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Reference: **Clarification of Soil Samples used to Generate 95% UCLM Concentrations**

INTRODUCTION

This technical memo has been prepared in response to information requests from Health Canada (IR#'s HC-024). The information request states:

“Please identify the (soil) samples used in the generation of the 95% UCLM (for soil)”

The statement is requesting clarification on the soil samples that were used to estimate the 95% UCLM soil concentrations. The purpose of this memo is to clarify which soil samples were used in the calculation of the 95% UCLM concentration.

Clarification on the Soil Samples used to Estimate the 95% UCLM

The dataset in Appendix B of the HHERA TDR (Appendix 10.4-A) did not include a portion of the baseline soil data used to calculate the 95% UCLM concentration, as this information was provided elsewhere in the submission. The soil dataset provided in Appendix B of Appendix 10.4-A has been revised to include the data used to calculate the 95% UCLM concentration in soil. This revised soil dataset is included as Attachment A to this memo. A description of the data is provided below.

Consistent with the ProUCL statistics provided in Appendix C of the HHERA TDR, a total of 55 soil samples were included in the calculation of the 95% UCLM soil concentration. There were five duplicate samples associated with the 55 soil samples; however these duplicate samples were averaged prior to calculating the 95% UCLM. Overall, the soil samples can be divided into sets, which are provided in Table 1 and discussed below.

Reference: Clarification of Soil Samples used to Generate 95% UCLM Concentrations

Table 1. Soil Samples Included in the Calculation of the 95% UCLM Soil Concentration

Sample Type	Year (s) Collected	Sample Count (Excluding Duplicates)	Duplicates	Media Collected
Key Site	2011	11	3	Soil, vegetation, mammals
Mine Site	2011	8	0	Soil
Reclamation Soils	2012 and 2014	17	0	Soil
Knights Piesold Samples	2011	7	0	Soil, vegetation
Backyard Gardens, Parks and Schools	2012	12	2	Soil, vegetation (from gardens)
Total		55	5	

KEY SITE AND MINE SITE SOILS

A total of 19 soil samples and three duplicates were collected in 2011 from around the proposed Project infrastructure and from private agricultural land to the south, east, and northeast of the Project area. These samples were divided into two groups:

- **Key Site Soils:** 11 samples and three duplicates were collected from locations identified as 'key sites'. A 'key site' indicates that in addition to soil, vegetation and mammal samples were collected from each of the 11 locations.
- **Mine Site Soils:** 8 samples and zero duplicates were collected from around the Project tenure area and were identified as 'mine site' soil.

RECLAMATION SOILS

A total of 17 soil samples were collected from within the Project boundary area. Five were collected in 2012 and twelve were collected in 2014.

KNIGHT PIESOLD SAMPLES

A total of seven samples were collected near waterways in the LSA by Knight Piesold in 2011. The samples were co-located with vegetation samples. The purpose of the sampling program was to establish pre-mining baseline vegetation and soils metal content.

BACKYARD GARDENS, PARKS AND SCHOOLS

A total of 12 samples and 2 duplicates were collected from schools, parks and community gardens in the following Human Health Study Areas: Aberdeen, Sahali, West-end/Downtown, Brocklehurst

Reference: Clarification of Soil Samples used to Generate 95% UCLM Concentrations

and North Shore. Due to the layout of the community, each area did not necessarily contain a school sample, a park sample and a garden sample. For example, only one sample was obtained for Brocklehurst and this sample was from a community garden. There were no school samples or park samples for Brocklehurst.

Table 3.3-8 in the HHERA TDR provides a breakdown of the soil samples collected from each Human Health Study areas. This table contained an error; there is no school sample for Sahali. The revised Table 3.3-8 is provided below.

Revised Table 3.3-8:

Residential Area	Number of Soil Samples		
	Community Garden	School	Park
Aberdeen	1	3	1
Sahali	1	-	1
West End/Downtown	1	1	1
North Shore	1	-	-
Brocklehurst	1	-	-

Figure 3.3-1 in Appendix 10.4, which identified the Human Health and Baseline Terrestrial Sampling locations, has been updated to reflect the different sample groups discussed above. That figure is included as Attachment B. Samples identified in the Key as "Soil" include both the Reclamation samples and the Mine Site samples.

The revised soil dataset used to calculate the 95% UCLM concentrations of metals in soil is provided as Attachment A. Sample AJX12-ABD-SS, which was previously included in the dataset provided in Appendix A of the HHERA TDR, was removed from the baseline soil dataset as this data was not associated with a community garden, park or school. This data was not used to estimate the 95% UCLM concentration nor was it used to estimate the baseline concentrations in the Human Health Study areas.

Conclusions

The information in this technical memorandum provides clarification on the soil samples used to calculate the 95% UCLM soil concentrations used in the HHERA. The revised dataset and the revised Figure 3.3-1 that shows the sampling locations are provided in Attachments A and B, respectively.

Reference: Clarification of Soil Samples used to Generate 95% UCLM Concentrations

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Attachment: A: Revised Soil Dataset
B: Revised Figure 3.3-1

ATTACHMENT A

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	Key Site Samples										
Sample ID	AJX12-MIN-KS01-SS	AJX12-MIN-KS02-SS	AJX12-MIN-KS03-SS	AJX12-MIN-KS03-SSD	AJX12-MIN-KS04-SS	AJX12-MIN-KS05-SS	AJX12-MIN-KS06-SS	AJX12-MIN-KS06-SSD	AJX12-MIN-KS07-SS	AJX12-PRI-KS08-SS	AJX12-PRI-KS09-SS
Date Sampled	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	15-AUG-12	15-AUG-12	16-AUG-12
Time Sampled	08:00	10:00	12:30	12:30	14:30	15:30	16:30	16:30	14:30	09:00	00:00
ALS Sample ID	L1194731-10	L1194731-5	L1194731-3	L1194731-6	L1194731-4	L1194731-8	L1194731-9	L1194731-11	L1195226-4	L1195226-5	L1198506-16
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests											
% Moisture	2.00	1.62	3.38	2.65	9.12	4.59	9.78	10.6	2.19	0.69	2.98
pH (1:2 soil:water)	7.01	7.50	7.41	7.41	6.81	7.95	6.77	7.29	7.16	6.94	7.47
Particle Size											
% Gravel (>2mm)	10.2	12.6	9.46	15.9	9.94	16.9	30.7	22.4	15.8	11.6	13.6
% Sand (2.0mm -	43.8	39.8	34.1	29.2	25.3	39.1	38.4	40.7	43.1	33.4	34.9
% Silt (0.063mm -	41.2	42.5	51.1	50.5	60.7	39.8	26.1	31.1	36.4	48.1	46.9
% Clay (<4um)	4.69	5.05	5.32	4.42	4.08	4.29	4.77	5.74	4.70	6.88	4.56
Texture	Sandy loam	Silt loam / Sandy loam	Silt loam	Silt loam	Silt loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Silt loam	Silt loam
Metals											
Aluminum (Al)	18600	16600	18500	18400	15200	16400	14500	14700	17300	17200	19200
Antimony (Sb)	0.55	0.42	0.33	0.30	0.28	0.42	0.60	0.51	0.30	0.50	0.48
Arsenic (As)	6.69	4.76	3.82	3.96	4.26	4.40	2.96	4.05	5.25	6.80	9.79
Barium (Ba)	169	168	231	206	259	169	136	154	246	192	235
Beryllium (Be)	0.39	0.33	0.37	0.39	0.29	0.40	0.33	0.40	0.35	0.34	0.41
Bismuth (Bi)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	0.209	0.146	0.173	0.144	0.171	0.133	0.105	0.096	0.226	0.199	0.228
Calcium (Ca)	10100	8860	9150	8920	9560	16500	8450	8870	5670	8270	7980
Chromium (Cr)	38.9	50.3	51.9	48.9	74.9	54.8	29.7	40.5	107	57.0	51.1
Cobalt (Co)	16.0	14.4	15.0	15.6	15.2	13.7	10.2	10.5	17.2	15.6	14.9
Copper (Cu)	93.9	137	124	122	47.5	72.3	61.1	81.1	48.9	78.9	90.7
Iron (Fe)	36000	34200	32200	31600	24000	33000	23000	26000	28200	36000	32000
Lead (Pb)	5.84	4.29	4.59	4.20	4.62	5.87	8.62	6.01	5.23	7.06	5.41
Lithium (Li)	7.9	7.4	7.6	8.0	8.1	10.2	9.8	9.1	10.0	7.5	8.8
Magnesium (Mg)	9890	7970	7500	7420	13800	17600	8780	9570	16100	9450	8420
Manganese (Mn)	976	690	875	802	721	661	843	531	835	795	854
Mercury (Hg)	0.0447	0.0494	0.0359	0.0989	0.0392	0.0381	0.0525	0.0426	0.0309	0.0293	0.0289
Molybdenum (Mo)	1.44	1.52	1.47	1.66	1.27	0.59	1.42	1.07	0.96	0.91	1.14
Nickel (Ni)	26.8	33.0	39.4	37.4	100	44.1	21.4	29.7	118	44.2	37.2
Phosphorus (P)	1370	924	763	714	1220	1250	539	516	753	975	1010
Potassium (K)	3480	2820	3390	3200	2930	2390	1870	2140	2850	2520	3180
Selenium (Se)	0.21	<0.20	<0.20	<0.20	<0.20	0.33	0.38	0.41	0.21	<0.20	0.33
Silver (Ag)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	0.15
Sodium (Na)	270	250	220	210	180	450	260	300	240	240	270
Strontium (Sr)	106	72.4	76.9	69.2	91.1	202	241	224	46.7	85.7	87.3
Thallium (Tl)	0.090	0.067	0.073	0.064	<0.050	0.092	0.055	0.062	0.127	0.069	0.086
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	754	828	967	879	587	845	687	765	979	930	1040
Uranium (U)	0.338	0.359	0.340	0.320	0.274	0.417	0.675	0.543	0.374	0.332	0.476
Vanadium (V)	128	126	109	109	64.3	119	80.2	81.1	72.6	131	96.2
Zinc (Zn)	70.7	50.2	63.5	58.6	55.8	54.9	37.6	37.5	61.7	65.5	65.1

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	Key Site Samples			Mine Site Samples							
Sample ID	AJX12-PR1-KS09-SS-D	AJX12-PR1-KS10-SS	AJX12-PR1-KS11-SS	AJX12-MIN-AS01-SS	AJX12-MIN-AS02-SS	AJX12-MIN-AS03-SS	AJX12-MIN-AS04-SS	AJX12-MIN-AS05-SS	AJX12-MIN-AS06-SS	AJX12-PR1-AS08-SS	AJX12-PR1-AS09-SS
Date Sampled	16-AUG-12	17-AUG-12	17-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12	15-AUG-12	15-AUG-12	16-AUG-12	17-AUG-12	17-AUG-12
Time Sampled	00:00	00:00	00:00	10:00	14:00	17:35	12:15	13:33	00:00	00:00	00:00
ALS Sample ID	L1198506-17	L1198506-18	L1198506-19	L1194731-1	L1194731-7	L1194731-2	L1195226-2	L1195226-3	L1198506-13	L1198506-14	L1198506-15
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests											
% Moisture	2.57	20.4	2.66	1	1.53	0.61	5.76	3.69	3.36	24.1	4.24
pH (1:2 soil:water)	7.32	7.48	7.38	7.38	7.51	7.42	6.63	6.97	6.77	7.59	7.87
Particle Size											
% Gravel (>2mm)	20.7	6.67	3.25	12.5	16.1	18.1	11.3	12.3	10.8	19.5	7.13
% Sand (2.0mm -	33.8	20.5	12.7	29.2	38.2	38.8	31.5	31.9	33.6	30.0	19.7
% Silt (0.063mm -	41.8	65.6	76.6	52.8	39.8	36.7	46.9	45.4	52.3	45.8	67.4
% Clay (<4um)	3.68	7.24	7.38	5.45	5.88	6.36	10.4	10.5	3.24	4.79	5.71
Texture	Silt loam	Silt loam	Silt	Silt loam	Sandy loam	Sandy loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Metals											
Aluminum (Al)	19800	19900	18300	19300	16300	17200	18800	19800	19600	18400	17500
Antimony (Sb)	0.46	0.48	0.44	0.52	0.42	0.57	0.29	0.45	0.36	0.38	0.47
Arsenic (As)	9.09	6.95	5.86	4.56	4.85	4.41	4.14	5.69	5.71	5.61	6.60
Barium (Ba)	215	171	156	225	166	221	201	210	240	145	163
Beryllium (Be)	0.39	0.41	0.41	0.39	0.35	0.37	0.54	0.37	0.50	0.41	0.40
Bismuth (Bi)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	0.244	0.126	0.119	0.266	0.133	0.138	0.167	0.161	0.267	0.116	0.113
Calcium (Ca)	7840	9090	8980	9540	8550	8780	8960	7950	6600	10800	10200
Chromium (Cr)	51.3	62.0	64.7	50.7	50.0	60.4	49.2	96.0	45.9	47.4	64.6
Cobalt (Co)	15.5	14.3	14.0	14.1	13.9	16.2	14.3	17.0	13.5	13.0	13.9
Copper (Cu)	85.1	63.1	60.3	69.8	156	80.5	62.2	63.3	60.8	61.3	62.6
Iron (Fe)	32000	34400	33600	33500	33200	37100	34100	35100	30700	32800	34300
Lead (Pb)	5.57	3.98	3.98	5.89	4.10	4.47	9.69	4.48	7.85	3.63	3.88
Lithium (Li)	8.8	9.9	9.7	8.5	7.6	7.0	8.9	9.1	9.0	9.0	7.9
Magnesium (Mg)	8360	9410	8860	7460	7780	9150	10400	12000	7070	9130	8510
Manganese (Mn)	870	706	834	936	668	808	997	886	1000	655	790
Mercury (Hg)	0.0284	0.0308	0.0301	0.0350	0.0349	0.0314	0.0429	0.0268	0.0313	0.0311	0.0349
Molybdenum (Mo)	1.06	0.61	0.75	1.33	1.46	1.00	1.27	0.72	1.37	0.50	0.64
Nickel (Ni)	38.9	40.5	41.2	33.2	33.3	52.2	32.9	83.5	26.8	31.1	42.0
Phosphorus (P)	950	1060	931	1030	911	814	787	663	1090	1050	873
Potassium (K)	3190	2590	3780	3060	2720	3040	3070	3070	3420	2370	3630
Selenium (Se)	0.34	0.24	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.29	0.20
Silver (Ag)	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	280	440	290	260	230	200	390	240	410	400	540
Strontium (Sr)	86.1	70.1	90.1	78.7	69.0	70.2	127	71.7	83.6	77.5	73.7
Thallium (Tl)	0.088	0.072	0.070	0.074	0.068	0.065	0.148	0.085	0.111	0.059	0.067
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	1040	1150	1100	893	708	832	1390	998	1010	966	1050
Uranium (U)	0.469	0.386	0.456	0.336	0.351	0.282	0.625	0.339	0.528	0.358	0.377
Vanadium (V)	95.9	117	109	111	116	131	112	113	93.3	111	112
Zinc (Zn)	68.6	50.2	58.8	78.8	48.3	50.9	64.8	52.0	89.2	55.8	54.4

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	Park Soil- Albert McGowan Park, Aberdeen	Park Soil- Petersen Creek Park, Sahali	Duplicate- Park Soil- Petersen Creek Park, Sahali	Park Soil- Riverside Park, West End/Downtown	School Soil- Pacific Way School, Aberdeen
Sample ID	AJX12-PRK-AMG-SS	AJX12-PRK-PET-SS	AJX12-PRK-PET-SS-D	AJX12-PRK-RIV-SS	AJX12-SCH-PWE-SS
Date Sampled	14-AUG-12	14-AUG-12	14-AUG-12	15-AUG-12	14-AUG-12
Time Sampled	12:45	14:15	14:15	17:00	11:30
ALS Sample ID	L1194738-10	L1194738-11	L1194738-12	L1195226-1	L1194738-7
Matrix	Soil	Soil	Soil	Soil	Soil
Physical Tests					
% Moisture	1.41	6.4	4.66	15.5	7.39
pH (1:2 soil:water)	6.73	7.90	7.88	6.88	7.73
Particle Size					
% Gravel (>2mm)	6.05	1.97	1.91	3.77	26.0
% Sand (2.0mm -	47.9	61.9	42.0	44.3	53.8
% Silt (0.063mm -	41.8	30.1	48.1	45.1	15.6
% Clay (<4um)	4.22	6.10	7.97	6.83	4.65
Texture	Sandy loam	Sandy loam	Silt loam	Sandy loam	Sandy loam
Metals					
Aluminum (Al)	11800	9940	15100	11300	23300
Antimony (Sb)	0.29	0.35	0.37	1.11	0.58
Arsenic (As)	3.28	3.98	5.18	5.84	12.9
Barium (Ba)	131	90.8	143	170	197
Beryllium (Be)	0.34	0.28	0.43	0.32	0.54
Bismuth (Bi)	<0.20	<0.20	<0.20	0.23	<0.20
Cadmium (Cd)	0.183	0.173	0.278	0.581	0.133
Calcium (Ca)	7040	8230	14100	11500	19000
Chromium (Cr)	53.6	37.0	52.2	43.3	49.9
Cobalt (Co)	10.7	10.7	14.3	11.2	13.5
Copper (Cu)	25.6	26.5	37.9	171	90.5
Iron (Fe)	21400	21800	29300	21500	34400
Lead (Pb)	5.10	7.95	10.4	81.0	5.45
Lithium (Li)	7.1	9.5	11.6	9.5	13.0
Magnesium (Mg)	8230	8960	11400	8750	10100
Manganese (Mn)	505	401	569	403	641
Mercury (Hg)	0.0326	0.0260	0.0257	0.163	0.0251
Molybdenum (Mo)	0.74	0.70	0.90	2.38	1.66
Nickel (Ni)	44.4	37.1	48.5	39.1	51.3
Phosphorus (P)	1100	833	1200	1700	734
Potassium (K)	2620	1550	2650	2350	1930
Selenium (Se)	<0.20	0.22	0.44	0.61	<0.20
Silver (Ag)	<0.10	<0.10	<0.10	0.26	0.13
Sodium (Na)	400	310	550	300	530
Strontium (Sr)	55.7	46.4	70.6	88.1	199
Thallium (Tl)	0.096	0.096	0.120	0.119	0.102
Tin (Sn)	<2.0	<2.0	<2.0	5.3	<2.0
Titanium (Ti)	830	730	1090	623	703
Uranium (U)	0.577	0.579	0.893	1.46	0.946
Vanadium (V)	50.1	46.1	61.1	44.7	125
Zinc (Zn)	52.3	49.5	65.3	125	66.4

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	School Soil- Dufferin School, Aberdeen	School Soil- Ralph Bell, West End/Downtown	School Soil- Aberdeen	Garden Soil- Crestline, Brocklehurst	Garden Soil-Sahali, Aberdeen
Sample ID	AJX12-SCH-DUF-SS	AJX12-RBE-SS	AJX12-SCH-ABD-SS	AJX12-GAR-CRE-SS	AJX12-GAR-SAH-SS
Date Sampled	14-AUG-12	14-AUG-12	17-AUG-12	14-AUG-12	14-AUG-12
Time Sampled	10:30	13:40	00:00	13:00	09:00
ALS Sample ID	L1194738-8	L1194738-9	L1198506-12	L1194738-1	L1194738-2
Matrix	Soil	Soil	Soil	Soil	Soil
Physical Tests					
% Moisture	4.25	20.1	26	13.6	21.7
pH (1:2 soil:water)	8.10	7.70	7.10	7.67	7.89
Particle Size					
% Gravel (>2mm)	10.2	21.0	10.3	4.85	6.88
% Sand (2.0mm -	34.7	45.9	42.5	34.5	50.2
% Silt (0.063mm -	47.3	26.7	41.1	49.7	33.4
% Clay (<4um)	7.84	6.38	6.10	11.0	9.57
Texture	Silt loam	Sandy loam	Sandy loam	Silt loam	Sandy loam
Metals					
Aluminum (Al)	16500	22100	12500	17700	12800
Antimony (Sb)	0.27	0.14	0.31	0.33	0.35
Arsenic (As)	3.70	2.70	3.85	4.92	4.05
Barium (Ba)	166	131	129	144	124
Beryllium (Be)	0.50	0.61	0.36	0.41	0.32
Bismuth (Bi)	<0.20	<0.20	<0.20	0.36	<0.20
Cadmium (Cd)	0.155	0.243	0.393	0.325	0.225
Calcium (Ca)	20400	14900	12500	10500	12800
Chromium (Cr)	44.0	55.3	49.4	43.4	47.5
Cobalt (Co)	13.6	22.3	11.7	13.5	10.5
Copper (Cu)	43.4	36.1	25.5	48.2	34.8
Iron (Fe)	30400	30000	24700	28400	22300
Lead (Pb)	6.06	5.10	4.64	12.5	5.74
Lithium (Li)	8.9	8.0	8.0	20.5	7.4
Magnesium (Mg)	13400	31000	12300	9730	8460
Manganese (Mn)	730	868	471	483	474
Mercury (Hg)	0.0411	0.0095	0.0530	0.0344	0.0524
Molybdenum (Mo)	1.13	0.59	0.77	1.51	0.78
Nickel (Ni)	34.1	102	49.4	37.3	39.2
Phosphorus (P)	1350	2810	1530	2580	1860
Potassium (K)	3260	3750	2130	5150	2220
Selenium (Se)	0.29	<0.20	<0.20	0.42	0.23
Silver (Ag)	0.11	<0.10	<0.10	0.45	0.24
Sodium (Na)	670	1740	570	380	380
Strontium (Sr)	196	140	97.5	69.5	78.0
Thallium (Tl)	0.130	0.090	0.097	0.209	0.089
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	951	1330	843	1010	816
Uranium (U)	0.638	0.722	0.963	1.39	0.654
Vanadium (V)	82.7	107	62.2	47.0	53.3
Zinc (Zn)	62.6	118	58.3	97.1	61.1

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	Garden Soil- McDonald Park, North Shore	Garden Soil- Glenfair, Sahali	Garden-Riverside, West-End/Downtown	Duplicate-Garden-Riverside, West-End/Downtown
Sample ID	AJX12-GAR-MCD-SS	AJX12-GAR-GLE-SS	AJX12-GAR-RIV-SS	AJX12-GAR-RIV-SS-D
Date Sampled	14-AUG-12	14-AUG-12	14-AUG-12	14-AUG-12
Time Sampled	12:30	09:30	10:30	10:30
ALS Sample ID	L1194738-3	L1194738-4	L1194738-5	L1194738-6
Matrix	Soil	Soil	Soil	Soil
Physical Tests				
% Moisture	23.7	34.9	36.4	37.2
pH (1:2 soil:water)	7.72	7.76	7.54	7.55
Particle Size				
% Gravel (>2mm)	22.5	11.4	7.81	8.68
% Sand (2.0mm -	43.9	37.9	28.1	30.0
% Silt (0.063mm -	28.0	42.2	55.3	53.2
% Clay (<4um)	5.57	8.60	8.76	8.14
Texture	Sandy loam	Loam	Silt loam	Silt loam
Metals				
Aluminum (Al)	14000	10300	10000	10200
Antimony (Sb)	0.39	0.34	0.45	0.39
Arsenic (As)	5.65	4.22	4.02	3.92
Barium (Ba)	142	131	123	125
Beryllium (Be)	0.28	0.25	0.27	0.24
Bismuth (Bi)	0.23	<0.20	0.24	0.23
Cadmium (Cd)	0.190	0.211	0.427	0.435
Calcium (Ca)	18600	38700	17700	18600
Chromium (Cr)	47.8	37.3	34.2	32.1
Cobalt (Co)	11.6	8.91	8.28	8.04
Copper (Cu)	62.2	61.1	46.3	46.6
Iron (Fe)	23800	18900	17100	17000
Lead (Pb)	6.65	5.68	16.6	16.2
Lithium (Li)	7.4	6.5	8.7	8.8
Magnesium (Mg)	9020	10000	7420	7030
Manganese (Mn)	563	567	347	368
Mercury (Hg)	0.0462	0.0346	0.0771	0.0571
Molybdenum (Mo)	1.21	1.84	1.28	1.16
Nickel (Ni)	44.8	33.5	27.1	26.1
Phosphorus (P)	3440	4720	2870	3100
Potassium (K)	2830	4590	4260	4110
Selenium (Se)	0.44	0.68	0.45	0.51
Silver (Ag)	0.35	<0.10	0.30	0.34
Sodium (Na)	330	590	360	350
Strontium (Sr)	88.2	173	112	116
Thallium (Tl)	0.085	0.078	0.101	0.097
Tin (Sn)	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	508	359	564	516
Uranium (U)	0.589	0.777	0.880	0.936
Vanadium (V)	68.4	52.9	32.8	32.8
Zinc (Zn)	88.5	133	108	109

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set	Knights Piesold Samples						
Project ALS File No.	101-246/8 L1067368		Date Received Date	04-Oct-11 15:20 29-Nov-11			
RESULTS OF ANALYSIS							
Sample ID	CC02 - SOIL	PC02 - SOIL	PC02.5 - SOIL	PC03 - SOIL	PC08 - SOIL	JC03 - SOIL	CC08 - SOIL
Date Sampled	29-SEP-11	29-SEP-11	29-SEP-11	29-SEP-11	29-SEP-11	29-SEP-11	29-SEP-11
ALS Sample ID	L1067368-1	L1067368-3	L1067368-5	L1067368-8	L1067368-11	L1067368-13	L1067368-16
Physical Tests							
pH (1:2 soil:water)	8.31	8.18	8.10	7.74	7.95	7.71	7.48
Metals							
Aluminum (Al)	14200.00	11400.00	12300.00	11700.00	19400.00	12600.00	14800.00
Antimony (Sb)	0.57	0.32	0.34	0.29	0.62	0.31	0.44
Arsenic (As)	8.01	4.24	4.45	2.58	9.02	3.66	4.72
Barium (Ba)	186.00	128.00	147.00	146.00	177.00	147.00	235.00
Beryllium (Be)	0.33	0.26	0.25	0.21	0.33	0.27	0.29
Bismuth (Bi)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)	0.14	0.15	0.09	0.12	0.17	0.10	0.09
Calcium (Ca)	25600.00	21200.00	18000.00	15000.00	36500.00	29000.00	17700.00
Chromium (Cr)	61.40	94.40	62.70	57.20	77.10	61.20	56.60
Cobalt (Co)	14.80	12.00	12.30	11.80	20.70	11.10	16.00
Copper (Cu)	84.70	50.70	77.90	92.80	135.00	65.50	91.40
Iron (Fe)	35300.00	23200.00	25500.00	21100.00	43900.00	26300.00	35200.00
Lead (Pb)	9.69	5.50	3.62	7.27	3.65	3.31	3.15
Magnesium (Mg)	12200.00	14000.00	9670.00	12400.00	17900.00	8720.00	12800.00
Manganese (Mn)	694.00	644.00	1160.00	476.00	779.00	626.00	716.00
Mercury (Hg)	0.07	0.04	0.05	0.05	0.08	0.08	0.05
Molybdenum (Mo)	1.22	1.02	0.87	2.11	1.60	0.65	1.28
Nickel (Ni)	29.20	67.90	42.10	70.40	55.30	33.70	25.90
Phosphorus (P)	1840.00	1050.00	1060.00	865.00	1070.00	1130.00	1700.00
Potassium (K)	3450.00	3640.00	2110.00	2040.00	2300.00	1940.00	3120.00
Rubidium (Rb)-Total	-	-	-	-	-	-	-
Selenium (Se)	0.40	0.55	0.66	0.79	0.42	0.66	0.36
Silver (Ag)	0.07	0.09	0.08	0.07	0.13	0.08	0.06
Sodium (Na)	800.00	1040.00	440.00	370.00	880.00	500.00	160.00
Strontium (Sr)	122.00	150.00	119.00	108.00	213.00	136.00	93.40
Thallium (Tl)	<0.050	0.07	0.06	<0.050	0.07	0.05	<0.050
Tin (Sn)	0.41	0.43	0.27	0.45	0.33	0.36	0.76
Titanium (Ti)	1190.00	856.00	872.00	597.00	1280.00	845.00	1490.00
Uranium (U)	0.44	0.55	0.40	0.52	0.47	0.59	0.38
Vanadium (V)	123.00	59.40	71.60	55.00	179.00	77.90	120.00
Zinc (Zn)	119.00	55.40	47.30	52.20	57.40	49.40	45.20

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

Sample Set		Reclamation Soils				
Sample ID		ED-H09 A	ED-M11 A	P-W05 A	P-V12 A	P-Z03 A
Date Sampled		20-OCT-12	20-OCT-12	20-OCT-12	20-OCT-12	20-OCT-12
Time Sampled		13:00	13:30	14:00	14:30	15:00
ALS Sample ID		L1229589-40	L1229589-43	L1229589-44	L1229589-47	L1229589-50
Matrix		Soil	Soil	Soil	Soil	Soil
	Northing	5609896.45	5609698.01	5610414.98	5609400.24	5610270.31
	Easting	686502.614	686998.709	685056.933	685198.98	685549.188
Physical Tests						
Loss on Ignition @ 375 C		3.8	8.0	12.3	5.1	4.9
Organic Matter		3.3	6.5	9.8	4.3	4.1
pH (1:2 soil:water)		7.43	7.24	6.89	7.09	7.13
Particle Size						
% Gravel (>2mm)		14.3	13.7	5.83	12.8	10.8
% Sand (2.0mm - 0.063mm)		43.2	40.0	23.7	36.9	37.4
% Silt (0.063mm - 4um)		34.2	38.4	61.6	41.2	43.4
% Clay (<4um)		8.23	7.92	8.91	9.04	8.41
Texture		Sandy loam	Sandy loam	Silt loam	Silt loam	Silt loam
Leachable Anions & Nutrients						
Total Kjeldahl Nitrogen		0.122	0.263	0.356	0.157	0.165
Organic / Inorganic Carbon						
CaCO3 Equivalent		<0.70	<0.70	<0.70	<0.70	<0.70
Inorganic Carbon		<0.10	<0.10	<0.10	<0.10	<0.10
Total Organic Carbon		1.57	2.96	4.79	2.22	1.98
Plant Available Nutrients						
Cation Exchange Capacity		16.4	25.5	37.3	17.7	19.5
Saturated Paste Extractables						
SAR		0.12	0.58	0.24	0.19	0.51
Calcium (Ca)		51.6	77.1	40.3	66.4	45.1
Conductivity Sat. Paste		0.55	0.65	0.34	0.60	0.60
Magnesium (Mg)		26.5	31.6	19.5	25.0	39.8
Potassium (K)		21.8	8.0	18.4	23.2	27.8
% Saturation		42.7	87.9	92.0	54.4	51.6
Sodium (Na)		4.4	23.9	7.5	7.2	19.7
Metals						
Aluminum (Al)		21500	19700	25100	21200	26000
Antimony (Sb)		0.55	0.63	0.24	0.37	0.53
Arsenic (As)		7.26	6.46	3.32	4.72	6.18
Barium (Ba)		190	113	263	228	235
Beryllium (Be)		0.48	0.36	0.41	0.41	0.47
Bismuth (Bi)		<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)		0.172	0.211	0.138	0.176	0.194
Calcium (Ca)		9610	13400	12600	9320	9360
Chromium (Cr)		54.1	44.5	34.2	52.1	52.2
Cobalt (Co)		17.1	12.4	15.7	19.1	17.2
Copper (Cu)		91.8	110	60.4	181	85.6
Iron (Fe)		39800	31600	40000	36800	36400
Lead (Pb)		5.31	3.41	3.37	4.43	4.96
Lithium (Li)		11.2	9.7	8.7	8.6	11.0
Magnesium (Mg)		9940	10100	9260	8580	10100
Manganese (Mn)		857	421	855	848	867
Mercury (Hg)		0.0295	0.0280	0.0260	0.0838	0.0316
Molybdenum (Mo)		0.93	0.76	<0.50	1.38	1.18
Nickel (Ni)		39.8	32.4	23.5	40.8	41.1
Phosphorus (P)		921	970	825	800	1040
Potassium (K)		3210	2930	3610	3490	3800
Selenium (Se)		0.37	1.25	0.33	<0.20	0.35
Silver (Ag)		<0.10	0.14	<0.10	0.11	0.14
Sodium (Na)		290	410	290	250	340
Strontium (Sr)		93.0	113	115	74.5	93.2
Thallium (Tl)		0.099	0.058	0.065	0.069	0.094
Tin (Sn)		<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)		849	876	1030	938	1130
Uranium (U)		0.469	0.698	0.382	0.379	0.499
Vanadium (V)		137	110	158	126	123
Zinc (Zn)		67.3	60.5	52.3	62.2	66.1

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

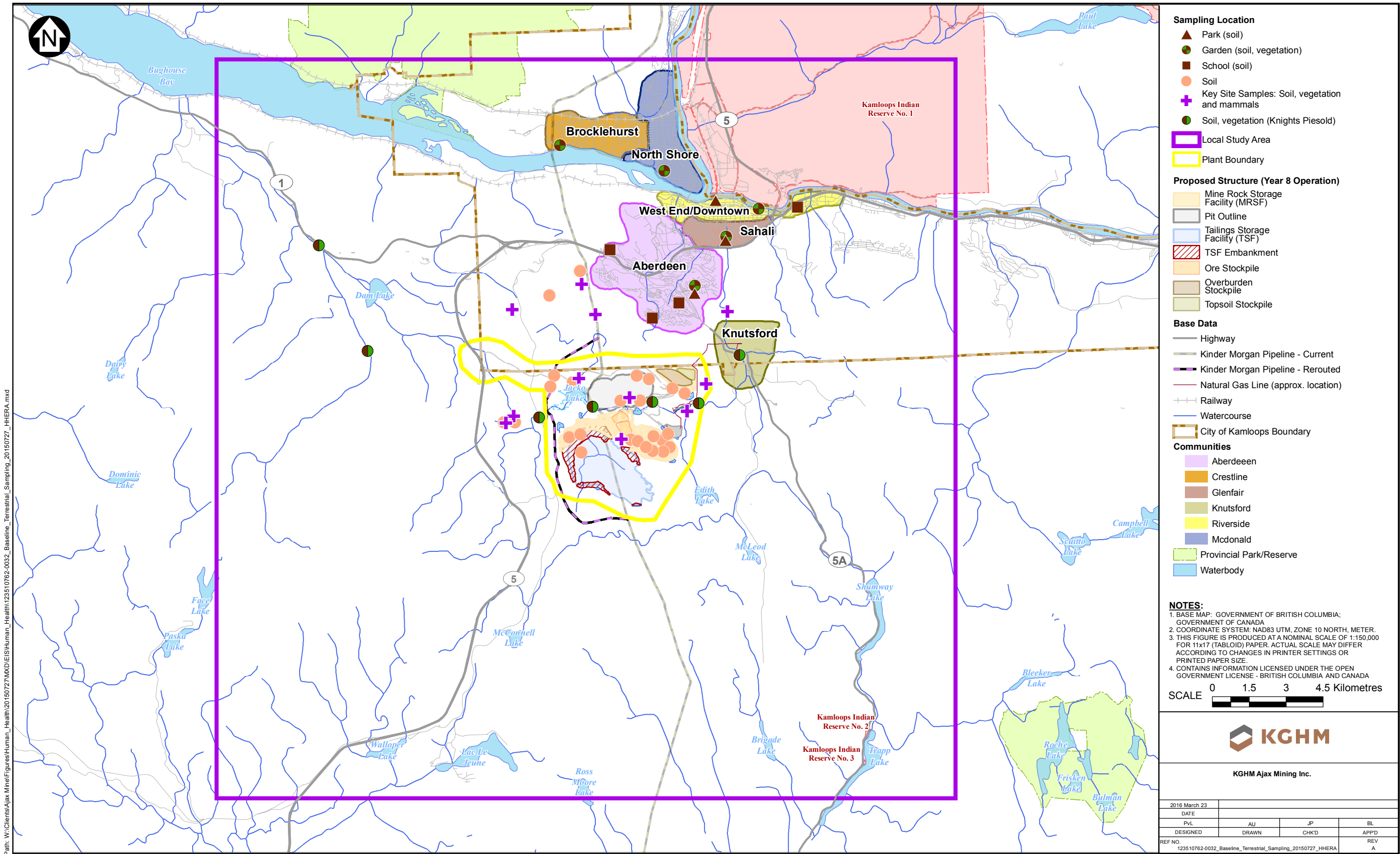
		Reclamation Soils					
Sample ID		S-R78 A SALINE	S-U75 A	S-E78 A	P-U80 A	S-S73 A	S-H77 A
Date Sampled		24-AUG-14	24-AUG-14	21-AUG-14	25-AUG-14	24-AUG-14	24-AUG-14
Time Sampled		00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID		L1508663-2	L1508663-3	L1508663-5	L1508663-7	L1508663-9	L1508663-11
Matrix		Soil	Soil	Soil	Soil	Soil	Soil
	Northing	5607783.00000	5607506.00000	5607805.00000	5608048.00000	5607326.00000	5607755.00000
	Easting	686107.00000	686402.00000	684812.00000	686331.00000	686132.00000	685089.00000
Physical Tests							
Loss on Ignition @ 375 C		18.6	4.5	7.4	8.2	10.7	4.6
Organic Matter		14.8	3.8	6.0	6.7	8.7	3.9
pH (1:2 soil:water)		8.40	7.21	8.23	7.41	7.06	7.02
Particle Size							
% Gravel (>2mm)		0.31	23.1	10.1	6.18	11.6	13.9
% Sand (2.0mm - 0.063mm)		4.33	30.9	29.6	22.8	17.3	34.8
% Silt (0.063mm - 4um)		62.8	39.5	55.5	64.1	61.6	44.0
% Clay (<4um)		32.6	6.51	4.85	6.91	9.50	7.33
Texture		Silty clay loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Leachable Anions & Nutrients							
Total Kjeldahl Nitrogen		0.580	0.181	0.401	0.408	0.576	0.248
Organic / Inorganic Carbon							
Inorganic Carbon		2.16	<0.10	<0.10	<0.10	<0.10	<0.10
Inorganic Carbon (as CaCO3 Equivalent)		18.0	<0.80	<0.80	<0.80	<0.80	<0.80
Total Organic Carbon		5.65	1.96	4.45	4.28	6.02	2.42
Plant Available Nutrients							
Cation Exchange Capacity		47.8	21.8	35.0	32.4	44.5	25.9
Saturated Paste Extractables							
SAR		24.6	0.36	0.15	<0.10	0.12	<0.10
Calcium (Ca)		370	68.0	51.6	50.6	62.2	41.1
Conductivity Sat. Paste		18.9	0.84	0.71	0.47	0.72	0.45
Magnesium (Mg)		800	58.1	61.9	22.3	26.2	31.0
Potassium (K)		653	26.6	58.0	39.5	73.0	20.3
% Saturation		98.6	48.7	69.6	67.0	77.4	49.4
Sodium (Na)		3690	16.7	6.8	<4.0	4.6	<4.0
Metals							
Aluminum (Al)		14400	21600	19000	18900	17400	19400
Antimony (Sb)		0.32	0.47	0.47	0.49	0.40	0.47
Arsenic (As)		2.77	5.93	6.62	6.22	4.20	5.29
Barium (Ba)		147	194	201	169	198	189
Beryllium (Be)		0.31	0.43	0.36	0.39	0.35	0.37
Bismuth (Bi)		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)		0.126	0.152	0.163	0.132	0.184	0.119
Calcium (Ca)		54500	8300	11100	12300	11800	8370
Chromium (Cr)		37.4	71.8	110	62.2	55.8	92.8
Cobalt (Co)		9.14	16.8	20.5	14.7	14.7	19.2
Copper (Cu)		57.0	93.3	67.7	87.5	98.8	74.6
Iron (Fe)		19800	35400	34000	34800	28000	36600
Lead (Pb)		3.39	3.76	3.94	4.18	3.86	3.93
Lithium (Li)		12.1	10.5	11.8	9.9	8.1	10.0
Magnesium (Mg)		41400	10100	23700	11000	9870	12500
Manganese (Mn)		648	715	706	746	731	747
Mercury (Hg)		0.0298	0.0199	0.0389	0.0425	0.0389	0.0290
Molybdenum (Mo)		1.41	0.73	0.52	1.27	1.26	0.68
Nickel (Ni)		28.4	57.0	151	44.2	51.4	90.8
Phosphorus (P)		1140	1010	980	1050	1110	967
Potassium (K)		6070	3140	2930	3280	4360	2970
Selenium (Se)		0.62	0.27	0.43	0.46	0.72	0.27
Silver (Ag)		<0.10	<0.10	<0.10	<0.10	0.10	<0.10
Sodium (Na)		6610	280	280	380	350	280
Strontium (Sr)		556	65.9	102	113	93.2	65.6
Thallium (Tl)		0.064	0.082	0.053	0.068	0.067	0.063
Tin (Sn)		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)		679	1040	783	1040	897	1040
Uranium (U)		2.08	0.426	0.272	0.405	0.336	0.336
Vanadium (V)		50.0	115	102	121	80.8	115
Zinc (Zn)		44.7	53.2	49.8	47.7	56.2	54.3

Table 1. Baseline Soil Samples used to Calculate 95% UCLM Concentrations.

	Reclamation Soils					
Sample ID	S-N74 A	S-K75 A	T-F79 A	S-N79 A	T-K80 A	T-K73 A
Date Sampled	24-AUG-14	21-AUG-14	23-AUG-14	23-AUG-14	26-AUG-14	26-AUG-14
Time Sampled	00:00	00:00	00:00	00:00	00:00	00:00
ALS Sample ID	L1508663-13	L1508663-15	L1508663-17	L1508663-19	L1508663-21	L1508663-23
Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Northing	5607358.00000	5607519.00000	5607905.00000	5607944.00000	5608037.00000	5607302.00000
Easting	685705.00000	685441.00000	682312.00000	685738.00000	682769.00000	682806.00000
Physical Tests						
Loss on Ignition @ 375 C	7.9	7.5	3.0	5.6	3.4	4.2
Organic Matter	6.4	6.2	2.6	4.7	2.9	3.5
pH (1:2 soil:water)	6.66	7.16	7.75	7.73	7.56	7.61
Particle Size						
% Gravel (>2mm)	18.1	5.52	18.2	22.8	11.8	17.1
% Sand (2.0mm - 0.063mm)	14.7	10.6	38.5	38.4	32.4	30.5
% Silt (0.063mm - 4um)	60.4	76.9	38.6	33.5	48.8	46.3
% Clay (<4um)	6.76	6.93	4.64	5.21	7.07	6.11
Texture	Silt loam	Silt	Sandy loam	Sandy loam	Silt loam	Silt loam
Leachable Anions & Nutrients						
Total Kjeldahl Nitrogen	0.416	0.358	0.193	0.300	0.144	0.204
Organic / Inorganic Carbon						
Inorganic Carbon	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Inorganic Carbon (as CaCO3 Equivalent)	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80
Total Organic Carbon	4.80	4.09	1.58	3.22	1.40	1.84
Plant Available Nutrients						
Cation Exchange Capacity	33.7	33.1	19.9	26.5	20.3	22.2
Saturated Paste Extractables						
SAR	<0.10	<0.10	0.11	<0.10	0.46	0.93
Calcium (Ca)	37.6	53.3	82.8	85.8	36.7	284
Conductivity Sat. Paste	0.57	0.48	0.65	0.70	0.45	2.69
Magnesium (Mg)	16.7	20.5	32.3	21.5	27.9	208
Potassium (K)	92.2	40.7	17.5	60.9	15.9	58.8
% Saturation	68.7	67.8	44.9	53.1	52.2	48.4
Sodium (Na)	<4.0	<4.0	4.8	<4.0	15.1	85
Metals						
Aluminum (Al)	17500	21000	19900	17300	19000	19100
Antimony (Sb)	0.34	0.47	0.59	0.37	0.42	0.59
Arsenic (As)	4.35	5.94	6.59	5.36	5.47	7.65
Barium (Ba)	226	248	225	194	144	168
Beryllium (Be)	0.36	0.47	0.41	0.36	0.45	0.42
Bismuth (Bi)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	0.193	0.197	0.138	0.134	0.102	0.139
Calcium (Ca)	9830	10600	10800	10800	8390	9390
Chromium (Cr)	60.3	74.8	86.8	62.5	72.6	63.9
Cobalt (Co)	14.3	17.0	17.1	15.6	15.2	14.9
Copper (Cu)	78.5	94.3	87.1	95.4	74.5	76.5
Iron (Fe)	28700	31600	39000	32300	36200	36300
Lead (Pb)	3.46	4.15	3.57	3.72	3.58	3.79
Lithium (Li)	8.1	9.8	10.4	9.3	10.7	10.3
Magnesium (Mg)	8840	10800	11100	10400	9850	10300
Manganese (Mn)	697	769	662	712	687	716
Mercury (Hg)	0.0263	0.0274	0.0297	0.0416	0.0337	0.0234
Molybdenum (Mo)	1.15	0.77	0.60	0.90	0.57	0.58
Nickel (Ni)	65.1	78.4	70.4	55.0	54.5	48.0
Phosphorus (P)	1220	1100	965	1050	818	1130
Potassium (K)	3830	3800	2570	2960	2470	2760
Selenium (Se)	0.27	0.22	0.23	0.22	0.22	0.24
Silver (Ag)	<0.10	0.12	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	270	350	310	250	300	420
Strontium (Sr)	78.4	78.4	69.1	70.5	60.0	74.8
Thallium (Tl)	0.058	0.081	0.072	0.054	0.068	0.076
Tin (Sn)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	907	1150	1160	807	1100	1030
Uranium (U)	0.360	0.415	0.406	0.307	0.391	0.418
Vanadium (V)	87.9	95.2	137	107	121	125
Zinc (Zn)	63.7	59.5	49.3	54.0	52.0	52.1

ATTACHMENT B

Figure 10.4-2
Human Health Baseline Terrestrial Sampling Locations



Path: W:\Clients\Ajax Mine\Figures\Human_Health\20150727\MD\GIS\Human_Health\123510762-0032_Baseline_Terrestrial_Sampling_20150727_HHERA.mxd