Digby Bridge Attachment D1-Tier 3 Report Vol.2

Appendices

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Appendix A Geological Cross-Sections

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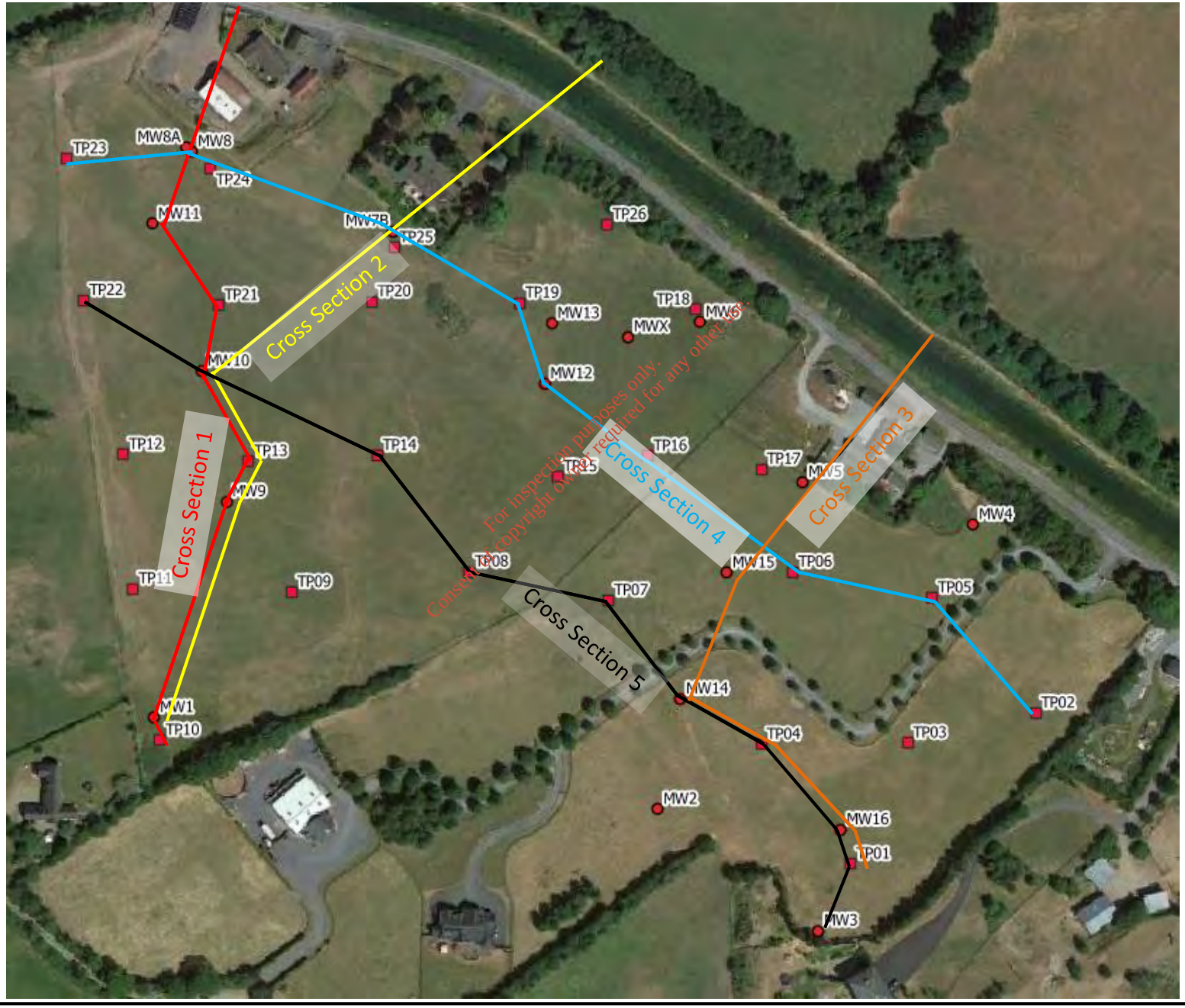
Project ID: 117838	Title: Cross Section 1
Project Title: Digby Bridge	Vertical Scale:
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare	Horizontal Scale:
Client: Kildare County Council	Engineer: CDM Smith Ltd.



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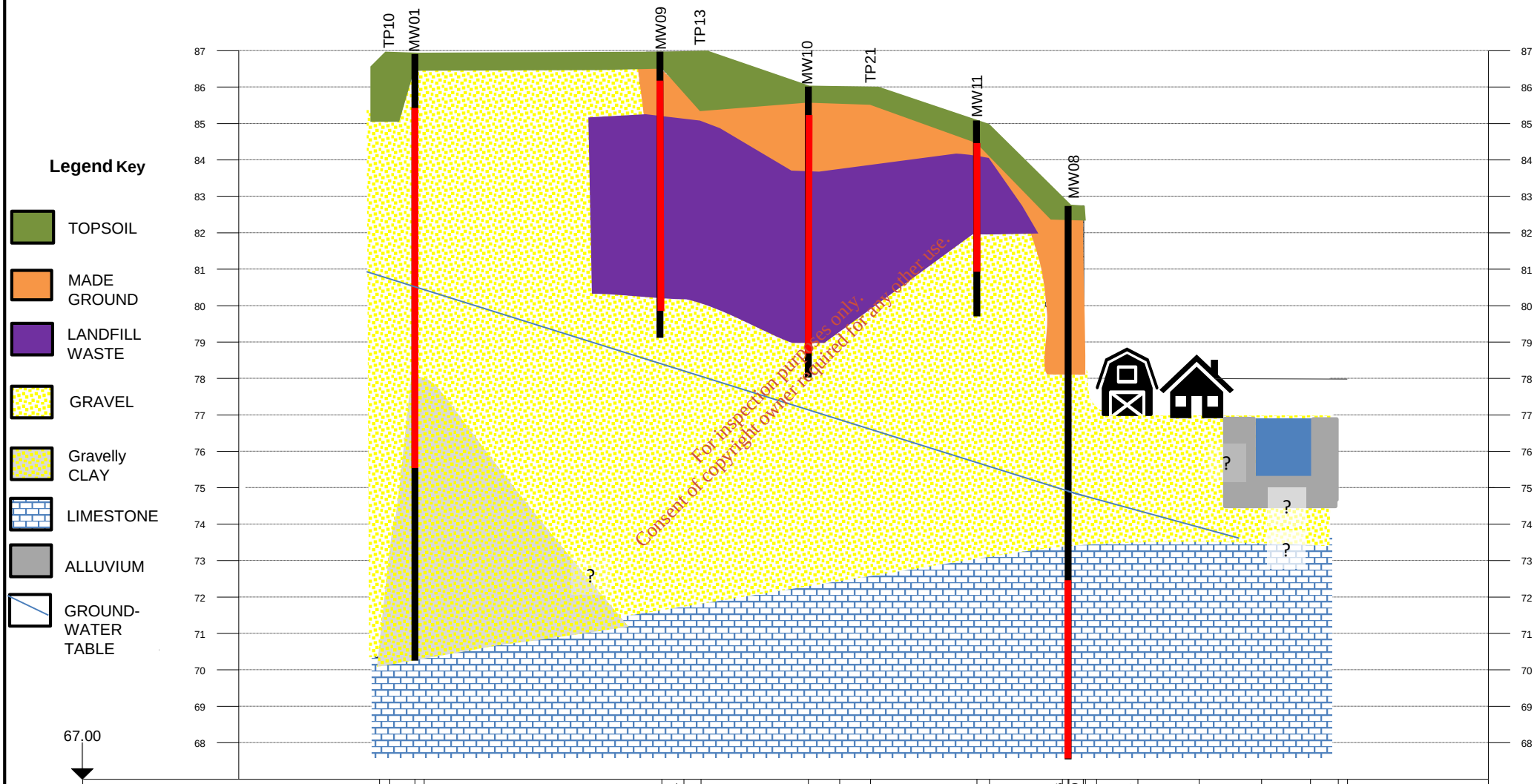
Project ID: 117838
Project Title: Digby Bridge
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare
Client: Kildare County Council

Title: Cross Section 1
Vertical Scale: 1:154
Horizontal Scale: 1:2150
Engineer: CDM Smith Ltd.



Chainage (m)	0.00	4.00	13.61	17.17	108.28	116.74	123.25	164.39	176.46	188.25	229.01	233.85	261.78	263.28	290.60	274.90	290.74	314.19	338.20	356.95	367.61	371.08
Offset (m)	1.04		0.65		0.67		8.91	0.52		14.00	1.44		11.47	11.41	1.63	2.36	3.79	7.76	0.10	0.91		
Elevation (mAOD)	86.54		86.91		86.96		86.88	86.01		85.89	84.69		83.39	82.69	82.74	77.20	77.20	77.20	76.99	76.99		

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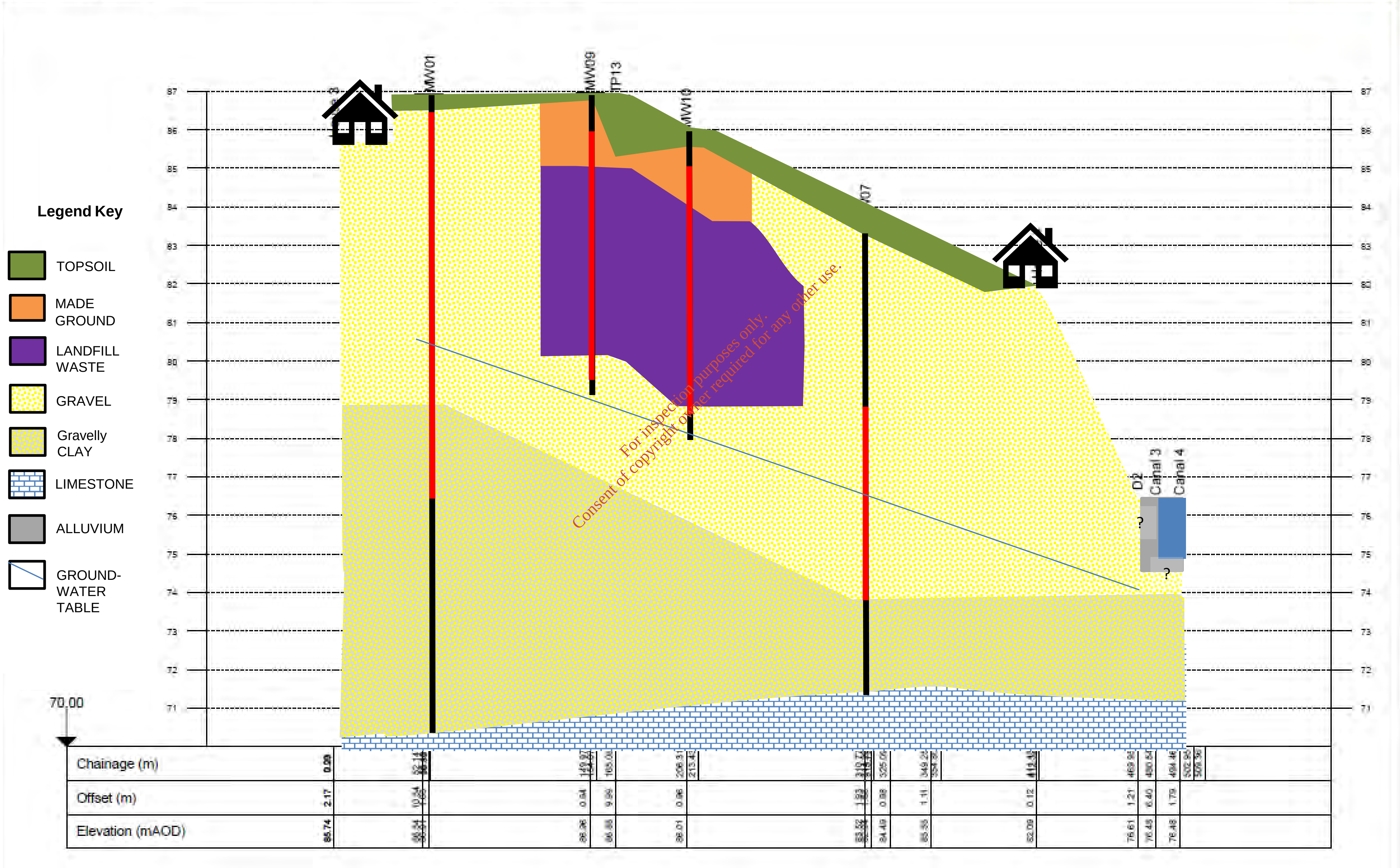
Project ID: 117838
Project Title: Digby Bridge
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare
Client: Kildare County Council

Title: Cross Section 2
Vertical Scale: 1:154
Horizontal Scale: 1:2150
Engineer : CDM Smith Ltd.

CDM Smith



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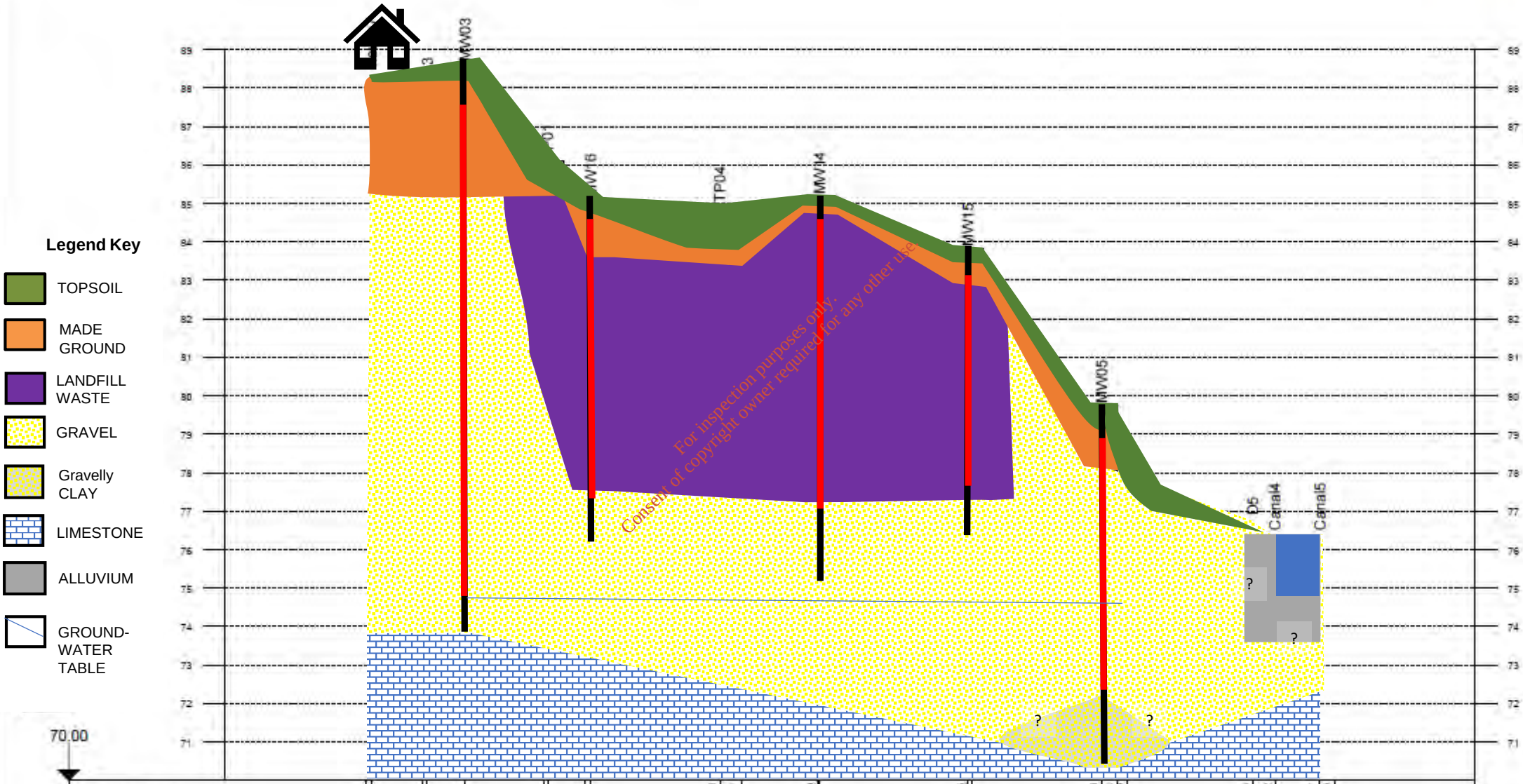
Project ID: 117838
Project Title: Digby Bridge
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare
Client: Kildare County Council

Title: Cross Section 3
Vertical Scale: 1:154
Horizontal Scale: 1:2150
Engineer: CDM Smith Ltd.

CDM Smith



Chainage (m)	0.00	21.36	37.30	66.36	83.46	133.10	141.27	179.82	229.34	276.59	282.54	286.10	333.33	341.72	358.57	363.99
Offset (m)	1.64	1.43	3.49	0.66	1.89	1.10	2.45	1.98	1.32	1.30	2.74	1.50	0.32			
Elevation (mAOD)	88.50	88.24	88.03	86.09	85.10	84.97	85.17	83.83	79.76	76.81	76.80	76.45	76.45			

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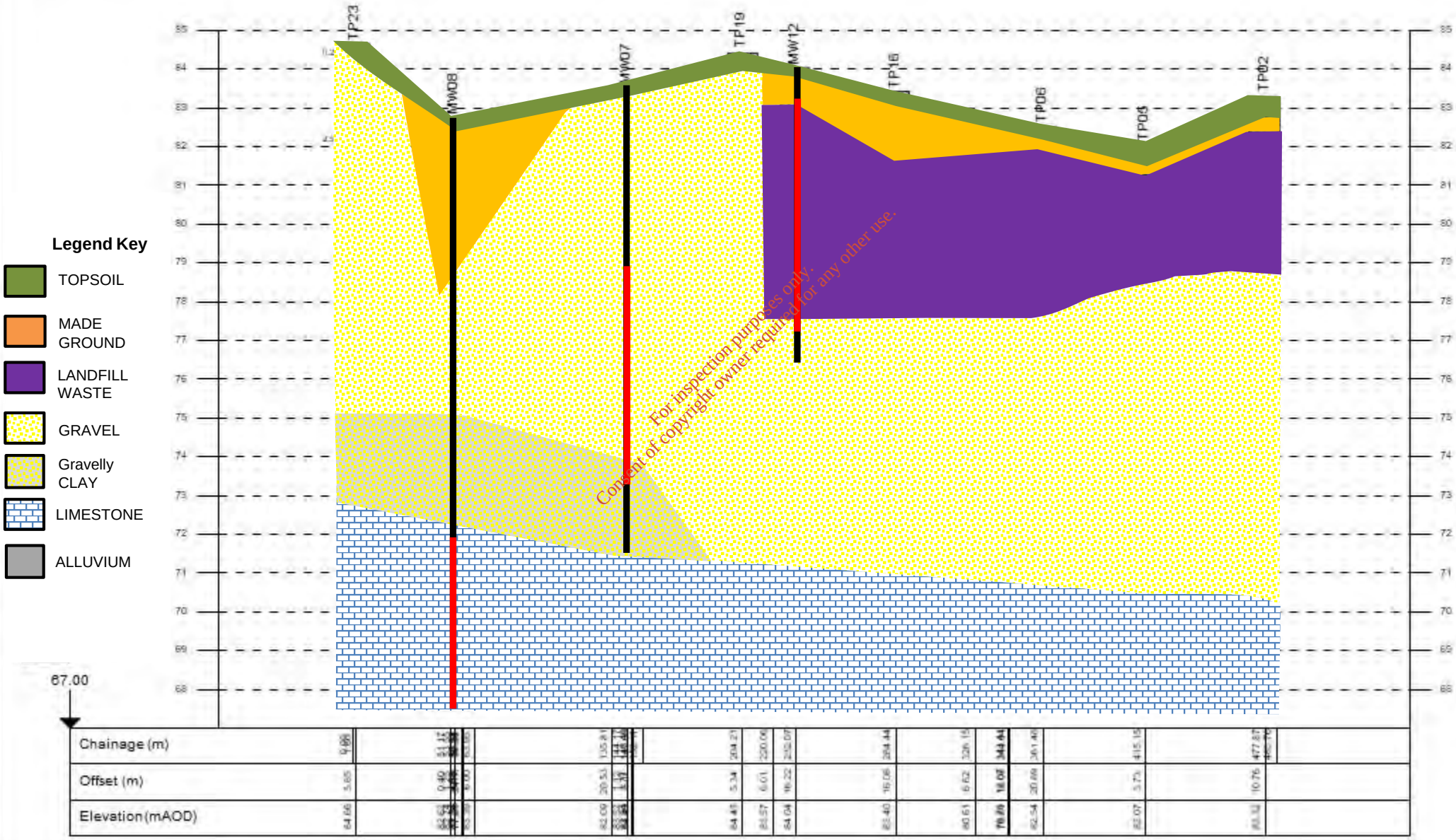
Project ID: 117838
Project Title: Digby Bridge
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare
Client: Kildare County Council

Title: Cross Section 4
Vertical Scale: 1:154
Horizontal Scale: 1:2150
Engineer: CDM Smith Ltd.

CDM Smith



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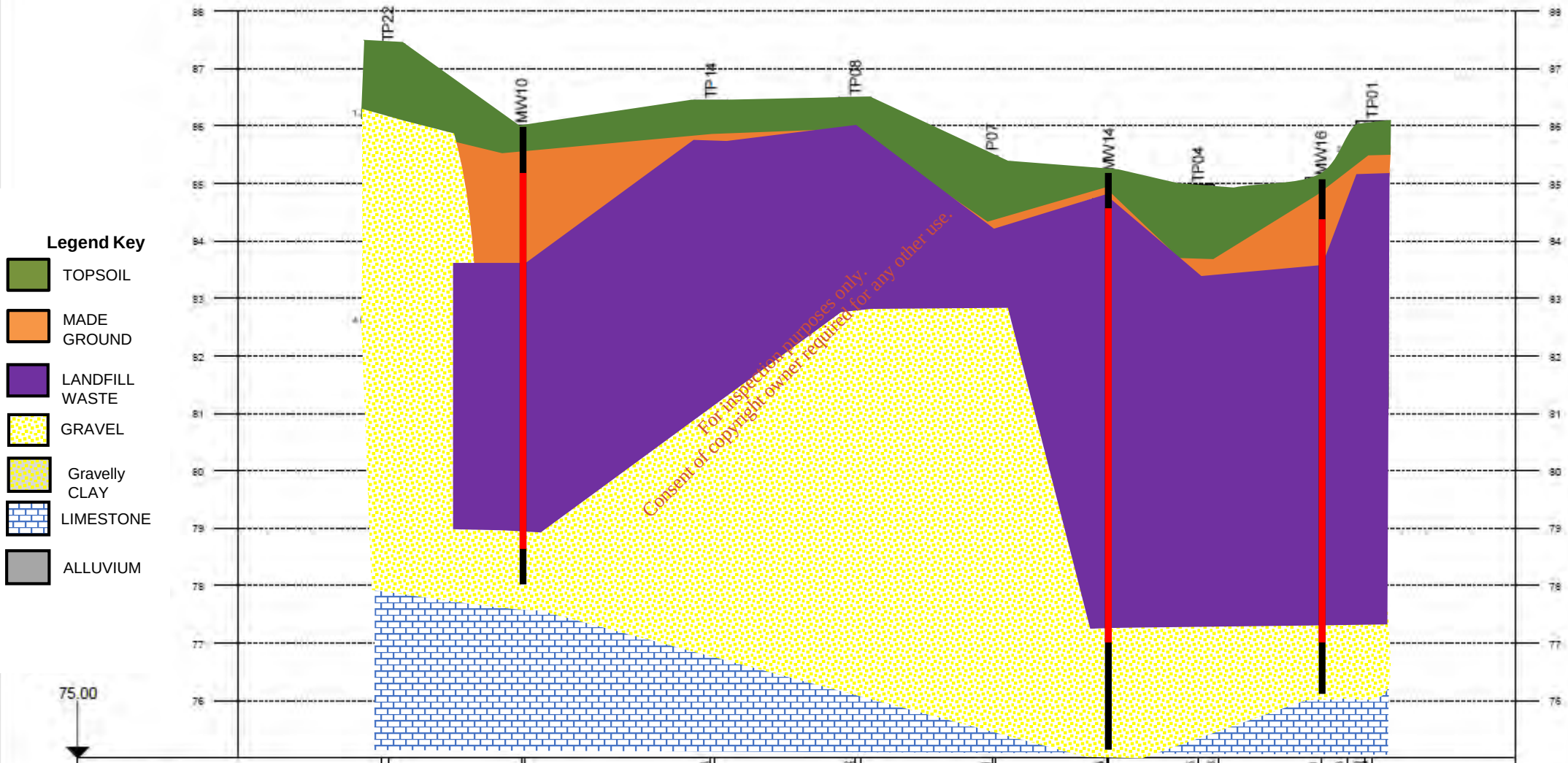
Project ID: 117838
Project Title: Digby Bridge
Location: Digby Bridge, Barrettstown, Sallins, Co. Kildare
Client: Kildare County Council

Title: Cross Section 5
Vertical Scale: 1:154
Horizontal Scale: 1:2150
Engineer: CDM Smith Ltd.

CDM Smith



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Chainage (m)	0.00	2.00	99.98	149.84	299.52	324.41	349.98	349.35	358.18	401.51	412.93	429.79	439.69
Offset (m)	0.58	1.13	0.13	1.85	0.48	2.04	5.82	0.91	2.55
Elevation (mAOD)	87.42	86.01	86.44	86.49	85.36	85.17	84.97	85.10	86.09

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Appendix B Groundwater Contour Maps

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EPA Export 11-11-2020:06:31:52

0 50 100 m

N W E S

Legend

Site Boundary

Wells

Contours:

Interval 1 m

Interval 0.2 m

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)

Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: GROUNDWATER CONTOUR - GRAVEL (DECEMBER 2018)

Drawn By: SM

Date: 16/08/2019

EPA Export 11-11-2020:06:31:52

0 50 100 m

N W E S

Legend

Site Boundary

Wells

Contours:

Interval 1 m

Interval 0.2 m

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)

Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: GROUNDWATER CONTOUR - GRAVEL (MARCH 2019)

Drawn By: SM

Date: 16/08/2019

EPA Export 11-11-2020:06:31:52

0 50 100 m

N W E S

Legend

Site Boundary

Wells

Contours:

Interval 1 m

Interval 0.2 m

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)

Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project:

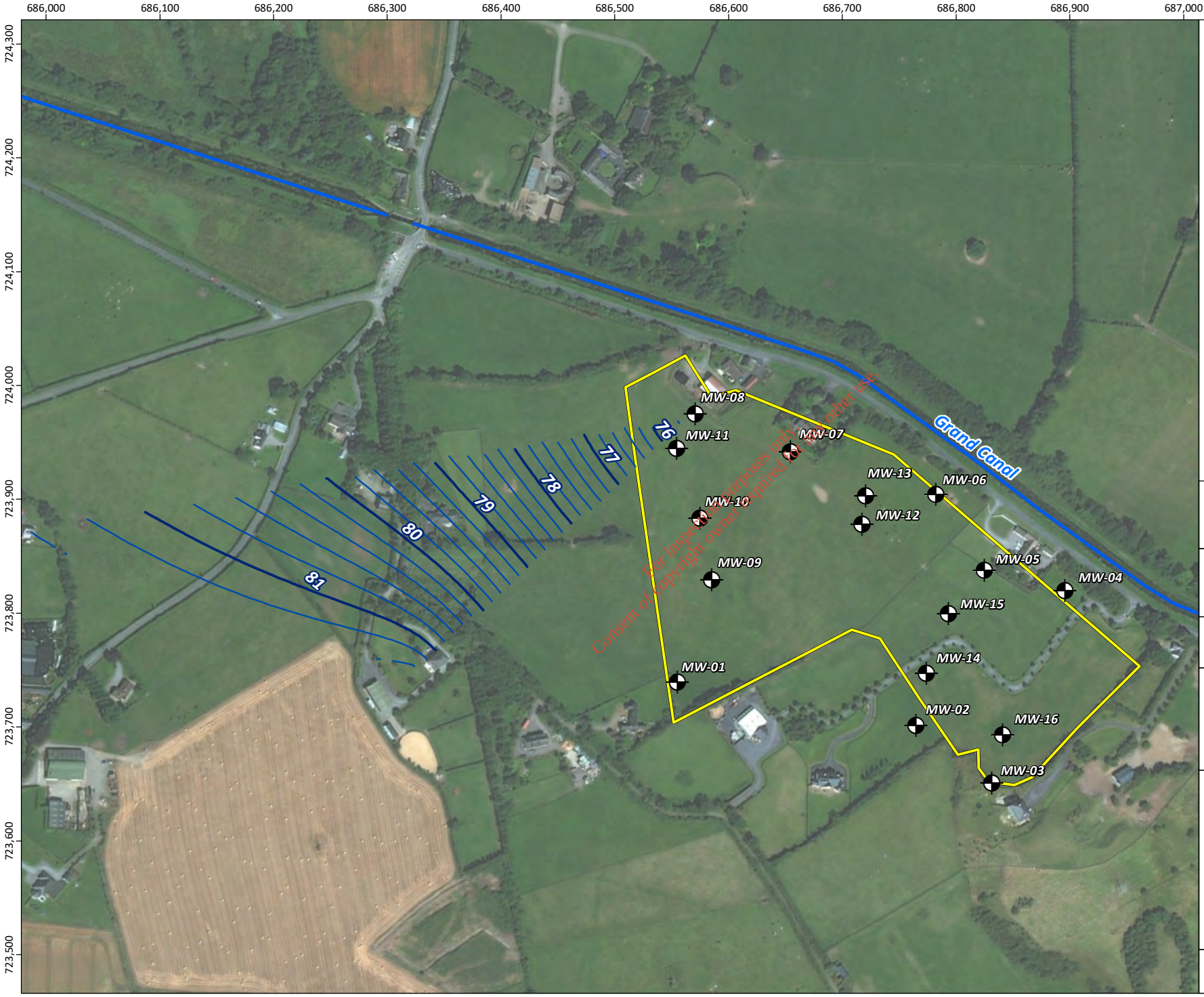
DIGBY BRIDGE

Drawing Title:

GROUNDWATER CONTOUR - GRAVEL (MAY 2019)

Drawn By:	Date:
SM	16/08/2019

EPA Export 11-11-2020:06:31:52



0 50 100 m

N
W E
S

Legend

Site Boundary

Wells

Contours:

Interval 1 m

Interval 0.2 m

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)

Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project:

DIGBY BRIDGE

Drawing Title:

GROUNDWATER CONTOUR - LIMESTONE (JUNE 2019)

Drawn By: SM

Date: 14/08/2019

EPA Export 11-11-2020:06:31:52

Appendix C Generic Quantitative Risk Assessment Screening Sheets

C.1 Leachate data assessed against GTV/IGV. Also included: Hazardous and non-hazardous substances screen

C.2 Groundwater Samples Screened against Drinking Water Quality Standards

C.3 Groundwater Sample Data Screened against WFD Quality Standards. Also included: Hazardous and non-hazardous substances screen

C.4 Surface Water Sample Data Screened against EQS Quality Standards

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of GTV/IGV
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010). Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / Non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances	EPA Historic Minimum	EPA Historic Mean	EPA Historic Maximum						
												Lab Job No.:	18-38288	18-38288	18-38288	18-38288	COV/1718174/2019	COV/1718174/2019
												Lab Sample ID.:	736561	736562	736560	736559	18259634	18259633
												Sample Location:	MW09	MW13	MW14	MW16	MW10	MW13
												Sample Type:	Water	Water	Water	Water	Water	Water
												Well Type:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
												Date Sampled:	30/11/2018	30/11/2018	30/11/2018	30/11/2018	28/05/2019	28/05/2019
												Response Zone	Waste	Waste	Waste	Waste	Waste	Waste
x	x	x	x	x		x	x	x	x			x	x	x	x		
Water Quality & Inorganics																	
pH	pH units	nc	9.5	6.9	7.2	7.6	5	0	6.8	7.5	8.2	6.9	7.3	7.1	7.6		7
Electrical Conductivity	uS/cm	nc	1875	780	1560	2300	5	2	5990	11502	19300	2300	1900	1100	780		1720
Total Dissolved Solids	mg/l	nc	1000	0.0	-	0.0	0	0									
Biochemical Oxygen Demand	mg/l	nc	No GTV/IGV	10.0	271.2	1050.0	5	0	97	374	1770	1050	160	10	120		16
Chemical Oxygen Demand	mg/l	nc	No GTV/IGV	57.0	282.8	558.0	5	0	622	2307	8000	360	360	79	57		558
Dissolved Oxygen	mg/l	nc	No GTV/IGV	2.2	6.8	8.0	6	0				8	8	8	7.9	2.2	<0.5
Total Organic Carbon	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0	184	733	2270						
Cyanide (Total)	mg/l	Non - Harardous	0.0375	0.000	-	0.000	6	0				<0.050	<0.050	<0.050	<0.050	<0.009	<0.009
Coliforms																	
Faecal Coliforms (Colilert)	cfu/100ml	Non - Harardous	0	5.0	8.0	11.0	2	2								11	5
Total Coliforms (Colilert)	cfu/100ml	nc	0	2420	2420	2420	2	2								2420	2420
Inorganic Ions																	
Calcium	mg/l	nc	No GTV/IGV	130	359	847	5	0	23	154	501	260	330	230	130		847
Potassium	mg/l	nc	5	5.1	23.3	76.0	5	5	100	564	1580	76	14	9.7	5.1		11.8
Magnesium	mg/l	nc	50	7.7	30.7	62.0	5	1	40	250	1580	36	38	10	7.7		62
Sodium	mg/l	nc	150	8.9	124.8	260.0	5	2	470	1480	3650	260	210	18	8.9		127
Chloride	mg/l	Non - Harardous	No GTV/IGV	15.0	80.2	130.0	5	0	370	2074	4710	130	110	41	15		105
Fluoride	mg/l	nc	1	0.2	0.3	0.5	5	0				0.23	0.23	0.5	0.25		0.2
Orthophosphate as PO4	mg/l	Non - Harardous	0.035	0.058	0.058	0.058	5	1	0.30	4.3	18	<0.050	<0.050	<0.050	0.058		<0.6
Sulphate	mg/l	nc	187.5	21.0	49.0	75.0	5	0	<5	67	322	<1.0	51	75	21		<4.4
Ammoniacal Nitrogen	mg/l	Non - Harardous	0.175	6.500	16.840	40.000	5		283	889	2040	40	12	10	6.5		15.7
Total Oxidised Nitrogen	mg/l	nc	No GTV/IGV	2.5	2.5	2.5	5	0				<0.20	<0.20	2.5	<0.20		<0.7
Alkalinity (Total)	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0	3000	5376	9130						
Metals																	
Arsenic (Dissolved)	µg/l	Hazardous substance	7.5	3.0	8.5	25.0	5	1	<1	34	485	6.7	25	3	3.4		4.2
Boron (Dissolved)	µg/l	Non - Harardous	750	99.0	917.8	3800.0	5	1				3800	270	140	99		280
Cadmium (Dissolved)	µg/l	Non - Harardous	3.75	0.09	1.15	2.20	5	0	<10	15	80	<0.080	2.2	0.09	<0.080		<0.6
Chromium (Dissolved)	µg/l	Hazardous substance	37.5	2.2	14.7	37.5	5	0	<30	90	560	13	6.1	<1.0	2.2		37.5
Copper (Dissolved)	µg/l	Non - Harardous	1500	3.3	11.2	19.0	5	0	<20	130	620	3.3	19	<1.0	<1.0		<9.00
Iron (Dissolved)	µg/l	nc	200	680	9594	28000	5	5	1600	27400	160000	17000	28000	760	680		1530
Lead (Dissolved)	µg/l	Hazardous substance	0.75	1.20	7.10	13.00	5	2	<40	200	1900	1.2	13	<1.0	<1.0		<6.00
Mercury (Dissolved)	µg/l	Hazardous substance	0.75	0.00	-	0.00	6	0	<0.1	0.20	0.80	<0.50	<0.50	<0.50	<0.50	<0.100	<0.100
Manganese (Dissolved)	µg/l	nc	50	450	3912	8300	5	5	40	460	3590	3500	8300	780	450		6530
Nickel (Dissolved)	µg/l	Non - Harardous	15	19.0	625.8	2900.0	5	5	<30	170	600	59	100	2900	19		51
Selenium (Dissolved)	µg/l	nc	No GTV/IGV	1.5	3.6	5.3	4	0				5.3	5.1	2.3	1.5		
Zinc (Dissolved)	µg/l	Non - Harardous	75	1.6	20.0	51.0	5	0	<30	1140	6700	7.2	51	20	1.6		<18.0
PAHs																	
Naphthalene	µg/l	Hazardous substance	1	1.45	1.45	1.45	6	1				<0.10	<0.10	<0.10	<0.10	1.45	<1.0
Acenaphthylene	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Acenaphthene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Fluorene	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Phenanthrene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Anthracene	µg/l	Hazardous substance	10000	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Fluoranthene	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Pyrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Benzo[a]anthracene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.10	<0.10	<0.10	<0.10		
Chrysene	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.10	<0.10	<0.10	<0.10		<2.0
Benzo[b]fluoranthene	µg/l	Hazardous substance	0.5	0.0	-	0.0	4	0				<0.10	<0.10	<0.10	<0.10		
Benzo[k]fluoranthene	µg/l	Hazardous substance	0.05	0.00	-	0.00	4	0				<0.10	<0.10	<0.10	<0.10		
Benzo[a]pyrene	µg/l	Hazardous substance	0.0075	0.0000	-	0.0000	4	0				<0.10	<0.10	<0.10	<0.10		
Indeno(1,2,3-c,d)Pyrene	µg/l	Hazardous substance	0.05	0.00	-	0.00	4	0				<0.10	<0.10	<0.10	<0.10		
Dibenz(a,h)Anthracene	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.10	<0.10	<0.10	<0.10		
Benzo[g,h,i]perylene	µg/l	Hazardous substance	0.05	0.00	-	0.00	4	0				<0.10	<0.10	<0.10	<0.10		
Total Of 16 PAH's	µg/l	nc	0.075	0.000	-	0.000	4	0				<2.0	<2.0	<2.0	<2.0		

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Checked by: EW
Reviewed by: CMC

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of GTV/IGV
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010). Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / Non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances	EPA Historic Minimum	EPA Historic Mean	EPA Historic Maximum						
Lab Job No.:												18-38288	18-38288	18-38288	18-38288	COV/1718174/2019	COV/1718174/2019
Lab Sample ID.:												736561	736562	736560	736559	18259634	18259633
Sample Location:												MW09	MW13	MW14	MW16	MW10	MW13
Sample Type:												Water	Water	Water	Water	Water	Water
Well Type:												Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
Date Sampled:												30/11/2018	30/11/2018	30/11/2018	30/11/2018	28/05/2019	28/05/2019
Response Zone												Waste	Waste	Waste	Waste	Waste	Waste
VOCS																	
1,1,2,2-Tetrachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	2	0								<1.00	<1.00
Chloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<2.00	<2.00
Vinyl Chloride	µg/l	Hazardous substance	0.375	0.698	0.698	0.698	6	1				<1.0	<1.0	<1.0	<1.0	0.698	<0.500
Bromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<5.0	<5.0	<5.0	<5.0	<1.00	<1.00
Trichlorofluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,1-Dichloroethene	µg/l	Hazardous substance	30	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Trans 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,1-Dichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
cis 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	2.34	2.34	2.34	6	0				<1.0	<1.0	<1.0	<1.0	2.34	<1.00
Bromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<5.0	<5.0	<5.0	<5.0	<1.00	<1.00
Trichloromethane	µg/l	Hazardous substance	12	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,1,1-Trichloroethane	µg/l	Hazardous substance	500	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Carbon Tetrachloride	µg/l	nc	2	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,1-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Benzene	µg/l	Hazardous substance	0.75	1.50	1.60	1.80	6	3				1.8	<1.0	1.5	<1.0	1.5	<1.00
1,2-Dichloroethane	µg/l	Hazardous substance	2.25	0.00	-	0.00	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
Trichloroethene	µg/l	nc	7.5	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,2-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Dibromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<10	<10	<10	<10	<1.00	<1.00
Bromodichloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<5.0	<5.0	<5.0	<5.0	<1.00	<1.00
cis-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<10	<10	<10	<10	<1.00	<1.00
Toluene	µg/l	Hazardous substance	525	1.1	11.4	29.0	6	0				2.5	22	29	1.1	9.72	3.79
Trans-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<10	<10	<10	<10	<1.00	<1.00
1,1,2-Trichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	6	0				<10	<10	<10	<10	<1.00	<1.00
Tetrachloroethene	µg/l	Hazardous substance	7.5	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,3-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
Dibromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<10	<10	<10	<10	<1.00	<1.00
1,2-Dibromoethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<5.0	<5.0	<5.0	<5.0	<1.00	<1.00
1,1,1,2-Tetrachloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
Ethylbenzene	µg/l	Hazardous substance	10	4.7	43.5	150.0	6	6				28	22	150	4.7	37.5	19
m & p-Xylene	µg/l	Hazardous substance	10	10.8	105.2	460.0	6	6				28	19	460	36	77.1	10.8
o-Xylene	µg/l	Hazardous substance	10	4.6	18.8	35.0	6	3				11	<1.0	35	4.6	24.4	<1.00
Styrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Tribromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Isopropylbenzene	µg/l	nc	No GTV/IGV	2.18	3.26	5.20	6	0				2.4	<1.0	5.2	<1.0	2.18	<1.00
Bromobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,2,3-Trichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<50	<50	<50	<50	<1.00	<1.00
2-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,3,5-Trimethylbenzene	µg/l	nc	No GTV/IGV	3.4	10.5	17.0	6	0				11	<1.0	17	3.4	<1.00	<1.00
4-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Tert-Butylbenzene	µg/l	nc	No GTV/IGV	5.3	5.3	5.3	6	0				<1.0	<1.0	5.3	<1.0	<1.00	<1.00
1,2,4-Trimethylbenzene	µg/l	Hazardous substance	No GTV/IGV	17.5	30.9	50.0	6	0				33	<1.0	50	23	17.5	<1.00
Sec-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
4-Isopropyltoluene	µg/l	nc	No GTV/IGV	9.15	17.05	24.00	6	0				18	<1.0	24	<1.0	9.15	<1.00
1,2-Dibromo-3-Chloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<50	<50	<50	<50	<2.00	<2.00
1,3,5-Trichlorobenzene	µg/l	nc	0.4	0.0	-	0.0	1	0									<0.01
1,2,3-Trichlorobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
Methyl Tert-Butyl Ether	µg/l	Non - Harardous	10	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
SVOCs																	
2,4-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
N-Propylbenzene	µg/l	nc	No GTV/IGV	1.36	1.36	1.36	6	0				<1.0	<1.0	<1.0	<1.0	1.36	<1.00
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
1,3-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Hexachlorobutadiene	µg/l	Hazardous substance	0.1	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,2,4-Trichlorobenzene	µg/l	Hazardous substance	0.4	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,4-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
N-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
1,2-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
2,6-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
4-Bromophenyl Phenyl Ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
4-Chlorophenyl phenyl ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Bis(2-chloroethoxy)methane	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Bis(2-chloroethyl)ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Bis(2-chloroisopropyl)ether	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<2.0

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Compiled by: CF
Checked by: EW
Reviewed by: CMC

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of GTV/IGV
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010). Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Lab Job No.:												18-38288	18-38288	18-38288	18-38288	COV/1718174/2019	COV/1718174/2019
Lab Sample ID.:												736561	736562	736560	736559	18259634	18259633
Sample Location:												MW09	MW13	MW14	MW16	MW10	MW13
Sample Type:												Water	Water	Water	Water	Water	Water
Well Type:												Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
Date Sampled:												30/11/2018	30/11/2018	30/11/2018	30/11/2018	28/05/2019	28/05/2019
Response Zone												Waste	Waste	Waste	Waste	Waste	Waste
Determinand	**Units**	**Hazardous / Non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**	**EPA Historic Minimum**	**EPA Historic Mean**	**EPA Historic Maximum**						
Pesticides																	
Demeton-O	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
Demeton-S	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Disulfoton	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Fenthion	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.005
Trichloronate	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Prothiofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Fensulphothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Sulprofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Azinphos-Methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.004
Azinphos-ethyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
Coumaphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Atraton	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Prometon	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Simazine	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<0.022
Atrazine	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<0.020
Propazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.020
Trietazine	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.012
Trifluralin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.03
Triallate	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.017
Triazophos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
Tecnazene	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<0.014
Propetamphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.003
Terbuthylazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Benzyl Butyl Phthalate	µg/l	nc	5	0.0	-	0.0	1	0									<2.0
Bis(2-ethylhexyl)phthalate	µg/l	nc	6	0.0	-	0.0	1	0									<10.0
Carbon Tetrachloride	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Carbophenothion	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<0.006
Chlorfenvinphos	µg/l	Hazardous substance	5	0.0	-	0.0	1	0									<0.004
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<2.0	<2.0	<2.0	<2.0	<1.00	<1.00
Chlorpyriphos	µg/l	Hazardous substance	90	0.0	-	0.0	1	0									<0.004
Diazinon	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.005
Dibenzofuran	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Dichlobenil	µg/l	Hazardous substance	0.075	0.000	-	0.000	1	0									<0.004
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Dichloromethane	µg/l	Non - Harardous	15	0.0	-	0.0	2	0								<1.00	<1.00
Dichlorvos	µg/l	Hazardous substance	0.001	0.000	-	0.000	1	0									<0.002
Diethylphthalate	µg/l	nc	5	0.0	-	0.0	1	0									<2.0
Dimethoate	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.02
Dimethylphthalate	µg/l	nc	5	0.0	-	0.0	1	0									<2.0
di-n-Butylphthalate	µg/l	nc	5	0.0	-	0.0	1	0									<2.0
Di-n-octylphthalate	µg/l	nc	5	0.0	-	0.0	1	0									<2.0
Diphenylamine	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
Fenitrothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.005

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of GTV/IGV
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010). Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

											Lab Job No.:	18-38288	18-38288	18-38288	18-38288	COV/1718174/2019	COV/1718174/2019
											Lab Sample ID.:	736561	736562	736560	736559	18259634	18259633
											Sample Location:	MW09	MW13	MW14	MW16	MW10	MW13
											Sample Type:	Water	Water	Water	Water	Water	Water
											Well Type:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
											Date Sampled:	30/11/2018	30/11/2018	30/11/2018	30/11/2018	28/05/2019	28/05/2019
											Response Zone	Waste	Waste	Waste	Waste	Waste	Waste
Determinand	**Units**	**Hazardous / Non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**	**EPA Historic Minimum**	**EPA Historic Mean**	**EPA Historic Maximum**						
Gamma-HCH	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<0.0043
Hexachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Isodrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.006
n-butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	6	0				<1.0	<1.0	<1.0	<1.0	<1.00	<1.00
Nitrobenzene	µg/l	nc	10	0.0	-	0.0	1	0									<2.0
n-Nitrosodi-n-propylamine	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
n-propylbenzene	µg/l	nc	No GTV/IGV	1.36	1.36	1.36	6	0				<1.0	<1.0	<1.0	<1.0	1.36	<1.00
o,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
o,p - DDT	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.005
o,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
p,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.004
p,p - DDT	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
p,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
Parathion-ethyl	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<0.004
Parathion-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.004
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.005
Phosalone	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.007
Pirimiphos-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0									<0.005
2-Methylnaphthalene	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Secbumeton	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Isophorone	µg/l	nc	No GTV/IGV	0.0	-	0.0	1	0									<2.0
Simetryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		
Malathion	µg/l	Hazardous substance	0.01	0.0	-	0.0	1	0									<0.004
Ametryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Mevinphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0									<0.020
Prometryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.020
Terbutryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.020
Alpha-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.004
Beta-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.004
Delta-HCH	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Heptachlor	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Aldrin	µg/l	Hazardous substance	20	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.005
Heptachlor Epoxide	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
Gamma-Chlordane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
Alpha-Chlordane	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
2-Chloronaphthalene	µg/l	nc	No GTV/IGV	0.0	-	0.0	1										<2.0
Endosulfan I	µg/l	Hazardous substance	0.001	0.000	-	0.000	4	0				<0.20	<0.20	<0.20	<0.20		
Dieldrin	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<0.005
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<0.006
p,p - DDD	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Endosulfan II	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Endrin Aldehyde	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Endosulfan Sulphate	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Methoxychlor	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Endrin Ketone	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Chlorothalonil	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	0	0									

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nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of GTV/IGV
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010). Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

											Lab Job No.:	18-38288	18-38288	18-38288	18-38288	COV/1718174/2019	COV/1718174/2019
											Lab Sample ID.:	736561	736562	736560	736559	18259634	18259633
											Sample Location:	MW09	MW13	MW14	MW16	MW10	MW13
											Sample Type:	Water	Water	Water	Water	Water	Water
											Well Type:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
											Date Sampled:	30/11/2018	30/11/2018	30/11/2018	30/11/2018	28/05/2019	28/05/2019
											Response Zone	Waste	Waste	Waste	Waste	Waste	Waste
Determinand	**Units**	**Hazardous / Non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**	**EPA Historic Minimum**	**EPA Historic Mean**	**EPA Historic Maximum**						
Phenols																	
Phenol	µg/l	Non - Harardous	0.5	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
2-Chlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20	<1.00	
2-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20	<1.00	
3-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
3+4-Methylphenol	µg/l	nc	No GTV/IGV	29.9	29.9	29.9	1	0								29.9	
3,5-Dimethylphenol	µg/l	nc	No GTV/IGV	3.83	3.83	3.83	1	0								3.83	
4-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
2,4-Dimethylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20	<1.00	
2,4-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20	<1.00	
2,6-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
4-Chlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	1	0								<1.00	
4-Chloro-3-Methylphenol	µg/l	Hazardous substance	0.075	0.000	-	0.000	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
2,3,4-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2,3,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2,3,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2,4,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20	<1.00	
2,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
4-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<10.0
2,3,4,5-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2,2-Dichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	2	0								<1.00	<1.00
2,3,4,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2,3,5,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
3,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
2-Methyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				<0.20	<0.20	<0.20	<0.20		
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	5	0				<0.20	<0.20	<0.20	<0.20		<2.0
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	4	0				< 0.20	< 0.20	< 0.20	< 0.20		
Total Phenols	µg/l	nc	0.5	0.0	-	0.0	5	0				<5.0	<5.0	<5.0	<5.0		
Organotin Compounds																	
Organotin (total as TBTO)	µg/l	nc	0.7	0.0	-	0.0	5	0				<0.050	<0.050	<0.050	<0.050		<0.02
Dibutyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	5	0				<0.050	<0.050	<0.050	<0.050		
Tetrabutyl Tin	µg/l	nc	0.7	0.0	-	0.0	4	0				<0.0010	<0.0010	<0.0010	<0.0010		
Tributyl Tin	µg/l	nc	0.7	0.0	-	0.0	5	0				<0.050	<0.050	<0.050	<0.050		<0.02
Triphenyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	5	0				<0.050	<0.050	<0.050	<0.050		<0.02
Monobutyl Tin	µg/l	nc	0.7	0.0	-	0.0	4	0				<0.050	<0.050	<0.050	<0.050		
Petroluem Hydrocarbons																	
Aliphatic EPH >C10 - C12	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aliphatic EPH >C10 - C44	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aliphatic EPH >C12 - C16	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aliphatic EPH >C16 - C35	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aliphatic EPH >C35 - C44	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aliphatic VPH >C5 - C10	µg/l	nc	10	10.7	78.9	147.0	2	2								147	10.7
Aliphatic VPH >C5 - C6	µg/l	nc	10	0.0	-	0.0	2	0								<10	<10
Aliphatic VPH >C6 - C8	µg/l	nc	10	100.0	100.0	100.0	2	1								100	<10
Aliphatic VPH >C8 - 10	µg/l	nc	10	10.7	28.9	47.0	2	2								47	10.7
Aliphatic VPH/EPH >C5 - C44	µg/l	nc	10	10.7	10.7	10.7	1	1									10.7
Aromatic EPH >C10 - C12	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic EPH >C10 - C44	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic EPH >C12 - C16	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic EPH >C16 - C21	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic EPH >C21 - C35	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic EPH >C35 - C44	µg/l	nc	10	0.0	-	0.0	1	0									<40
Aromatic VPH >C5 - C10	µg/l	nc	10	25.6	82.3	139.0	2	2								139	25.6
Aromatic VPH >C5 - C7	µg/l	nc	10	0.0	-	0.0	2	0								<10	<10
Aromatic VPH >C7 - C8	µg/l	nc	10	0.0	-	0.0	2	0								<10	<10
Aromatic VPH >C8 - C10	µg/l	nc	10	25.6	82.3	139.0	2	2								139	25.6
Aromatic VPH/EPH >C5 - C44	µg/l	nc	10	25.6	25.6	25.6	1	1									25.6
EPH >C10 - C44	µg/l	nc	10	0.0	-	0.0	1	0									<40

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Compiled by: CF
Checked by: EW
Reviewed by: CMC

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**							
Water Quality & Inorganics															
pH	pH units	nc	9.5	6.8	7.2	7.5	16	0	7.5	7.5	7	6.8	6.9	6.9	7.3
Electrical Conductivity	uS/cm	nc	2500	575	991	1990	16	0	790	650	1100	1600	1000	1200	900
Total Dissolved Solids	mg/l	nc	No DWS	382	619	1000	16	0	510	420	720	1000	650	780	590
Biochemical Oxygen Demand	mg/l	nc	No DWS	0.0	-	0.0	0	0							
Chemical Oxygen Demand	mg/l	nc	No DWS	0.0	-	0.0	0	0							
Dissolved Oxygen	mg/l	nc	No DWS	0.7	4.9	8.1	16	0	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Total Organic Carbon	mg/l	nc	No DWS	1.2	9.5	18.0	16	0	4.4	13	18	18	18	17	18
Cyanide (Total)	mg/l	Non - Harardous	0.05	0.066	0.111	0.155	16	2	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Suspended Solids		nc	No DWS	0.0	-	0.0	0	0							
Coliforms															
Faecal Coliforms (Colilert)	cfu/100ml	nc	0	0	772	10000	8	8	10000	1	0	6	0	11	0
Total Coliforms (Colilert)	cfu/100ml	nc	0	0	916	10000	15	15	10000	51	210	150	3	490	0
Inorganic Ions															
Calcium	mg/l	nc	No DWS	84.0	1144.2	7220.0	16	0	95	95	180	160	150	84	120
Potassium	mg/l	nc	No DWS	1.6	12.6	62.9	16	0	1.7	1.6	7.7	16	2.8	16	5.1
Magnesium	mg/l	nc	No DWS	5.9	46.3	151.0	16	0	5.9	12	13	29	24	14	21
Sodium	mg/l	nc	200	15.4	35.8	94.1	16	0	35	22	23	88	27	49	26
Chloride	mg/l	Non - Harardous	250	6.6	36.9	124.0	16	0	50	29	35	76	6.6	14	45
Fluoride	mg/l	nc	1.5	0.064	0.175	0.300	16	0	0.14	0.19	0.13	0.14	0.064	0.17	0.16
Orthophosphate as PO4	mg/l	Non - Harardous	No DWS	0.066	0.103	0.260	16	0	0.26	0.081	0.1	0.074	0.066	0.07	0.071
Sulphate	mg/l	nc	250	4.8	16.9	43.7	16	0	27	24	25	15	<1.0	6.7	15
Ammoniacal Nitrogen	mg/l	Non - Harardous	0.3	0.68	12.30	66.70	16	11	0.7	2.5	3	13	0.68	13	6.2
Total Oxidised Nitrogen	mg/l	nc	50.5	0.57	7.92	34.00	16	0	1.9	0.57	34	21	1.6	6.3	0.75
Alkalinity (Total)	mg/l	nc	No DWS	84.0	786.8	3590.0	16	0	230	220	470	580	84	530	510
Metals															
Arsenic (Dissolved)	µg/l	Hazardous substance	10	1.0	1.5	2.2	16	0	1.5	<1.0	1	<1.0	<1.0	1.1	1.6
Boron (Dissolved)	µg/l	Non - Harardous	1000	70.0	309.6	1120.0	16	1	<20	<20	74	330	76	180	70
Cadmium (Dissolved)	µg/l	Hazardous substance	5	0.11	0.63	3.10	16	0	0.11	<0.080	0.14	0.16	0.11	0.18	3.1
Chromium (Dissolved)	µg/l	Hazardous substance	50	3.3	23.3	107.0	16	1	<1.0	3.3	6.5	11	9.9	8	<1.0
Copper (Dissolved)	µg/l	Non - Harardous	2000	1.6	4.4	11.0	16	0	1.6	<1.0	<1.0	2.2	<1.0	2.5	<1.0
Iron (Dissolved)	µg/l	nc	200	240	329	440	16	7	290	240	350	360	370	440	250
Lead (Dissolved)	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Mercury (Dissolved)	µg/l	Hazardous substance	1	0.203	0.225	0.246	16	0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Manganese (Dissolved)	µg/l	nc	50	8.0	669.0	1900.0	16	14	310	500	410	300	160	520	1700
Nickel (Dissolved)	µg/l	Non - Harardous	20	2.7	15.3	79.1	16	3	2.7	6	5.2	19	11	12	12
Selenium (Dissolved)	µg/l	nc	10	0.0	-	0.0	0	0							
Zinc (Dissolved)	µg/l	Non - Harardous	No DWS	3.9	13.3	56.1	16	0	5.9	5.1	3.9	7.9	4.6	6	8.5
PAHs															
Naphthalene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[a]anthracene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[b]fluoranthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[k]fluoranthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[a]pyrene	µg/l	Hazardous substance	0.01	0.00	-	0.00	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)Pyrene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenz(a,h)Anthracene	µg/l	nc	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[g,h,i]perylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Of 16 PAH's	µg/l	nc	0.1	0.0	-	0.0	15	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<XX	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**							
VOCs															
1,1,2,2-Tetrachloroethane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0							
Chloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	µg/l	Hazardous substance	0.5	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichlorofluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trans 1,2-Dichloroethene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis 1,2-Dichloroethene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloromethane	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/l	Hazardous substance	3	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Trichloroethene	µg/l	nc	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/l	Hazardous substance	40	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Bromodichloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Toluene	µg/l	Hazardous substance	700	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trans-1,3-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Tetrachloroethene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	µg/l	nc	100	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
1,2-Dibromoethane	µg/l	Hazardous substance	0.4	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethylbenzene	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m & p-Xylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	µg/l	nc	20	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tribromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<50	<50	<50	<50	<50	<50	<50
2-Chlorotoluene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tert-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sec-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-Chloropropane	µg/l	nc	1	0.0	-	0.0	16	0	<50	<50	<50	<50	<50	<50	<50
1,3,5-Trichlorobenzene	µg/l	nc	0.1	0.0	-	0.0	8	0							
1,2,3-Trichlorobenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl Tert-Butyl Ether	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SVOCs															
2,4-Dinitrotoluene	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Chlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Propylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-Dichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,6-Dinitrotoluene	µg/l	nc	No DWS	0.0	-	0.0	9	0							
4-Bromophenyl Phenyl Ether	µg/l	nc	No DWS	0.0	-	0.0	9	0							
4-Chlorophenyl phenyl ether	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Bis(2-chloroethoxy)methane	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Bis(2-chloroethyl)ether	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Bis(2-chloroisopropyl)ether	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0							

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<LOD	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**							
Pesticides															
Demeton-O	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Demeton-S	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Disulfoton	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenthion	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Trichloronate	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Prothiofos	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fensulphothion	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sulprofos	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-Methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-ethyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Coumaphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Atraton	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Prometon	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Simazine	µg/l	Hazardous substance	0.1	0.023	0.030	0.040	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Atrazine	µg/l	Hazardous substance	0.1	0.024	0.036	0.042	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Propazine	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Trietazine	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Trifluralin	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Triallate	µg/l	Hazardous substance	0.1	0.063	0.063	0.063	8	0							
Triazophos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Tecnazene	µg/l	nc	0.1	0.0	-	0.0	8	0							
Propetamphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Terbuthylazine	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzyl Butyl Phthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Bis(2-ethylhexyl)phthalate	µg/l		No DWS	0.0	-	0.0	9								
Carbon Tetrachloride	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbophenothion	µg/l	nc	0.1	0.0	-	0.0	8	0							
Chlorfenvinphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Chlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chlorpyriphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Diazinon	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Dibenzofuran	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Dichlobenil	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Dichlorodifluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloromethane	µg/l	Non - Harardous	20	0.0	-	0.0	9	0							
Dichlorvos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Diethylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Dimethoate	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Dimethylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0							
di-n-Butylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Di-n-octylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Diphenylamine	µg/l	Non - Harardous	No DWS	0.0	-	0.0	9	0							
Endrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenitrothion	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Gamma-HCH	µg/l	Hazardous substance	0.1	0.0043	0	0.0057	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Hexachloroethane	µg/l	Hazardous substance	0.1	0.0	-	0.0	9	0							
Isodrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
n-butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrobenzene	µg/l	nc	0.1	0.0	-	0.0	9	0							
n-Nitrosodi-n-propylamine	µg/l	nc	0.1	0.0	-	0.0	9	0							
n-propylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p - DDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
o,p - DDT	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
o,p - TDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
p,p - DDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDT	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - TDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Parathion-ethyl	µg/l	nc	0.1	0.0	-	0.0	8	0							
Parathion-methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Pentachlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phosalone	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Pirimiphos-methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
4-Isopropyltoluene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Compiled by: CF
Checked by: EW
Reviewed by: CMC

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<XX	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**							
2-Methylnaphthalene	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Secbumeton	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Isophorone	µg/l	nc	No DWS	0.0	-	0.0	9	0							
Simetryn	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Malathion	µg/l	Hazardous substance	0.1	0.005	0.006	0.006	8	0							
Ametryn	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mevinphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0							
Prometryn	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Terbutryn	µg/l	nc	0.1	0.024	0.092	0.181	15	1	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Alpha-HCH	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Beta-HCH	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Delta-HCH	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor	µg/l	Hazardous substance	0.03	0.00	-	0.00	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Aldrin	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor Epoxide	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Gamma-Chlordane	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Alpha-Chlordane	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Chloronaphthalene	µg/l	nc	0.1	0.0	-	0.0	9	0							
Endosulfan I	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDE	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dieldrin	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDD	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan II	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin Aldehyde	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDT	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan Sulphate	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methoxychlor	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin Ketone	µg/l	nc	0.1	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorothalonil	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Phenols															
Phenol	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Chlorophenol	µg/l	Hazardous substance	No DWS	1.16	1.16	1.16	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3+4-Methylphenol	µg/l	nc	No DWS	1.11	1.62	1.99	9	0							
3,5-Dimethylphenol	µg/l	nc	No DWS	0.0	-	0.0	9	0							
4-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Nitrophenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-Dimethylphenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-Dichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,6-Dichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4-Chlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0							
4-Chloro-3-Methylphenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,4-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,6-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4,6-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4-Nitrophenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,4,5-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,2-Dichloropropane	µg/l	nc	No DWS	0.0	-	0.0	9	0							
2,3,4,6-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,5,6-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3,4,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Methyl-4,6-Dinitrophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Pentachlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Total Phenols	µg/l	nc	No DWS	0.0	-	0.0	7	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Organotin Compounds															
Organotin (total as TBTO)	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibutyl Tin	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tetrabutyl Tin	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tributyl Tin	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Triphenyl Tin	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Monobutyl Tin	µg/l	nc	No DWS	0.0	-	0.0	7	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

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EPA Export 11-11-2020:06:31:53

CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**									
Water Quality & Inorganics																	
pH	pH units	nc	9.5	6.8	7.2	7.5	16	0	7.5	7.3	7.2	7.3	7.2	7.1	7.1	7.5	7.2
Electrical Conductivity	uS/cm	nc	2500	575	991	1990	16	0	657	634	786	924	1990	840	1360	845	575
Total Dissolved Solids	mg/l	nc	No DWS	382	619	1000	16	0	457	427	531	649	966	526	764	529	382
Biochemical Oxygen Demand	mg/l	nc	No DWS	0.0	-	0.0	0	0									
Chemical Oxygen Demand	mg/l	nc	No DWS	0.0	-	0.0	0	0									
Dissolved Oxygen	mg/l	nc	No DWS	0.7	4.9	8.1	16	0	2.8	1.5	2.1	0.7	1.7	3.8	1.8	<0.5	2
Total Organic Carbon	mg/l	nc	No DWS	1.2	9.5	18.0	16	0	1.4	<0.7	2.7 *	2.3	17.8	1.5	5.8	3.3	1.2
Cyanide (Total)	mg/l	Non - Harardous	0.05	0.066	0.111	0.155	16	2	<0.009	<0.009	<0.009	<0.009	0.066	<0.009	<0.009	0.155	<0.009
Total Suspended Solids		nc	No DWS	0.0	-	0.0	0	0									
Coliforms																	
Faecal Coliforms (Colilert)	cfu/100ml	nc	0	0	772	10000	8	8	2	0	1203	0	0	0	1120	0	1
Total Coliforms (Colilert)	cfu/100ml	nc	0	0	916	10000	15	15	2	128 *	2420	4	1	2	613	579	2
Inorganic Ions																	
Calcium	mg/l	nc	No DWS	84.0	1144.2	7220.0	16	0	538	269 *	7220	1090	1080	962	303	1810	1730
Potassium	mg/l	nc	No DWS	1.6	12.6	62.9	16	0	6.05	10.5	12.7	10.9	62.9	2.35	19.6	<9.00	<9.00
Magnesium	mg/l	nc	No DWS	5.9	46.3	151.0	16	0	20.9	136	151	37.3	71.7	29.1	19.8	117	39.5
Sodium	mg/l	nc	200	15.4	35.8	94.1	16	0	23.1	20.2	15.7	29.5	94.1	15.4	37.3	31.9	<0.30
Chloride	mg/l	Non - Harardous	250	6.6	36.9	124.0	16	0	22.6	20.2	13.5	30.9	124	21	50.9	42.8	8.1
Fluoride	mg/l	nc	1.5	0.064	0.175	0.300	16	0	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.2	0.2
Orthophosphate as PO4	mg/l	Non - Harardous	No DWS	0.066	0.103	0.260	16	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Sulphate	mg/l	nc	250	4.8	16.9	43.7	16	0	43	15.4	23.5	14	4.9	8.5	4.8	13.3	12
Ammoniacal Nitrogen	mg/l	Non - Harardous	0.3	0.68	12.30	66.70	16	11	<0.41	<0.41	4	<0.41	66.7	<0.41	24.7	0.87	<0.41
Total Oxidised Nitrogen	mg/l	nc	50.5	0.57	7.92	34.00	16	0	<0.7	1.8	<0.7	18.3	7.6	5.3	5.2	2.9	3.6
Alkalinity (Total)	mg/l	nc	No DWS	84.0	786.8	3590.0	16	0	539	947	473	719	1220	1050	697	729	3590
Metals																	
Arsenic (Dissolved)	µg/l	Hazardous substance	10	1.0	1.5	2.2	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0
Boron (Dissolved)	µg/l	Non - Harardous	1000	70.0	309.6	1120.0	16	0	<230	<230	<230	280	1120	<230	347	<230	<230
Cadmium (Dissolved)	µg/l	Hazardous substance	5	0.11	0.63	3.10	16	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chromium (Dissolved)	µg/l	Hazardous substance	50	3.3	23.3	107.0	16	1	47	107	4.7	24	24.7	24.5	8.9	<100	<100
Copper (Dissolved)	µg/l	Non - Harardous	2000	1.6	4.4	11.2	16	0	<9.00	<9.00	<9.00	<9.00	11.2	<9.00	<9.00	<9.00	<9.00
Iron (Dissolved)	µg/l	nc	200	240	329	440	16	7	<230	<230	<230	<230	<230	<230	<230	<230	<230
Lead (Dissolved)	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00
Mercury (Dissolved)	µg/l	Hazardous substance	1	0.203	0.225	0.246	16	0	<0.200	<0.200	<0.200	0.203	<0.200	0.246	<0.200	<0.200	<0.100
Manganese (Dissolved)	µg/l	nc	50	8.0	669.0	1900.0	16	14	237	8	735	181	1900	<7.00	1180	1830	64.3
Nickel (Dissolved)	µg/l	Non - Harardous	20	2.7	15.3	79.1	16	3	<3.00	4.4	20.3	7.7	79.1	5.5	17.4	22.1	5.1
Selenium (Dissolved)	µg/l	nc	10	0.0	-	0.0	0	0									
Zinc (Dissolved)	µg/l	Non - Harardous	No DWS	3.9	13.3	56.1	16	0	<18.0	<18.0	<18.0	<18.0	21.6	<18.0	<18.0	56.1	<18.0
PAHs																	
Naphthalene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo[a]anthracene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Chrysene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo[b]fluoranthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[k]fluoranthene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[a]pyrene	µg/l	Hazardous substance	0.01	0.00	-	0.00	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Indeno(1,2,3-c,d)Pyrene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Dibenz(a,h)Anthracene	µg/l	nc	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[g,h,i]perylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Total Of 16 PAH's	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
xxx	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**									
VOCs																	
1,1,2,2-Tetrachloroethane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Vinyl Chloride	µg/l	Hazardous substance	0.5	0.0	-	0.0	16	0	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Bromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichlorofluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloroethene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trans 1,2-Dichloroethene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloroethane	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
cis 1,2-Dichloroethene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromochloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichloromethane	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,1-Trichloroethane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Carbon Tetrachloride	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Benzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichloroethane	µg/l	Hazardous substance	3	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichloroethene	µg/l	nc	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichloropropane	µg/l	Hazardous substance	40	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dibromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromodichloromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
cis-1,3-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Toluene	µg/l	Hazardous substance	700	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trans-1,3-Dichloropropene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,2-Trichloroethane	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tetrachloroethene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3-Dichloropropane	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dibromochloromethane	µg/l	nc	100	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dibromoethane	µg/l	Hazardous substance	0.4	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,1,2-Tetrachloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Ethylbenzene	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
m & p-Xylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
o-Xylene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Styrene	µg/l	nc	20	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tribromomethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Isopropylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromobenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,3-Trichloropropane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chlorotoluene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3,5-Trimethylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chlorotoluene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tert-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,4-Trimethylbenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Sec-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Isopropyltoluene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dibromo-3-Chloropropane	µg/l	nc	1	0.0	-	0.0	16	0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
1,3,5-Trichlorobenzene	µg/l	nc	0.1	0.0	-	0.0	8	0	<0.012	<0.012	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1,2,3-Trichlorobenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Methyl Tert-Butyl Ether	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
SVOCs																	
2,4-Dinitrotoluene	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichlorodifluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
N-Propylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3-Dichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobutadiene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,4-Trichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,4-Dichlorobenzene	µg/l	Hazardous substance	300	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
N-Butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,6-Dinitrotoluene	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Bromophenyl Phenyl Ether	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorophenyl phenyl ether	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethoxy)methane	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethyl)ether	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroisopropyl)ether	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Compiled by: CF
Checked by: EW
Reviewed by: CMC

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
xxx	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**									
Pesticides																	
Demeton-O	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Phorate	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Demeton-S	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Disulfoton	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Fenthion	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.011	<0.011	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
Trichloronate	µg/l	nc	0.1	0.0	-	0.0	7	0									
Prothiofos	µg/l	nc	0.1	0.0	-	0.0	7	0									
Fensulphothion	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Sulprofos	µg/l	nc	0.1	0.0	-	0.0	7	0									
Azinphos-Methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.008	<0.008	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Azinphos-ethyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
Coumaphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Atraton	µg/l	nc	0.1	0.0	-	0.0	7	0									
Prometon	µg/l	nc	0.1	0.0	-	0.0	7	0									
Simazine	µg/l	Hazardous substance	0.1	0.023	0.030	0.040	15	0	<0.054	<0.054	0.04	<0.020	<0.020	<0.022	0.026	0.023	
Atrazine	µg/l	Hazardous substance	0.1	0.024	0.036	0.042	15	0	<0.044	<0.044	0.038	0.024	<0.020	<0.020	0.039	0.042	
Propazine	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.034	<0.034	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Trietazine	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.030	<0.030	<0.012	<0.010	<0.010	<0.012	<0.012	<0.012	
Trifluralin	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.037	<0.037	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Triallate	µg/l	Hazardous substance	0.1	0.063	0.063	0.063	8	0	0.063	<0.017	<0.017	<0.01	<0.01	<0.017	<0.017	<0.017	
Triazophos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Tecnazene	µg/l	nc	0.1	0.0	-	0.0	8	0	<0.034	<0.034	<0.014	<0.01	<0.01	<0.014	<0.014	<0.014	
Propetamphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.008	<0.008	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	
Terbuthylazine	µg/l	nc	0.1	0.0	-	0.0	7	0									
Benzyl Butyl Phthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate	µg/l		No DWS	0.0	-	0.0	9	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon Tetrachloride	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Carbophenothion	µg/l	nc	0.1	0.0	-	0.0	8	0	<0.014	<0.014	<0.006	<0.003	<0.003	<0.006	<0.006	<0.006	
Chlorfenvinphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.010	<0.010	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Chlorobenzene	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloroethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chlorpyriphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.007	<0.007	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Diazinon	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.012	<0.012	<0.005	<0.003	<0.003	<0.005	<0.005	<0.005	
Dibenzofuran	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlobenil	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Dichlorodifluoromethane	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichloromethane	µg/l	Non - Harardous	20	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichlorvos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.006	<0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Diethylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dimethoate	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.02	<0.02	<0.02	<0.020	<0.020	<0.02	<0.02	<0.020	
Dimethylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
di-n-Butylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Di-n-octylphthalate	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diphenylamine	µg/l	Non - Harardous	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Endrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Fenitrothion	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.010	<0.010	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
Gamma-HCH	µg/l	Hazardous substance	0.1	0.0043	0	0.0057	15	0	<0.0093	<0.0093	<0.0043	<0.0027	<0.0027	<0.0043	0.0057	0.0043	
Hexachloroethane	µg/l	Hazardous substance	0.1	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isodrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
n-butylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Nitrobenzene	µg/l	nc	0.1	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Nitrosodi-n-propylamine	µg/l	nc	0.1	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-propylbenzene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
o,p - DDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
o,p - DDT	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.01	<0.01	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
o,p - TDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
p,p - DDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.01	<0.01	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
p,p - DDT	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
p,p - TDE	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Parathion-ethyl	µg/l	nc	0.1	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Parathion-methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.008	<0.008	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Pentachlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phorate	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Phosalone	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.016	<0.016	<0.007	<0.004	<0.004	<0.007	<0.007	<0.007	
Pirimiphos-methyl	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.010	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
4-Isopropyltoluene	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
DWS	Drinking Water Regulations, 2014 (S.I. No. 122 of 2014). Drinking Water Regulations, 2007 (S.I. No. 106 of 2007)

Lab Job No.:									COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**DWS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of DWS Exceedances**									
2-Methylnaphthalene	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Secbumeton	µg/l	nc	0.1	0.0	-	0.0	7	0									
Isophorone	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Simetryn	µg/l	nc	0.1	0.0	-	0.0	7	0									
Malathion	µg/l	Hazardous substance	0.1	0.005	0.006	0.006	8	0	<0.011	<0.011	<0.004	<0.004	<0.004	<0.004	0.006	0.005	
Ametryn	µg/l	nc	0.1	0.0	-	0.0	7	0									
Mevinphos	µg/l	Hazardous substance	0.1	0.0	-	0.0	8	0	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Prometryn	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.034	<0.034	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Terbutryn	µg/l	nc	0.1	0.024	0.092	0.181	15	1	0.181	0.071	<0.02	<0.020	<0.020	<0.020	<0.02	0.024	
Alpha-HCH	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Beta-HCH	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Delta-HCH	µg/l	nc	0.1	0.0	-	0.0	7	0									
Heptachlor	µg/l	Hazardous substance	0.03	0.00	-	0.00	7	0									
Aldrin	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.011	<0.011	<0.006	<0.004	<0.004	<0.005	<0.005	<0.005	
Heptachlor Epoxide	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Gamma-Chlordane	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Alpha-Chlordane	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.003	<0.003	<0.006	<0.006	<0.006	
2-Chloronaphthalene	µg/l	nc	0.1	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Endosulfan I	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
p,p - DDE	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.01	<0.01	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Dieldrin	µg/l	Hazardous substance	0.03	0.00	-	0.00	15	0	<0.012	<0.012	<0.005	<0.004	<0.004	<0.005	<0.005	<0.005	
Endrin	µg/l	Hazardous substance	0.1	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
p,p - DDD	µg/l	nc	0.1	0.0	-	0.0	7	0									
Endosulfan II	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Endrin Aldehyde	µg/l	nc	0.1	0.0	-	0.0	7	0									
p,p - DDT	µg/l	nc	0.1	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Endosulfan Sulphate	µg/l	nc	0.1	0.0	-	0.0	7	0									
Methoxychlor	µg/l	nc	0.1	0.0	-	0.0	7	0									
Endrin Ketone	µg/l	nc	0.1	0.0	-	0.0	7	0									
Chlorothalonil	µg/l	Hazardous substance	0.1	0.0	-	0.0	7	0									
Phenols																	
Phenol	µg/l	Non - Harardous	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	µg/l	Hazardous substance	No DWS	1.16	1.16	1.16	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.16	<1.00	<1.00
2-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
3-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
3+4-Methylphenol	µg/l	nc	No DWS	1.11	1.62	1.94	9	0	1.11	<1.00	<1.00	<1.00	<1.00	<1.00	1.94	1.81	<1.00
3,5-Dimethylphenol	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Methylphenol	µg/l	nc	No DWS	0.0	-	0.0		0									
2-Nitrophenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4-Dichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,6-Dichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
4-Chlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chloro-3-Methylphenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,3,4-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
2,3,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
2,3,6-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
2,4,6-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Nitrophenol	µg/l	nc	No DWS	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,5-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
2,2-Dichloropropane	µg/l	nc	No DWS	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,4,6-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
2,3,5,6-Tetrachlorophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
3,4,5-Trichlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
2-Methyl-4,6-Dinitrophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
Pentachlorophenol	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	nc	No DWS	0.0	-	0.0	7	0									
Total Phenols	µg/l	nc	No DWS	0.0	-	0.0	7	0									
Organotin Compounds																	
Organotin (total as TBTO)	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibutyl Tin	µg/l	Hazardous substance	No DWS	0.0	-	0.0	7	0									
Tetrabutyl Tin	µg/l	nc	No DWS	0.0	-	0.0	7	0									
Tributyl Tin	µg/l	nc	No DWS	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Triphenyl Tin	µg/l	Hazardous substance	No DWS	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Monobutyl Tin	µg/l	nc	No DWS	0.0	-	0.0	7	0									

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**							
Water Quality & Inorganics															
pH	pH units	nc	9.5	6.8	7.2	7.5	16	0	7.5	7.5	7	6.8	6.9	6.9	7.3
Electrical Conductivity	uS/cm	nc	1,875	575	991	1990	16	1	790	650	1100	1600	1000	1200	900
Total Dissolved Solids	mg/l	nc	1000	382	619	1000	16	0	510	420	720	1000	650	780	590
Biochemical Oxygen Demand	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0							
Chemical Oxygen Demand	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0							
Dissolved Oxygen	mg/l	nc	No GTV/IGV	0.7	4.9	8.1	16	0	8.1	8.1	8.1	8.1	8.1	8.1	8.1
Total Organic Carbon	mg/l	nc	No GTV/IGV	1.2	9.5	18.0	16	0	4.4	13	18	18	18	17	18
Cyanide (Total)	mg/l	Non - Harardous	0.0375	0.0660	0.1105	0.1550	16	2	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Suspended Solids		nc	No GTV/IGV	0.0	-	0.0	0	0							
Coliforms															
Faecal Coliforms (Colilert)	cfu/100ml	nc	0	0	772	10000	8	8	10000	1	0	6	0	11	0
Total Coliforms (Colilert)	cfu/100ml	nc	0	0	916	10000	15	15	10000	51	210	150	3	490	0
Inorganic Ions															
Calcium	mg/l	nc	No GTV/IGV	84.0	1144.2	7220.0	16	0	95	95	180	160	150	84	120
Potassium	mg/l	nc	5	1.6	12.6	62.9	16	10	1.7	1.6	7.7	16	2.8	16	5.1
Magnesium	mg/l	nc	50	5.9	46.3	151.0	16	4	5.9	12	13	29	24	14	21
Sodium	mg/l	nc	150	15.4	35.8	94.1	16	0	35	22	23	88	27	49	26
Chloride	mg/l	Non - Harardous	No GTV/IGV	6.6	36.9	124.0	16	0	50	29	35	76	6.6	14	45
Fluoride	mg/l	nc	1.0	0.064	0.175	0.300	16	0	0.14	0.19	0.13	0.14	0.064	0.17	0.16
Orthophosphate as PO4	mg/l	Non - Harardous	0.035	0.066	0.103	0.260	16	7	0.26	0.081	0.1	0.074	0.066	0.07	0.071
Sulphate	mg/l	nc	188	4.8	16.9	43.7	16	0	27	24	25	15	<1.0	6.7	15
Ammoniacal Nitrogen	mg/l	Non - Harardous	0.175	0.680	12.305	66.700	16	11	0.7	2.5	3	13	0.68	13	6.2
Total Oxidised Nitrogen	mg/l	nc	No GTV/IGV	0.57	7.92	34.00	16	0	1.9	0.57	34	21	1.6	6.3	0.75
Alkalinity (Total)	mg/l	nc	No GTV/IGV	84.0	786.8	3590.0	16	0	230	220	470	580	84	530	510
Metals															
Arsenic (Dissolved)	µg/l	Hazardous substance	7.5	1.0	1.5	2.2	16	0	1.5	<1.0	1	<1.0	<1.0	1.1	1.6
Boron (Dissolved)	µg/l	Non - Harardous	750	70.0	309.6	1120.0	16	1	<20	<20	74	330	76	180	70
Cadmium (Dissolved)	µg/l	Hazardous substance	3.75	0.11	0.63	3.10	16	0	0.11	<0.080	0.14	0.16	0.11	0.18	3.1
Chromium (Dissolved)	µg/l	Hazardous substance	37.5	3.3	23.3	107.0	16	2	<1.0	3.3	6.5	11	9.9	8	<1.0
Copper (Dissolved)	µg/l	Non - Harardous	1500	1.6	4.4	11.4	16	0	1.6	<1.0	<1.0	2.2	<1.0	2.5	<1.0
Iron (Dissolved)	µg/l	nc	200	240	329	440	16	7	290	240	350	360	370	440	250
Lead (Dissolved)	µg/l	Hazardous substance	0.75	0.00	-	0.00	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Mercury (Dissolved)	µg/l	Hazardous substance	0.75	0.203	0.225	0.246	16	0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Manganese (Dissolved)	µg/l	nc	50	8.0	669.0	1900.0	16	14	310	500	410	300	160	520	1700
Nickel (Dissolved)	µg/l	Non - Harardous	15	2.7	15.3	79.1	16	5	2.7	6	5.2	19	11	12	12
Selenium (Dissolved)	µg/l	nc	No GTV/IGV	0.0	-	0.0	0	0							
Zinc (Dissolved)	µg/l	Non - Harardous	75	3.9	13.3	56.1	16	0	5.9	5.1	3.9	7.9	4.6	6	8.5
PAHs															
Naphthalene	µg/l	Hazardous substance	1.0	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	µg/l	Hazardous substance	10000	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[a]anthracene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[b]fluoranthene	µg/l	Hazardous substance	0.5	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[k]fluoranthene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[a]pyrene	µg/l	Hazardous substance	0.0075	0.000	-	0.000	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno(1,2,3-c,d)Pyrene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenz(a,h)Anthracene	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[g,h,i]perylene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Of 16 PAH's	µg/l	nc	0.075	0.000	-	0.000	15	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**							
VOCs															
1,1,2,2-Tetrachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0							
Chloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	µg/l	Hazardous substance	0.375	0.000	-	0.000	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichlorofluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	µg/l	Hazardous substance	30	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trans 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloromethane	µg/l	Hazardous substance	12	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-Trichloroethane	µg/l	Hazardous substance	500	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	µg/l	nc	2	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	µg/l	Hazardous substance	0.75	0.00	-	0.00	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	µg/l	Hazardous substance	2.25	0.00	-	0.00	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Trichloroethene	µg/l	nc	7.5	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Bromodichloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
cis-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Toluene	µg/l	Hazardous substance	525	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trans-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
1,1,2-Trichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
Tetrachloroethene	µg/l	Hazardous substance	7.5	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<10	<10	<10	<10	<10	<10	<10
1,2-Dibromoethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,1,1,2-Tetrachloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethylbenzene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m & p-Xylene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tribromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,3-Trichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<50	<50	<50	<50	<50	<50	<50
2-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3,5-Trimethylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tert-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trimethylbenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sec-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Isopropyltoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromo-3-Chloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<50	<50	<50	<50	<50	<50	<50
1,3,5-Trichlorobenzene	µg/l	nc	0.4	0.0	-	0.0	8	0							
1,2,3-Trichlorobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl Tert-Butyl Ether	µg/l	Non - Harardous	10	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SVOCs															
2,4-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Propylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,3-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/l	Hazardous substance	0.1	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/l	Hazardous substance	0.4	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
N-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,6-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
4-Bromophenyl Phenyl Ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
4-Chlorophenyl phenyl ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Bis(2-chloroethoxy)methane	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Bis(2-chloroethyl)ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Bis(2-chloroisopropyl)ether	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0							

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**							
Pesticides															
Demeton-O	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Demeton-S	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Disulfoton	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenthion	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Trichloronate	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Prothiofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fensulphothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sulprofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-Methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Azinphos-ethyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Coumaphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Atraton	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Prometon	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Simazine	µg/l	Hazardous substance	0.1	0.023	0.030	0.040	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Atrazine	µg/l	Hazardous substance	0.075	0.024	0.036	0.042	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Propazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Trietazine	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Trifluralin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Triallate	µg/l	Hazardous substance	No GTV/IGV	0.063	0.063	0.063	8	0							
Triazophos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Tecnazene	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0							
Propetamphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Terbuthylazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzyl Butyl Phthalate	µg/l	nc	5	0.0	-	0.0	9	0							
Bis(2-ethylhexyl)phthalate	µg/l		6	0.0	-	0.0	9	0							
Carbon Tetrachloride	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbophenothion	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0							
Chlorfenvinphos	µg/l	Hazardous substance	5	0.0	-	0.0	8	0							
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chlorpyriphos	µg/l	Hazardous substance	90	0.0	-	0.0	8	0							
Diazinon	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Dibenzofuran	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Dichlobenil	µg/l	Hazardous substance	0.075	0.000	-	0.000	8	0							
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloromethane	µg/l	Non - Harardous	15	0.0	-	0.0	9	0							
Dichlorvos	µg/l	Hazardous substance	0.001	0.000	-	0.000	8	0							
Diethylphthalate	µg/l	nc	5	0.0	-	0.0	9	0							
Dimethoate	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Dimethylphthalate	µg/l	nc	5	0.0	-	0.0	9	0							
di-n-Butylphthalate	µg/l	nc	5	0.0	-	0.0	9	0							
Di-n-octylphthalate	µg/l	nc	5	0.0	-	0.0	9	0							
Diphenylamine	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	9	0							
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Fenitrothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
gamma-HCH	µg/l	Hazardous substance	0.075	0.0043	0.0050	0.0057	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Hexachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0							
Isodrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
n-butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrobenzene	µg/l	nc	10	0.0	-	0.0	9	0							
n-Nitrosodi-n-propylamine	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
n-propylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
o,p - DDT	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
o,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
p,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDT	µg/l	Hazardous substance	0.075	0.000	-	0.000	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Parathion-ethyl	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0							
Parathion-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Phosalone	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Pirimiphos-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
4-Isopropyltoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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EPA Export 11-11-2020:06:31:53

CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of DWS
XX	Concentration above LOD
<XX	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Lab Job No.:									18-40094	18-40094	18-40094	18-40094	18-40094	18-40094	18-40094
Lab Sample ID.:									745347	745348	745349	745350	745351	745352	745353
Sample Location:									MW01	MW02	MW04	MW05	MW06	MW07	MW08
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring	Monitoring
Date Sampled:									18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018	18/12/2018
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation
Determinand	**Units**	**Hazardous / non-hazardous Classification Per JAGDAG (2018)**	**GTV/IGV**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of GTV / IGV Exceedances**							
2-Methylnaphthalene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Secbumeton	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Isophorone	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
Simetryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Malathion	µg/l	Hazardous substance	0.01	0.005	0.006	0.006	8	0							
Ametryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Mevinphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0							
Prometryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Terbutryn	µg/l	nc	No GTV/IGV	0.024	0.092	0.181	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Alpha-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Gamma-HCH	µg/l	Hazardous substance	0.075	0.0043	0.0050	0.0057	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Beta-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Delta-HCH	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Aldrin	µg/l	Hazardous substance	20	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor Epoxide	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Gamma-Chlordane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Alpha-Chlordane	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan I	µg/l	Hazardous substance	0.001	0.000	-	0.000	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Chloronaphthalene	µg/l	nc		0.0	-	0.0	9	0							
p,p - DDE	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dieldrin	µg/l	Hazardous substance	0.075	0.000	-	0.000	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDD	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan II	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin Aldehyde	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p,p - DDT	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endosulfan Sulphate	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Methoxychlor	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Endrin Ketone	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chlorothalonil	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Phenols															
Phenol	µg/l	Non - Harardous	0.5	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Chlorophenol	µg/l	Hazardous substance	200	1.16	1.16	1.16	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3+4-Methylphenol	µg/l	nc	No GTV/IGV	1.11	1.62	1.94	9	0							
3,5-Dimethylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
4-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-Dimethylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,6-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4-Chlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0							
4-Chloro-3-Methylphenol	µg/l	Hazardous substance	0.075	0.000	-	0.000	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,4-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
4-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,4,5-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,2-Dichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0							
2,3,4,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,3,5,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
3,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Methyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	16	0	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Total Phenols	µg/l	nc	0.5	0.0	-	0.0	7	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Organotin Compounds															
Organotin (total as TBTO)	µg/l	nc	0.7	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibutyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	7	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Tetrabutyl Tin	µg/l	nc	0.7	0.0	-	0.0	7	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tributyl Tin	µg/l	nc	0.7	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Triphenyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	16	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Monobutyl Tin	µg/l	nc	0.7	0.0	-	0.0	7	0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

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CDM Smith

nc	No criteria
blank	Sample not scheduled for analysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Water Quality & Inorganics																	
pH	pH units	nc	9.5	6.8	7.2	7.5	16	0	7.5	7.3	7.2	7.3	7.2	7.1	7.1	7.5	7.2
Electrical Conductivity	uS/cm	nc	1,875	575	991	1990	16	1	657	634	786	924	1990	840	1360	845	575
Total Dissolved Solids	mg/l	nc	1000	382	619	1000	16	0	457	427	531	649	966	526	764	529	382
Biochemical Oxygen Demand	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0									
Chemical Oxygen Demand	mg/l	nc	No GTV/IGV	0.0	-	0.0	0	0									
Dissolved Oxygen	mg/l	nc	No GTV/IGV	0.7	4.9	8.1	16	0	2.8	1.5	2.1	0.7	1.7	3.8	1.8	<0.5	2
Total Organic Carbon	mg/l	nc	No GTV/IGV	1.2	9.5	18.0	16	0	1.4	<0.7	2.7	2.3	17.8	1.5	5.8	3.3	1.2
Cyanide (Total)	mg/l	Non - Harardous	0.0375	0.0660	0.1105	0.1550	16	2	<0.009	<0.009	<0.009	<0.009	0.066	<0.009	<0.009	0.155	<0.009
Total Suspended Solids		nc	No GTV/IGV	0.0	-	0.0	0	0									
Coliforms																	
Faecal Coliforms (Colilert)	cfu/100ml	nc	0	0	772	10000	8	8	2	0	1203	0	0	0	1120	0	1
Total Coliforms (Colilert)	cfu/100ml	nc	0	0	916	10000	15	15	2	128	2420	4	1	2	613	579	2
Inorganic Ions																	
Calcium	mg/l	nc	No GTV/IGV	84.0	1144.2	7220.0	16	0	538	2690	7220	1090	1080	962	303	1810	1730
Potassium	mg/l	nc	5	1.6	12.6	62.9	16	10	6.05	10.5	12.7	10.9	62.9	2.35	19.6	<9.00	<9.00
Magnesium	mg/l	nc	50	5.9	46.3	151.0	16	4	20.9	136	151	37.3	71.7	29.1	19.8	117	39.5
Sodium	mg/l	nc	150	15.4	35.8	94.1	16	0	23.1	20.2	15.7	29.5	94.1	15.4	37.3	31.9	<0.30
Chloride	mg/l	Non - Harardous	No GTV/IGV	6.6	36.9	124.0	16	0	22.6	20.2	13.5	30.9	124	21	50.9	42.8	8.1
Fluoride	mg/l	nc	1.0	0.064	0.175	0.300	16	0	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.2	0.2
Orthophosphate as PO4	mg/l	Non - Harardous	0.035	0.066	0.103	0.260	16	7	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Sulphate	mg/l	nc	188	4.8	16.9	43.7	16	0	43	15.4	23.5	14	4.9	8.5	4.8	13.3	12
Ammoniacal Nitrogen	mg/l	Non - Harardous	0.175	0.680	12.305	66.700	16	11		<0.41	4	<0.41	66.7	<0.41	24.7	0.87	<0.41
Total Oxidised Nitrogen	mg/l	nc	No GTV/IGV	0.57	7.92	34.00	16	0	<0.7	1.8	<0.7	18.3	7.6	5.3	5.2	2.9	3.6
Alkalinity (Total)	mg/l	nc	No GTV/IGV	84.0	786.8	3590.0	16	0	539	947	473	719	1220	1050	697	729	3590
Metals																	
Arsenic (Dissolved)	µg/l	Hazardous substance	7.5	1.0	1.5	2.2	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0
Boron (Dissolved)	µg/l	Non - Harardous	750	70.0	309.6	1120.0	16	1	<230	<230	<230	280	1120	<230	347	<230	<230
Cadmium (Dissolved)	µg/l	Hazardous substance	3.75	0.11	0.63	3.10	16	0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chromium (Dissolved)	µg/l	Hazardous substance	37.5	3.3	23.3	107.0	16	2	47	107	4.7	24	24.7	24.5	8.9	<100	<100
Copper (Dissolved)	µg/l	Non - Harardous	1500	1.6	4.4	11.2	16	0	<9.00	<9.00	<9.00	<9.00	11.2	<9.00	<9.00	<9.00	<9.00
Iron (Dissolved)	µg/l	nc	200	240	329	440	16	7	<230	<230	<230	<230	<230	<230	<230	<230	<230
Lead (Dissolved)	µg/l	Hazardous substance	0.75	0.00	-	0.00	16	0	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00	<6.00
Mercury (Dissolved)	µg/l	Hazardous substance	0.75	0.203	0.225	0.246	16	0	<0.200	<0.200	<0.200	0.203	<0.200	0.246	<0.200	<0.200	<0.100
Manganese (Dissolved)	µg/l	nc	50	8.0	669.0	1900.0	16	14	237	8	735	181	1900	<7.00	1180	1830	64.3
Nickel (Dissolved)	µg/l	Non - Harardous	15	2.7	15.3	79.1	16	5	<3.00	4.4	20.3	7.7	79.1	5.5	17.4	22.1	5.1
Selenium (Dissolved)	µg/l	nc	No GTV/IGV	0.0	-	0.0	0	0									
Zinc (Dissolved)	µg/l	Non - Harardous	75	3.9	13.3	56.1	16	0	<18.0	<18.0	<18.0	<18.0	21.6	<18.0	<18.0	56.1	<18.0
PAHs																	
Naphthalene	µg/l	Hazardous substance	1.0	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	µg/l	Hazardous substance	10000	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo[a]anthracene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Chrysene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo[b]fluoranthene	µg/l	Hazardous substance	0.5	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[k]fluoranthene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[a]pyrene	µg/l	Hazardous substance	0.0075	0.000	-	0.000	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Indeno(1,2,3-c,d)Pyrene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Dibenz(a,h)Anthracene	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[g,h,i]perylene	µg/l	Hazardous substance	0.05	0.00	-	0.00	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Total Of 16 PAH's	µg/l	nc	0.075	0.000	-	0.000	15	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	

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CDM Smith

nc	No criteria
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xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
VOCs																	
1,1,2,2-Tetrachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Vinyl Chloride	µg/l	Hazardous substance	0.375	0.000	-	0.000	16	0	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Bromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichlorofluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloroethene	µg/l	Hazardous substance	30	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trans 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
cis 1,2-Dichloroethene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichloromethane	µg/l	Hazardous substance	12	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,1-Trichloroethane	µg/l	Hazardous substance	500	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Carbon Tetrachloride	µg/l	nc	2	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Benzene	µg/l	Hazardous substance	0.75	0.00	-	0.00	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichloroethane	µg/l	Hazardous substance	2.25	0.00	-	0.00	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trichloroethene	µg/l	nc	7.5	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dibromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromodichloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
cis-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Toluene	µg/l	Hazardous substance	525	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Trans-1,3-Dichloropropene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,2-Trichloroethane	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tetrachloroethene	µg/l	Hazardous substance	7.5	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3-Dichloropropane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dibromochloromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dibromoethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,1,2-Tetrachloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Ethylbenzene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
m & p-Xylene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
o-Xylene	µg/l	Hazardous substance	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Styrene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tribromomethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Isopropylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bromobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,3-Trichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3,5-Trimethylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chlorotoluene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tert-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,4-Trimethylbenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Sec-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Isopropyltoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dibromo-3-Chloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
1,3,5-Trichlorobenzene	µg/l	nc	0.4	0.0	-	0.0	8	0	<0.012	<0.012	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1,2,3-Trichlorobenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Methyl Tert-Butyl Ether	µg/l	Non - Harardous	10	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
SVOCs																	
2,4-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
N-Propylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,3-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobutadiene	µg/l	Hazardous substance	0.1	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2,4-Trichlorobenzene	µg/l	Hazardous substance	0.4	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,4-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
N-Butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichlorobenzene	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,6-Dinitrotoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Bromophenyl Phenyl Ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chlorophenyl phenyl ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethoxy)methane	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroethyl)ether	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-chloroisopropyl)ether	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances									
Lab Job No.:									COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
Lab Sample ID.:									18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
Sample Location:									MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
Sample Type:									WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Well Type:									Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Date Sampled:									08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
Response Zone									Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
Pesticides																	
Demeton-O	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Demeton-S	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Disulfoton	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Fenthion	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.011	<0.011	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
Trichloronate	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Prothiofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Fensulphothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Sulprofos	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Azinphos-Methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.008	<0.008	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Azinphos-ethyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	
Coumaphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Atraton	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Prometon	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Simazine	µg/l	Hazardous substance	0.1	0.023	0.030	0.040	15	0	<0.054	<0.054	0.04	<0.020	<0.020	<0.022	0.026	0.023	
Atrazine	µg/l	Hazardous substance	0.075	0.024	0.036	0.042	15	0	<0.044	<0.044	0.038	0.024	<0.020	<0.020	0.039	0.042	
Propazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.034	<0.034	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Trietazine	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.030	<0.030	<0.012	<0.010	<0.010	<0.012	<0.012	<0.012	
Trifluralin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.037	<0.037	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Triallate	µg/l	Hazardous substance	No GTV/IGV	0.063	0.063	0.063	8	0	0.063	<0.017	<0.017	<0.01	<0.01	<0.017	<0.017	<0.017	
Triazophos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Tecnazene	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0	<0.034	<0.034	<0.014	<0.01	<0.01	<0.014	<0.014	<0.014	
Propetamphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.008	<0.008	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	
Terbuthylazine	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Benzyl Butyl Phthalate	µg/l	nc	5	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate	µg/l		6	0.0	-	0.0	9	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Carbon Tetrachloride	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Carbophenothion	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0	<0.014	<0.014	<0.006	<0.003	<0.003	<0.006	<0.006	<0.006	
Chlorfenvinphos	µg/l	Hazardous substance	5	0.0	-	0.0	8	0	<0.010	<0.010	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Chlorobenzene	µg/l	Hazardous substance	1	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chloroethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Chlorpyriphos	µg/l	Hazardous substance	90	0.0	-	0.0	8	0	<0.007	<0.007	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Diazinon	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.012	<0.012	<0.005	<0.003	<0.003	<0.005	<0.005	<0.005	
Dibenzofuran	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlobenil	µg/l	Hazardous substance	0.075	0.000	-	0.000	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Dichlorodifluoromethane	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichloromethane	µg/l	Non - Harardous	15	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Dichlorvos	µg/l	Hazardous substance	0.001	0.000	-	0.000	9	0	<0.006	<0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Diethylphthalate	µg/l	nc	5	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dimethoate	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.02	<0.02	<0.02	<0.020	<0.020	<0.02	<0.02	<0.020	
Dimethylphthalate	µg/l	nc	5	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
di-n-Butylphthalate	µg/l	nc	5	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Di-n-octylphthalate	µg/l	nc	5	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Diphenylamine	µg/l	Non - Harardous	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Fenitrothion	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.010	<0.010	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
gamma-HCH	µg/l	Hazardous substance	0.075	0.0043	0.0050	0.0057	15	0	<0.0093	<0.0093	<0.0043	<0.0027	<0.0027	<0.0043	0.0057	0.0043	
Hexachloroethane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Isodrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
n-butylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Nitrobenzene	µg/l	nc	10	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Nitrosodi-n-propylamine	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-propylbenzene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
o,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
o,p - DDT	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.01	<0.01	<0.005	<0.002	<0.002	<0.005	<0.005	<0.005	
o,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
p,p - DDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.01	<0.01	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
p,p - DDT	µg/l	Hazardous substance	0.075	0.000	-	0.000	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
p,p - TDE	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Parathion-ethyl	µg/l	nc	No GTV/IGV	0.0	-	0.0	8	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Parathion-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.008	<0.008	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phorate	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Phosalone	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.016	<0.016	<0.007	<0.004	<0.004	<0.007	<0.007	<0.007	
Pirimiphos-methyl	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.010	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
4-Isopropyltoluene	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

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Checked by: EW
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CDM Smith

nc	No criteria
blank	Sample not scheduled for anlaysis or not selected during round
xx	Exceedance of DWS
xx	Concentration above LOD
<xx	Below LOD
GTV/IGV	Groundwater Regulations, 2010 (S.I. No. 9 of 2010) Groundwater (Amendment) Regulations, 2016 (S.I. No. 366 of 2016). EPA Interim Report, 2003

Determinand	Units	Hazardous / non-hazardous Classification Per JAGDAG (2018)	GTV/IGV	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of GTV / IGV Exceedances									
								Lab Job No.:	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1709355/2019	COV/1718174/2019
								Lab Sample ID.:	18200400	18200401	18200402	18200403	18200404	18200405	18200406	18200407	18259632
								Sample Location:	MW01	MW02	MW03	MW04	MW05	MW06	MW07	MW08	BH02
								Sample Type:	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
								Well Type:	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
								Date Sampled:	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	08/05/2019	28/05/2019
								Response Zone	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Gravel Formation	Rickardstown Formation	Gravel Formation
2-Methylnaphthalene	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Secbumeton	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Isophorone	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Simetryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Malathion	µg/l	Hazardous substance	0.01	0.005	0.006	0.006	8	0	<0.011	<0.011	<0.004	<0.004	<0.004	<0.004	0.006	0.005	
Ametryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Mevinphos	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	8	0	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Prometryn	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.034	<0.034	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Terbutryn	µg/l	nc	No GTV/IGV	0.024	0.092	0.181	15	0	0.181	0.071	<0.02	<0.020	<0.020	<0.020	<0.02	0.024	
Alpha-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Gamma-HCH	µg/l	Hazardous substance	0.075	0.0043	0.0050	0.0057	15	0	<0.0093	<0.0093	<0.0043	<0.0027	<0.0027	<0.0043	0.0057	0.0043	
Beta-HCH	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.009	<0.009	<0.004	<0.003	<0.003	<0.004	<0.004	<0.004	
Delta-HCH	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Heptachlor	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Aldrin	µg/l	Hazardous substance	20	0.0	-	0.0	15	0	<0.011	<0.011	<0.005	<0.004	<0.004	<0.005	<0.005	<0.005	
Heptachlor Epoxide	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Gamma-Chlordane	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Alpha-Chlordane	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.013	<0.013	<0.006	<0.003	<0.003	<0.006	<0.006	<0.006	
Endosulfan I	µg/l	Hazardous substance	0.001	0.000	-	0.000	7	0									
2-Chloronaphthalene	µg/l	nc		0.0	-	0.0	9	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p,p - DDE	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.01	<0.01	<0.004	<0.002	<0.002	<0.004	<0.004	<0.004	
Dieldrin	µg/l	Hazardous substance	0.075	0.000	-	0.000	15	0	<0.012	<0.012	<0.005	<0.004	<0.004	<0.005	<0.005	<0.005	
Endrin	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
p,p - DDD	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Endosulfan II	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Endrin Aldehyde	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
p,p - DDT	µg/l	nc	No GTV/IGV	0.0	-	0.0	15	0	<0.014	<0.014	<0.006	<0.004	<0.004	<0.006	<0.006	<0.006	
Endosulfan Sulphate	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Methoxychlor	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Endrin Ketone	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Chlorothalonil	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
Phenols																	
Phenol	µg/l	Non - Harardous	0.5	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	µg/l	Hazardous substance	200	1.16	1.16	1.16	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.16	<1.00	<1.00
2-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
3-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
3+4-Methylphenol	µg/l	nc	No GTV/IGV	1.11	1.62	1.94	9	0	1.11	<1.00	<1.00	<1.00	<1.00	<1.00	1.94	1.81	<1.00
3,5-Dimethylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Methylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
2-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,6-Dichlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	7	0									
4-Chlorophenol	µg/l	Hazardous substance	No GTV/IGV	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chloro-3-Methylphenol	µg/l	Hazardous substance	0.075	0.000	-	0.000	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,3,4-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0									
2,3,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0									
2,3,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0									
2,4,6-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	16	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Nitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	16	0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,3,4,5-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
2,2-Dichloropropane	µg/l	nc	No GTV/IGV	0.0	-	0.0	9	0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,4,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
2,3,5,6-Tetrachlorophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
3,4,5-Trichlorophenol	µg/l	Hazardous substance	200	0.0	-	0.0	7	0									
2-Methyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Pentachlorophenol	µg/l	Hazardous substance	2	0.0	-	0.0	16	0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	nc	No GTV/IGV	0.0	-	0.0	7	0									
Total Phenols	µg/l	nc	0.5	0.0	-	0.0	7	0									
Organotin Compounds																	
Organotin (total as TBTO)	µg/l	nc	0.7	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibutyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	7	0									
Tetrabutyl Tin	µg/l	nc	0.7	0.0	-	0.0	7	0									
Tributyl Tin	µg/l	nc	0.7	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Triphenyl Tin	µg/l	Hazardous substance	0.7	0.0	-	0.0	16	0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Monobutyl Tin	µg/l	nc	0.7	0.0	-	0.0	7	0									

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Compiled by: CF
Checked by: EW
Reviewed by: CMC

EPA Export 11-11-2020:06:31:53

CDM Smith

nc	nc
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of EWS
XX	Concentration above LOD
<XX	Below LOD
EQS	Surface Waters Regulations 2015 (S.I. No. 386 of 2015) Surface Waters Regulations 2009 (S.I. No. 272 of 2009)

Lab Job No.:	18-40094	18-40094	COV/1709355/2019	COV/1709355/2019
Lab Sample ID.:	745354	745355	18200398	18200399
Sample Location:	SW01	SW02	SW01	SW02
Sample Type:	WATER	WATER	WATER	WATER
Well Type:	Surface Water	Surface Water	Surface Water	Surface Water
Date Sampled:	18/12/2018	18/12/2018	08/05/2019	08/05/2019

Determinand	Units	EQS	Minimum (result above detection limit)	Mean	Maximum	No. of Samples	No. of EQS Exceedances				
Water Quality & Inorganics											
pH		9	7.9	8.1	8.2	4	0	7.9	7.9	8.2	8.2
Electrical Conductivity	µS/cm	1000	521	604	720	4	0	650	720	521	526
Total Dissolved Solids	mg/l	No EQS	12.0	12.0	12.0	2	0	12	< 5.0		
Biochemical Oxygen Demand	mg O2/l	1.5	3.0	3.5	4.0	3	2	< 4.0		3	4
Chemical Oxygen Demand	mg O2/l	No EQS	19.0	23.3	27.0	4	0	24	19	27	23
Dissolved Oxygen	mg O2/l	No EQS	8.2	8.8	10.3	4	0	8.2	8.2	8.4	10.3
Total Organic Carbon	mg/l	No EQS	0.0	-	0.0	0	0				
Cyanide (Total)	mg/l	10	0.0	-	0.0	4	0	< 0.050	< 0.050	<0.009	<0.009
Total Suspended Solids	µg/l	No EQS	10.0	13.0	16.0	2	0			10	16
Inorganic Ions											
Calcium	mg/l	No EQS	111	133	160	4	0	150	160	111	112
Potassium	mg/l	No EQS	1.36	1.92	2.60	4	0	2.6	2.3	1.42	1.36
Magnesium	mg/l	No EQS	8.5	11.0	12.0	4	0	12	8.5	12	11.3
Sodium	mg/l	No EQS	7.70	8.09	8.49	4	0	8.1	7.7	8.49	8.08
Chloride	mg/l	No EQS	20.4	23.1	26.0	4	0	26	24	22.1	20.4
Fluoride	mg/l	0.5	0.14	0.17	0.20	4	0	0.14	0.14	0.2	0.2
Orthophosphate as PO4	mg/l	0.035	0.071	0.071	0.071	4	2	0.071	0.071	<0.6	<0.6
Sulphate	mg/l	No EQS	26.1	42.0	58.0	4	0	56	58	26.1	27.8
Ammoniacal Nitrogen	mg/l	0.065	2.900	2.950	3.000	4	2	3	2.9	<0.41	<0.41
Total Oxidised Nitrogen	mg/l	No EQS	2.5	2.7	2.9	4	0	2.5	2.9	<0.7	<0.7
Alkalinity (Total)	mg/l	No EQS	167	275	480	4	0	480	250	201	167
Metals											
Arsenic (Dissolved)	µg/l	25	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.0	<1.0
Boron (Dissolved)	µg/l	No EQS	0.0	-	0.0	4	0	< 20	< 20	<230	<230
Cadmium (Dissolved)	µg/l	0.15	0.00	-	0.00	4	0	< 0.080	< 0.080	<0.6	<0.6
Chromium (Total)	µg/l	3.4	7.7	8.0	8.3	4	2	7.7	8.3	<2.00	<2.00
Copper (Dissolved)	µg/l	30	1.6	1.8	1.9	4	0	1.6	1.9	<9.00	<9.00
Iron (Dissolved)	µg/l	No EQS	230	265	300	4	0	230	300	<230	<230
Lead (Dissolved)	µg/l	1.2	0.0	-	0.0	4	0	< 1.0	< 1.0	<6.00	<6.00
Mercury (Dissolved)	µg/l	0.05	0.00	-	0.00	4	0	< 0.50	< 0.50	<0.200	<0.200
Manganese (Dissolved)	µg/l	No EQS	7.4	8.1	8.8	4	0	7.4	8.8	<7.00	<7.00
Nickel (Dissolved)	µg/l	4	1.6	1.8	1.9	4	0	1.6	1.9	<3.00	<3.00
Selenium (Dissolved)	µg/l	No EQS	0.0	-	0.0	2	0	-	-		
Zinc (Dissolved)	µg/l	100	1.6	2.0	2.3	4	0	2.3	1.6	<18.0	<18.0
PAHs											
Naphthalene	µg/l	2	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Acenaphthylene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Acenaphthene	µg/l	No EQS	0.010	0.012	0.013	4	0	< 0.10	< 0.10	0.01	0.013
Fluorene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Phenanthrene	µg/l	No EQS	0.011	0.011	0.011	4	0	< 0.10	< 0.10	<0.01	0.011
Anthracene	µg/l	0.1	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Fluoranthene	µg/l	0.0063	0.0000	-	0.0000	4	0	< 0.10	< 0.10	<0.01	<0.01
Pyrene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Benzo[a]anthracene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Chrysene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.02
Benzo[b]fluoranthene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Benzo[k]fluoranthene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Benzo[a]pyrene	µg/l	0.00017	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Indeno(1,2,3-c,d)Pyrene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Dibenz(a,h)Anthracene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Benzo[g,h,i]perylene	µg/l	No EQS	0.0	-	0.0	4	0	< 0.10	< 0.10	<0.01	<0.01
Total Of 16 PAH's	µg/l	No EQS	0.0	-	0.0	2	0	< 2.0	< 2.0		
VOCS											
1,1,2,2-Tetrachloroethane	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
Chloromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<2.00	<2.00
Vinyl Chloride	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<0.500	<0.500
Bromomethane	µg/l	No EQS	0.0	-	0.0	4	0	< 5.0	< 5.0	<1.00	<1.00
Trichlorofluoromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,1-Dichloroethene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Trans 1,2-Dichloroethene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,1-Dichloroethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
cis 1,2-Dichloroethene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Bromochloromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 5.0	< 5.0	<1.00	<1.00
Trichloromethane	µg/l	2.5	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,1,1-Trichloroethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,1-Dichloropropene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Benzene	µg/l	10	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,2-Dichloroethane	µg/l	10	0.0	-	0.0	4	0	< 2.0	< 2.0	<1.00	<1.00
Trichloroethene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,2-Dichloropropane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Dibromomethane	µg/l	No EQS	0.0	-	0.0	4	0	< 10	< 10	<1.00	<1.00
Bromodichloromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 5.0	< 5.0	<1.00	<1.00
cis-1,3-Dichloropropene	µg/l	No EQS	0.0	-	0.0	4	0	< 10	< 10	<1.00	<1.00
Toluene	µg/l	10	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Trans-1,3-Dichloropropene	µg/l	No EQS	0.0	-	0.0	4	0	< 10	< 10	<1.00	<1.00
1,1,2-Trichloroethane	µg/l	No EQS	0.0	-	0.0	4	0	< 10	< 10	<1.00	<1.00
Tetrachloroethene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,3-Dichloropropane	µg/l	No EQS	0.0	-	0.0	4	0	< 2.0	< 2.0	<1.00	<1.00
Dibromochloromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 10	< 10	<1.00	<1.00
1,2-Dibromoethane	µg/l	No EQS	0.0	-	0.0	4	0	< 5.0	< 5.0	<1.00	<1.00
1,1,1,2-Tetrachloroethane	µg/l	No EQS	0.0	-	0.0	4	0	< 2.0	< 2.0	<1.00	<1.00
Ethylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
m & p-Xylene	µg/l	10	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
o-Xylene	µg/l	10	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Styrene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Tribromomethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Isopropylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00

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nc	nc
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of EWS
XX	Concentration above LOD
<XX	Below LOD
EQS	Surface Waters Regulations 2015 (S.I. No. 386 of 2015) Surface Waters Regulations 2009 (S.I. No. 272 of 2009)

Lab Job No.:								18-40094	18-40094	COV/1709355/2019	COV/1709355/2019
Lab Sample ID.:								745354	745355	18200398	18200399
Sample Location:								SW01	SW02	SW01	SW02
Sample Type:								WATER	WATER	WATER	WATER
Well Type:								Surface Water	Surface Water	Surface Water	Surface Water
Date Sampled:								18/12/2018	18/12/2018	08/05/2019	08/05/2019
Determinand	**Units**	**EQS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of EQS Exceedances**				
Bromobenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,2,3-Trichloropropane	µg/l	No EQS	0.0	-	0.0	4	0	< 50	< 50	<1.00	<1.00
2-Chlorotoluene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,3,5-Trimethylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
4-Chlorotoluene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Tert-Butylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,2,4-Trimethylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Sec-Butylbenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
4-Isopropyltoluene	µg/l	No EQS	0.0	-	0.0	2	0	< 1.0	< 1.0		
1,2-Dibromo-3-Chloropropane	µg/l	No EQS	0.0	-	0.0	4	0	< 50	< 50	<2.00	<2.00
1,3,5-Trichlorobenzene	µg/l	0.4	0.0	-	0.0	2	0			<0.010	<0.010
1,2,3-Trichlorobenzene	µg/l	0.4	0.0	-	0.0	4	0	< 2.0	< 2.0	<0.010	<0.010
Methyl Tert-Butyl Ether	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
SVOCs											
2,4-Dinitrotoluene	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Chlorobenzene	µg/l	1.5	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Dichlorodifluoromethane	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
N-Propylbenzene	µg/l	No EQS	0.0	-	0.0	2	0	< 1.0	< 1.0		
Chloroethane	µg/l	No EQS	0.0	-	0.0	4	0	< 2.0	< 2.0	<1.00	<1.00
1,3-Dichlorobenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Hexachlorobutadiene	µg/l	0.1	0.0	-	0.0	4	0	< 1.0	< 1.0	<0.007	<0.007
1,2,4-Trichlorobenzene	µg/l	0.4	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
1,4-Dichlorobenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
N-Butylbenzene	µg/l	No EQS	0.0	-	0.0	2	0	< 1.0	< 1.0		
1,2-Dichlorobenzene	µg/l	No EQS	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
2,6-Dinitrotoluene	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
4-Bromophenyl Phenyl Ether	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
4-Chlorophenyl phenyl ether	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Bis(2-chloroethoxy)methane	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Bis(2-chloroethyl)ether	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Bis(2-chloroisopropyl)ether	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Pesticides											
Demeton-O	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Phorate	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Demeton-S	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Disulfoton	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Fenthion	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20	<0.002	<0.002
Trichloronate	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Prothiofos	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20	<0.003	<0.003
Fensulphothion	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Sulprofos	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Azinphos-Methyl	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.002	<0.002
Azinphos-ethyl	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
Coumaphos	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Atraton	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Prometon	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Simazine	µg/l	1	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.020	<0.020
Atrazine	µg/l	0.6	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.020	<0.020
Propazine	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.020	<0.020
Trietazine	µg/l	No EQS	0.0	-	0.0	2	0			<0.010	<0.010
Trifluralin	µg/l	0.03	0.00	-	0.00	2	0			<0.003	<0.030
Triallate	µg/l	No EQS	0.0	-	0.0	2	0			<0.001	<0.010
Triazophos	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
Tecnazene	µg/l	No EQS	0.0	-	0.0	2	0			<0.001	<0.010
Propetamphos	µg/l	No EQS	0.0	-	0.0	0	0				
Terbuthylazine	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Benzyl Butyl Phthalate	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Bis(2-ethylhexyl)phthalate	µg/l	1.3	0.0	-	0.0	2	0			<5.0	<5.0
Carbon Tetrachloride	µg/l	12	0.0	-	0.0	4	0	< 1.0	< 1.0	<1.00	<1.00
Carbophenothion	µg/l	No EQS	0.0	-	0.0	2	0			<0.003	<0.003
Chlorfenvinphos	µg/l	0.1	0.0	-	0.0	2	0			<0.002	<0.002
Chlorobenzene	µg/l	1.5	0.0	-	0.0	2	0			<1.00	<1.00
Chloroethane	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
Chlorpyriphos	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
Diazinon	µg/l	0.01	0.00	-	0.00	2	0			<0.003	<0.003
Dibenzofuran	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Dichlobenil	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
Dichlorodifluoromethane	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
Dichloromethane	µg/l	20	0.0	-	0.0	2	0			<1.00	<1.00
Dichlorvos	µg/l	0.0006	0.0000	-	0.0000	2	0			<0.002	<0.002
Diethylphthalate	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Dimethoate	µg/l	0.8	0.0	-	0.0	2	0			<0.020	<0.02
Dimethylphthalate	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
di-n-Butylphthalate	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Di-n-octylphthalate	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Diphenylamine	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Endrin	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
Fenitrothion	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
Hexachloroethane	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Isodrin	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
n-butylbenzene	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
Nitrobenzene	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
n-Nitrosodi-n-propylamine	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
n-propylbenzene	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
o,p - DDE	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
o,p - DDT	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
o,p - TDE	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
p,p - DDE	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.002	<0.002

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nc	nc
blank	Sample not scheduled for anlaysis or not selected during round
XX	Exceedance of EWS
XX	Concentration above LOD
<XX	Below LOD
EQS	Surface Waters Regulations 2015 (S.I. No. 386 of 2015) Surface Waters Regulations 2009 (S.I. No. 272 of 2009)

Lab Job No.:								18-40094	18-40094	COV/1709355/2019	COV/1709355/2019
Lab Sample ID.:								745354	745355	18200398	18200399
Sample Location:								SW01	SW02	SW01	SW02
Sample Type:								WATER	WATER	WATER	WATER
Well Type:								Surface Water	Surface Water	Surface Water	Surface Water
Date Sampled:								18/12/2018	18/12/2018	08/05/2019	08/05/2019
Determinand	**Units**	**EQS**	**Minimum (result above detection limit)**	**Mean**	**Maximum**	**No. of Samples**	**No. of EQS Exceedances**				
p,p - DDT	µg/l	0.01	0.00	-	0.00	2	0			<0.004	<0.004
p,p - TDE	µg/l	No EQS	0.0	-	0.0	2	0			<0.002	<0.002
4,4-DDD	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Parathion-ethyl	µg/l	No EQS	0.0	-	0.0	2	0			<0.003	<0.003
Parathion-methyl	µg/l	No EQS	0.0	-	0.0	2	0			<0.003	<0.003
Pentachlorophenol	µg/l	0.4	0.0	-	0.0	2	0			<1.0	<1.0
Phorate	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
Phosalone	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
Pirimiphos-methyl	µg/l	No EQS	0.0	-	0.0	2	0			<0.005	<0.005
p-isopropyltoluene	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
2-Methylnaphthalene	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Secbumeton	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Isophorone	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Simetryn	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Malathion	µg/l	No EQS	0.0	-	0.0	2	0			<0.004	<0.004
Ametryn	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Mevinphos	µg/l	No EQS	0.0	-	0.0	2	0			<0.020	<0.020
Prometryn	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.020	<0.020
Terbutryn	µg/l	0.065	0.000	-	0.000	4	0	< 0.20	< 0.20	<0.020	<0.020
Alpha-HCH	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.003	<0.003
Gamma-HCH	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.0027	<0.0027
Beta-HCH	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.003	<0.003
Delta-HCH	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Heptachlor	µg/l	0.0000002	0.0000000	-	0.0000000	2	0	< 0.20	< 0.20		
Aldrin	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.004	<0.004
Heptachlor Epoxide	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.004	<0.004
Gamma-Chlordane	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.004	<0.004
Alpha-Chlordane	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.003	<0.003
2-Chloronaphthalene	µg/l	No EQS	0.0	-	0.0	2	0			<1.0	<1.0
Endosulfan I	µg/l	0.005	0.000	-	0.000	4	0	< 0.20	< 0.20	<0.004	<0.004
Dieldrin	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.004	<0.004
Endrin	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<0.004	<0.004
Endosulfan II	µg/l	0.005	0.000	-	0.000	4	0	< 0.20	< 0.20	<0.004	<0.013
Endrin Aldehyde	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
4,4-DDT	µg/l	0.01	0.0	-	0.0	2	0	< 0.20	< 0.20		
Endosulfan Sulphate	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Methoxychlor	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Endrin Ketone	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Chlorothalonil	µg/l	No EQS	0.0	-	0.0	2	0	< 0.50	< 0.50		
Phenols											
Phenol	µg/l	8	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2-Chlorophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.00	<1.00
2-Methylphenol (o-Cresol)	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
3-Methylphenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
3+4-Methylphenol	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
3,5-Dimethylphenol	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
2 - Methylphenol	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
4-Methylphenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2-Nitrophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2,4-Dimethylphenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2,4-Dichlorophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2,6-Dichlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
4-Chlorophenol	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
4-Chloro-3-Methylphenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2,3,4-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2,3,5-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2,3,6-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2,4,6-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
2,4,5-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.00	<1.00
4-Nitrophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<5.0	<5.0
2,3,4,5-Tetrachlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2,2-Dichloropropane	µg/l	No EQS	0.0	-	0.0	2	0			<1.00	<1.00
2,3,4,6-Tetrachlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2,3,5,6-Tetrachlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
3,4,5-Trichlorophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
2-Methyl-4,6-Dinitrophenol	µg/l	No EQS	0.0	-	0.0	4	0	< 0.20	< 0.20	<1.0	<1.0
Pentachlorophenol	µg/l	0.4	0.0	-	0.0	2	0	< 0.20	< 0.20		
2-Sec-Butyl-4,6-Dinitrophenol	µg/l	No EQS	0.0	-	0.0	2	0	< 0.20	< 0.20		
Total Phenols	µg/l	No EQS	0.0	-	0.0	2	0	< 5.0	< 5.0		
Organotin Compounds											
Organotin (total as TBTO)	µg/l	No EQS	0.0	-	0.0	4	0	< 0.050	< 0.050	<0.02	<0.02
Dibutyl Tin	µg/l	No EQS	0.0	-	0.0	2	0	< 0.050	< 0.050		
Tetrabutyl Tin	µg/l	No EQS	0.0	-	0.0	2	0	< 0.0010	< 0.0010		
Tributyl Tin	µg/l	0.0002	0.0000	-	0.0000	4	0	< 0.050	< 0.050	<0.02	<0.02
Triphenyl Tin	µg/l	No EQS	0.0	-	0.0	4	0	< 0.050	< 0.050	<0.02	<0.02
Monobutyl Tin	µg/l	No EQS	0.0	-	0.0	2	0	< 0.050	< 0.050		

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Appendix D Plots of WQS Exceedances

D.1 Plots of Leachate data assessed against GTV/IGV

D.2 Plots of Groundwater data assessed against DWS

D.3 Plots of Groundwater data assessed against GTV/IGV

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ALIPHATIC VPH >C5 - C10 LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:53

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ALIPHATIC VPH >C6-C8 LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:53

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ALIPHATIC VPH >C8 - C10 LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF AMMONIACAL NITROGEN LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:53

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF AROMATIC VPH >C5 - C10 LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:53

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF AROMATIC VPH >C8 - C10 LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ARSENIC LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF BENZENE LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF BORON LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µS/cm) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ELECTRICAL CONDUCTIVITY LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ETHYLBENZENE LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF FAECAL COLIFORMS LEACHATE

Drawn By: SM

Date: 13/05/2020

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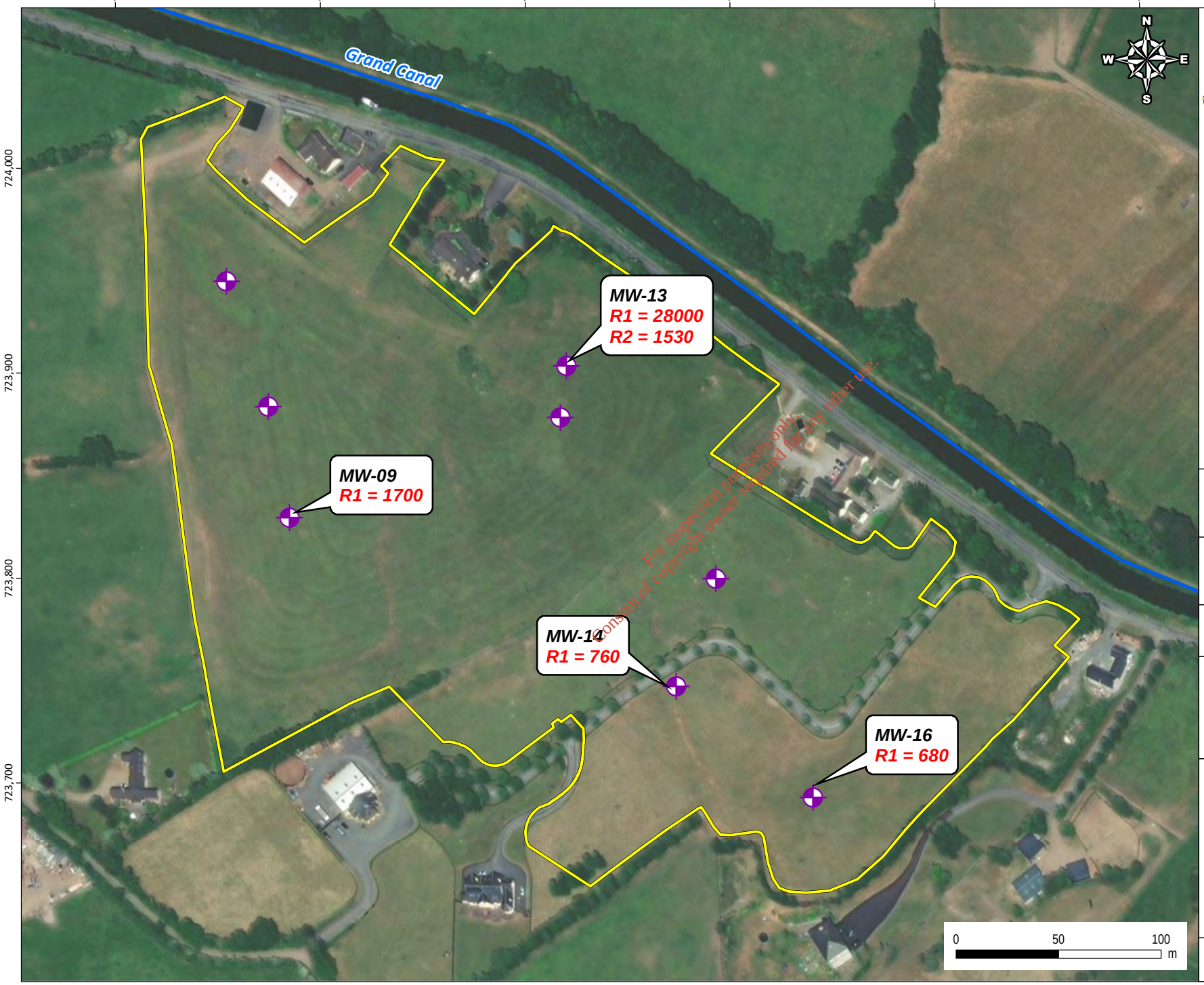

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF IRON LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF LEAD LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF M & P-XYLENE LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF MAGNESIUM LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF MANGANESE LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF NAPHTHALENE LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF NICKEL LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ORTHOPHOSPHATE AS PO_4 LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF O-XYLENE LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF POTASSIUM LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF SODIUM LEACHATE

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (cfu/100ml) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF TOTAL COLIFORMS LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Waste

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

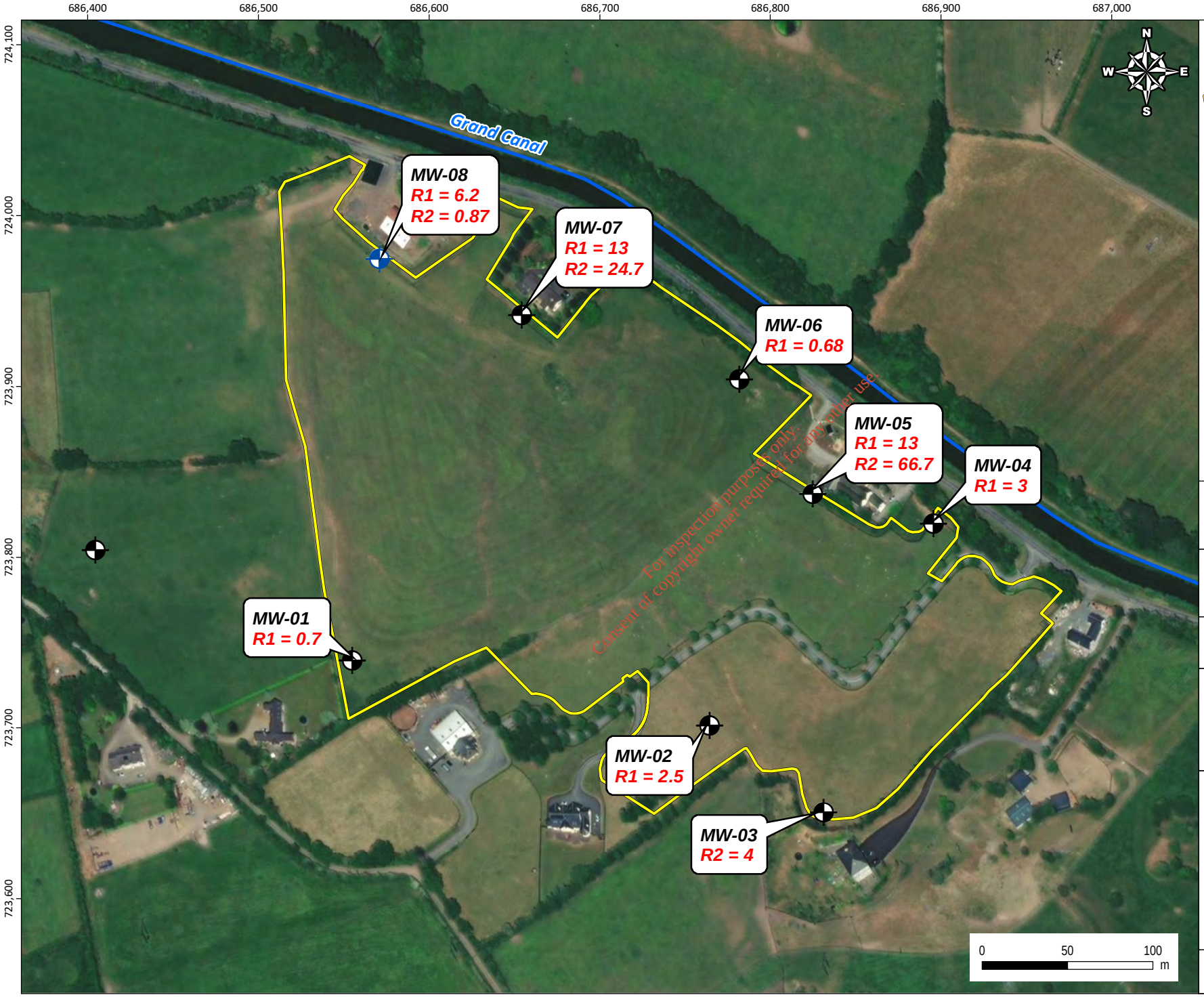
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF VINYL CHLORIDE LEACHATE

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF AMMONIACAL NITROGEN GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF BORON GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

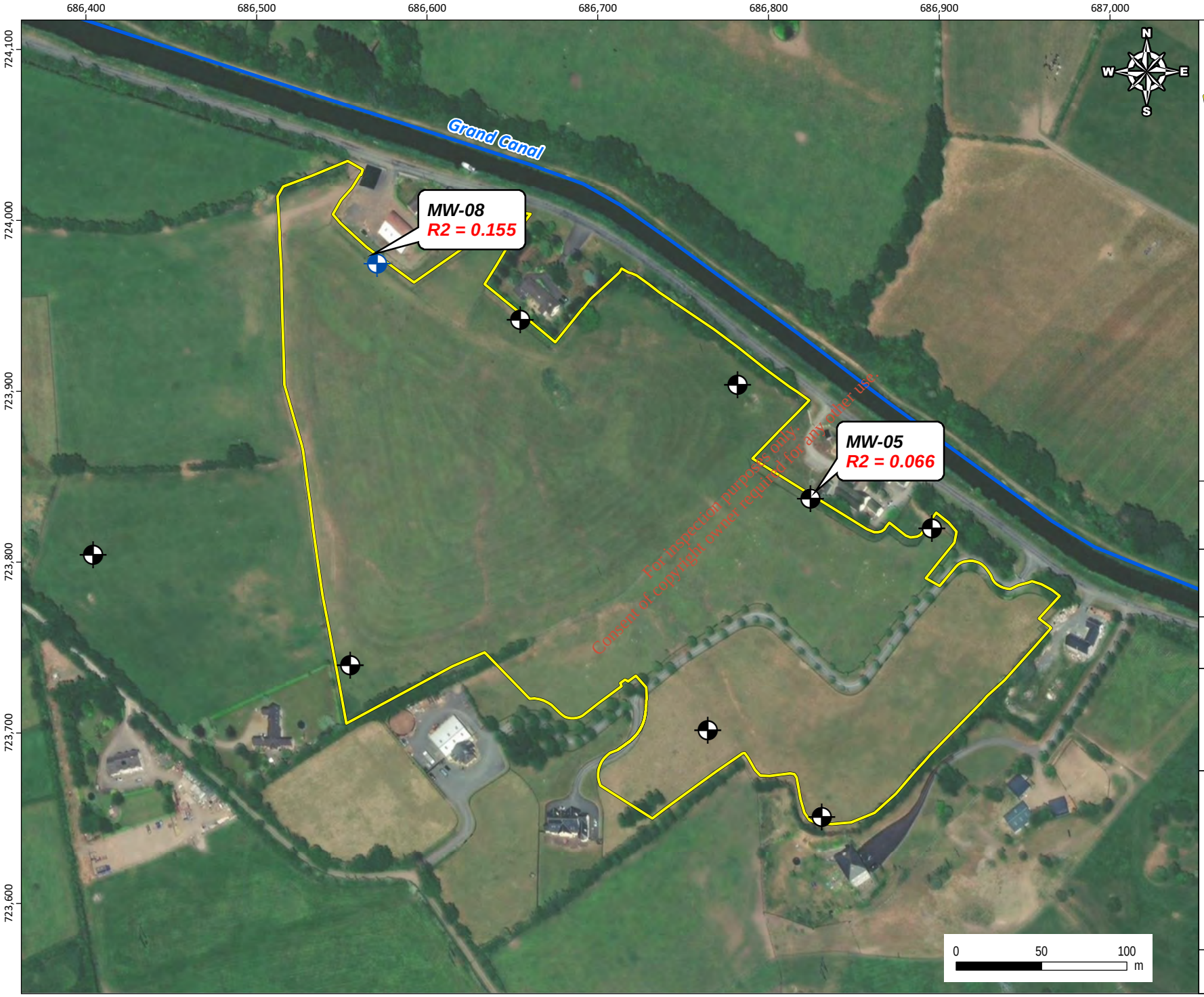
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF CHROMIUM GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:54



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

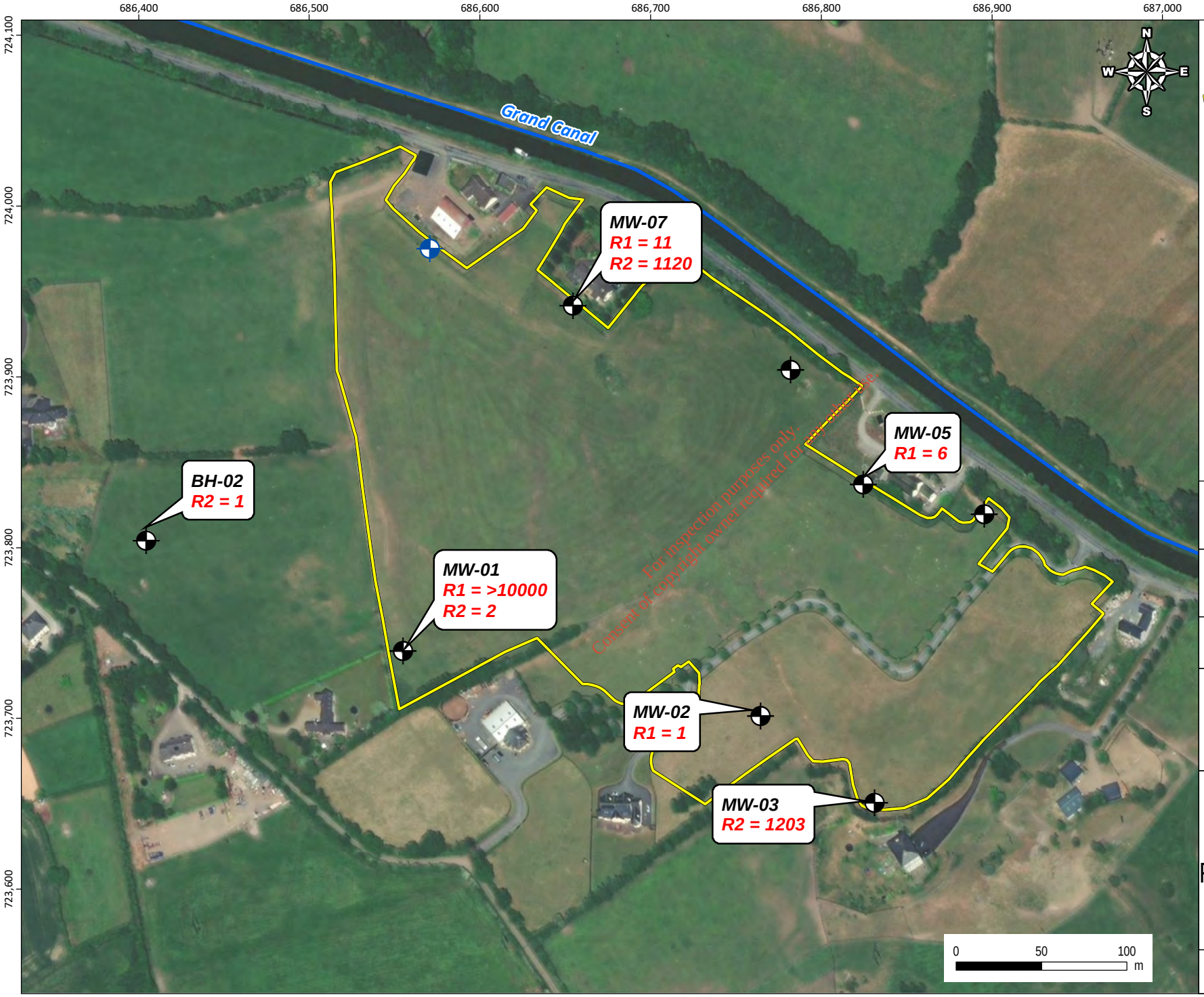
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF CYANIDE GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (cfu/100ml) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

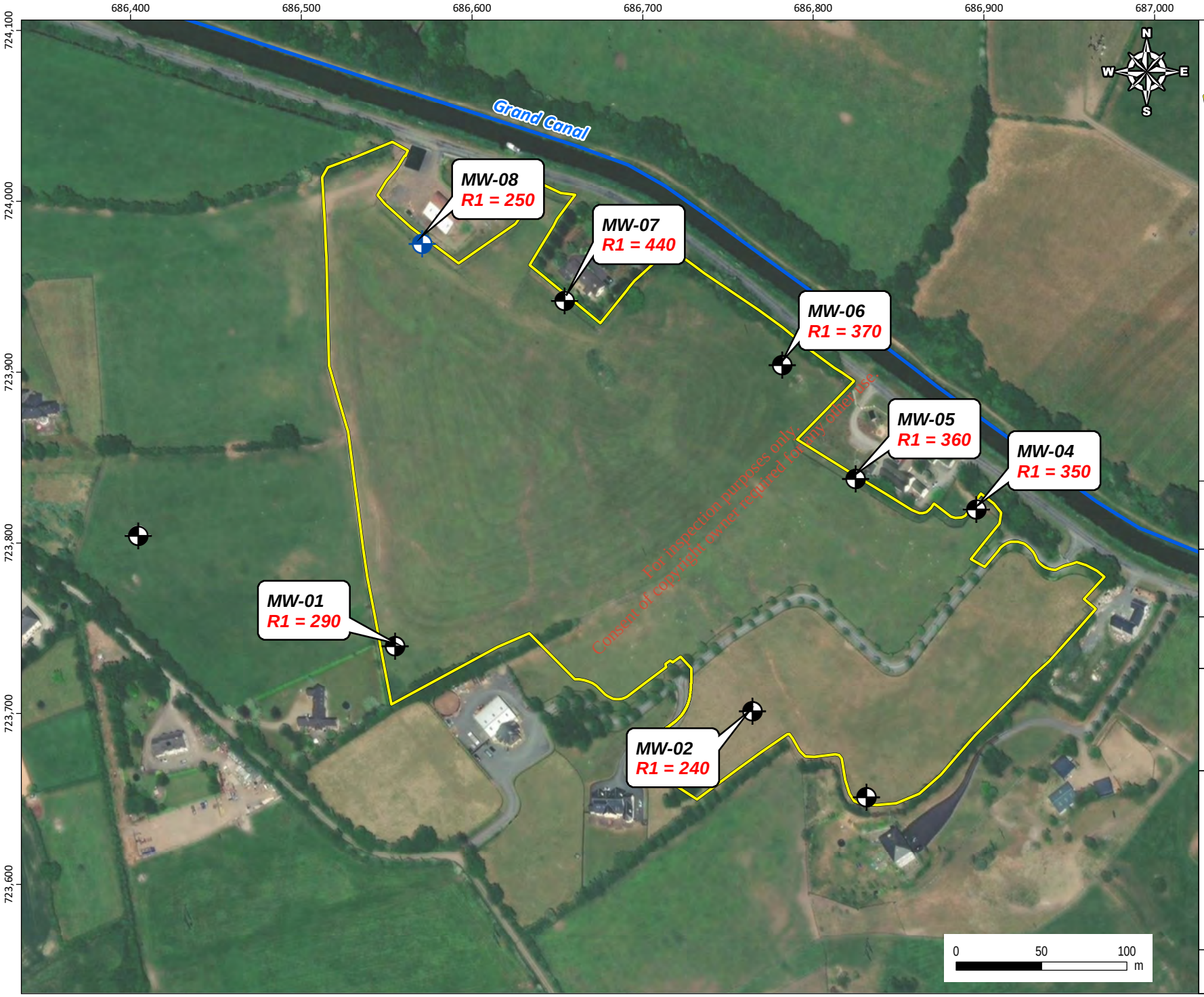
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF FAECAL COLIFORMS GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

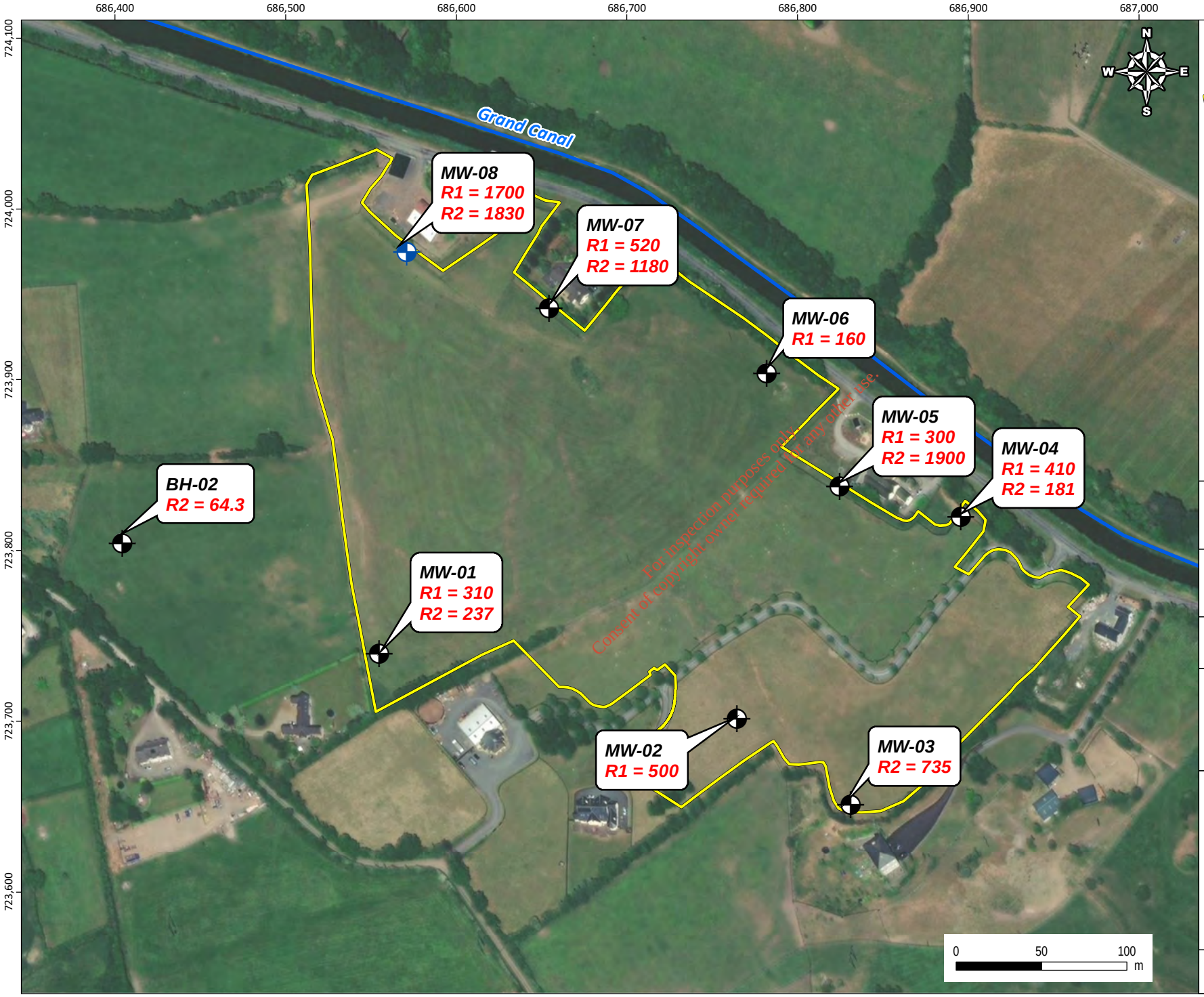
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF IRON GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF MANGANESE GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

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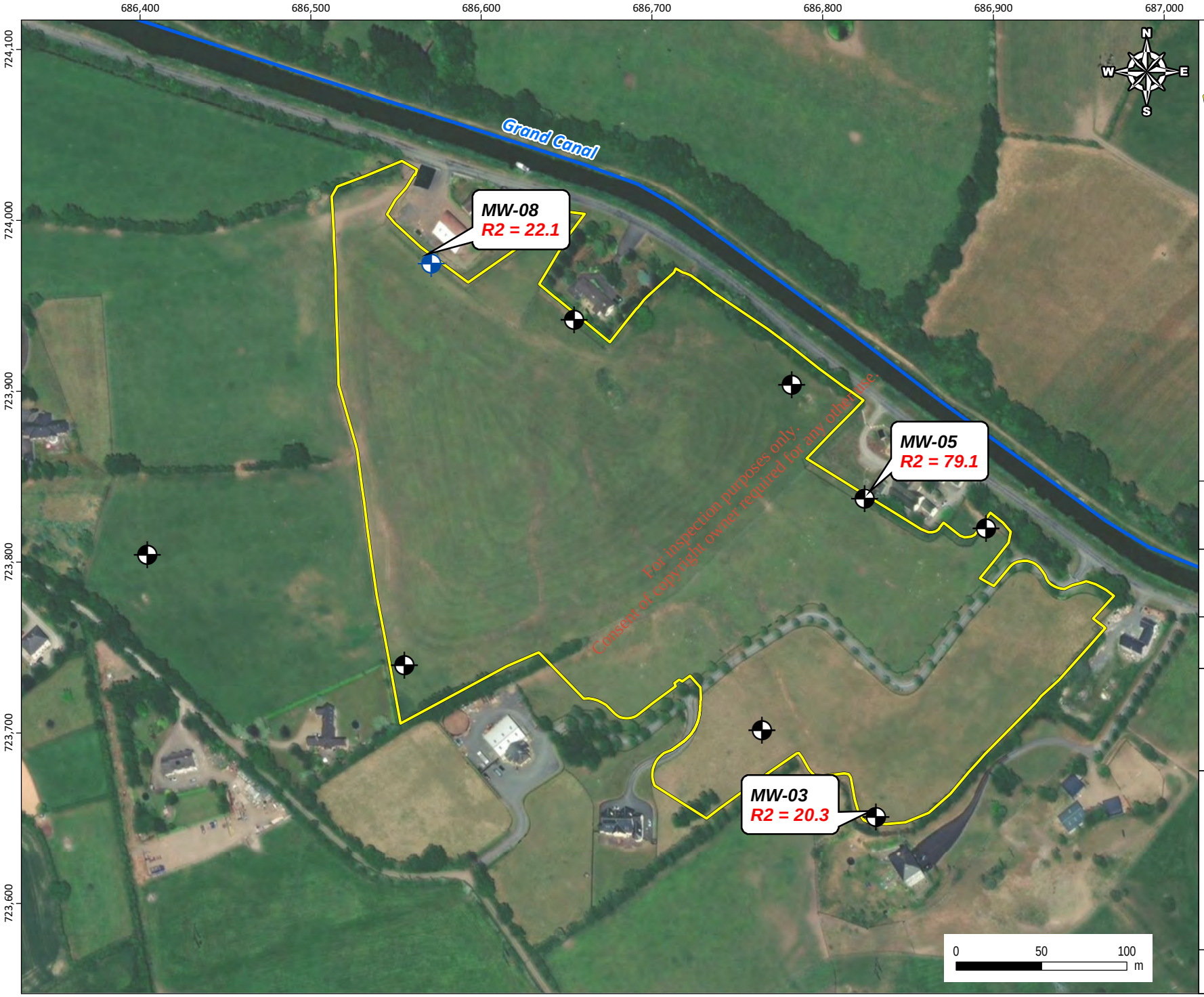

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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF NICKEL GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

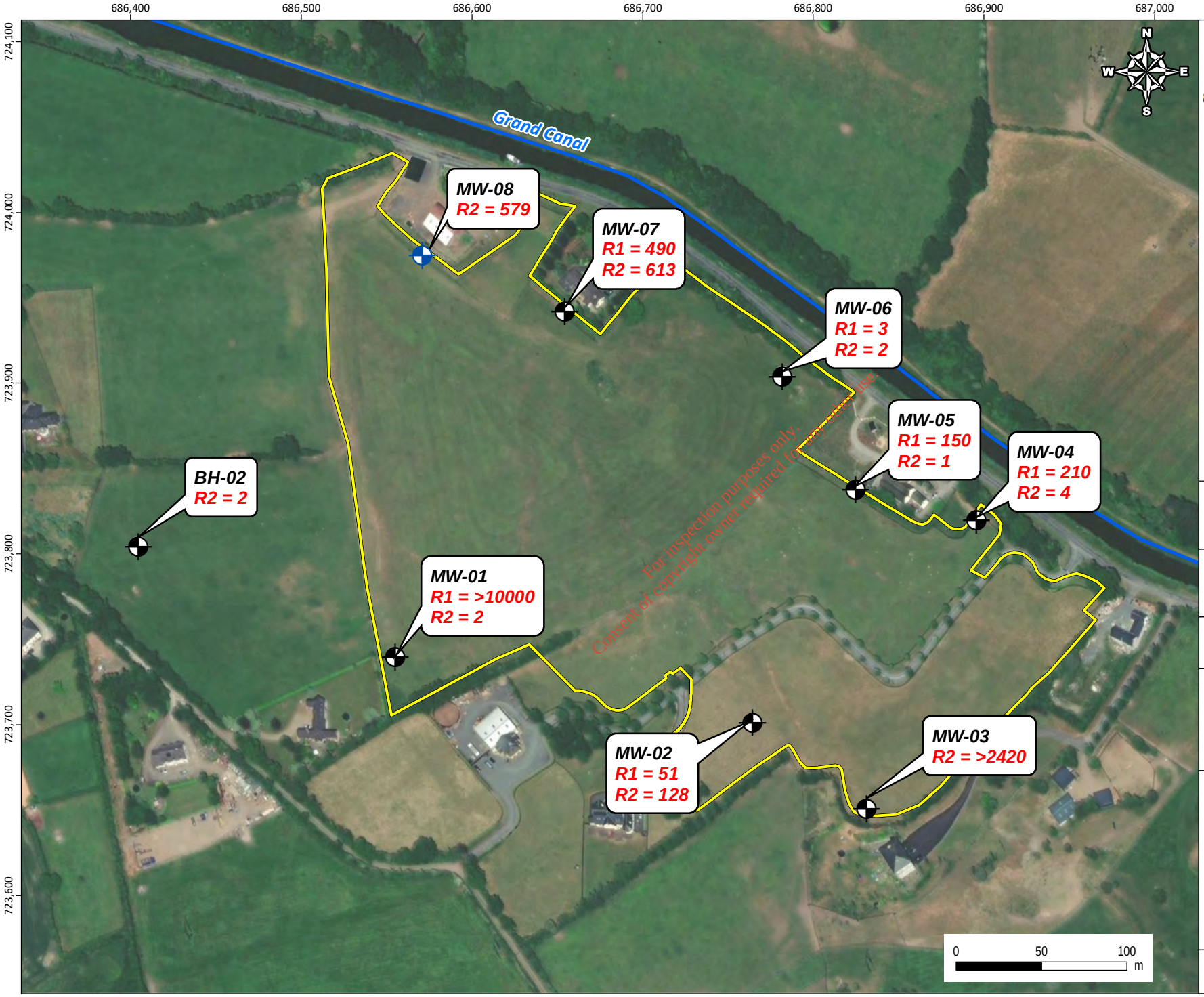
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF TERBUTRYN GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (cfu/100ml) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

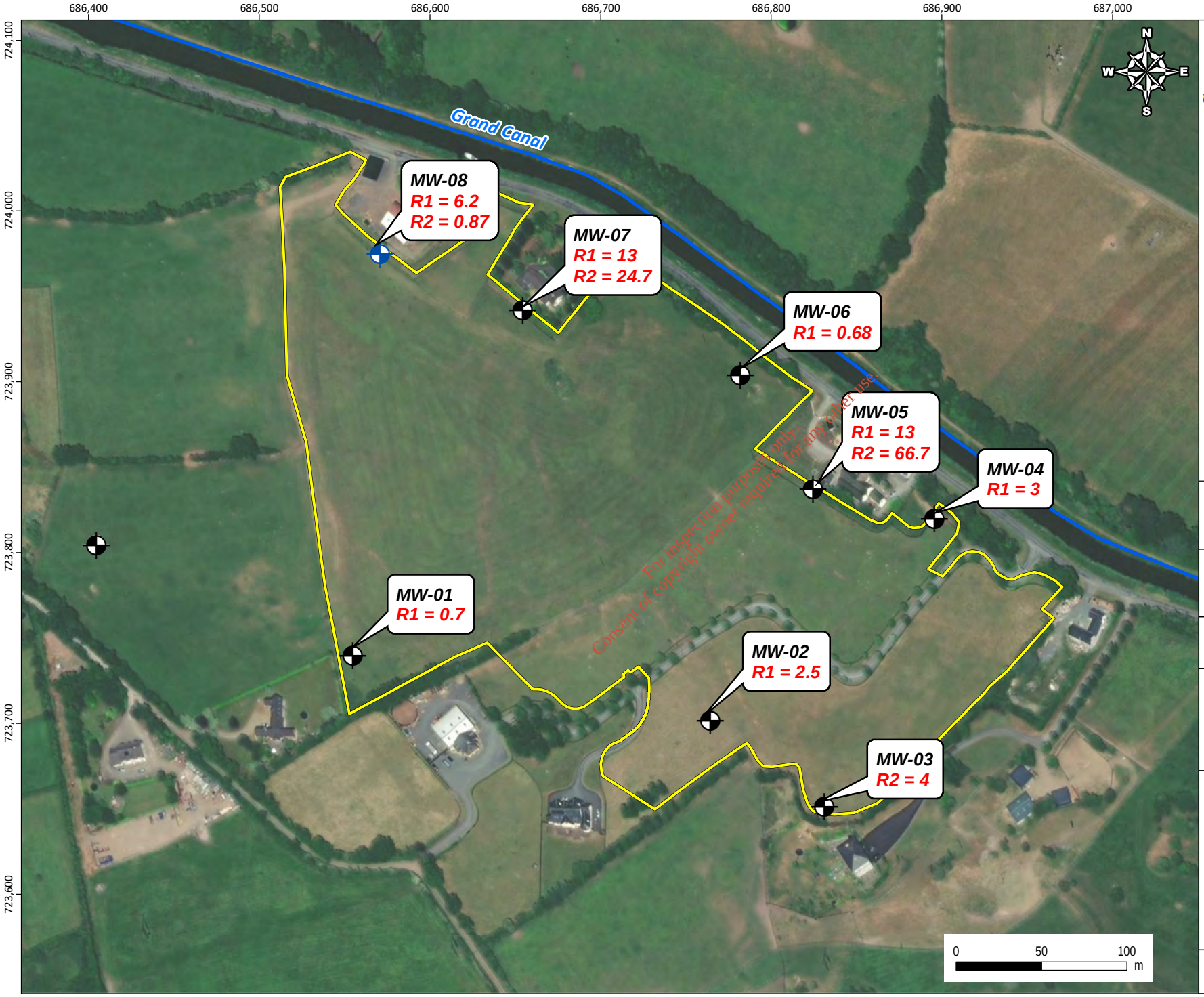
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF TOTAL COLIFORMS GROUNDWATER DWS

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF AMMONIACAL NITROGEN GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF BORON GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

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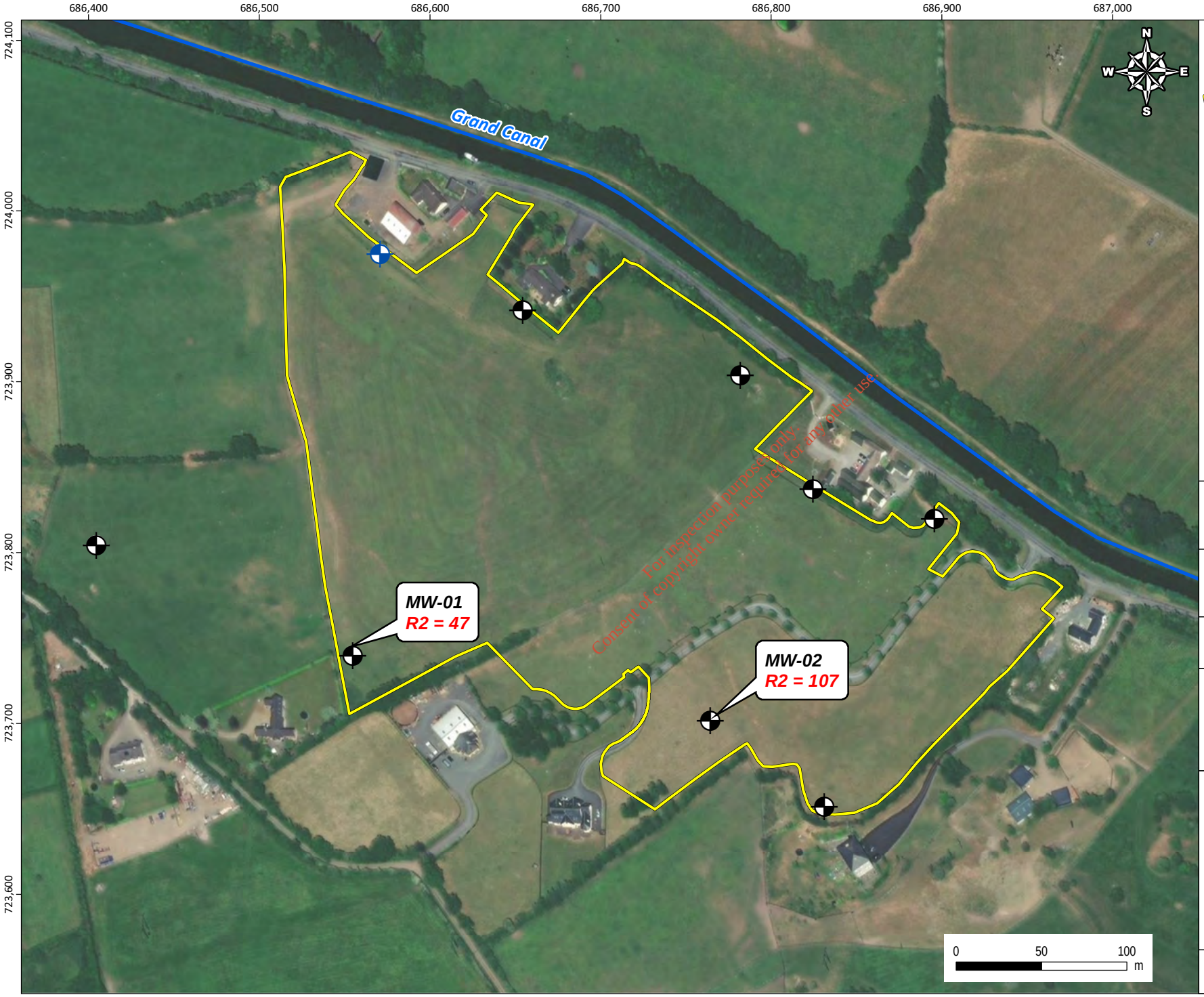

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF CHROMIUM GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

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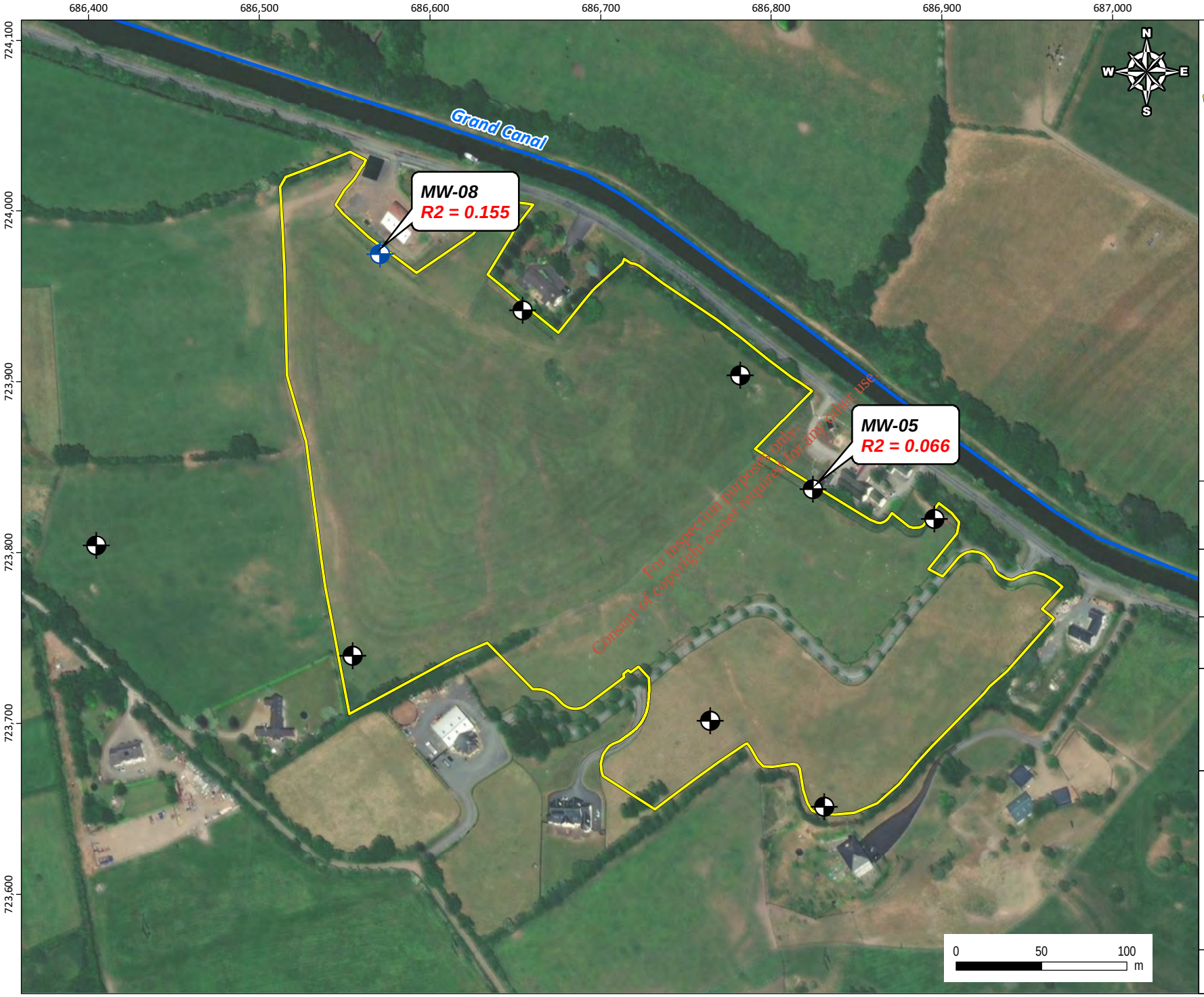

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF CYANIDE GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55

Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µS/cm) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ELECTRICAL CONDUCTIVITY GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

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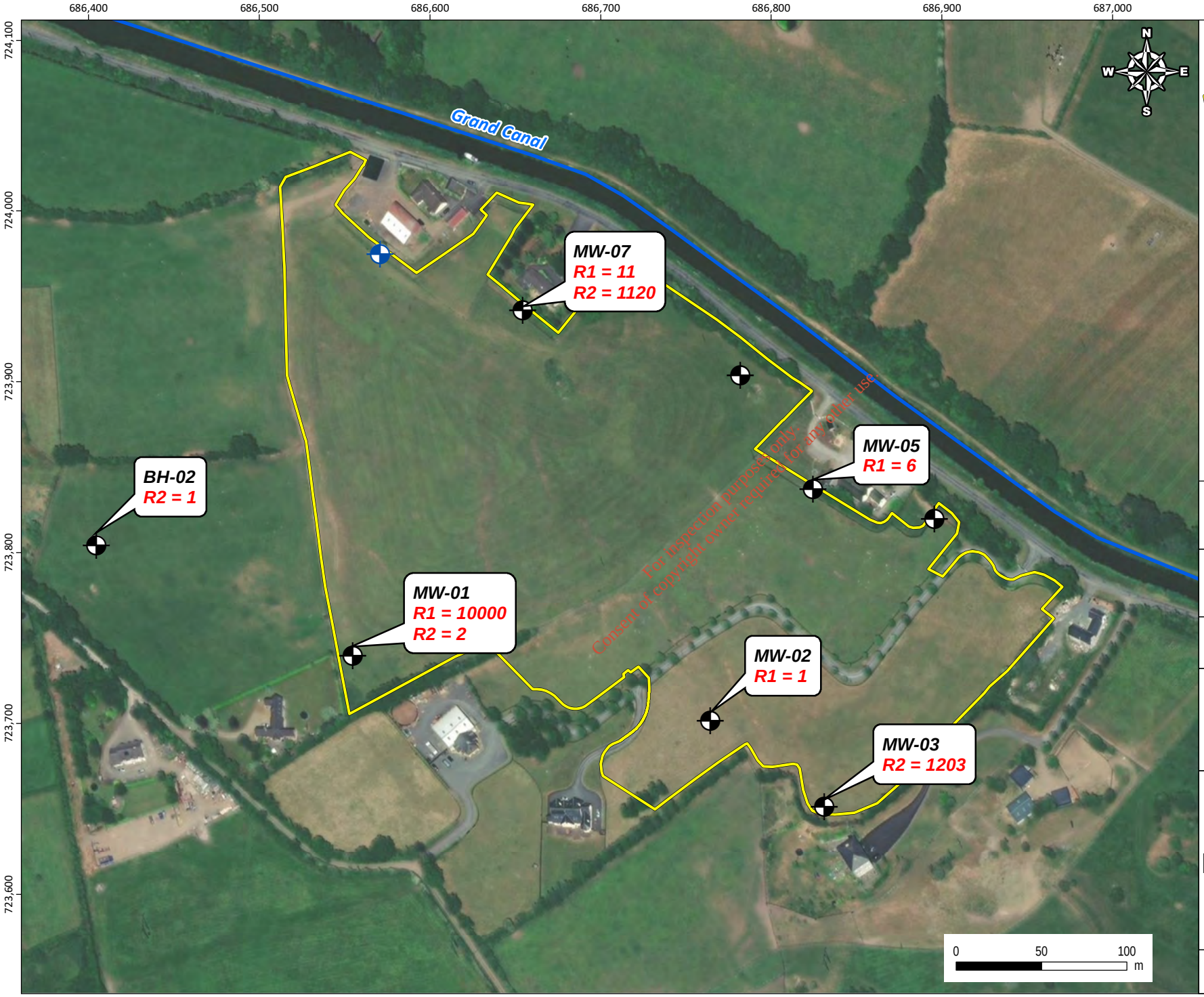


Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (cfu/100ml) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

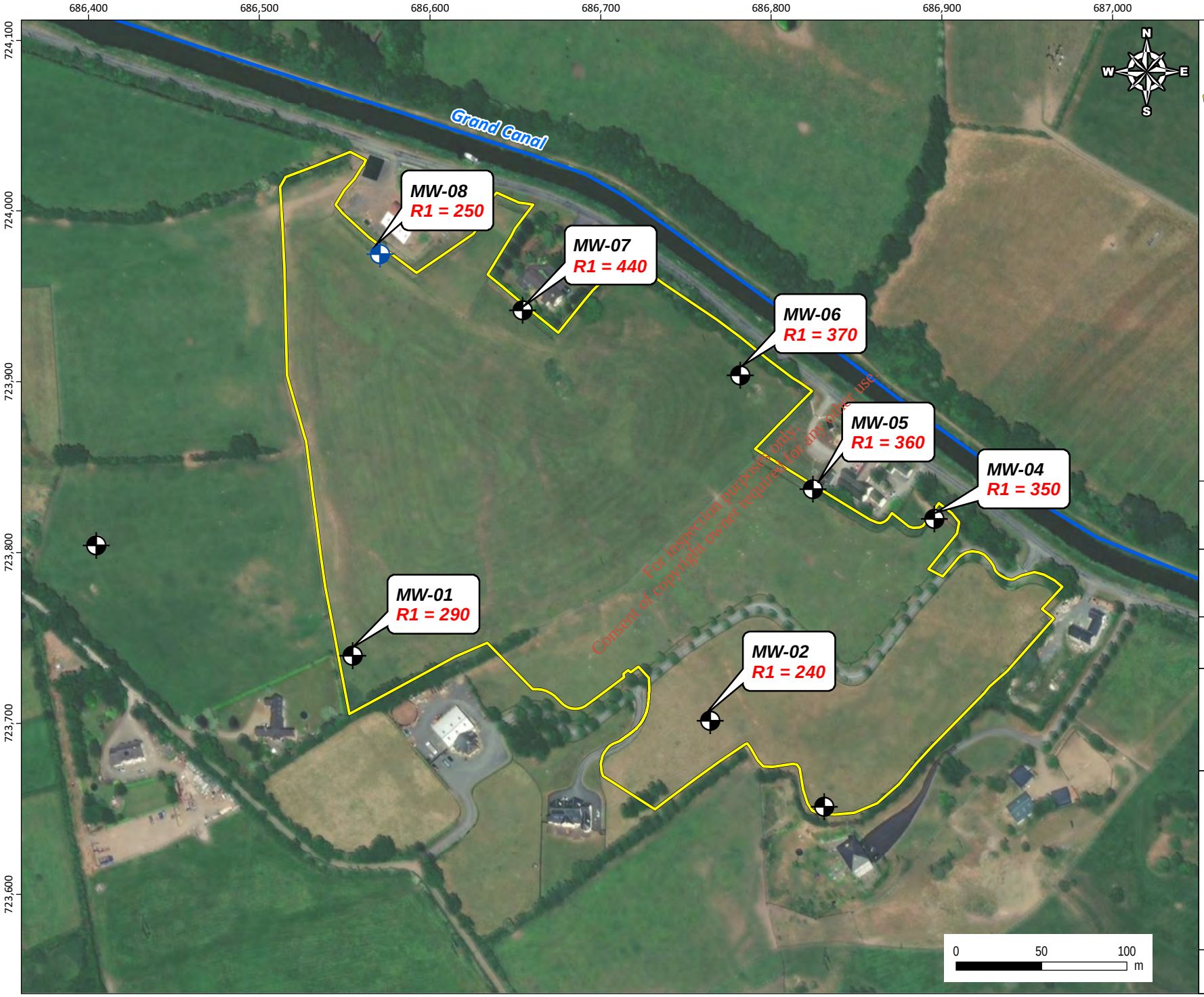
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF FAECAL COLIFORMS GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

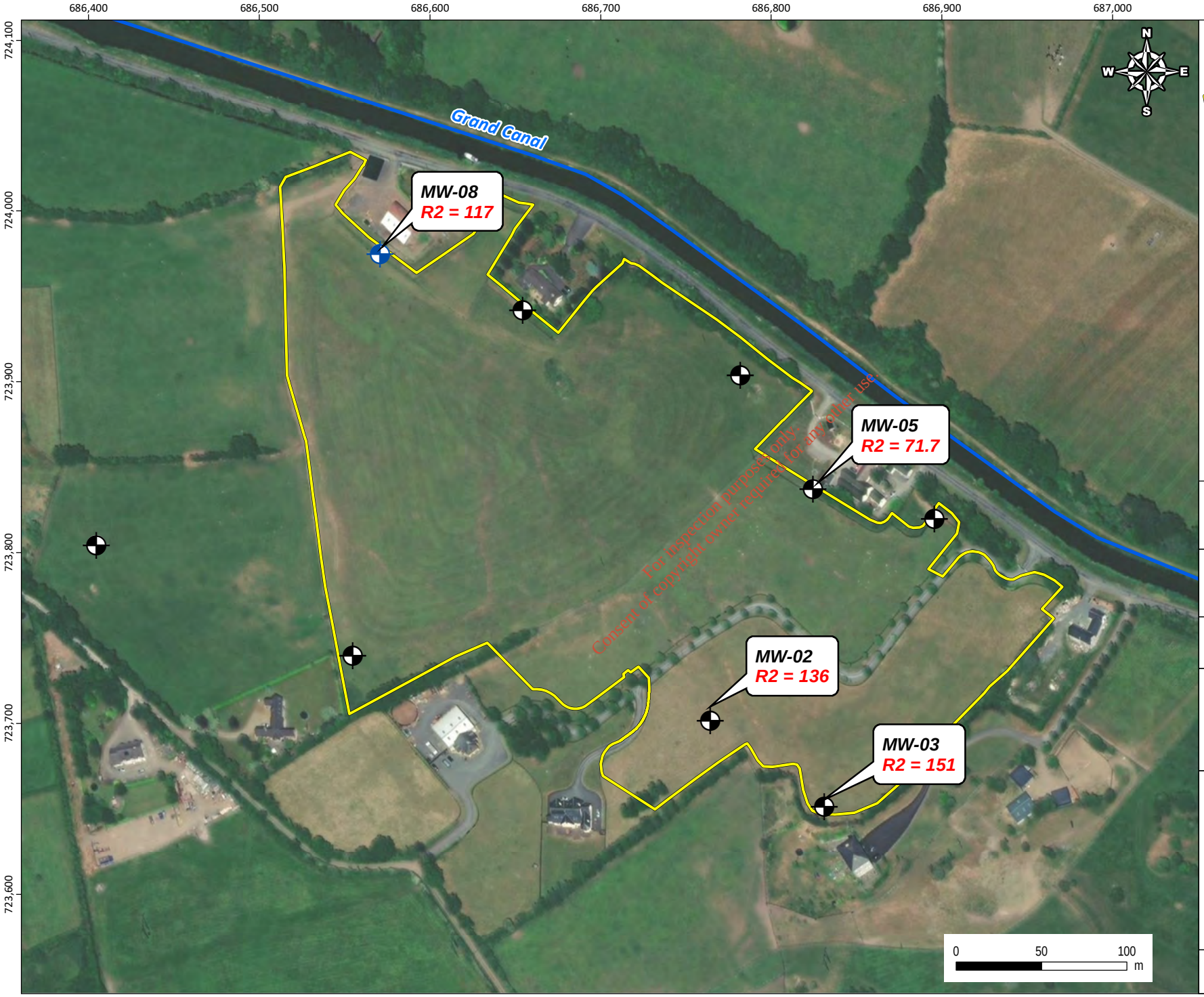
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF IRON GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

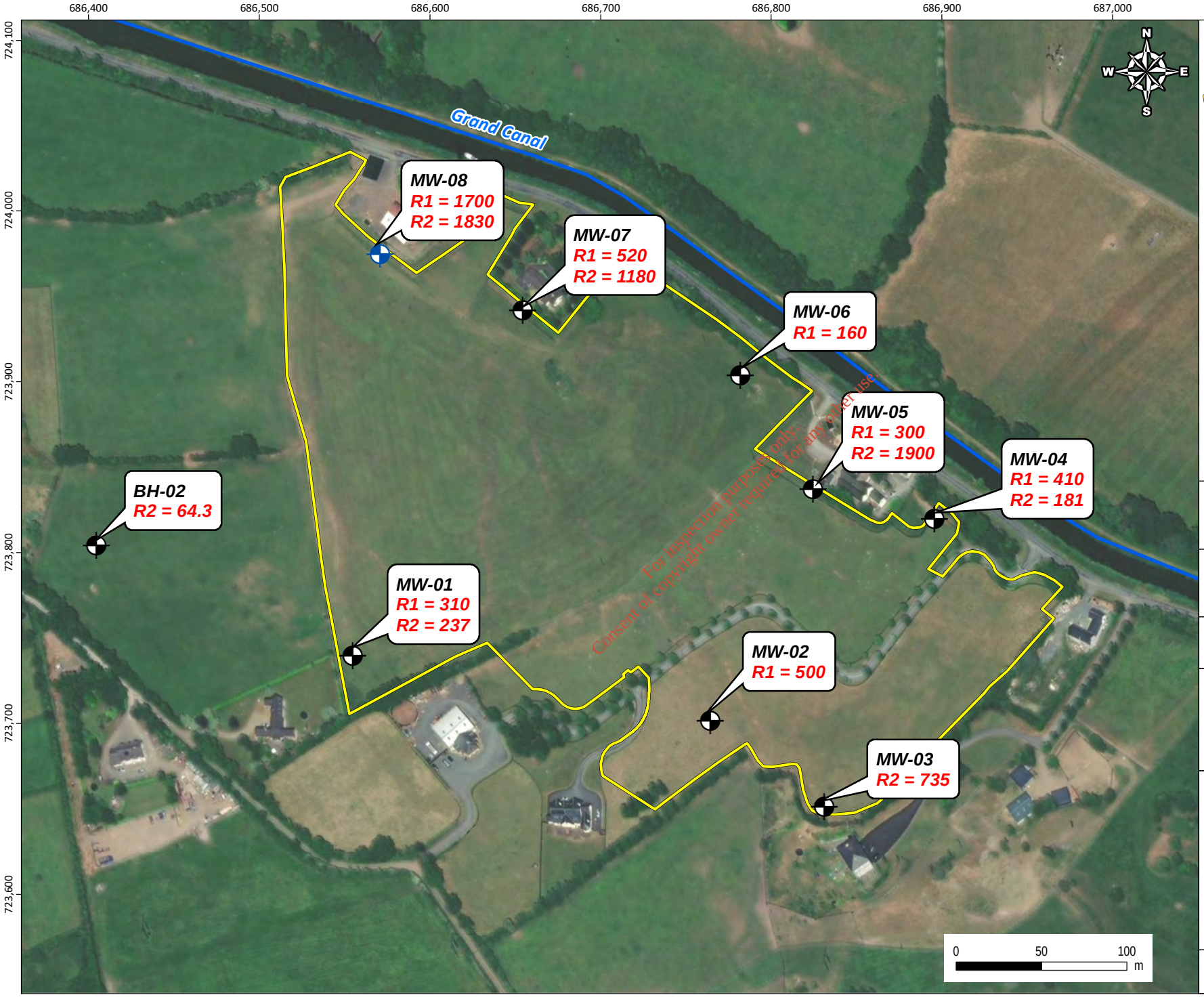
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF MAGNESIUM GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
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Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF MANGANESE GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

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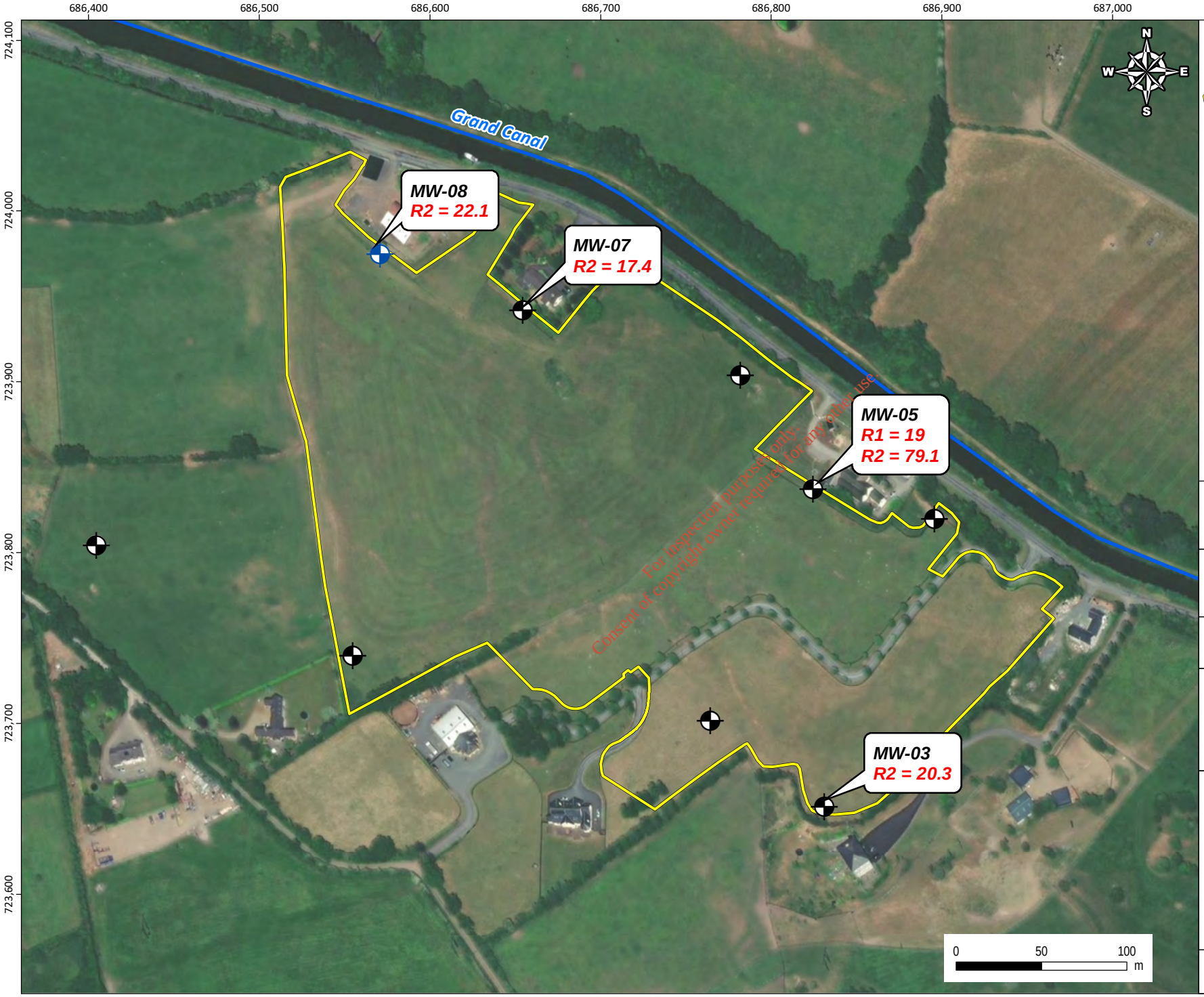


Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (µg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

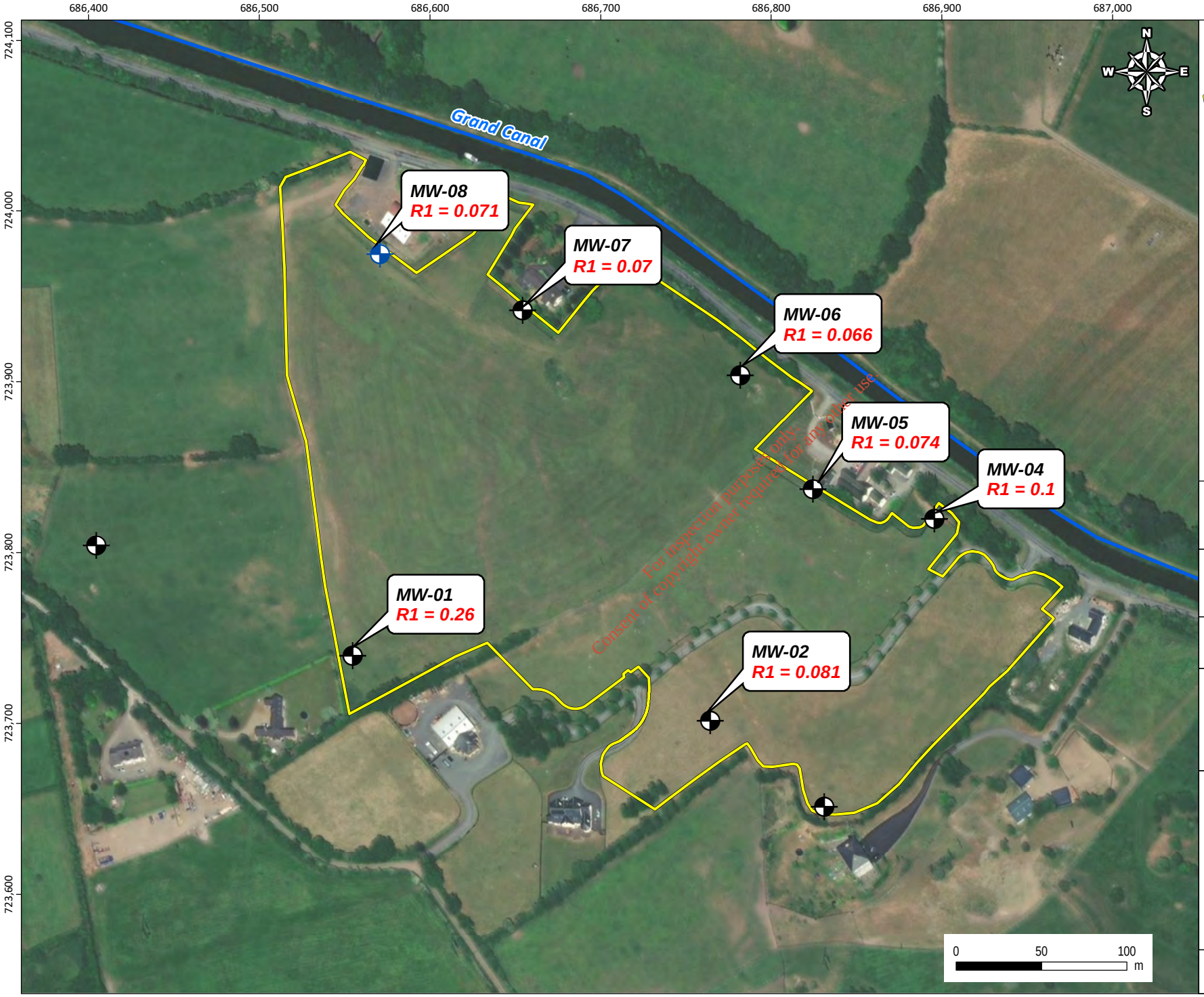
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF NICKEL GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

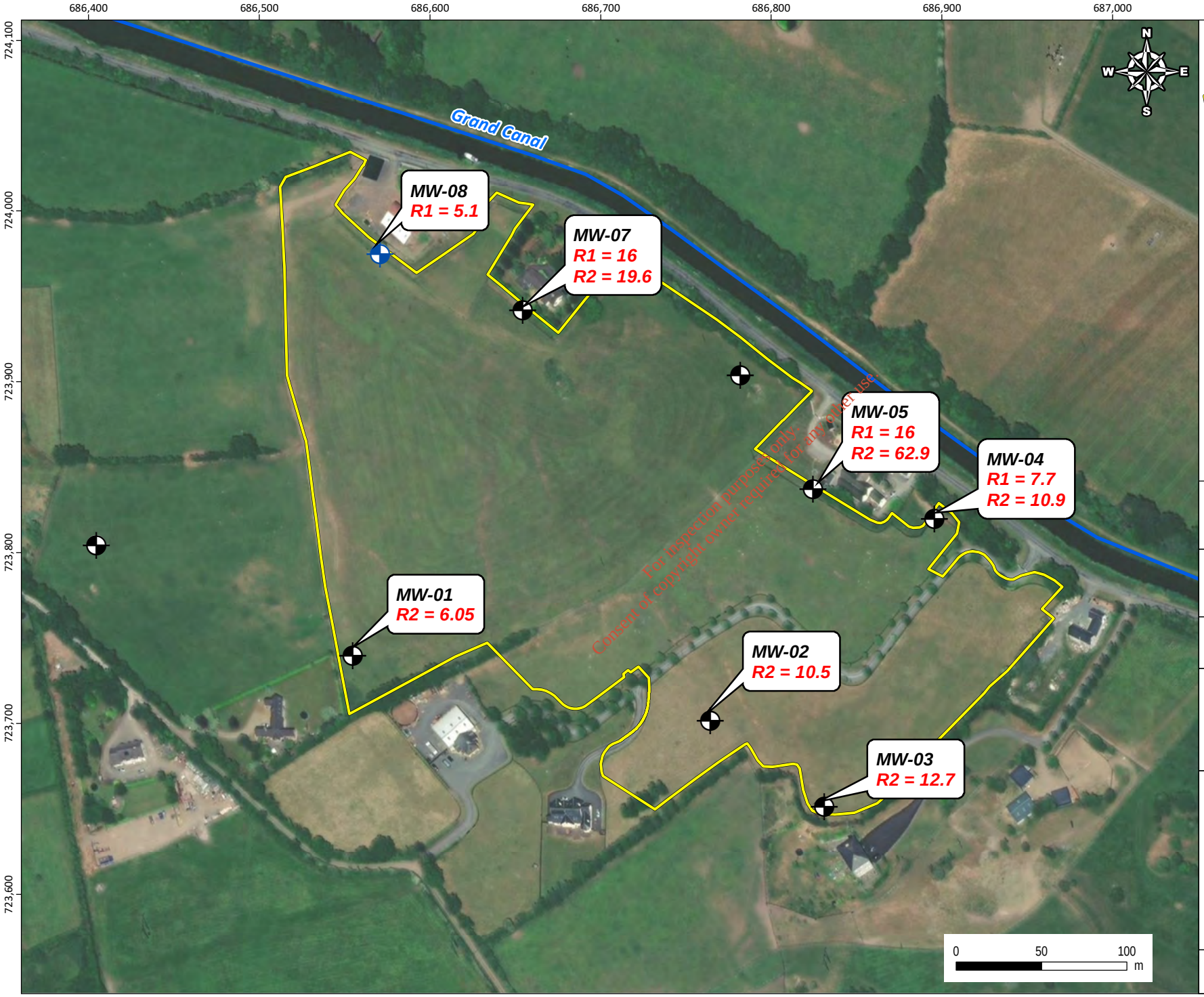
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF ORTHOPHOSPHATE AS PO_4 GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (mg/l) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client:

Consultant: CDM Smith

Project Code: 117838

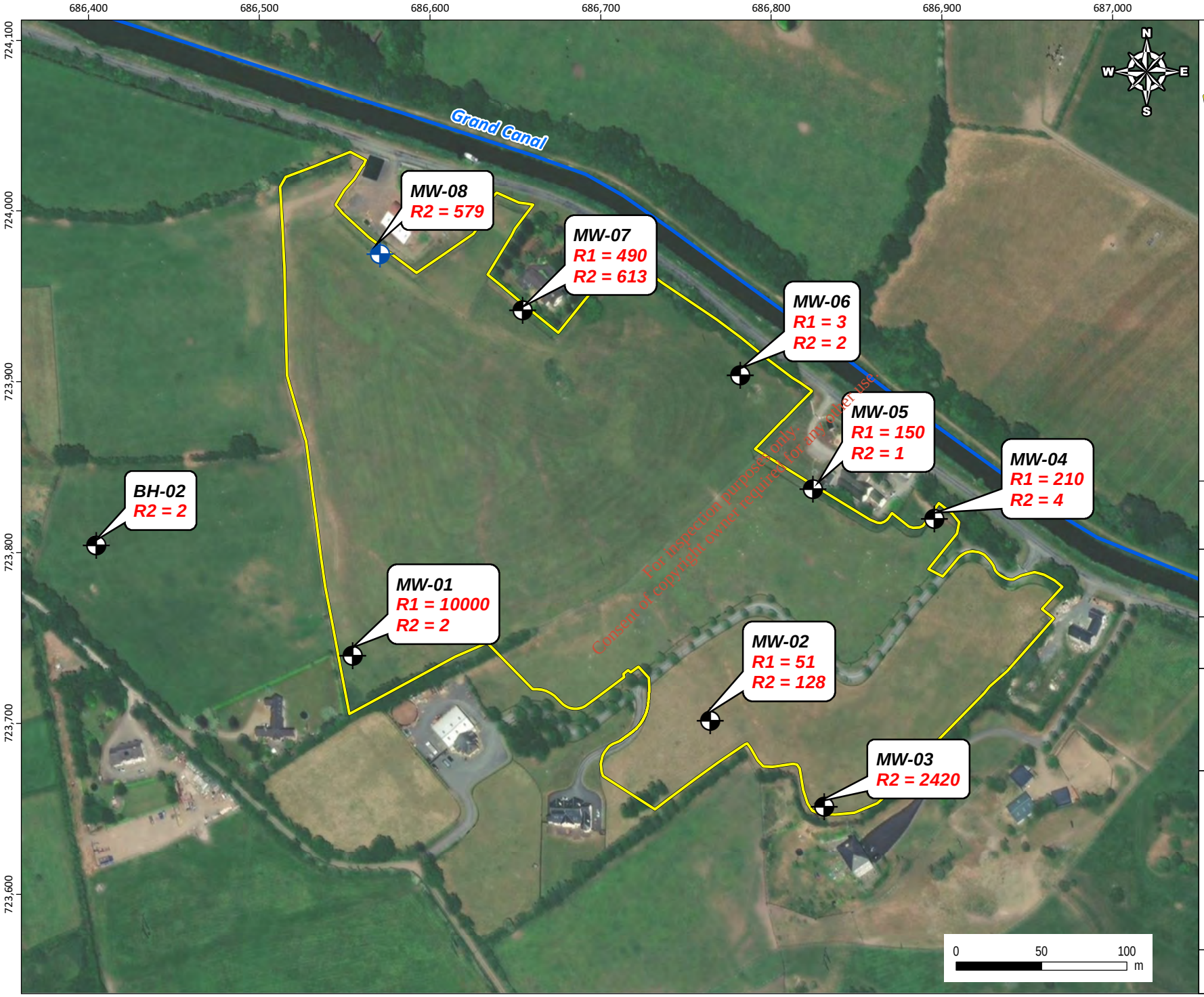
Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF POTASSIUM GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

EPA Export 11-11-2020:06:31:55



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Legend

Landfill

Monitoring Wells: Gravel Formation

Monitoring Wells: Rickardstown Formation

Red Text — Concentration (cfu/100ml) above WQS

Source:
- ESRI World Imagery. © ESRI (Vivid-UK imagery courtesy of Digital Globe, acquired on 13/08/2015)
Coordinates are in Irish Transverse Mercator

Client: Kildare County Council

Consultant: CDM Smith

Project Code: 117838

Project: DIGBY BRIDGE

Drawing Title: EXCEEDANCES OF TOTAL COLIFORMS GROUNDWATER GTV,IGV

Drawn By: SM

Date: 13/05/2020

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Appendix E Remedial Target Worksheets

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Gravel Formation Models

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Ammonium**		
Target concentration	C_T	**0.065**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	9.00E-01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.00E-01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**7.48E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.065	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.95E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.25E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	0.065	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		40	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	2.19E+03	days	
Calculated decay rate	λ	3.17E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	1.09E+01	fraction
Decay rate used	λ	3.17E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	5.31E-01	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.60E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.78E+01**	**fraction**
Soil leachate concentration	Co	4.00E+01	

Remedial Targets

Level 3 Remedial Target		**5.43E+01**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		6.25E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**3.60E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	9.00E-01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

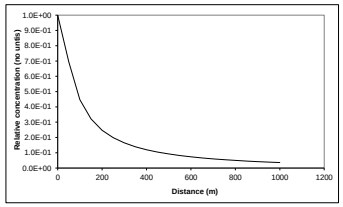
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.33E+00
50.0	6.95E-01	9.24E-01
100.0	4.47E-01	5.94E-01
150.0	3.21E-01	4.27E-01
200.0	2.47E-01	3.29E-01
250.0	1.98E-01	2.64E-01
300.0	1.64E-01	2.19E-01
350.0	1.39E-01	1.85E-01
400.0	1.20E-01	1.59E-01
450.0	1.05E-01	1.39E-01
500.0	9.21E-02	1.23E-01
550.0	8.19E-02	1.09E-01
600.0	7.34E-02	9.76E-02
650.0	6.62E-02	8.80E-02
700.0	6.00E-02	7.98E-02
750.0	5.46E-02	7.26E-02
800.0	4.99E-02	6.64E-02
850.0	4.58E-02	6.09E-02
900.0	4.21E-02	5.60E-02
950.0	3.89E-02	5.17E-02
1000.0	3.60E-02	4.78E-02

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Aromatic TPH >C8 - C10**	
Target concentration	C_T	**0.01**	**mg/l**

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	3.70E-02	fraction	
Organic carbon partition coefficient	Koc	7.90E+01	l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.92E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**3.17E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Aromatic TPH >C8 - C10**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**3.01E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		9.54E-01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Aromatic TPH >C8 - C10		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		0.01	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	8.69E+04	days	
Calculated decay rate	λ	7.98E-06	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.90E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	9.69E+00	fraction
Decay rate used	λ	7.98E-06	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	5.98E-01	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.24E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.60E+01**	**fraction**
Soil leachate concentration	Co	1.00E-02	

Remedial Targets

Level 3 Remedial Target	**4.82E+00**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.53E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	**C_{ED}/C_0 6.24E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd [redacted] l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	1.00E-02	fraction
Organic carbon partition coefficient	Koc	7.90E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$	[redacted]	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	[redacted]	l/kg
pH value	pH	[redacted]	
Acid dissociation constant	pKa	[redacted]	
Fraction of organic carbon in aquifer	foc	[redacted]	fraction
Soil water partition coefficient	Kd	7.90E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

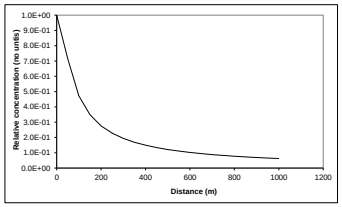
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.33E-04
50.0	7.14E-01	2.37E-04
100.0	4.72E-01	1.57E-04
150.0	3.49E-01	1.16E-04
200.0	2.76E-01	9.17E-05
250.0	2.28E-01	7.57E-05
300.0	1.94E-01	6.45E-05
350.0	1.69E-01	5.61E-05
400.0	1.49E-01	4.97E-05
450.0	1.34E-01	4.45E-05
500.0	1.21E-01	4.04E-05
550.0	1.11E-01	3.69E-05
600.0	1.02E-01	3.40E-05
650.0	9.46E-02	3.15E-05
700.0	8.81E-02	2.93E-05
750.0	8.25E-02	2.74E-05
800.0	7.75E-02	2.58E-05
850.0	7.31E-02	2.43E-05
900.0	6.91E-02	2.30E-05
950.0	6.56E-02	2.18E-05
1000.0	6.24E-02	2.07E-05

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Chromium**		
Target concentration	C_T	**0.0047**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	4.80E+02	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**4.80E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**2.26E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0047	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Chromium**		from Level 1
Target concentration	C_T	**0.0047**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.41E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.79E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Chromium		from Level 1
Target Concentration	C_T	0.0047	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		0.0375	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+99	days	
Calculated decay rate	λ	6.93E-100	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.80E+02	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	5.28E+03	fraction
Decay rate used	λ	6.93E-100	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	1.10E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.58E+01**	**fraction**
Soil leachate concentration	Co	3.75E-02	

Remedial Targets

Level 3 Remedial Target		**2.24E+00**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.07E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.32E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	4.80E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.80E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

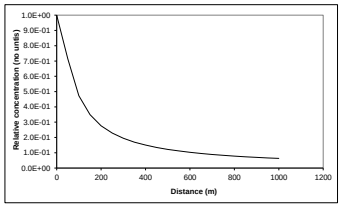
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.25E-03
50.0	7.15E-01	8.91E-04
100.0	4.73E-01	5.90E-04
150.0	3.49E-01	4.36E-04
200.0	2.76E-01	3.45E-04
250.0	2.29E-01	2.85E-04
300.0	1.95E-01	2.43E-04
350.0	1.70E-01	2.11E-04
400.0	1.50E-01	1.87E-04
450.0	1.35E-01	1.68E-04
500.0	1.22E-01	1.52E-04
550.0	1.12E-01	1.39E-04
600.0	1.03E-01	1.28E-04
650.0	9.55E-02	1.19E-04
700.0	8.90E-02	1.11E-04
750.0	8.33E-02	1.04E-04
800.0	7.83E-02	9.77E-05
850.0	7.39E-02	9.22E-05
900.0	7.00E-02	8.72E-05
950.0	6.64E-02	8.28E-05
1000.0	6.32E-02	7.88E-05

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Manganese**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**2.51E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.50E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.56E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		8.3	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+99	days	
Calculated decay rate	λ	6.93E-100	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	5.51E+02	fraction
Decay rate used	λ	6.93E-100	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	1.05E-02	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.58E+01**	**fraction**
Soil leachate concentration	Co	8.30E+00	

Remedial Targets

Level 3 Remedial Target		**2.38E+01**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.20E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.32E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

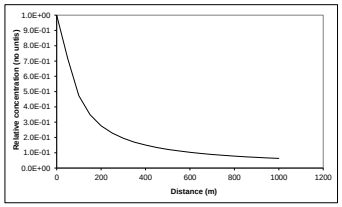
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.76E-01
50.0	7.15E-01	1.97E-01
100.0	4.73E-01	1.31E-01
150.0	3.49E-01	9.64E-02
200.0	2.76E-01	7.63E-02
250.0	2.29E-01	6.31E-02
300.0	1.95E-01	5.37E-02
350.0	1.70E-01	4.68E-02
400.0	1.50E-01	4.14E-02
450.0	1.35E-01	3.72E-02
500.0	1.22E-01	3.37E-02
550.0	1.12E-01	3.08E-02
600.0	1.03E-01	2.84E-02
650.0	9.55E-02	2.63E-02
700.0	8.90E-02	2.46E-02
750.0	8.33E-02	2.30E-02
800.0	7.83E-02	2.16E-02
850.0	7.39E-02	2.04E-02
900.0	7.00E-02	1.93E-02
950.0	6.64E-02	1.83E-02
1000.0	6.32E-02	1.74E-02

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Nickle**		
Target concentration	C_T	**0.004**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**2.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.004	**mg/l**	**(for comparison with leachate test results)**

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Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Nickle**		from Level 1
Target concentration	C_T	**0.004**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.20E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.02E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Nickle		from Level 1
Target Concentration	C_T	0.004	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		2.9	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+99	days	
Calculated decay rate	λ	6.93E-100	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	5.50E+03	fraction
Decay rate used	λ	6.93E-100	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	1.05E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.58E+01**	**fraction**
Soil leachate concentration	Co	2.90E+00	

Remedial Targets

Level 3 Remedial Target		**1.90E+00**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		9.52E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.32E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd 5.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc fraction
Organic carbon partition coefficient Koc l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species $K_{oc,n}$ l/kg
Sorption coefficient for ionised species $K_{oc,i}$ l/kg
pH value pH
Acid dissociation constant pKa
Fraction of organic carbon in aquifer foc fraction

Soil water partition coefficient Kd 5.00E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

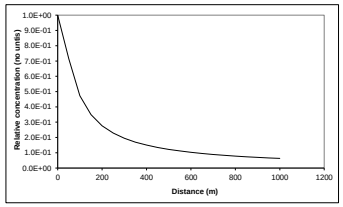
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	9.64E-02
50.0	7.15E-01	6.89E-02
100.0	4.73E-01	4.56E-02
150.0	3.49E-01	3.37E-02
200.0	2.76E-01	2.67E-02
250.0	2.29E-01	2.20E-02
300.0	1.95E-01	1.88E-02
350.0	1.70E-01	1.63E-02
400.0	1.50E-01	1.45E-02
450.0	1.35E-01	1.30E-02
500.0	1.22E-01	1.18E-02
550.0	1.12E-01	1.08E-02
600.0	1.03E-01	9.93E-03
650.0	9.55E-02	9.21E-03
700.0	8.90E-02	8.58E-03
750.0	8.33E-02	8.03E-03
800.0	7.83E-02	7.55E-03
850.0	7.39E-02	7.13E-03
900.0	7.00E-02	6.75E-03
950.0	6.64E-02	6.40E-03
1000.0	6.32E-02	6.09E-03

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Rickardstown Formation Models

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Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	6.50E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 2 directions

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.20E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	4.38E+03	days	
Calculated decay rate	λ	1.58E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.45E+02	m	
Plume thickness at source	Sy	2.00E+01	m	
Saturated aquifer thickness	da	1.00E+02	m	
Bulk density of aquifer materials	ρ	2.10E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+00	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+03	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable	
Groundwater flow velocity	v	6.00E-01 m/d
Retardation factor	Rf	1.50E+01 fraction
Decay rate used	λ	1.58E-04 d^{-1}
Rate of contaminant flow due to retardation	u	4.00E-02 m/d
Contaminant concentration at distance x, assuming two-way vertical dispersion	C_{ED}	1.91E-02 mg/l
Attenuation factor (two way vertical dispersion, CO/CED)	**AF**	**3.24E+02**

Remedial Targets

Remedial Target		**2.11E+01**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.91E-02**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	2.00E-01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

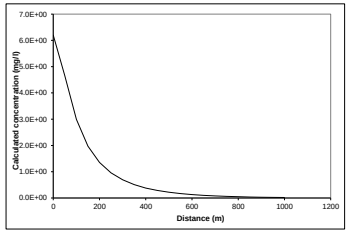
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E+00
50.0	4.66E+00
100.0	2.99E+00
150.0	1.97E+00
200.0	1.35E+00
250.0	9.57E-01
300.0	6.92E-01
350.0	5.09E-01
400.0	3.80E-01
450.0	2.87E-01
500.0	2.18E-01
550.0	1.68E-01
600.0	1.29E-01
650.0	1.01E-01
700.0	7.85E-02
750.0	6.16E-02
800.0	4.84E-02
850.0	3.82E-02
900.0	3.03E-02
950.0	2.40E-02
1000.0	1.91E-02

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Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.77E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	9.00E+99	days	
Calculated decay rate	λ	7.70E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.00E+02	m	
Plume thickness at source	Sy	1.13E+01	m	
Saturated aquifer thickness	da	3.00E+01	m	
Bulk density of aquifer materials	ρ	2.61E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+00	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	9.90E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.00E-01	m/d
Retardation factor	Rf	4.35E+03	fraction
Decay rate used	λ	7.70E-101	d^{-1}
Rate of contaminant flow due to retardation	u	1.38E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.58E-01	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**1.12E+01**	

Remedial Targets

Remedial Target		**5.60E-01**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.58E-01**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

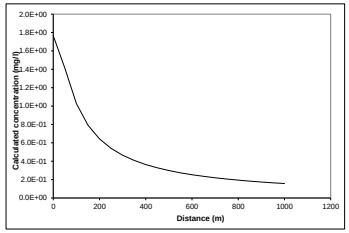
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
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Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	1.8E+00
50.0	1.42E+00
100.0	1.03E+00
150.0	7.93E-01
200.0	6.43E-01
250.0	5.40E-01
300.0	4.65E-01
350.0	4.08E-01
400.0	3.64E-01
450.0	3.28E-01
500.0	2.99E-01
550.0	2.74E-01
600.0	2.53E-01
650.0	2.35E-01
700.0	2.20E-01
750.0	2.06E-01
800.0	1.94E-01
850.0	1.84E-01
900.0	1.74E-01
950.0	1.65E-01
1000.0	1.58E-01

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Sensitivity Analysis – Infiltration

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-07	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**2.91E+04**		
Level 2 Remedial Target		**1.89E+03**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.17E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	4.00E+01	mg/l	
Calculated concentration within receptor (dilution only)		1.38E-03	mg/l	0

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	4.70E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**5.91E+01**		
Level 2 Remedial Target		**3.84E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.42E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	4.00E+01	mg/l	
Calculated concentration within receptor (dilution only)		6.76E-01	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-06	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**2.91E+03**		
Level 2 Remedial Target		**1.45E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.31E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	8.30E+00	mg/l	
Calculated concentration within receptor (dilution only)		2.85E-03	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	4.70E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**5.91E+01**		
Level 2 Remedial Target		**2.96E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.49E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	8.30E+00	mg/l	
Calculated concentration within receptor (dilution only)		1.40E-01	mg/l	0

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Sensitivity Analysis – Hydraulic Conductivity (GF)

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Ammonium**		
Target concentration	C_T	**0.065**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	9.00E-01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.00E-01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**7.48E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.065	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+00	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.91E+00**		
Level 2 Remedial Target		**2.54E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.92E-01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	0.065	mg/l	from Level 1
Dilution Factor	DF	3.91E+00		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		40	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	2.19E+03	days	
Calculated decay rate	λ	3.17E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	3.76E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+00	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	7.53E-01	m/d
Retardation factor	Rf	1.09E+01	fraction
Decay rate used	λ	3.17E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.76E-02	fraction
Rate of contaminant flow due to retardation	u	6.90E-02	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	2.07E-03	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**4.82E+02**	**fraction**
Soil leachate concentration	Co	4.00E+01	

Remedial Targets

Level 3 Remedial Target	**1.22E+02**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.41E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	**C_{ED}/C_0 2.07E-03**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	9.00E-01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

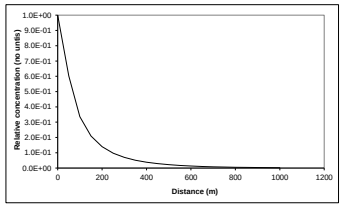
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.02E+01
50.0	6.02E-01	6.17E+00
100.0	3.36E-01	3.44E+00
150.0	2.09E-01	2.14E+00
200.0	1.40E-01	1.43E+00
250.0	9.73E-02	9.96E-01
300.0	6.99E-02	7.15E-01
350.0	5.13E-02	5.25E-01
400.0	3.83E-02	3.92E-01
450.0	2.90E-02	2.96E-01
500.0	2.21E-02	2.27E-01
550.0	1.71E-02	1.75E-01
600.0	1.33E-02	1.36E-01
650.0	1.04E-02	1.06E-01
700.0	8.14E-03	8.33E-02
750.0	6.42E-03	6.58E-02
800.0	5.09E-03	5.21E-02
850.0	4.05E-03	4.15E-02
900.0	3.23E-03	3.31E-02
950.0	2.59E-03	2.65E-02
1000.0	2.07E-03	2.12E-02

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Ammonium**		
Target concentration	C_T	**0.065**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	9.00E-01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.00E-01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**7.48E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.065	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.00E+02	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**9.79E+01**		
Level 2 Remedial Target		**6.36E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.32E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	0.065	mg/l	from Level 1
Dilution Factor	DF	9.79E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		40	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	2.19E+03	days	
Calculated decay rate	λ	3.17E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.83E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	1.00E+02	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.89E+01	m/d
Retardation factor	Rf	1.09E+01	fraction
Decay rate used	λ	3.17E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.83E-02	fraction
Rate of contaminant flow due to retardation	u	1.73E+00	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	5.28E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.89E+01**	**fraction**
Soil leachate concentration	Co	4.00E+01	

Remedial Targets

Level 3 Remedial Target		**1.21E+02**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.39E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**5.28E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	9.00E-01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

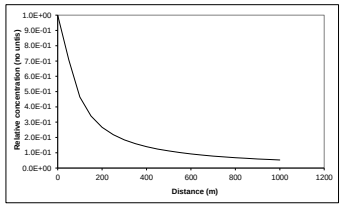
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
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Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.09E-01
50.0	7.08E-01	2.89E-01
100.0	4.64E-01	1.90E-01
150.0	3.40E-01	1.39E-01
200.0	2.67E-01	1.09E-01
250.0	2.18E-01	8.93E-02
300.0	1.84E-01	7.54E-02
350.0	1.59E-01	6.50E-02
400.0	1.40E-01	5.71E-02
450.0	1.24E-01	5.08E-02
500.0	1.12E-01	4.56E-02
550.0	1.01E-01	4.14E-02
600.0	9.24E-02	3.78E-02
650.0	8.49E-02	3.47E-02
700.0	7.85E-02	3.21E-02
750.0	7.28E-02	2.97E-02
800.0	6.78E-02	2.77E-02
850.0	6.34E-02	2.59E-02
900.0	5.95E-02	2.43E-02
950.0	5.60E-02	2.29E-02
1000.0	5.28E-02	2.16E-02

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Manganese**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**2.51E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

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Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+00	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.91E+00**		
Level 2 Remedial Target		**1.95E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		9.82E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	3.91E+00		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		8.3	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+99	days	
Calculated decay rate	λ	6.93E-100	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	3.76E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+00	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	7.53E-01	m/d
Retardation factor	Rf	5.51E+02	fraction
Decay rate used	λ	6.93E-100	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.76E-02	fraction
Rate of contaminant flow due to retardation	u	1.37E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.58E+01**	**fraction**
Soil leachate concentration	Co	8.30E+00	

Remedial Targets

Level 3 Remedial Target		**3.09E+00**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.55E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.32E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

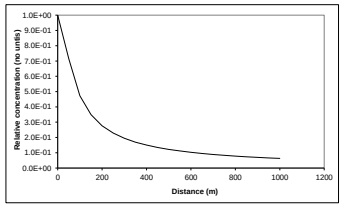
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Digbybridge
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Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.12E+00
50.0	7.15E-01	1.52E+00
100.0	4.73E-01	1.00E+00
150.0	3.49E-01	7.42E-01
200.0	2.76E-01	5.87E-01
250.0	2.29E-01	4.85E-01
300.0	1.95E-01	4.14E-01
350.0	1.70E-01	3.60E-01
400.0	1.50E-01	3.19E-01
450.0	1.35E-01	2.86E-01
500.0	1.22E-01	2.59E-01
550.0	1.12E-01	2.37E-01
600.0	1.03E-01	2.19E-01
650.0	9.55E-02	2.03E-01
700.0	8.90E-02	1.89E-01
750.0	8.33E-02	1.77E-01
800.0	7.83E-02	1.66E-01
850.0	7.39E-02	1.57E-01
900.0	7.00E-02	1.49E-01
950.0	6.64E-02	1.41E-01
1000.0	6.32E-02	1.34E-01

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Manganese**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H		dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**2.51E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.00E+02	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**9.79E+01**		
Level 2 Remedial Target		**4.90E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.46E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

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Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
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Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	9.79E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		8.3	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+99	days	
Calculated decay rate	λ	6.93E-100	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.83E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	1.00E+02	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.89E+01	m/d
Retardation factor	Rf	5.51E+02	fraction
Decay rate used	λ	6.93E-100	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.83E-02	fraction
Rate of contaminant flow due to retardation	u	3.42E-02	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.58E+01**	**fraction**
Soil leachate concentration	Co	8.30E+00	

Remedial Targets

Level 3 Remedial Target		**7.75E+01**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.89E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.32E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

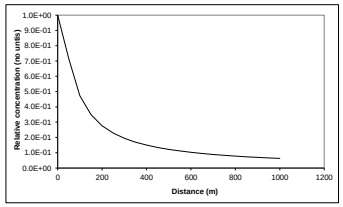
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

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Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.48E-02
50.0	7.15E-01	6.06E-02
100.0	4.73E-01	4.01E-02
150.0	3.49E-01	2.96E-02
200.0	2.76E-01	2.34E-02
250.0	2.29E-01	1.94E-02
300.0	1.95E-01	1.65E-02
350.0	1.70E-01	1.44E-02
400.0	1.50E-01	1.27E-02
450.0	1.35E-01	1.14E-02
500.0	1.22E-01	1.04E-02
550.0	1.12E-01	9.47E-03
600.0	1.03E-01	8.73E-03
650.0	9.55E-02	8.09E-03
700.0	8.90E-02	7.54E-03
750.0	8.33E-02	7.06E-03
800.0	7.83E-02	6.64E-03
850.0	7.39E-02	6.27E-03
900.0	7.00E-02	5.93E-03
950.0	6.64E-02	5.63E-03
1000.0	6.32E-02	5.36E-03

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Sensitivity Analysis – Hydraulic Conductivity (LF)

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R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	6.50E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 2 directions

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.20E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	4.38E+03	days	
Calculated decay rate	λ	1.58E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.45E+02	m	
Plume thickness at source	Sy	2.00E+01	m	
Saturated aquifer thickness	da	1.00E+02	m	
Bulk density of aquifer materials	ρ	2.10E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E-01	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+03	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.00E-02	m/d
Retardation factor	Rf	1.50E+01	fraction
Decay rate used	λ	1.58E-04	d^{-1}
Rate of contaminant flow due to retardation	u	4.00E-03	m/d
Contaminant concentration at distance x, assuming two-way vertical dispersion	C_{ED}	2.64E-11	mg/l
Attenuation factor (two way vertical dispersion, CO/CED)	**AF**	**2.35E+11**	

Remedial Targets

Remedial Target		**1.52E+10**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**2.64E-11**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	2.00E-01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

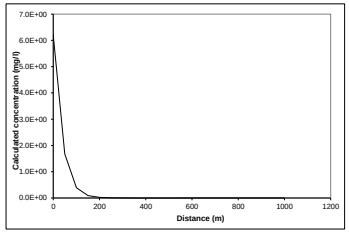
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E+00
50.0	1.68E+00
100.0	3.89E-01
150.0	9.25E-02
200.0	2.29E-02
250.0	5.83E-03
300.0	1.52E-03
350.0	4.04E-04
400.0	1.09E-04
450.0	2.96E-05
500.0	8.12E-06
550.0	2.25E-06
600.0	6.26E-07
650.0	1.75E-07
700.0	4.93E-08
750.0	1.39E-08
800.0	3.96E-09
850.0	1.13E-09
900.0	3.22E-10
950.0	9.21E-11
1000.0	2.64E-11

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R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	6.50E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 2 directions

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.20E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	4.38E+03	days	
Calculated decay rate	λ	1.58E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.45E+02	m	
Plume thickness at source	Sy	2.00E+01	m	
Saturated aquifer thickness	da	1.00E+02	m	
Bulk density of aquifer materials	ρ	2.10E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+01	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+03	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.00E+00	m/d
Retardation factor	Rf	1.50E+01	fraction
Decay rate used	λ	1.58E-04	d^{-1}
Rate of contaminant flow due to retardation	u	4.00E-01	m/d
Contaminant concentration at distance x, assuming two-way vertical dispersion	C_{ED}	4.76E-01	mg/l
Attenuation factor (two way vertical dispersion, CO/CED)	**AF**	**1.30E+01**	

Remedial Targets

Remedial Target		**8.47E-01**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**4.76E-01**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	2.00E-01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

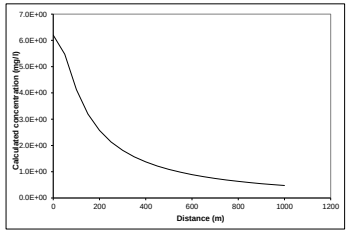
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

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Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E+00
50.0	5.47E+00
100.0	4.12E+00
150.0	3.20E+00
200.0	2.57E+00
250.0	2.14E+00
300.0	1.81E+00
350.0	1.57E+00
400.0	1.37E+00
450.0	1.22E+00
500.0	1.09E+00
550.0	9.82E-01
600.0	8.91E-01
650.0	8.12E-01
700.0	7.45E-01
750.0	6.86E-01
800.0	6.34E-01
850.0	5.87E-01
900.0	5.46E-01
950.0	5.09E-01
1000.0	4.76E-01

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Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.77E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	9.00E+99	days	
Calculated decay rate	λ	7.70E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.00E+02	m	
Plume thickness at source	Sy	1.13E+01	m	
Saturated aquifer thickness	da	3.00E+01	m	
Bulk density of aquifer materials	ρ	2.61E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E-01	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	9.90E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.00E-02	m/d
Retardation factor	Rf	4.35E+03	fraction
Decay rate used	λ	7.70E-101	d^{-1}
Rate of contaminant flow due to retardation	u	1.38E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.58E-01	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**1.12E+01**	

Remedial Targets

Remedial Target		**5.60E-01**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.58E-01**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

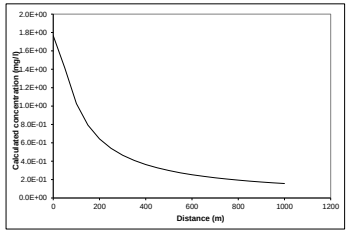
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report $ax = 0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	1.8E+00
50.0	1.42E+00
100.0	1.03E+00
150.0	7.93E-01
200.0	6.43E-01
250.0	5.40E-01
300.0	4.65E-01
350.0	4.08E-01
400.0	3.64E-01
450.0	3.28E-01
500.0	2.99E-01
550.0	2.74E-01
600.0	2.53E-01
650.0	2.35E-01
700.0	2.20E-01
750.0	2.06E-01
800.0	1.94E-01
850.0	1.84E-01
900.0	1.74E-01
950.0	1.65E-01
1000.0	1.58E-01

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R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.77E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	9.00E+99	days	
Calculated decay rate	λ	7.70E-101	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.00E+02	m	
Plume thickness at source	Sy	1.13E+01	m	
Saturated aquifer thickness	da	3.00E+01	m	
Bulk density of aquifer materials	ρ	2.61E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+01	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	9.90E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable	
Groundwater flow velocity	v	6.00E+00 m/d
Retardation factor	Rf	4.35E+03 fraction
Decay rate used	λ	7.70E-101 d^{-1}
Rate of contaminant flow due to retardation	u	1.38E-03 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	1.58E-01 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**1.12E+01**

Remedial Targets

Remedial Target		**5.60E-01**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.58E-01**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

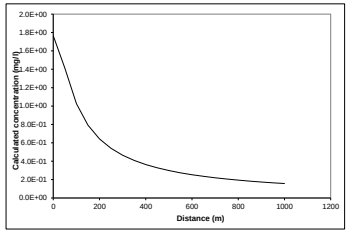
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-0	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report $ax = 0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	1.8E+00
50.0	1.42E+00
100.0	1.03E+00
150.0	7.93E-01
200.0	6.43E-01
250.0	5.40E-01
300.0	4.65E-01
350.0	4.08E-01
400.0	3.64E-01
450.0	3.28E-01
500.0	2.99E-01
550.0	2.74E-01
600.0	2.53E-01
650.0	2.35E-01
700.0	2.20E-01
750.0	2.06E-01
800.0	1.94E-01
850.0	1.84E-01
900.0	1.74E-01
950.0	1.65E-01
1000.0	1.58E-01

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Sensitivity Analysis - Biodegradation (GF)

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Ammonium**		
Target concentration	C_T	**0.065**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	9.00E-01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.00E-01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**7.48E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.065	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.95E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.25E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	0.065	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		16.8	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.10E+03	days	
Calculated decay rate	λ	6.33E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	1.09E+01	fraction
Decay rate used	λ	6.33E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	5.31E-01	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	2.16E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**4.64E+01**	**fraction**
Soil leachate concentration	Co	1.68E+01	

Remedial Targets

Level 3 Remedial Target		**9.07E+01**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.04E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**2.16E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	9.00E-01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

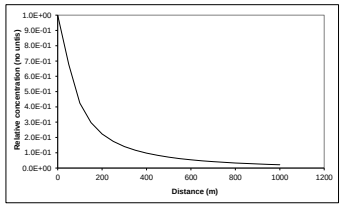
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+01	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	5.59E-01
50.0	6.77E-01	3.78E-01
100.0	4.25E-01	2.37E-01
150.0	2.97E-01	1.66E-01
200.0	2.23E-01	1.25E-01
250.0	1.75E-01	9.76E-02
300.0	1.41E-01	7.88E-02
350.0	1.16E-01	6.50E-02
400.0	9.76E-02	5.46E-02
450.0	8.30E-02	4.64E-02
500.0	7.13E-02	3.99E-02
550.0	6.18E-02	3.46E-02
600.0	5.40E-02	3.02E-02
650.0	4.74E-02	2.65E-02
700.0	4.19E-02	2.34E-02
750.0	3.72E-02	2.08E-02
800.0	3.31E-02	1.85E-02
850.0	2.96E-02	1.66E-02
900.0	2.66E-02	1.48E-02
950.0	2.39E-02	1.34E-02
1000.0	2.16E-02	1.20E-02

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Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Ammonium**		
Target concentration	C_T	**0.065**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_W	2.50E-01	fraction	
Air filled soil porosity	θa	3.60E-02	fraction	
Bulk density of soil zone material	ρ	1.00E+00	g/cm^3	
Henry's Law constant	H	8.00E-05	dimensionless	
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	9.00E-01	l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.00E-01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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Level 1 Remedial Target

Level 1 Remedial Target	**7.48E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.065	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	21-Jun-19
Version:	0

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Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Ammonium**		from Level 1
Target concentration	C_T	**0.065**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	9.39E-04	m/d		
Area of contaminant source	A	4.83E+04	m^2		Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	4.00E+02	m		
Saturated aquifer thickness	da	1.30E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	3.00E+01	m/d		
Hydraulic gradient of water table	i	2.80E-02	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+02	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.30E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**3.01E+01**		
Level 2 Remedial Target		**1.95E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.25E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc		mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Digbybridge
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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	0.065	mg/l	from Level 1
Dilution Factor	DF	3.01E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to pollutants in all phases (e.g. field derived value, l**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil leachate concentration as mg/l		
Enter soil leachate concentration		40	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	1.10E+03	days	
Calculated decay rate	λ	6.33E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+02	m	from Level 2
Plume thickness in aquifer at source	Sy	1.30E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.65E+00	g/cm^3	
Effective porosity of aquifer	n	1.50E-01	fraction	
Hydraulic gradient	i	2.90E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	3.00E+01	m/d	from Level 2
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	100.000	m	*see options*
Transverse dispersivity	az	10.000	m	*see options*
Vertical dispersivity	ay	1.000	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.79E+00	m/d
Retardation factor	Rf	1.09E+01	fraction
Decay rate used	λ	6.33E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	2.90E-02	fraction
Rate of contaminant flow due to retardation	u	5.31E-01	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	2.16E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**4.64E+01**	**fraction**
Soil leachate concentration	Co	4.00E+01	

Remedial Targets

Level 3 Remedial Target		**9.07E+01**	**mg/l**	For comparison with measured pore water concentration.
Domenico - Steady state		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.04E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**1000**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**2.16E-02**	**fraction**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	9.00E-01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

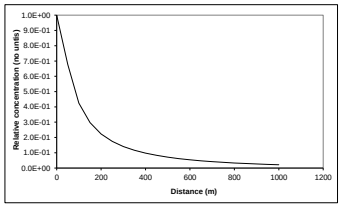
User defined values for dispersivity

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	1.00E+02	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.00E+01	1.00E+01	1.18E+01	m
Vertical dispersivity	**ay**	1.00E+00	1.00E+00	1.18E+00	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc then an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.E+99.

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	######
Version:	0

Calculated (relative) concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.33E+00
50.0	6.77E-01	9.01E-01
100.0	4.25E-01	5.65E-01
150.0	2.97E-01	3.96E-01
200.0	2.23E-01	2.97E-01
250.0	1.75E-01	2.32E-01
300.0	1.41E-01	1.88E-01
350.0	1.16E-01	1.55E-01
400.0	9.76E-02	1.30E-01
450.0	8.30E-02	1.10E-01
500.0	7.13E-02	9.49E-02
550.0	6.18E-02	8.23E-02
600.0	5.40E-02	7.18E-02
650.0	4.74E-02	6.31E-02
700.0	4.19E-02	5.57E-02
750.0	3.72E-02	4.95E-02
800.0	3.31E-02	4.41E-02
850.0	2.96E-02	3.94E-02
900.0	2.66E-02	3.53E-02
950.0	2.39E-02	3.18E-02
1000.0	2.16E-02	2.87E-02

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Sensitivity Analysis -Biodegradation (RF)

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Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	6.50E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 2 directions

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.20E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	2.19E+03	days	
Calculated decay rate	λ	3.17E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.45E+02	m	
Plume thickness at source	Sy	2.00E+01	m	
Saturated aquifer thickness	da	1.00E+02	m	
Bulk density of aquifer materials	ρ	2.10E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+00	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+03	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable	
Groundwater flow velocity	v	6.00E-01 m/d
Retardation factor	Rf	1.50E+01 fraction
Decay rate used	λ	3.17E-04 d^{-1}
Rate of contaminant flow due to retardation	u	4.00E-02 m/d
Contaminant concentration at distance x, assuming two-way vertical dispersion	C_{ED}	8.66E-04 mg/l
Attenuation factor (two way vertical dispersion, CO/CED)	**AF**	**7.16E+03**

Remedial Targets

Remedial Target		**4.65E+02**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**8.66E-04**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	2.00E-01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

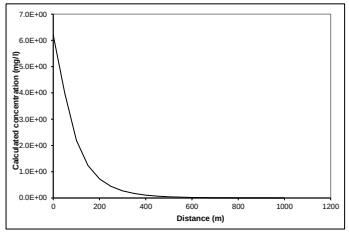
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E+00
50.0	3.99E+00
100.0	2.19E+00
150.0	1.24E+00
200.0	7.29E-01
250.0	4.41E-01
300.0	2.73E-01
350.0	1.72E-01
400.0	1.10E-01
450.0	7.12E-02
500.0	4.65E-02
550.0	3.05E-02
600.0	2.02E-02
650.0	1.35E-02
700.0	9.00E-03
750.0	6.04E-03
800.0	4.07E-03
850.0	2.75E-03
900.0	1.87E-03
950.0	1.27E-03
1000.0	8.66E-04

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R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Ammonium		from Level 1
Target Concentration	C_T	6.50E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 2 directions

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.20E+00	mg/l	
Half life for degradation of contaminant in water	$t_{1/2}$	8.76E+03	days	
Calculated decay rate	λ	7.91E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.45E+02	m	
Plume thickness at source	Sy	2.00E+01	m	
Saturated aquifer thickness	da	1.00E+02	m	
Bulk density of aquifer materials	ρ	2.10E+00	g/cm^3	
Effective porosity of aquifer	n	3.00E-02	fraction	
Hydraulic gradient	i	1.80E-02	fraction	
Hydraulic conductivity of aquifer	K	1.00E+00	m/d	
Distance to compliance point	x	1.00E+03	m	
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+03	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.00E-01	l/kg	*see options*
Longitudinal dispersivity	ax	2.70E+01	m	*see options*
Transverse dispersivity	az	1.35E+01	m	*see options*
Vertical dispersivity	ay	2.70E-01	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.00E-01	m/d
Retardation factor	Rf	1.50E+01	fraction
Decay rate used	λ	7.91E-05	d^{-1}
Rate of contaminant flow due to retardation	u	4.00E-02	m/d
Contaminant concentration at distance x, assuming two-way vertical dispersion	C_{ED}	1.07E-01	mg/l
Attenuation factor (two way vertical dispersion, CO/CED)	**AF**	**5.79E+01**	

Remedial Targets

Remedial Target		**3.76E+00**	**mg/l**	For comparison with measured groundwater concentration.
Domenico - Steady state				
Distance to compliance point		**1000**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**1.07E-01**	**mg/l**	Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	2.00E-01	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.00E-01	l/kg

Define dispersivity (click brown cell and use pull down list)

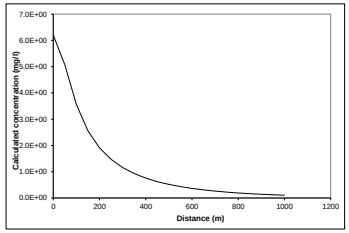
User defined values for dispersivity

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	2.70E+01	1.00E+02	1.18E+01	m
Transverse dispersivity	**az**	1.35E+01	1.00E+01	1.18E+00	m
Vertical dispersivity	**ay**	2.70E-01	1.00E+00	1.18E-01	m

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	Digbybridge
Completed by:	Conor McCabe
Date:	########
Version:	0

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
	mg/l
0	6.2E+00
50.0	5.08E+00
100.0	3.55E+00
150.0	2.56E+00
200.0	1.91E+00
250.0	1.47E+00
300.0	1.16E+00
350.0	9.31E-01
400.0	7.57E-01
450.0	6.23E-01
500.0	5.17E-01
550.0	4.32E-01
600.0	3.64E-01
650.0	3.08E-01
700.0	2.62E-01
750.0	2.24E-01
800.0	1.92E-01
850.0	1.65E-01
900.0	1.43E-01
950.0	1.24E-01
1000.0	1.07E-01

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