APPENDIX D

LABORATORY MDL STUDIES

New ICP MDL

Column Count	Method	Matrix	Lab	Instrument	Analysis Dates	Element	Symbol	MDL (mg/l)	MDL (ug/L)	Average Re	RecFlag
1	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Ag 328.068	**Ag**	**0.002**	**2.0**	99.8	
4	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Al 394.401	**Al**	**0.018**	**18.5**	115.4	
8	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	As 188.979	**As**	**0.17**	**173.6**	95.9	
11	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	B 249.772	**B**	**0.0073**	**7.3**	93.5	
15	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Ba 455.403	**Ba**	**0.0012**	**1.2**	97.5	
18	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Be 313.042	**Be**	**0.0008**	**0.8**	78.3	
19	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Ca 396.847	**Ca**	**0.0022**	**2.2**	199.9	High
23	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Cd 228.802	**Cd**	**0.0037**	**3.7**	97.5	
25	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Co 228.616	**Co**	**0.0089**	**8.9**	95.2	
31	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Cr 283.563	**Cr**	**0.0063**	**6.3**	100.3	
33	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Cu 324.752	**Cu**	**0.0030**	**3.0**	99.9	
38	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Fe 238.204	**Fe**	**0.0080**	**8.0**	66.3	
40	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	K 766.490	**K**	**0.037**	**37.4**	84.2	
41	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Li 670.784	**Li**	**0.0062**	**6.2**	122.1	
44	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Mg 280.271	**Mg**	**0.0110**	**11.0**	54.5	
46	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Mn 260.568	**Mn**	**0.0017**	**1.7**	110.7	
58	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Mo 281.616	**Mo**	**0.038**	**38.2**	95.5	
59	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Na 589.592	**Na**	**0.0241**	**24.1**	102.0	
63	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Ni 231.604	**Ni**	**0.015**	**15.2**	98.4	
64	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Pb 220.353	**Pb**	**0.093**	**93.3**	95.6	
65	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Sb 206.836	**Sb**	**0.088**	**88.0**	94.5	
67	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Se 196.026	**Se**	**0.25**	**251.6**	97.6	
70	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Si 251.611	**Si**	**0.015**	**14.8**	88.1	
72	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Sn 189.927	**Sn**	**0.048**	**47.8**	98.5	
74	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Sr 407.771	**Sr**	**0.0009**	**0.9**	85.6	
76	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Ti 334.940	**Ti**	**0.012**	**11.7**	85.9	
80	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Tl 190.801	**Tl**	**0.172**	**172.1**	101.4	
81	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	V 292.402	**V**	**0.0047**	**4.7**	99.2	
88	200.7	Aqueous	Thornton	Optima7300	3/12/2014-3/14/2014	Zn 213.857	**Zn**	**0.0037**	**3.7**	106.6	

MDL Spike 2x dilution
MDL Spike 5x dilution
MDL Spike soln 2
Line for High Calibration

Spike/MDL	Spike Flag	PQL	PQL/MDL	PQL Flag	MDL x3		
9.9		0.02	9.9		0.006	1	Ag
5.4		0.1	5.4		0.055	1	Al
2.9		0.5	2.9	Low	0.521	1	As
6.9		0.05	6.9		0.022	1	B
41.6	High	0.05	41.6		0.004	1	Ba
6.0		0.005	6.0		0.003	1	Be
9.0		0.1	45.2		0.007	1	Ca
13.4	High	0.05	13.4		0.011	1	Cd
5.6		0.05	5.6		0.027	1	Co
7.9		0.05	7.9		0.019	1	Cr
16.7	High	0.05	16.7		0.009	1	Cu
6.2		0.05	6.2		0.024	1	Fe
6.7		0.5	13.4		0.112	1	K
1.6		0.05	8.0		0.019	1	Li
1.8		0.1	9.1		0.033	1	Mg
5.8		0.01	5.8		0.005	3	Mn
2.6		0.1	2.6	Low	0.115	1	Mo
20.8	High	1	41.5		0.072	1	Na
6.6		0.1	6.6		0.045	1	Ni
5.4		0.5	5.4		0.280	1	Pb
5.7		0.5	5.7		0.264	1	Sb
2.0		0.5	2.0	Low	0.755	1	Sn
3.4		0.05	3.4		0.044	1	Si
5.2		0.25	5.2		0.143	1	Sn
5.6		0.01	11.2		0.003	1	Sr
4.3		0.05	4.3		0.035	1	Ti
2.9		0.5	2.9	Low	0.516	1	Tl
10.5	High	0.05	10.5		0.014	1	V
13.6	High	0.05	13.6		0.011	1	Zn

Analyte	MDL1	MDL2	MDL3	MDL4	MDL5	MDL6	MDL7	MDL8
	3/26/14 14:10	3/26/14 14:13	3/26/14 14:15	3/31/14 13:59	3/31/14 14:02	3/31/14 14:04	4/1/14 12:57	4/1/14 13:00
Antimony	0.122218	0.113245	0.0955	0.102777	0.107153	0.104744	0.086235	0.085628
Arsenic	0.112794	0.104945	0.078504	0.094955	0.110569	0.090554	0.094443	0.08825
Cadmium	0.125117	0.097061	0.091963	0.096132	0.09584	0.098884	0.102162	0.099541
Copper	0.178256	0.169323	0.161091	0.017515			0.107355	0.098636
Manganese	0.116855	0.090814	0.096832	0.052134	0.071516	0.088757	0.083062	0.106041
Nickel	0.140615	0.101992	0.107485	0.096241	0.086859	0.110903	0.131057	0.126142
Strontium	0.13891	0.110177	0.110308	0.098338	0.098659	0.106525	0.112077	0.092107
Tin	0.132949	0.096579	0.096482	0.107871	0.111567	0.107043	0.086893	0.079827
Uranium	0.118376	0.093676	0.097256	0.093005	0.092818	0.096311	0.094792	0.096395
Bismuth	0.118942	0.099793	0.097366	0.101463	0.101032	0.097498	0.097512	0.100876
Lead	0.133068	0.108652	0.109068	0.108705	0.10487	0.102512	0.103304	0.106701
Thallium	0.110278	0.084446	0.094567	0.102667	0.09399	0.090215	0.096932	0.089978

	3/26/14 14:20	3/26/14 14:23	3/26/14 14:25	3/31/14 14:11	3/31/14 14:14	3/31/14 14:16	4/1/14 13:17	4/1/14 13:20
Barium	0.490309	0.515831	0.493717	0.550572	0.508627	0.5026	0.48568	0.528426
Beryllium	0.572915	0.533145	0.348199	0.488164	0.68919	0.480117	0.408506	0.76979
Bismuth	0.492915	0.490412	0.489574	0.481833	0.4826	0.497133	0.478784	0.511734
Chromium	0.470474	0.467037	0.4862	0.477834	0.480376	0.478824	0.474821	0.523227
Cobalt	0.48237	0.499383	0.479151	0.474045	0.475724	0.467309	0.471487	0.514084
Lead	0.502554	0.492912	0.507209	0.50323	0.504659	0.487046	0.511169	0.537441
Magnesium	49.450317	48.94932	49.413543	48.794179	50.022817	48.921619	49.966914	56.779467
Molybdenum	0.527023	0.477139	0.497788	0.513988	0.493896	0.508422	0.498978	0.533958
Selenium	0.711742	0.75733	0.637515	0.641147	0.490485	0.624	0.664633	0.899533
Silver	0.469238	0.475152	0.493094	0.49611	0.495064	0.495034	0.076593	0.14777
Thallium	0.482942	0.486158	0.479399	0.488861	0.503023	0.496676	0.50122	0.517273
Titanium	0.529048	0.446536	0.534975	0.54858	0.557788		0.479185	0.599982
Vanadium	0.481355	0.486688	0.488266	0.501271	0.512161	0.477673	0.490723	0.539637
Copper	0.529083	0.523989	0.536688	0.46634	0.454549	0.476763	0.505217	0.558264

	3/26/14 14:40	3/26/14 14:42	3/26/14 14:45	3/31/14 14:34	3/31/14 14:36	3/31/14 14:39	4/1/14 13:27	4/1/14 13:29
Calcium	95.260464	104.532904	92.479978	107.658227	101.742024	105.415683	93.346611	97.136741
Potassium	103.142315	104.368302	100.373906	104.94234	103.724579	104.666626	100.408991	98.855517
Sodium	97.426785	96.467585	96.572568	111.649522	110.23206	111.170745	101.741473	102.989506

	3/26/14 14:50	3/26/14 14:52	3/26/14 14:55	3/31/14 14:46	3/31/14 14:49	3/31/14 14:51	4/1/14 13:47	4/1/14 13:49
Iron	10.735705	14.784279	10.844435	10.362347	10.338182	10.477177	10.82373	10.538893

	4/24/14 13:19	4/24/14 13:16	4/22/14 14:11	4/22/14 13:58	4/22/14 13:56	4/21/14 15:10	4/21/14 14:57	4/21/14 14:55
Aluminum	5.793826	5.504654	5.546231	6.234163	6.031363	6.687034	7.156529	7.818588
Boron	4.624064	4.083788	6.835304	5.717297	5.512345	5.153499	5.243596	4.083165
Zinc	4.790471	5.107848	7.152302	7.121945	7.189082	7.143199	7.009494	7.198594

s	t	mdl	Units	PQL	spike	spike/mdl	pql/mdl	av recov		
s	t	mdl	Units	PQL	spike	spike/mdl	pql/mdl	av recov		lookup
0.012697	3.142668	**0.040**	**ug/l**	0.1	0.1	2.5	2.5	102		mdl_sb
0.011756	3.142668	**0.037**	**ug/l**	0.15	0.1	2.7	4.1	97		mdl_as
0.01026	3.142668	**0.032**	**ug/l**	0.1	0.1	3.1	3.1	101		mdl_cd
0.061008	3.142668	**0.192**	**ug/l**	0.25	0.1	0.5	1.3	122	OK -see 0.5	mdl_cu
0.020095	3.142668	**0.063**	**ug/l**	0.25	0.1	1.6	4.0	88		mdl_mn
0.018442	3.142668	**0.058**	**ug/l**	0.25	0.1	1.7	4.3	113		mdl_ni
0.014224	3.142668	**0.045**	**ug/l**	0.1	0.1	2.2	2.2	108		mdl_sr
0.016422	3.142668	**0.052**	**ug/l**	0.1	0.1	1.9	1.9	102		mdl_sn
0.008466	3.142668	**0.027**	**ug/l**	0.05	0.1	3.8	1.9	98		mdl_u
0.007131	3.142668	**0.022**	**ug/l**	0.5	0.1	4.5	22.3	102		mdl_bi0.1
0.009808	3.142668	**0.031**	**ug/l**	0.2	0.1	3.2	6.5	110		mdl_pb0.1
0.008066	3.142668	**0.025**	**ug/l**	0.2	0.1	3.9	7.9	95		mdl_tl0.1

s	t	mdl	Units	PQL	spike	spike/mdl	pql/mdl	av recov		
0.021773	3.142668	**0.068**	**ug/l**	0.25	0.5	7.3	3.7	102		mdl_ba
0.139607	3.142668	**0.439**	**ug/l**	0.15	0.5	1.1	0.3	107		mdl_be
0.010531	3.142668	**0.033**	**ug/l**	0.5	0.5	15.1	15.1	98	OK, see 0.1	mdl_bi
0.017545	3.142668	**0.055**	**ug/l**	0.5	0.5	9.1	9.1	96		mdl_cr
0.015864	3.142668	**0.050**	**ug/l**	0.5	0.5	10.0	10.0	97		mdl_co
0.014968	3.142668	**0.047**	**ug/l**	0.2	0.5	10.6	4.3	101	OK, see 0.1	mdl_pb
2.663765	3.142668	**8.371**	**ug/l**	50	50	6.0	6.0	101		mdl_mg
0.018471	3.142668	**0.058**	**ug/l**	0.5	0.5	8.6	8.6	101		mdl_mo
0.118178	3.142668	**0.371**	**ug/l**	0.5	0.5	1.3	1.3	136		mdl_se
0.174965	3.142668	**0.550**	**ug/l**	0.1	0.5	0.9	0.2	79		mdl_ag
0.012559	3.142668	**0.039**	**ug/l**	0.2	0.5	12.7	5.1	99	OK, see 0.1	mdl_tl
0.050927	3.142668	**0.160**	**ug/l**	1	0.5	3.1	6.2	106		mdl_ti
0.020375	3.142668	**0.064**	**ug/l**	5	0.5	7.8	78.1	99		mdl_v
0.037041	3.142668	**0.116**	**ug/l**	0.25	0.5	4.3	2.1	101		mdl_cu0.5

s	t	mdl	Units	PQL	spike	spike/mdl	pql/mdl	av recov	
5.883429	3.142668	**18.490**	**ug/l**	100	100	5.4	5.4	100	mdl_ca
2.33629	3.142668	**7.342**	**ug/l**	100	100	13.6	13.6	103	mdl_k
6.63593	3.142668	**20.855**	**ug/l**	100	100	4.8	4.8	104	mdl_na
1.496383	3.142668	**4.703**	**ug/l**	10	10	2.1	2.1	111	mdl_fe

s	t	mdl	Units	PQL	spike	spike/mdl	pql/mdl	av recov	
0.819901	3.142668	**2.577**	**ug/l**	1	5	1.9	0.4	127	mdl_al
0.914435	3.142668	**2.874**	**ug/l**	2	5	1.7	0.7	103	mdl_b
1.017385	3.142668	**3.197**	**ug/l**	2.5	5	1.6	0.8	132	mdl_zn

Agilent MDL Study for Undigested Waters
Helium Mode
Method 200.8 and 6020

Analyte	Type	MDL	Units	PQL	PQL/MDL	
Silver (Ag)	**MDL**	**0.061**	**ug/L**	0.1	1.6	
Aluminum (Al)	**MDL**	**0.44**	**ug/L**	1	2.3	
Arsenic (As)	**MDL**	**0.08**	**ug/L**	0.15	2.0	
Barium (Ba)	**MDL**	**0.08**	**ug/L**	0.25	3.3	
Beryllium (Be)	**MDL**	**0.35**	**ug/L**	0.15	~~0.4~~	Must raise PQL
Bismuth (Bi)	**MDL**	**0.05**	**ug/L**	0.5	10.0	
Calcium (Ca)	**MDL**	**13.57**	**ug/L**	100	7.4	
Cadmium (Cd) - from CRDL1	**MDL**	**0.04**	**ug/L**	0.1	2.4	
Cobalt (Co)	**MDL**	**0.06**	**ug/L**	0.5	8.0	
Chromium (Cr, mass 52)	**MDL**	**0.16**	**ug/L**	0.5	3.1	
Chromium (Cr, mass 53)	**MDL**	**0.30**	**ug/L**	0.5	1.7	
Copper (Cr, mass 63)	**MDL**	**0.06**	**ug/L**	0.25	3.9	
Copper (Cr, mass 65)	**MDL**	**0.03**	**ug/L**	0.25	7.3	
Iron (Fe) - uses CRDL1	**MDL**	**1.92**	**ug/L**	10	5.2	
Potasium (K)	**MDL**	**15.55**	**ug/L**	100	6.4	
Magnesium (Mg)	**MDL**	**7.48**	**ug/L**	2.5	~~0.3~~	Must raise PQL
Manganese (Mn) - from CRDL1	**MDL**	**0.091**	**ug/L**	0.25	2.7	
Molybdenum (Mo)	**MDL**	**0.11**	**ug/L**	0.5	4.5	
Sodium (Na)	**MDL**	**6.41**	**ug/L**	100	15.6	
Nickel (Ni) - from CRDL1	**MDL**	**0.04**	**ug/L**	0.25	6.1	
Lead (Pb)	**MDL**	**0.05**	**ug/L**	0.2	4.0	
Antimony (Sb) - from CRDL1 runs	**MDL**	**0.03**	**ug/L**	0.1	3.0	
Selenium (Se)	**MDL**	**0.44**	**ug/L**	0.5	1.1	
Tin (Sn) -from CRDL1	**MDL**	**0.04**	**ug/L**	0.1	2.5	
Strontium (Sr) -from CRDL1	**MDL**	**0.02**	**ug/L**	0.1	4.5	
Titanium (Ti)	**MDL**	**0.20**	**ug/L**	1	5.0	
Thallium (Tl)	**MDL**	**0.09**	**ug/L**	0.2	2.3	
Uranium (U) - from CRDL1	**MDL**	**0.01**	**ug/L**	0.05	3.6	
Vanadium (V)	**MDL**	**0.07**	**ug/L**	5	69.8	
Zinc (Zn)	**MDL**	**0.49**	**ug/L**	2.5	5.1	

Col Count	LGN	Method	Matrix	Lab	Instrument	Analysis Date	Analyte Name	Spike Level
1	B1402022	1631	Aqueous	AEL - Thornton	HG	12/6/2013-2/4/2014	Mercury	0.5
								ng/L

MDL1	MDL2	MDL3	MDL4	MDL5	MDL6	MDL7	Average	stddev	count
0.7248	0.7381	0.7106	0.514	0.7316	0.5700	0.5762	0.6521857	0.0949	7
2/26/14	2/26/14	2/26/14	3/25/14	3/13/14	3/25/14	3/25/14			

tvalue	MDL	AvRecov	RecFlag	Spike/MDL	SpikeFlag	PQL	PQL/MDL	PQL Flag	Analyte Name
3.1426684	0.2981302	130.43714		1.6771194		0.6	2.0125433	Low	Mercury
	ng/L					ng/L			

Outlier Test

								average	standard dev	count	Significance	T-Value	Critical Z-Value
	0.7248	0.7381	0.7106	0.2271	0.7316	0.57	0.5762	0.6112	0.18432	7	0.05	5.1644456	2.0810937
z-value	0.6163237	0.6884813	0.5392833	2.0838904	0.6532163	0.2235259	0.1898885						
outlier?	No	No	No	Yes	No	No	No						