043	ug/l
		Sulphate	R	126	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	627	mg/l
		Arsenic, total	R	2	ug/l
		Manganese, total	R	2298	ug/l
		Zinc, total	R	96	ug/l
		Chromium, total	R	19	ug/l
		Nickel, total	R	35	ug/l
		Cadmium, total	R	4	ug/l
		Barium, total	R	388	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	35	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	35	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	145 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	752	mg/l CaCO3
		Lead Total	S	233	ug/l
		Magnesium Total 10 days	S	27.6	mg/l
		Potassium Total 10 days	S	3.31	mg/l
		Calcium Total 10 days	S	1196	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	6.19	ug/l
		Sodium Total 10 days	S	130	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

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Approved by:

Barbara Lee

**Barbara Lee
Environmental**

Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674076	RP-2-05S. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294988
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674083	RP-2-03. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	86	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	3	ug/l
		Chloride	R	34.4	mg/l
		Nitrate as NO3	R	8.13	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	431	ug/l
		Sulphate	R	27.6	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	109	mg/l
		Arsenic, total	R	0.5	ug/l
		Manganese, total	R	50	ug/l
		Zinc, total	R	12	ug/l
		Chromium, total	R	1	ug/l
		Nickel, total	R	4	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	30	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	129 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	354	mg/l CaCO3
		Lead Total	S	3.56	ug/l
		Magnesium Total 10 days	S	7.91	mg/l
		Potassium Total 10 days	S	3.64	mg/l
		Calcium Total 10 days	S	137	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	3.06	ug/l
		Sodium Total 10 days	S	43.3	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

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Approved by:

Barbara Lee

Barbara Lee
Environmental

Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674083	RP-2-03. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294986
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 30/06/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674081	SW-2-4. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH3-N	R	0.021	mg/l
		Phosphorus as PO4-P	R	0.039	mg/l
		Copper, total	R	1	ug/l
		Chloride	R	23.9	mg/l
		Nitrate as NO3	R	8.22	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	<10	ug/l
		Sulphate	R	18.6	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	150	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Nickel, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	8	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	46	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	46	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	137 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	235	mg/l CaCO3
		Lead Total	S	<0.12	ug/l
		Magnesium Total 10 days	S	3.32	mg/l
		Potassium Total 10 days	S	2.99	mg/l
		Calcium Total 10 days	S	95.5	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	2.58	ug/l
		Sodium Total 10 days	S	15.8	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

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Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674081	SW-2-4. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 294983
 Date of Receipt : 11/05/2016
 Start Date of Analysis : 11/05/2016
 Date of Report : 06/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
674078	SW-2-5. 10/05/16	BOD	R	<1	mg/l
		Suspended Solids	R	20	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH3-N	R	0.068	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Chloride	R	21.4	mg/l
		Nitrate as NO3	R	2.15	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	434	ug/l
		Sulphate	R	48.5	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	374	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	6	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.8	ug/l
		Nickel, total	R	1	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	6	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	79	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	79	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	217 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Alkalinity Total by Autotitration	R	283	mg/l CaCO3
		Lead Total	S	<0.12	ug/l
		Magnesium Total 10 days	S	3.63	mg/l
		Potassium Total 10 days	S	2.07	mg/l
		Calcium Total 10 days	S	108	mg/l
		Molybdenum Total 5 days	S	<5	ug/l
		Antimony Total 10 days	S	<2.06	ug/l
		Selenium Total 10 days	S	2.81	ug/l
		Sodium Total 10 days	S	14.7	mg/l
		Mercury Total 10 days	S	<0.04	ug/l

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental

Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
Lead Total	ICP MS, (UKAS Accredited in GW, SW, DW) SOP 177	N/A	N/A	N/A	Yes	Yes
Magnesium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Potassium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No

Calcium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Molybdenum Total 5 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Antimony Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Selenium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	Yes
Sodium Total 10 days	177, ICP-MS	N/A	N/A	N/A	Yes	No
Mercury Total 10 days	178, ICP-MS	N/A	N/A	N/A	Yes	Yes

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²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
674078	SW-2-5. 10/05/16	Good condition	10/05/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298058
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 12/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680825	BH 3/48. 09/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	24	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.02	mg/l
		Sodium, total	R	37	mg/l
		Chloride	R	50	mg/l
		Nitrate as NO ₃	R	5.56	mg/l
		Temperature	R	19.9 @ lab	C
		Iron, total	R	443	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	37.2	mg/l
		TDS (gravimetric)	R	367	mg/l
		Manganese, total	R	24	ug/l
		Calcium, total	R	94	mg/l
		E coli (Filtration) (Environmental Waters)	R	96	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	96	cfu/100ml
		Alkalinity Total by Autotitration	R	221	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680825	BH 3/48. 09/06/16	Good condition	09/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298049
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 20/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680812	LQMW6. 08/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	30	mg/l
		COD	R	10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	3.13	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	27	mg/l
		Chloride	R	33.4	mg/l
		Nitrate as NO ₃	R	0.833	mg/l
		Temperature	R	19.9 @ lab	C
		Iron, total	R	355	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	5	mg/l
		Sulphate	R	218	mg/l
		TDS (gravimetric)	R	678	mg/l
		Manganese, total	R	466	ug/l
		Calcium, total	R	192	mg/l
		E coli (Filtration) (Environmental Waters)	R	7	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	7	cfu/100ml
		Alkalinity Total by Autotitration	R	324	mg/l CaCO ₃



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680812	LQMW6. 08/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298054
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 11/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680820	MW03. 08/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	16	mg/l
		Chloride	R	27	mg/l
		Nitrate as NO ₃	R	4.34	mg/l
		Temperature	R	19.6 @ lab	C
		Iron, total	R	111	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	6.36	mg/l
		TDS (gravimetric)	R	415	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	127	mg/l
		E coli (Filtration) (Environmental Waters)	R	9	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	9	cfu/100ml
		Alkalinity Total by Autotitration	R	327	mg/l CaCO ₃



Approved by:

Barbara Lee

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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680820	MW03. 08/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298052
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 11/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680815	RC 133. 09/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.019	mg/l
		Sodium, total	R	18	mg/l
		Chloride	R	25.1	mg/l
		Nitrate as NO ₃	R	17.2	mg/l
		Temperature	R	19.8 @ lab	C
		Iron, total	R	59	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	29.6	mg/l
		TDS (gravimetric)	R	348	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	84	mg/l
		E coli (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Alkalinity Total by Autotitration	R	203	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680815	RC 133. 09/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298057
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 15/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680824	RP-2-01. 09/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	21	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	19	mg/l
		Chloride	R	29	mg/l
		Nitrate as NO ₃	R	13.8	mg/l
		Temperature	R	19.5 @ lab	C
		Iron, total	R	189	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	8	mg/l
		Sulphate	R	24.9	mg/l
		TDS (gravimetric)	R	367	mg/l
		Manganese, total	R	15	ug/l
		Calcium, total	R	104	mg/l
		E coli (Filtration) (Environmental Waters)	R	24	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	24	cfu/100ml
		Alkalinity Total by Autotitration	R	263	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680824	RP-2-01. 09/06/16	Good condition	09/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298047
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 11/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680810	RP-2-05D. 08/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	17	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	19	mg/l
		Chloride	R	31.4	mg/l
		Nitrate as NO ₃	R	5.1	mg/l
		Temperature	R	19.5 @ lab	C
		Iron, total	R	184	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	14	mg/l
		Sulphate	R	13.5	mg/l
		TDS (gravimetric)	R	354	mg/l
		Manganese, total	R	7	ug/l
		Calcium, total	R	97	mg/l
		E coli (Filtration) (Environmental Waters)	R	18	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	18	cfu/100ml
		Alkalinity Total by Autotitration	R	242	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680810	RP-2-05D. 08/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298048
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 12/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680811	RP-2-05S. 08/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	474	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	146	mg/l
		Chloride	R	129	mg/l
		Nitrate as NO ₃	R	8.54	mg/l
		Temperature	R	19.8 @ lab	C
		Iron, total	R	4210	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	16	mg/l
		Sulphate	R	133	mg/l
		TDS (gravimetric)	R	746	mg/l
		Manganese, total	R	225	ug/l
		Calcium, total	R	235	mg/l
		E coli (Filtration) (Environmental Waters)	R	28	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	28	cfu/100ml
		Alkalinity Total by Autotitration	R	425	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680811	RP-2-05S_ 08/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298055
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 11/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680822	RP-2-03. 09/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	14	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	61	mg/l
		Chloride	R	39	mg/l
		Nitrate as NO ₃	R	10.6	mg/l
		Temperature	R	19.7 @ lab	C
		Iron, total	R	379	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	7	mg/l
		Sulphate	R	41.4	mg/l
		TDS (gravimetric)	R	430	mg/l
		Manganese, total	R	9	ug/l
		Calcium, total	R	113	mg/l
		E coli (Filtration) (Environmental Waters)	R	67	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	67	cfu/100ml
		Alkalinity Total by Autotitration	R	333	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680822	RP-2-03. 09/06/16	Good condition	09/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 298050
 Date of Receipt : 10/06/2016
 Start Date of Analysis : 10/06/2016
 Date of Report : 11/07/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
680813	SW-2-5. 08/06/16	BOD	R	<1	mg/l
		Suspended Solids	R	8	mg/l
		COD	R	32	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH ₃ -N	R	0.079	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	15	mg/l
		Chloride	R	22.8	mg/l
		Nitrate as NO ₃	R	0.713	mg/l
		Temperature	R	19.6 @ lab	C
		Iron, total	R	242	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	54.8	mg/l
		TDS (gravimetric)	R	500	mg/l
		Manganese, total	R	9	ug/l
		Calcium, total	R	115	mg/l
		E coli (Filtration) (Environmental Waters)	R	73	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	73	cfu/100ml
		Alkalinity Total by Autotitration	R	262	mg/l CaCO ₃



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
680813	SW-2-5. 08/06/16	Good condition	08/06/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302767
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692271	BH 3/48. 21/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	16	mg/l
		COD	R	<10	mg/l
		pH	R	6.9	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.085	mg/l
		Sodium, total	R	31	mg/l
		Chloride	R	42.8	mg/l
		Nitrate as NO ₃	R	8.88	mg/l
		Temperature	R	15.2 @ lab	C
		Iron, total	R	12	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	22.4	mg/l
		TDS (gravimetric)	R	461	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	83	mg/l
		E coli (Filtration) (Environmental Waters)	R	137est	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	137est	cfu/100ml
		Alkalinity Total by Autotitration	R	247	mg/l CaCO ₃

**Note: est means that results obtained were calculated from plates containing greater than 100 colonies



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692271	BH 3/48. 21/07/16	Good condition	21/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302763
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692268	LQMW6. 20/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	15	mg/l
		COD	R	<10	mg/l
		pH	R	6.8	pH Units
		Ammonia as NH ₃ -N	R	3.93	mg/l
		Phosphorus as PO ₄ -P	R	0.091	mg/l
		Sodium, total	R	26	mg/l
		Chloride	R	36.5	mg/l
		Nitrate as NO ₃	R	0.661	mg/l
		Temperature	R	15.5 @ lab	C
		Iron, total	R	635	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	5	mg/l
		Sulphate	R	186	mg/l
		TDS (gravimetric)	R	704	mg/l
		Manganese, total	R	563	ug/l
		Calcium, total	R	178	mg/l
		E coli (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Alkalinity Total by Autotitration	R	371	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692268	LQMW6. 20/07/16	Good condition	20/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302760
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692266	MW03. 20/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	4	mg/l
		COD	R	<10	mg/l
		pH	R	6.7	pH Units
		Ammonia as NH ₃ -N	R	0.015	mg/l
		Phosphorus as PO ₄ -P	R	0.014	mg/l
		Sodium, total	R	14	mg/l
		Chloride	R	25.7	mg/l
		Nitrate as NO ₃	R	4.91	mg/l
		Temperature	R	15.3 @ lab	C
		Iron, total	R	38	ug/l
		Potassium, total	R	0.9	mg/l
		Magnesium, total	R	5	mg/l
		Sulphate	R	5.5	mg/l
		TDS (gravimetric)	R	399	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	113	mg/l
		E coli (Filtration) (Environmental Waters)	R	13	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	13	cfu/100ml
		Alkalinity Total by Autotitration	R	378	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692266	MW03. 20/07/16	Good condition	20/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302761
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692267	RC 133. 20/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.1	mg/l
		Sodium, total	R	16	mg/l
		Chloride	R	19.7	mg/l
		Nitrate as NO ₃	R	0.484	mg/l
		Temperature	R	15.4 @ lab	C
		Iron, total	R	16	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	20.1	mg/l
		TDS (gravimetric)	R	314	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	79	mg/l
		E coli (Filtration) (Environmental Waters)	R	38	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	38	cfu/100ml
		Alkalinity Total by Autotitration	R	221	mg/l CaCO ₃



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692267	RC 133. 20/07/16	Good condition	20/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302768
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692272	RP-2-01. 21/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	49	mg/l
		COD	R	<10	mg/l
		pH	R	6.9	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	18	mg/l
		Chloride	R	28.6	mg/l
		Nitrate as NO ₃	R	14.2	mg/l
		Temperature	R	15.3 @ lab	C
		Iron, total	R	781	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	7	mg/l
		Sulphate	R	27.2	mg/l
		TDS (gravimetric)	R	368	mg/l
		Manganese, total	R	17	ug/l
		Calcium, total	R	100	mg/l
		E coli (Filtration) (Environmental Waters)	R	12	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	12	cfu/100ml
		Alkalinity Total by Autotitration	R	251	mg/l CaCO ₃



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Environmental
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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692272	RP-2-01. 21/07/16	Good condition	21/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302769
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 05/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692273	RP-2-03. 21/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	81	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	0.006	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	44	mg/l
		Chloride	R	37.2	mg/l
		Nitrate as NO ₃	R	7.52	mg/l
		Temperature	R	15.7 @ lab	C
		Iron, total	R	216	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	7	mg/l
		Sulphate	R	32.6	mg/l
		TDS (gravimetric)	R	241	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	100	mg/l
		E coli (Filtration) (Environmental Waters)	R	2	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	2	cfu/100ml
		Alkalinity Total by Autotitration	R	358	mg/l CaCO ₃



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692273	RP-2-03. 21/07/16	Good condition	21/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302764
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692269	RP-2-05D. 20/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	21	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Ammonia as NH ₃ -N	R	0.074	mg/l
		Phosphorus as PO ₄ -P	R	0.03	mg/l
		Sodium, total	R	15	mg/l
		Chloride	R	32.8	mg/l
		Nitrate as NO ₃	R	5.02	mg/l
		Temperature	R	15.4 @ lab	C
		Iron, total	R	15	ug/l
		Potassium, total	R	0.8	mg/l
		Magnesium, total	R	12	mg/l
		Sulphate	R	16.6	mg/l
		TDS (gravimetric)	R	528	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	73	mg/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	24	cfu/100ml
		Alkalinity Total by Autotitration	R	284	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692269	RP-2-05D. 20/07/16	Good condition	20/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 302766
 Date of Receipt : 21/07/2016
 Start Date of Analysis : 21/07/2016
 Date of Report : 03/08/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
692270	RP-2-05S. 20/07/16	BOD	R	<1	mg/l
		Suspended Solids	R	364	mg/l
		COD	R	34	mg/l
		pH	R	6.8	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	160	mg/l
		Chloride	R	112	mg/l
		Nitrate as NO ₃	R	7.43	mg/l
		Temperature	R	15.6 @ lab	C
		Iron, total	R	313	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	12	mg/l
		Sulphate	R	134	mg/l
		TDS (gravimetric)	R	848	mg/l
		Manganese, total	R	18	ug/l
		Calcium, total	R	123	mg/l
		E coli (Filtration) (Environmental Waters)	R	840	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	840	cfu/100ml
		Alkalinity Total by Autotitration	R	490	mg/l CaCO ₃



Approved by:

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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
692270	RP-2-05S. 20/07/16	Good condition	20/07/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306107
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 19/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700859	BH3/06. 24/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	51	mg/l
		COD	R	37	mg/l
		pH	R	6.8	pH Units
		Ammonia as NH3-N	R	0.188	mg/l
		Phosphorus as PO4-P	R	0.023	mg/l
		Copper, total	R	14	ug/l
		Sodium, total	R	16	mg/l
		Chloride	R	32.4	mg/l
		Nitrate as NO3	R	<0.44	mg/l
		Temperature	R	16.7 @ lab	C
		Iron, total	R	831	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	40.7	mg/l
		Chromium hexavalent in water	S	0.005	mg/l
		TDS (gravimetric)	R	311	mg/l
		Arsenic, total	R	0.8	ug/l
		Manganese, total	R	293	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	3	ug/l
		Calcium, total	R	48	mg/l
		Nickel, total	R	2	ug/l
		Lead, total	R	8	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	51	ug/l
		Selenium, total	R	0.6	ug/l
		Molybdenum, total	R	1	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	1	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	1	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	115 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	131	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

**Barbara Lee
Environmental**

Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013 , (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
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700859	BH3/06. 24/08/16	Good condition	24/08/2016
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CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306106
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 22/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700858	BH3/17. 24/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	209	mg/l
		COD	R	14	mg/l
		pH	R	6.6	pH Units
		Ammonia as NH3-N	R	0.099	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	22	ug/l
		Sodium, total	R	14	mg/l
		Chloride	R	22.4	mg/l
		Nitrate as NO3	R	2.75	mg/l
		Temperature	R	17.2 @ lab	C
		Iron, total	R	Cannot be reported - unknown matrix interference	ug/l
		Potassium, total	R	5	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	17.4	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	114	mg/l
		Arsenic, total	R	3	ug/l
		Manganese, total	R	447	ug/l
		Zinc, total	R	28	ug/l
		Chromium, total	R	10	ug/l
		Calcium, total	R	32	mg/l
		Nickel, total	R	10	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	228	ug/l
		Selenium, total	R	0.8	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	24	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	24	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	146 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	81.2	mg/l CaCO3



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700858	BH3/17. 24/08/16	Good condition	24/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306105
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 14/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700857	BH3/48. 24/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.5	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	0.095	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	26	mg/l
		Chloride	R	38.8	mg/l
		Nitrate as NO3	R	14.1	mg/l
		Temperature	R	18.0 @ lab	C
		Iron, total	R	43	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	20.4	mg/l
		Chromium hexavalent in water	S	0.007	mg/l
		TDS (gravimetric)	R	414	mg/l
		Arsenic, total	R	0.6	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	0.5	ug/l
		Calcium, total	R	100	mg/l
		Nickel, total	R	0.6	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	0.6	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	16	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	0.6	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	86	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	86	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	113 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	267	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700857	BH3/48. 24/08/16	Good condition	24/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306104
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 14/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700856	LQMW6. 24/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	131	mg/l
		COD	R	26	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH3-N	R	5.02	mg/l
		Phosphorus as PO4-P	R	0.077	mg/l
		Copper, total	R	5	ug/l
		Sodium, total	R	27	mg/l
		Chloride	R	40	mg/l
		Nitrate as NO3	R	<0.44	mg/l
		Temperature	R	17.8 @ lab	C
		Iron, total	R	8073	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	5	mg/l
		Sulphate	R	174	mg/l
		Chromium hexavalent in water	S	0.004	mg/l
		TDS (gravimetric)	R	684	mg/l
		Arsenic, total	R	2	ug/l
		Manganese, total	R	1591	ug/l
		Zinc, total	R	122	ug/l
		Chromium, total	R	5	ug/l
		Calcium, total	R	196	mg/l
		Nickel, total	R	13	ug/l
		Lead, total	R	5	ug/l
		Antimony, total	R	1	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	54	ug/l
		Selenium, total	R	<0.5	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	248 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	372	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700856	LQMW6. 24/08/16	Good condition	24/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306026
 Date of Receipt : 24/08/2016
 Start Date of Analysis : 24/08/2016
 Date of Report : 19/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700475	MW03. 23/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	23	mg/l
		COD	R	10	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	0.087	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	15	mg/l
		Chloride	R	16.6	mg/l
		Nitrate as NO3	R	<0.44	mg/l
		Temperature	R	18.3 @ lab	C
		Iron, total	R	472	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	16.1	mg/l
		Chromium hexavalent in water	S	0.008	mg/l
		TDS (gravimetric)	R	291	mg/l
		Arsenic, total	R	0.7	ug/l
		Manganese, total	R	129	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	3	ug/l
		Calcium, total	R	103	mg/l
		Nickel, total	R	3	ug/l
		Lead, total	R	3	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	11	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	33	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	33	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	95 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	224	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013 , (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700475	MW03. 23/08/16	Good condition	23/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306025
 Date of Receipt : 24/08/2016
 Start Date of Analysis : 24/08/2016
 Date of Report : 12/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700474	RC133. 23/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	6.8	pH Units
		Ammonia as NH3-N	R	0.014	mg/l
		Phosphorus as PO4-P	R	0.025	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	15	mg/l
		Chloride	R	24.5	mg/l
		Nitrate as NO3	R	3.05	mg/l
		Temperature	R	17.2 @ lab	C
		Iron, total	R	41	ug/l
		Potassium, total	R	0.9	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	21.4	mg/l
		Chromium hexavalent in water	S	0.008	mg/l
		TDS (gravimetric)	R	289	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	127	mg/l
		Nickel, total	R	<0.5	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	13	ug/l
		Selenium, total	R	<0.5	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	45	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	45	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	62 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	370	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700474	RC133. 23/08/16	Good condition	23/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 305866
 Date of Receipt : 23/08/2016
 Start Date of Analysis : 23/08/2016
 Date of Report : 12/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700203	RP-2-01. 22/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Ammonia as NH3-N	R	0.02	mg/l
		Phosphorus as PO4-P	R	0.019	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	14	mg/l
		Chloride	R	28.7	mg/l
		Nitrate as NO3	R	15.4	mg/l
		Temperature	R	17.5 @ lab	C
		Iron, total	R	39	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	30.7	mg/l
		Chromium hexavalent in water	S	0.013	mg/l
		TDS (gravimetric)	R	297	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	89	mg/l
		Nickel, total	R	<0.5	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	15	ug/l
		Selenium, total	R	2	ug/l
		Molybdenum, total	R	0.6	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	85 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	217	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700203	RP-2-01. 22/08/16	Good condition	22/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 305867
 Date of Receipt : 23/08/2016
 Start Date of Analysis : 23/08/2016
 Date of Report : 12/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700204	RP-2-03. 22/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	8	mg/l
		COD	R	<10	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH3-N	R	0.034	mg/l
		Phosphorus as PO4-P	R	0.012	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	57	mg/l
		Chloride	R	36.6	mg/l
		Nitrate as NO3	R	8.77	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	21	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	36.8	mg/l
		Chromium hexavalent in water	S	0.009	mg/l
		TDS (gravimetric)	R	453	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	5	ug/l
		Zinc, total	R	22	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	108	mg/l
		Nickel, total	R	2	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	36	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	2	ug/l
		PRO Water (C5-C12) by GC-FID	R	42	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	250	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	250	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	152 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	318	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

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Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700204	RP-2-03. 22/08/16	Good condition	22/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306103
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 14/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700855	RP-2-05D. 25/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	108	mg/l
		COD	R	21	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH3-N	R	0.017	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	9	ug/l
		Sodium, total	R	18	mg/l
		Chloride	R	33.8	mg/l
		Nitrate as NO3	R	4.34	mg/l
		Temperature	R	18.7 @ lab	C
		Iron, total	R	1757	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	13	mg/l
		Sulphate	R	11	mg/l
		Chromium hexavalent in water	S	0.003	mg/l
		TDS (gravimetric)	R	339	mg/l
		Arsenic, total	R	0.8	ug/l
		Manganese, total	R	60	ug/l
		Zinc, total	R	55	ug/l
		Chromium, total	R	2	ug/l
		Calcium, total	R	110	mg/l
		Nickel, total	R	3	ug/l
		Lead, total	R	18	ug/l
		Antimony, total	R	2	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	23	ug/l
		Selenium, total	R	<0.5	ug/l
		Molybdenum, total	R	1	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	49 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	269	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013 , (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700855	RP-2-05D. 25/08/16	Good condition	25/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 306102
 Date of Receipt : 25/08/2016
 Start Date of Analysis : 25/08/2016
 Date of Report : 14/09/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
700854	RP-2-05S. 25/08/16	BOD	R	<1	mg/l
		Suspended Solids	R	163	mg/l
		COD	R	15	mg/l
		pH	R	6.8	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	5	ug/l
		Sodium, total	R	131	mg/l
		Chloride	R	97.7	mg/l
		Nitrate as NO3	R	8.28	mg/l
		Temperature	R	17.1 @ lab	C
		Iron, total	R	10234	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	13	mg/l
		Sulphate	R	115	mg/l
		Chromium hexavalent in water	S	0.006	mg/l
		TDS (gravimetric)	R	805	mg/l
		Arsenic, total	R	4	ug/l
		Manganese, total	R	520	ug/l
		Zinc, total	R	24	ug/l
		Chromium, total	R	8	ug/l
		Calcium, total	R	145	mg/l
		Nickel, total	R	9	ug/l
		Lead, total	R	4	ug/l
		Antimony, total	R	0.6	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	140	ug/l
		Selenium, total	R	3	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	51**Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<65	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	445	mg/l CaCO3

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Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	No	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
700854	RP-2-05S. 25/08/16	Good condition	25/08/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309829
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 17/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710448	BH 3/06. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	41	mg/l
		COD	R	24	mg/l
		pH	R	6.6	pH Units
		Ammonia as NH ₃ -N	R	0.046	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	12	mg/l
		Chloride	R	16.4	mg/l
		Nitrate as NO ₃	R	1.24	mg/l
		Temperature	R	16.7 @ lab	C
		Iron, total	R	1165	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	2	mg/l
		Sulphate	R	12.8	mg/l
		TDS (gravimetric)	R	170	
		Manganese, total	R	315	ug/l
		Calcium, total	R	32	mg/l
		E coli (Filtration) (Environmental Waters)	R	1	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	1	cfu/100ml
		Alkalinity Total by Autotitration	R	78.7	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710448	BH 3/06. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309830
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 17/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710450	BH 3/17. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	90	mg/l
		COD	R	32	mg/l
		pH	R	6.9	pH Units
		Ammonia as NH ₃ -N	R	0.088	mg/l
		Phosphorus as PO ₄ -P	R	0.022	mg/l
		Sodium, total	R	16	mg/l
		Chloride	R	29	mg/l
		Nitrate as NO ₃	R	30.6	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	1504	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	2	mg/l
		Sulphate	R	14	mg/l
		TDS (gravimetric)	R	655	
		Manganese, total	R	425	ug/l
		Calcium, total	R	44	mg/l
		E coli (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	10	cfu/100ml
		Alkalinity Total by Autotitration	R	114	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710450	BH 3/17. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309828
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 14/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710447	BH 3/48. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	17	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.105	mg/l
		Sodium, total	R	23	mg/l
		Chloride	R	36.6	mg/l
		Nitrate as NO ₃	R	8.84	mg/l
		Temperature	R	16.8 @ lab	C
		Iron, total	R	249	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	18.4	mg/l
		TDS (gravimetric)	R	334	
		Manganese, total	R	23	ug/l
		Calcium, total	R	111	mg/l
		E coli (Filtration) (Environmental Waters)	R	26	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	26	cfu/100ml
		Alkalinity Total by Autotitration	R	295	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710447	BH 3/48. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309826
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 17/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710444	LQMW6. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	17	mg/l
		COD	R	13	mg/l
		pH	R	6.9	pH Units
		Ammonia as NH ₃ -N	R	6.44	mg/l
		Phosphorus as PO ₄ -P	R	0.075	mg/l
		Sodium, total	R	32	mg/l
		Chloride	R	33.4	mg/l
		Nitrate as NO ₃	R	0.884	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	199	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	119	mg/l
		TDS (gravimetric)	R	622	mg/l
		Manganese, total	R	650	ug/l
		Calcium, total	R	181	mg/l
		E coli (Filtration) (Environmental Waters)	R	31	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	31	cfu/100ml
		Alkalinity Total by Autotitration	R	409	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710444	LQMW6. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309823
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 11/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710441	MW03. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	5	mg/l
		COD	R	14	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	0.02	mg/l
		Phosphorus as PO ₄ -P	R	0.011	mg/l
		Sodium, total	R	13	mg/l
		Chloride	R	22.1	mg/l
		Nitrate as NO ₃	R	0.879	mg/l
		Temperature	R	15.9 @ lab	C
		Iron, total	R	39	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	5.51	mg/l
		TDS (gravimetric)	R	530	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	140	mg/l
		E coli (Filtration) (Environmental Waters)	R	65	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	65	cfu/100ml
		Alkalinity Total by Autotitration	R	395	mg/l CaCO ₃



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Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710441	MW03. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309824
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 11/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710442	RC133. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	14	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.093	mg/l
		Sodium, total	R	12	mg/l
		Chloride	R	15.3	mg/l
		Nitrate as NO ₃	R	6.99	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	<10	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	12.9	mg/l
		TDS (gravimetric)	R	230	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	81	mg/l
		E coli (Filtration) (Environmental Waters)	R	63	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	63	cfu/100ml
		Alkalinity Total by Autotitration	R	225	mg/l CaCO ₃



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710442	RC133. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309827
 Date of Receipt : 30/09/2016
 Start Date of Analysis : 30/09/2016
 Date of Report : 17/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
710445	RP-2-01. 29/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	66	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	16	mg/l
		Chloride	R	28.9	mg/l
		Nitrate as NO ₃	R	9.99	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	1240	ug/l
		Potassium, total	R	3	mg/l
		Magnesium, total	R	7	mg/l
		Sulphate	R	27.3	mg/l
		TDS (gravimetric)	R	417	mg/l
		Manganese, total	R	23	ug/l
		Calcium, total	R	110	mg/l
		E coli (Filtration) (Environmental Waters)	R	8	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	8	cfu/100ml
		Alkalinity Total by Autotitration	R	256	mg/l CaCO ₃



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
710445	RP-2-01. 29/09/16	Good condition	29/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309467
 Date of Receipt : 28/09/2016
 Start Date of Analysis : 28/09/2016
 Date of Report : 11/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
709669	RP-2-03. 28/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	11	mg/l
		COD	R	13	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	29	mg/l
		Chloride	R	30.1	mg/l
		Nitrate as NO ₃	R	6.69	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	136	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	25.8	mg/l
		TDS (gravimetric)	R	443	mg/l
		Manganese, total	R	17	ug/l
		Calcium, total	R	118	mg/l
		E coli (Filtration) (Environmental Waters)	R	158est	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	158est	cfu/100ml
		Alkalinity Total by Autotitration	R	339	mg/l CaCO ₃

**Note: est means that results obtained were calculated from plates containing greater than 100 colonies



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Barbara Lee

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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
709669	RP-2-03. 28/09/16	Good condition	28/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309469
 Date of Receipt : 28/09/2016
 Start Date of Analysis : 28/09/2016
 Date of Report : 11/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
709671	RP-2-05D. 28/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	25	mg/l
		COD	R	11	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH ₃ -N	R	0.043	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	19	mg/l
		Chloride	R	30.5	mg/l
		Nitrate as NO ₃	R	2.65	mg/l
		Temperature	R	16.5 @ lab	C
		Iron, total	R	72	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	12	mg/l
		Sulphate	R	12	mg/l
		TDS (gravimetric)	R	32	mg/l
		Manganese, total	R	8	ug/l
		Calcium, total	R	89	mg/l
		E coli (Filtration) (Environmental Waters)	R	150est	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	150est	cfu/100ml
		Alkalinity Total by Autotitration	R	258	mg/l CaCO ₃

**Note: est means that results obtained were calculated from plates containing greater than 100 colonies



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
709671	RP-2-05D. 28/09/16	Good condition	28/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 309468
 Date of Receipt : 28/09/2016
 Start Date of Analysis : 28/09/2016
 Date of Report : 17/10/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
709670	RP-2-05S. 28/09/16	BOD	R	<1	mg/l
		Suspended Solids	R	162	mg/l
		COD	R	14	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	0.028	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	134	mg/l
		Chloride	R	67.5	mg/l
		Nitrate as NO ₃	R	3.61	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	1842	ug/l
		Potassium, total	R	4	mg/l
		Magnesium, total	R	11	mg/l
		Sulphate	R	98.2	mg/l
		TDS (gravimetric)	R	664	mg/l
		Manganese, total	R	220	ug/l
		Calcium, total	R	164	mg/l
		E coli (Filtration) (Environmental Waters)	R	99	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	99	cfu/100ml
		Alkalinity Total by Autotitration	R	476	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
709670	RP-2-05S. 28/09/16	Good condition	28/09/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314057
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 24/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719842	BH 3/04. 02/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	18	mg/l
		COD	R	77	mg/l
		pH	R	6.4	pH Units
		Ammonia as NH ₃ -N	R	0.029	mg/l
		Phosphorus as PO ₄ -P	R	0.013	mg/l
		Sodium, total	R	22	mg/l
		Chloride	R	29.6	mg/l
		Nitrate as NO ₃	R	0.44	mg/l
		Temperature	R	16.1 @ lab	C
		Iron, total	R	1083	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	11.7	mg/l
		TDS (gravimetric)	R	151	mg/l
		Manganese, total	R	264	ug/l
		Calcium, total	R	61	mg/l
		E coli (Filtration) (Environmental Waters)	R	9	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	9	cfu/100ml
		Alkalinity Total by Autotitration	R	184	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719842	BH 3/04. 02/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314058
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 25/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719843	BH 3/18. 03/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	240	mg/l
		COD	R	13	mg/l
		pH	R	6.6	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	16	mg/l
		Chloride	R	24.3	mg/l
		Nitrate as NO ₃	R	3.92	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	2632	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	7.56	mg/l
		TDS (gravimetric)	R	346	mg/l
		Manganese, total	R	822	ug/l
		Calcium, total	R	36	mg/l
		E coli (Filtration) (Environmental Waters)	R	21	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	21	cfu/100ml
		Alkalinity Total by Autotitration	R	106	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719843	BH 3/18. 03/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314053
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 24/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719838	BH 3/38. 03/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	52	mg/l
		COD	R	33	mg/l
		pH	R	6.9	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.201	mg/l
		Sodium, total	R	38	mg/l
		Chloride	R	45.5	mg/l
		Nitrate as NO ₃	R	39.9	mg/l
		Temperature	R	16.1 @ lab	C
		Iron, total	R	353	ug/l
		Potassium, total	R	7	mg/l
		Magnesium, total	R	5	mg/l
		Sulphate	R	20.6	mg/l
		TDS (gravimetric)	R	331	mg/l
		Manganese, total	R	100	ug/l
		Calcium, total	R	137	mg/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Alkalinity Total by Autotitration	R	363	mg/l CaCO ₃



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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719838	BH 3/38. 03/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314054
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 24/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719839	BH 3/41. 02/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	2417	mg/l
		COD	R	90	mg/l
		pH	R	7.0	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	20	mg/l
		Chloride	R	15.9	mg/l
		Nitrate as NO ₃	R	4.23	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	586	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	7	mg/l
		Sulphate	R	7.94	mg/l
		TDS (gravimetric)	R	98	mg/l
		Manganese, total	R	172	ug/l
		Calcium, total	R	124	mg/l
		E coli (Filtration) (Environmental Waters)	R	6	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	6	cfu/100ml
		Alkalinity Total by Autotitration	R	818	mg/l CaCO ₃



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Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719839	BH 3/41. 02/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314055
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 24/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719840	BH 3/42. 02/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	1018	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	24	mg/l
		Chloride	R	34.4	mg/l
		Nitrate as NO ₃	R	2.46	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	791	ug/l
		Potassium, total	R	23	mg/l
		Magnesium, total	R	23	mg/l
		Sulphate	R	31.4	mg/l
		TDS (gravimetric)	R	181	mg/l
		Manganese, total	R	229	ug/l
		Calcium, total	R	484	mg/l
		E coli (Filtration) (Environmental Waters)	R	36	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	36	cfu/100ml
		Alkalinity Total by Autotitration	R	653	mg/l CaCO ₃



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Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719840	BH 3/42. 02/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314056
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 24/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719841	GCR1. 03/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	41	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH ₃ -N	R	0.092	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	15	mg/l
		Chloride	R	19	mg/l
		Nitrate as NO ₃	R	1.06	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	3891	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	12	mg/l
		Sulphate	R	<5	mg/l
		TDS (gravimetric)	R	173	mg/l
		Manganese, total	R	251	ug/l
		Calcium, total	R	99	mg/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Alkalinity Total by Autotitration	R	328	mg/l CaCO ₃



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Environmental
Scientist

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It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719841	GCR1. 03/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314052
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 14/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719837	LQMW4. 03/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	15	mg/l
		COD	R	<10	mg/l
		pH	R	7.8	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Sodium, total	R	6	mg/l
		Chloride	R	9.08	mg/l
		Nitrate as NO ₃	R	5.40	mg/l
		Temperature	R	16.3 @ lab	C
		Iron, total	R	61	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	25.2	mg/l
		TDS (gravimetric)	R	132	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	40	mg/l
		E coli (Filtration) (Environmental Waters)	R	20	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	20	cfu/100ml
		Alkalinity Total by Autotitration	R	89.0	mg/l CaCO ₃



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Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719837	LQMW4. 03/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 314051
 Date of Receipt : 03/11/2016
 Start Date of Analysis : 03/11/2016
 Date of Report : 14/11/2016
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
719836	RC 133. 03/11/16	BOD	R	<1	mg/l
		Suspended Solids	R	5	mg/l
		COD	R	<10	mg/l
		pH	R	7.2	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.072	mg/l
		Sodium, total	R	15	mg/l
		Chloride	R	17.9	mg/l
		Nitrate as NO ₃	R	31.6	mg/l
		Temperature	R	16.1 @ lab	C
		Iron, total	R	<10	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	23.3	mg/l
		TDS (gravimetric)	R	708	mg/l
		Manganese, total	R	<5	ug/l
		Calcium, total	R	91	mg/l
		E coli (Filtration) (Environmental Waters)	R	16	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	16	cfu/100ml
		Alkalinity Total by Autotitration	R	241	mg/l CaCO ₃



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
719836	RC 133. 03/11/16	Good condition	03/11/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317062
 Date of Receipt : 07/12/2016
 Start Date of Analysis : 07/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
727801	BH 3/04. 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	7	mg/l
		COD	R	44	mg/l
		pH	R	6.6	pH Units
		Ammonia as NH3-N	R	0.075	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	21	mg/l
		Chloride	R	32.4	mg/l
		Nitrate as NO3	R	0.889	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	2990	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	4	mg/l
		Sulphate	R	11.4	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	269	mg/l
		Arsenic, total	R	1	ug/l
		Manganese, total	R	610	ug/l
		Zinc, total	R	7	ug/l
		Chromium, total	R	1	ug/l
		Calcium, total	R	58	mg/l
		Nickel, total	R	1	ug/l
		Lead, total	R	4	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	463	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	28	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	28	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	50 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	340.6	ug/l
		Mercury, total (in water)	S	<0.1	ug/l
		Alkalinity Total by Autotitration	R	184	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land	N/A	N/A	N/A	Yes	Yes

	Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
727801	BH 3/04. 06/12/16	Good condition	06/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317063
 Date of Receipt : 07/12/2016
 Start Date of Analysis : 07/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
727802	BH 3/18. 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	155	mg/l
		COD	R	<10	mg/l
		pH	R	6.7	pH Units
		Ammonia as NH3-N	R	<0.005	mg/l
		Phosphorus as PO4-P	R	0.014	mg/l
		Copper, total	R	15	ug/l
		Sodium, total	R	15	mg/l
		Chloride	R	26.2	mg/l
		Nitrate as NO3	R	2.95	mg/l
		Temperature	R	16.6 @ lab	C
		Iron, total	R	3308	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	7.38	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	74	mg/l
		Arsenic, total	R	1	ug/l
		Manganese, total	R	783	ug/l
		Zinc, total	R	22	ug/l
		Chromium, total	R	5	ug/l
		Calcium, total	R	37	mg/l
		Nickel, total	R	6	ug/l
		Lead, total	R	29	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	1	ug/l
		Barium, total	R	58	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	68	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	54 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.1	ug/l
		Alkalinity Total by Autotitration	R	95.6	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

**Barbara Lee
Environmental**

Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in	CV-AFS, WAS013 ,	N/A	N/A	N/A	Yes	Yes

water)	(Accredited in Trade Effluent, Sewage, Land Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
727802	BH 3/18. 06/12/16	Good condition	06/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317066
 Date of Receipt : 07/12/2016
 Start Date of Analysis : 07/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
727805	BH 3/38. 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	246	mg/l
		COD	R	<10	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH3-N	R	0.039	mg/l
		Phosphorus as PO4-P	R	0.18	mg/l
		Copper, total	R	16	ug/l
		Sodium, total	R	43	mg/l
		Chloride	R	63.6	mg/l
		Nitrate as NO3	R	23.7	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	2034	ug/l
		Potassium, total	R	8	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	23.2	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	332	mg/l
		Arsenic, total	R	3	ug/l
		Manganese, total	R	569	ug/l
		Zinc, total	R	26	ug/l
		Chromium, total	R	7	ug/l
		Calcium, total	R	132	mg/l
		Nickel, total	R	44	ug/l
		Lead, total	R	6	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	1	ug/l
		Barium, total	R	40	ug/l
		Selenium, total	R	4	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	96	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	96	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	187 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	0.2	ug/l
		Alkalinity Total by Autotitration	R	360	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land	N/A	N/A	N/A	Yes	Yes

	Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
727805	BH 3/38. 06/12/16	Good condition	06/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317316
 Date of Receipt : 08/12/2016
 Start Date of Analysis : 08/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
728553	BH 3/41. 07/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	1962	mg/l
		COD	R	31	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	<0.01	mg/l
		Copper, total	R	21	ug/l
		Sodium, total	R	19	mg/l
		Chloride	R	21.9	mg/l
		Nitrate as NO ₃	R	2.43	mg/l
		Temperature	R	15.6 @ lab	C
		Iron, total	R	18361	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	9	mg/l
		Sulphate	R	<5	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	319	mg/l
		Arsenic, total	R	1	ug/l
		Manganese, total	R	766	ug/l
		Zinc, total	R	79	ug/l
		Chromium, total	R	14	ug/l
		Calcium, total	R	423	mg/l
		Nickel, total	R	43	ug/l
		Lead, total	R	21	ug/l
		Antimony, total	R	1	ug/l
		Cadmium, total	R	2	ug/l
		Barium, total	R	110	ug/l
		Selenium, total	R	2	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	15	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	95 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	504	mg/l CaCO ₃

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	No	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land	N/A	N/A	N/A	Yes	Yes

	Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
728553	BH 3/41. 07/12/16	Good condition	07/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317317
 Date of Receipt : 08/12/2016
 Start Date of Analysis : 08/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
728554	BH 3/42. 07/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	1345	mg/l
		COD	R	40	mg/l
		pH	R	7.1	pH Units
		Ammonia as NH3-N	R	0.032	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	6	ug/l
		Sodium, total	R	22	mg/l
		Chloride	R	35.2	mg/l
		Nitrate as NO3	R	0.577	mg/l
		Temperature	R	15.8 @ lab	C
		Iron, total	R	1646	ug/l
		Potassium, total	R	20	mg/l
		Magnesium, total	R	15	mg/l
		Sulphate	R	25.9	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	493	mg/l
		Arsenic, total	R	1	ug/l
		Manganese, total	R	134	ug/l
		Zinc, total	R	27	ug/l
		Chromium, total	R	3	ug/l
		Calcium, total	R	210	mg/l
		Nickel, total	R	11	ug/l
		Lead, total	R	4	ug/l
		Antimony, total	R	1	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	86	ug/l
		Selenium, total	R	1	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	139est	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	139est	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	130 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	475	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited

** Note: est means that results obtained were calculated from plates containing greater than 100 colonies



**Barbara Lee
 Environmental
 Scientist**

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 * Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.
 It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No

Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013 , (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
728554	BH 3/42. 07/12/16	Good condition	07/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317318
 Date of Receipt : 08/12/2016
 Start Date of Analysis : 08/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
728555	GCR1. 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	11	mg/l
		COD	R	<10	mg/l
		pH	R	7.3	pH Units
		Ammonia as NH3-N	R	0.554	mg/l
		Phosphorus as PO4-P	R	0.012	mg/l
		Copper, total	R	7	ug/l
		Sodium, total	R	14	mg/l
		Chloride	R	19.1	mg/l
		Nitrate as NO3	R	0.638	mg/l
		Temperature	R	15.6 @ lab	C
		Iron, total	R	1485	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	11	mg/l
		Sulphate	R	<5	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	333	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	141	ug/l
		Zinc, total	R	56	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	93	mg/l
		Nickel, total	R	1	ug/l
		Lead, total	R	12	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	76	ug/l
		Selenium, total	R	<0.5	ug/l
		Molybdenum, total	R	2	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	158 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.10	ug/l
		Alkalinity Total by Autotitration	R	310	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade Effluent, Sewage, Land Leachate)	N/A	N/A	N/A	Yes	Yes

Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No
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¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
728555	GCR1. 06/12/16	Good condition	08/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317064
 Date of Receipt : 07/12/2016
 Start Date of Analysis : 07/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
727803	LQMW4 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	9	mg/l
		COD	R	<10	mg/l
		pH	R	7.9	pH Units
		Ammonia as NH3-N	R	0.137	mg/l
		Phosphorus as PO4-P	R	<0.01	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	10	mg/l
		Chloride	R	18.5	mg/l
		Nitrate as NO3	R	1.47	mg/l
		Temperature	R	16.4 @ lab	C
		Iron, total	R	148	ug/l
		Potassium, total	R	1	mg/l
		Magnesium, total	R	6	mg/l
		Sulphate	R	40.6	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	189	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	7	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	45	mg/l
		Nickel, total	R	14	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	14	ug/l
		Selenium, total	R	2	ug/l
		Molybdenum, total	R	2	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	13	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	117 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.1	ug/l
		Alkalinity Total by Autotitration	R	103	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

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* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP / FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013 , (Accredited in Trade	N/A	N/A	N/A	Yes	Yes

	Effluent, Sewage, Land Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
727803	LQMW4 06/12/16	Good condition	06/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 317065
 Date of Receipt : 07/12/2016
 Start Date of Analysis : 07/12/2016
 Date of Report : 09/01/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	*	Result	Units
727804	RC 133 06/12/16	BOD	R	<1	mg/l
		Suspended Solids	R	<2	mg/l
		COD	R	<10	mg/l
		pH	R	7.4	pH Units
		Ammonia as NH ₃ -N	R	<0.005	mg/l
		Phosphorus as PO ₄ -P	R	0.079	mg/l
		Copper, total	R	<1	ug/l
		Sodium, total	R	16	mg/l
		Chloride	R	23.3	mg/l
		Nitrate as NO ₃	R	14.1	mg/l
		Temperature	R	16.2 @ lab	C
		Iron, total	R	<10	ug/l
		Potassium, total	R	2	mg/l
		Magnesium, total	R	3	mg/l
		Sulphate	R	29.8	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		TDS (gravimetric)	R	108	mg/l
		Arsenic, total	R	<0.5	ug/l
		Manganese, total	R	<5	ug/l
		Zinc, total	R	<5	ug/l
		Chromium, total	R	<0.5	ug/l
		Calcium, total	R	83	mg/l
		Nickel, total	R	<0.5	ug/l
		Lead, total	R	<0.5	ug/l
		Antimony, total	R	<0.5	ug/l
		Cadmium, total	R	<0.5	ug/l
		Barium, total	R	7	ug/l
		Selenium, total	R	2	ug/l
		Molybdenum, total	R	<0.5	ug/l
		PRO Water (C5-C12) by GC-FID	R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	R	<10	ug/l
		MTBE by GC-FID	R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	R	63	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	R	63	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	R	95 ** Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S	<0.1	ug/l
		Alkalinity Total by Autotitration	R	224	mg/l CaCO ₃

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of Complete Laboratory Solutions.

* Location of analysis: R=Ros Muc, M=MedPharma, S=Subcontracted.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

Test	Specification	CLS 17025 status	GMP/FDA ¹	ISO ²	Sub ³	Sub 17025 Status
BOD	CLS 12	Yes	No	Yes	No	No
Suspended Solids	CLS 13	Yes	No	Yes	No	No
COD	CLS 52	Yes	No	Yes	No	No
pH	CLS 26	Yes	No	Yes	No	No
Ammonia as NH ₃ -N	Konelab CLS 40	Yes	No	Yes	No	No
Phosphorus as PO ₄ -P	Konelab CLS 35	Yes	No	Yes	No	No
Copper, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Sodium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Chloride	Konelab CLS 36	Yes	No	Yes	No	No
Nitrate as NO ₃	Konelab CLS 39	Yes	No	Yes	No	No
Temperature	Probe	No	No	Yes	No	No
Iron, total	ICP-MS CLS129	Yes	No	Yes	No	No
Potassium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Magnesium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Sulphate	Konelab CLS 88	Yes	No	Yes	No	No
Chromium hexavalent in water	WAS031 Colorimetry (Accredited in trade effluent and land leachate only.)	N/A	N/A	N/A	Yes	No
TDS (gravimetric)	CLS 93	No	No	Yes	No	No
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Manganese, total	ICP-MS CLS129	Yes	No	Yes	No	No
Zinc, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Chromium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Calcium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Nickel, total	ICP-MS CLS129	Yes	No	Yes	No	No
Lead, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Antimony, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes	No	No
Barium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Selenium, total	ICP-MS CLS129	Yes	No	Yes	No	No
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes	No	No
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes	No	No
BTEX (Benzene, Toluene, Ethylbenzene m,p- & o-Xyl)	CLS 148	Yes	No	Yes	No	No
MTBE by GC-FID	CLS 148	Yes	No	Yes	No	No
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes	No	No
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes	No	No
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes	No	No
Mercury, total (in water)	CV-AFS, WAS013, (Accredited in Trade	N/A	N/A	N/A	Yes	Yes

	Effluent, Sewage, Land Leachate)					
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes	No	No

¹Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

²Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

³Subcontracted.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
727804	RC 133 06/12/16	Good condition	06/12/2016

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 326542
 Date of Receipt : 11/04/2017
 Start Date of Analysis : 11/04/2017
 Date of Report : 05/05/2017
 Order Number :
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
756845	Ballinafoyle Lough. 11/04/17	BOD	I, R	<1	mg/l
		Suspended Solids	I, R	2	mg/l
		COD	I, R	16	mg/l
		pH	I, R	7.8	pH Units
		Ammonia as NH3-N	I, R	0.065	mg/l
		Phosphorus as PO4-P	I, R	0.034	mg/l
		Copper, total	I, R	<1	ug/l
		Sodium, total	I, R	29	mg/l
		Chloride	I, R	51.1	mg/l
		Nitrate as NO3	I, R	<0.44	mg/l
		Temperature	R	16.4 @ Lab	C
		Iron, total	I, R	53	ug/l
		Potassium, total	I, R	2	mg/l
		Magnesium, total	I, R	3	mg/l
		Sulphate	I, R	11.2	mg/l
		Chromium hexavalent in water	S,	<0.003	mg/l
		TDS (gravimetric)	R	274	mg/l
		Arsenic, total	I, R	<0.5	ug/l
		Manganese, total	I, R	9	ug/l
		Zinc, total	I, R	<5	ug/l
		Chromium, total	I, R	<0.5	ug/l
		Calcium, total	I, R	83	mg/l
		Nickel, total	I, R	<0.5	ug/l
		Lead, total	I, R	<0.5	ug/l
		Antimony, total	I, R	<0.5	ug/l
		Cadmium, total	I, R	<0.5	ug/l
		Barium, total	I, R	16	ug/l
		Selenium, total	I, R	<0.5	ug/l
		Molybdenum, total	I, R	0.5	ug/l
		PRO Water (C5-C12) by GC-FID	I, R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	I, R	<10	ug/l
		MTBE by GC-FID	I, R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	I, R	0	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I, R	0	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	I, R	160 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	<130	ug/l
		Mercury, total (in water)	S,	0.03	ug/l
		Alkalinity Total by Autotitration	I, R	239	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



**Barbara Lee
 Environmental
 Scientist**

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

In-House Test	Specification	17025	GMP/FDA*	ISO**
BOD	CLS 12	Yes	No	Yes
Suspended Solids	CLS 13	Yes	No	Yes
COD	CLS 52	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes
Copper, total	ICP-MS CLS 129	Yes	No	Yes
Sodium, total	ICP-MS CLS129	Yes	No	Yes
Chloride	Konelab CLS 36	Yes	No	Yes
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes
Temperature	Probe	No	No	Yes
Iron, total	ICP-MS CLS129	Yes	No	Yes
Potassium, total	ICP-MS CLS129	Yes	No	Yes
Magnesium, total	ICP-MS CLS129	Yes	No	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes
TDS (gravimetric)	CLS 93	No	No	Yes
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes
Manganese, total	ICP-MS CLS129	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	Yes	No	Yes
Chromium, total	ICP-MS CLS129	Yes	No	Yes
Calcium, total	ICP-MS CLS129	Yes	No	Yes
Nickel, total	ICP-MS CLS129	Yes	No	Yes
Lead, total	ICP-MS CLS 129	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes
Barium, total	ICP-MS CLS129	Yes	No	Yes
Selenium, total	ICP-MS CLS129	Yes	No	Yes
Molybdenum, total	ICP-MS CLS129	Yes	No	Yes
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes
MTBE by GC-FID	CLS 148	Yes	No	Yes
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
756845	Ballinafoyle Lough. 11/04/17	Good condition	11/04/2017

CERTIFICATE OF ANALYSIS

Client : Dr. Les Brown, Senior Hydrogeologist
 Arup
 50 Ringsend Road
 Dublin 4

Report No. : 322778
 Date of Receipt : 27/02/2017
 Start Date of Analysis : 27/02/2017
 Date of Report : 16/03/2017
 Order Number : SC004704
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
745665	K31. 27/02/17	BOD	I, R	<1	mg/l
		Suspended Solids	I, R	7	mg/l
		COD	I, R	10	mg/l
		pH	I, R	7.6	pH Units
		Ammonia as NH3-N	I, R	0.005	mg/l
		Phosphorus as PO4-P	I, R	0.056	mg/l
		Copper, total	I, R	6	ug/l
		Sodium, total	I, R	16	mg/l
		Chloride	I, R	26.4	mg/l
		Nitrate as NO3	I, R	7.64	mg/l
		Temperature	R	16.1 @ lab	C
		Iron, total	I, R	<10	ug/l
		Potassium, total	I, R	2	mg/l
		Magnesium, total	I, R	3	mg/l
		Sulphate	I, R	15.5	mg/l
		Chromium hexavalent in water	S,	<0.003	mg/l
		TDS (gravimetric)	R	264	mg/l
		Arsenic, total	I, R	<0.5	ug/l
		Manganese, total	I, R	<5	ug/l
		Zinc, total	I, R	<5	ug/l
		Chromium, total	I, R	<0.5	ug/l
		Calcium, total	I, R	84	mg/l
		Nickel, total	I, R	<0.5	ug/l
		Lead, total	I, R	<0.5	ug/l
		Antimony, total	I, R	<0.5	ug/l
		Cadmium, total	I, R	<0.5	ug/l
		Barium, total	I, R	6	ug/l
		Selenium, total	I, R	0.9	ug/l
		Molybdenum, total	I, R	0.6	ug/l
		PRO Water (C5-C12) by GC-FID	I, R	<10	ug/l
		BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl	I, R	<10	ug/l
		MTBE by GC-FID	I, R	<10	ug/l
		E coli (Filtration) (Environmental Waters)	I, R	58	cfu/100ml
		Total Coliforms (Filtration) (Environmental Waters)	I, R	58	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	I, R	144 **Unknown Pattern	ug/l
		Mineral Oil (Total Aliphatics C8-C44)	R	96.9	ug/l
		Mercury, total (in water)	S,	<0.1	ug/l
		Alkalinity Total by Autotitration	I, R	218	mg/l CaCO3

** Note: The comment expressed here is an interpretation and is not INAB accredited



Approved by:

Barbara Lee

Barbara Lee
Environmental
Scientist

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling.

In-House Test	Specification	17025	GMP/FDA*	ISO**
BOD	CLS 12	Yes	No	Yes
Suspended Solids	CLS 13	Yes	No	Yes
COD	CLS 52	Yes	No	Yes
pH	CLS 26	Yes	No	Yes
Ammonia as NH3-N	Konelab CLS 40	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	Yes	No	Yes
Copper, total	ICP-MS CLS 129	Yes	No	Yes
Sodium, total	ICP-MS CLS 129	Yes	No	Yes
Chloride	Konelab CLS 36	Yes	No	Yes
Nitrate as NO3	Konelab CLS 39	Yes	No	Yes
Temperature	Probe	No	No	Yes
Iron, total	ICP-MS CLS 129	Yes	No	Yes
Potassium, total	ICP-MS CLS 129	Yes	No	Yes
Magnesium, total	ICP-MS CLS 129	Yes	No	Yes
Sulphate	Konelab CLS 88	Yes	No	Yes
TDS (gravimetric)	CLS 93	No	No	Yes
Arsenic, total	ICP-MS CLS 129	Yes	No	Yes
Manganese, total	ICP-MS CLS 129	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	Yes	No	Yes
Chromium, total	ICP-MS CLS 129	Yes	No	Yes
Calcium, total	ICP-MS CLS 129	Yes	No	Yes
Nickel, total	ICP-MS CLS 129	Yes	No	Yes
Lead, total	ICP-MS CLS 129	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	Yes	No	Yes
Barium, total	ICP-MS CLS 129	Yes	No	Yes
Selenium, total	ICP-MS CLS 129	Yes	No	Yes
Molybdenum, total	ICP-MS CLS 129	Yes	No	Yes
PRO Water (C5-C12) by GC-FID	CLS 148	Yes	No	Yes
BTEX (Benzene, Toluene, Ethylbenzene, m,p- & o-Xyl)	CLS 148	Yes	No	Yes
MTBE by GC-FID	CLS 148	Yes	No	Yes
E coli (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	Yes	No	Yes
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	Yes	No	Yes
Mineral Oil (Total Aliphatics C8-C44)	CLS 196 GC-GC-FID	No	No	Yes
Alkalinity Total by Autotitration	CLS 195	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Technical Backup, Training, Food Safety Program Auditing and Monitoring are all ISO 9001:2008 certified (Ros Muc site only).

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
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745665	K31. 27/02/17	Good condition	27/02/2017
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A.10.4 Groundwater Quality Monitoring 2024

CERTIFICATE OF ANALYSIS

Client : Gerry Baker
 ARUP
 50 Ringsend Road
 Dublin
 D04 T6X0

Report No. : 565731
 Date of Receipt : 19/07/2024
 Start Date of Analysis : 22/07/2024
 Date of Report : 09/08/2024
 Order Number : None given
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
1767890	BH3/48	E.coli (Filtration)	I,R	>100	cfu/100ml
		Suspended Solids	I,R	8	mg/l
		TON as N	I,R	2.46	mg/l
		COD	I,R	<10	mg/l
		pH	I,R	7.3	pH Units
		Conductivity @20C	I,R	746	uS/cm
		Nitrate as N Calculated	I,R	2.46	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		Sodium, total	I,R	70	mg/l
		Chloride	I,R	94.1	mg/l
		Total dissolved solids	R	376	mg/l
		Temperature	F,R	3.2@lab	°C
		Potassium, total	I,R	6	mg/l
		Magnesium, total	I,R	4	mg/l
		Sulphate (SO4)	I,R	42.2	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		Orthophosphate as PO4-P	I,R	0.088	mg/l
		Ammonia as N	I,R	0.046	mg/l
		Calcium, total	I,R	96	mg/l
		Iron, dissolved	I,R	<10	ug/l
		Manganese, dissolved	I,R	<5	ug/l
		Copper, dissolved	I,R	<1	ug/l
		Lead, dissolved	I,R	<0.5	ug/l
		Chromium, dissolved	I,R	<0.5	ug/l
		Nickel, dissolved	I,R	1	ug/l
		Cadmium, dissolved	I,R	<0.5	ug/l
		Arsenic, dissolved	I,R	1	ug/l
		Mercury, dissolved	I,R	<0.05	ug/l
		Antimony, dissolved	I,R	<0.5	ug/l
		Selenium, dissolved	I,R	2	ug/l
		Zinc, dissolved	I,R	<5	ug/l
		Barium, dissolved	I,R	18	ug/l
		Mineral Oil (by calculation)	R	9	ug/l
		MTBE (Water) by GC-FID	I,R	<10	ug/l
		Molybdenum, dissolved	I,R	4	ug/l
		Total Coliforms (Filtration) (Environmental Waters)	I,R	>100	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	I,R	<10 **Unknown Pattern	ug/l
		TPH (>C5 - C44) by GC-FID	I,R	54 **Unknown Pattern	ug/l
		Alkalinity Total by Autotitration	I,R	233	mg/l CaCO3
		Benzene (Water) by GC-FID	I,R	<10	ug/l
		Ethylbenzene (Water) by GC-FID	I,R	<10	ug/l
		Toluene (Water) by GCFID	I,R	<10	ug/l
		m and p- Xylene (Water) by GC-FID	I,R	<20	ug/l

		o-Xylene (Water) by GC-FID	I,R	<10	ug/l
		BOD Automated	I,R	<1	mg/l



Approved by:

Ann Marie Nee

AnnMarie Nee
Environmental Account
Manager

See below for test specifications and accreditation status.

This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.

Ocfu is reported in waters, this refers to 'not detected in volume tested'

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling. CLS will test food, water and swabs samples within 24 hours of receipt.

Where samples have been taken by the Client, results apply to the samples as received.

In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
E.coli (Filtration)	CLS 16	±0.17 cfu/100ml	Yes	No	Yes
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Conductivity @20C	CLS 67	+/- 4.92 %	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Sodium, total	ICP-MS CLS129	+/- 11.62 %	Yes	No	Yes
Chloride	Konelab CLS 36	+/- 12.10 %	Yes	No	Yes
Total dissolved solids	CLS 68	0	No	No	Yes
Temperature	Probe	+/- 0.1 °C	No	No	Yes
Potassium, total	ICP-MS CLS129	+/-0.53@5mg/l	Yes	No	Yes
Magnesium, total	ICP-MS CLS129	+/-0.74@4mg/l	Yes	No	Yes
Sulphate (SO4)	Konelab CLS 88	+/- 7.29 %	Yes	No	Yes
Orthophosphate as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Calcium, total	ICP-MS CLS129	+/-5.5@30mg/l	Yes	No	Yes
Iron, dissolved	ICP-MS CLS 129	+/- 10.28 %	Yes	No	Yes
Manganese, dissolved	ICP-MS CLS129	+/- 14.53 %	Yes	No	Yes
Copper, dissolved	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Lead, dissolved	ICP-MS CLS129	+/-20@100ug/l	Yes	No	Yes
Chromium, dissolved	ICP-MS CLS 129	+/- 8.38 %	Yes	No	Yes
Nickel, dissolved	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Cadmium, dissolved	ICP-MS CLS129	+/- 10.42 %	Yes	No	Yes
Arsenic, dissolved	ICP-MS CLS129	+/- 9.34 %	Yes	No	Yes
Mercury, dissolved	ICP-MS CLS 129	+/- 27.72 %	Yes	No	Yes
Antimony, dissolved	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Selenium, dissolved	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Zinc, dissolved	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Barium, dissolved	ICP-MS CLS129	+/-33@250ug/l	Yes	No	Yes
Mineral Oil (by calculation)	Calculation		No	No	Yes
MTBE (Water) by GC-FID	CLS 148	+/- 2.3 @ 30ug/l	Yes	No	Yes
Molybdenum, dissolved	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	±0.16 cfu/100ml	Yes	No	Yes
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	+/- 26.37@200ug/l	Yes	No	Yes
TPH (>C5 - C44) by GC-FID	CLS 193	0	Yes	No	Yes
Alkalinity Total by Autotitration	CLS 195	+/- 23.24 %	Yes	No	Yes
Benzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Ethylbenzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Toluene (Water) by GCFID	CLS 148		Yes	No	Yes
m and p- Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
o-Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1767890	BH3/48	Good condition	19/07/2024

CERTIFICATE OF ANALYSIS

Client : Gerry Baker
ARUP
50 Ringsend Road
Dublin
D04 T6X0

Report No. : 565732
Date of Receipt : 19/07/2024
Start Date of Analysis : 22/07/2024
Date of Report : 09/08/2024
Order Number : None given
Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
1767891	BH3/42	E.coli (Filtration)	I,R	61	cfu/100ml
		Suspended Solids	I,R	24	mg/l
		TON as N	I,R	0.969	mg/l
		COD	I,R	10	mg/l
		pH	I,R	7.2	pH Units
		Conductivity @20C	I,R	581	uS/cm
		Nitrate as N Calculated	I,R	0.951	mg/l
		Nitrite as N	I,R	0.018	mg/l
		Sodium, total	I,R	13	mg/l
		Chloride	I,R	14.4	mg/l
		Total dissolved solids	R	292	mg/l
		Temperature	F,R	3.6@lab	°C
		Potassium, total	I,R	5	mg/l
		Magnesium, total	I,R	5	mg/l
		Sulphate (SO4)	I,R	35.3	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		Orthophosphate as PO4-P	I,R	0.051	mg/l
		Ammonia as N	I,R	0.96	mg/l
		Calcium, total	I,R	123	mg/l
		Iron, dissolved	I,R	<10	ug/l
		Manganese, dissolved	I,R	9	ug/l
		Copper, dissolved	I,R	2	ug/l
		Lead, dissolved	I,R	<0.5	ug/l
		Chromium, dissolved	I,R	<0.5	ug/l
		Nickel, dissolved	I,R	7	ug/l
		Cadmium, dissolved	I,R	<0.5	ug/l
		Arsenic, dissolved	I,R	<0.5	ug/l
		Mercury, dissolved	I,R	<0.05	ug/l
		Antimony, dissolved	I,R	<0.5	ug/l
		Selenium, dissolved	I,R	1	ug/l
		Zinc, dissolved	I,R	<5	ug/l
		Barium, dissolved	I,R	13	ug/l
		Mineral Oil (by calculation)	R	25	ug/l
		MTBE (Water) by GC-FID	I,R	<10	ug/l
		Molybdenum, dissolved	I,R	1	ug/l
		Total Coliforms (Filtration) (Environmental Waters)	I,R	>100	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	I,R	25 **Unknown Pattern	ug/l
		TPH (>C5 - C44) by GC-FID	I,R	49 **Unknown Pattern	ug/l
		Alkalinity Total by Autotitration	I,R	299	mg/l CaCO3
		Benzene (Water) by GC-FID	I,R	<10	ug/l
		Ethylbenzene (Water) by GC-FID	I,R	<10	ug/l
		Toluene (Water) by GCFID	I,R	<10	ug/l
		m and p- Xylene (Water) by GC-FID	I,R	<20	ug/l

		o-Xylene (Water) by GC-FID	I,R	<10	ug/l
		BOD Automated	I,R	2	mg/l



Approved by:

Ann Marie Nee

AnnMarie Nee
Environmental Account
Manager

See below for test specifications and accreditation status.

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Ocfu is reported in waters, this refers to 'not detected in volume tested'

It is recommended that water samples requiring microbiological analysis should be tested within 24 hours of sampling. CLS will test food, water and swabs samples within 24 hours of receipt.

Where samples have been taken by the Client, results apply to the samples as received.

In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
E.coli (Filtration)	CLS 16	±0.17 cfu/100ml	Yes	No	Yes
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Conductivity @20C	CLS 67	+/- 4.92 %	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Sodium, total	ICP-MS CLS129	+/- 11.62 %	Yes	No	Yes
Chloride	Konelab CLS 36	+/- 12.10 %	Yes	No	Yes
Total dissolved solids	CLS 68	0	No	No	Yes
Temperature	Probe	+/- 0.1 °C	No	No	Yes
Potassium, total	ICP-MS CLS129	+/-0.53@5mg/l	Yes	No	Yes
Magnesium, total	ICP-MS CLS129	+/-0.74@4mg/l	Yes	No	Yes
Sulphate (SO4)	Konelab CLS 88	+/- 7.29 %	Yes	No	Yes
Orthophosphate as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Calcium, total	ICP-MS CLS129	+/-5.5@30mg/l	Yes	No	Yes
Iron, dissolved	ICP-MS CLS 129	+/- 10.28 %	Yes	No	Yes
Manganese, dissolved	ICP-MS CLS129	+/- 14.53 %	Yes	No	Yes
Copper, dissolved	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Lead, dissolved	ICP-MS CLS129	+/-20@100ug/l	Yes	No	Yes
Chromium, dissolved	ICP-MS CLS 129	+/- 8.38 %	Yes	No	Yes
Nickel, dissolved	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Cadmium, dissolved	ICP-MS CLS129	+/- 10.42 %	Yes	No	Yes
Arsenic, dissolved	ICP-MS CLS129	+/- 9.34 %	Yes	No	Yes
Mercury, dissolved	ICP-MS CLS 129	+/- 27.72 %	Yes	No	Yes
Antimony, dissolved	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Selenium, dissolved	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Zinc, dissolved	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Barium, dissolved	ICP-MS CLS129	+/-33@250ug/l	Yes	No	Yes
Mineral Oil (by calculation)	Calculation		No	No	Yes
MTBE (Water) by GC-FID	CLS 148	+/- 2.3 @ 30ug/l	Yes	No	Yes
Molybdenum, dissolved	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	±0.16 cfu/100ml	Yes	No	Yes
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	+/- 26.37@200ug/l	Yes	No	Yes
TPH (>C5 - C44) by GC-FID	CLS 193	0	Yes	No	Yes
Alkalinity Total by Autotitration	CLS 195	+/- 23.24 %	Yes	No	Yes
Benzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Ethylbenzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Toluene (Water) by GCFID	CLS 148		Yes	No	Yes
m and p- Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
o-Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

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Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1767891	BH3/42	Good condition	19/07/2024

CERTIFICATE OF ANALYSIS

Client : Gerry Baker
 ARUP
 50 Ringsend Road
 Dublin
 D04 T6X0

Report No. : 565733
 Date of Receipt : 19/07/2024
 Start Date of Analysis : 22/07/2024
 Date of Report : 09/08/2024
 Order Number : None given
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
1767892	BH4/38	E.coli (Filtration)	I,R	>100	cfu/100ml
		Suspended Solids	I,R	45	mg/l
		TON as N	I,R	4.52	mg/l
		COD	I,R	18	mg/l
		pH	I,R	6.9	pH Units
		Conductivity @20C	I,R	685	uS/cm
		Nitrate as N Calculated	I,R	4.52	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		Sodium, total	I,R	20	mg/l
		Chloride	I,R	27.6	mg/l
		Total dissolved solids	R	344	mg/l
		Temperature	F,R	4.0@lab	°C
		Potassium, total	I,R	7	mg/l
		Magnesium, total	I,R	6	mg/l
		Sulphate (SO4)	I,R	31.1	mg/l
		Chromium hexavalent in water	S	<0.003	mg/l
		Orthophosphate as PO4-P	I,R	0.242	mg/l
		Ammonia as N	I,R	0.086	mg/l
		Calcium, total	I,R	134	mg/l
		Iron, dissolved	I,R	<10	ug/l
		Manganese, dissolved	I,R	26	ug/l
		Copper, dissolved	I,R	<1	ug/l
		Lead, dissolved	I,R	<0.5	ug/l
		Chromium, dissolved	I,R	<0.5	ug/l
		Nickel, dissolved	I,R	7	ug/l
		Cadmium, dissolved	I,R	<0.5	ug/l
		Arsenic, dissolved	I,R	2	ug/l
		Mercury, dissolved	I,R	<0.05	ug/l
		Antimony, dissolved	I,R	1	ug/l
		Selenium, dissolved	I,R	2	ug/l
		Zinc, dissolved	I,R	<5	ug/l
		Barium, dissolved	I,R	15	ug/l
		Mineral Oil (by calculation)	R	129	ug/l
		MTBE (Water) by GC-FID	I,R	<10	ug/l
		Molybdenum, dissolved	I,R	2	ug/l
		Total Coliforms (Filtration) (Environmental Waters)	I,R	>100	cfu/100ml
		Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	I,R	129 **Unknown Pattern	ug/l
		TPH (>C5 - C44) by GC-FID	I,R	66 **Unknown Pattern	ug/l
		Alkalinity Total by Autotitration	I,R	309	mg/l CaCO3
		Benzene (Water) by GC-FID	I,R	<10	ug/l
		Ethylbenzene (Water) by GC-FID	I,R	<10	ug/l
		Toluene (Water) by GCFID	I,R	<10	ug/l
		m and p- Xylene (Water) by GC-FID	I,R	<20	ug/l

		o-Xylene (Water) by GC-FID	I,R	<10	ug/l
		BOD Automated	I,R	2	mg/l



Approved by:

Ann Marie Nee

AnnMarie Nee
Environmental Account
Manager

See below for test specifications and accreditation status.

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E.coli (Filtration)	CLS 16	±0.17 cfu/100ml	Yes	No	Yes
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Conductivity @20C	CLS 67	+/- 4.92 %	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Sodium, total	ICP-MS CLS129	+/- 11.62 %	Yes	No	Yes
Chloride	Konelab CLS 36	+/- 12.10 %	Yes	No	Yes
Total dissolved solids	CLS 68	0	No	No	Yes
Temperature	Probe	+/- 0.1 °C	No	No	Yes
Potassium, total	ICP-MS CLS129	+/-0.53@5mg/l	Yes	No	Yes
Magnesium, total	ICP-MS CLS129	+/-0.74@4mg/l	Yes	No	Yes
Sulphate (SO4)	Konelab CLS 88	+/- 7.29 %	Yes	No	Yes
Orthophosphate as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Calcium, total	ICP-MS CLS129	+/-5.5@30mg/l	Yes	No	Yes
Iron, dissolved	ICP-MS CLS 129	+/- 10.28 %	Yes	No	Yes
Manganese, dissolved	ICP-MS CLS129	+/- 14.53 %	Yes	No	Yes
Copper, dissolved	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Lead, dissolved	ICP-MS CLS129	+/-20@100ug/l	Yes	No	Yes
Chromium, dissolved	ICP-MS CLS 129	+/- 8.38 %	Yes	No	Yes
Nickel, dissolved	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Cadmium, dissolved	ICP-MS CLS129	+/- 10.42 %	Yes	No	Yes
Arsenic, dissolved	ICP-MS CLS129	+/- 9.34 %	Yes	No	Yes
Mercury, dissolved	ICP-MS CLS 129	+/- 27.72 %	Yes	No	Yes
Antimony, dissolved	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Selenium, dissolved	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Zinc, dissolved	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Barium, dissolved	ICP-MS CLS129	+/-33@250ug/l	Yes	No	Yes
Mineral Oil (by calculation)	Calculation		No	No	Yes
MTBE (Water) by GC-FID	CLS 148	+/- 2.3 @ 30ug/l	Yes	No	Yes
Molybdenum, dissolved	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Total Coliforms (Filtration) (Environmental Waters)	CLS 16	±0.16 cfu/100ml	Yes	No	Yes
Extractable Hydrocarbons Water (C8-C40, Diesel Range and Lube Oil) by GC-FID	CLS 147	+/- 26.37@200ug/l	Yes	No	Yes
TPH (>C5 - C44) by GC-FID	CLS 193	0	Yes	No	Yes
Alkalinity Total by Autotitration	CLS 195	+/- 23.24 %	Yes	No	Yes
Benzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Ethylbenzene (Water) by GC-FID	CLS 148		Yes	No	Yes
Toluene (Water) by GCFID	CLS 148		Yes	No	Yes
m and p- Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
o-Xylene (Water) by GC-FID	CLS 148		Yes	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1767892	BH4/38	Good condition	19/07/2024

