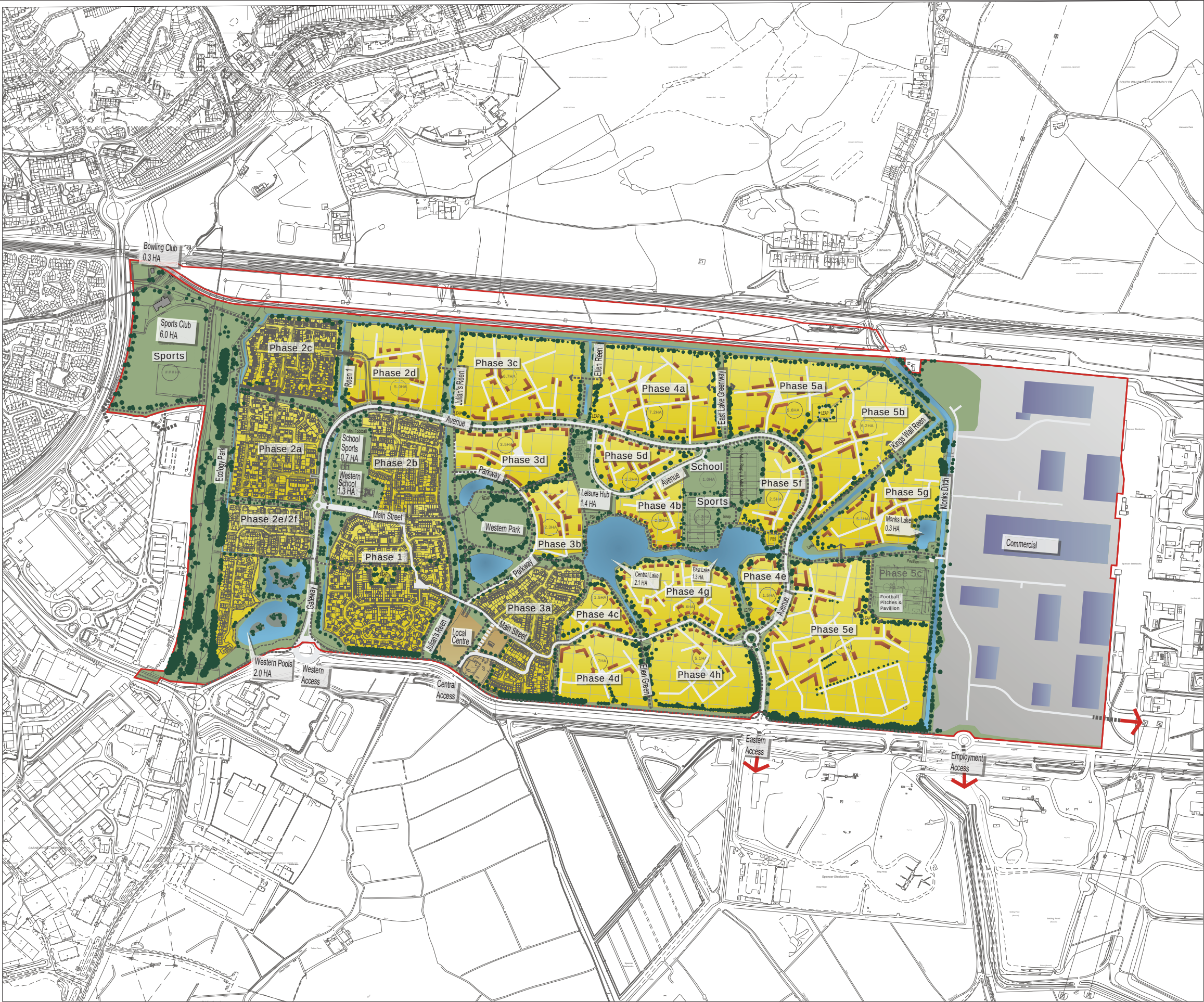


Glan Llyn -ESAMP Indicative Masterplan



Glan Llyn Residential Numbers (based on existing masterplan)					
Phase/Plot	Outlet	Area (HA)	Area (Acres)	Density (HA)	Total Units
1	Persimmon	9.77	24.15	31.4	307
2/a	Bellway	5.20	12.84	35	182
2/b	SMH	4.06	10.02	35	142
2/c	Bellway	4.30	10.62	35.3	152
2/d	Persimmon	4.98	12.30	35	174
2/e&f	SMH	5.10	12.61	29.8	152
1 and 2/Total		33.40	82.54		1109
3a		5.86	14.49	35	205
3b		2.32	5.74	35	81
3c		6.72	16.60	38.1	256
3d		3.45	8.53	35	121
3 Total		18.36	45.36		663
4a		7.19	17.78	34.8	250
4b		2.04	5.04	35	71
4c		1.53	3.78	35	54
4d		3.65	9.03	35	128
4e		1.49	3.68	35	52
4f		-	-	-	-
4g		4.64	11.46	35	162
4h		5.15	12.73	35	180
5a		5.65	13.95	35	198
5b		6.23	15.41	35	218
5c	Sports	2.67	6.60	35	93
5d		2.24	5.53	35	78
5e		13.72	33.90	35	480
5f		2.49	6.15	35	87
5g		5.06	12.50	35	177
4 and 5/Total		63.75	157.53		2230
1,2,3,4,5 Total		115.51	285.44		4002

NOTE: Areas and housing numbers assume that plot 5c sports is moved to CBP and converted to resi



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OTHERWISE.

ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

ANY DISCREPANCIES NOTED ON SITE ARE TO BE
REPORTED TO THE ENGINEER IMMEDIATELY.

- Full turnover Specification
- 1m Turnover Specification
- Coking works area treated separately
- Residential/Commercial boundary

Rev	Date	Amendments	By	Chk



Client

Project P18-669 Llanwern Reclamation

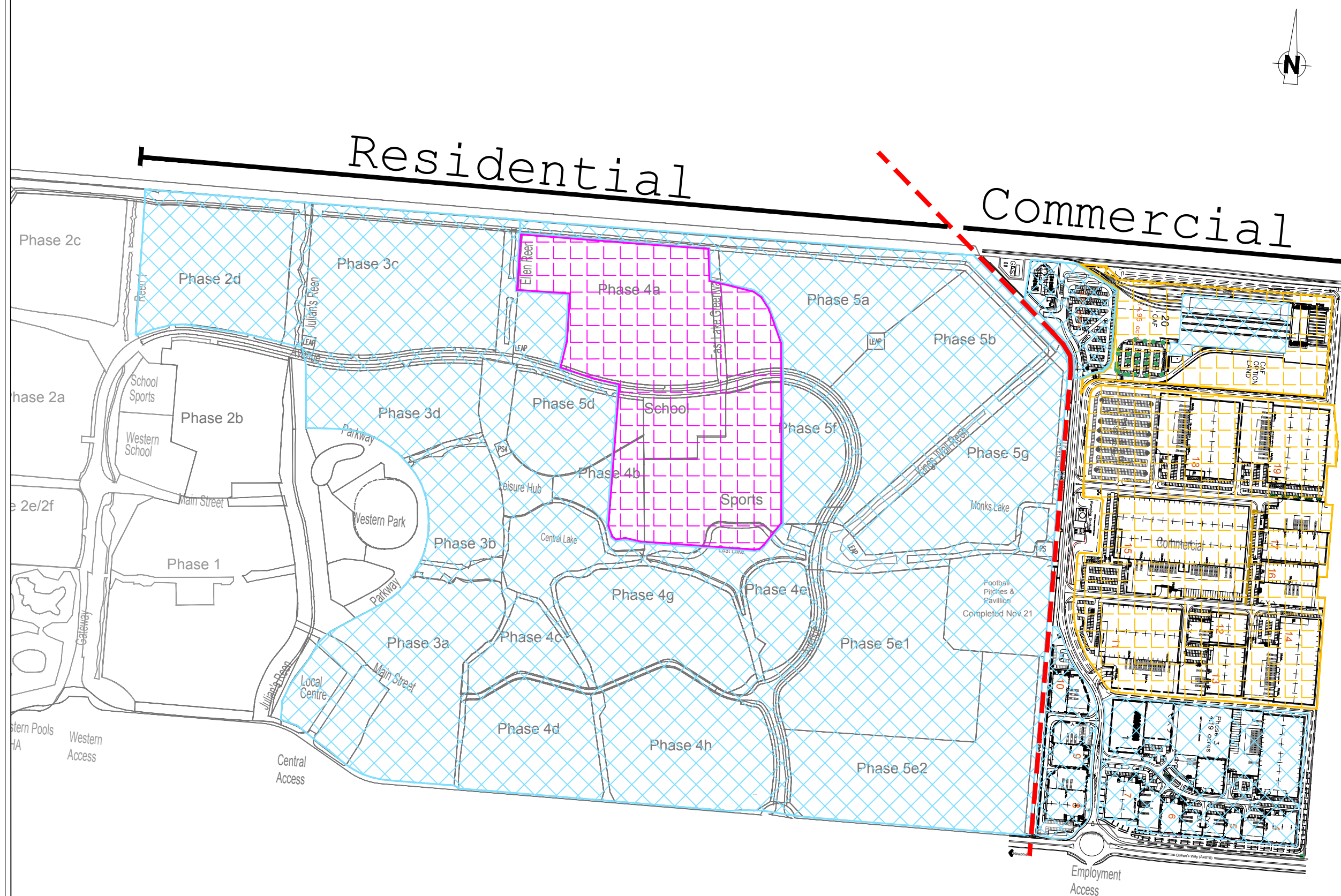
Drawing Title

Remediation phasing plan

	Drawn	Checked	Date
NTS	ET	CW	07.10.21
Drawing No.			Rev.

18669-RLL-21-XX-DR-O-0165

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KEY:

- Monks Ditch
- Clean discharge to Drain 2
- Monks Lake connection
- Site discharge through Celtic treatment works
- Sampling Location
- Blocked off drain

Rev	Date	Amendments	By	Chk



Client
St Modwen Developments

Project
P18-669 Llanwern Reclamation

Drawing Title
Site Surface Water Plan

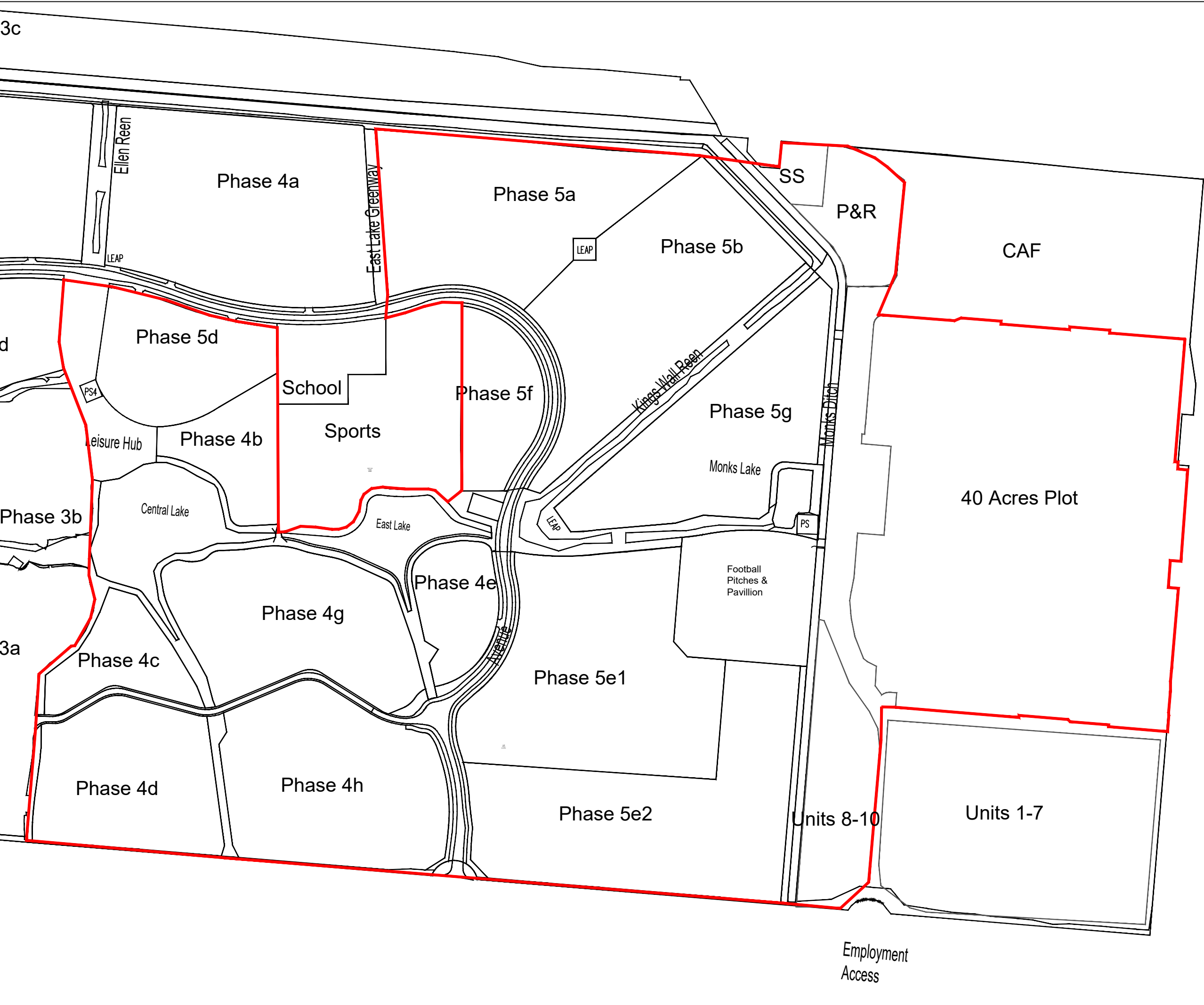
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Drawn	Checked	Date
NTS	SR	CW
12.10.21		
Drawing No.	Rev.	
18669-RLL-21-XX-DR-O-0167		
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SCALE BAR

0m 50m 100m 200m 400m



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KEY:

- REMEDIATION STRATEGY BOUNDARY
- PHASE BOUNDARIES

A	03:05:22	Updated Boundary	SR	CW	
Rev	Date	Amendments	By	Chk	



Client
St Modwen Developments

Project
P18-669 Llanwern Reclamation

Drawing Title
Remediation Strategy
Boundary Plan

INFORMATION

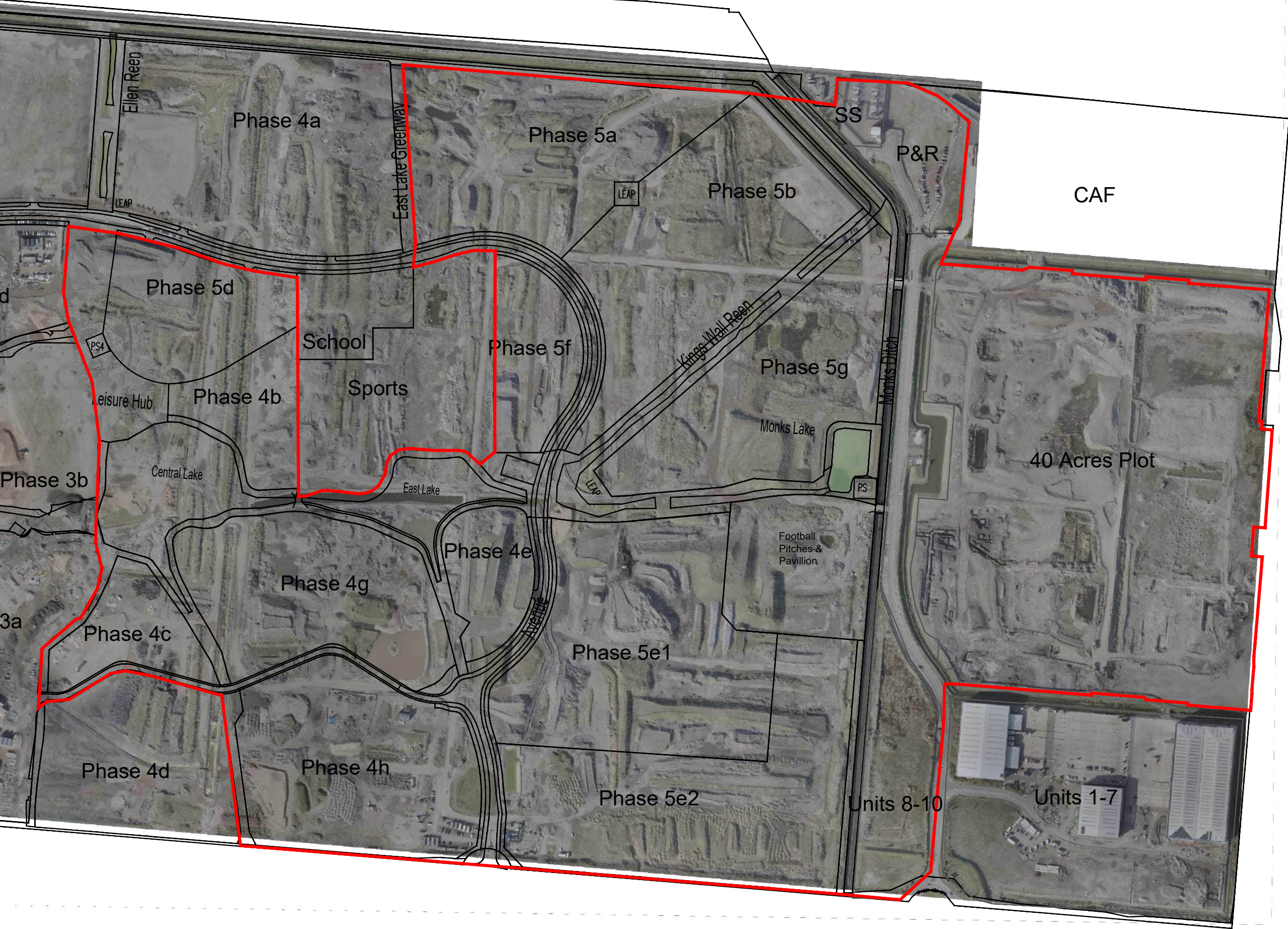
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NTS	SR	CW	27.04.22
Drawing No.		Rev.	

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ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:

- REMEDIATION STRATEGY BOUNDARY
- PHASE BOUNDARIES

Rev	Date	Amendments	By	Chk



Client
St Modwen Developments

Project
P18-669 Llanwern Reclamation

Drawing Title
2021 Aerial Survey Overlay with Remediation Strategy Boundary

INFORMATION

	Drawn	Checked	Date
NTS	SR	CW	29.04.22
Drawing No.	Rev.		

18669-RLL-22-XX-DR-O-0265 A

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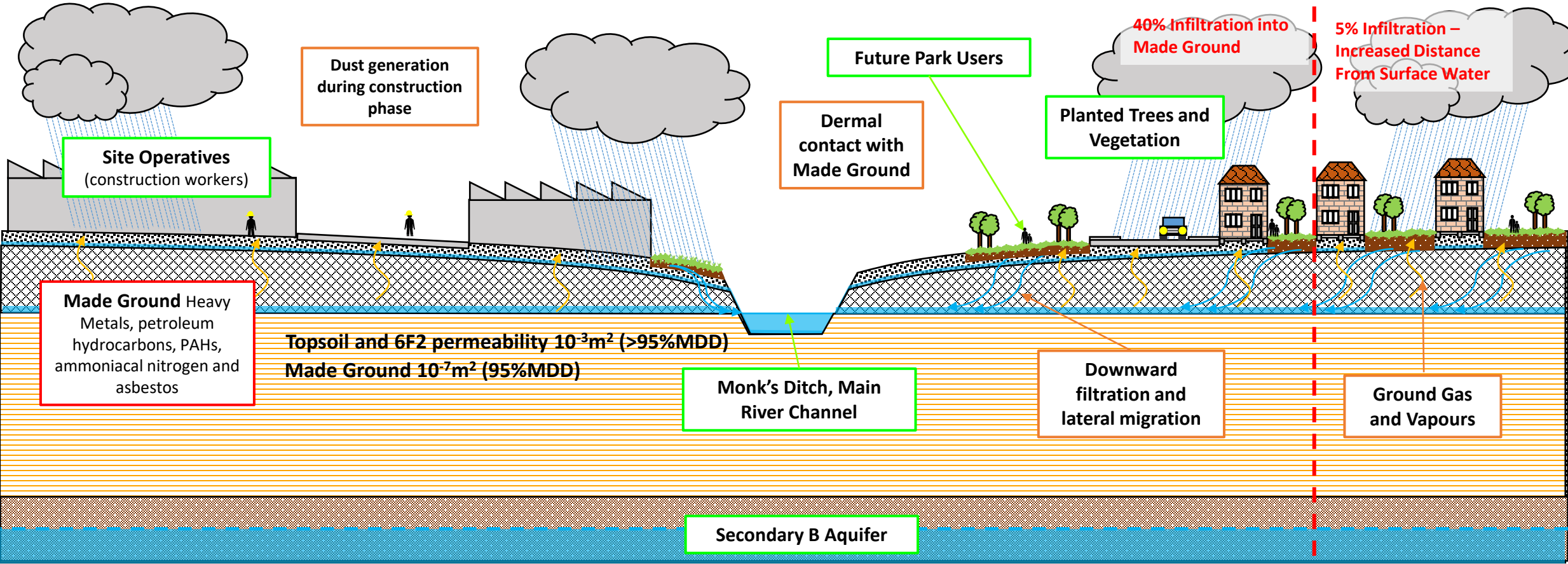
Appendix B – RLE CWDQRA

INCLUDED PRIOR

Appendix C - CSM

Commercial Development

Residential Development



Area covered by landscaping = 23.8%



Conceptual Site Model

Source	Pathways	Receptor	Mitigation
Made Ground – Contaminants within Soil	Direct Contact – dermal contact, absorption through skin, ingestion. Inhalation of vapours (VOCs) from soil derived gas via Made Ground. Inhalation of contaminants in soils/dust.	Human Health -End Users -Adjacent residents	- Made Ground to be placed below clean cover to break pathways.
Inorganic substances (heavy metals/asbestos)	Direct contact – contaminants in soils, perched water and groundwater.	Growth Inhibition -Planted Trees and Vegetation	- Material to be placed below clean cover to break pathways.
Organic substances (ammoniacal nitrogen, petroleum hydrocarbons, PAHs, VOCs, SVOCs)	Potential migration of leachable contaminants through shallow groundwater	Controlled Waters – Secondary B Aquifer, Hough Drain, Forebridge Drain and River Sow.	- Reduced permeability of Made Ground through engineering. Rainwater landing on hard standing intercepted by drainage network. No downward migration through cohesive Tidal Flat deposits to aquifer.

Legend

	Sewage Material Placement
	Approximate Depth of Groundwater
	Topsoil Clean Cover (imported)
	Construction Material including 6F2 (to be placed)
	Imported General Fill (already placed)
	Tidal Flat Deposits
	Bedrock

Project ID: P16-669
Project Title: Glan Llyn
Location: Llanwern
Client: St. Modwen Developments

Title: Conceptual Site Model
Scale: Not to scale
Engineer: RT
Contractor:
Date: October, 2021



Appendix D – Chemical Screening

Customer Sample ID		Depth	ASL	Sample Type	285E-1		285E-2	285E-3	285E-4	285E-5	285E-6	285E-7	285E-8	285E-9	285E-10	285E-11	285E-12	285E-13	285E-14	285E-22	285E-23	285E-24	285E-25	285E-26	285E-27	285E-28	285E-29	285E-30	285E-31	285E-32	285E-33	285E-34	285E-35	M33-1	M33-2	
SDQ(s):	201212-45				0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.00-0.00	0.50-0.50	1.40-1.40	
Customer:	Rodgers Leasik Almondbury (12763)				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	
Client Reference / Location:	Llanwrn				10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	
Order no:	108281				12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	
Final Instruction Date					05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	05/01/2021	
All results expressed on a dry weight basis					19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021	19/01/2021
Report Completed Date					201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45	201212-45
Lab Sample Number					23419848	23419856	23419865	23419873	23419881	23419889	23419897	23419905	23419913	23419921	23419929	23419937	23419945	23419953	23419961	23419969	23419977	23419985	23419993	23420001	23420009	23420017	23420025	23420033	23420041	23420049	23420057	23420065	23420073	23420081	23420089	23420097
Sample Temperature					10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Sample Time																																				
Analysis	Test	Method	Units	LOD																																
Sample Description	Colour	PM024	No units																																	
	Description	PM024	No units																																	
	Inclusion 1)	PM024	No units																																	
	Inclusion 2)	PM024	No units																																	
	Moisture Content Ratio (% of as received sample)	PM024	No units																																	
		PM024			None	Vegetation	None	Stones	Stones	None	None	None	Stones	Vegetation	None	None	Vegetation	Crushed Brick	None	Vegetation	None	Vegetation	None	None	Vegetation	None	None	Vegetation	None	None	None	Crushed Brick	None	None	None	Brick
		PM024			7.9	13	10	10	10	10	11	12	7.3	13	11	10	5.7	7.8	16	15	17	14	12	16	15	17	15	14	13	16	12	14	3.6	5	5	
Asbestos	Asbestos Quantification - Gravimetric - %	TM304	%	<0.001	0.02	0.03																														
	Date of Analysis	TM048	No units																																	
	Analyse By	TM048	No units																																	
	Asbestos Quantification - PCM Evaluation - %	TM304	%	<0.001																																
	Total Asbestos Components (Using TM048)	TM304	No units																																	
	Analysts Comments	TM304	No units																																	
	Asbestos Quantification - Total - %	TM304	%	<0.001																																
	Chrysotile (White) Asbestos	TM048	No units																																	
	Amosite (Brown) Asbestos	TM048	No units																																	
	Crocidolite (Blue) Asbestos	TM048	No units																																	
	Fibrous Anthophyllite	TM048	No units																																	
	Fibrous Tremolite	TM048	No units																																	
	Fibrous Actinolite	TM048	No units																																	
	Non-Asbestos Fibre	TM048	No units																																	
	Comments	TM048	No units																																	
Carbon	Soil Organic Matter (SOM)	TM132	%	<0.35																																
					13.6	18.1	22.8	16.8	23.3	30	32.9	19.5	60.7	28.6	45	31.2	34.3	27.8	21	20.3	33.4	20.5	7.55	26.5	32.1	35	34.8	26.2	25.2	39.7	24.3	22.4	<0.35	0.359		
Inorganics	pH	TM133	pH Units	<1																																
	Cyanide, Total	TM153	mg/kg	<1	2.313	9.14	273	2.44	<1	<1	<1	2.96	<1	1.03	<1	<1	<1	<1	2.13	<1	1.38	<1	1.18	<1	1.18	<1	<1	1.28	<1	<1	<1	<1	<1	<1	<1	
	Exchangeable Ammonia as N	TM024	mg/kg	<12	176.983	699.276	1260	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	
Metals - (Solids)	Arsenic	TM181	mg/kg	<0.6	2902.688	11468.786	282	7.61	6.63	5.83	6.09	7.19	1.2	4.84	56.8	1.06	13.6	6.63	10.1	5.12	10.3	6.88	8.11	8.88	7.36	<6	1.52	9.27	1.33	7.87	8.96	6.41	1.39	9.12	1.63	2.71
	Cadmium	TM189	mg/kg	<0.01	83.661	330.551	38.2	34.8	0.534	0.341	<0.02	0.127	0.977	0.45	0.217	0.825	0.342	1.23	0.625	1.42	1.38	2.07	0.793	<0.02	0.094	<0.02	0.084	<0.02	0.084	<0.02	0.084	<0.02	0.084	<0.02	0.084	
	Chromium	TM181	mg/kg	<0.9	10006.307	42609.08	1290	416	174	187	358	227	133	200	227	397	195	282	253	144	118	318	129	209	216	<0.9	208	209	376	53.2	230	109	43.1	958	10.6	
	Copper	TM181	mg/kg	<1.4	516.883	2042.252	560	25.7	19.6	14.6	20.1	<1.4	5.49	13.1	75.6	<1.4	28.9	21.5	23.9	15.1	24	16.2	20.3	23.4	20.2	15.5	8.73	20.6	<1.4	22.4	18.1	37.8	4.52	51.1	11.3	8.69
	Iron	TM181	mg/kg	<1000	349148.01	1579515.806	467000	177000	116000	101000	130000	180000	100000	157000	100000	160000	94500	78500	90100	92900	82200	72200	173000	94500	91600	136000	113000	115000	96000	111000	99500	90100	127000	7440	144000	
	Lead	TM181	mg/kg	<0.7	18025.071	71246.366	7150	179	81.8	54.2	77.1	<0.7	156	81	157	112	112	246	185	114	82.8	61	140	180	<0.7	186	<0.7	181	132	99.4	<0.7	181	<0.7	181	<0.7	181
	Manganese	TM181	mg/kg	<0.13	38175.69	150835.652	348000	277000	161000	154000	238000	180000	201000	157000	165000	186000	148000	154000	110000	86400	237000	115000	115000	189000	235000	192000	155000	133000	117000	251000	135000	187000	136000	7710	403000	
	Mercury	TM181	mg/kg	<0.14	150.809	595.859	22.9	<1.4	<0.14	<0.14	<0.14	<1.4	0.512	<1.4	<0.14	<0.14	<0.14	<1.4	<0.14	<1.4	<															

K3-1 0.30-0.30	K3-2 1.60-1.60		2B-1 0.00-0.00		2B-2 0.00-0.00		2B-3 0.00-0.00		2B-4 0.00-0.00		2B-5 0.00-0.00		2B-6 0.00-0.00		2B-7 0.00-0.00		2B-8 0.00-0.00		2B-9 0.00-0.00		2B-10 0.00-0.00		2B-11 0.00-0.00		2B-12 0.00-0.00		2B-13 0.00-0.00		2B-14 0.00-0.00		2B-15 0.00-0.00		2B-16 0.00-0.00		2B-17 0.00-0.00		2B-18 0.00-0.00		2B-19 0.00-0.00		2B-20 0.00-0.00		2B-21 0.00-0.00		2B-22 0.00-0.00		2B-23 0.00-0.00		2B-24 0.00-0.00		2B-25 0.00-0.00		2B-26 0.00-0.00		2B-27 0.00-0.00		2B-28 0.00-0.00		2B-29 0.00-0.00		2B-30 0.00-0.00		2B-31 0.00-0.00		2B-32 0.00-0.00		2B-33 0.00-0.00		2B-34 0.00-0.00		2B-35 0.00-0.00		2B-36 0.00-0.00		2B-37 0.00-0.00		2B-38 0.00-0.00		2B-39 0.00-0.00		2B-40 0.00-0.00		2B-41 0.00-0.00		2B-42 0.00-0.00		2B-43 0.00-0.00		2B-44 0.00-0.00		2B-45 0.00-0.00		2B-46 0.00-0.00		2B-47 0.00-0.00		2B-48 0.00-0.00		2B-49 0.00-0.00		2B-50 0.00-0.00		2B-51 0.00-0.00		2B-52 0.00-0.00		2B-53 0.00-0.00		2B-54 0.00-0.00		2B-55 0.00-0.00		2B-56 0.00-0.00		2B-57 0.00-0.00		2B-58 0.00-0.00		2B-59 0.00-0.00		2B-60 0.00-0.00		2B-61 0.00-0.00		2B-62 0.00-0.00		2B-63 0.00-0.00		2B-64 0.00-0.00		2B-65 0.00-0.00		2B-66 0.00-0.00		2B-67 0.00-0.00		2B-68 0.00-0.00		2B-69 0.00-0.00		2B-70 0.00-0.00		2B-71 0.00-0.00		2B-72 0.00-0.00		2B-73 0.00-0.00		2B-74 0.00-0.00		2B-75 0.00-0.00		2B-76 0.00-0.00		2B-77 0.00-0.00		2B-78 0.00-0.00		2B-79 0.00-0.00		2B-80 0.00-0.00		2B-81 0.00-0.00		2B-82 0.00-0.00		2B-83 0.00-0.00		2B-84 0.00-0.00		2B-85 0.00-0.00		2B-86 0.00-0.00		2B-87 0.00-0.00		2B-88 0.00-0.00		2B-89 0.00-0.00		2B-90 0.00-0.00		2B-91 0.00-0.00		2B-92 0.00-0.00		2B-93 0.00-0.00		2B-94 0.00-0.00		2B-95 0.00-0.00		2B-96 0.00-0.00		2B-97 0.00-0.00		2B-98 0.00-0.00		2B-99 0.00-0.00		2B-100 0.00-0.00		2B-101 0.00-0.00		2B-102 0.00-0.00		2B-103 0.00-0.
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28SE-18 0.00-0.00	28SE-19 0.00-0.00	28SE-20 0.00-0.00	28SE-21 0.00-0.00	28SE-36 0.00-0.00	28SE-37 0.00-0.00	28SE-38 0.00-0.00	28SE-39 0.00-0.00	28SE-40 0.00-0.00	28SE-41 0.00-0.00	28SE-42 0.00-0.00	AT6-1 0.20-0.20	AT6-2 1.70-1.70	AUT-1 0.50-0.50	AV7-1 0.30-0.30	AW7-1 0.40-0.40	AW7-2 2.00-2.00	SPFO-1 0.00-0.00	SPFO-2 0.00-0.00	SPFO-3 0.00-0.00	SPFO-4 0.00-0.00	SPFO-5 0.00-0.00	SPFO-6 0.00-0.00	SPFO-7 0.00-0.00	SPFO-8 0.00-0.00	SPFO-9 0.00-0.00	SPFO-10 0.00-0.00	SPFO-11 0.00-0.00	SPFO-12 0.00-0.00	SPFO-13 0.00-0.00	U37-1 0.30-0.30	U37-2 1.50-1.50	V35-1 0.20-0.20	V35-2 1.50-1.50	V37-1 0.50-0.50	V37-2 1.50-1.50	W37-1 0.50-0.50	W37-2 1.50-1.50	R37-1 0.30-0.30	
SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	11/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	16/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020	08/12/2020		
15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	17/12/2020	08/12/2020	08/12/2020	08/12/2020	08/12/2020	08/12/2020	08/12/2020	08/12/2020	08/12/2020	09/12/2020	
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201215-62 23432990 8.4	201215-62 23432986 8.4	201215-62 23432990 8.4	201215-62 23432994 8.4	201215-62 23433001 8.4	201215-62 23433006 8.4	201215-62 23432728 8.4	201215-62 23432735 8.4	201215-62 23432740 8.4	201215-62 23432745 8.4	201215-62 23432753 8.4	201215-62 23450096 6.1	201217-34 23450104 6.1	201217-34 23450074 6.1	201217-34 23450081 6.1	201217-34 23450088 6.1	201217-34 23450092 6.1	201217-34 23450052 6.1	201217-34 23450108 6.1	201217-34 23450112 6.1	201217-34 23450117 6.1	201217-34 23450122 6.1	201217-34 23450127 6.1	201217-34 23450139 6.1	201217-34 23450148 6.1	201217-34 23450057 6.1	201217-34 23450061 6.1	201217-34 23450065 6.1	201217-34 23450069 6.1	201217-34 23450073 6.1	201217-34 23450077 6.1	201217-34 23450081 6.1	201217-34 23450085 6.1	201217-34 23450089 6.1	201217-34 23450093 6.1	201217-34 23450097 6.1	201217-34 23450101 6.1	201217-34 23450105 6.1		

Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark 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-	22/12/2020	-	22/12/20	-	22/12/2020	-	22/12/2020	-	22/12/2020	-	30/12/2020	-	30/12/2020	-	30/12/2020	-	30/12/2020	-	30/12/2020	-	30/12/2020	-	22/12/20	-	23/12/2020	-	30/12/2020	-	30/12/2020	-	30/12/2020	-	11/12/2020	-	11/12/2020	-	14/12/2020	-	11/12/2020	-
Barbara Urbanek-Walsh		Andrzej Ferfeki		March Magdzianek	Barbara Urbanek-Walsh		Agnieszka Chetmowska		Christian Hallam		Christian Hallam		Christian Hallam		Christian Hallam		Christian Hallam		Christian Hallam		Andrzej Ferfeki		March Magdzianek		Christian Hallam		Christian Hallam		Christian Hallam		Barbara Urbanek-Walsh		James Richards		March Magdzianek		James Richards			

Not Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
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Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected

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26.7	13	15.7	12.9	37.9	15.6	20	23.6	14.1	19.3	20.9	5.91	0.833	6.5	8.96	14.4	20.9	46.5	74.8	48.3	28.1	5.81	2.45	40.9	50.9	8.88	15	5.45	2.17	2.22	0.572	1.48	2	1.28	1.53	5.64	5.07	2.43	4.22
11.8	8.89	10.8	10.6	11.6	10.5	9.77	11.2	8.98	10.3	11.4	12.1	12.1	11.4	11.6	9.36	10.8	9.04	8.43	9.77	8.29	8.14	9.02	8.92	8.8	9.07	8.27	8.62	8.77	8.64	8.23	7.83	10.8	11.5	9.1	7.91	8.46	7.95	8.98
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5	7.95	8.28	6.24	7.11	6.2	21.1	5.1	8.35	12.6	6.88	9.79	<6	16.3	17.2	14.3	11.9	3.68	9.34	9.24	30.4	16.2	9.27	6.28	7.19	8.06	19.2	11.4	10.2	9.96	4.98	3.67	5.73	3.64	5.18	9.2	35.1	66.6	7.39	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
300	226	240	452	285	309	55.4	331	66.3	68.8	252	408	1200	273	91.7	59.3	35.4	181	98.7	84.5	15.3	10.2	19.2	66	52.3	49.3	49	7.62	12.3	89	23	3.47	50.3	225	<0.9	10.1	99.7	389	256	
17.8	23.2	19.1	31.5	19.4	17.7	44.2	18.8	15.9	26.5	19.6	43	<14	56.3	40.1	33.5	108	19.6	15.7	42	29.6	14.7	21	15.3	23.1	32.2	24	17.9	14.6	20.6	6.84	12	12.8	7.88	8.51	13.4	12	16.9	23.7	
102000	63500	120000	135000	91100	132000	174000	123000	75600	134000	113000	187000	184000	255000	327000	226000	45800	77900	63100	259000	55300	27400	131000	40000	32600	267000	37300	38100	24600	23300	7080	95700	35900	25200	71600	133000	91900			
21400	9480	14400	18000	14500	17300	21200	6350	6700	17400	98800	17400	98800	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	116000	
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9.33	19.13	12.8	10.3	11.7	9.94	10.5	12	20.8	29.1	11.9	7.29	46.5	60.2	46.4	50.5	8.2	17.3	48.3	24.8	12.4	17.2	11.8	14.5	42.6	42.1	41.4	42.1	41.4	42.1	41.4	42.1	41.4	42.1	41.4	42.1	41.4	42.1	41.4	42.1
2.19	2.19	1.18	1.84	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65	1.18	1.65
376	169	303	569	437	512	112	591	98.4	134	248	1470	1470	911	1180	691	355	239	137	159	93.7	348	36.2	39.1	29.7	54.4	30.7	26.7	41.5	52	33.5	5.23	14.7	26.2	16.7	27.5	110	269	160	460
117	249	268	201	167	242	422	4980	148	222	453	197	2530	332	5510	5830	3100	1720	168	282	290	6490	305	382	253	215	268	5490	152	574	224	81.2	15	270	136	37.1	101	48.8	131	

N36-1		N36-2		O39-1		O34-1		O34-2		O35-1		O35-2		O35-3		A4-1		A4-2		A2-1		A2-2		A3-1		A3-2		A1-1		A1-2		A1-3		A1-4		A1-5		A1-6		A1-7		A1-8		A1-9		A1-10		A1-11		A1-12		A1-13		A1-14		A1-15		A1-16		A1-17		A1-18		A1-19		A1-20		A1-21		A1-22		A1-23		A1-24		A1-25		A1-26		A1-27		A1-28		A1-29		A1-30		A1-31		A1-32		A1-33		A1-34		A1-35		A1-36		A1-37		A1-38		A1-39		A1-40		A1-41		A1-42		A1-43		A1-44		A1-45		A1-46		A1-47		A1-48		A1-49		A1-50		A1-51		A1-52		A1-53		A1-54		A1-55		A1-56		A1-57		A1-58		A1-59		A1-60		A1-61		A1-62		A1-63		A1-64		A1-65		A1-66		A1-67		A1-68		A1-69		A1-70		A1-71		A1-72		A1-73		A1-74		A1-75		A1-76		A1-77		A1-78		A1-79		A1-80		A1-81		A1-82		A1-83		A1-84		A1-85		A1-86		A1-87		A1-88		A1-89		A1-90		A1-91		A1-92		A1-93		A1-94		A1-95		A1-96		A1-97		A1-98		A1-99		A1-100		A1-101		A1-102		A1-103		A1-104		A1-105		A1-106		A1-107		A1-108		A1-109		A1-110		A1-111		A1-112		A1-113		A1-114		A1-115		A1-116		A1-117		A1-118		A1-119		A1-120		A1-121		A1-122		A1-123		A1-124		A1-125		A1-126		A1-127		A1-128		A1-129		A1-130		A1-131		A1-132		A1-133		A1-134		A1-135		A1-136		A1-137		A1-138		A1-139		A1-140		A1-141		A1-142		A1-143		A1-144		A1-145		A1-146		A1-147		A1-148		A1-149		A1-150		A1-151		A1-152		A1-153		A1-154		A1-155		A1-156		A1-157		A1-158		A1-159		A1-160		A1-161		A1-162		A1-163		A1-164		A1-165		A1-166		A1-167		A1-168		A1-169		A1-170		A1-171		A1-172		A1-173		A1-174		A1-175		A1-176		A1-177		A1-178		A1-179		A1-180		A1-181		A1-182		A1-183		A1-184		A1-185		A1-186		A1-187		A1-188		A1-189		A1-190		A1-191		A1-192		A1-193		A1-194		A1-195		A1-196		A1-197		A1-198		A1-199		A1-200		A1-201		A1-202		A1-203		A1-204		A1-205		A1-206		A1-207		A1-208		A1-209		A1-210		A1-211		A1-212		A1-213		A1-214		A1-215		A1-216		A1-217		A1-218		A1-219		A1-220		A1-221		A1-222		A1-223		A1-224		A1-225		A1-226		A1-227		A1-228		A1-229		A1-230		A1-231		A1-232		A1-233		A1-234		A1-235		A1-236		A1-237		A1-238		A1-239		A1-240		A1-241		A1-242		A1-243		A1-244		A1-245		A1-246		A1-247		A1-248		A1-249		A1-250		A1-251		A1-252		A1-253		A1-254		A1-255		A1-256		A1-257		A1-258		A1-259		A1-260		A1-261		A1-262		A1-263		A1-264		A1-265		A1-266		A1-267		A1-268		A1-269		A1-270		A1-271		A1-272		A1-273		A1-274		A1-275		A1-276		A1-277		A1-278		A1-279		A1-280		A1-281		A1-282		A1-283		A1-284		A1-285		A1-286		A1-287		A1-288		A1-289		A1-290		A1-291		A1-292		A1-293		A1-294		A1-295		A1-296		A1-297		A1-298		A1-299		A1-300		A1-301		A1-302		A1-303		A1-304		A1-305		A1-306		A1-307		A1-308		A1-309		A1-310		A1-311		A1-312		A1-313		A1-314		A1-315		A1-316		A1-317		A1-318		A1-319		A1-320		A1-321		A1-322		A1-323		A1-324		A1-325		A1-326		A1-327		A1-328		A1-329		A1-330		A1-331		A1-332		A1-333		A1-334		A1-335		A1-336		A1-337		A1-338		A1-339		A1-340		A1-341		A1-342		A1-343		A1-344		A1-345		A1-346		A1-347		A1-348		A1-349		A1-350		A1-351		A1-352		A1-353		A1-354		A1-355		A1-356		A1-357		A1-358		A1-359		A1-360		A1-361		A1-362		A1-363		A1-364		A1-365		A1-366		A1-367		A1-368		A1-369		A1-370		A1-371		A1-372		A1-373		A1-374		A1-375		A1-376		A1-377		A1-378		A1-379		A1-380		A1-381		A1-382		A1-383		A1-384		A1-385		A1-386		A1-387		A1-388		A1-389		A1-390		A1-391		A1-392		A1-393		A1-394		A1-395		A1-396		A1-397		A1-398		A1-399		A1-400		A1-401		A1-402		A1-403		A1-404		A1-405		A1-406		A1-407		A1-408		A1-409		A1-410		A1-411		A1-412		A1-413		A1-414		A1-415		A1-416		A1-417		A1-418		A1-419		A1-420		A1-421		A1-422		A1-423		A1-424		A1-425		A1-426		A1-427		A1-428		A1-429		A1-430		A1-431		A1-432		A1-433		A1-434		A1-435		A1-436		A1-437		A1-438		A1-439		A1-440		A1-441		A1-442		A1-443		A1-444		A1-445		A1-446		A1-447		A1-448		A1-449		A1-450		A1-451		A1-452		A1-453		A1-454		A1-455		A1-456		A1-457		A1-458		A1-459		A1-460		A1-461		A1-462		A1-463		A1-464		A1-465		A1-466		A1-467		A1-468		A1-469		A1-470		A1-471		A1-472		A1-473		A1-474		A1-475		A1-476		A1-477		A1-478		A1-479		A1-480		A1-481		A1-482		A1-483		A1-484		A1-485		A1-486		A1-487		A1-488		A1-489		A1-490		A1-491		A1-492		A1-493		A1-494		A1-495		A1-496		A1-497		A1-498		A1-499		A1-500		A1-501		A1-502		A1-503		A1-504		A1-505		A1-506		A1-507		A1-508		A1-509		A1-510		A1-511		A1-512		A1-513		A1-514		A1-515		A1-516		A1-517		A1-518		A1-519		A1-520		A1-521		A1-522		A1-523		A1-524		A1-525		A1-526		A1-527		A1-528		A1-529		A1-530		A1-531		A1-532		A1-533		A1-534		A1-535		A1-536		A1-537		A1-538		A1-539		A1-540		A1-541		A1-542		A1-543		A1-544		A1-545		A1-546		A1-547		A1-548		A1-549		A1-550		A1-551		A1-552		A1-553		A1-554		A1-555		A1-556		A1-557		A1-558		A1-559		A1-560		A1-561		A1-562		A1-563		A1-564		A1-565		A1-566		A1-567		A1-568		A1-569		A1-570		A1-571		A1-572		A1-573		A1-574		A1-575		A1-576		A1-577		A1-578		A1-579		A1-580		A1-581		A1-582		A1-583		A1-584		A1-585		A1-586		A1-587		A1-588		A1-589		A1-590		A1-591		A1-592		A1-593		A1-594		A1-595		A1-596		A1-597		A1-598		A1-599		A1-600		A1-601		A1-602		A1-603		A1-604		A1-605		A1-606		A1-607		A1-608		A1-609		A1-610		A1-611		A1-612		A1-613		A1-614		A1-615		A1-616		A1-617		A1-618		A1-619		A1-620		A1-621		A1-622		A1-623		A1-624		A1-625		A1-626		A1-627		A1-628		A1-629		A1-630		A1-631		A1-632		A1-633		A1-634		A1-635		A1-636		A1-637		A1-638		A1-639		A1-640		A1-641		A1-642		A1-643		A1-644		A1-645		A1-646		A1-647		A1-648		A1-649		A1-650		A1-651		A1-652		A1-653		A1-654		A1-655		A1-656		A1-657		A1-658		A1-659		A1-660		A1-661		A1-662		A1-663		A1-664		A1-665		A1-666		A1-667		A1-668		A1-669		A1-670		A1-671		A1-672		A1-673		A1-674		A1-675		A1-676		A1-677		A1-678		A1-679		A1-680		A1-681		A1-682		A1-683		A1-684		A1-685		A1-686		A1-687		A1-688		A1-689		A1-690		A1-691		A1-692		A1-693		A1-694		A1-695		A1-696		A1-697		A1-698		A1-699		A1-700		A1-701		A1-702		A1-703		A1-704		A1-705		A1-706		A1-707		A1-708		A1-709		A1-710		A1-711		A1-712		A1-713		A1-714		A1-715		A1-716		A1-717		A1-718		A1-719		A1-720		A1-721		A1-722		A1-723		A1-724		A1-725		A1-726		A1-727		A1-728		A1-729		A1-730		A1-731		A1-732		A1-733		A1-734		A1-735		A1-736		A1-737		A1-738		A1-739		A1-740		A1-741		A1-742		A1-743		A1-744		A1-745		A1-746		A1-747		A1-748		A1-749		A1-750		A1-751		A1-752		A1-753		A1-754		A1-755		A1-756		A1-757		A1-758		A1-759		A1-760		A1-761		A1-762		A1-763		A1-764		A1-765		A1-766		A1-767		A1-768		A1-769		A1-770		A1-771		A1-772		A1-773		A1-774		A1-775		A1-776		A1-777		A1-778		A1-779		A1-780		A1-781		A1-782		A1-783		A1-784		A1-785		A1-786		A1-787		A1-788		A1-789		A1-790		A1-791		A1-792		A1-793		A1-794		A1-795		A1-796		A1-797		A1-798		A1-799		A1-800		A1-801		A1-802		A1-803		A1-804		A1-805		A1-806		A1-807		A1-808		A1-809		A1-810		A1-811		A1-812		A1-813		A1-814		A1-815		A1-816		A1-817		A1-818		A1-819		A1-820		A1-821		A1-822		A1-823		A1-824		A1-825		A1-826		A1-827		A1-828		A1-829		A1-830		A1-831		A1-832		A1-833		A1-834		A1-835		A1-836		A1-837		A1-838		A1-839		A1-840		A1-841		A1-842		A1-843		A1-844		A1-845		A1-846		A1-847		A1-848		A1-849		A1-850		A1-851		A1-852		A1-853		A1-854		A1-855		A1-856		A1-857		A1-858		A1-859		A1-860		A1-861		A1-862		A1-863		A1-864		A1-865		A1-866		A1-867		A1-868		A1-869		A1-870		A1-871		A1-872		A1-873		A1-874		A1-875		A1-876		A1-877		A1-878		A1-879		A	
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1.10-1.10	A1-1 0.40-0.40	A1-1 0.20-0.20	A1-2 1.00-1.00	A16-1 0.50-0.50	A16-2 1.30-1.30	A17-1 0.50-0.50	A18-1 0.40-0.40	A18-2 1.00-1.00	A18-3 0.30-0.30	A18-4 1.70-1.70	A18-5 0.50-0.50	A18-6 1.20-1.20	A18-7 0.50-0.50	A18-8 1.00-1.00	A18-9 0.30-0.30	A18-10 1.70-1.70	A18-11 0.50-0.50	A18-12 1.20-1.20	A18-13 0.50-0.50	A18-14 1.00-0.00	A18-15 0.00-0.00	A18-16 0.00-0.00	A18-17 0.00-0.00	A18-18 0.00-0.00	A18-19 0.00-0.00	A18-20 0.00-0.00	A18-21 0.00-0.00	A18-22 0.00-0.00	A18-23 0.00-0.00	A18-24 0.00-0.00	A18-25 0.00-0.00	A18-26 0.00-0.00	A18-27 0.00-0.00	A18-28 0.00-0.00	A18-29 0.00-0.00	A18-30 0.00-0.00	A18-31 0.00-0.00	A18-32 0.00-0.00	A18-33 0.00-0.00	A18-34 0.00-0.00	A18-35 0.00-0.00	A18-36 0.00-0.00	A18-37 0.00-0.00	A18-38 0.00-0.00	A18-39 0.00-0.00	A18-40 0.00-0.00	A18-41 0.00-0.00	A18-42 0.00-0.00	A18-43 0.00-0.00	A18-44 0.00-0.00	A18-45 0.00-0.00	A18-46 0.00-0.00	A18-47 0.00-0.00	A18-48 0.00-0.00	A18-49 0.00-0.00	A18-50 0.00-0.00	A18-51 0.00-0.00	A18-52 0.00-0.00	A18-53 0.00-0.00	A18-54 0.00-0.00	A18-55 0.00-0.00	A18-56 0.00-0.00	A18-57 0.00-0.00	A18-58 0.00-0.00	A18-59 0.00-0.00	A18-60 0.00-0.00	A18-61 0.00-0.00	A18-62 0.00-0.00	A18-63 0.00-0.00	A18-64 0.00-0.00	A18-65 0.00-0.00	A18-66 0.00-0.00	A18-67 0.00-0.00	A18-68 0.00-0.00	A18-69 0.00-0.00	A18-70 0.00-0.00	A18-71 0.00-0.00	A18-72 0.00-0.00	A18-73 0.00-0.00	A18-74 0.00-0.00	A18-75 0.00-0.00	A18-76 0.00-0.00	A18-77 0.00-0.00	A18-78 0.00-0.00	A18-79 0.00-0.00	A18-80 0.00-0.00	A18-81 0.00-0.00	A18-82 0.00-0.00	A18-83 0.00-0.00	A18-84 0.00-0.00	A18-85 0.00-0.00	A18-86 0.00-0.00	A18-87 0.00-0.00	A18-88 0.00-0.00	A18-89 0.00-0.00	A18-90 0.00-0.00	A18-91 0.00-0.00	A18-92 0.00-0.00	A18-93 0.00-0.00	A18-94 0.00-0.00	A18-95 0.00-0.00	A18-96 0.00-0.00	A18-97 0.00-0.00	A18-98 0.00-0.00	A18-99 0.00-0.00	A18-100 0.00-0.00	A18-101 0.00-0.00	A18-102 0.00-0.00	A18-103 0.00-0.00	A18-104 0.00-0.00	A18-105 0.00-0.00	A18-106 0.00-0.00	A18-107 0.00-0.00	A18-108 0.00-0.00	A18-109 0.00-0.00	A18-110 0.00-0.00	A18-111 0.00-0.00	A18-112 0.00-0.00	A18-113 0.00-0.00	A18-114 0.00-0.00	A18-115 0.00-0.00	A18-116 0.00-0.00	A18-117 0.00-0.00	A18-118 0.00-0.00	A18-119 0.00-0.00	A18-120 0.00-0.00	A18-121 0.00-0.00	A18-122 0.00-0.00	A18-123 0.00-0.00	A18-124 0.00-0.00	A18-125 0.00-0.00	A18-126 0.00-0.00	A18-127 0.00-0.00	A18-128 0.00-0.00	A18-129 0.00-0.00	A18-130 0.00-0.00	A18-131 0.00-0.00	A18-132 0.00-0.00	A18-133 0.00-0.00	A18-134 0.00-0.00	A18-135 0.00-0.00	A18-136 0.00-0.00	A18-137 0.00-0.00	A18-138 0.00-0.00	A18-139 0.00-0.00	A18-140 0.00-0.00	A18-141 0.00-0.00	A18-142 0.00-0.00	A18-143 0.00-0.00	A18-144 0.00-0.00	A18-145 0.00-0.00	A18-146 0.00-0.00	A18-147 0.00-0.00	A18-148 0.00-0.00	A18-149 0.00-0.00	A18-150 0.00-0.00	A18-151 0.00-0.00	A18-152 0.00-0.00	A18-153 0.00-0.00	A18-154 0.00-0.00	A18-155 0.00-0.00	A18-156 0.00-0.00	A18-157 0.00-0.00	A18-158 0.00-0.00	A18-159 0.00-0.00	A18-160 0.00-0.00	A18-161 0.00-0.00	A18-162 0.00-0.00	A18-163 0.00-0.00	A18-164 0.00-0.00	A18-165 0.00-0.00	A18-166 0.00-0.00	A18-167 0.00-0.00	A18-168 0.00-0.00	A18-169 0.00-0.00	A18-170 0.00-0.00	A18-171 0.00-0.00	A18-172 0.00-0.00	A18-173 0.00-0.00	A18-174 0.00-0.00	A18-175 0.00-0.00	A18-176 0.00-0.00	A18-177 0.00-0.00	A18-178 0.00-0.00	A18-179 0.00-0.00	A18-180 0.00-0.00	A18-181 0.00-0.00	A18-182 0.00-0.00	A18-183 0.00-0.00	A18-184 0.00-0.00	A18-185 0.00-0.00	A18-186 0.00-0.00	A18-187 0.00-0.00	A18-188 0.00-0.00	A18-189 0.00-0.00	A18-190 0.00-0.00	A18-191 0.00-0.00	A18-192 0.00-0.00	A18-193 0.00-0.00	A18-194 0.00-0.00	A18-195 0.00-0.00	A18-196 0.00-0.00	A18-197 0.00-0.00	A18-198 0.00-0.00	A18-199 0.00-0.00	A18-200 0.00-0.00	A18-201 0.00-0.00	A18-202 0.00-0.00	A18-203 0.00-0.00	A18-204 0.00-0.00	A18-205 0.00-0.00	A18-206 0.00-0.00	A18-207 0.00-0.00	A18-208 0.00-0.00	A18-209 0.00-0.00	A18-210 0.00-0.00	A18-211 0.00-0.00	A18-212 0.00-0.00	A18-213 0.00-0.00	A18-214 0.00-0.00	A18-215 0.00-0.00	A18-216 0.00-0.00	A18-217 0.00-0.00	A18-218 0.00-0.00	A18-219 0.00-0.00	A18-220 0.00-0.00	A18-221 0.00-0.00	A18-222 0.00-0.00	A18-223 0.00-0.00	A18-224 0.00-0.00	A18-225 0.00-0.00	A18-226 0.00-0.00	A18-227 0.00-0.00	A18-228 0.00-0.00	A18-229 0.00-0.00	A18-230 0.00-0.00	A18-231 0.00-0.00	A18-232 0.00-0.00	A18-233 0.00-0.00	A18-234 0.00-0.00	A18-235 0.00-0.00	A18-236 0.00-0.00	A18-237 0.00-0.00	A18-238 0.00-0.00	A18-239 0.00-0.00	A18-240 0.00-0.00	A18-241 0.00-0.00	A18-242 0.00-0.00	A18-243 0.00-0.00	A18-244 0.00-0.00	A18-245 0.00-0.00	A18-246 0.00-0.00	A18-247 0.00-0.00	A18-248 0.00-0.00	A18-249 0.00-0.00	A18-250 0.00-0.00	A18-251 0.00-0.00	A18-252 0.00-0.00	A18-253 0.00-0.00	A18-254 0.00-0.00	A18-255 0.00-0.00	A18-256 0.00-0.00	A18-257 0.00-0.00	A18-258 0.00-0.00	A18-259 0.00-0.00	A18-260 0.00-0.00	A18-261 0.00-0.00	A18-262 0.00-0.00	A18-263 0.00-0.00	A18-264 0.00-0.00	A18-265 0.00-0.00	A18-266 0.00-0.00	A18-267 0.00-0.00	A18-268 0.00-0.00	A18-269 0.00-0.00	A18-270 0.00-0.00	A18-271 0.00-0.00	A18-272 0.00-0.00	A18-273 0.00-0.00	A18-274 0.00-0.00	A18-275 0.00-0.00	A18-276 0.00-0.00	A18-277 0.00-0.00	A18-278 0.00-0.00	A18-279 0.00-0.00	A18-280 0.00-0.00	A18-281 0.00-0.00	A18-282 0.00-0.00	A18-283 0.00-0.00	A18-284 0.00-0.00	A18-285 0.00-0.00	A18-286 0.00-0.00	A18-287 0.00-0.00	A18-288 0.00-0.00	A18-289 0.00-0.00	A18-290 0.00-0.00	A18-291 0.00-0.00	A18-292 0.00-0.00	A18-293 0.00-0.00	A18-294 0.00-0.00	A18-295 0.00-0.00	A18-296 0.00-0.00	A18-297 0.00-0.00	A18-298 0.00-0.00	A18-299 0.00-0.00	A18-300 0.00-0.00	A18-301 0.00-0.00	A18-302 0.00-0.00	A18-303 0.00-0.00	A18-304 0.00-0.00	A18-305 0.00-0.00	A18-306 0.00-0.00	A18-307 0.00-0.00	A18-308 0.00-0.00	A18-309 0.00-0.00	A18-310 0.00-0.00	A18-311 0.00-0.00	A18-312 0.00-0.00	A18-313 0.00-0.00	A18-314 0.00-0.00	A18-315 0.00-0.00	A18-316 0.00-0.00	A18-317 0.00-0.00	A18-318 0.00-0.00	A18-319 0.00-0.00	A18-320 0.00-0.00	A18-321 0.00-0.00	A18-322 0.00-0.00	A18-323 0.00-0.00	A18-324 0.00-0.00	A18-325 0.00-0.00	A18-326 0.00-0.00	A18-327 0.00-0.00	A18-328 0.00-0.00	A18-329 0.00-0.00	A18-330 0.00-0.00	A18-331 0.00-0.00	A18-332 0.00-0.00	A18-333 0.00-0.00	A18-334 0.00-0.00	A18-335 0.00-0.00	A18-336 0.00-0.00	A18-337 0.00-0.00	A18-338 0.00-0.00	A18-339 0.00-0.00	A18-340 0.00-0.00	A18-341 0.00-0.00	A18-342 0.00-0.00	A18-343 0.00-0.00	A18-344 0.00-0.00	A18-345 0.00-0.00	A18-346 0.00-0.00	A18-347 0.00-0.00	A18-348 0.00-0.00	A18-349 0.00-0.00	A18-350 0.00-0.00	A18-351 0.00-0.00	A18-352 0.00-0.00	A18-353 0.00-0.00	A18-354 0.00-0.00	A18-355 0.00-0.00	A18-356 0.00-0.00	A18-357 0.00-0.00	A18-358 0.00-0.00	A18-359 0.00-0.00	A18-360 0.00-0.00	A18-361 0.00-0.00	A18-362 0.00-0.00	A18-363 0.00-0.00	A18-364 0.00-0.00	A18-365 0.00-0.00	A18-366 0.00-0.00	A18-367 0.00-0.00	A18-368 0.00-0.00	A18-369 0.00-0.00	A18-370 0.00-0.00	A18-371 0.00-0.00	A18-372 0.00-0.00	A18-373 0.00-0.00	A18-374 0.00-0.00	A18-375 0.00-0.00	A18-376 0.00-0.00	A18-377 0.00-0.00	A18-378 0.00-0.00	A18-379 0.00-0.00	A18-380 0.00-0.00	A18-381 0.00-0.00	A18-382 0.00-0.00	A18-383 0.00-0.00	A18-384 0.00-0.00	A18-385 0.00-0.00	A18-386 0.00-0.00	A18-387 0.00-0.00	A18-388 0.00-0.00	A18-389 0.00-0.00	A18-390 0.00-0.00	A18-391 0.00-0.00	A18-392 0.00-0.00	A18-393 0.00-0.00	A18-394 0.00-0.00	A18-395 0.00-0.00	A18-396 0.00-0.00	A18-397 0.00-0.00	A18-398 0.00-0.00	A18-399 0.00-0.00	A18-400 0.00-0.00	A18-401 0.00-0.00	A18-402 0.00-0.00	A18-403 0.00-0.00	A18-404 0.00-0.00	A18-405 0.00-0.00	A18-406 0.00-0.00	A18-407 0.00-0.00	A18-408 0.00-0.00	A18-409 0.00-0.00	A18-410 0.00-0.00	A18-411 0.00-0.00	A18-412 0.00-0.00	A18-413 0.00-0.00	A18-414 0.00-0.00	A18-415 0.00-0.00	A18-416 0.00-0.00	A18-417 0.00-0.00	A18-418 0.00-0.00	A18-419 0.00-0.00	A18-420 0.00-0.00	A18-421 0.00-0.00	A18-422 0.00-0.00	A18-423 0.00-0.00	A18-424 0.00-0.00	A18-425 0.00-0.00	A18-426 0.00-0.00	A18-427 0.00-0.00	A18-428 0.00-0.00	A18-429 0.00-0.00	A18-430 0.00-0.00	A18-431 0.00-0.00	A18-432 0.00-0.00	A18-433 0.00-0.00	A18-434 0.00-0.00	A18-435 0.00-0.00	A18-436 0.00-0.00	A18-437 0.00-0.00	A18-438 0.00-0.00	A18-439 0.00-0.00	A18-440 0.00-0.00	A18-441 0.00-0.00	A18-442 0.00-0.00	A18-443 0.00-0.00	A18-444 0.00-0.00	A18-445 0.00-0.00	A18-446 0.00-0.00	A18-447 0.00-0.00	A18-448 0.00-0.00	A18-449 0.00-0.00	A18-450 0.00-0.00	A18-451 0.00-0.00	A18-452 0.00-0.00	A18-453 0.00-0.00	A18-454 0.00-0.00	A18-455 0.00-0.00	A18-456 0.00-0.00	A18-457 0.00-0.00	A18-458 0.00-0.00	A18-459 0.00-0.00	A18-460 0.00-0.00	A18-461 0.00-0.00	A18-462 0.00-0.00	A18-463 0.00-0.00	A18-464 0.00-0.00	A18-465 0.00-0.00	A18-466 0.00-0.00	A18-467 0.00-0.00	A18-468 0.00-0.00	A18-469 0.00-0.00	A18-470 0.00-0.00	A18-471 0.00-0.00	A18-472 0.00-0.00	A18-473 0.00-0.00	A18-474 0.00-0.00	A18-475 0.00-0.00	A18-476 0.00-0.00	A18-477 0.00-0.00	A18-478 0.00-0.00	A18-479 0.00-0.00	A18-480 0.00-0.00	A18-481 0.00-0.00	A18-482 0.00-0.00	A18-483 0.00-0.00	A18-484 0.00-0.00	A18-485 0.00-0.00	A18-486 0.00-0.00	A18-487 0.00-0.00	A18-488 0.00-0.00	A18-489 0.00-0.00	A18-490 0.00-0.00	A18-491 0.00-0.00	A18-492 0.00-0.00	A18-493 0.00-0.00	A18-494 0.00-0.00	A18-495 0.00-0.00	A18-496 0.00-0.00	A18-497 0.00-0.00	A18-498 0.00-0.00	A18-499 0.00-0.00	A18-500 0.00-0.00	A18-501 0.00-0.00	A18-502 0.00-0.00	A18-503 0.00-0.00	A18-504 0.00-0.00	A18-505 0.00-0.00	A18-506 0.00-0.00	A18-507 0.00-0.00	A18-508 0.00-0.00	A18-509 0.00-0.00	A18-510 0.00-0.00	A18-511 0.00-0.00	A18-512 0.00-0.00	A18-513 0.00-0.00	A18-514 0.00-0.00	A18-515 0.00-0.00	A18-516 0.00-0.00	A18-517 0.00-0.00	A18-518 0.00-0.00	A18-519 0.00-0.00	A18-520 0.00-0.00	A18-521 0.00-0.00	A18-522 0.00-0.00	A18-523 0.00-0.00	A18-524 0.00-0.00	A18-525 0.00-0.00	A18-526 0.00-0.00	A18-527 0.00-0.00	A18-528 0.00-0.00	A18-529 0.00-0.00	A18-530 0.00-0.00	A18-531 0.00-0.00	A18-532 0.00-0.00	A18-533 0.00-0.00	A18-534 0.00-0.00	A18-535 0.00-0.00	A18-536 0.00-0.00	A18-537 0.00-0.00	A18-538 0.00-0.00	A18-539 0.00-0.00	A18-540 0.00-0.00	A18-541 0.00-0.00	A18-542 0.00-0.00	A18-543 0.00-0.00	A18-544 0.00-0.00	A18-545 0.00-0.00	A18-546 0.00-0.00	A18-547 0.00-0.00	A18-548 0.00-0.00	A18-549 0.00-0.00	A18-550 0.00-0.00	A18-551 0.00-0.00	A18-552 0.00-0.00	A18-553 0.00-0.00	A18-554 0.00-0.00	A18-555 0.00-0.00	A18-556 0.00-0.00	A18-557 0.00-0.00	A18-558 0.00-0.00	A18-559 0.00-0.00	A18-560 0.00-0.00	A18-561 0.00-0.00	A18-562 0.00-
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Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark 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[illegible]

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8.62	4.69						14.1	4.73	<1	<1	7.76	5.66	24	1.78	40.9	14.7	<1	<1	<1	<1	<1	2.99	1.48	<1	<1	<1	<1	9.84	4.26	3.98	4.98		3.78	<1	1.64	<1	<1	<1
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[illegible]

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<10	30.2	<10	<10	73	<10	<10	<10	40.3	<10	<10	47	<10	<10	53.7	<10	25.5	<10	<10	<10	<10	<10	57.8	66.6	<10	38.7	<10	<10	25	40.3	<10	11	10.4	46.8	17.9	56.2	21.8	<10	<10
<10	32.5	<10	<10	78.7	<10	<10	<10	491	<10	<10	199	<10	<10	163	<10	29.5	<10	<10	<10	<10	<10	57.8	803	<10	48.4	<10	<10	114	41.4	<10	13.4	12.8	109	19	67.9	33.9	<10	106.6

[illegible]

[illegible]

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Silt Loam	Loamy Sand	Sand	Sand	Sand	Sand	Sand	Sand	Stone/Soil	Sand	Sand	Sand	Loamy Sand	Sand	Sand	Sand	Sand	Stone/Soil	Stone/Soil	Sandy Silt Loam	Sand	Sand	Loamy Sand	Sand	Loamy Sand	Sand	Sand	Sand	Stone/Soil	N/A	Sand	Loamy Sand	Stone/Soil	Sandy Clay Loam	Sand	Sand	Sandy Loam	
Stones	Stones	Stones	Stones	Vegetation	Vegetation	Stones	Vegetation	None	Vegetation	Stones	None	None	Stones	Vegetation	None	N/A	Stones	Stones	None	Stones	Stones	Stones	Stones	Stones	Stones	Stones	None	Stones	Stones	None	None	Stones	Stones	Stones	Stones	Stones	
N/A 18	None 10	None 10	None 11	None 15	None 13	None 10	None 12	None 11	None 9	None 7.9	None 9.4	None 14	None 6.4	None 11	None 13	Brick 8.6	None 8.1	None 13	None 13	None 12	None 11	None 14	None 12	None 13	None 13	None 13	None 10	None 14	Vegetation 6.5	None 13	None 10	None 13	None 12	None 12			

[illegible]

2.24	61.5	1.24	5.74	4.17	8.79	2.45	5.84	1.98	2.69	1.3	4.19	15.3	4.12	8.4	5.83	7.15	10.7	-0.35	12.9	28.3	15.6	42.1	0.702	34.1	0.61	43.6	7.33	15.8	2.02	4.4	0.931	2.1	1.49	2.4	15.3	6.43	25.3	9.26
11.2	9.14	12.1	11.8	11.2	8.84	10.2	8.99	10.2	9.3	9.41	11	11.1	8.94	10.4	11.3	10.8	10.1	11	10.9	11.1	11.1	11.2	9.52	11.5	10.7	10.9	10.1	11.2	10.9	9.18	11.5	10.1	9.8	11.3	10.1	11.4	10.3	11.5
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.85	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.55	<1	<1	<1	<1	
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AW20-1 1.60-1.60		AW21-1 2.50-2.50		AW21-2 0.30-0.30		AW21-3 1.90-1.90		AW21-4 2.40-2.40		AW21-5 0.40-0.40		AW21-6 1.90-1.90		AW21-7 0.30-0.30		AW21-8 1.20-1.20		AW21-9 0.40-0.40		AW21-10 2.00-2.00		AW21-11 1.70-1.70		AW21-12 0.30-0.30		AW21-13 1.20-1.20		AW21-14 0.40-0.40		AW21-15 2.00-2.00		AW21-16 1.50-1.50		AW21-17 1.10-1.10		AW21-18 0.40-0.40		AW21-19 2.00-2.00		AW21-20 1.50-1.50		AW21-21 1.10-1.10		AW21-22 0.40-0.40		AW21-23 2.00-2.00		AW21-24 1.50-1.50		AW21-25 1.10-1.10		AW21-26 0.40-0.40		AW21-27 2.00-2.00		AW21-28 1.50-1.50		AW21-29 1.10-1.10		AW21-30 0.40-0.40		AW21-31 2.00-2.00		AW21-32 1.50-1.50		AW21-33 1.10-1.10		AW21-34 0.40-0.40		AW21-35 2.00-2.00		AW21-36 1.50-1.50		AW21-37 1.10-1.10		AW21-38 0.40-0.40		AW21-39 2.00-2.00		AW21-40 1.50-1.50		AW21-41 1.10-1.10		AW21-42 0.40-0.40		AW21-43 2.00-2.00		AW21-44 1.50-1.50		AW21-45 1.10-1.10		AW21-46 0.40-0.40		AW21-47 2.00-2.00		AW21-48 1.50-1.50		AW21-49 1.10-1.10		AW21-50 0.40-0.40		AW21-51 2.00-2.00		AW21-52 1.50-1.50		AW21-53 1.10-1.10		AW21-54 0.40-0.40		AW21-55 2.00-2.00		AW21-56 1.50-1.50		AW21-57 1.10-1.10		AW21-58 0.40-0.40		AW21-59 2.00-2.00		AW21-60 1.50-1.50		AW21-61 1.10-1.10		AW21-62 0.40-0.40		AW21-63 2.00-2.00		AW21-64 1.50-1.50		AW21-65 1.10-1.10		AW21-66 0.40-0.40		AW21-67 2.00-2.00		AW21-68 1.50-1.50		AW21-69 1.10-1.10		AW21-70 0.40-0.40		AW21-71 2.00-2.00		AW21-72 1.50-1.50		AW21-73 1.10-1.10		AW21-74 0.40-0.40		AW21-75 2.00-2.00		AW21-76 1.50-1.50		AW21-77 1.10-1.10		AW21-78 0.40-0.40		AW21-79 2.00-2.00		AW21-80 1.50-1.50		AW21-81 1.10-1.10		AW21-82 0.40-0.40		AW21-83 2.00-2.00		AW21-84 1.50-1.50		AW21-85 1.10-1.10		AW21-86 0.40-0.40		AW21-87 2.00-2.00		AW21-88 1.50-1.50		AW21-89 1.10-1.10		AW21-90 0.40-0.40		AW21-91 2.00-2.00		AW21-92 1.50-1.50		AW21-93 1.10-1.10		AW21-94 0.40-0.40		AW21-95 2.00-2.00		AW21-96 1.50-1.50		AW21-97 1.10-1.10		AW21-98 0.40-0.40		AW21-99 2.00-2.00		AW21-100 1.50-1.50		AW21-101 1.10-1.10		AW21-102 0.40-0.40		AW21-103 2.00-2.00		AW21-104 1.50-1.50		AW21-105 1.10-1.10		AW21-106 0.40-0.40		AW21-107 2.00-2.00		AW21-108 1.50-1.50		AW21-109 1.10-1.10		AW21-110 0.40-0.40		AW21-111 2.00-2.00		AW21-112 1.50-1.50		AW21-113 1.10-1.10		AW21-114 0.40-0.40		AW21-115 2.00-2.00		AW21-116 1.50-1.50		AW21-117 1.10-1.10		AW21-118 0.40-0.40		AW21-119 2.00-2.00		AW21-120 1.50-1.50		AW21-121 1.10-1.10		AW21-122 0.40-0.40		AW21-123 2.00-2.00		AW21-124 1.50-1.50		AW21-125 1.10-1.10		AW21-126 0.40-0.40		AW21-127 2.00-2.00		AW21-128 1.50-1.50		AW21-129 1.10-1.10		AW21-130 0.40-0.40		AW21-131 2.00-2.00		AW21-132 1.50-1.50		AW21-133 1.10-1.10		AW21-134 0.40-0.40		AW21-135 2.00-2.00		AW21-136 1.50-1.50		AW21-137 1.10-1.10		AW21-138 0.40-0.40		AW21-139 2.00-2.00		AW21-140 1.50-1.50		AW21-141 1.10-1.10		AW21-142 0.40-0.40		AW21-143 2.00-2.00		AW21-144 1.50-1.50		AW21-145 1.10-1.10		AW21-146 0.40-0.40		AW21-147 2.00-2.00		AW21-148 1.50-1.50		AW21-149 1.10-1.10		AW21-150 0.40-0.40		AW21-151 2.00-2.00		AW21-152 1.50-1.50		AW21-153 1.10-1.10		AW21-154 0.40-0.40		AW21-155 2.00-2.00		AW21-156 1.50-1.50		AW21-157 1.10-1.10		AW21-158 0.40-0.40		AW21-159 2.00-2.00		AW21-160 1.50-1.50		AW21-161 1.10-1.10		AW21-162 0.40-0.40		AW21-163 2.00-2.00		AW21-164 1.50-1.50		AW21-165 1.10-1.10		AW21-166 0.40-0.40		AW21-167 2.00-2.00		AW21-168 1.50-1.50		AW21-169 1.10-1.10		AW21-170 0.40-0.40		AW21-171 2.00-2.00		AW21-172 1.50-1.50		AW21-173 1.10-1.10		AW21-174 0.40-0.40		AW21-175 2.00-2.00		AW21-176 1.50-1.50		AW21-177 1.10-1.10		AW21-178 0.40-0.40		AW21-179 2.00-2.00		AW21-180 1.50-1.50		AW21-181 1.10-1.10		AW21-182 0.40-0.40		AW21-183 2.00-2.00		AW21-184 1.50-1.50		AW21-185 1.10-1.10		AW21-186 0.40-0.40		AW21-187 2.00-2.00		AW21-188 1.50-1.50		AW21-189 1.10-1.10		AW21-190 0.40-0.40		AW21-191 2.00-2.00		AW21-192 1.50-1.50		AW21-193 1.10-1.10		AW21-194 0.40-0.40		AW21-195 2.00-2.00		AW21-196 1.50-1.50		AW21-197 1.10-1.10		AW21-198 0.40-0.40		AW21-199 2.00-2.00		AW21-200 1.50-1.50		AW21-201 1.10-1.10		AW21-202 0.40-0.40		AW21-203 2.00-2.00		AW21-204 1.50-1.50		AW21-205 1.10-1.10		AW21-206 0.40-0.40		AW21-207 2.00-2.00		AW21-208 1.50-1.50		AW21-209 1.10-1.10		AW21-210 0.40-0.40		AW21-211 2.00-2.00		AW21-212 1.50-1.50		AW21-213 1.10-1.10		AW21-214 0.40-0.40		AW21-215 2.00-2.00		AW21-216 1.50-1.50		AW21-217 1.10-1.10		AW21-218 0.40-0.40		AW21-219 2.00-2.00		AW21-220 1.50-1.50		AW21-221 1.10-1.10		AW21-222 0.40-0.40		AW21-223 2.00-2.00		AW21-224 1.50-1.50		AW21-225 1.10-1.10		AW21-226 0.40-0.40		AW21-227 2.00-2.00		AW21-228 1.50-1.50		AW21-229 1.10-1.10		AW21-230 0.40-0.40		AW21-231 2.00-2.00		AW21-232 1.50-1.50		AW21-233 1.10-1.10		AW21-234 0.40-0.40		AW21-235 2.00-2.00		AW21-236 1.50-1.50		AW21-237 1.10-1.10		AW21-238 0.40-0.40		AW21-239 2.00-2.00		AW21-240 1.50-1.50		AW21-241 1.10-1.10		AW21-242 0.40-0.40		AW21-243 2.00-2.00		AW21-244 1.50-1.50		AW21-245 1.10-1.10		AW21-246 0.40-0.40		AW21-247 2.00-2.00		AW21-248 1.50-1.50		AW21-249 1.10-1.10		AW21-250 0.40-0.40		AW21-251 2.00-2.00		AW21-252 1.50-1.50		AW21-253 1.10-1.10		AW21-254 0.40-0.40		AW21-255 2.00-2.00		AW21-256 1.50-1.50		AW21-257 1.10-1.10		AW21-258 0.40-0.40		AW21-259 2.00-2.00		AW21-260 1.50-1.50		AW21-261 1.10-1.10		AW21-262 0.40-0.40		AW21-263 2.00-2.00		AW21-264 1.50-1.50		AW21-265 1.10-1.10		AW21-266 0.40-0.40		AW21-267 2.00-2.00		AW21-268 1.50-1.50		AW21-269 1.10-1.10		AW21-270 0.40-0.40		AW21-271 2.00-2.00		AW21-272 1.50-1.50		AW21-273 1.10-1.10		AW21-274 0.40-0.40		AW21-275 2.00-2.00		AW21-276 1.50-1.50		AW21-277 1.10-1.10		AW21-278 0.40-0.40		AW21-279 2.00-2.00		AW21-280 1.50-1.50		AW21-281 1.10-1.10		AW21-282 0.40-0.40		AW21-283 2.00-2.00		AW21-284 1.50-1.50		AW21-285 1.10-1.10		AW21-286 0.40-0.40		AW21-287 2.00-2.00		AW21-288 1.50-1.50		AW21-289 1.10-1.10		AW21-290 0.40-0.40		AW21-291 2.00-2.00		AW21-292 1.50-1.50		AW21-293 1.10-1.10		AW21-294 0.40-0.40		AW21-295 2.00-2.00		AW21-296 1.50-1.50		AW21-297 1.10-1.10		AW21-298 0.40-0.40		AW21-299 2.00-2.00		AW21-300 1.50-1.50		AW21-301 1.10-1.10		AW21-302 0.40-0.40		AW21-303 2.00-2.00		AW21-304 1.50-1.50		AW21-305 1.10-1.10		AW21-306 0.40-0.40		AW21-307 2.00-2.00		AW21-308 1.50-1.50		AW21-309 1.10-1.10		AW21-310 0.40-0.40		AW21-311 2.00-2.00		AW21-312 1.50-1.50		AW21-313 1.10-1.10		AW21-314 0.40-0.40		AW21-315 2.00-2.00		AW21-316 1.50-1.50		AW21-317 1.10-1.10		AW21-318 0.40-0.40		AW21-319 2.00-2.00		AW21-320 1.50-1.50		AW21-321 1.10-1.10		AW21-322 0.40-0.40		AW21-323 2.00-2.00		AW21-324 1.50-1.50		AW21-325 1.10-1.10		AW21-326 0.40-0.40		AW21-327 2.00-2.00		AW21-328 1.50-1.50		AW21-329 1.10-1.10		AW21-330 0.40-0.40		AW21-331 2.00-2.00		AW21-332 1.50-1.50		AW21-333 1.10-1.10		AW21-334 0.40-0.40		AW21-335 2.00-2.00		AW21-336 1.50-1.50		AW21-337 1.10-1.10		AW21-338 0.40-0.40		AW21-339 2.00-2.00		AW21-340 1.50-1.50		AW21-341 1.10-1.10		AW21-342 0.40-0.40		AW21-343 2.00-2.00		AW21-344 1.50-1.50		AW21-345 1.10-1.10		AW21-346 0.40-0.40		AW21-347 2.00-2.00		AW21-348 1.50-1.50		AW21-349 1.10-1.10		AW21-350 0.40-0.40		AW21-351 2.00-2.00		AW21-352 1.50-1.50		AW21-353 1.10-1.10		AW21-354 0.40-0.40		AW21-355 2.00-2.00		AW21-356 1.50-1.50		AW21-357 1.10-1.10		AW21-358 0.40-0.40		AW21-359 2.00-2.00		AW21-360 1.50-1.50		AW21-361 1.10-1.10		AW21-362 0.40-0.40		AW21-363 2.00-2.00		AW21-364 1.50-1.50		AW21-365 1.10-1.10		AW21-366 0.40-0.40		AW21-367 2.00-2.00		AW21-368 1.50-1.50		AW21-369 1.10-1.10		AW21-370 0.40-0.40		AW21-371 2.00-2.00		AW21-372 1.50-1.50		AW21-373 1.10-1.10		AW21-374 0.40-0.40		AW21-375 2.00-2.00		AW21-376 1.50-1.50		AW21-377 1.10-1.10		AW21-378 0.40-0.40		AW21-379 2.00-2.00		AW21-380 1.50-1.50		AW21-381 1.10-1.10		AW21-382 0.40-0.40		AW21-383 2.00-2.00		AW21-384 1.50-1.50		AW21-385 1.10-1.10		AW21-386 0.40-0.40		AW21-387 2.00-2.00		AW21-388 1.50-1.50		AW21-389 1.10-1.10		AW21-390 0.40-0.40		AW21-391 2.00-2.00		AW21-392 1.50-1.50		AW21-393 1.10-1.10		AW21-394 0.40-0.40		AW21-395 2.00-2.00		AW21-396 1.50-1.50		AW21-397 1.10-1.10		AW21-398 0.40-0.40		AW21-399 2.00-2.00		AW21-400 1.50-1.50		AW21-401 1.10-1.10		AW21-402 0.40-0.40		AW21-403 2.00-2.00		AW21-404 1.50-1.50		AW21-405 1.10-1.10		AW21-406 0.40-0.40		AW21-407 2.00-2.00		AW21-408 1.50-1.50		AW21-409 1.10-1.10		AW21-410 0.40-0.40		AW21-411 2.00-2.00		AW21-412 1.50-1.50		AW21-413 1.10-1.10		AW21-414 0.40-0.40		AW21-415 2.00-2.00		AW21-416 1.50-1.50		AW21-417 1.10-1.10		AW21-418 0.40-0.40		AW21-419 2.00-2.00		AW21-420 1.50-1.50		AW21-421 1.10-1.10		AW21-422 0.40-0.40		AW21-423 2.00-2.00		AW21-424 1.50-1.50		AW21-425 1.10-1.10		AW21-426 0.40-0.40		AW21-427 2.00-2.00		AW21-428 1.50-1.50		AW21-429 1.10-1.10		AW21-430 0.40-0.40		AW21-431 2.00-2.00		AW21-432 1.50-1.50		AW21-433 1.10-1.10		AW21-434 0.40-0.40		AW21-435 2.00-2.00		AW21-436 1.50-1.50		AW21-437 1.10-1.10		AW21-438 0.40-0.40		AW21-439 2.00-2.00		AW21-440 1.50-1.50		AW21-441 1.10-1.10		AW21-442 0.40-0.40		AW21-443 2.00-2.00		AW21-444 1.50-1.50		AW21-445 1.10-1.10		AW21-446 0.40-0.40		AW21-447 2.00-2.00		AW21-448 1.50-1.50		AW21-449 1.10-1.10		AW21-450 0.40-0.40		AW21-451 2.00-2.00		AW21-452 1.50-1.50		AW21-453 1.10-1.10		AW21-454 0.40-0.40		AW21-455 2.00-2.00		AW21-456 1.50-1.50		AW21-457 1.10-1.10		AW21-458 0.40-0.40		AW21-459 2.00-2.00		AW21-460 1.50-1.50		AW21-461 1.10-1.10		AW21-462 0.40-0.40		AW21-463 2.00-2.00		AW21-464 1.50-1.50		AW21-465 1.10-1.10		AW21-466 0.40-0.40		AW21-467 2.00-2.00		AW21-468 1.50-1.50		AW21-469 1.10-1.10		AW21-470 0.40-0.40		AW21-471 2.00-2.00		AW21-472 1.50-1.50		AW21-473 1.10-1.10		AW21-474 0.40-0.40		AW21-475 2.00-2.00		AW21-476 1.50-1.50		AW21-477 1.10-1.10		AW21-478 0.40-0.40		AW21-479 2.00-2.00		AW21-4	
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A10-0.90		A11-1.2		A11-1.1		A11-2		A11-3		A12-1		A12-2		A13-1		A13-2		A14-1		A14-2		A14-3		A15-1		A15-2		A16-1		A17-1		A17-2		A18-1		A18-2		A19-1		A19-2		A20-1		A20-2		A21-1		A21-2		A22-1		A22-2		A23-1		A23-2		A24-1		A24-2		A25-1		A25-2		A26-1		A26-2		A27-1		A27-2		A28-1		A28-2		A29-1		A29-2		A30-1		A30-2		A31-1		A31-2		A32-1		A32-2		A33-1		A33-2		A34-1		A34-2		A35-1		A35-2		A36-1		A36-2		A37-1		A37-2		A38-1		A38-2		A39-1		A39-2		A40-1		A40-2		A41-1		A41-2		A42-1		A42-2		A43-1		A43-2		A44-1		A44-2		A45-1		A45-2		A46-1		A46-2		A47-1		A47-2		A48-1		A48-2		A49-1		A49-2		A50-1		A50-2		A51-1		A51-2		A52-1		A52-2		A53-1		A53-2		A54-1		A54-2		A55-1		A55-2		A56-1		A56-2		A57-1		A57-2		A58-1		A58-2		A59-1		A59-2		A60-1		A60-2		A61-1		A61-2		A62-1		A62-2		A63-1		A63-2		A64-1		A64-2		A65-1		A65-2		A66-1		A66-2		A67-1		A67-2		A68-1		A68-2		A69-1		A69-2		A70-1		A70-2		A71-1		A71-2		A72-1		A72-2		A73-1		A73-2		A74-1		A74-2		A75-1		A75-2		A76-1		A76-2		A77-1		A77-2		A78-1		A78-2		A79-1		A79-2		A80-1		A80-2		A81-1		A81-2		A82-1		A82-2		A83-1		A83-2		A84-1		A84-2		A85-1		A85-2		A86-1		A86-2		A87-1		A87-2		A88-1		A88-2		A89-1		A89-2		A90-1		A90-2		A91-1		A91-2		A92-1		A92-2		A93-1		A93-2		A94-1		A94-2		A95-1		A95-2		A96-1		A96-2		A97-1		A97-2		A98-1		A98-2		A99-1		A99-2		A100-1		A100-2		A101-1		A101-2		A102-1		A102-2		A103-1		A103-2		A104-1		A104-2		A105-1		A105-2		A106-1		A106-2		A107-1		A107-2		A108-1		A108-2		A109-1		A109-2		A110-1		A110-2		A111-1		A111-2		A112-1		A112-2		A113-1		A113-2		A114-1		A114-2		A115-1		A115-2		A116-1		A116-2		A117-1		A117-2		A118-1		A118-2		A119-1		A119-2		A120-1		A120-2		A121-1		A121-2		A122-1		A122-2		A123-1		A123-2		A124-1		A124-2		A125-1		A125-2		A126-1		A126-2		A127-1		A127-2		A128-1		A128-2		A129-1		A129-2		A130-1		A130-2		A131-1		A131-2		A132-1		A132-2		A133-1		A133-2		A134-1		A134-2		A135-1		A135-2		A136-1		A136-2		A137-1		A137-2		A138-1		A138-2		A139-1		A139-2		A140-1		A140-2		A141-1		A141-2		A142-1		A142-2		A143-1		A143-2		A144-1		A144-2		A145-1		A145-2		A146-1		A146-2		A147-1		A147-2		A148-1		A148-2		A149-1		A149-2		A150-1		A150-2		A151-1		A151-2		A152-1		A152-2		A153-1		A153-2		A154-1		A154-2		A155-1		A155-2		A156-1		A156-2		A157-1		A157-2		A158-1		A158-2		A159-1		A159-2		A160-1		A160-2		A161-1		A161-2		A162-1		A162-2		A163-1		A163-2		A164-1		A164-2		A165-1		A165-2		A166-1		A166-2		A167-1		A167-2		A168-1		A168-2		A169-1		A169-2		A170-1		A170-2		A171-1		A171-2		A172-1		A172-2		A173-1		A173-2		A174-1		A174-2		A175-1		A175-2		A176-1		A176-2		A177-1		A177-2		A178-1		A178-2		A179-1		A179-2		A180-1		A180-2		A181-1		A181-2		A182-1		A182-2		A183-1		A183-2		A184-1		A184-2		A185-1		A185-2		A186-1		A186-2		A187-1		A187-2		A188-1		A188-2		A189-1		A189-2		A190-1		A190-2		A191-1		A191-2		A192-1		A192-2		A193-1		A193-2		A194-1		A194-2		A195-1		A195-2		A196-1		A196-2		A197-1		A197-2		A198-1		A198-2		A199-1		A199-2		A200-1		A200-2		A201-1		A201-2		A202-1		A202-2		A203-1		A203-2		A204-1		A204-2		A205-1		A205-2		A206-1		A206-2		A207-1		A207-2		A208-1		A208-2		A209-1		A209-2		A210-1		A210-2		A211-1		A211-2		A212-1		A212-2		A213-1		A213-2		A214-1		A214-2		A215-1		A215-2		A216-1		A216-2		A217-1		A217-2		A218-1		A218-2		A219-1		A219-2		A220-1		A220-2		A221-1		A221-2		A222-1		A222-2		A223-1		A223-2		A224-1		A224-2		A225-1		A225-2		A226-1		A226-2		A227-1		A227-2		A228-1		A228-2		A229-1		A229-2		A230-1		A230-2		A231-1		A231-2		A232-1		A232-2		A233-1		A233-2		A234-1		A234-2		A235-1		A235-2		A236-1		A236-2		A237-1		A237-2		A238-1		A238-2		A239-1		A239-2		A240-1		A240-2		A241-1		A241-2		A242-1		A242-2		A243-1		A243-2		A244-1		A244-2		A245-1		A245-2		A246-1		A246-2		A247-1		A247-2		A248-1		A248-2		A249-1		A249-2		A250-1		A250-2		A251-1		A251-2		A252-1		A252-2		A253-1		A253-2		A254-1		A254-2		A255-1		A255-2		A256-1		A256-2		A257-1		A257-2		A258-1		A258-2		A259-1		A259-2		A260-1		A260-2		A261-1		A261-2		A262-1		A262-2		A263-1		A263-2		A264-1		A264-2		A265-1		A265-2		A266-1		A266-2		A267-1		A267-2		A268-1		A268-2		A269-1		A269-2		A270-1		A270-2		A271-1		A271-2		A272-1		A272-2		A273-1		A273-2		A274-1		A274-2		A275-1		A275-2		A276-1		A276-2		A277-1		A277-2		A278-1		A278-2		A279-1		A279-2		A280-1		A280-2		A281-1		A281-2		A282-1		A282-2		A283-1		A283-2		A284-1		A284-2		A285-1		A285-2		A286-1		A286-2		A287-1		A287-2		A288-1		A288-2		A289-1		A289-2		A290-1		A290-2		A291-1		A291-2		A292-1		A292-2		A293-1		A293-2		A294-1		A294-2		A295-1		A295-2		A296-1		A296-2		A297-1		A297-2		A298-1		A298-2		A299-1		A299-2		A300-1		A300-2		A301-1		A301-2		A302-1		A302-2		A303-1		A303-2		A304-1		A304-2		A305-1		A305-2		A306-1		A306-2		A307-1		A307-2		A308-1		A308-2		A309-1		A309-2		A310-1		A310-2		A311-1		A311-2		A312-1		A312-2		A313-1		A313-2		A314-1		A314-2		A315-1		A315-2		A316-1		A316-2		A317-1		A317-2		A318-1		A318-2		A319-1		A319-2		A320-1		A320-2		A321-1		A321-2		A322-1		A322-2		A323-1		A323-2		A324-1		A324-2		A325-1		A325-2		A326-1		A326-2		A327-1		A327-2		A328-1		A328-2		A329-1		A329-2		A330-1		A330-2		A331-1		A331-2		A332-1		A332-2		A333-1		A333-2		A334-1		A334-2		A335-1		A335-2		A336-1		A336-2		A337-1		A337-2		A338-1		A338-2		A339-1		A339-2		A340-1		A340-2		A341-1		A341-2		A342-1		A342-2		A343-1		A343-2		A344-1		A344-2		A345-1		A345-2		A346-1		A346-2		A347-1		A347-2		A348-1		A348-2		A349-1		A349-2		A350-1		A350-2		A351-1		A351-2		A352-1		A352-2		A353-1		A353-2		A354-1		A354-2		A355-1		A355-2		A356-1		A356-2		A357-1		A357-2		A358-1		A358-2		A359-1		A359-2		A360-1		A360-2		A361-1		A361-2		A362-1		A362-2		A363-1		A363-2		A364-1		A364-2		A365-1		A365-2		A366-1		A366-2		A367-1		A367-2		A368-1		A368-2		A369-1		A369-2		A370-1		A370-2		A371-1		A371-2		A372-1		A372-2		A373-1		A373-2		A374-1		A374-2		A375-1		A375-2		A376-1		A376-2		A377-1		A377-2		A378-1		A378-2		A379-1		A379-2		A380-1		A380-2		A381-1		A381-2		A382-1		A382-2		A383-1		A383-2		A384-1		A384-2		A385-1		A385-2		A386-1		A386-2		A387-1		A387-2		A388-1		A388-2		A389-1		A389-2		A390-1		A390-2		A391-1		A391-2		A392-1		A392-2		A393-1		A393-2		A394-1		A394-2		A395-1		A395-2		A396-1		A396-2		A397-1		A397-2		A398-1		A398-2		A399-1		A399-2		A400-1		A400-2		A401-1		A401-2		A402-1		A402-2		A403-1		A403-2		A404-1		A404-2		A405-1		A405-2		A406-1		A406-2		A407-1		A407-2		A408-1		A408-2		A409-1		A409-2		A410-1		A410-2		A411-1		A411-2		A412-1		A412-2		A413-1		A413-2		A414-1		A414-2		A415-1		A415-2		A416-1		A416-2		A417-1		A417-2		A418-1		A418-2		A419-1		A419-2		A420-1		A420-2		A421-1		A421-2		A422-1		A422-2		A423-1		A423-2		A424-1		A424-2		A425-1		A425-2		A426-1		A426-2		A427-1		A427-2		A428-1		A428-2		A429-1		A429-2		A430-1		A430-2		A431-1		A431-2		A432-1		A432-2		A433-1		A433-2		A434-1		A434-2		A435-1		A435-2		A436-1		A436-2		A437-1		A437-2		A438-1		A438-2		A439-1		A439-2		A440-1		A440-2		A441-1		A441-2		A442-1		A442-2		A443-1		A443-2		A444-1		A444-2		A445-1		A445-2		A446-1		A446-2		A447-1		A447-2		A448-1		A448-2		A449-1		A449-2		A450-1		A450-2		A451-1		A451-2		A452-1		A452-2		A453-1		A453-2		A454-1		A454-2		A455-1		A455-2		A456-1		A456-2		A457-1		A457-	
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TS-2 1.30-1.30	AG30-1 0.50-0.50	AG30-2 1.30-1.30	AG31-1 0.30-0.30	AG31-2 1.20-1.20	AH29-1 0.30-0.30	AH29-2 1.60-1.60	AH30-1 0.20-0.20	AH30-2 1.40-1.40	AH31-1 0.50-0.50	AH31-2 1.70-1.70	A30-1 0.30-0.30	A30-2 1.80-1.80	A31-1 0.50-0.50	A31-2 1.50-1.50	T6-1 0.50-0.50	T6-2 0.00-1.50	T6-3 2.20-2.20	T7-1 0.50-0.50	T7-2 1.20-1.20	A127-1 0.70-0.70	A129-1 0.70-0.70	A129-2 1.50-1.50	A30-1 0.40-0.40	A30-2 1.50-1.50	AK27-1 0.80-0.80	AK28-1 1.00-1.00	AK30-1 0.20-0.20	AK30-2 1.00-1.00	AK31-1 1.10-1.10	AK31-2 1.00-1.00	AK32-1 1.00-1.00	AK33-1 0.20-0.20	AK34-1 0.80-0.80	AK34-2 1.60-1.60	AL28-1 0.50-0.50	AL28-2 1.20-1.20	AL29-1 0.80-0.80	AL30-1 0.50-0.50					
SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID		
27/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	28/01/2021	27/01/2021	27/01/2021	27/01/2021	27/01/2021	27/01/2021	1/29/2021	1/28/2021	1/28/2021	1/28/2021	1/29/2021	1/29/2021	1/28/2021	1/28/2021	1/28/2021	1/28/2021	1/28/2021	1/28/2021	1/28/2021	1/29/2021	1/29/2021	1/29/2021	1/29/2021	1/29/2021	1/29/2021	1/29/2021	1/28/2021	1/28/2021		
28/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	29/01/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	
08/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	09/02/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	1/30/2021	
210128-35 2362188 10.2	210129-39 23630284 11.2	210129-39 23630288 11.2	210129-39 23630297 11.2	210129-39 23630306 11.2	210129-39 23630255 11.2	210129-39 23630262 11.2	210129-39 23630239 11.2	210129-39 23630248 11.2	210129-39 23630211 11.2	210129-39 23630215 11.2	210129-39 23630227 11.2	210129-39 23630232 11.2	210129-39 23630219 11.2	210129-39 23630223 11.2	210129-39 23630206 11.2	210129-39 23630267 11.2	210129-39 23630280 11.2	210129-39 23630271 11.2	210129-39 23630275 11.2	210130-32 23638988 8.7	210130-32 23638993 8.7	210130-32 23638999 8.7	210130-32 23638993 8.7	210130-32 23638999 8.7	210130-32 23638980 8.7	210130-32 23638976 8.7	210130-32 23639025 8.7	210130-32 23639030 8.7	210130-32 23639006 8.7	210130-32 23639015 8.7	210130-32 23639020 8.7	210130-32 23639007 8.7	210130-32 23639071 8.7	210130-32 23639077 8.7	210130-32 23639064 8.7	210130-32 23638970 8.7	210130-32 23638954 8.7	210130-32 23638934 8.7					
Grey	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Black	Black	Black	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Grey	Dark Brown	Grey	Dark Brown	Black	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Grey		
Sand	Sand	Sand	Sand	Loamy Sand	Loamy Sand	Sand	Sandy Clay	Sand	Sandy Loam	Sandy Loam	Sandy Loam	Sand	Sandy Loam	Sand	Sand	Sand	Chalk	N/A	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand		
Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Coal fragments	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones		
None 5.5	None 11	None 9.5	Vegetation 6.7	N/A 11	Vegetation 13	None 11	Vegetation 15	Vegetation 11	Fibres 9.8	N/A 12	None 12	None 14	N/A 12	None 14	None 5.9	None 4.9	None 10	Vegetation 5.2	None 9	None 14	None 1.4	None 10	None 13	None 20	None 17	None 7.5	None 12	None 13	None 11	None 23	None 16	None 12	None 11	None 13	None 6.9	None 6.9	None 9.3	None 12	None 12	None 12			
05/02/2021	0	05/02/2021	-	05/02/2021	-	05/02/21	-	05/02/2021	-	08/02/2021	-	08/02/2021	-	05/02/21	05/02/2021	-	05/02/21	08/02/2021	-	-	05/02/2021	-	05/02/21	-	05/02/2021	-	05/02/2021	-	05/02/2021	-	-	-	05/02/2021	-	05/02/2021	-	05/02/2021	-	05/02/2021	08/02/21	05/02/2021		
James Richards	-	Paul Poynton	-	Paul Poynton	-	Eva Guerra	-	Paul Poynton	-	Marcin Magdziarek	-	James Richards	-	Eva Guerra	Marcin Magdziarek	-	Eva Guerra	James Richards	-	-	Marcin Magdziarek	-	Eva Guerra	-	James Richards	-	Marcin Magdziarek	-	Marcin Magdziarek	-	Marcin Magdziarek	-	-	-	Paul Poynton	-	Paul Poynton	-	Paul Poynton	-	Paul Poynton	Eva Guerra	Paul Poynton
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
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Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	
Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected	-	Not Detected						

[illegible]

Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark 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Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown</
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Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	-	Not Detected	Not Detected	-	Not Detected	Not Detected	-
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5.9	50.7	3.43	4.41	11	61.7	32.1	4.47	62.9	33.6	45.2	16.5	21.7	24.3	37.2	36.7	8.26	7.57	4.86	33.1	9.09	6.62	0.465	1.06	0.817	0.503	0.574	1.43	3.31	1.38	3.02	0.476	3.79	1.44	14	1.66	2.84	2.34	0.779
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8.53	10.5	11.4	11.1	10.1	11.1	8.96	12.6	10.1	11	10.5	11.2	10.2	9.63	10.8	10.4	12	10.9	10.1	9.8	10.4	9.6	11	11.7	11.4	11.8	11.3	11.5	11	10.5	11.3	11.1	9.41	11.3	9.44	11.6	11	9.79	8.49
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232	27.3	32.4	12.8	41.1	22.2	20.2	9.23	66.1	64.8	52.4	75	44.6	114	58	51.7	31.5	24.6	424	169	91.7	213	8.79	57.1	9.06	<7	14.9	58.5	87.7	<7	85.7	12.2	73	14.4	16.7	15.8	350	34.8	7.03
8720	105.00	82.10	3330	4560	2280	4100	29000	3260	1880	9620	4170	6900	7740	2400	8280	28200	1380	6270	3200	9670	6760	13800	18600	9500	1190	4140	6570	11800	20400	9330	4470	13700	837	4740	67300	4090	8150	

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[illegible]

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[illegible]

637	359	526	232	165	783	51.8	118	3230	5310	1140	324	1130	606	322	341	293	19.6	73.4	893	140	379	32.1	104	28.2	55.4	<14	131	195	121	178	21.4	233	122	<14	484	328	<14	37.5
1240	826	806	41.5	276	135	98.6	185	5230	10100	2310	673	2320	1340	627	660	505	44.8	145	1600	243	774	49.7	191	61.1	106	<15	219	355	204	338	36	449	179	<15	1220	782	36.1	72.5

12100	716	618	33.3	305	127	82.9	179	3230	6440	4530	456	1580	929	445	494	378	45	129	1050	210	681	47	184	56.7	97.4	<24	165	283	190	303	36.7	172	<24	967	571	32.5	66.8	
33900	14800	12100		818	4190	1760	3700	87300	203000	150000	12400	33500	18600	11400	10000	8040	1050	1500	26100	3640	11000	675	2840	894	1360	<118	3090	4530	2800	5390	499	5390	2640	202	15100	10600	443	725

[illegible][illegible][illegible]

0.50-0.50		2.00-2.00		AT5-1 0.40-0.40		AT5-2 1.30-1.30		AUS-1 0.70-0.70		AUS-2 1.60-1.60		AUS-3 0.50-0.50		AUS-4 0.50-0.50		AUS-5 1.70-1.70		AUS-6 1.20-1.20		AV6-1 0.50-0.50		AV6-2 1.20-1.20		AV6-3 2.00-2.00		S1A-1 0.20-0.20		S1A-2 0.20-0.20		S1A-3 0.20-0.20		S1A-4 0.20-0.20		S1A-5 0.20-0.20		S1A-6 0.20-0.20		S1A-7 0.20-0.20		S1A-8 0.20-0.20		S1A-9 0.20-0.20		S1A-10 0.20-0.20		S1A-11 0.20-0.20		S1A-12 0.20-0.20		S1A-13 0.20-0.20		S1A-14 0.20-0.20		S1A-15 0.20-0.20		S1A-16 0.20-0.20		S1A-17 0.20-0.20		S1A-18 0.20-0.20		S1A-19 0.20-0.20		S1A-20 0.20-0.20		S1A-21 0.20-0.20		S1A-22 0.20-0.20		S1A-23 0.20-0.20		S1A-24 0.20-0.20		S1A-25 0.20-0.20		S1A-26 0.20-0.20		S1A-27 0.20-0.20		S1A-28 0.20-0.20		S1A-29 0.20-0.20		S1A-30 0.20-0.20		S1A-31 0.20-0.20		S1A-32 0.20-0.20		S1A-33 0.20-0.20		S1A-34 0.20-0.20		S1A-35 0.20-0.20		S1A-36 0.20-0.20		S1A-37 0.20-0.20		S1A-38 0.20-0.20		S1A-39 0.20-0.20		S1A-40 0.20-0.20		S1A-41 0.20-0.20		S1A-42 0.20-0.20		S1A-43 0.20-0.20		S1A-44 0.20-0.20		S1A-45 0.20-0.20		S1A-46 0.20-0.20		S1A-47 0.20-0.20		S1A-48 0.20-0.20		S1A-49 0.20-0.20		S1A-50 0.20-0.20		S1A-51 0.20-0.20		S1A-52 0.20-0.20		S1A-53 0.20-0.20		S1A-54 0.20-0.20		S1A-55 0.20-0.20		S1A-56 0.20-0.20		S1A-57 0.20-0.20		S1A-58 0.20-0.20		S1A-59 0.20-0.20		S1A-60 0.20-0.20		S1A-61 0.20-0.20		S1A-62 0.20-0.20		S1A-63 0.20-0.20		S1A-64 0.20-0.20		S1A-65 0.20-0.20		S1A-66 0.20-0.20		S1A-67 0.20-0.20		S1A-68 0.20-0.20		S1A-69 0.20-0.20		S1A-70 0.20-0.20		S1A-71 0.20-0.20		S1A-72 0.20-0.20		S1A-73 0.20-0.20		S1A-74 0.20-0.20		S1A-75 0.20-0.20		S1A-76 0.20-0.20		S1A-77 0.20-0.20		S1A-78 0.20-0.20		S1A-79 0.20-0.20		S1A-80 0.20-0.20		S1A-81 0.20-0.20		S1A-82 0.20-0.20		S1A-83 0.20-0.20		S1A-84 0.20-0.20		S1A-85 0.20-0.20		S1A-86 0.20-0.20		S1A-87 0.20-0.20		S1A-88 0.20-0.20		S1A-89 0.20-0.20		S1A-90 0.20-0.20		S1A-91 0.20-0.20		S1A-92 0.20-0.20		S1A-93 0.20-0.20		S1A-94 0.20-0.20		S1A-95 0.20-0.20		S1A-96 0.20-0.20		S1A-97 0.20-0.20		S1A-98 0.20-0.20		S1A-99 0.20-0.20		S1A-100 0.20-0.20		S1A-101 0.20-0.20		S1A-102 0.20-0.20		S1A-103 0.20-0.20		S1A-104 0.20-0.20		S1A-105 0.20-0.20		S1A-106 0.20-0.20		S1A-107 0.20-0.20		S1A-108 0.20-0.20		S1A-109 0.20-0.20		S1A-110 0.20-0.20		S1A-111 0.20-0.20		S1A-112 0.20-0.20		S1A-113 0.20-0.20		S1A-114 0.20-0.20		S1A-115 0.20-0.20		S1A-116 0.20-0.20		S1A-117 0.20-0.20		S1A-118 0.20-0.20		S1A-119 0.20-0.20		S1A-120 0.20-0.20		S1A-121 0.20-0.20		S1A-122 0.20-0.20		S1A-123 0.20-0.20		S1A-124 0.20-0.20		S1A-125 0.20-0.20		S1A-126 0.20-0.20		S1A-127 0.20-0.20		S1A-128 0.20-0.20		S1A-129 0.20-0.20		S1A-130 0.20-0.20		S1A-131 0.20-0.20		S1A-132 0.20-0.20		S1A-133 0.20-0.20		S1A-134 0.20-0.20		S1A-135 0.20-0.20		S1A-136 0.20-0.20		S1A-137 0.20-0.20		S1A-138 0.20-0.20		S1A-139 0.20-0.20		S1A-140 0.20-0.20		S1A-141 0.20-0.20		S1A-142 0.20-0.20		S1A-143 0.20-0.20		S1A-144 0.20-0.20		S1A-145 0.20-0.20		S1A-146 0.20-0.20		S1A-147 0.20-0.20		S1A-148 0.20-0.20		S1A-149 0.20-0.20		S1A-150 0.20-0.20		S1A-151 0.20-0.20		S1A-152 0.20-0.20		S1A-153 0.20-0.20		S1A-154 0.20-0.20		S1A-155 0.20-0.20		S1A-156 0.20-0.20		S1A-157 0.20-0.20		S1A-158 0.20-0.20		S1A-159 0.20-0.20		S1A-160 0.20-0.20		S1A-161 0.20-0.20		S1A-162 0.20-0.20		S1A-163 0.20-0.20		S1A-164 0.20-0.20		S1A-165 0.20-0.20		S1A-166 0.20-0.20		S1A-167 0.20-0.20		S1A-168 0.20-0.20		S1A-169 0.20-0.20		S1A-170 0.20-0.20		S1A-171 0.20-0.20		S1A-172 0.20-0.20		S1A-173 0.20-0.20		S1A-174 0.20-0.20		S1A-175 0.20-0.20		S1A-176 0.20-0.20		S1A-177 0.20-0.20		S1A-178 0.20-0.20		S1A-179 0.20-0.20		S1A-180 0.20-0.20		S1A-181 0.20-0.20		S1A-182 0.20-0.20		S1A-183 0.20-0.20		S1A-184 0.20-0.20		S1A-185 0.20-0.20		S1A-186 0.20-0.20		S1A-187 0.20-0.20		S1A-188 0.20-0.20		S1A-189 0.20-0.20		S1A-190 0.20-0.20		S1A-191 0.20-0.20		S1A-192 0.20-0.20		S1A-193 0.20-0.20		S1A-194 0.20-0.20		S1A-195 0.20-0.20		S1A-196 0.20-0.20		S1A-197 0.20-0.20		S1A-198 0.20-0.20		S1A-199 0.20-0.20		S1A-200 0.20-0.20		S1A-201 0.20-0.20		S1A-202 0.20-0.20		S1A-203 0.20-0.20		S1A-204 0.20-0.20		S1A-205 0.20-0.20		S1A-206 0.20-0.20		S1A-207 0.20-0.20		S1A-208 0.20-0.20		S1A-209 0.20-0.20		S1A-210 0.20-0.20		S1A-211 0.20-0.20		S1A-212 0.20-0.20		S1A-213 0.20-0.20		S1A-214 0.20-0.20		S1A-215 0.20-0.20		S1A-216 0.20-0.20		S1A-217 0.20-0.20		S1A-218 0.20-0.20		S1A-219 0.20-0.20		S1A-220 0.20-0.20		S1A-221 0.20-0.20		S1A-222 0.20-0.20		S1A-223 0.20-0.20		S1A-224 0.20-0.20		S1A-225 0.20-0.20		S1A-226 0.20-0.20		S1A-227 0.20-0.20		S1A-228 0.20-0.20		S1A-229 0.20-0.20		S1A-230 0.20-0.20		S1A-231 0.20-0.20		S1A-232 0.20-0.20		S1A-233 0.20-0.20		S1A-234 0.20-0.20		S1A-235 0.20-0.20		S1A-236 0.20-0.20		S1A-237 0.20-0.20		S1A-238 0.20-0.20		S1A-239 0.20-0.20		S1A-240 0.20-0.20		S1A-241 0.20-0.20		S1A-242 0.20-0.20		S1A-243 0.20-0.20		S1A-244 0.20-0.20		S1A-245 0.20-0.20		S1A-246 0.20-0.20		S1A-247 0.20-0.20		S1A-248 0.20-0.20		S1A-249 0.20-0.20		S1A-250 0.20-0.20		S1A-251 0.20-0.20		S1A-252 0.20-0.20		S1A-253 0.20-0.20		S1A-254 0.20-0.20		S1A-255 0.20-0.20		S1A-256 0.20-0.20		S1A-257 0.20-0.20		S1A-258 0.20-0.20		S1A-259 0.20-0.20		S1A-260 0.20-0.20		S1A-261 0.20-0.20		S1A-262 0.20-0.20		S1A-263 0.20-0.20		S1A-264 0.20-0.20		S1A-265 0.20-0.20		S1A-266 0.20-0.20		S1A-267 0.20-0.20		S1A-268 0.20-0.20		S1A-269 0.20-0.20		S1A-270 0.20-0.20		S1A-271 0.20-0.20		S1A-272 0.20-0.20		S1A-273 0.20-0.20		S1A-274 0.20-0.20		S1A-275 0.20-0.20		S1A-276 0.20-0.20		S1A-277 0.20-0.20		S1A-278 0.20-0.20		S1A-279 0.20-0.20		S1A-280 0.20-0.20		S1A-281 0.20-0.20		S1A-282 0.20-0.20		S1A-283 0.20-0.20		S1A-284 0.20-0.20		S1A-285 0.20-0.20		S1A-286 0.20-0.20		S1A-287 0.20-0.20		S1A-288 0.20-0.20		S1A-289 0.20-0.20		S1A-290 0.20-0.20		S1A-291 0.20-0.20		S1A-292 0.20-0.20		S1A-293 0.20-0.20		S1A-294 0.20-0.20		S1A-295 0.20-0.20		S1A-296 0.20-0.20		S1A-297 0.20-0.20		S1A-298 0.20-0.20		S1A-299 0.20-0.20		S1A-300 0.20-0.20		S1A-301 0.20-0.20		S1A-302 0.20-0.20		S1A-303 0.20-0.20		S1A-304 0.20-0.20		S1A-305 0.20-0.20		S1A-306 0.20-0.20		S1A-307 0.20-0.20		S1A-308 0.20-0.20		S1A-309 0.20-0.20		S1A-310 0.20-0.20		S1A-311 0.20-0.20		S1A-312 0.20-0.20		S1A-313 0.20-0.20		S1A-314 0.20-0.20		S1A-315 0.20-0.20		S1A-316 0.20-0.20		S1A-317 0.20-0.20		S1A-318 0.20-0.20		S1A-319 0.20-0.20		S1A-320 0.20-0.20		S1A-321 0.20-0.20		S1A-322 0.20-0.20		S1A-323 0.20-0.20		S1A-324 0.20-0.20		S1A-325 0.20-0.20		S1A-326 0.20-0.20		S1A-327 0.20-0.20		S1A-328 0.20-0.20		S1A-329 0.20-0.20		S1A-330 0.20-0.20		S1A-331 0.20-0.20		S1A-332 0.20-0.20		S1A-333 0.20-0.20		S1A-334 0.20-0.20		S1A-335 0.20-0.20		S1A-336 0.20-0.20		S1A-337 0.20-0.20		S1A-338 0.20-0.20		S1A-339 0.20-0.20		S1A-340 0.20-0.20		S1A-341 0.20-0.20		S1A-342 0.20-0.20		S1A-343 0.20-0.20		S1A-344 0.20-0.20		S1A-345 0.20-0.20		S1A-346 0.20-0.20		S1A-347 0.20-0.20		S1A-348 0.20-0.20		S1A-349 0.20-0.20		S1A-350 0.20-0.20		S1A-351 0.20-0.20		S1A-352 0.20-0.20		S1A-353 0.20-0.20		S1A-354 0.20-0.20		S1A-355 0.20-0.20		S1A-356 0.20-0.20		S1A-357 0.20-0.20		S1A-358 0.20-0.20		S1A-359 0.20-0.20		S1A-360 0.20-0.20		S1A-361 0.20-0.20		S1A-362 0.20-0.20		S1A-363 0.20-0.20		S1A-364 0.20-0.20		S1A-365 0.20-0.20		S1A-366 0.20-0.20		S1A-367 0.20-0.20		S1A-368 0.20-0.20		S1A-369 0.20-0.20		S1A-370 0.20-0.20		S1A-371 0.20-0.20		S1A-372 0.20-0.20		S1A-373 0.20-0.20		S1A-374 0.20-0.20		S1A-375 0.20-0.20		S1A-376 0.20-0.20		S1A-377 0.20-0.20		S1A-378 0.20-0.20		S1A-379 0.20-0.20		S1A-380 0.20-0.20		S1A-381 0.20-0.20		S1A-382 0.20-0.20		S1A-383 0.20-0.20		S1A-384 0.20-0.20		S1A-385 0.20-0.20		S1A-386 0.20-0.20		S1A-387 0.20-0.20		S1A-388 0.20-0.20		S1A-389 0.20-0.20		S1A-390 0.20-0.20		S1A-391 0.20-0.20		S1A-392 0.20-0.20		S1A-393 0.20-0.20		S1A-394 0.20-0.20		S1A-395 0.20-0.20		S1A-396 0.20-0.20		S1A-397 0.20-0.20		S1A-398 0.20-0.20		S1A-399 0.20-0.20		S1A-400 0.20-0.20		S1A-401 0.20-0.20		S1A-402 0.20-0.20		S1A-403 0.20-0.20		S1A-404 0.20-0.20		S1A-405 0.20-0.20		S1A-406 0.20-0.20		S1A-407 0.20-0.20		S1A-408 0.20-0.20		S1A-409 0.20-0.20		S1A-410 0.20-0.20		S1A-411 0.20-0.20		S1A-412 0.20-0.20		S1A-413 0.20-0.20		S1A-414 0.20-0.20		S1A-415 0.20-0.20		S1A-416 0.20-0.20		S1A-417 0.20-0.20		S1A-418 0.20-0.20		S1A-419 0.20-0.20		S1A-420 0.20-0.20		S1A-421 0.20-0.20		S1A-422 0.20-0.20		S1A-423 0.20-0.20		S1A-424 0.20-0.20		S1A-425 0.20-0.20		S1A-426 0.20-0.20		S1A-427 0.20-0.20		S1A-428 0.20-0.20		S1A-429 0.20-0.20		S1A-430 0.20-0.20		S1A-431 0.20-0.20		S1A-432 0.20-0.20		S1A-433 0.20-0.20		S1A-434 0.20-0.20		S1A-435 0.20-0.20		S1A-436 0.20-0.20		S1A-437 0.20-0.20		S1A-438 0.20-0.20		S1A-439 0.20-0.20		S1A-440 0.20-0.20		S1A-441 0.20-0.20		S1A-442 0.20-0.20		S1A-443 0.20-0.20		S1A-444 0.20-0.20		S1A-445 0.20-0.20		S1A-446 0.20-0.20		S1A-447 0.20-0.20		S1A-448 0.20-0.20		S1A-449 0.20-0.20		S1A-450 0.20-0.20		S1A-451 0.20-0.20		S1A-452 0.20-0.20		S1A-453 0.20-0.20		S1A-454 0.20-0.20		S1A-455 0.20-0.20		S1A-456 0.20-0.20		S1A-457 0.20-0.20		S1A-458 0.20-0.20		S1A-459 0.20-0.20		S1A-460 0.20-0.20		S1A-461 0.20-0.20		S1A-462 0.20-0.20		S1A-463 0.20-0.20		S1A-464 0.20-0.20		S1A-465 0.20-0.20		S1A-466 0.20-0.20		S1A-467 0.20-0.20		S1A-468 0.20-0.20		S1A-469 0.20-0.20			
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AH18-3 3.00-3.00	AH19-1 0.90-0.90	AH19-2 1.50-1.50	AH1-1 0.70-0.70	AH1-2 1.30-1.30	AH11-3 2.60-2.60	AH12-1 0.50-0.50	AH12-2 1.80-1.80	AH13-1 0.20-0.20	AH13-2 1.50-1.50	AH14-1 0.30-0.30	AH14-2 1.00-1.00	AH14-3 2.00-2.00	AH15-1 0.20-0.20	AH15-2 1.60-1.60	AH16-1 0.20-0.20	AH16-2 1.80-1.80	AH17-1 0.40-0.40	AH17-2 1.30-1.30	AH18-1 0.50-0.50	AH18-2 1.50-1.50	AH19-1 1.00-1.00	AH19-2 2.00-2.00	SP01-1 0.20-0.20	SP01-2 0.20-0.20	SP03-1 0.20-0.20	SP03-2 0.20-0.20	SP04-1 0.20-0.20	SP04-2 0.20-0.20	SP05-1 0.20-0.20	SP05-2 0.20-0.20	SP06-1 0.20-0.20	SP06-2 0.20-0.20	SP07-1 0.20-0.20	SP07-2 0.20-0.20	SP08-1 0.20-0.20	SP08-2 0.20-0.20	SP09-1 0.20-0.20	SP09-2 0.20-0.20	SP10-1 0.20-0.20	SP10-2 0.20-0.20	SP11-1 0.20-0.20	SP11-2 0.20-0.20	SP12-1 0.20-0.20	SP12-2 0.20-0.20	SP13-1 0.20-0.20	SP13-2 0.20-0.20	SP14-1 0.20-0.20	SP14-2 0.20-0.20	SP15-1 0.20-0.20	SP15-2 0.20-0.20	SP16-1 0.20-0.20	SP16-2 0.20-0.20	SP17-1 0.20-0.20	SP17-2 0.20-0.20	SP18-1 0.20-0.20	SP18-2 0.20-0.20	SP19-1 0.20-0.20	SP19-2 0.20-0.20	SP20-1 0.20-0.20	SP20-2 0.20-0.20	SP21-1 0.20-0.20	SP21-2 0.20-0.20	SP22-1 0.20-0.20	SP22-2 0.20-0.20	SP23-1 0.20-0.20	SP23-2 0.20-0.20	SP24-1 0.20-0.20	SP24-2 0.20-0.20	SP25-1 0.20-0.20	SP25-2 0.20-0.20	SP26-1 0.20-0.20	SP26-2 0.20-0.20	SP27-1 0.20-0.20	SP27-2 0.20-0.20	SP28-1 0.20-0.20	SP28-2 0.20-0.20	SP29-1 0.20-0.20	SP29-2 0.20-0.20	SP30-1 0.20-0.20	SP30-2 0.20-0.20	SP31-1 0.20-0.20	SP31-2 0.20-0.20	SP32-1 0.20-0.20	SP32-2 0.20-0.20	SP33-1 0.20-0.20	SP33-2 0.20-0.20	SP34-1 0.20-0.20	SP34-2 0.20-0.20	SP35-1 0.20-0.20	SP35-2 0.20-0.20	SP36-1 0.20-0.20	SP36-2 0.20-0.20	SP37-1 0.20-0.20	SP37-2 0.20-0.20	SP38-1 0.20-0.20	SP38-2 0.20-0.20	SP39-1 0.20-0.20	SP39-2 0.20-0.20	SP40-1 0.20-0.20	SP40-2 0.20-0.20	SP41-1 0.20-0.20	SP41-2 0.20-0.20	SP42-1 0.20-0.20	SP42-2 0.20-0.20	SP43-1 0.20-0.20	SP43-2 0.20-0.20	SP44-1 0.20-0.20	SP44-2 0.20-0.20	SP45-1 0.20-0.20	SP45-2 0.20-0.20	SP46-1 0.20-0.20	SP46-2 0.20-0.20	SP47-1 0.20-0.20	SP47-2 0.20-0.20	SP48-1 0.20-0.20	SP48-2 0.20-0.20	SP49-1 0.20-0.20	SP49-2 0.20-0.20	SP50-1 0.20-0.20	SP50-2 0.20-0.20	SP51-1 0.20-0.20	SP51-2 0.20-0.20	SP52-1 0.20-0.20	SP52-2 0.20-0.20	SP53-1 0.20-0.20	SP53-2 0.20-0.20	SP54-1 0.20-0.20	SP54-2 0.20-0.20	SP55-1 0.20-0.20	SP55-2 0.20-0.20	SP56-1 0.20-0.20	SP56-2 0.20-0.20	SP57-1 0.20-0.20	SP57-2 0.20-0.20	SP58-1 0.20-0.20	SP58-2 0.20-0.20	SP59-1 0.20-0.20	SP59-2 0.20-0.20	SP60-1 0.20-0.20	SP60-2 0.20-0.20	SP61-1 0.20-0.20	SP61-2 0.20-0.20	SP62-1 0.20-0.20	SP62-2 0.20-0.20	SP63-1 0.20-0.20	SP63-2 0.20-0.20	SP64-1 0.20-0.20	SP64-2 0.20-0.20	SP65-1 0.20-0.20	SP65-2 0.20-0.20	SP66-1 0.20-0.20	SP66-2 0.20-0.20	SP67-1 0.20-0.20	SP67-2 0.20-0.20	SP68-1 0.20-0.20	SP68-2 0.20-0.20	SP69-1 0.20-0.20	SP69-2 0.20-0.20	SP70-1 0.20-0.20	SP70-2 0.20-0.20	SP71-1 0.20-0.20	SP71-2 0.20-0.20	SP72-1 0.20-0.20	SP72-2 0.20-0.20	SP73-1 0.20-0.20	SP73-2 0.20-0.20	SP74-1 0.20-0.20	SP74-2 0.20-0.20	SP75-1 0.20-0.20	SP75-2 0.20-0.20	SP76-1 0.20-0.20	SP76-2 0.20-0.20	SP77-1 0.20-0.20	SP77-2 0.20-0.20	SP78-1 0.20-0.20	SP78-2 0.20-0.20	SP79-1 0.20-0.20	SP79-2 0.20-0.20	SP80-1 0.20-0.20	SP80-2 0.20-0.20	SP81-1 0.20-0.20	SP81-2 0.20-0.20	SP82-1 0.20-0.20	SP82-2 0.20-0.20	SP83-1 0.20-0.20	SP83-2 0.20-0.20	SP84-1 0.20-0.20	SP84-2 0.20-0.20	SP85-1 0.20-0.20	SP85-2 0.20-0.20	SP86-1 0.20-0.20	SP86-2 0.20-0.20	SP87-1 0.20-
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Llanwern Controlled Waters Risk Assessment
Soil Screening

Project: 5111373

carbon									
Soil Organic Matter (SOM)	TM132	%		0.35					
Metals (Solids)									
Arsenic	TM181	mg/kg	<0.6	11468.786	2002.60	276.00			
Cadmium	TM181	mg/kg	<0.02	330.551	83.06	9.23			
Chromium	TM181	mg/kg	<0.9	42699.08	10896.01	876.00			
Copper	TM181	mg/kg	<1.4	2.042	516.88	318.00			
Lead	TM181	mg/kg	<0.7	71.246.37	18032.07	787.00			
Mercury	TM181	mg/kg	<0.14	595.80	150.81	2.69			
Nickel	TM181	mg/kg	<0.2	52.199.37	13188.60	169.00			
Selenium	TM181	mg/kg	<1	3.177.88	804.31	40.20			
Vanadium	TM181	mg/kg	<0.2	7.270.79	1840.20	1560.00			
Zinc	TM181	mg/kg	<1.9	622.690.14	157599.62	3690.00			
TPH Criteria Working Group (TPH CWG)									
Benzene	TM089	mg/kg	<0.01	17.22	4.30	0.00			
Toluene	TM089	mg/kg	<0.002	581.53	147.18	0.00			
Ethylbenzene	TM089	mg/kg	<0.003	363.62	92.03	0.00			
sum of detected mpo xylene by GC	TM089	µg/kg	9						
Aliphatics >C5-C6	TM089	mg/kg	<0.01	330.56	83.06	0.25			
Aliphatics >C6-C8	TM089	mg/kg	<0.01	1.626.37	411.63	3.90			
Aliphatics >C9-C10	TM089	mg/kg	<0.01	12.860.73	3254.98	26.00			
Aliphatics >C10-C12	TM089	mg/kg	<0.01	102.089.22	25838.23	29.20			
Aliphatics >C12-C16	TM173	mg/kg	<0.1	2.036.742.73	515488.60	1330.00			
Aliphatics >C16-C21	TM173	mg/kg	<0.1	256.407.138.28	64895263.78	1106.00			
Aliphatics >C21-C35	TM173	mg/kg	<0.1	256.407.138.28	64895263.78	3280.00			
Aliphatics >C35-C44	TM173	mg/kg	<0.1	256407.138.3	64895263.78	1380.00			
Aromatics >EC5-EC7	TM089	mg/kg	<0.01	38.53	9.75	0.83			
Aromatics >EC7-EC8	TM089	mg/kg	<0.01	801.64	202.89	0.11			
Aromatics >EC8-EC10	TM089	mg/kg	<0.01	650.33	164.69	17.40			
Aromatics >EC10-EC12	TM089	mg/kg	<0.01	1.027.02	259.93	19.40			
Aromatics >EC12-EC16	TM173	mg/kg	<0.1	2.042.96	517.00	507.00			
Aromatics >EC16-EC21	TM173	mg/kg	<0.1	6.448.89	1631.07	1360.00			
Aromatics >EC21-EC35	TM173	mg/kg	<0.1	51.166.14	12949.88	4070.00			
Aromatics >EC35-EC44	TM173	mg/kg	<0.1	51166.143	12949.88	1250.00			
Aromatics >EC40-EC44	TM173	mg/kg	<0.1	51166.143	12949.88	632.00			
Polyaromatic Hydrocarbons (PAHs)									
Acenaphthylene	TM218	µg/kg	<0.012	75733	19188	1920.00			
Acenaphthene	TM218	µg/kg	<0.008	134627	34073	6190.00			
Anthracene	TM218	µg/kg	<0.016	154563	39116	3990.00			
Benzo[a]anthracene	TM218	µg/kg	<0.014	27475.12	695380	15900.00			
Benzofluoranthene	TM218	µg/kg	<0.015	156523	39486	19500.00			
Benzol[fluoranthene	TM218	µg/kg	<0.015	15466	3794	27000.00			
Benzol[fluoranthene	TM218	µg/kg	<0.014	22876	5750	8500.00			
Benzol[h]perylene	TM218	µg/kg	<0.024	60170	15229	8800.00			
Chrysene	TM218	µg/kg	<0.018	2811508	711578	19400.00			
Dibenzol[a,h]anthracene	TM218	µg/kg	<0.023	3725258	955886	3260.00			
Indeno[1,2,3-cd]pyrene	TM218	µg/kg	<0.018	114651	29018	10100.00			
Fluoranthene	TM218	µg/kg	<0.017	30083	7914	17300.00			
Fluorene	TM218	µg/kg	<0.01	122780	31077	9160.00			
Naphthalene	TM218	µg/kg	<0.009	124254	31455	38100.00			
Phenanthrene	TM218	µg/kg	<0.015	122786	31077	11600.00			
Pyrene	TM218	µg/kg	15	345549	87557	18.30			
PAH, Total Detected USEPA 16	TM218	mg/kg	<0.118						
Naphthalene-d8 % recovery**	TM218	%							
Acenaphthene-d10 % recovery**	TM218	%							
Phenanthrene-d10 % recovery**	TM218	%							
Chrysene-d12 % recovery**	TM218	%							
Perylene-d12 % recovery**	TM218	%							
Total Aliphatics >C12-C44	TM173	mg/kg	<0.1						
Total Aromatics >EC12-EC44	TM173	mg/kg	<0.1						
Total Aliphatics & Aromatics >C5-C44	TM173	µg/kg	100						
Metals - (Liquid)									
Calcium	TM224	mg/kg	<21						
Magnesium	TM24	mg/kg	<8						
Phenols									
Phenol	TM062 (S)	mg/kg	<0.01						
Cresols	TM062 (S)	mg/kg	<0.01						
Xylenols	TM062 (S)	mg/kg	<0.015						
Phenols, Total Detected monohydric	TM062 (S)	mg/kg	<0.035						
Inorganics									
Soluble Sulphate 2-1 extract as SO4 BRE	TM243	g/l	<0.004						
pH	TM133	pH Units	<1						
Sulphate, Total	TM221	mg/kg	<48						
Sulphur, Total	TM132	%	<0.02						
Sulphate, Total potential	TM132	%	<0.06						
Sulphate, acid soluble (total)	TM221	%	<0.02						
Quartz, Total	TM153	mg/kg	<1						
Exchangeable Ammonia as N	TM024	mg/kg	<12						
Asbestos									
Asbestos Quantification - Gravimetric - %	TM304	%	<0.001						
Date of Analysis	TM048	No units							
Analysed By	TM048	No units							
Asbestos Quantification - PCOM Evaluation - %	TM304	%	<0.001	0.03	0.02	0.00			
Additional Asbestos Components (Using TM048)	TM304	No units							
Analysts Comments	TM304	No units							
Asbestos Quantification - Total - %	TM304	%	<0.001						
Chrysotile (White) Asbestos	TM048	No units							
Amosite (Brown) Asbestos	TM048	No units							
Crocidolite (Blue) Asbestos	TM048	No units							
Fibrous Anthophyllite	TM048	No units							
Fibrous Tremolite	TM048	No units							
Fibrous Actinolite	TM048	No units							
Non-Asbestos Fibre	TM048	No units							
Comments	TM048	No units							
Volatile Organic Compounds (VOCs)									
Dibromofluoromethane**	TM116	%				138.00			
Toluene-d8**	TM116	%				106.00			
4-Bromofluorobenzene**	TM116	%				114.00			
Methyl Tertiary Butyl Ether	TM116	mg/kg	<0.1			0.00			
Benzene	TM116	mg/kg	<0.09			0.57			
Toluene	TM116	mg/kg	<0.07			0.00			
Ethylbenzene	TM116	mg/kg	<0.04			0.50			
p,m-Xylene	TM116	mg/kg	<0.1			2.23			
o-Xylene	TM116	mg/kg	<0.1			1.42			
Naphthalene	TM116	mg/kg	<0.13			37.10			
Sum of BTEX	TM116	mg/kg	<0.4			4.15			
Subcontracted: Inorganics									
Gross Calorific Value in Dry Matter Q(Vi/gr(d)	SUB	MJ/kg	<0.5			6.31			
Gross Calorific Value Original Q(Vi/gr(ar)	SUB	MJ/kg	<0.5			5.85			
Net Calorific Value in Dry Matter Q(Vi/net(d)	SUB	MJ/kg	<0.5			2.53			
Net Calorific Value in Original Q(Vi/net(ar)	SUB	MJ/kg	<0.5			1.09			
Water Analytical M (ad)	SUB	%	<0.5			3.37			
Water Gross M(w)	SUB	%	<0.5			58.20			
Water Total M(ar)	SUB	%	<0.5			59.60			

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	40AH27	40AH10V	40AH14V	40AH16V	40AH19V	40AH21V	40AH11	40AH13	40AH15	40AH17	40AH19	40AH21	40AH23	40AH25	40AH27	40AH29	40AH31	40AH33	40AH35	40AH37	40AH39	40AH41	40AH43	40AH45	40AH47	40AH49	40AH51	40AH53	40AH55	40AH57	40AH59	40AH61	40AH63	40AH65	40AH67	40AH69	40AH71	40AH73	40AH75	40AH77	40AH79	40AH81	40AH83	40AH85	40AH87	40AH89	40AH91	40AH93	40AH95	40AH97	40AH99	40AH101	40AH103	40AH105	40AH107	40AH109	40AH111	40AH113	40AH115	40AH117	40AH119	40AH121	40AH123	40AH125	40AH127	40AH129	40AH131	40AH133	40AH135	40AH137	40AH139	40AH141	40AH143	40AH145	40AH147	40AH149	40AH151	40AH153	40AH155	40AH157	40AH159	40AH161	40AH163	40AH165	40AH167	40AH169	40AH171	40AH173	40AH175	40AH177	40AH179	40AH181	40AH183	40AH185	40AH187	40AH189	40AH191	40AH193	40AH195	40AH197	40AH199	40AH201	40AH203	40AH205	40AH207	40AH209	40AH211	40AH213	40AH215	40AH217	40AH219	40AH221	40AH223	40AH225	40AH227	40AH229	40AH231	40AH233	40AH235	40AH237	40AH239	40AH241	40AH243	40AH245	40AH247	40AH249	40AH251	40AH253	40AH255	40AH257	40AH259	40AH261	40AH263	40AH265	40AH267	40AH269	40AH271	40AH273	40AH275	40AH277	40AH279	40AH281	40AH283	40AH285	40AH287	40AH289	40AH291	40AH293	40AH295	40AH297	40AH299	40AH301	40AH303	40AH305	40AH307	40AH309	40AH311	40AH313	40AH315	40AH317	40AH319	40AH321	40AH323	40AH325	40AH327	40AH329	40AH331	40AH333	40AH335	40AH337	40AH339	40AH341	40AH343	40AH345	40AH347	40AH349	40AH351	40AH353	40AH355	40AH357	40AH359	40AH361	40AH363	40AH365	40AH367	40AH369	40AH371	40AH373	40AH375	40AH377	40AH379	40AH381	40AH383	40AH385	40AH387	40AH389	40AH391	40AH393	40AH395	40AH397	40AH399	40AH401	40AH403	40AH405	40AH407	40AH409	40AH411	40AH413	40AH415	40AH417	40AH419	40AH421	40AH423	40AH425	40AH427	40AH429	40AH431	40AH433	40AH435	40AH437	40AH439	40AH441	40AH443	40AH445	40AH447	40AH449	40AH451	40AH453	40AH455	40AH457	40AH459	40AH461	40AH463	40AH465	40AH467	40AH469	40AH471	40AH473	40AH475	40AH477	40AH479	40AH481	40AH483	40AH485	40AH487	40AH489	40AH491	40AH493	40AH495	40AH497	40AH499	40AH501	40AH503	40AH505	40AH507	40AH509	40AH511	40AH513	40AH515	40AH517	40AH519	40AH521	40AH523	40AH525	40AH527	40AH529	40AH531	40AH533	40AH535	40AH537	40AH539	40AH541	40AH543	40AH545	40AH547	40AH549	40AH551	40AH553	40AH555	40AH557	40AH559	40AH561	40AH563	40AH565	40AH567	40AH569	40AH571	40AH573	40AH575	40AH577	40AH579	40AH581	40AH583	40AH585	40AH587	40AH589	40AH591	40AH593	40AH595	40AH597	40AH599	40AH601	40AH603	40AH605	40AH607	40AH609	40AH611	40AH613	40AH615	40AH617	40AH619	40AH621	40AH623	40AH625	40AH627	40AH629	40AH631	40AH633	40AH635	40AH637	40AH639	40AH641	40AH643	40AH645	40AH647	40AH649	40AH651	40AH653	40AH655	40AH657	40AH659	40AH661	40AH663	40AH665	40AH667	40AH669	40AH671	40AH673	40AH675	40AH677	40AH679	40AH681	40AH683	40AH685	40AH687	40AH689	40AH691	40AH693	40AH695	40AH697	40AH699	40AH701	40AH703	40AH705	40AH707	40AH709	40AH711	40AH713	40AH715	40AH717	40AH719	40AH721	40AH723	40AH725	40AH727	40AH729	40AH731	40AH733	40AH735	40AH737	40AH739	40AH741	40AH743	40AH745	40AH747	40AH749	40AH751	40AH753	40AH755	40AH757	40AH759	40AH761	40AH763	40AH765	40AH767	40AH769	40AH771	40AH773	40AH775	40AH777	40AH779	40AH781	40AH783	40AH785	40AH787	40AH789	40AH791	40AH793	40AH795	40AH797	40AH799	40AH801	40AH803	40AH805	40AH807	40AH809	40AH811	40AH813	40AH815	40AH817	40AH819	40AH821	40AH823	40AH825	40AH827	40AH829	40AH831	40AH833	40AH835	40AH837	40AH839	40AH841	40AH843	40AH845	40AH847	40AH849	40AH851	40AH853	40AH855	40AH857	40AH859	40AH861	40AH863	40AH865	40AH867	40AH869	40AH871	40AH873	40AH875	40AH877	40AH879	40AH881	40AH883	40AH885	40AH887	40AH889	40AH891	40AH893	40AH895	40AH897	40AH899	40AH901	40AH903	40AH905	40AH907	40AH909	40AH911	40AH913	40AH915	40AH917	40AH919	40AH921	40AH923	40AH925	40AH927	40AH929	40AH931	40AH933	40AH935	40AH937	40AH939	40AH941	40AH943	40AH945	40AH947	40AH949	40AH951	40AH953	40AH955	40AH957	40AH959	40AH961	40AH963	40AH965	40AH967	40AH969	40AH971	40AH973	40AH975	40AH977	40AH979	40AH981	40AH983	40AH985	40AH987	40AH989	40AH991	40AH993	40AH995	40AH997	40AH999	40AH1001	40AH1003	40AH1005	40AH1007	40AH1009	40AH1011	40AH1013	40AH1015	40AH1017	40AH1019	40AH1021	40AH1023	40AH1025	40AH1027	40AH1029	40AH1031	40AH1033	40AH1035	40AH1037	40AH1039	40AH1041	40AH1043	40AH1045	40AH1047	40AH1049	40AH1051	40AH1053	40AH1055	40AH1057	40AH1059	40AH1061	40AH1063	40AH1065	40AH1067	40AH1069	40AH1071	40AH1073	40AH1075	40AH1077	40AH1079	40AH1081	40AH1083	40AH1085	40AH1087	40AH1089	40AH1091	40AH1093	40AH1095	40AH1097	40AH1099	40AH1101	40AH1103	40AH1105	40AH1107	40AH1109	40AH1111	40AH1113	40AH1115	40AH1117	40AH1119	40AH1121	40AH1123	40AH1125	40AH1127	40AH1129	40AH1131	40AH1133	40AH1135	40AH1137	40AH1139	40AH1141	40AH1143	40AH1145	40AH1147	40AH1149	40AH1151	40AH1153	40AH1155	40AH1157	40AH1159	40AH1161	40AH1163	40AH1165	40AH1167	40AH1169	40AH1171	40AH1173	40AH1175	40AH1177	40AH1179	40AH1181	40AH1183	40AH1185	40AH1187	40AH1189	40AH1191	40AH1193	40AH1195	40AH1197	40AH1199	40AH1201	40AH1203	40AH1205	40AH1207	40AH1209	40AH1211	40AH1213	40AH1215	40AH1217	40AH1219	40AH1221	40AH1223	40AH1225	40AH1227	40AH1229	40AH1231	40AH1233	40AH1235	40AH1237	40AH1239	40AH1241	40AH1243	40AH1245	40AH1247	40AH1249	40AH1251	40AH1253	40AH1255	40AH1257	40AH1259	40AH1261	40AH1263	40AH1265	40AH1267	40AH1269	40AH1271	40AH1273	40AH1275	40AH1277	40AH1279	40AH1281	40AH1283	40AH1285	40AH1287	40AH1289	40AH1291	40AH1293	40AH1295	40AH1297	40AH1299	40AH1301	40AH1303	40AH1305	40AH1307	40AH1309	40AH1311	40AH1313	40AH1315	40AH1317	40AH1319	40AH1321	40AH1323	40AH1325	40AH1327	40AH1329	40AH1331	40AH1333	40AH1335	40AH1337	40AH1339	40AH1341	40AH1343	40AH1345	40AH1347	40AH1349	40AH1351	40AH1353	40AH1355	40AH1357	40AH1359	40AH1361	40AH1363	40AH1365	40AH1367	40AH1369	40AH1371	40AH1373	40AH1375	40AH1377	40AH1379	40AH1381	40AH1383	40AH1385	40AH1387	40AH1389	40AH1391	40AH1393	40AH1395	40AH1397	40AH1399	40AH1401	40AH1403	40AH1405	40AH1407	40AH1409	40AH1411	40AH1413	40AH1415	40AH1417	40AH1419	40AH1421	40AH1423	40AH1425	40AH1427	40AH1429	40AH1431	40AH1433	40AH1435	40AH1437	40AH1439	40AH1441	40AH1443	40AH1445	40AH1447	40AH1449	40AH1451	40AH1453	40AH1455	40AH1457	40AH1459	40AH1461	40AH1463	40AH1465	40AH1467	40AH1469	40AH1471	40AH1473	40AH1475	40AH1477	40AH1479	40AH1481	40AH1483	40AH1485	40AH1487	40AH1489	40AH1491	40AH1493	40AH1495	40AH1497	40AH1499	40AH1501	40AH1503	40AH1505	40AH1507	40AH1509	40AH1511	40AH1513	40AH1515	40AH1517	40AH1519	40AH1521	40AH1523	40AH1525	40AH1527	40AH1529	40AH1531	40AH1533	40AH1535	40AH1537	40AH1539	40AH1541	40AH1543	40AH1545	40AH1547	40AH1549	40AH1551	40AH1553	40AH1555	40AH1557	40AH1559	40AH1561	40AH1563	40AH1565	40AH1567	40AH1569	40AH1571	40AH1573	40AH1575	40AH1577	40AH1579	40AH1581	40AH1583	40AH1585	40AH1587	40AH1589	40AH1591	40AH1593	40AH1595	40AH1597	40AH1599	40AH1601	40AH1603	40AH1605	40AH1607	40AH1609	40AH1611	40AH1613	40AH1615	40AH1617	40AH1619	40AH1621	40AH1623	40AH1625	40AH1627	40AH1629	40AH1631	40AH1633	40AH1635	40AH1637	40AH1639	40AH1641	40AH1643	40AH1645	40AH1647	40AH1649	40AH1651	40AH1653	40AH1655	40AH1657	40AH1659	40AH1661	40AH1663	40AH1665	40AH1667	40AH1669	40AH1671	40AH1673	40AH1675	40AH1677	40AH1679	40AH1681	40AH1683	40AH1685	40AH1687	40AH1689	40AH1691	40AH1693	40AH1695	40AH1697	40AH1699	40AH1701	40AH1703	40AH1705	40AH1707	40AH1709	40AH1711	40AH1713	40AH1715	40AH1717	40AH1719	40AH1721	40AH1723	40AH1725	40AH1727	40AH1729	40AH1731	40AH1733	40AH1735	40AH1737	40AH1739	40AH1741	40AH1743	40AH1745	40AH1747	40AH1749	40AH1751	40AH1753	40AH1755	40AH1757	40AH1759	40AH1761	40AH1763	40AH1765	40AH1767	40AH1769	40AH1771	40AH1773	40AH1775	40AH1777	40AH1779	40AH1781	40AH1783	40AH1785	40AH1787	40AH1789	40AH1791	40AH1793	40AH1795	40AH1797	40AH1799	40AH1801	40AH1803	40AH1805	40AH1807	40AH1809	40AH1811	40AH1813	40AH1815	40AH1817	40AH1819	40AH1821	40AH1823	40AH1825	40AH1827	40AH1829	40AH1831	40AH1833	40AH1835	40AH1837	40AH1839	40AH1841	40AH1843	40AH1845	40AH1847	40AH1849	40AH1851	40AH1853	40AH1855	40AH1857	40AH1859	40AH1861	40AH1863	40AH1865	40AH1867	40AH1869	40AH1871	40AH1873	40AH1875	40AH1877	40AH1879	40AH1881	40AH1883	40AH1885	40AH1887	40AH1889	40AH1891	40AH1893	40AH1895	40AH1897	40AH1899	40AH1901	40AH1903	40AH1905	40AH1907	40AH1909	40AH1911	40AH1913	40AH1915	40AH1917	40AH1919	40AH1921	40AH1923	40AH1925	40AH1927	40AH1929	40AH1931	40AH1933	40AH1935	40AH1937	40AH1939	40AH1941	40AH1943	40AH1945	40AH1947	40AH1949	40AH1951	40AH1953	40AH1955	40AH1957	40AH1959	40AH1961	40AH1963	40AH1965	40AH1967	40AH1969	40AH1971	40AH1973	40AH1975	40AH1977	40AH1979	40AH1981	40AH1983	40AH1985	40AH1987	40AH1989	40AH1991	40AH1993	40AH1995	40AH1997	40AH1999	40AH2001	40AH2003	40AH2005	40AH2007	40AH2009	40AH2011	40AH2013	40AH2015	40AH2017	40AH2019	40AH2021	40AH2023	40AH2025	40AH2027	40AH2029	40AH2031	40AH2033	40AH2035	40AH2037	40AH2039	40AH2041	40AH2043	40AH2045	40AH2047	40AH2049	40AH2051	40AH2053	40AH2055	40AH2057	40AH2059	40AH2061	40AH2063	40AH2065	40AH2067	40AH2069	40AH2071	40AH2073	40AH2075	40AH2077	40AH2079	40AH2081	40AH2083	40AH2085	40AH2087	40AH2089	40AH2091	40AH2093	40AH2095	40AH2097	40AH2099	40AH2101	40AH2103	40AH2105	40AH2107	40AH2109	40AH2111	40AH2113	40AH2115	40AH2117	40AH2119	40AH2121	40AH2123	40AH2125	40AH2127	40AH2129	40AH2131	40AH2133	40AH2135	40AH2137	40AH2139	40AH2141	40AH2143	40AH2145	40AH2147	40AH2149	40AH2151
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22/06/2018	22/06/2018	22/06/2018	22/06/2018	22/06/2018	30/05/2018	30/05/2018	30/05/2018	22/06/2018	22/06/2018	27/06/2018	27/06/2018	27/06/2018	27/06/2018	27/06/2018	28/06/2018	22/06/2018	22/06/2018	05/06/2018	05/06/2018	05/06/2018	05/06/2018	29/05/2018	29/05/2018	29/05/2018	29/05/2018	27/06/2018	27/06/2018	28/06/2018	22/06/2018	05/06/2018	29/05/2018	30/05/2018	29/05/2018	29/05/2018	29/05/2018	30/05/2018	22/06/2018	22/06/2018	22/06/2018	14/06/2018	14/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	06/06/2018	29/05/2018	29/05/2018	22/06/2018	14/06/2018
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[illegible][illegible][illegible]

RLS2TP8	RLS2TP8	RLS2TP9	RLS2TP9	RLS2TP10V	RLS2TP11V	RLS2TP12V	RLS2TP13V	RLS2TP14V	RLS2TP15V	RLS2TP1V	RLS2TP2V	RLS2TP3V	RLS2TP4V	RLS2TP5V	RLS2TP6V	RLS2TP7V	RLS2TP8V	RLS2TP9V
2.202.20	2.802.80	0.500.50	1.001.00	4.004.00	0.800.80	0.700.70	0.650.65	2.252.25	2.302.30	0.400.40	1.201.20	1.101.10	0.450.45	1.301.30	5.305.30	3.803.80	3.203.20	1.601.60

12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	14/06/2018	14/06/2018	14/06/2018	14/06/2018	14/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018
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2.83	5.38	1.32	1.83	55.5	6.72	15.9	7.14	26.5	5.86	1.54	5.83	4.26	4.38	3.97	6.12	1.61	30.7	8.29
9.19	11.3	7.62	9.23	7.63	16.3	9.36	11.8	11.3	15.5	5.34	5.2	9.65	9.94	11.2	11.2	11.6	27.5	15.9
1.26	0.41	1.14	0.492	0.236	0.379	0.269	0.415	0.607	0.438	0.104	0.177	0.289	0.186	0.304	0.346	0.161	0.439	0.567
81.7	18.1	200	19.1	16.3	40	32	33.6	30.7	39.2	24	31.2	30.1	22.5	38.9	25.9	33.2	28.5	37
26.9	23.6	27.2	28.1	18	34.1	21.8	26.8	37	26.2	10.4	17.3	21.2	10.9	25.5	14.1	12.9	35.6	30.3
145	131	64.7	17.8	7.5	134	19.3	33.4	21.9	35.3	19.5	20.5	21.7	24.7	26.8	20.1	33.9	19.2	43.5
<0.14	<0.14	<0.14	<1.4	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14
20.3	26.2	90.4	26.6	21.3	36.2	29	31.6	36.6	34.1	27.8	29.7	35.7	32.9	42.3	33.1	41.4	39.2	35
3.82	1.68	4.98	<10	3.22	1.66	1.66	1.41	2.86	1.29	<1	1.1	<1	<1	1.68	<1	<1	3.19	1.37
117	37.6	269	42.7	22.3	61.2	48.6	53	47.5	64.7	40.9	47.5	44.6	61.2	41.2	59.7	54.4	62.9	
302	79.1	331	67.5	64.6	143	81.3	96.6	79.9	122	74.6	76.6	86.2	96.7	104	111	117	42.1	156

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0.0433	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
0.0888	0.0762	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
0.135	0.291	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
0.379	0.611	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
12.7	9.17	6.54	<0.1	1.62	<0.1	<0.1	<0.1	3.46	0.102	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.13	<0.1
34	9.12	31.4	1.72	4.95	<0.1	<0.1	7.54	2.51	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.24	<0.1
146	37.5	207	20.1	231	1.98	15.5	3.88	37.9	5.23	<0.1	1.23	0.865	6.64	1.15	2.58	<0.1	74.1	<0.1
51.3	10.9	49.6	2.32	3.39	<0.1	<0.1	<0.1	1.37	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
0.105	0.213	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
0.252	0.406	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
2.99	2.39	2.4	0.778	<0.1	<0.1	<0.1	2.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.304	<0.1	<0.1	<0.1	<0.1
12.9	7.05	18.2	3.51	4.52	<0.1	2.17	<0.1	5.97	0.589	<0.1	3.95	0.182	<0.1	0.115	<0.1	4.31	2.01	
70.3	31.5	117	15.6	280	7.54	111	21.6	159	17.8	7.46	34.7	5.34	26.5	5.82	7.44	3.8	284	19.3
50.6	15.2	53.8	8.42	24.8	0.891	6.33	2.31	27.1	1.88	<0.1	4.44	0.139	2.12	1.59	3.41	<0.1	25.2	2.37
22.8	6.26	20.1	3.55	8.32	<0.1	<0.1	9.72	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.349	1.34	<0.1	7.71	<0.1

<12	<12	15	<12	<80	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
10.7	<8	20.5	<8	<40	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
25	<16	69.9	<16	<80	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
185	24.9	1150	155	<70	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	32.4
191	21.5	1090	93.5	<75	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	25.4
315	56.8	1810	182	<75	<15	<15	<15	<15	35.1	<15	<15	<15	<15	<15	<15	<15	<15	44.2
113	18	711	73.8	<70	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14	<14
172	<24	983	72.9	<120	<24	<24	<24	<24	104	<24	<24	<24	<24	<24	<24	<24	<24	<24
238	30.9	1250	172	<50	<10	<10	<10	<10	20.3	<10	<10	<10	<10	<10	<10	<10	<10	38.3
34.6	<0.023	177	<0.023	<0.115	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023
141	25.8	866	67.2	<90	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
275	64	854	136	<0.085	<0.017	<0.017	30.4	<0.017	32.4	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	68.3
<10	<10	11.8	<10	<50	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
27.2	22.8	60	28.2	<45	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	<9	67.4
124	57.2	288	116	<75	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	107
0.329	0.0522	2.36	0.335	<0.075	<0.015	<0.015	<0.015	<0.015	0.0275	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.0596

2.18	0.374	11.7	1.43	<0.59	<0.118	<0.118	<0.118	<0.118	0.219	<0.118	<0.118	<0.118	<0.118	<0.118	<0.118	<0.118	<0.118	0.439
91.7	93.2	92	91	86.1	85.9	86.6	85.9	86.6	89.8	82.2	75.9	88	95.3	90.5	86.7	88.1	87.6	88.1
95.4	96.2	90.3	91.4	81.3	90.5	93.2	91.9	89.6	89.3	81.3	76.5	93	94.7	87.3	86	79.5	97.7	87.4
98.4	98.5	97.9	91.1	81.9	101	95	92.5	88.1	85.7	85.1	95.6	97.7	89.2	89.6	85	102	102	93
103	97.1	106	95.8	86.7	97.9	89	89.7	103	79.8	85.2	83.3	99.9	95.1	90.1	88.7	92.4	90.4	95.6
100	93.2	107	90.4	79.6	98.9	88.9	87.2	98.4	83.3	85.6	89.7	97.8	95.1	90.8	86.6	87.9	87.6	90.5
244	66.7	295	24.2	241	1.98	15.5	3.88	50.2	7.85	<0.1	1.23	0.865	6.64	1.15	2.58	<0.1	76.5	<0.1
137	56.1	192	28.3	309	8.44	120	23.9	194	20.2	7.46	42.2	5.67	28.7	7.83	10.8	3.8	314	23.7
382	124	487	52.4	550	10.4	135	27.8	244	28.1	7.46	43.4	6.53	35.3	8.98	13.4	3.8	390	23.7

-	-	-	-	-	-	-	-	193000	-	-	156000	-	175000	-	217000	-	-	153000	110000
-	-	-	-	-	-	-	-	18000	-	-	16200	-	26500	-	8890	-	-	13700	22800

<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0155	<0.01	<0.01	0.0222	<0.01	<0.01	<0.01	0.0115	0.0109	<0.01	<0.01	<0.01	0.249
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0155	<0.01	<0.01	0.0555	<0.01	<0.01	0.0111	0.046	<0.01	<0.01	<0.01	0.0108	<0.01
<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.0555	<0.015	<0.015	<0.015	0.023	<0.015	<0.015	<0.015	<0.015	<0.015
<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	0.133	<0.035	<0.035	<0.035	0.0805	<0.035	<0.035	<0.035	<0.035	0.249

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-	-	-	-	-	-	-	03/08/2018	-	-	17/07/2018	-	17/07/2018	-	16/07/2018	-	-	18/07/2018	18/07/2018
-	-	-	-	-	-	-	Lucy Caroe	-	-	Lucy Caroe	-	rzej Ferlecki	-	Magdziarek	-	-	es Richards	Lucy Caroe

Appendix E – IOM Report



WORKING FOR A HEALTHIER FUTURE

Report 610-34464 Rev 1
12 March 2014

Final Report

Assessment of asbestos contamination at former Llanwern Steelworks site, Newport, Wales

Report prepared by:

A handwritten signature in black ink, reading 'Jane Tierney'.

Jane Tierney, Senior Consultant

Report reviewed by:

A handwritten signature in black ink, reading 'Alison Searl'.

Alison Searl, Director of Analytical Services



OUR IMPACT ON THE ENVIRONMENT

At IOM we seek to minimise our environmental impact. We produce thousands of reports every year and these consume a large quantity of paper. To minimise our impact on the environment, we prefer to only provide an electronic copy of reports, although we can provide a paper copy on request. If you have any additional requirements please let us know.



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SUMMARY

INTRODUCTION

Asbestos contamination is present on the former Tata Steelworks, Llanwern, off Queensway Road, Newport NP19 4QZ. The site is currently being developed as residential accommodation.

The client is St Modwen Homes. Phase 1 of the development is in progress and nearing completion. This is outside the scope of Atkins/IOM involvement. Atkins is the project manager for the remediation works to the remainder of the site.

This report aims to provide the following:

- A review of the existing site investigation information
- Recommendations for further investigation and sampling
- Recommendations for construction phase and future use
- Assessment and provision of case to support our recommendations

Previous site investigations identified the presence of asbestos on this site both in the remaining office buildings and as a contaminant in the ground. Asbestos is present mainly as free fibre but also in bitumen products, board and lagging materials.

The asbestos is present as Chrysotile and /or Amosite and the highest proportion in the results to date was quantified at 0.006%.

Exposure to airborne soil dust and asbestos fibres was estimated for various construction activities using the Advanced Reach Tool (ART). The potential exposure to airborne fibre arising from the proposed works is associated with a predicted cancer risk of less than 1 in 100,000.

Exposures and risk during residential occupation of the site or for neighbours to the construction site are expected to be lower again.

In order to minimise exposure of workers and the local community during site works, measures should be in place to prevent airborne dust emissions and associated nuisance arising from site work. The recommended measures should prevent uncovered soil drying out, wind pick up of dust and mud being spread onto the local road network.

POTENTIAL FOR EXPOSURE DURING REDEVELOPMENT

The absence of significant quantities of asbestos containing materials or substantial quantities of dispersed fibre in soil at the site means that airborne dust released during disturbance of this soil is unlikely to have substantial respirable asbestos fibre content.

The workers directly involved in redeveloping the site the most likely group to be exposed to airborne asbestos released during operations involving



active disturbance of soil on this site. The highest exposures to airborne fibre are likely to arise during materials transfer operations such as excavating soil and transferring it to a truck. It should, however, be possible to control exposures to a low level through the application of appropriate working methods as described in the recommendations below.

During the redevelopment process, concentrations of airborne fibre on site are very unlikely to, even sporadically, exceed the workplace control limit of 0.1 f/ml or even the 0.01 f/ml clearance indicator (used to determine when buildings can be re-occupied after asbestos works). Average fibre concentrations are likely to be well below 0.01 f/ml, provided that appropriate dust control measures are in place. It will be of particular importance to ensure that soil is not allowed to dry out. (see recommendations).

Offsite exposure to airborne fibre during redevelopment of this site based on results to date would be anticipated to be extremely low and well below the detection limit of available measurement methods, provide adequate measures are in place to prevent significant off-site dust nuisance occurring.

Due to the low levels of asbestos containing materials that have been identified to date on this site in our opinion the target on-site concentration of asbestos in air during remediation works should be the clearance indicator level of 0.01fibres/ml and ideally dust levels should be controlled to maintain concentrations well below this level.

POTENTIAL FOR EXPOSURE SUBSEQUENT TO REDEVELOPMENT

Following redevelopment of the site, exposure to airborne asbestos is unlikely as the ground will be covered with clean soil to a minimum depth of 0.6m. Unless there is active disturbance of the soils at depths of greater than 0.6m e.g. workers involved in occasional activities such as installing or repairing buried services could be intermittently exposed to low concentrations of asbestos. It should be possible to control these exposures to an extremely low level by ensuring that appropriate precautions are in place whenever such works are performed (see recommendations below).

Where areas of soft landscaping are proposed, the underlying soil would need to be capped with a layer of clean material, preferably with a barrier between the clean soil and underlying contaminated material in areas where asbestos is present at levels >0.001%. The depth of clean soil required would depend on the nature of any planned planting but would need to be sufficient to accommodate the root systems of plants once they have reached maturity.



RECOMMENDATIONS

During redevelopment

The following measures are likely to be appropriate during the redevelopment work:

- Workers have appropriate asbestos awareness training, know the control measures they must employ and understand the importance of implementing these control measures;
- Workers must be made aware that although the quantities of asbestos identified to date are low there may be a possibility that significant asbestos materials may be encountered during remediation;
- Soil is maintained in a damp condition throughout works;
- Drop heights kept to a minimum during materials transfer operations;
- Traffic across the contaminated soil is minimised;
- Any soil that cannot be accommodated within the excavation must be tested to ensure it is disposed of to the correct waste stream;
- A bootwash is employed with no exit from the working area with dirty footwear;
- Vehicle/plant wheels are washed on exit from the working area;
It is unlikely that workers will be required to use respiratory protection (P3 filter) when involved in operations that involve direct handling of soil or if present in the vicinity of these operations but this may change during the works if significant ACMs are encountered;
- It may be prudent to have a watching brief for asbestos during the main excavating works as a precaution;
- Reassurance monitoring including personal samples on operatives involved in earth moving operations and fixed point samples from the site boundary.

A minimum of 0.6m of clean soil (asbestos content <0.001%) will be placed across the Llanwern site. Soil will be screened and, if asbestos contamination is less than 0.02% (200ppm) in the soil, that soil may be used in residential areas; and if the asbestos contamination is less than 0.03% (300ppm), the soil may be used in commercial areas.

Long term management of the site

As significant quantities of asbestos have not been identified to date, in our opinion there is no requirement to inform the site occupiers. If however the status changes during the works this will need to be given consideration depending on what is encountered and the levels that may be present.



1 INTRODUCTION

1.1 BACKGROUND

The site is part of the former Tata (previously Corus) steelworks at Llanwern, Newport, Wales.

It is located approximately 3km from the centre of Newport, South Wales and occupies 240 hectares.

It is being developed in stages where residential plots, services and access are constructed as required. The development occupies an area of approximately 240 hectares.

It is bounded to the north by the Swansea to London mainline railway track, to the east by Tata's remaining steel processing operations and to the south by a road (Queen's Way).

From the information provided construction of the steelworks commenced in 1958 and began with raising of site levels using imported materials. Major additions to the plant layout took place in 1971-1975 periods and it appears that the site was set out in the following way, process areas covered the central and eastern areas of the site, the materials stockyards were sited within the western end of the site which included the administrative headquarters block.

From the various ordnance survey maps provided the site was green field up to 1965, then a 1967 map shows buildings to the north west of the site and also to the south of the site mainly towards the west end. A map published in 1973 shows the presence of the office block on the west side of the site. Across the rest of the site there are small individual stand-alone buildings or structures which appear to date from 1967 also. From these dates, the former use of the site as a steelworks with associated facility buildings and our knowledge of the history of asbestos use in the UK and it is highly likely that asbestos containing materials were used on this site. In the main the buildings are now demolished and there is an element of asbestos contamination within the soil.

The phase 1 development has been sub-divided into 3 areas, Gateway and Landscaping, Western Park and the Persimmon Housing development. The housing works are on-going with many of the houses already constructed and some are occupied. To the west of phase 1 there are a few remaining buildings which we understand will be subjected to asbestos removal prior to demolition.

The purpose of this report is to review the sampling data associated with this site and then to provide a target for the remediation of the site prior to the development and also to look at the risks associated with the soils that remain or are reused on site in relation to asbestos only.



The site (Fig. 1.1) is to be redeveloped as residential accommodation and associated facilities with Western Park (western lakes and parkland) and Gateway and Landscaping (roads, footways, cycle ways and western ponds) following Phase 1 housing works.



Figure 1.1: Location of site, Llanwern, Newport

The red line demarcates the site boundary with the blue line indicating phase 1.

1.2 AIMS

The aim of this report is to:

- Review the existing site investigation information
- Provide recommendations for further investigation and sampling
- If required undertake further investigation and sampling
- Review results and recommendations for construction phase and future use
- Assess and provide a case to support our recommendations and provide

IOM were provided with the following documentation:

- Appendix A Notice of Decision from Newport City Council, Application No. 06/0471, decision date 01/04/2010, Granted with conditions
- Appendix B Landmark Envirocheck Report
 - B1 – 2009 Envirocheck report
 - B2 – 2002 Envirocheck historical maps



- Appendix C Exploratory Logs
 - Gateway and Landscaping
 - Western Park
- Appendix D Laboratory testing summary sheets
- Appendix E DETR Risk Classification
- Appendix F Open spaces technical note
- Appendix G Gas monitoring
- CD data
- Hawk asbestos tests
- 5111373-LLA-OUT-0005_FINAL for ISSUE May 13 ALL
- 5111373-LLA-OUT-0007_FINAL DRAFT 050213
- Appendices from 5111373-LLA-OUT-0007_FINAL DRAFT 050213
- Glan Llyn Phases 2a 2e Geo Env Interpretive Report Final v2

1.3 SITE VISIT AND DESCRIPTION

A site visit was undertaken on the 25th June 2013 to gain an understanding of the site, its dimensions and the asbestos issues associated with the site. A selection of photos showing various aspects of the site follows:



West of site showing existing office block



East of site showing area where landscaping is proposed





Monks ditch towards East side of site
with Phase 1 visible in the distance



View across made ground with Phase
1 visible in distance



Perimeter fence to south of site

Figure 1.1: Photographs taken during site visit on 25 June 2013

2 METHODS

2.1 RISK ASSESSMENT

The risk assessment process involved establishing the likely levels of worker and off-site exposure to airborne asbestos fibre during remediation work on the basis of the nature and quantity of asbestos and ACMs present on site. The likely level of exposure associated with remediation was assessed on the basis of published information about dust and fibre exposure and the potential of soils to release fibres, taking account of soil type (likelihood of drying out) and climate (frequency of dry weather, particularly during the summer). The Advanced REACH Tool (ART) was used to model personal exposure to airborne dust during different activities likely to be undertaken during site remediation such as working with an excavator or as a ground worker. The prediction of asbestos concentrations in air was undertaken following established IOM procedures. In recent years we have reviewed



published dust and asbestos in air concentrations and established relationships between ground contamination, airborne dust and airborne asbestos concentrations. These relationships are continually updated as more published measurement data become available and as we increase our own measurement data base. An assessment was also made of the potential for offsite exposure.

The estimated exposures were assessed against the workplace control limit for asbestos (0.1fibres/ml) and also the clearance limit (the concentration of fibres in air at which re-occupation of a building following asbestos works is permitted which is 0.01fibres/ml).

3 REVIEW OF SAMPLE RESULTS FROM SITE INVESTIGATION

3.1 SITE CONDITIONS

From the borehole and trial pit logs, the site appears to be comprised of made ground incorporating sandy gravel, bricks, concrete, slag, sandstone and topsoil with elements of tarmac, clinker, mudstone, burnt stone and cobbles at depths of 1.5-2.5m across the site.

Table 3.1: Summary of sample analysis

Sample ref	Sample location	date	analysis	in fines	form	%
SP1	6N Area B2 SP1	03/08/2012	Chrysotile		lagging	<0.001
SP2	6N Area B2 SP2	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	<0.001
SP3	6N Area B2 SP3	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.003
SP4	6N Area B2 SP4	03/08/2012	Chrysotile	Amphiboles	Lagging & bitumen	0.006
SP5	6N Area B2 SP5	03/08/2012	Chrysotile		lagging	0.003
SP6	6N Area B2 SP6	03/08/2012	Amosite	Amphiboles	free fibres	0.002
SP7	6N Area B2 SP7	03/08/2012	Chrysotile	Amphiboles	free fibres	0.002
SP8	6N Area B2 SP8	03/08/2012	Chrysotile	Amphiboles	Lagging & bitumen	0.002
SP9	6N Area B2 SP9	03/08/2012	Chrysotile		free fibres	<0.001
SP10	6N Area B2 SP10	03/08/2012	Chrysotile	Amphiboles	free fibres & lagging	<0.001
SP11	6N Area B2 SP11	03/08/2012	Chrysotile & Amosite	Amphiboles	free fibres	<0.001
SP12	6N Area B2 SP12	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.002



Sample ref	Sample location	date	analysis	in fines	form	%
SP13	6N Area B2 SP13	03/08/2012	Chrysotile & Amosite	Amphiboles	free fibres & bitumen	0.003
SP14	6N Area B2 SP14	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.002
SP15	6N Area B2 SP15	03/08/2012	Chrysotile		free fibres & bitumen	0.002
NL 3981- 16/3	Stockpile	18/03/2013	NAD			
NL 3981- 16/4	Stockpile	18/03/2013	NAD			
NL 3981- 16/5	Stockpile	18/03/2013	NAD			
NL 3981- 16/6	Stockpile	18/03/2013	NAD			
NL 3981- 16/7	Stockpile	18/03/2013	NAD			
NL 3981- 17/2	Stockpile	18/03/2013	Chrysotile & Amosite		free fibres	0.001
NL 3981- 17/3	Stockpile	18/03/2013	NAD			
NL 3981- 17/4	Stockpile	18/03/2013	NAD			
NL 3981- 17/5	Stockpile	18/03/2013	Chrysotile & Amosite		board	0.004
NL 3981- 17/6	Stockpile	18/03/2013	Chrysotile & Amosite		board	0.001
NL 3981- 25/1	SP1 retest	23/04/2013	NAD			
NL 3981- 25/2	SP2 retest	23/04/2013	NAD			
NL 3981- 25/3	SP3 retest	23/04/2013	NAD			
NL 3981- 25/4	SP4 retest	23/04/2013	NAD			
NL 3981- 25/5	SP5 retest	23/04/2013	NAD			
NL 3981- 25/6	SP6 retest	23/04/2013	NAD			
NL 3981- 25/7	SP7 retest	23/04/2013	NAD			
NL 3981- 25/8	SP8 retest	23/04/2013	NAD			
NL 3981- 25/9	SP9 retest	23/04/2013	NAD			
NL 3981- 25/10	SP10 retest	23/04/2013	NAD			
NL 3981- 25/11	SP11 retest	23/04/2013	NAD			
NL 3981- 25/12	SP12 retest	23/04/2013	NAD			



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Sample ref	Sample location	date	analysis	in fines	form	%
NL 3981-30/1	Stockpile (Disturbed)	14/05/2013	Chrysotile		free fibres	<0.001
NL 3981-30/2	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/3	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/4	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/5	Stockpile (Disturbed)	14/05/2013	Chrysotile		free fibres	<0.001
NL 3981-30/6	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/7	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/8	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/9	Stockpile (Disturbed)	14/05/2013	NAD			
NL 3981-30/10	Stockpile (Disturbed)	14/05/2013	NAD			
CL/1264518	6N 14/05/12 B2 1	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264519	6N 14/05/12 B2 10	29/05/2013	Chrysotile	Amphiboles	bitumen	0.002
CL/1264520	6N 14/05/12 B2 11	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001
CL/1264521	6N 14/05/12 B2 12	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264522	6N 14/05/12 B2 13	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264523	6N 14/05/12 B2 14	29/05/2013	Chrysotile	Amphiboles	lagging	0.003
CL/1264524	6N 14/05/12 B2 15	29/05/2013	Chrysotile	Amphiboles	free fibres & lagging	<0.001
CL/1264525	6N 14/05/12 B2 2	29/05/2013	Chrysotile	Amphiboles	free fibres, bitumen & entrapped free fibres	0.001
CL/1264526	6N 14/05/12 B2 3	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001
CL/1264527	6N 14/05/12 B2 4	29/05/2013	Chrysotile	Amphiboles	bitumen	0.001
CL/1264528	6N 14/05/12 B2 5	29/05/2013	Chrysotile		free fibres	0.003
CL/1264529	6N 14/05/12 B2 6	29/05/2013	Chrysotile	Amphiboles	free fibres & bitumen	0.001
CL/1264530	6N 14/05/12 B2 7	29/05/2013	Chrysotile	Amphiboles	free fibres & lagging	0.002
CL/1264531	6N 14/05/12 B2 8	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001



Sample ref	Sample location	date	analysis	in fines	form	%
CL/1264532	6N 14/05/12 B2 9	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001
OSTP3	Made ground, WP & Southern Landscaping		No fibre present			
OSTP9	Made ground, WP & Southern Landscaping					
OSTP9	Made ground, WP & Southern Landscaping		No fibre present			
OSTP14	Made ground, WP & Southern Landscaping					
BH231	Made ground, WP & Southern Landscaping					
BH232	Made ground, WP & Southern Landscaping		NAD			
BH235	Made ground, WP & Southern Landscaping					
BH235	Made ground, WP & Southern Landscaping					
BH236	Made ground, WP & Southern Landscaping		NAD			
BH237	Made ground, WP & Southern Landscaping					
TP247	Made ground, WP & Southern Landscaping		NAD			
TP249	Made ground, WP & Southern Landscaping		NAD			



Sample ref	Sample location	date	analysis	in fines	form	%
TP250	Made ground, WP & Southern Landscaping		NAD			
TP252	Made ground, WP & Southern Landscaping		NAD			
TP255	Made ground, WP & Southern Landscaping					
TP256	Made ground, WP & Southern Landscaping					
TP257	Made ground, WP & Southern Landscaping					
TP268	Made ground, WP & Southern Landscaping					
TP270	Made ground, WP & Southern Landscaping					
TP273	Made ground, WP & Southern Landscaping					
TP311	Made ground, WP & Southern Landscaping					
TP312	Made ground, WP & Southern Landscaping					
TP312	Made ground, WP & Southern Landscaping					
TP313	Made ground, WP & Southern Landscaping					



Sample ref	Sample location	date	analysis	in fines	form	%
TP314	Made ground, WP & Southern Landscaping					
TP315	Made ground, WP & Southern Landscaping					
TP320	Made ground, WP & Southern Landscaping					
TP322	Made ground, WP & Southern Landscaping					
TP323	Made ground, WP & Southern Landscaping					
ATADTP6	Made ground, Gateway & Landscaping					
TP232	Made ground, Gateway & Landscaping		NAD			
BH224	Made ground, Gateway & Landscaping					
BH225	Made ground, Gateway & Landscaping					
BH246	Made ground, Gateway & Landscaping					
TP238A	Made ground, Gateway & Landscaping					
TP 267	Made ground, Gateway & Landscaping					
BH244	Made ground, Gateway & Landscaping					
TP403	Made ground, Gateway & Landscaping					

Table 3.1 shows that a total of 100 samples have been taken across this site. Out of the 100 samples 35 contained asbestos as Amosite and/or



Chrysotile. The asbestos was found in the form of free fibre, bitumen, lagging, board and mixtures of these products.

Of the 35 samples quantification shows that just over 1/3 were <0.001% and this increases to 80% up to 0.002% with the remaining 20% between 0.003-0.006%.

21 samples had asbestos contents greater than or equal to 0.001% with the highest recorded at 0.006%.

A detailed breakdown is shown in the tables that follow:

Table 3.2: Summary of samples with % asbestos

%	Number of samples
<0.001	12
0.001	8
0.002	8
0.003	5
0.004	1
0.005	0
0.006	1
Total	35

Table 3.3: Summary of samples showing asbestos form

Asbestos form	Number of Samples
Free fibre	15
bitumen	2
Lagging	3
board	2
Lagging & bitumen	1
Free fibre & Lagging	3
Free fibre & bitumen	8
Free fibre & bitumen & Entrapped free fibres	1
Total	35

Table 3.4: Summary of samples showing asbestos type

Asbestos form	No of samples
Chrysotile	3
Amosite	1
Both	19
Total	23



3.2 CONCENTRATIONS OF ASBESTOS IN SOIL

Table 3.5 shows the types and quantities of ACM and asbestos found in the samples based on the information provided. From these results it appears that there are not significant quantities of ACM present on this site. More detail is required on where the samples have been taken to understand whether there is sufficient sampling to cover the site and thus ensure the recommendations are appropriate.

The average soil asbestos content is unlikely to exceed 0.01% based on the results to date and there does not appear to be significant ACMs present at surface.

The majority of the samples with asbestos have free fibre present albeit sometimes with bitumen or other ACM. Both board and lagging was noted in about 9% of the total samples taken.

Table 3.5: Summary of sample analysis

Sample ref	Sample location	date	analysis	in fines	form	%
SP1	6N Area B2 SP1	03/08/2012	Chrysotile		lagging	<0.001
SP2	6N Area B2 SP2	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	<0.001
SP3	6N Area B2 SP3	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.003
SP4	6N Area B2 SP4	03/08/2012	Chrysotile	Amphiboles	Lagging & bitumen	0.006
SP5	6N Area B2 SP5	03/08/2012	Chrysotile		lagging	0.003
SP6	6N Area B2 SP6	03/08/2012	Amosite	Amphiboles	free fibres	0.002
SP7	6N Area B2 SP7	03/08/2012	Chrysotile	Amphiboles	free fibres	0.002
SP8	6N Area B2 SP8	03/08/2012	Chrysotile	Amphiboles	Lagging & bitumen	0.002
SP9	6N Area B2 SP9	03/08/2012	Chrysotile		free fibres	<0.001
SP10	6N Area B2 SP10	03/08/2012	Chrysotile	Amphiboles	free fibres & lagging	<0.001
SP11	6N Area B2 SP11	03/08/2012	Chrysotile & Amosite	Amphiboles	free fibres	<0.001
SP12	6N Area B2 SP12	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.002
SP13	6N Area B2 SP13	03/08/2012	Chrysotile & Amosite	Amphiboles	free fibres & bitumen	0.003
SP14	6N Area B2 SP14	03/08/2012	Chrysotile	Amphiboles	free fibres & bitumen	0.002



Sample ref	Sample location	date	analysis	in fines	form	%
SP15	6N Area B2 SP15	03/08/2012	Chrysotile		free fibres & bitumen	0.002
NL 3981- 17/2	Stockpile	18/03/2013	Chrysotile & Amosite		free fibres	0.001
NL 3981- 17/5	Stockpile	18/03/2013	Chrysotile & Amosite		board	0.004
NL 3981- 17/6	Stockpile	18/03/2013	Chrysotile & Amosite		board	0.001
NL 3981- 30/1	Stockpile (Disturbed)	14/05/2013	Chrysotile		free fibres	<0.001
NL 3981- 30/5	Stockpile (Disturbed)	14/05/2013	Chrysotile		free fibres	<0.001
CL/1264518	6N 14/05/12 B2 1	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264519	6N 14/05/12 B2 10	29/05/2013	Chrysotile	Amphiboles	bitumen	0.002
CL/1264520	6N 14/05/12 B2 11	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001
CL/1264521	6N 14/05/12 B2 12	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264522	6N 14/05/12 B2 13	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264523	6N 14/05/12 B2 14	29/05/2013	Chrysotile	Amphiboles	lagging	0.003
CL/1264524	6N 14/05/12 B2 15	29/05/2013	Chrysotile	Amphiboles	free fibres & lagging	<0.001
CL/1264525	6N 14/05/12 B2 2	29/05/2013	Chrysotile	Amphiboles	free fibres, bitumen & entrapped free fibres	0.001
CL/1264526	6N 14/05/12 B2 3	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001
CL/1264527	6N 14/05/12 B2 4	29/05/2013	Chrysotile	Amphiboles	bitumen	0.001
CL/1264528	6N 14/05/12 B2 5	29/05/2013	Chrysotile		free fibres	0.003
CL/1264529	6N 14/05/12 B2 6	29/05/2013	Chrysotile	Amphiboles	free fibres & bitumen	0.001
CL/1264530	6N 14/05/12 B2 7	29/05/2013	Chrysotile	Amphiboles	free fibres & lagging	0.002
CL/1264531	6N 14/05/12 B2 8	29/05/2013	Chrysotile	Amphiboles	free fibres	<0.001
CL/1264532	6N 14/05/12 B2 9	29/05/2013	Chrysotile	Amphiboles	free fibres	0.001



Table 3.6: Summary statistics for soil samples

Parameter	% Asbestos in soil
Range	<0.001- 0.006
Mean	0.002
Standard deviation	0.001
Median	0.0035
10 th percentile	0.001
90 th percentile	0.003

Summary of information about site wide levels of asbestos contamination

Overall it can be noted that the quantities of asbestos detected were generally low or very low and for a site with the known industrial historic usage it is not unexpected that some asbestos would be found. Although asbestos in the form of free fibre is present, it is not in sufficient quantities to be considered to represent gross asbestos contamination.

If the 12 samples with asbestos detected at less than the detection limit (of 0.001%) are assumed to have an average content of 0.0005%, then the overall average content of asbestos over the 100 samples would be 0.001%. If we assume this indicates the average asbestos content in soil on the site, then that gives a basis for estimating the average asbestos concentration in air if the concentration of soil dust is at levels considered typical of various activities.

4 EXPOSURE ASSESSMENT

4.1 CIRCUMSTANCES POTENTIALLY LEADING TO EXPOSURE

4.1.1 Overview

This chapter describes the predicted exposure to asbestos associated with the following scenarios:

- Current remediation works;
- Future remediation works
- Current construction works – residential accommodation;
- Future construction works;
- Future occupancy of residential accommodation and associated leisure areas e.g. parkland

The receptors and scenarios for which exposure modelling has been conducted are described below.



4.1.2 Site Activities

The remediation works are still to commence, apart from Phase 1 works (undertaken by others) which is on-going. We assume there will be major excavation and piling works programmed for this site. We also assume this will include many of the following activities

- Movement of materials & soils across the site
- Excavation works
- Stockpiling of materials
- Soil treatment work

Alongside these will be further investigation work, trial pits and boreholes. The remediation works also included asbestos removal/demolition of existing buildings (office accommodation) on west of site which was completed in September 2013.

Many of the main activities will involve the use of machinery so the receptors will be located within the machine cabs. There will however be ground workers working adjacent to the mechanised activities and so must be considered when assessing exposure levels.

4.1.3 Construction of New Development

Workers involved in site redevelopment could be exposed to airborne asbestos during any activity involving disturbance of dry soil, if and where the soil contains asbestos.

4.1.4 Occupants of New Residential Accommodation

Once the site has been redeveloped, there will be no exposure to asbestos from soils that are under new buildings or under hard-standing under normal circumstances. We assume there will be cover with clean soil in the gardens to a depth of 0.5 - 1.0m. The layer of clean top soil will be generally effective as a barrier unless there is some future digging that goes down deeper than this top soil layer, for example if ground were excavated for a pond, an extension or a conservatory. Where there is ground cover to a depth of between 0.6m and 1m, it is unlikely that the underlying material would ever be disturbed by this type of work but if it is then the arisings would be a mixture of the clean surface cover soil and soil that may contain 0.001% asbestos so is likely to be less than 0.0001%.

As the house construction is taking part in phases there will be periods before all the construction has been completed when residents will be occupying new accommodation completed on part of the site and would therefore be present while part of the site is still being constructed. In effect, the new residents will be "neighbours" to an area the construction process.

In summary, once the site has been completed, almost all residents will have no exposure to asbestos.



4.2 FACTORS AFFECTING POTENTIAL EXPOSURE TO ASBESTOS

4.2.1 Quantity and type of asbestos

The quantity, type of asbestos and type of ACM have a substantial impact on the potential for fibre release from soil. The soils at this site are not heavily contaminated with asbestos and the majority of soil samples analysed did not contain detectable quantities of asbestos. However, where asbestos was detected, it was in the form of free fibres that would be relatively readily released on the disturbance of dry soil.

From a total of 100 samples, only 23 contained asbestos above 0.001%. The highest was 0.006%. Most samples were described as being free fibre or free fibre with other ACM. We will assume therefore that the asbestos is in the form of free fibre. When asbestos is in the form of free fibres there is a greater potential for airborne fibre release during disturbance of soils. As described above (section 3.3), the results from all 100 samples indicate an average soil asbestos content of about 0.001%. This value is used in our risk assessment.

We are not aware of the presence of ACMs on the soil surface but the average asbestos content in material near the surface is likely to be less than 0.001%, such that the potential exposure to airborne fibre associated with disturbance of these materials would be less than predicted below.

4.2.2 Moisture

Moisture is an extremely important determinant of the extent of potential dust and fibre release from soils. The presence of even a small amount of moisture severely inhibits dust and fibre release. Swartjes et al (2003) reported that the results of experiments undertaken by the Dutch research organisation TNO demonstrated that a soil moisture content of 5-10% reduced airborne fibre concentrations by a factor of 100. Addison et al (1988) reported that a soil moisture content of 5-10% reduced fibre emissions by a factor of ≥ 10 .

The moisture content of soil depends on a range of factors including climate (rainfall versus evaporation/transpiration), vegetation cover, soil type and organic content and depth. Typically, in the UK, rainfall exceeds evaporation of soil water for most of the year and therefore during most of the year, soils have significant moisture content. During dry weather, especially warm dry weather with sunshine to dry the surface layer, there is likely to be dry surface soil. A succession of dry days can lead to a deeper layer of dry soils. Soil spilt onto hard surfacing (patios, paths, hard tracks) can dry relatively quickly. The number of dry days, particularly during summer, is a good indication of how often there is likely to be scope for dust to be dispersed from dry soils.



On this site, the end use will have hard-standing or turf covering the site out with the building footprints; the presence of this surface cover will protect the underlying soil from moisture loss.

4.2.3 Soil type

Soil type plays an important role in determining the likelihood that soils may dry out and potentially release fibres. Well drained sandy soils are more likely to dry out and will dry out to a greater depth than clay and/or organic rich soils. In addition, clays and organic matter help to trap fibres within the soil structure and therefore reduce the potential for fibre release. The soils at this site include a substantial component of made ground and have very variable textures ranging from clay, through sandy, gravelly clays to sands and gravels.

4.2.4 Soil disturbance

Disturbance of soil leading to the generation of airborne dust cloud is an important influence on fibre release, if free fibre is present in soil. Generation of airborne dust will usually be as a result of human activity, but wind can also be important for uncovered soils that have a relatively low clay and/or organic content and are prone to drying out, both in drying the soil and in creating windblown dust.

4.2.5 Surface cover

There is no potential for fibre release from soil beneath buildings. There is also no potential for fibre release from soil under hard standing or from soil below the top few decimetres during normal circumstances, although it is foreseeable that these buried soils may be occasionally uncovered and disturbed. The presence of vegetation greatly reduces the potential for soil disturbance by human activities, animals or the weather leading to low potential for fibre release, particularly from underneath well-established turf.

4.2.6 Climate

Soils are most prone to drying out in dry weather during the summer months when drying can be produced by sunshine, warmth and wind. In the UK, winter conditions give low evaporation rates so that soils generally remain damp during the winter months.

A summary of typical weather for the region is given by the Met Office Website:

“Over much of Wales, the number of days with a rainfall total of 1 mm or more ('wet days') tends to follow a pattern similar to the monthly rainfall totals. In the higher parts, over 50 days is the norm in winter (December-February) and over 35 days in summer (June-August). In the driest areas of



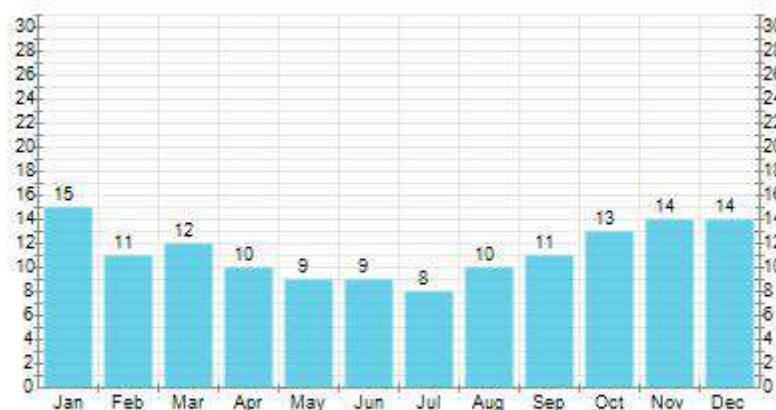
the east and south, about 40 days in winter and about 25 days in summer are typical.”

From this description, about 75 days have less than 1 mm of rainfall typically during the summer months of June to August.

A similar indication is obtained from a graph of numbers of days with rainfall (recorded at Newport), obtained from http://www.yr.no/place/United_Kingdom/Wales/Newport/statistics.html

The graph shows average amount of days (24h) with precipitation during a month. When precipitation has surpassed 1mm per day (24h) it is defined as a day with precipitation. The mean period is 1961–1990.

Average days with precipitation per month



This information enables the weather conditions to be taken into account in assessing the likely exposure to airborne dust and airborne asbestos. This winter however there have been much higher levels of rainfall than the averages measured over previous years so this will contribute to keeping soils moist.

4.3 RELATIONSHIP BETWEEN AIRBORNE DUST AND AIRBORNE FIBRE CONCENTRATIONS

4.3.1 Published information about airborne fibre concentrations associated with soil-borne asbestos.

There are two main sources of published information on concentrations of asbestos in air from soils containing asbestos. Studies undertaken by the Dutch regulatory authorities are described first but we also refer to laboratory studies undertaken by Addison et al (1988) who measured both the asbestos in air concentration and the soil dust in air concentration. That



provides a basis for using the likely soil dust in air concentration as a basis for predicting the likely average asbestos in air concentration.

4.3.2 From reports by the Dutch authorities

The most extensive set of studies has been undertaken by the Dutch regulatory authorities (Swartjes and Tromp, 2008; Swartjes et al, 2003). They presented both laboratory studies and field measurements of fibre in air concentrations from sources with measured asbestos in soil concentrations that ranged from 10 mg/kg (0.001%) to about 1000,000 mg/kg (=100%), i.e. a 100,000 fold range. They had data for three conditions:

- Friable asbestos in soil, measured in laboratory tests;
- Friable asbestos in soil, in field measurements; and
- Bound asbestos (e.g. asbestos cement), in field measurements (note that the definition of “bound” in this Dutch study is very different from that used by the HSE in, for example, bound insulation).

Their field measurements included concentrations during activities such as digging, sorting etc. Figure 4.1 summarises the results of their study. The first two conditions (i.e. friable asbestos in soils) showed concentrations of fibres in air rising with asbestos in soil concentrations by about 1000 fold for the 100,000 fold range in asbestos-in-soil concentrations, with a 10 fold increase in asbestos in soil producing about a 4 fold increase in asbestos in air concentration.

Field measurements of fibre concentrations were consistently lower than those reported in experimental studies, but the extent of dilution is controlled within the experimental studies. The fact that there is a consistently similar trend of fibre concentration in air increasing with asbestos in soil concentration is the important comparison.

The field measurements are a compilation of results, so that the variation in the data is not surprising, and would be attributed to variations in sampling and environmental condition. Furthermore, it is not clear whether these field measurements are representative of the personal exposure of an individual disturbing the soil or merely represent the concentrations arising in relatively close proximity to activities causing soil disturbance. As an example, a soil concentration of 0.01% (100 mg/kg) gave average concentrations of asbestos fibres in air of about 0.005 f.ml⁻¹ (5000 f.m⁻³) in laboratory experiments, whereas the field measurements gave average asbestos fibre in air concentrations of about 0.0002 f.ml⁻¹ (200 f.m⁻³).

With tightly bound asbestos (e.g. asbestos cement), asbestos-in-soil concentrations up to 1% gave no detectable asbestos fibres in air.

The Dutch authors concluded that:

- The release of fibres from the matrix into the soil is less for more durable materials (i.e. less likely to release fibres);



- There is less release for chrysotile than for amosite for each type of matrix – which appears consistent with the physical properties of the two types of asbestos, but may also be linked to the concentrations of asbestos in the matrix (e.g. if amosite was used in higher concentrations than chrysotile in the type of matrix).

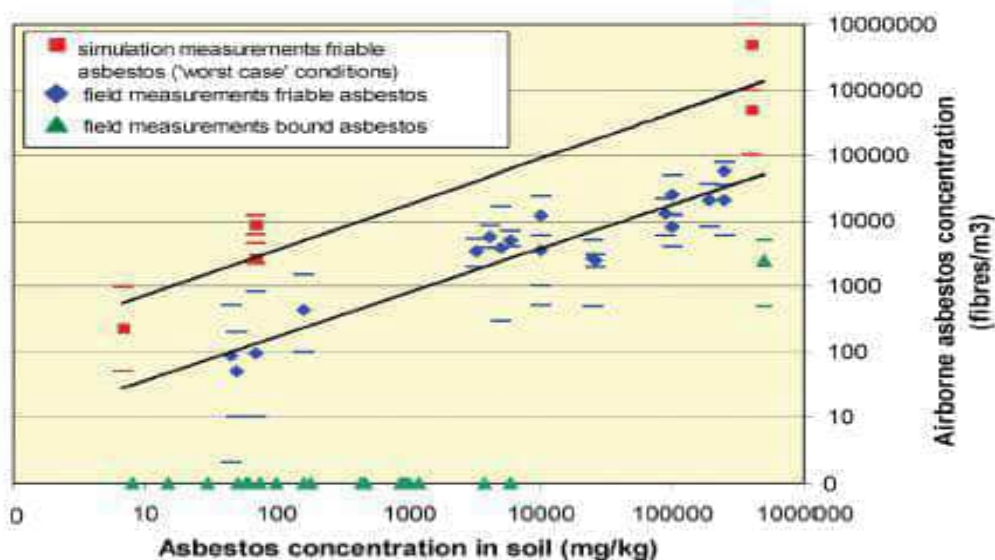


Figure 4.1: Graph reproduced from Swartjes and Tromp (2008). The ▲◆■ symbols are the average concentrations from “comparable” measurements, the horizontal bars are the 95% confidence intervals. 1 f.ml-1 = 106 f.m-3; 0.01% in soil = 1000 mg/kg.

4.3.3 From results reported by Addison et al (1988)

Discussion and explanation of the Addison et al results

Addison et al (1988) undertook a series of simulation experiments in which they measured the concentrations of airborne fibre released from three soil types: sand, clay and a mixed soil (approximately a loam). Known quantities of each of three types of asbestos were added to samples of each soil type. For this site, it is the results with amosite or chrysotile that are relevant. Addison et al (1988) recorded their results in terms of f.ml-1 per mg.m-3 respirable dust (Table 4.1). Fibre concentrations were determined by optical fibre counting and no distinction was made between asbestos and non-asbestos fibres.



Table 4.1: Normalised concentrations of airborne respirable fibre measured in experimental studies undertaken at IOM expressed as f.ml⁻¹ per mg.m⁻³ respirable dust (Addison et al, 1988).

asbestos in soil %	Normalised concentrations of airborne fibres relative to airborne soil dust concentration f.ml ⁻¹ per mg.m ⁻³ respirable dust						Blank corrected average*
	Sand		Loam		Clay		
	Amosite	Chrysotile	Amosite	Chrysotile	Amosite	Chrysotile	
No asbestos	0.03	0.03	0.005	0.005	0.01	0.01	-
0.001	0.04	0.01	0.04	0.01	0.01	0.02	0.007
0.01	0.15	0.17	0.05	0.03	0.02	0.02	0.058
0.1	0.39	0.40	0.13	0.06	0.11	0.07	0.178
1.0	3.56	3.78	1.56	1.74	0.88	0.84	2.045

*Average concentration across soil types and asbestos minerals after subtraction of the background

At the lowest concentrations of asbestos in soil, the results (in Fig. 4.2) appear to show anomalously high concentrations of airborne fibre (as measured by optical microscopy). The report by Addison et al included some Scanning Electron Microscopy (SEM) analysis which indicated that a high proportion (two thirds) of the airborne fibres counted for these samples (with the lowest asbestos in soil concentration) were not asbestos; this was reflected in the fibre concentration data reported for experiments with asbestos-free soil (shown in Table 4.1 above). In contrast, the airborne fibres counted for the higher asbestos in soil concentrations were predominantly asbestos. Therefore, the fibre to respirable dust ratios reported for the soils with 0.1 and 1.0% asbestos are representative of the asbestos concentrations whereas the fibre to respirable dust ratios reported for the lowest asbestos in soil concentration (0.001%) over-estimates airborne asbestos concentrations, probably by a factor of at about 10. The right hand column of Table 4.1 shows the average fibre concentrations as f.ml⁻¹/(mg.m⁻³) for each soil concentration after correction for the average background fibre concentration recorded when no asbestos was present in soil.



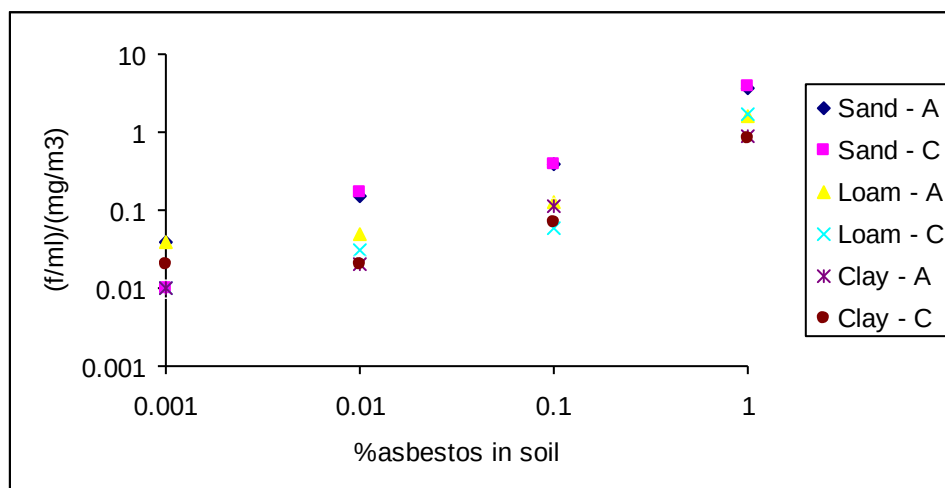


Figure 4.2: Relationship between normalised airborne fibre concentration relative to soil dust concentration plotted against the asbestos-in-soil concentration, reported by Addison et al (1988).
(In the key, A = amosite, C = chrysotile).

An approximate relationship between concentration of asbestos in soil (as a mass percentage) and the airborne concentration (in fibres/ml) can be expressed as f.ml⁻¹ per mg.m⁻³, (i.e. f.ml⁻¹ / mg.m⁻³).

The linear correlation between fibre in air concentration and asbestos in soil concentration is high, e.g. with a linear correlation coefficient >0.9.

The normalised fibre concentration as f.ml⁻¹/(mg.m⁻³) is approximately 3.63, 1.65 and 0.85 times the percentage of asbestos in soil for the sand, loam and clay, respectively. Pooled across all the soil types, the normalised fibre concentration is about 2 times the percentage of asbestos in soil.

The data (from Table 4.1) for the average concentration (after subtraction of the background) are shown in Figure 4.3 with a straight line fit forced through the origin.



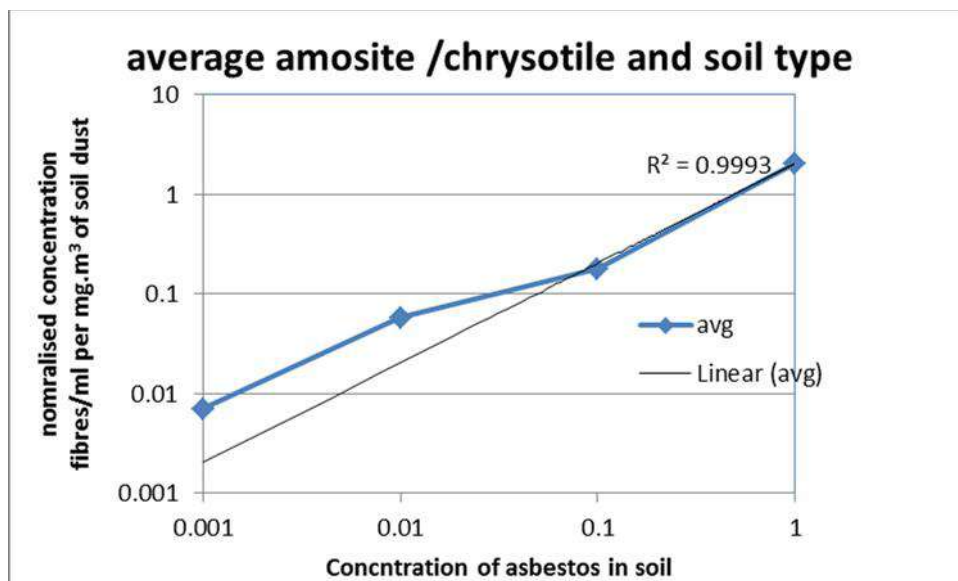


Figure 4.3: Relationship airborne fibre concentration normalised relative to airborne soil dust concentration plotted against the asbestos-in-soil concentration – using average values for amosite, chrysotile and three soil types (Table 4.1 data from Addison et al (1988)).

Application of the Addison et al findings to this site.

The discussion above provides a calibration from asbestos in soil concentration to normalised asbestos in air concentration (i.e. an asbestos in air concentration relative to the concentration of respirable soil dust in air).

For the average concentration of asbestos in soil at the level estimated from all the samples from this site of 0.001%, the normalised fibre in air concentration would be respectively 0.004, 0.002 and 0.001 f.ml-1 per mg.m-3 for sand, loam and clay respectively and 0.002 f.ml-1/(mg.m-3) for the pooled estimate. As the soil on this site is variable mixture, the pooled estimate is chosen.

The Addison et al experiments employed finely divided preparations of asbestos mixed in with the soil. On this site, the descriptions of asbestos in samples mostly reported free fibres. However, as noted above, 8 of the 23 samples containing quantifiable amounts of asbestos were described as bitumen, lagging or board. If some of the asbestos is bound into a matrix, then that would be expected to give rise to lower normalised fibre concentrations (fibres/ml per mg.m-3 of respirable soil dust) than would be the case if the fibres were all present as free fibres.

In summary, the Addison et al data appear relevant to the materials on this site, but it is possible that fibres in the soil on the site are less well dispersed into the soil than in the prepared soils used by Addison et al. The application of the Addison et al test results gives a realistic but



precautionary estimation of the average asbestos fibre in air concentrations for this site.

4.3.4 Estimated normalised asbestos fibre concentrations (relative to soil dust in air)

The concentrations of asbestos in soil on the site are variable but the estimate of the average value is based on the data from 100 samples from the site. The average concentrations in soils near the surface are likely to be lower than 0.001%. For the purposes of this risk assessment, it has been assumed that a mixture of soil types with an overall fibre content of 0.001% (as a worst case estimate) is present on site. Based on the Addison et al results, this concentration in soil would correspond to a normalised fibre in air concentration of 0.002 f.ml-1/(mg.m-3) respirable soil dust in air (as a worst case estimate).

4.3.5 Estimates of soil dust in air concentrations

If there is effective suppression of soil dust, then there will also be suppression of asbestos. However, the risk assessment has considered the exposures that would arise if the soil dust in air concentrations were of the order to be expected for the relevant activities on a construction site.

An appropriate approach to producing estimates of likely soil dust in air concentrations is the Advanced Reach Tool (ART), a web-based tool that is freely available for estimating likely exposures for a wide range of activities. The ART derived estimates of soil dust in air exposures provide the basis for using the normalised fibre concentrations from Addison et al.

4.3.6 The Advanced Reach Tool – estimation of soil dust in air concentrations

The Advanced REACH Tool (ART) (<http://www.advancedreachtool.com/>) is a higher tier exposure assessment tool that combines mechanistically modelled inhalation exposure predictions with available exposure data using a Bayesian approach. It was developed by a multinational team of occupational hygienists and is designed to aid exposure assessments required under by the REACH (Registration, Evaluation, Authorisation & restriction of CHEmicals) Regulations.

The ART model has not yet been developed to estimate fibre exposures but it can be applied to dusts and its algorithms can model personal exposure to inhalable dust associated with different activities.

Part of the information required as input to ART is an estimate of the relative amount of fine dust in the material being processed. From observations on site, the soil contains gravel and coarse material and appears likely to have a fines content of about 10%. This was the basis of making an assumption for the release of dust from the ART model.



The Advanced Reach Tool (ART) estimates exposure in terms of inhalable dust rather than respirable airborne dust. The inhalable fraction of airborne dust includes all particles that enter the respiratory system. The respirable fraction is a sub-fraction of the inhalable fraction. The Addison et al measurements compared fibres in air to concentrations of respirable soil dust in air and therefore a conversion from inhalable dust to respirable dust is needed.

4.3.7 Relationship between respirable and inhalable dust concentrations

In a review of agricultural exposures to soil dust, Schenker (2000) reported that typical concentrations of respirable dust were in the range 1-5 mg.m⁻³ whereas typical concentrations of total dust were ≥20 mg.m⁻³. This indicates that for soil dust the respirable dust concentration may be about 25% of the inhalable dust concentration.

For the purposes of this risk assessment, it is assumed that the respirable fraction of total inhalable dust is 25%.

4.4 ESTIMATED CURRENT ASBESTOS EXPOSURES FOR SITE REMEDIATION/ DEVELOPMENT WORKERS

4.4.1 Overview

Workers at this site may be exposed to soil-derived airborne dust when they are actively disturbing the soil, particularly during dry weather. Using suitable assumptions, the likely exposures to respirable soil dust were estimated for various activities, and then the associated asbestos exposure was derived based on the information of the average asbestos content in the soil. The estimated exposures are presented in terms of likely inhalable soil dust concentrations and then in terms of the likely asbestos in air concentrations.

We would expect that if soil dust exposure is minimised, (e.g. by damping down) and kept to a level less than estimated, then the exposures to asbestos will be less than derived from the modelling.

4.4.2 Site remediation / Development Activities considered

We considered the workers on the site during the present remediation and development work. We understand that most soil handling would be undertaken using a mechanical excavator. Some manual work may be involved but not significant earth moving by hand. Excavating a deep pit is likely to involve moving soil with significant moisture content which would reduce the likely release of dust or fibres. Therefore, it is sufficient to consider the excavator operator as part of general exposure estimation in moving soils on this site.



4.4.3 Predicted Exposures associated with Disturbing Soil

The Advanced Reach Tool (ART) is used to estimate exposure to soil dust.

The people potentially exposed to airborne asbestos fibre during the remediation works and/or the adjacent construction of the new residential accommodation on the site are listed in Table 4.3 with the assumptions made in the derivation of (soil dust) exposure estimates using ART.

Table 4.3: Assumptions made in exposure modelling using the ART

Activity	Assumptions made in exposure modelling
Operator of mechanical excavator	40 hour week, mixed particle size, cab windows closed, drop height >0.5 m, transferring >1 tonne minute, driver >4 m from dust source
Piling operator	40 hour week, drop height >0.5 m, piling, driver >4 m from dust source
Truck driver	1 hour/day, 10-50% fine dust in ground surface soil layer, vehicle windows part open, driver >4 m from dust source,
Construction worker	8 hour/day, 50% fine dust, >4 m from dust source, multiple vehicle movements – exposure <10% of that of ground worker
Ground worker	40 hour week, <4m from dust source

Using these assumptions Table 4.4 shows the predicted total inhalable soil dust concentrations for 5 types of worker.

Table 4.4: Concentrations of total inhalable soil dust (mg.m⁻³) predicted by the Advanced Reach Tool (ART) model for soil handling activities: median and (90th percentile)

Person	Activity	Inhalable soil dust concentrations predicted by ART model Median (and 90 th percentile) mg.m ⁻³					
		Dry soil		5-10 % moisture		>10 % moisture	
		5-10% fines	50-90% fines	5-10% fines	50-90% fines	5-10% fines	50-90% fines
Operator of mechanical excavator	Moving 100-1000kg	0.067 (0.76)	0.63 (7)	0.0067 (0.075)	0.063 (0.7)	0.00067 (0.0075)	0.0063 (0.07)
Truck driver	Transport of soils across or off site	0.067 (0.76)	0.63 (7)	0.0067 (0.075)	0.063 (0.7)	0.00067 (0.0075)	0.0063 (0.07)
Construction worker	Undertaking construction during remediation	0.34 (3.9)	3.2 (36)	0.034 (0.39)	0.32 (3.6)	0.0034 (0.039)	0.032 (0.36)
Ground worker	Ad-hoc hand digging	3.1 (35)	29 (320)	0.031 (3.5)	2.9 (32)	0.0031 (0.35)	0.29 (3.2)

The values predicted from the ART model indicate that the presence of moisture reduces dust substantially, and the degree of reduction is consistent with that reported by Addison et al for the effect of moisture in reducing concentrations of airborne asbestos released from soils.



A feature of the predicted values is that the 90th percentiles are approximately 11 times larger than the medians.

For the purposes of the risk assessment, it is assumed that the respirable fraction of total inhalable dust generated from the soils is 25%, although the actual proportion of respirable dust may be smaller.

4.4.4 Predictions of exposure to asbestos fibres derived from the ART model predictions of exposure to soil dust

Table 4.5 shows the predicted asbestos fibre concentrations based on the estimated inhalable dust concentrations shown in Table 4.4, based on an assumed respirable dust concentrations that is 25% of the inhalable dust concentrations and an average asbestos in soil asbestos concentration of about 0.001%. Table 4.5 represents the fibre in air concentrations that would arise if the soil dust concentrations are at the median values (estimated typical exposures) predicted using ART, assuming that no dust suppression was used. Table 4.6 shows estimated fibre concentrations based on the 90th percentile (reasonable worst case) estimates of exposure predicted using ART. Results are shown for the operator of a mechanical excavator, a truck driver, a construction worker and a ground worker.

Table 4.5: Predicted MEDIAN (90th PERCENTILE) concentrations of asbestos fibres (fibre.ml⁻¹), from median and 90th percentile predictions of concentrations of soil dust in air for dry soils and soil with moisture content.

Person	Activity	Predicted Median (and 90 th percentile) concentrations of asbestos fibres Fibre.ml ⁻¹					
		Dry soil		5-10 % moisture soil		>10 % moisture soil	
		5-10 % fines	50-90 % fines	5-10 % fines	50-90 % fines	5-10 % fines	50-90 % fines
Operator of mechanical excavator	Moving 100-1000kg	1.68E-05 (0.00019)	0.000158 (0.00175)	1.68E-06 (1.88E-05)	1.58E-05 (0.000175)	1.68E-07 (1.88E-06)	1.58E-06 (1.75E-05)
Truck driver	Transport of soils across or off site	1.68E-05 (0.00019)	0.000158 (0.00175)	1.68E-06 (1.88E-05)	1.58E-05 (0.000175)	1.68E-07 (1.88E-06)	1.58E-06 (1.75E-05)
Construction worker	Undertaking construction during remediation	0.000085 (0.000975)	0.0008 (0.009)	8.5E-06 (9.75E-05)	0.00008 (0.0009)	8.5E-07 (9.75E-06)	0.000008 (0.00009)
Ground worker	Ad-hoc hand digging	0.000775 (0.00875)	0.00725 (0.08)	7.75E-06 (0.000875)	0.000725 (0.008)	7.75E-07 (8.75E-05)	0.0000725 (0.0008)

The main feature of the results is that all the predicted exposure concentrations are extremely small. The model output also illustrates the importance of moisture in determining exposure levels. Providing the soil is damp or wet, then exposures to airborne asbestos fibre should remain <<<0.1fml⁻¹. In addition, the following features are apparent:



- the predicted concentrations of fibres in air are all much less than the Control Limit for asbestos (0.1 fibres/ml);
- the predicted median values are all much less than the clearance indicator (0.01 fibres/ml).

From Table 4.5, it is readily apparent that only one of the 90th percentile estimates exceeds the clearance indicator and this is for a ground worker working with dry soil with 50-90% fines which is a very unlikely scenario but yet again indicates the importance of keeping soils wetted. These values suggest that if sampling for airborne asbestos fibres had been undertaken, the measurements (of asbestos fibres) would have been less than the clearance indicator for the great majority of samples.

4.4.5 Comparison of modelled exposures to airborne fibre associated with site works with typical exposures to airborne fibre in urban environments

Asbestos is ubiquitous in the urban environment as a result of its former widespread use. This section summarises the information describing background levels of exposure to airborne asbestos fibre in the general or indoor or outdoor environment.

- The IEH (1997) reported that background outdoor (ambient) levels of respirable asbestos fibres may range from 0.000001 to 0.0001 fml-1 (1-100 f.m-3) and that most indoor air concentrations of asbestos are below 0.0002 f/ml, which rises to around 0.0005 f.ml-1 (500 fm-3) in buildings which contain asbestos in good condition.
- RIVM (2004) estimated that “for background houses”, asbestos levels in air are approximately 1×10^3 fibres per m³ (0.001f.ml-1).
- RIVM (2004) concluded that “Based on a hypothetical calculation, significant contribution of asbestos to house dust from asbestos contaminated soil may occur at soil concentrations greater than 100 mg/kg. To gain more insight into the contribution of exterior soil contamination to interior house dust contamination with asbestos, it is recommended to determine asbestos levels in house dust in houses adjacent to sites that are contaminated with asbestos above 1000 mg/kg for non-friable asbestos, and above 100 mg/kg for friable asbestos.”
- In a survey of airborne asbestos fibre concentrations in indoor air, Lee and Van Orden (2008) report that average indoor asbestos concentrations in US are 120f.m-3 for all buildings and 50f.m-3 for residential properties with a maximum of 4000 fm-3 reported in residential properties. Their study did not consider the possibility of any linkage to soil asbestos concentrations although they did compare indoor concentrations to outdoor concentrations. In an earlier paper, they concluded that their “results provide substantive



verification of the findings of the U.S. Environmental Protection Agency public building study which found very low ambient concentrations of asbestos fibers in buildings with ACM, irrespective of the condition of the material in the buildings”.

The modelled fibre concentrations that workers at the Llanwern site may have been exposed to are within the range of typical urban exposures. For that reason they would not be considered to represent a significant risk to health, although this is discussed in more detail in the following chapter.

4.5 PREDICTED CUMULATIVE ASBESTOS EXPOSURE DURING SITE REDEVELOPMENT

4.5.1 Estimations and assumptions for producing estimates of cumulative exposures to asbestos

The risks to health from exposure to asbestos are related to the cumulative exposure to asbestos. Cumulative exposure to asbestos is calculated as the concentration (fibres/ml) multiplied by the exposure duration (e.g. in hours) to give a cumulative exposure in fibre/ml.hours.

As noted earlier, the estimates of exposure are based on predicted levels of soil dust in air during activities that disturb dust. If necessary, the durations of such activities during the course of the day are taken into account. However, if we take the duration of such activities as being a full 8 hour day (except for driving a truck on site – where 1 hour per day appears much more appropriate), then the estimates will be precautionary. We also assume that work activities take place for 5 days per week, 48 weeks per year (240 days per year).

The summer of 2013 was a period with more than typical numbers of dry days and elevated temperatures and despite the greater than average rainfall over the winter months of 2013/4 if the summer of 2014 has a similar profile then it seems sensible to use the following assumptions for the numbers of days (per calendar year) when soil (or top layer of soil) will have been dry or with low moisture levels.

- 90 days with dry soil
- 50 days with soil at 5 to 10% moisture
- 50 days with soil at greater than 10% moisture
- 50 days with soil not releasing any dust due to high level of moisture or frost etc.

The exposure concentrations are estimated as the level derived from the median airborne soil dust concentrations derived from ART (as described earlier).



4.5.2 Cumulative exposures based upon the predicted concentrations of asbestos fibres in air

The cumulative exposures to asbestos were calculated with the assumptions described above.

For the operator of the mechanical excavator, assuming exposure for 8 hours per day, the contributions to cumulative exposure are shown in Table 4.6.

Table 4.6: Cumulative exposure for the operator of the mechanical excavator

Soil condition (moisture content)	Number of days per year	Estimated exposure concentration on these days Fibres/ml	Contribution to cumulative exposure Fibre/ml.hours
Dry	90	0.000017	0.01224
moisture content 5%-10%	50	0.0000017	0.001224
>10%	50	0.00000017	0.0001224
Wet /frozen	50	0	0
	Days / yr		Fibre/ml.hours
Total	240	Total	0.0136

For the truck driver (transporting soils across or off site), with the assumption of exposure for 1 hour per day every day, the calculated cumulative exposures are shown in Table 4.9.

Table 4.7: Cumulative exposure for the truck driver

Soil condition (moisture content)	Number of days per year	Estimated exposure concentration on these days Fibres/ml	Contribution to cumulative exposure Fibre/ml.hours
dry	90	0.000017	0.00153
moisture content 5%-10%	50	0.0000017	0.000153
>10%	50	0.00000017	0.0000153
Wet /frozen	50	0	0
	Days / yr		Fibre/ml.hours
Total	240	Total	0.0017



For the house construction worker, again with the assumption of exposure for 8 hours per day every day, the calculated cumulative exposures are shown in Table 4.10.

Table 4.8: Cumulative exposure for the house construction worker

Soil condition (moisture content)	Number of days per year	Estimated exposure concentration on these days Fibres/ml	Contribution to cumulative exposure Fibre/ml.hours
dry	90	0.000085	0.0612
moisture content 5%-10%	50	0.0000085	0.00612
>10%	50	0.00000085	0.000612
Wet /frozen	50	0	0
	Days / yr		Fibre/ml.hours
Total	240	Total	0.0679

For the ground worker, again with the assumption of exposure for 8 hours per day every day, the calculated cumulative exposures are shown in Table 4.10.

Table 4.9: Cumulative exposure for the ground worker

Soil condition (moisture content)	Number of days per year	Estimated exposure concentration on these days Fibres/ml	Contribution to cumulative exposure Fibre/ml.hours
dry	90	0.000775	0.558
moisture content 5%-10%	50	0.0000775	0.0558
>10%	50	0.00000775	0.00558
Wet /frozen	50	0	0
	Days / yr		Fibre/ml.hours
Total	240	Total	0.619

Table 4.10 shows the predicted cumulative exposures for all of the occupations considered in terms of f.ml-1.years based on an assumed working year of 1920 hours.



Table 4.10: Predicted annual cumulative exposures for site workers
derived as described in the text

Activity	Hours per day	Cumulative exposure from one year on remediation / construction site	
		f.ml ⁻¹ .hours	Fibre / ml.years
Operating mechanical excavator	8	0.0136	0.0000071
Ground worker	8	0.619	0.0003224
Driving truck	1	0.0017	0.00000089
House construction	8	0.0679	0.0000354

The values estimated for the cumulative exposures in the right hand column are used to assess the consequent risk to health. It should be noted that if dust suppression is applied, exposures are likely to be less than estimated above.

4.6 PREDICTED EXPOSURES FOR NEIGHBOURS OF THE CURRENT DEVELOPMENT

For neighbours of the development / remediation site, the levels of exposure would be less than for site workers due to dilution with distance from the site activities. HSE guidance has indicated that a reduction to about a tenth can be expected with a distance of 20 to 30 feet from an activity. Given the size of the site, neighbours will be substantially more than 30 feet away from almost all site activities.

Some of the activities on site would be intermittent. For example, the movement of trucks is likely to be one of the most noticeable sources of dust disturbance but will be only intermittent.

The concentrations estimated for excavator operator and ground workers when the soil is dry has been estimated at about 0.008 fibres/ml, and substantially lower when soil contained more than 5% moisture (by a factor of 10).

Based on the expected difference compared to site operatives, the neighbours to the site are predicted to have average exposures that are around 0.00002 fibres/ml when and if soils are dry.

The durations of exposures for neighbours would depend on how long construction activities (generating any dust) take place. On the expectation that activities would only take place in specific parts of the site at any particular time, for much of the time neighbours would be at greater



distance from the source of any dust and the dilution with distance would be greater.

It is worth noting that WHO (2000) commented on the risks estimated for a lifetime exposure to a concentration of 0.0005 fibres/ml “proposed with a view to providing adequate health protection”, but WHO were cautious about the validity of the assessment. On our estimation, it is unlikely that neighbours were exposed above this level even when soils are dry. If steps are taken to suppress dust, the confidence that neighbours are not exposed above this level becomes very high.

4.7 PREDICTED ASBESTOS EXPOSURE FOR RESIDENTS IN NEW DEVELOPMENT

Conditions in the new development

The potential for exposure to underlying soil with low levels of asbestos contamination will depend on how the site is used. There will be no potential exposure to soil derived dust from soil that is buried under buildings, hard standing or beneath parkland and gardens. We assume a minimum depth of 0.6m of clean material will be placed in the gardens.

Activity that could disturb underlying soil with potential contamination

There is a possibility that in the future workers may very occasionally dig down through hard-standing or other cover to build extensions or conservatories or create new or undertake maintenance on existing buried services. It is likely that the soil under hard-standing or other cover would be damp and unlikely to release significant quantities of airborne dust on disturbance. If the work was undertaken by hand, the estimated exposure concentrations for respirable dust and airborne fibre are likely to be higher than if a small mechanical excavator is used (due to the worker being in close proximity to the soil) however they will still be of the same order as during the remediation work i.e. very low. Cumulative exposures associated with any future activities that involve disturbance of buried soil would be extremely small because of the short duration of any works.

Future occupants

With regard to future occupants, we have assumed that all the additional exposure will have arisen by inhalation from dust containing asbestos fibres being made airborne by either some form of activity or from the wind. The potential routes of residents' exposure may be:

- windblown dust containing fibres,
- dust dispersed if contaminated soil reaches the surface (from installing of a pond, conservatory, etc.)
- contaminated material inadvertently being transferred into buildings and being made airborne during cleaning or other disturbance.

In domestic gardens, windblown dust is generally unusual due to ground being covered with vegetation, sheltered by vegetation and buildings and



fences, and ground cover. On the expectation that concentrations of asbestos in any arisings (that might be brought to the surface) are likely to be of the order of 0.001% or less, average concentrations in a garden where some arisings have become mixed with top soil material will be much less than 0.001%.

The concentrations of asbestos in soil are likely to be much lower than during the construction phase. Therefore, any future exposure concentrations on the site (for residents or future workers involving ground works for utilities, conservatories or ponds) are going to be from soil with lower concentrations of asbestos and airborne fibre concentrations unlikely to be as high as those estimated as possible for the construction phase. Activities leading to disturbance of buried soils are likely to be very infrequent and last only for a few days, giving rise to minimal cumulative exposure

Predicted exposures to airborne dust and fibre for future residents are shown in Table 4.13. The approach to exposure assessment is necessarily approximate and needs to consider the exposures that might occur. For many residents, it is likely that there would be no exposure if there is no disturbance of material from below the clean topsoil in their gardens.

Table 4.11: Estimated potential concentrations of asbestos fibres (fibres.ml⁻¹), as affected by soil moisture content based on comparison to site operatives.

person	Activity	Predicted Median concentrations of asbestos fibres Fibres.ml ⁻¹		
		Dry soil	5-10% moisture soil	>10% moisture soil
Residents (in occupation while site construction on-going)	Construction on part of the site	0.00002	0.000002	0.0000002

The above estimates lead to the estimates of cumulative exposure for “neighbours” or new residents who are in occupation during on-going activity on site that are shown in Table 4.12.

Table 4.12: Estimates of potential exposure for residents in occupation while the site construction is on-going.

Activity	Hours per day	Cumulative exposure from one year on remediation site	
		f.ml ⁻¹ .hours	Fibre/ml.years
Residents (in occupation while site construction on-going)	8	0.015	0.00001



4.8 SUMMARY OF EXPOSURES

The estimates of exposures have been based on the understanding that, at Llanwern, the measurements of amounts of asbestos in soil relate to free fibres, however some of the asbestos is in the form of bitumen, lagging and board. In the free fibre form, asbestos is readily available for dispersal into air. However, the concentrations are generally low. Asbestos does not diffuse or spread through soil, the asbestos content can remain very varied. Therefore, the estimate of average concentration can only be approximate but for this site the estimate is based on a reasonably large number of samples.

Estimates of potential exposure during the construction phase are based on the assumption that tasks are undertaken without attempts to suppress dust. The estimates of likely soil dust in air are based on the "Advanced Reach Tool", and are believed to be realistic but may merit confirmation by measurement of actual soil dust in air concentrations.

Laboratory tests with soils prepared with accurately measured amounts of dispersed asbestos fibres added (in tests conducted by Addison et al 1988) have provided a basis for deriving the asbestos in air concentrations that would arise during exposure to given levels of soil dust in air.

Exposure to asbestos fibres is expressed as the concentration multiplied by the time. Asbestos fibre concentrations are generally expressed in fibres/ml and the exposure units used here are fibre.ml-1.hours.

The exposures calculated are all low.

For evaluation in terms of risk to health, we refer to a summary table of the risks associated with various levels of cumulative exposure in units of fibre/ml.years based on occupational epidemiological studies (i.e. studies which compared incidence of disease with exposure in the historical asbestos industries). The occupational year is normally assumed to be about 48 weeks of 40 hours, or 1920 hours. Therefore exposure in fibre/ml.hours can be converted to exposure in fibre/ml.years by dividing by the number of hours in an occupational year (i.e. by 1920 hours).

4.9 PREDICTED RISKS TO HEALTH

4.9.1 Background

Inhalation of high concentrations of asbestos fibres for long periods is known to produce a risk of asbestosis, lung cancer and mesothelioma.

Asbestosis is a fibrosis of the lung, and it occurs only after very heavy industrial exposure. This disease is not a concern at the exposure levels considered to arise from the asbestos contamination at Llanwern.



Mesothelioma is a rare form of cancer. It has been shown, in epidemiological studies and in experiments with rodents, to be caused by exposure to asbestos. Mesothelioma is a cancer of the lining of the lung (the pleura) or the abdominal cavity (the peritoneum). There is a delay of a decade at least (and generally several decades) from first exposure and any incidence of this cancer. Currently, there are annually about 2000 new cases of mesothelioma in the UK, and almost all of these cases are associated with exposure to asbestos (Peto et al, 1995). Mesothelioma leads to death, usually within 18 months of diagnosis of the disease. The risks of mesothelioma are believed to be independent of smoking habit. Risks also depend on age at first exposure, with risks being higher for younger people.

Lung cancer is much more common than mesothelioma and, in the vast majority of cases, is attributable to causes other than asbestos exposure, especially smoking.

The risk of lung cancer due to asbestos exposure increases in proportion to exposure to asbestos. Asbestos exposure causes approximately the same percentage increase in existing risk for smokers and non-smokers, but the existing risk is much greater in smokers. Therefore, most of the additional lung cancers caused by asbestos occur in smokers. Again, there is generally a delay of decades between exposure and occurrence of disease.

4.9.2 Estimated Risks

The risk estimations are generally conservative in approach. They assume relatively long periods of dry and dusty ground conditions and that time spent undertaking dusty activities is quite extensive. For future exposures, it is assumed that the asbestos containing material has been broken down into free fibres and is widely dispersed in the soils. No account has been taken in the occupational risk assessments of any control measures taken to reduce emissions and exposures. Health risks are based on Amosite exposure when it is known that there is a mixture of Amosite and Chrysotile (which is less hazardous) on site. The risk assessments are therefore close to worst case.

The residential exposures and health risks are all low as there is no clear route of significant exposure, assuming that the gardens are all covered with a minimum of 0.6m of clean soil.

The occupational risks for workers on the site are predicted to be low on an individual basis, even without additional controls, but airborne asbestos concentrations are likely to exceed acceptable levels during dry periods.

4.9.3 Levels of Risk

Hodgson and Darnton (2000) provided risk summaries for cumulative exposure included the following estimates of risk of mesothelioma for exposures starting at age 30 (Table 4.13). The highest exposures estimated for the construction activities at this site are at the level where they



described risks as insignificant. The risks are estimated as less than 1 in 100,000. These predictions are based on exposure starting at age 30, and if exposure started at age 20, the lifetime risk of mesothelioma would be about double the value for exposure from age 30.

Table 4.13: Risk summaries reported by Hodgson and Darnton (2000) – from table 11 of their paper.

Cumulative exposure	Mesothelioma – Lifetime Risk per 100,000 exposed	
Fibre/ml.years	Amosite	Chrysotile
0.1	15 (Highest arguable estimate 80 lowest 2)	(Highest 4)
0.01	3 (highest 20)	
0.005	about 2 (highest arguable 15)	Insignificant
0.00007	Highest arguable becomes insignificant	
Notes: The term 'insignificant' is used in a colloquial rather than legal sense by Hodgson and Darnton (2000).		

For lung cancer, the risk predictions from Hodgson and Darnton indicate risks to be less than 1 in 100,000 where cumulative exposures are less than 0.001 fibre/ml.years.

In summary, the best estimates of lifetime risks from the cumulative asbestos exposure that could arise from construction activities on this site are less than 1 in 100,000.

4.9.4 Comments on risk predictions

The models of relating exposure to risk are based on observations in workplace populations where the exposures were substantially higher than those estimated here. Extrapolation of a model to lower levels of exposure obviously involves uncertainty and therefore the values estimated as the risk arising from the estimated level of exposure should be treated as approximate, not as precise values.

Although the risks from this construction site activity are small, they should not be dismissed as unimportant. There are uncertainties in the evaluation of the asbestos content in fill materials and therefore practicable precautions should be taken to prevent or minimise exposure to dusts that might contain asbestos.

If control measures are taken to prevent or minimise dust release, then there can be high confidence that risk from asbestos on this site will be extremely small.



4.10 RISK ASSESSMENT – RECOMMENDED CONTROL PROCEDURES

It is important to ensure that workers on site, visitors to site, neighbours and the local environment are protected from asbestos exposure. The planning of site works and specification of appropriate control measures should take account of the following:

- weather conditions, prevailing wind and potential for soils and stockpiled materials to dry out;
- soil composition and potential for fibre release, i.e. deal with the stock piles where asbestos has been detected with suitable procedures to suppress dust release (e.g. damping down if the stockpile has dried);
- durations/times of significant activities (pay attention to dust suppression at times when earth works are taking place);
- contamination of ground/surface water (potentially an issue for run-off water from stockpiles with identified asbestos content);
- pay particular attention to dust release near the site boundary, where there is an interface with residential and commercial neighbours, and
- all persons likely to be affected by the work on this site, workers, visitors to site, machinery operators, drivers, office personnel, site security, etc.

The use of the control measures indicated below should control exposure to airborne asbestos fibre to an extremely low level and no significant risk to health would be anticipated. This could be confirmed by undertaking personal monitoring during task based activities.

4.11 CONTROL MEASURES DURING GROUND WORKS

The required control measures will depend on the quantities and types of asbestos present and the likely exposure but are likely to include:

- suitable method statements for types of tasks, indicating dampening down of materials, protection from wind blow, keeping cab windows closed (if there is a risk of dust), reducing the number of persons working adjacent to excavation/transfer of materials, etc.
- on-going inspections of excavated areas by a competent asbestos specialist to determine if there are further findings of asbestos contamination.

The risks of significant exposure to airborne fibre associated with large scale excavation and removal are likely to significantly outweigh the exposures that are likely to occur if material remains on site. It will be necessary to agree with the local authority what information must be provided for future occupiers of the site.



5 CONCLUSIONS

5.1 PRESENCE OF ASBESTOS IN SOILS

The results of the soil sampling undertaken during the site investigation and the remediation work for Phase 1 indicate that dispersed asbestos fibre is present at low concentrations in the soil across the site. There was a small quantity of ACMs as bitumen, lagging and board also present. The asbestos types encountered were Chrysotile and/or Amosite. Where Chrysotile was the main fibre type, often Amosite was present in the fines.

In total 100 samples have been analysed, with 35 containing asbestos. 23 out of 100 samples contained more than 0.001% asbestos with the highest being 0.006%.

5.2 POTENTIAL EXPOSURE TO ASBESTOS DURING SITE GROUND WORKS AND CONSEQUENT RISK TO HEALTH

The quantity of asbestos present in soil is relatively small, based on the evidence from the sample analysis. The risk assessment, based on estimates of the probable soil dust in air concentrations and laboratory data relating airborne soil dust concentrations to airborne asbestos concentrations (for fibres dispersed in soil) indicates that exposures to airborne asbestos are likely to be very low, much less than 0.01 fibres/ml for workers involved in the development process. Based on the estimated exposures and information from published occupational epidemiological studies relating to cumulative exposure, the consequent risks to health from asbestos are very low, less than 1 in 100,000. The exposures to airborne fibre and associated risk to health would be even lower for site neighbours, the first occupants and for all the future residents.

5.3 RECOMMENDATIONS FOR RETENTION OF SUITABLE SOILS DURING REDEVELOPMENT

A minimum of 0.6m of clean soil (asbestos content <0.001%) will be placed across the Llanwern site. Soil will be screened and, if asbestos contamination is less than 0.02% (200ppm) in the soil, that soil may be used in residential areas; and if the asbestos contamination is less than 0.03% (300ppm), the soil may be used in commercial areas.

It is our view that the re-use of soil at these levels in these types of areas, in combination with the proposed coverage of the site with clean soil will not materially increase the risks of mesothelioma or lung cancer amongst residents at the Llanwern site.

5.4 RELIABILITY AND UNCERTAINTIES

The site has been assessed based on the evidence provided and the results of the analysis of 100 samples of soil. The estimates of asbestos content are believed to be reliable. The estimates of airborne soil dusts are derived



from the Advanced Reach Tool which provides a reasonably robust and reliable estimate. It is however, an estimate.

An important uncertainty is that asbestos contamination in soils may be very variable. This is a site where asbestos might be locally present to a greater extent than revealed by the sampling to date. There is always a risk that ACMs may be unexpectedly encountered and this should be addressed in the site management plan.

The sample data has not indicated significant quantities of ACM to be present, neither has the bore-holing and trial pitting to date.

If precautions to prevent dust exposure are taken, then there can be high confidence that risks to health from asbestos on this site will be extremely low. In our view, this assessment is supported by the results reported by the Dutch field studies reported by Swartjes and Tromp (2008), described earlier.

5.5 ENVIRONMENTAL EXPOSURES AND RISKS FOR THE NEIGHBOURING COMMUNITY

The potential risks to the community from asbestos exposures originating from the asbestos detected on the site are estimated to be extremely low.

However, the site will be developed in phases and therefore will have close proximity to some neighbours (Phase 1 is partially completed) at various stages. This is another reason to have effective dust control. If neighbours are exposed to soil dust, they might form a perception of a risk that would require a huge amount of monitoring to refute. Good dust control is therefore important.

5.6 RECOMMENDATIONS FOR PRECAUTIONS DURING CONSTRUCTION

In order to minimise exposure of workers during site activities, the following measures should be implemented:

The normal measures required to prevent airborne dust emissions and associated nuisance arising from site work should be in place including measures to prevent uncovered soil drying out resulting in wind pick up of dust; and mud being spread onto the local road network. This will require dampening down of uncovered soil during dry weather and wheel cleaning for any vehicles leaving the site.

The risk assessment has not assumed the use of respiratory protective equipment (RPE). The contractor may wish to consider the use of appropriate RPE during dry dusty weather, but there is no requirement to use RPE when working with moist soils. Workers are likely to be better protected by measures to prevent soils drying out and wind pickup of dust



than by the use of RPE. If RPE is employed, each individual must be face-fit tested for the mask to be used. There are various RPE options: disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3), half mask respirator (to standard EN140) with P3 filter, or semi-disposable respirator (to EN405) with P3 filter. A half mask will give a more reliable fit (and protection) than a disposable respirator.

The following measures are likely to be appropriate during the redevelopment work:

- Workers have appropriate asbestos awareness training, know the control measures they must employ and understand the importance of implementing these control measures;
- Workers must be aware that asbestos may be present in soil even when the soil does not contain visible ACMs and therefore it is sensible (and to their benefit) to minimise airborne soil dust;
- Soil be maintained in a damp condition throughout works;
- Drop heights be kept to a minimum during materials transfer operations;
- Traffic across the infill in which asbestos was detected be minimised and a haul route provided that is covered with clean hard-core or paved.

5.7 POTENTIAL FOR EXPOSURE SUBSEQUENT TO REDEVELOPMENT

Following completion of the redevelopment of the site, exposure to airborne asbestos might arise as a result of any activity leading to the disturbance of underlying fill material in which there is the presence of low concentrations of asbestos. The asbestos content of the underlying fill material is sufficiently low that any such exposure will be extremely low.

Where the ground surface is covered by buildings and hard landscaping, then no exposure would be anticipated to arise from those areas during residential use of the site.

5.8 RECOMMENDATIONS FOR OCCUPATION AFTER COMPLETION OF DEVELOPMENT

Workers involved in occasional activities leading to disturbance of underlying soil such as installing or repairing buried services could be intermittently exposed to very low concentrations of asbestos. It should be possible to control these exposures to an extremely low level by ensuring that appropriate precautions are in place whenever such works are performed.



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APPENDIX 1. SITE LOCATION PLAN

Plan provided by Atkins





Key



Area Boundary

REVISIONS

Drawn By
Checked By
Date

PURPOSE OF ISSUE

Rev.
Authorised for Issue
Date

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CLIENT

ST.MODWEN

PROJECT

Llanwern

DRAWING TITLE

Former Llanwern Steelworks Site Location Plan

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Appendix F – Addendum Validation Information

Technical Note

Project:	P18-669 Glan Llyn, Newport
Subject:	Remediation Strategy Addendum Information
Date:	January 2022
Document Reference:	18669-RLL-22-XX-RP-O-0192
Prepared by	Chris Wilson BSc (Hons) MCIWEM
Reviewed by	Howel Morris BSc (Hons) MSc CGeol FGS

A site wide Remediation Strategy was submitted by Rodgers Leask Limited (RLL) in November 2021 for the Glan Llyn development in Newport pursuant to the discharge of condition 27 of outline planning approval 06/0471. The Senior Scientific Officer (Steve Manning) at Newport City Council (NCC) reviewed and provided a response. This note provides addendum information to the Remediation Strategy following correspondence with the Senior Scientific Officer. The paragraphs numbered below relate to the points raised by NCC and discussed in the correspondence between NCC and RLL (Technical Note 187), presented in **Appendix A**.

1. Pictorial versions of the earthworks process intended to enhance the conceptual site model (CSM) for the residential and commercial parts of the development have been prepared and are presented in **Drawings**. The Made Ground in the residential areas will be cleared to the natural underlying clay before placement of suitable material from within the phase and from pre validated stockpiles to achieve the required formation level. Photographs of the process are inserted. The commercial area will undergo an excavation/ trim to 2m below formation level with obstructions and unsuitable material removed to natural clay before suitable material from the trim exercise and the residential site is re-engineered to achieve formation level.

2. The removal of unsuitable material from the residential phases and the turnover and placement of retained suitable Made Ground in 300mm layers is intended reduce the contamination risks (Phase 4h – vapour) by thinly spreading and compacting source material to improve consistency and reduce permeability. Monitoring (chemical surface validation sampling, gas monitoring and, where appropriate, vapour monitoring in each residential phase) will be undertaken following the remedial earthworks to assess the remediated condition and the contamination status of the formation surface. The Validation Report (submitted pursuant to the approval of NCC & partial discharge of planning condition 28) will recommended appropriate mitigation measures, if required, in addition to the clean cover as part of the listed developer actions.

3. The post remedial earthworks formation in residential areas will undergo chemical sampling (greater than 1 per 50m²) in addition to the pre-remediation testing to comply with the recommended testing frequency but also provide information to assess the contamination status of the formation surface as recommended by NCC. The surface contamination status,

in addition to earthworks validation, will be assessed to recommend the form of mitigation measures in addition to the clean cover.

4. A clean cover provision of 600mm in landscape areas is accepted. The landscape areas will also undergo formation surface chemical sampling to assess the contamination status and whether mitigation measures are required in addition to 600mm of clean cover.

5. The trim and chase strategy (also referred to as the 1m turnover) within the Remediation Strategy applies only to the central business park. The business park will have the benefit of at least 2m of re-engineered material underlying the construction material before the hardstanding or floor slabs area constructed. This is presented in the commercial area pictorial earthworks CSM (**Drawings**). The re-engineered material will have a reduced permeability in comparison with undisturbed in situ Made Ground and the hydraulic gradient would likely be away from the engineered material towards the undisturbed Made Ground. The hydraulic gradient would protect the engineered profile.

6. The Validation Report for each phase includes a section on the developer actions. The actions typically comprise the provision of clean cover and gas protection measures. The final form of the developer actions are to be confirmed following the post remedial works monitoring and validation sampling.

General Items

It is noted that the LPA and the project team await the comments from Natural Resources Wales (NRW) regarding the controlled waters.

The NRW and NCC have accepted an invite to attend site on 26th January 2022.

It is hoped that a greater understanding of the proposed Remediation Strategy has been provided in the correspondence. It is understood that the potential mitigation measures (to break pathways) will be reviewed following the assessment of the contamination status of the surface formation. This will comprise chemical sampling of the formation surface, shallow gas monitoring of the phase and, where appropriate, vapour monitoring.

Llanwern Residential Phases, Conceptual Site Model

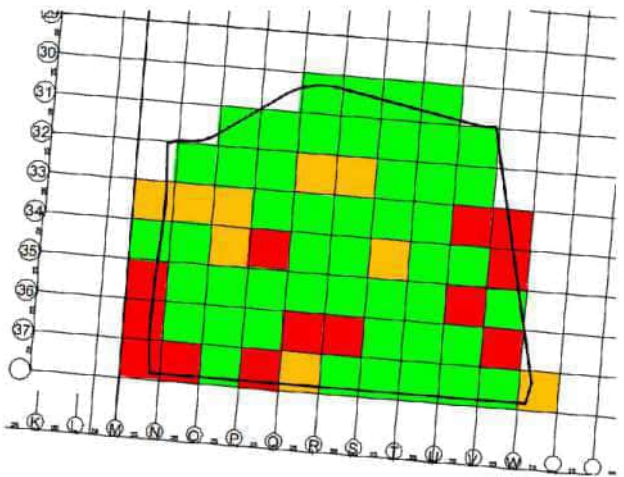
1. Pre-Reclamation Sampling Exercise

Chemical assessment undertaken on in-situ made ground and stockpiled material. Sampling across a 25m grid identifies chemically unsuitable material within phase.

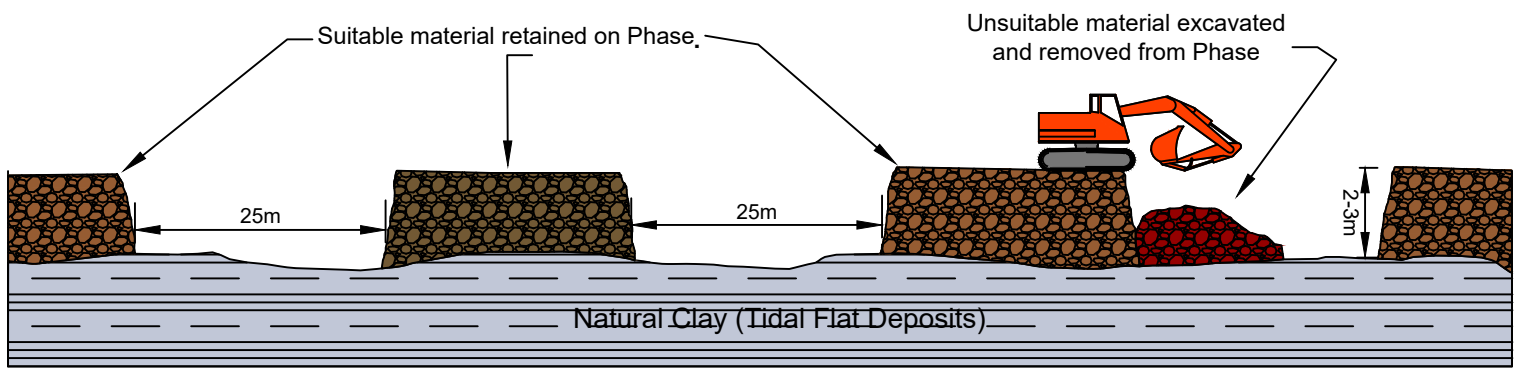
Made Ground to be excavated to natural Clay and removed for treatment or re-use on commercial area.

Potential for re-use within plot following turnover.

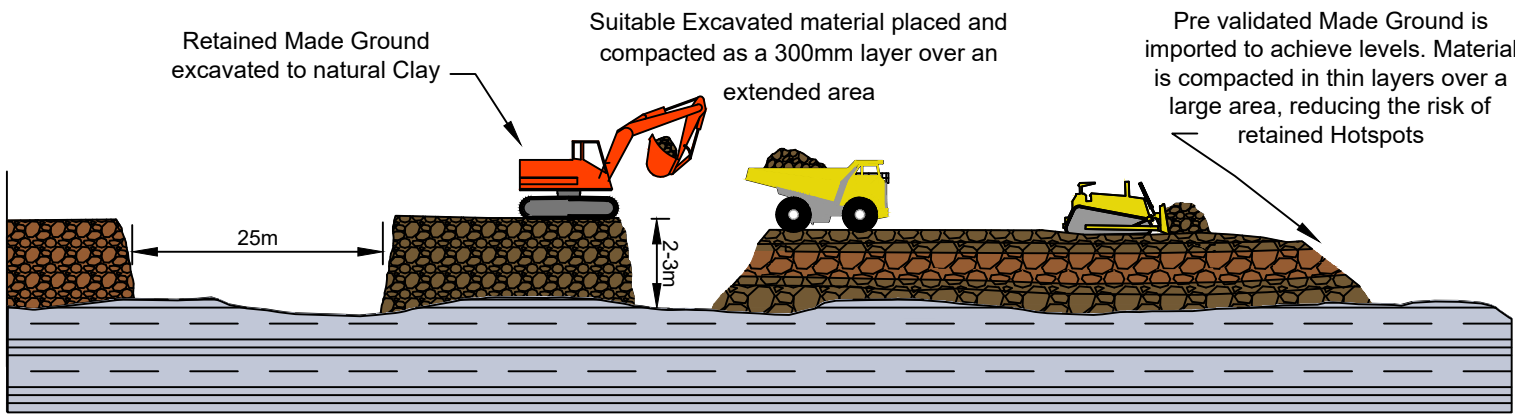
Made Ground to be turned over for re use within plot.



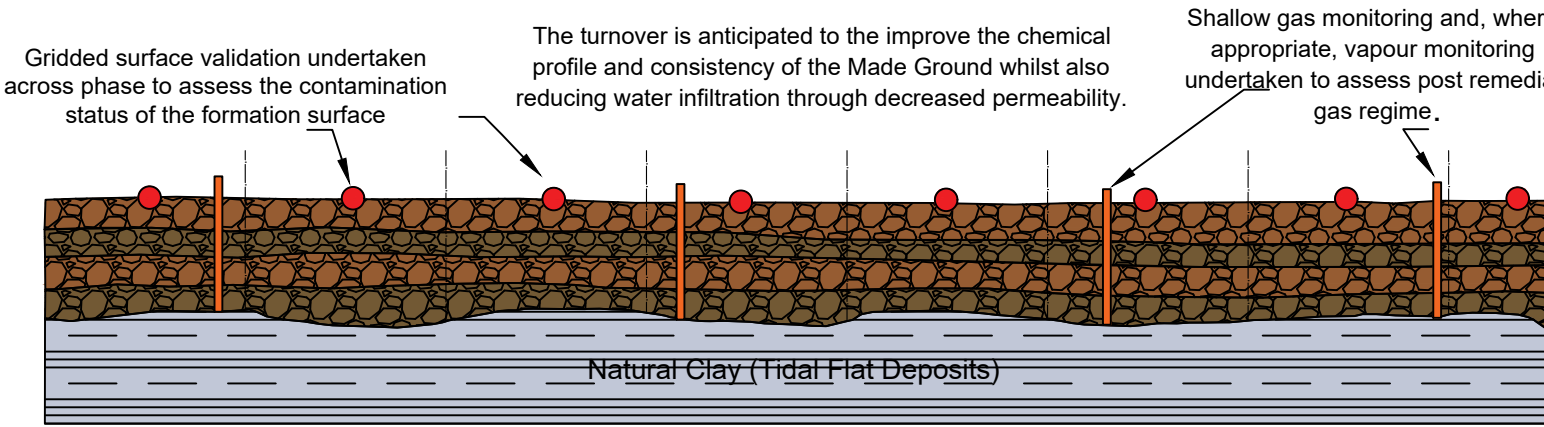
2. Unsuitable material removed from Site. Phase ready for turnover.



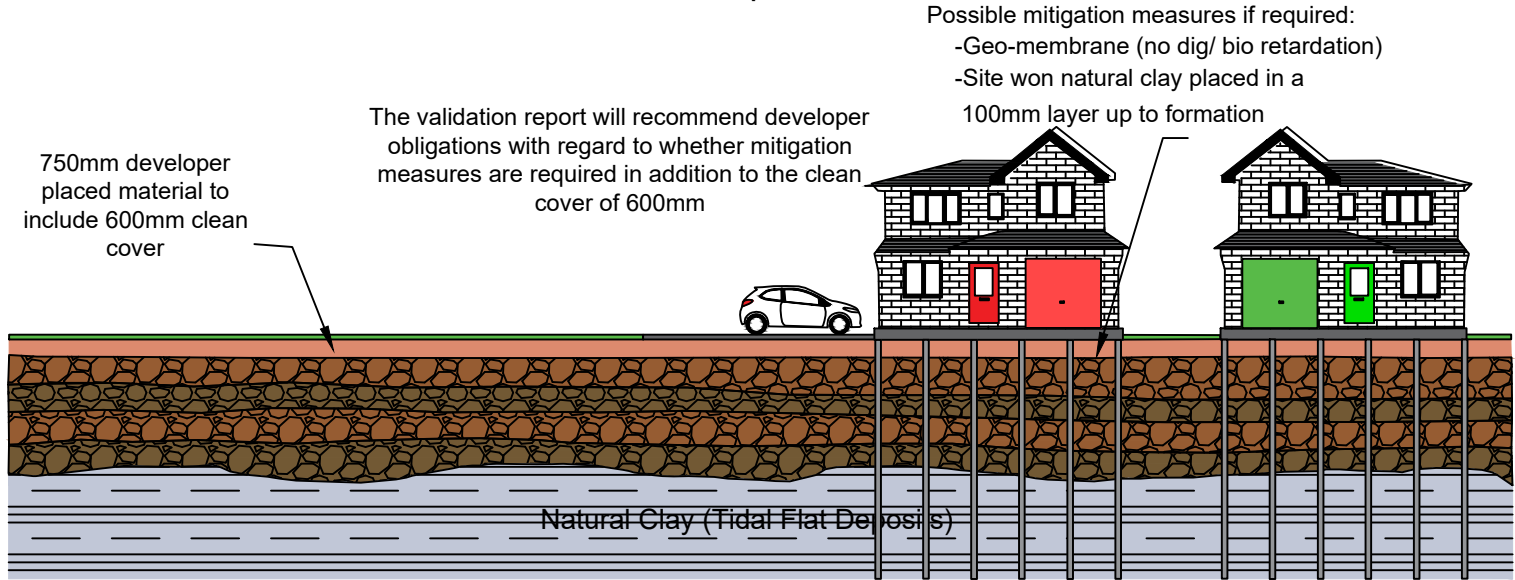
3. Turnover Exercise



4. Post Earthworks Additional Surface Validation

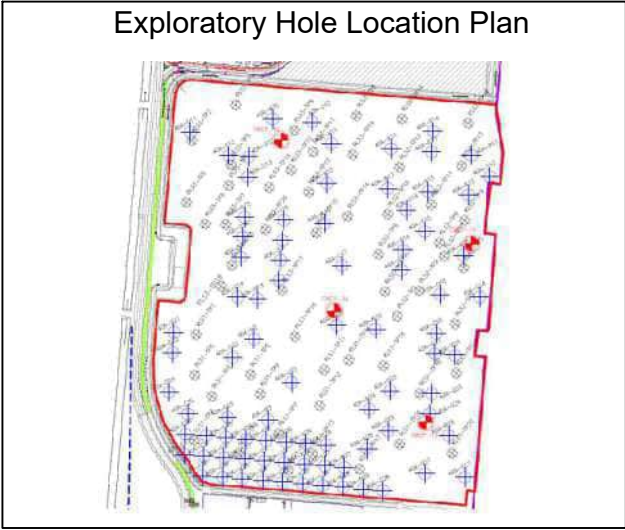
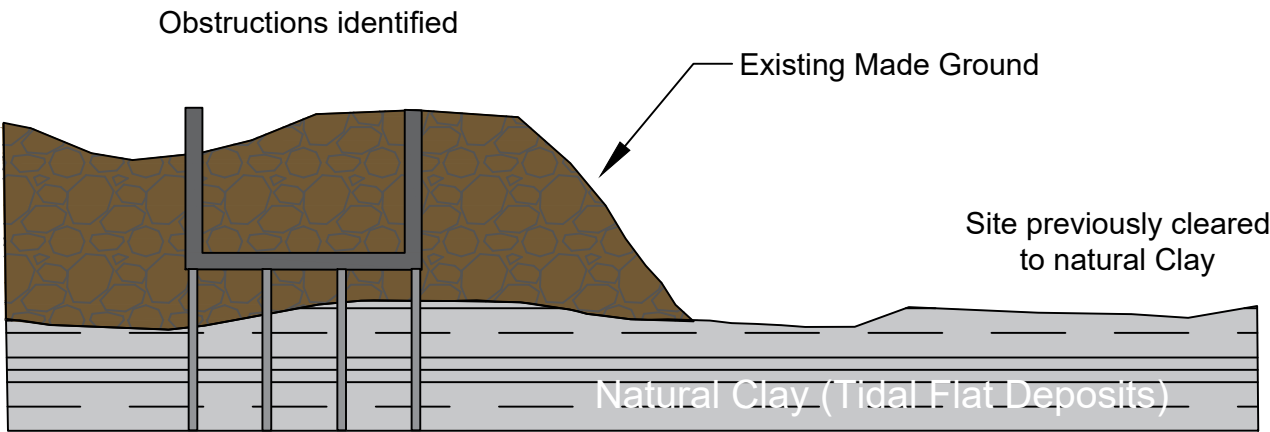


5. Developed Site

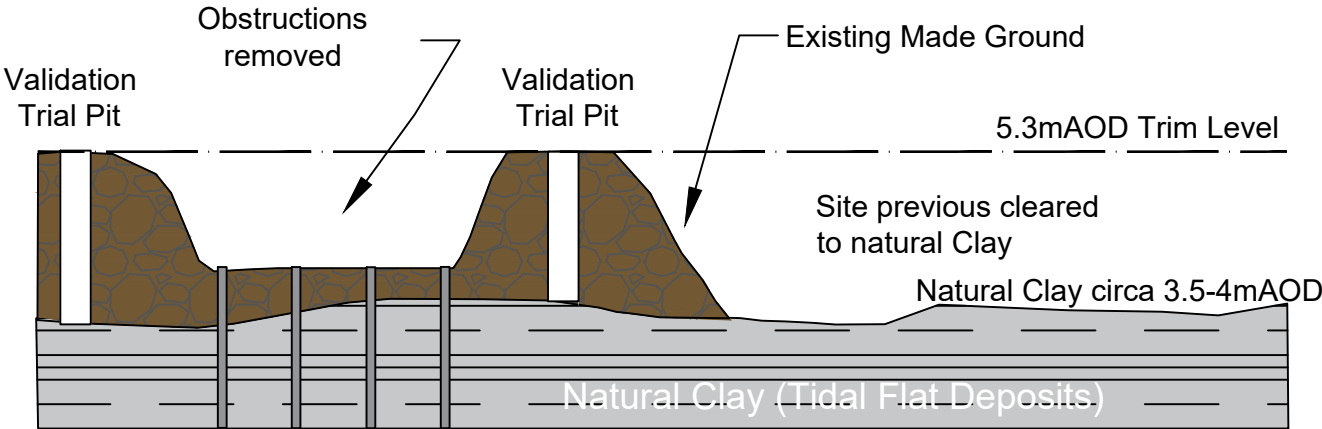


Llanwern Business Park, Conceptual Site Model

1. Site Pre-Trim



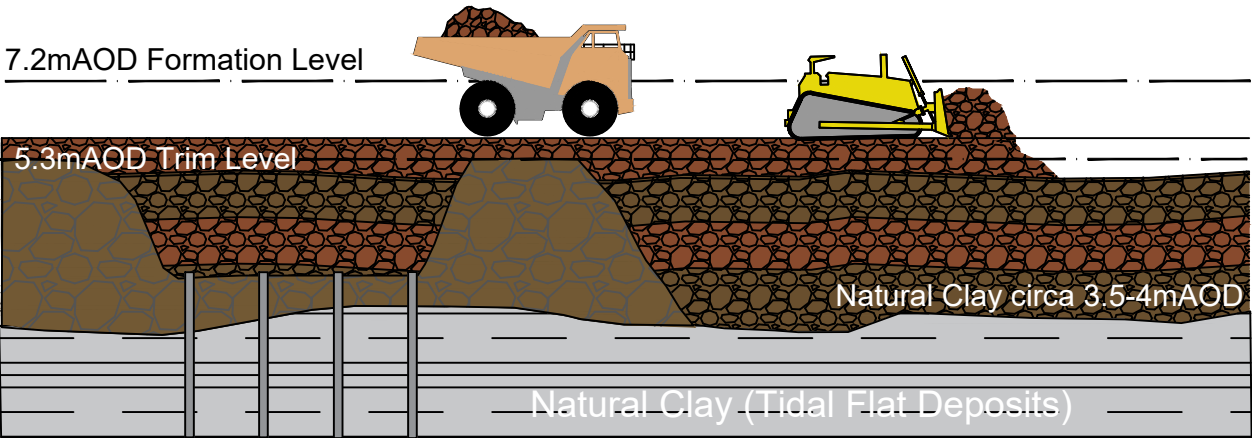
2. Site Trimmed to 5.3mAOD and obstructions removed



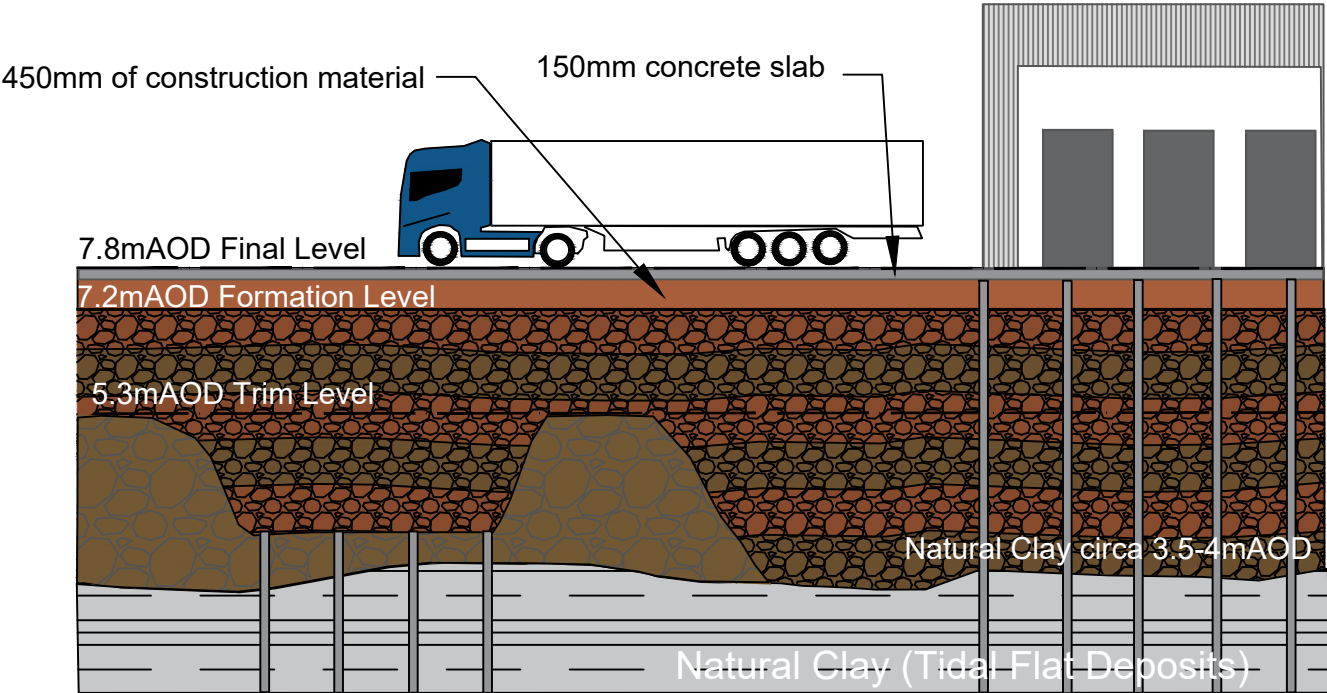
3. Fill engineered across site to formation level.

Suitable material from the trim exercise and material from the residential site placed and compacted as a 300mm layer over an extended area

Made Ground is imported to achieve levels. Material is compacted in thin layers over a large area, reducing the risk of retained Hotspots



3. Developed Site Including 0.6m of clean cover material





Appendix A – TN187, LPA Comments

Technical Note

Project:	P18-669 Glan Llyn, Newport
Subject:	Phase 4h Response to LPA Comments
Date:	December 2021
Document Reference:	18669-RLE-21-XX-RP-O-0187
Prepared by	Chris Wilson BSc (Hons) MCIWEM
Reviewed by	Howel Morris BSc (Hons) MSc CGeol FGS

It is worth stating that all made ground will be removed and only suitable material will be used in the formation of the plot. The Phase II report for Phase 4h reports the pre remediation conditions and all of the made ground will have been excavated to a validated natural clay. The full turnover of the made ground is exceptional and hugely conservative as it allows for the visual and olfactory assessment of all of the made ground in addition to chemical assessment. Approximately 40% of the made ground from Phase 4h has already been removed and stockpiled for treatment or reuse in the commercial area.

Comments:

1. Detailed cut and fill/reuse drawings for all areas requiring remediation are sought so that extents and depths can be better understood prior to works.

The site will have all unsuitable made ground removed and the remaining made ground assessed as suitable for retention will be turned over to the underlying natural clay. The removal or turnover of all of the made ground is a conservative approach where 100% of the made ground is excavated. A normal ground investigation would cover less than 1% of the material and therefore there is confidence in the consistency and suitability of the material. The natural clay will be sampled as a part of the validation testing. *A base of excavation drawing showing the surface of the natural deposits and relevant validation information will be provided within the validation report.* Is there an existing drawing which confirms this conceptually? it is important NCC has a clear picture of what is intended as well as what is done.

2. Will the removal of contaminated material be sufficient to remove the vapour pathway for hydrocarbons into dwellings/garden areas? *Yes, although as a precaution we will undertake vapour monitoring post earthworks.* The CSM in appendix D makes no reference to this. a vapour pathways will remain after made ground remediation then full protection of dwellings, services and garden areas needs to be considered for the benefit of future developers and the onward developer documentation trail. It is noted that a post remedial vapour assessment is proposed however this pathway needs to be included in the CSM for completeness. *Accepted, we will update the CSM as an addendum to the report.* Both items in red text are supported.

3. The Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground are noted and cause concern given their high levels at a what will be depth of only 600mm below residential gardens. Engineered cover systems appear to be warranted and not simple cover systems; in view of significantly elevated levels that will exist below cover. *The*

earthworks will provide an engineered difficult dig layer of low permeability which will be validated to assess compliance with the earthworks specification. The formation created would prove a difficult dig for a JCB even without the 600mm above. This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from domestic digging activity contact is required through engineered cover. The use of a semi permeable or impermeable membrane incorporating a bright orange geomembrane should be considered as part of engineered cover to deter against digging beneath clean material – a combined anti-dig/capillary break layer should also be considered as part of the remedial approach for final development. This is considered necessary to prevent both the upward migration of any contamination into cover systems and contact with material beneath them. The use of a 'Bentomat' type system (geotextiles with bentonite clay layer) to prevent infiltration may be warranted in this situation given the nature of contaminated material being proposed for reuse beneath cover and proposals regarding this are sought. Although 600mm is specified in the remediation strategy the formation level is set 750mm below the final ground level. Could the proposed developer actions regarding cover be recommended following review of the validation report. It is anticipated that the average concentrations will be well below the proposed thresholds. The remedial criteria is based on an average approach and the complete removal of made ground across the plot with placement of validated site won made ground. The turnover of the made ground will cause improvement of the material, where the organic concentrations are likely to be reduced, from the pre remediated state reported in the phase II report. The post remedial conditions are designed to be much improved and we can provide an isopachyte of concentrations to assist in zoning the site should enhanced protection measure be required. This appears to be a suitably pragmatic approach to specifying final developer cover and must take the form of an engineered cover system design with detailed drawings so that requirements are clear to all when available.

4. The proposed cover of only 300mm in landscaped areas does not appear sufficient given the level of contamination that will remain as a result of the proposed Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground. Either the reuse levels are made more conservative given the level of proposed cover ; or the level of cover is increased to a minimum of 600mm. 600mm is likely to be acceptable. 600mm will be accepted as suggested subject to its engineered nature. Incorporation of the features in 3 above would be relevant in landscaped areas also for any thickness of cover. The reengineered ground is likely to be provide a sufficient no dig barrier. This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from domestic digging activity contact is required through engineered features.

5. It is not clear whether the one metre turn over specification will prevent any lateral movement of contaminants into regions that have had the full turnover applied of full turn over ? The 1m turnover applies to the central business park where the interception of rainfall is >90% when the site is developed and the proposed levels are to be raised providing at least 2m of low permeability reengineered material above the base of excavation. The remediation strategy proposed by RLE recommends full turnover in the residential areas. Where this meets the remediation strategy proposed by Vertase FLI, the full depth of reengineered made ground would retard migration from the 1m turnover strategy. or what the significance of this would be? Graphical illustration of how this will work between areas of the two specifications is sought. If there is any risk of migration from one meter turnover regions into full turnover regions then an approach where all regions undergo full turnover may be worth considering ? This has been assessed as part of the CWRA, appended to the remediation strategy, the hydraulic gradient would suggest that the direction of migration would be from the engineered material to the non engineered material. Thus protecting the fully engineered profile. However the likely volume of perched water will be reduced due to

the reduced permeability of the engineered profile. This aspect is noted and may require further consideration by NRW – copied in for comment.

6. Onward developer action documentation needs to be provided in advance of any developers being in the frame; and the format of this is sought at this stage. *A general developer actions list can be provided. The actions typically comprise the provision of clean cover and gas protection measures.* Accepted that a draft format may be all that is possible at this stage in view of finalising developer engineered cover design further to validation of this first remedial phase.

It is important that the LPA obtain comments from NRW in respect of this site as controlled waters are clearly a sensitive receptor and Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground are concerningly high. *The strategy is intended to deliver an acceptable water quality into the surface waters by turning over the made ground and creating a consistent low permeability, 2m thick, engineered material. This is intended inhibit the percolation of rainwater into the made ground. The compaction also reduces the ability to disturb the made ground without the use of heavy mechanical means.* This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from end user digging activity contact is required.

I am not at present reassured that the human health pathway will be sufficiently mitigated at both made ground remedial and developer remedial stages and as such the above matters need to be addressed before any consideration can be given to support for discharge. *We would like to invite the local authority to attend site for a walkover as the benefit and scale of the remediation works are better understood during a site visit.* A site meeting is welcomed and I would suggest NRW are invited to such a meeting also.

1.

Technical Note

Project:	P18-669 Glan Llyn, Newport
Subject:	CWDQRA Validation Plan
Date:	June 2022
Document Reference:	18669-RLL-22-XX-RP-O-0260
Prepared by	Chris Wilson BSc (Hons) MCIWEM
Reviewed by	Howel Morris BSc (Hons) MSc CGeol FGS

A site wide Remediation Strategy was submitted by Rodgers Leask Limited (RLL) in November 2021 for the Glan Llyn development in Newport pursuant to the sitewide discharge of part of condition 27 of the outline planning approval 06/0471. Natural Resources Wales (NRW) reviewed the strategy and the appended updated controlled water detailed quantitative risk assessment (CWDQRA). A meeting was held with NRW on 20th April 2022 and following the meeting RLL has prepared this CWDQRA validation plan to verify that material with contaminants of concern exceeding the criteria are placed at the appropriate distance from a surface water, to assess whether the hydraulic conductivity and the pore water chemical concentrations within the reengineered material are as assumed in the CWDQRA. This note provides the method to collect and assess the CWDQRA validation information as an addendum to the remediation strategy and also presents a number of points as a contingency plan.

Contaminants of Concern Validation

The updated CWDQRA identified some exceedances for concentrations of contaminants of concern (CoC) in relation to a 20m compliance distance. A further assessment has shown material recording concentrations exceeding the 20m compliance criteria for the CoC is suitable when placed at a distance of greater than 30m from the compliance point. The phase specific validation report will show that material with CoC exceeding the 20m compliance criteria has been placed at a suitable distance i.e. greater than 30m.

Hydraulic Conductivity Validation

The updated CWDQRA recognises the benefits of excavating and reengineering the made ground on the permeability of the material. The earthworks validation report presents test results characterising the made ground and standard results for compaction and air voids validating that the compaction requirements have been achieved. It is considered helpful, as a line of evidence to support the poor drainage characterisation of the reengineered material, to undertake falling head tests, and where possible rising head tests, upon and within the reengineered material.

The formation falling head tests are to be undertaken using a cylinder to hold a head of water against the formation surface. Approximately 10 falling head tests will be undertaken per phase or a minimum of 1 test per 100m². Whilst the dimensions of the falling head test are not



complaint with BRE Soakaway test, the monitoring and assessment will be undertaken in accordance with the BRE. The standard dimensions of the BRE Soakaway test would damage the formation and potentially be influenced by the underlying clay.

The falling and rising head tests will be undertaken on the shallow monitoring wells installed, following the earthworks, in the reengineered made ground. Up to 8 shallow monitoring locations will be installed in each phase.

The CWDQRA describes the permeability of piling mat post construction. The validation report shall include, as part of the developer obligations, confirmation or verification of construction material/ piling mat with the suitable permeability characteristics in accordance with the CWDQRA & Remediation Strategy.

Pore Water Concentration Assessment

The updated DQCWRA assumed pore water concentrations as shown in Table 1.

Table 1. Calculated Pore-water Concentrations for Contaminants of Concern (CoC) Modelled in P20 Remedial Target Worksheets

Determinands	Calculated Porewater Concentrations (mg/l) based upon laboratory derived totals soil concentrations (mg/kg) and 1806 (No.) Soil Samples		
	Average	Upper 95 % Percentile	Maximum
Iron	113.57	314.67	2949.27
Manganese	12.00	44.70	566.00
Vanadium	0.97	3.01	13.498
Benzo(a)pyrene	2.85E-4	0.00113	0.07
Benzo(b)fluoranthene	0.0767	0.28	20.77
Naphthalene	0.231	0.165	128.68

It is intended, as part of the validation, to then compare the field chemical concentrations with the pore water concentrations adopted within the CWDQRA. This will only be possible where perched water is encountered. Where water is present within the shallow monitoring wells the sample will be collected using a peristaltic (low flow) pump.

The monitoring locations, the positions of the formation surface tests falling head tests, the results and the assessment of the results will be presented in the validation report for each phase.

Following validation of the earthworks to achieve the formation surface, it is proposed that a limited number of monitoring wells are retained (approximately 30% or 3 per phase) or



installed in landscaping areas. The validation report for each phase will contain specific information on how this will be achieved. This will allow long-term monitoring of the perched water post construction and build on a sitewide dataset of perched water quality.

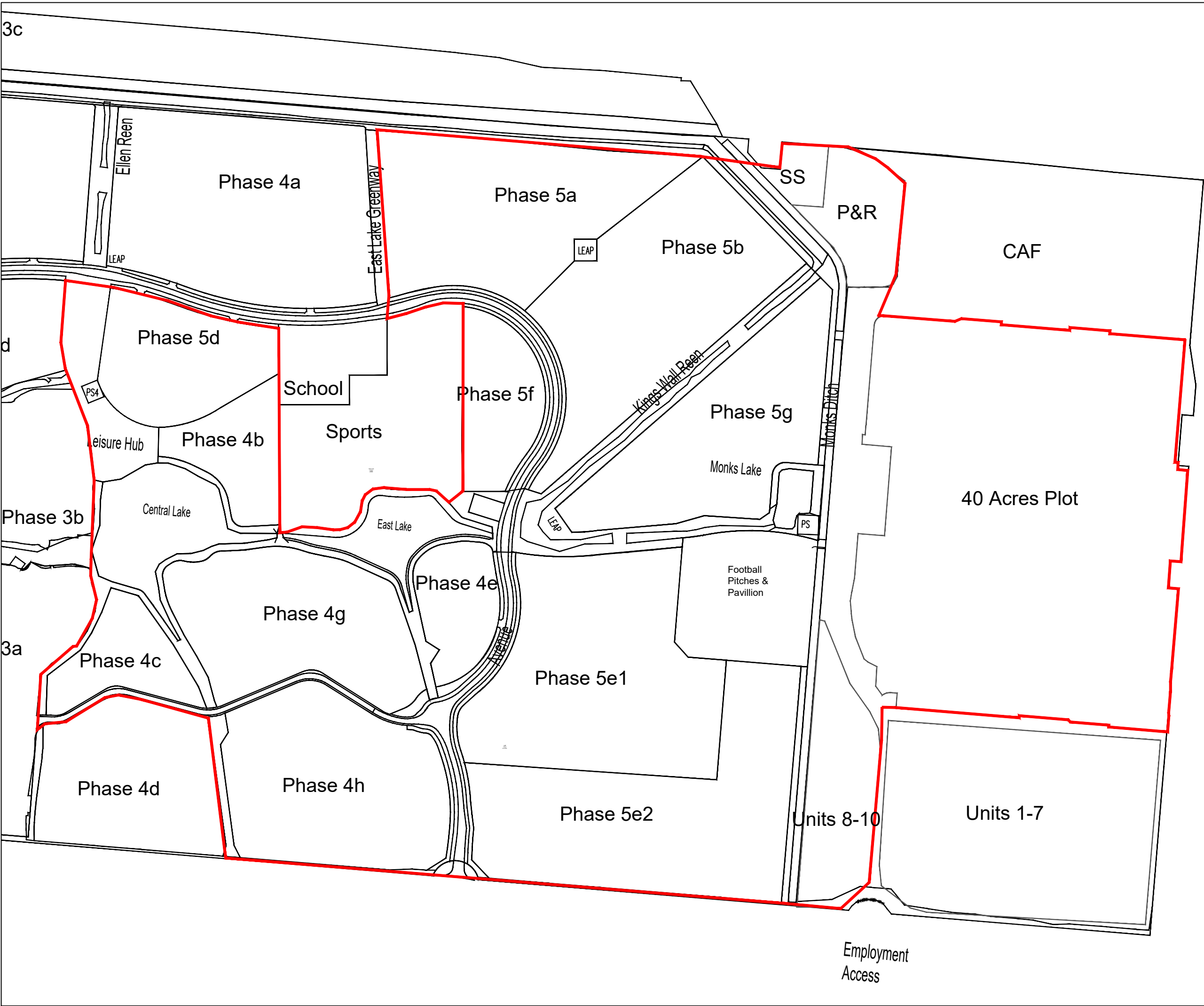
Contingency Plan

The validation assessment will also, where appropriate, compare results from adjacent phases and site wide monitoring results as part of the validation assessment. The creation of baseline set of data for the site, through the accumulation of results from individual phases, to support the maintenance of suitable site wide surface water quality. The comparison of phase specific information and sitewide information may also be used as contingency where soil concentrations exceed criteria or pore water concentrations exceed modelled parameters but monitoring indicates suitable sitewide conditions.

The CWDQRA also considers that there is a potential for natural attenuation benefits from further improving the existing surface water features on the site, which mainly comprise reens and ponds/small lakes. This is anticipated particularly through:

1. Further establishing the vegetation within the reens which will help reduce the concentrations of organic contaminants and particularly nutrients such as ammoniacal nitrogen. The reens are known to vegetate rapidly and require regular maintenance to remove surplus growth;
2. Undertaking organic matter enrichment of soils along margins of the reens and ponds/lakes into which water penetrating the Made Ground are likely to discharge. This could be undertaken by placement of locally excavated peat (obtained from Alluvial and underlying Tidal Flat Deposits) and other soils containing high concentrations of organic matter. This should enable a further stripping out of low concentrations of PAHs and TPH within these discharge waters. Amendment of these soils with other materials will also be considered, taking into consideration further knowledge of the residual contaminant profile, in order to provide a passive sustainable solution to the long-term remediation of this site.

The preliminary validation plan for Phase 4h is attached to this note as an example of the typical layout of post earthworks validation sampling and monitoring locations for a residential phase.



GENERAL NOTES

NO DIMENSIONS TO BE SCALED OFF THIS DRAWING.
THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS.
ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:

- DQCRWA BOUNDARY
- PHASE BOUNDARIES

Rev	Date	Amendments	By	Chk



Client
St Modwen Developments

Project
P18-669 Llanwern Reclamation

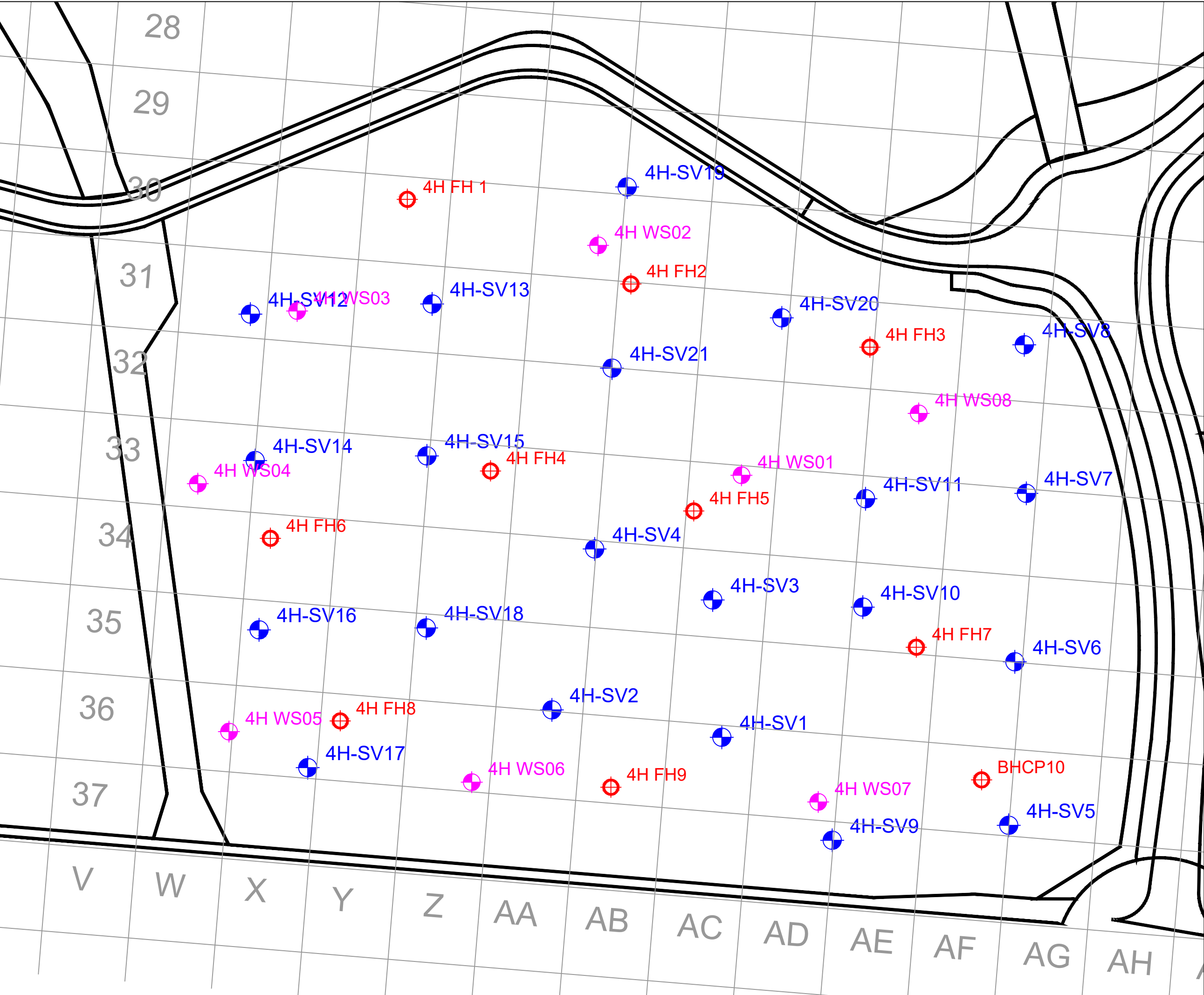
Drawing Title
DQCWRA Boundary Plan

INFORMATION

Drawn	Checked	Date
NTS	SR	CW
27.04.22		

Drawing No.	Rev.
18669-RLL-22-XX-DR-O-0262	A

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ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:

-  **4H-SV** SURFACE VALIDATION CHEMICAL SAMPLE LOCATION
-  **4H WS08** WINDOW SAMPLE LOCATION FOR GAS AND PERCHED WATER MONITORING
-  **4H FH3** FALLING HEAD TEST LOCATION

Rev	Date	Amendments	By	Chk



Client
St Modwen Developments

Project
P18-669 Llanwern Reclamation

Drawing Title
Phase 4H Validation Plan

INFORMATION

Drawn	Checked	Date
NTS	SR	CW
27.04.22		

Drawing No.	Rev.
18669-RLL-22-XX-DR-O-0269	

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Appendix G:

RLL, Glan Llyn, Remediation Strategy Addendum Information.

Technical Note

Project:	P18-669 Glan Llyn, Newport
Subject:	Remediation Strategy Addendum Information
Date:	January 2022
Document Reference:	18669-RLL-22-XX-RP-O-0192
Prepared by	Chris Wilson BSc (Hons) MCIWEM
Reviewed by	Howel Morris BSc (Hons) MSc CGeol FGS

A site wide Remediation Strategy was submitted by Rodgers Leask Limited (RLL) in November 2021 for the Glan Llyn development in Newport pursuant to the discharge of condition 27 of outline planning approval 06/0471. The Senior Scientific Officer (Steve Manning) at Newport City Council (NCC) reviewed and provided a response. This note provides addendum information to the Remediation Strategy following correspondence with the Senior Scientific Officer. The paragraphs numbered below relate to the points raised by NCC and discussed in the correspondence between NCC and RLL (Technical Note 187), presented in **Appendix A**.

1. Pictorial versions of the earthworks process intended to enhance the conceptual site model (CSM) for the residential and commercial parts of the development have been prepared and are presented in **Drawings**. The Made Ground in the residential areas will be cleared to the natural underlying clay before placement of suitable material from within the phase and from pre validated stockpiles to achieve the required formation level. Photographs of the process are inserted. The commercial area will undergo an excavation/ trim to 2m below formation level with obstructions and unsuitable material removed to natural clay before suitable material from the trim exercise and the residential site is re-engineered to achieve formation level.
2. The removal of unsuitable material from the residential phases and the turnover and placement of retained suitable Made Ground in 300mm layers is intended reduce the contamination risks (Phase 4h – vapour) by thinly spreading and compacting source material to improve consistency and reduce permeability. Monitoring (chemical surface validation sampling, gas monitoring and, where appropriate, vapour monitoring in each residential phase) will be undertaken following the remedial earthworks to assess the remediated condition and the contamination status of the formation surface. The Validation Report (submitted pursuant to the approval of NCC & partial discharge of planning condition 28) will recommend appropriate mitigation measures, if required, in addition to the clean cover as part of the listed developer actions.
3. The post remedial earthworks formation in residential areas will undergo chemical sampling (greater than 1 per 50m²) in addition to the pre-remediation testing to comply with the recommended testing frequency but also provide information to assess the contamination status of the formation surface as recommended by NCC. The surface contamination status,

in addition to earthworks validation, will be assessed to recommend the form of mitigation measures in addition to the clean cover.

4. A clean cover provision of 600mm in landscape areas is accepted. The landscape areas will also undergo formation surface chemical sampling to assess the contamination status and whether mitigation measures are required in addition to 600mm of clean cover.

5. The trim and chase strategy (also referred to as the 1m turnover) within the Remediation Strategy applies only to the central business park. The business park will have the benefit of at least 2m of re-engineered material underlying the construction material before the hardstanding or floor slabs area constructed. This is presented in the commercial area pictorial earthworks CSM (**Drawings**). The re-engineered material will have a reduced permeability in comparison with undisturbed in situ Made Ground and the hydraulic gradient would likely be away from the engineered material towards the undisturbed Made Ground. The hydraulic gradient would protect the engineered profile.

6. The Validation Report for each phase includes a section on the developer actions. The actions typically comprise the provision of clean cover and gas protection measures. The final form of the developer actions are to be confirmed following the post remedial works monitoring and validation sampling.

General Items

It is noted that the LPA and the project team await the comments from Natural Resources Wales (NRW) regarding the controlled waters.

The NRW and NCC have accepted an invite to attend site on 26th January 2022.

It is hoped that a greater understanding of the proposed Remediation Strategy has been provided in the correspondence. It is understood that the potential mitigation measures (to break pathways) will be reviewed following the assessment of the contamination status of the surface formation. This will comprise chemical sampling of the formation surface, shallow gas monitoring of the phase and, where appropriate, vapour monitoring.

Llanwern Residential Phases, Conceptual Site Model

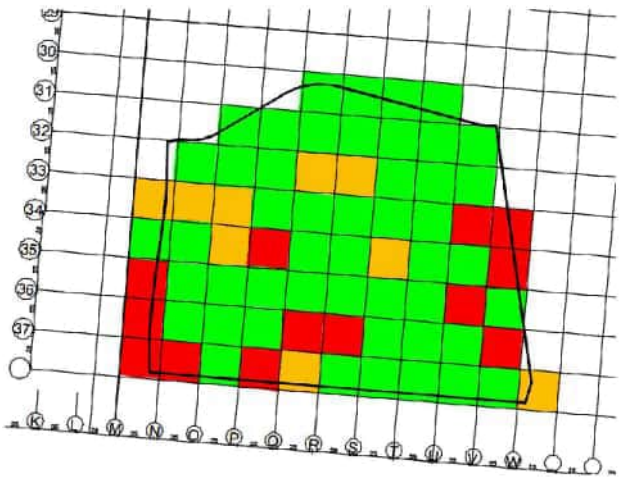
1. Pre-Reclamation Sampling Exercise

Chemical assessment undertaken on in-situ made ground and stockpiled material. Sampling across a 25m grid identifies chemically unsuitable material within phase.

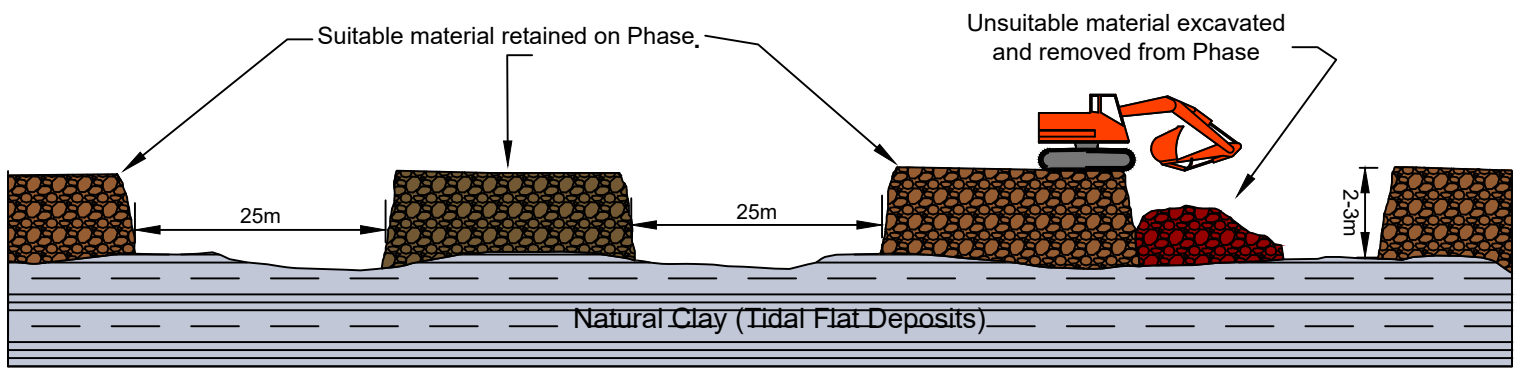
Made Ground to be excavated to natural Clay and removed for treatment or re-use on commercial area.

Potential for re-use within plot following turnover.

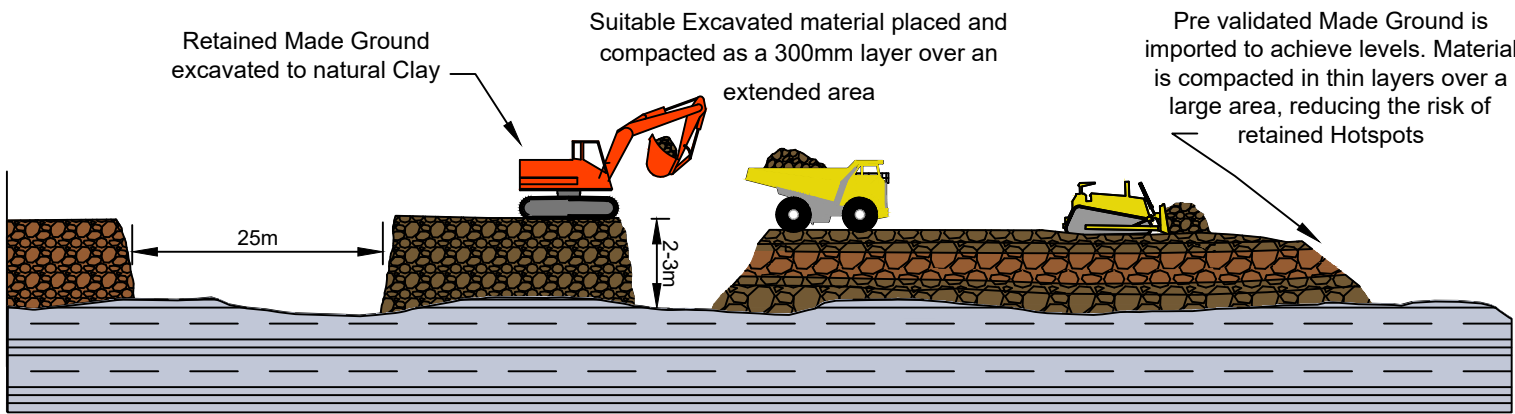
Made Ground to be turned over for re use within plot.



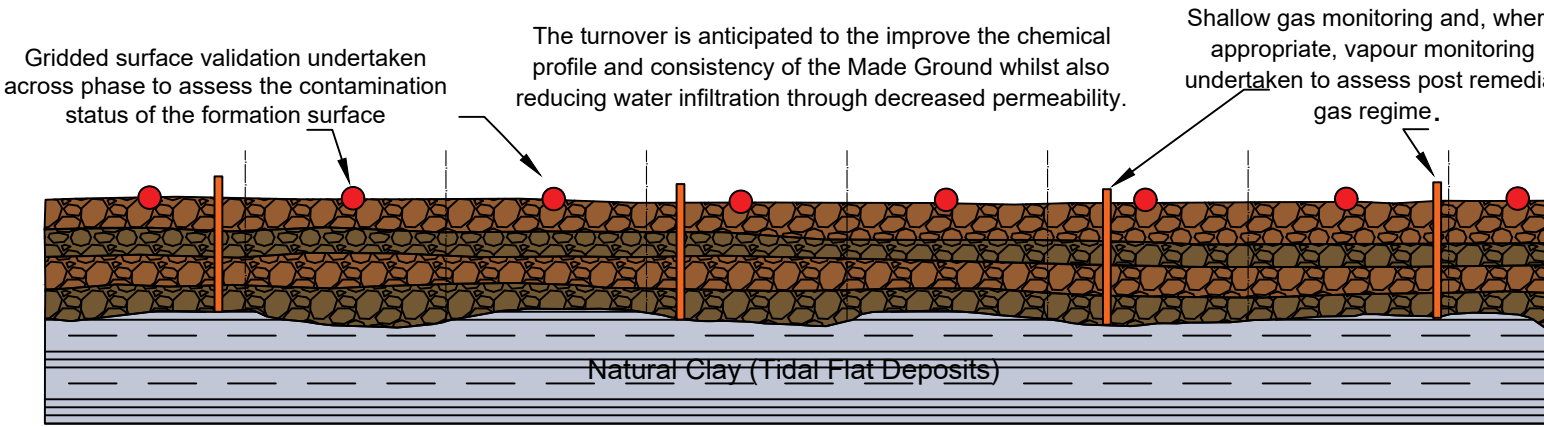
2. Unsuitable material removed from Site. Phase ready for turnover.



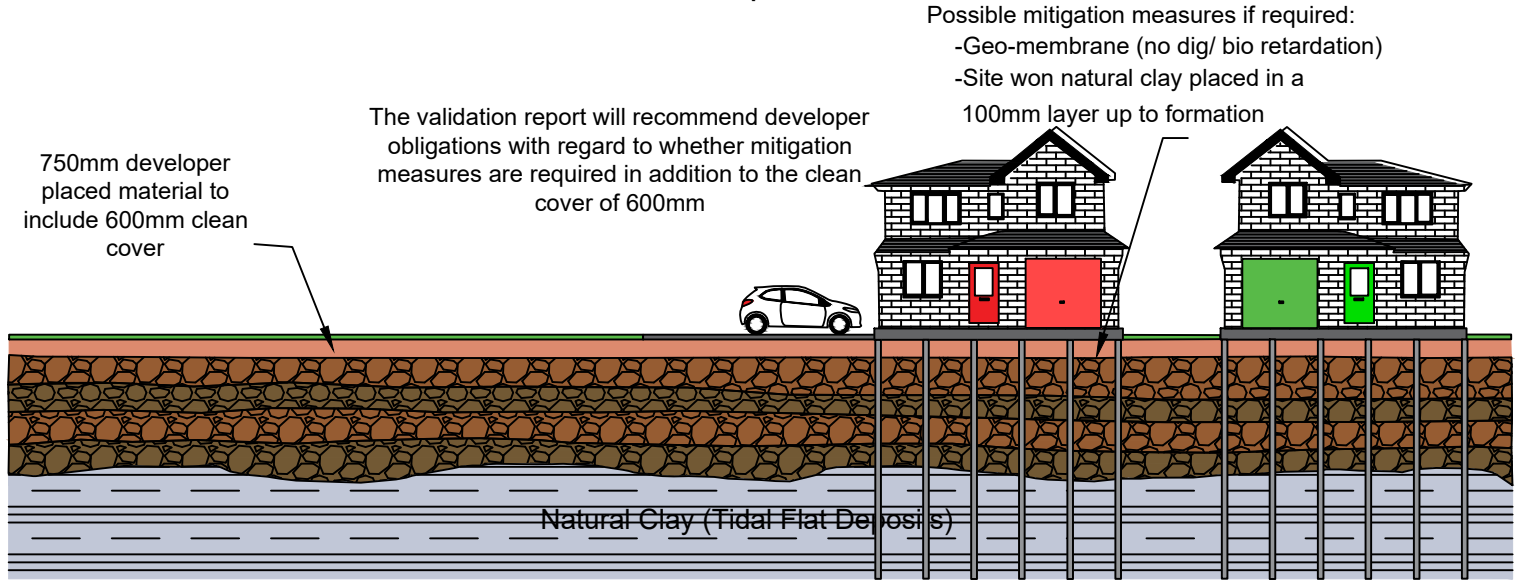
3. Turnover Exercise



4. Post Earthworks Additional Surface Validation

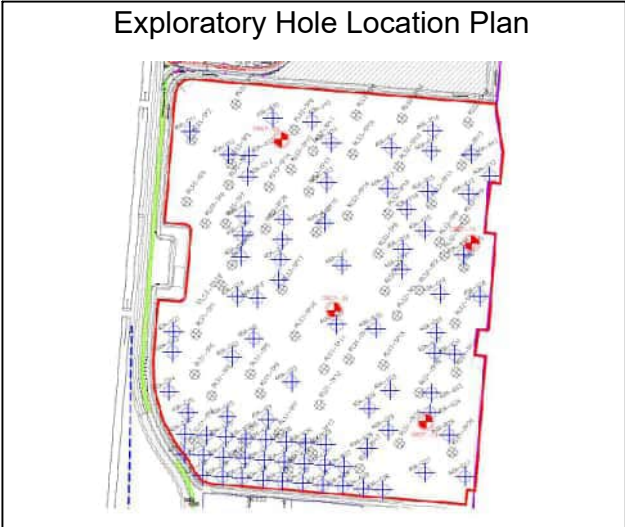
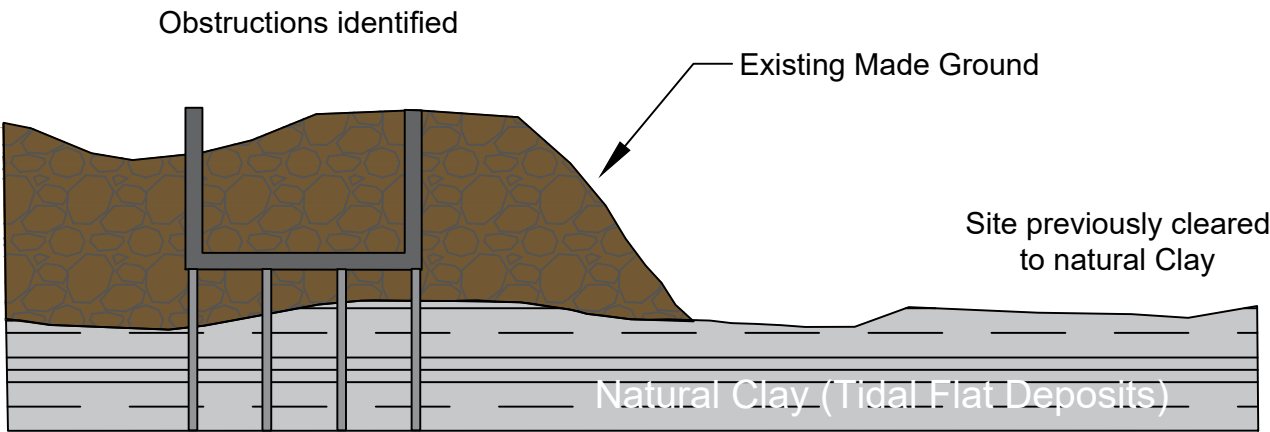


5. Developed Site

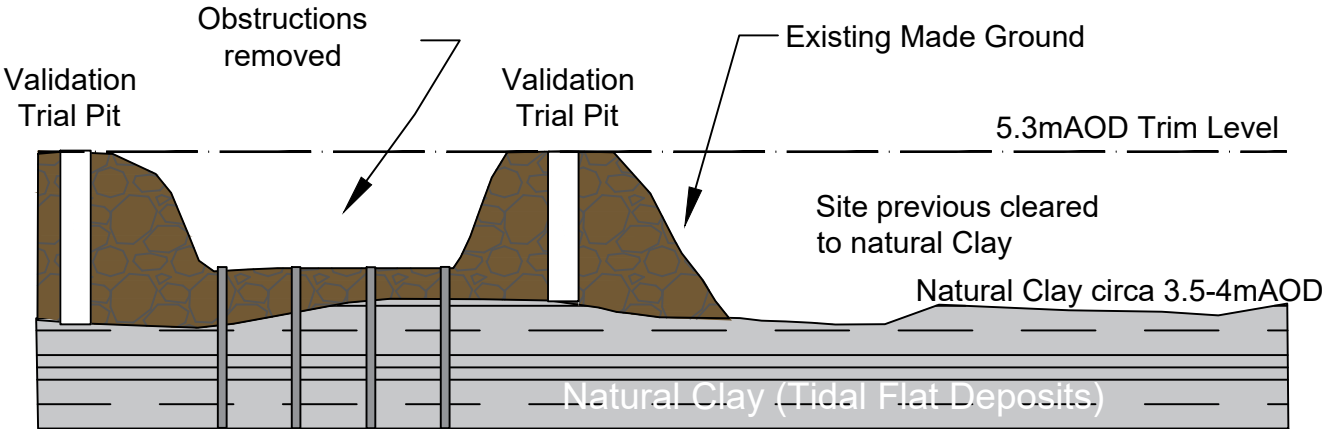


Llanwern Business Park, Conceptual Site Model

1. Site Pre-Trim



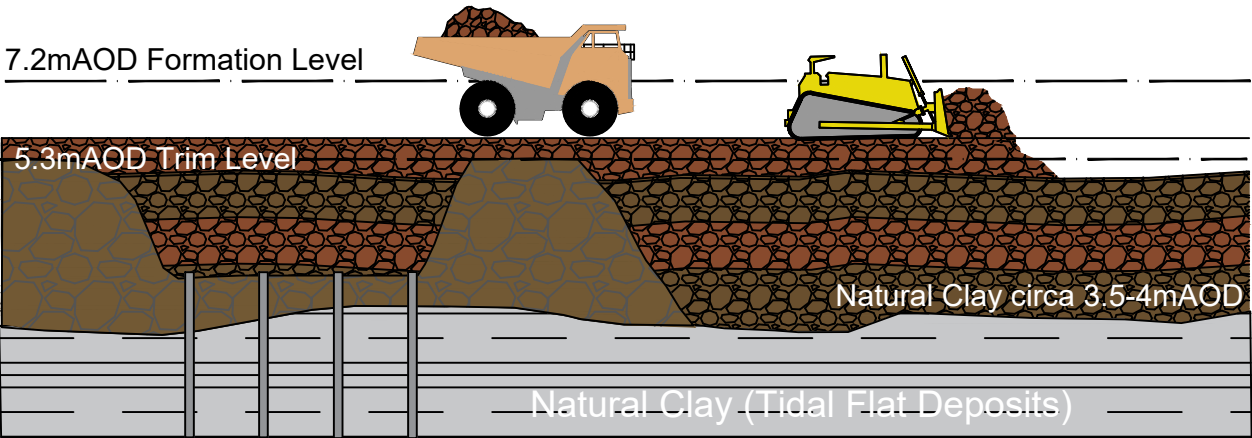
2. Site Trimmed to 5.3mAOD and obstructions removed



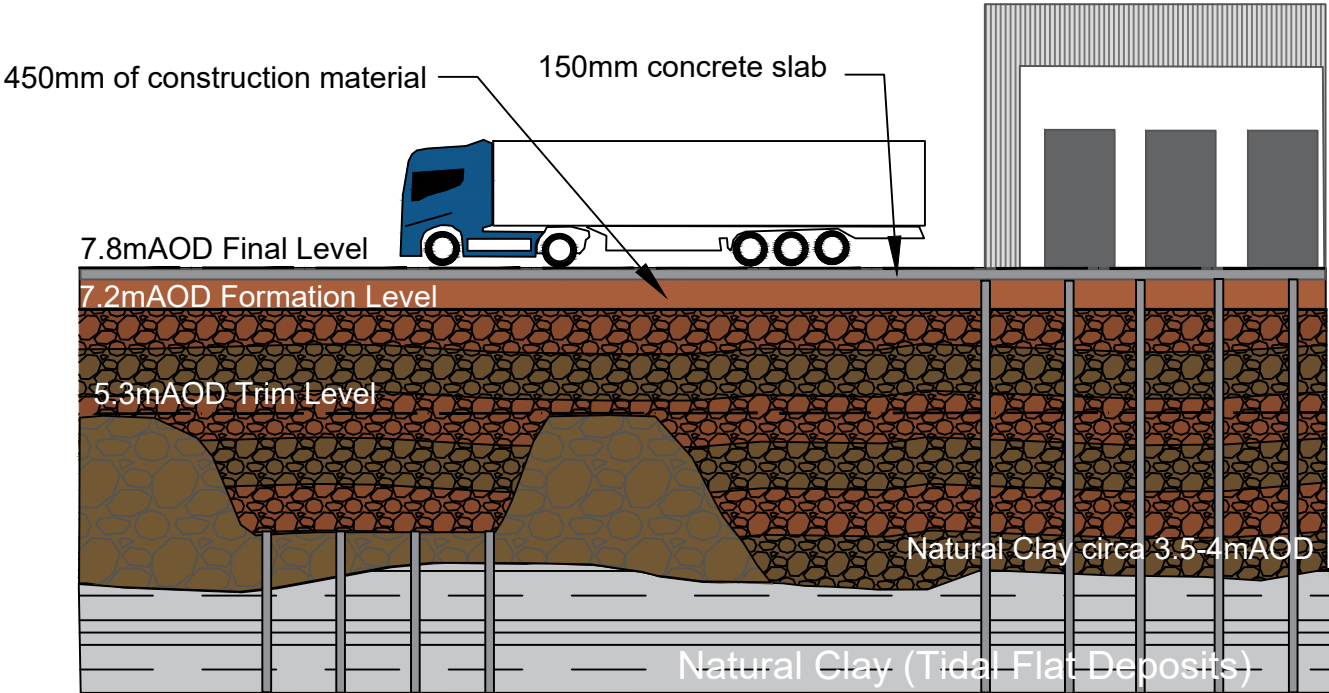
3. Fill engineered across site to formation level.

Suitable material from the trim exercise and material from the residential site placed and compacted as a 300mm layer over an extended area

Made Ground is imported to achieve levels. Material is compacted in thin layers over a large area, reducing the risk of retained Hotspots



3. Developed Site Including 0.6m of clean cover material





Appendix A – TN187, LPA Comments

Technical Note

Project:	P18-669 Glan Llyn, Newport
Subject:	Phase 4h Response to LPA Comments
Date:	December 2021
Document Reference:	18669-RLE-21-XX-RP-O-0187
Prepared by	Chris Wilson BSc (Hons) MCIWEM
Reviewed by	Howel Morris BSc (Hons) MSc CGeol FGS

It is worth stating that all made ground will be removed and only suitable material will be used in the formation of the plot. The Phase II report for Phase 4h reports the pre remediation conditions and all of the made ground will have been excavated to a validated natural clay. The full turnover of the made ground is exceptional and hugely conservative as it allows for the visual and olfactory assessment of all of the made ground in addition to chemical assessment. Approximately 40% of the made ground from Phase 4h has already been removed and stockpiled for treatment or reuse in the commercial area.

Comments:

1. Detailed cut and fill/reuse drawings for all areas requiring remediation are sought so that extents and depths can be better understood prior to works.

The site will have all unsuitable made ground removed and the remaining made ground assessed as suitable for retention will be turned over to the underlying natural clay. The removal or turnover of all of the made ground is a conservative approach where 100% of the made ground is excavated. A normal ground investigation would cover less than 1% of the material and therefore there is confidence in the consistency and suitability of the material. The natural clay will be sampled as a part of the validation testing. *A base of excavation drawing showing the surface of the natural deposits and relevant validation information will be provided within the validation report.* Is there an existing drawing which confirms this conceptually? it is important NCC has a clear picture of what is intended as well as what is done.

2. Will the removal of contaminated material be sufficient to remove the vapour pathway for hydrocarbons into dwellings/garden areas? *Yes, although as a precaution we will undertake vapour monitoring post earthworks.* The CSM in appendix D makes no reference to this. a vapour pathways will remain after made ground remediation then full protection of dwellings, services and garden areas needs to be considered for the benefit of future developers and the onward developer documentation trail. It is noted that a post remedial vapour assessment is proposed however this pathway needs to be included in the CSM for completeness. *Accepted, we will update the CSM as an addendum to the report.* Both items in red text are supported.

3. The Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground are noted and cause concern given their high levels at a what will be depth of only 600mm below residential gardens. Engineered cover systems appear to be warranted and not simple cover systems; in view of significantly elevated levels that will exist below cover. *The*

earthworks will provide an engineered difficult dig layer of low permeability which will be validated to assess compliance with the earthworks specification. The formation created would prove a difficult dig for a JCB even without the 600mm above. This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from domestic digging activity contact is required through engineered cover. The use of a semi permeable or impermeable membrane incorporating a bright orange geomembrane should be considered as part of engineered cover to deter against digging beneath clean material – a combined anti-dig/capillary break layer should also be considered as part of the remedial approach for final development. This is considered necessary to prevent both the upward migration of any contamination into cover systems and contact with material beneath them. The use of a 'Bentomat' type system (geotextiles with bentonite clay layer) to prevent infiltration may be warranted in this situation given the nature of contaminated material being proposed for reuse beneath cover and proposals regarding this are sought. Although 600mm is specified in the remediation strategy the formation level is set 750mm below the final ground level. Could the proposed developer actions regarding cover be recommended following review of the validation report. It is anticipated that the average concentrations will be well below the proposed thresholds. The remedial criteria is based on an average approach and the complete removal of made ground across the plot with placement of validated site won made ground. The turnover of the made ground will cause improvement of the material, where the organic concentrations are likely to be reduced, from the pre remediated state reported in the phase II report. The post remedial conditions are designed to be much improved and we can provide an isopachyte of concentrations to assist in zoning the site should enhanced protection measure be required. This appears to be a suitably pragmatic approach to specifying final developer cover and must take the form of an engineered cover system design with detailed drawings so that requirements are clear to all when available.

4. The proposed cover of only 300mm in landscaped areas does not appear sufficient given the level of contamination that will remain as a result of the proposed Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground. Either the reuse levels are made more conservative given the level of proposed cover ; or the level of cover is increased to a minimum of 600mm. 600mm is likely to be acceptable. 600mm will be accepted as suggested subject to its engineered nature. Incorporation of the features in 3 above would be relevant in landscaped areas also for any thickness of cover. The reengineered ground is likely to be provide a sufficient no dig barrier. This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from domestic digging activity contact is required through engineered features.

5. It is not clear whether the one metre turn over specification will prevent any lateral movement of contaminants into regions that have had the full turnover applied of full turn over ? The 1m turnover applies to the central business park where the interception of rainfall is >90% when the site is developed and the proposed levels are to be raised providing at least 2m of low permeability reengineered material above the base of excavation. The remediation strategy proposed by RLE recommends full turnover in the residential areas. Where this meets the remediation strategy proposed by Vertase FLI, the full depth of reengineered made ground would retard migration from the 1m turnover strategy. or what the significance of this would be? Graphical illustration of how this will work between areas of the two specifications is sought. If there is any risk of migration from one meter turnover regions into full turnover regions then an approach where all regions undergo full turnover may be worth considering ? This has been assessed as part of the CWRA, appended to the remediation strategy, the hydraulic gradient would suggest that the direction of migration would be from the engineered material to the non engineered material. Thus protecting the fully engineered profile. However the likely volume of perched water will be reduced due to

the reduced permeability of the engineered profile. This aspect is noted and may require further consideration by NRW – copied in for comment.

6. Onward developer action documentation needs to be provided in advance of any developers being in the frame; and the format of this is sought at this stage. *A general developer actions list can be provided. The actions typically comprise the provision of clean cover and gas protection measures.* Accepted that a draft format may be all that is possible at this stage in view of finalising developer engineered cover design further to validation of this first remedial phase.

It is important that the LPA obtain comments from NRW in respect of this site as controlled waters are clearly a sensitive receptor and Reuse Criteria for 40% Infiltration of Incident Rainfall into Engineered Made Ground are concerningly high. The strategy is intended to deliver an acceptable water quality into the surface waters by turning over the made ground and creating a consistent low permeability, 2m thick, engineered material. This is intended inhibit the percolation of rainwater into the made ground. The compaction also reduces the ability to disturb the made ground without the use of heavy mechanical means. This aspect is noted however it is the contamination status of the final formations surface that will dictate the degree to which additional separation from end user digging activity contact is required.

I am not at present reassured that the human health pathway will be sufficiently mitigated at both made ground remedial and developer remedial stages and as such the above matters need to be addressed before any consideration can be given to support for discharge. We would like to invite the local authority to attend site for a walkover as the benefit and scale of the remediation works are better understood during a site visit. A site meeting is welcomed and I would suggest NRW are invited to such a meeting also.

1.

