

Appendixes 1—5

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Appendix 1. Bulk geochemistry of mine waste from the Pike Hill mines study area.

[mg/kg, milligrams per kilogram; wt. %, weight percent; ICP-MS, inductively coupled plasma-mass spectrometry; ICP-AES, inductively coupled plasma-atomic emission spectrometry; HG-AAS, continuous-flow hydride-generation atomic absorption spectrophotometry; <, less than; Dup, field replicate sample]

Element/Lab information		Job number	Lab number	Ag mg/kg	Ag mg/kg	Al mg/kg	Al wt. %	As mg/kg	As mg/kg	Au mg/kg	Ba mg/kg	Ba mg/kg	Be mg/kg	Be mg/kg	Bi mg/kg
Units	Methods			ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS
04Smith1		MRP-05662	C-245972	5.89	7	44,200	4.6	1	<8	<10	308	580	1.4	1	2.21
04Smith2		MRP-05662	C-245973	5.49	7	30,200	3.5	0.6	<8	<10	236	560	1.2	1	3.36
04Smith3		MRP-05662	C-245974	6.6	8	25,700	3.2	1	<8	<10	195	590	1.2	1	2.73
04Smith4		MRP-05662	C-245975	<3	<2	1,180	0.16	0.6	<8	<10	83.4	850	0.04	<1	0.09
04Smith5		MRP-05662	C-245976	<3	<2	27,600	3	0.6	<8	<10	325	520	1	1	0.23
04Smith6		MRP-05662	C-245977	<3	<2	47,600	4.7	0.5	<8	<10	222	240	1.6	2	0.15
04Smith7		MRP-05662	C-245978	<3	<2	43,600	3.9	0.8	<8	<10	198	220	1.6	2	0.13
04PKHL1		MRP-05662	C-245979	10.3	12	25,800	3	6.3	<8	<10	179	500	1	1	3.39
04PKHL2		MRP-05662	C-245980	6.26	7	40,200	4.7	3.1	<8	<10	256	540	1.5	2	2.28
04PKHL3		MRP-05662	C-245981	11.9	14	34,600	4.1	3.3	<8	<10	269	550	1.1	1	6.03
04PKHL7		MRP-05662	C-245982	11.4	14	26,400	3.3	8.5	<8	<10	193	490	1	1	4.38
04PKHL9		MRP-05662	C-245983	27.8	32	15,400	2	9.7	<8	<10	186	620	0.65	<1	9.35
04PKHL10		MRP-05662	C-245984	3	4	31,100	3.7	57	<8	85	167	210	1.1	1	1.92
04PKHL11		MRP-05662	C-245985	7.63	10	23,000	2.8	3.2	<8	<10	170	480	0.99	1	5.28
05PKHL11 Dup		MRP-06686	C-271421	8.97	<2	26,200	2.7	3	-	<30	171	180	1.1	<1	6.12
04PKHL11-A		MRP-05662	C-245986	<3	<2	33,700	3.4	0.3	<8	<10	325	320	1.4	1	0.26
04PKHL12		MRP-05662	C-245987	<3	3	5,570	0.77	0.2	<8	<10	44.1	690	0.26	<1	1.48
04PKHL13		MRP-05662	C-245988	12.9	16	30,300	3.7	6.6	<8	<10	206	530	1.1	1	5.15
04PKHL13-B		MRP-05662	C-245989	<3	2	1,860	0.27	0.5	<8	<10	26.3	780	0.07	<1	0.86

Appendix 1. Bulk geochemistry of mine waste from the Pike Hill mines study area.—Continued

[mg/kg, milligrams per kilogram; wt. %, weight percent; ICP-MS, inductively coupled plasma-mass spectrometry; ICP-AES, inductively coupled plasma-atomic emission spectrometry; HG-AAS, continuous-flow hydride-generation atomic absorption spectrophotometry; <, less than; Dup, field replicate sample]

Element	Bi		Ca		Cd		Ce		Co		Cr		Cs		Cu		Eu		
	mg/kg	ICP-AES	mg/kg	ICP-MS	wt. %	ICP-AES	mg/kg	ICP-MS	mg/kg	ICP-AES	mg/kg	ICP-MS	mg/kg	ICP-AES	mg/kg	ICP-MS	mg/kg	ICP-AES	
Methods																			
Sample number																			
04Smith1	<10		7,650		0.78	0.63	2	22.7	18	39.4	59	85.1	59	4.3	1,800	1,800	<2		
04Smith2	<10		7,120		0.78	0.29	<2	13.2	8	28.4	46	40.8	10	1.2	1,530	1,700	<2		
04Smith3	<10		5,010		0.57	0.22	2	12.5	6	31.7	61	28.2	<1	0.94	1,380	1,500	<2		
04Smith4	<10		262		0.015	0.1	3	2	<4	1.3	36	23.1	<1	0.16	1,120	1,300	<2		
04Smith5	<10		5,890		0.62	0.49	<2	16.1	13	14	20	38.7	21	3.7	559	610	<2		
04Smith6	<10		7,000		0.68	0.13	<2	51.4	52	10.7	10	52.8	54	2.4	19	18	<2		
04Smith7	<10		4,590		0.4	0.11	<2	53.3	50	9.8	10	45.4	40	2.3	18	15	<2		
04PKHL1	<10		6,620		0.73	0.59	<2	9.6	5	35	59	24.9	<1	1.1	4,410	4,700	<2		
04PKHL2	<10		7,680		0.87	0.27	3	12.1	8	29.1	47	37	11	2	3,000	3,200	<2		
04PKHL3	<10		4,450		0.5	0.35	2	12.6	9	47.9	76	41.2	16	1.7	3,240	3,400	<2		
04PKHL7	<10		7,120		0.85	2.5	4	13.9	10	50.7	88	31.8	4	1.5	8,060	9,000	<2		
04PKHL9	<10		4,350		0.54	2	5	11.4	4	103	170	20	<1	1.2	9,200	11,000	<2		
04PKHL10	<10		29,800		3.4	91.8	110	31.7	29	122	180	42.3	38	1.8	7,200	7,900	<2		
04PKHL11	<10		8,320		0.95	0.64	2	8.7	4	36.2	66	24.3	<1	0.97	6,400	7,200	<2		
05PKHL-11 Dup	<30		8560		0.96	1.1	<2	8.8	<4	39.3	45	22.6	19.8	0.98	8,410	10,000	-		
04PKHL11-A	<10		9,070		0.87	0.06	<2	17	16	1.1	<1	54.8	64	5.2	2,370	2,400	<2		
04PKHL12	<10		1,300		0.16	0.41	3	2.5	<4	8	37	11.9	<1	0.24	1,610	2,100	<2		
04PKHL13	<10		6,350		0.76	0.29	3	8.6	4	34.4	63	32.1	5	2.1	3,670	4,300	<2		
04PKHL13-B	<10		418		0.043	0.1	2	0.98	<4	3.6	36	17.8	<1	0.21	874	1,000	<2		

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Element Units	Fe		Ga		Ho		K		La		Li		Mg		Mn		
	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	mg/kg	wt. %	
Methods	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	
Sample number																	
04Smith1	200,000	19	16	23	<4	18,100	1.8	11.5	10	33	32	18,000	1.8	1,370	2,100		
04Smith 2	210,000	21	14	20	<4	15,600	1.7	9.2	8	14.3	12	6,690	0.74	865	1,800		
04Smith3	230,000	25	12	18	<4	12,300	1.4	8.2	6	9.7	10	4,130	0.5	609	740		
04Smith4	410,000	47	2.4	18	<4	2,850	0.36	0.9	<2	<0.2	<2	250	0.036	39	13		
04Smith 5	130,000	14	10	14	<4	5,800	0.66	5.5	5	16.7	16	6,620	0.71	807	860		
04Smith6	26,000	2.6	12	8	<4	6,540	0.68	20.6	19	30.3	28	14,700	1.5	1,120	1,100		
04Smith7	26,000	2.4	9.9	8	<4	6,790	0.66	16.3	15	27.8	24	7,830	0.71	606	570		
04PKHL1	200,000	20	12	20	<4	13,800	1.6	6.1	5	9.3	10	3,190	0.37	166	170		
04PKHL2	170,000	18	16	18	<4	18,700	2.1	7	6	15	14	4,980	0.57	218	210		
04PKHL3	180,000	19	15	19	<4	21,500	2.4	7	6	17.7	17	6,090	0.72	238	250		
04PKHL7	170,000	19	11	18	<4	14,900	1.8	7.8	7	14.4	14	5,710	0.71	302	340		
04PKHL9	260,000	27	6.6	17	<4	9,490	1.2	5.8	4	5.7	7	2,350	0.34	223	240		
04PKHL10	33,000	3.6	10	12	<4	12,200	1.4	15.1	15	21.8	21	12,300	1.4	1,360	1,600		
04PKHL11	170,000	19	9.6	14	<4	12,400	1.5	4.9	4	9	8	3,730	0.46	159	180		
05PKHL-11 Dup	180,000	22	9.7	28	-	13,400	1.4	4.9	5	4.9	9	3,640	0.41	160	190		
04PKHL11-A	5,700	0.65	11	10	<4	9,740	0.98	8	8	21.3	18	6,830	0.72	196	210		
04PKHL12	310,000	40	3.2	20	<4	2,800	0.39	1.3	<2	1.8	2	722	0.11	32	14		
04PKHL13	170,000	20	14	19	<4	17,000	2.1	5.1	4	16	14	4,640	0.56	234	260		
04PKHL13-B	360,000	46	5.4	21	<4	2,510	0.34	0.52	<2	0.3	<2	281	0.039	22	<4		

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Element Units Methods	Mo	Mo	Na	Na	Nb	Nb	Nd	Ni	Ni	P	P	Pb	Pb	Rb	Sb
	mg/kg ICP-MS	mg/kg ICP-AES	wt. % ICP-AES	wt. % ICP-MS	mg/kg ICP-MS	mg/kg ICP-AES	mg/kg ICP-AES	mg/kg ICP-MS	mg/kg ICP-AES	wt. % ICP-AES	wt. % ICP-MS	mg/kg ICP-MS	mg/kg ICP-AES	mg/kg ICP-MS	mg/kg ICP-MS
Sample number															
04Smith1	4.6	18	6,620	0.74	2.3	8	18	15	10	980	0.11	69.9	86	67.2	0.1
04Smith 2	4	16	7,640	1	<2	6	17	10	7	910	0.11	115	130	67.2	0.07
04Smith3	16.2	22	6,880	0.98	<2	18	20	9.9	7	840	0.1	83.2	110	51.2	0.22
04Smith4	0.2	<2	58	0.027	<2	30	32	1.4	<2	970	0.13	22.2	70	3.2	0.2
04Smith 5	1.4	<2	3,970	0.5	3.4	9	14	25.4	23	1,300	0.14	9.8	26	25	0.07
04Smith6	0.36	<2	5,160	0.59	2	<4	20	27.3	25	190	0.02	14.1	12	28.2	0.07
04Smith7	0.46	<2	4,040	0.41	2.8	<4	15	23	20	260	0.024	14.2	13	30.6	0.05
04PKHL1	37.4	34	5,980	0.78	4.7	14	15	7.2	3	370	0.054	89.2	120	62.2	0.22
04PKHL2	32.2	35	9,500	1.3	6.6	14	14	7	3	400	0.053	58.9	79	89.4	0.1
04PKHL3	18.5	18	4,540	0.61	7.2	14	14	7.9	3	430	0.059	85.7	110	93.9	0.2
04PKHL7	21.6	22	4,140	0.59	5.2	12	16	9.6	6	360	0.062	238	250	67.5	1.1
04PKHL9	44.5	42	1,850	0.3	5.6	17	19	13.6	10	180	0.046	182	200	46.1	5.7
04PKHL10	4.1	8	3,080	0.42	2.2	<4	14	8.9	6	420	0.066	103	110	56.1	0.57
04PKHL11	19.4	23	5,110	0.7	5.5	15	13	7.1	3	280	0.054	78.3	120	55.9	0.1
05PKHL-11 Dup	22.5	28	6,110	0.72	5.8	12	16	4.9	9	310	0.009	85.5	40	55.1	0.2
04PKHL11-A	0.62	<2	5,680	0.61	6.9	4	8	6.8	3	460	0.054	14	17	51.8	0.1
04PKHL12	4.9	4	1,160	0.18	<2	30	25	1.1	<2	120	0.023	15.4	64	13.2	0.08
04PKHL13	34.5	24	6,340	0.89	6.6	16	14	7.4	4	320	0.052	102	130	86	0.2
04PKHL13-B	1.9	7	419	0.081	<2	28	30	<1	<2	250	0.041	29.4	86	8.3	0.07

Appendix 1. Bulk geochemistry of mine waste from the Pike Hill mines study area.—Continued

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Element Units Methods	Sc	Sc	Se	Sn	Sr	Sr	Ta	Th	Th	Ti	Ti	Ti	U	U
	mg/kg ICP-MS	mg/kg ICP-AES	mg/kg HG-AAS	mg/kg ICP-AES	mg/kg ICP-MS	mg/kg ICP-AES	mg/kg ICP-AES	mg/kg ICP-MS	mg/kg ICP-AES	mg/kg ICP-MS	wt. % ICP-AES	mg/kg ICP-MS	mg/kg ICP-MS	mg/kg ICP-AES
Sample number														
04Smith1	13	16	20.1	<5	96.9	94	<20	4.8	<4	2,500	0.18	0.61	1.1	<100
04Smith 2	7.4	11	22.7	28	81.2	75	<20	2.7	<4	2,000	0.16	0.88	0.69	<100
04Smith3	5.4	10	24.8	<5	64.4	61	<20	2.6	<4	1,200	0.094	1.1	0.7	<100
04Smith4	1.3	9	2.1	<5	12.1	<2	<20	4.4	6	180	<0.005	0.2	0.36	<100
04Smith 5	8.3	11	0.8	<5	251	260	<20	12.1	16	1,600	0.16	0.2	0.99	<100
04Smith6	8.8	9	0.3	18	404	400	<20	7.5	4	1,300	0.12	0.3	1.3	<100
04Smith7	6.8	7	0.4	<5	274	250	<20	6.7	7	1,400	0.13	0.3	1.1	<100
04PKHL1	4.6	8	48.9	<5	71.4	67	<20	2.1	<4	1,600	0.051	1.3	0.54	<100
04PKHL2	7.5	11	47	10	88.5	82	<20	3.6	<4	2,200	0.14	1.6	0.65	<100
04PKHL3	8.4	12	47.6	19	70.5	65	<20	3	<4	2,400	0.16	1.6	0.64	<100
04PKHL7	5.6	10	52	<5	61.5	63	<20	2.8	<4	1,800	<0.005	1.2	0.7	<100
04PKHL9	3.3	9	124.2	36	68.6	65	<20	1.8	<4	1,400	<0.005	0.83	0.66	<100
04PKHL10	7	8	7.4	<5	70.7	72	<20	4.5	<4	1,700	<0.005	0.78	1.6	<100
04PKHL11	4.7	8	60.7	5	74.6	74	<20	1.9	<4	1,600	<0.005	1	0.5	<100
05PKHL-11 Dup	4.8	3	65.6	-	73.8	90	-	2.2	<4	1,800	0.16	1.1	0.57	<30
04PKHL11-A	14	14	9.2	7	173	160	<20	16.4	22	3,200	0.27	0.3	2.5	<100
04PKHL12	1.3	8	11.2	11	18.9	10	<20	1.2	<4	350	<0.005	0.2	0.16	<100
04PKHL13	6	10	53.9	7	69.9	67	<20	2.2	<4	2,000	0.11	2.3	0.44	<100
04PKHL13-B	0.8	8	7.1	11	8.9	<2	<20	0.57	<4	330	<0.005	0.2	0.06	<100

Appendix 1. Bulk geochemistry of mine waste from the Pike Hill mines study area.—Continued

[mg/kg, milligrams per kilogram; wt. %, weight percent; ICP-MS, inductively coupled plasma-mass spectrometry; ICP-AES, inductively coupled plasma-atomic emission spectrometry; HG-AAS, continuous-flow hydride-generation atomic absorption spectrophotometry; <, less than; Dup, field replicate sample]

Element	V	V	Y	Yb	Zn	Zn
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Methods	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES
Sample number						
04Smith1	137	140	15.4	13	2	614
04Smith 2	138	150	12.7	10	2	315
04Smith3	125	140	7.5	5	1	344
04Smith4	32.9	42	0.58	<2	<1	55
04Smith 5	61.7	69	5.8	4	<1	521
04Smith6	63.5	65	20.1	18	2	66
04Smith7	55.6	53	13.9	12	1	46
04PKHL1	83.8	92	3.4	<2	<1	246
04PKHL2	82.2	89	4.8	3	<1	213
04PKHL3	89	98	6	4	<1	354
04PKHL7	67	79	7.1	6	1	593
04PKHL9	47.6	57	4	<2	<1	640
04PKHL10	60.4	66	16.9	16	2	16,000
04PKHL11	63.1	74	4.2	2	<1	233
05PKHL-11 Dup	65.5	78	4.2	3	2.4	278
04PKHL11-A	42.5	44	9.4	8	1	24
04PKHL12	24.7	34	1.2	<2	<1	88
04PKHL13	72.5	87	3.8	2	<1	218
04PKHL13-B	138	190	0.38	<2	<1	32
						60

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Characteristic/element	Job number	Lab number	pH	sp. cond. µS/cm	temp. °C	DO mg/L	ORP mV	Fe ²⁺		Fe ²⁺ /Fe ^{total}	Ag µg/L ICP-MS	Al µg/L ICP-MS	Al µg/L ICP-AES	
								Hach mg/L	Hach mg/L					
Units	AES & MS	AES & MS						Hach mg/L	Hach mg/L		µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	
Sample number														
04Smith1	MRP-05718	C-247284	3.55	225	23.4	8	508.7	0.45	0.55	0.8	<3	2,080	<10	2,010
04Smith2	MRP-05718	C-247285	3.36	244	23.1	8	496.6	0.17	0.24	0.7	<3	127	<10	126
04Smith3	MRP-05718	C-247288	3.20	304	23.3	7	444.4	0.04	0.12	0.3	<3	90	<10	79.9
04Smith5	MRP-05718	C-247287	3.28	295	23.1	8	410.8	n.d.	0.09	n.d.	<3	582	<10	577
04Smith6	MRP-05718	C-247278	5.89	17.6	22.7	8	283.0	n.d.	0.00	n.d.	<3	7.3	<10	<50
04Smith7	MRP-05718	C-247277	5.87	13.3	23.1	8	277.0	n.d.	0.01	n.d.	<3	13.8	<10	<50
04PKHL1	MRP-05718	C-247294	3.11	577	22.4	8	390.2	0.22	0.31	0.7	<3	587	<10	630
04PKHL2	MRP-05718	C-247289	3.17	314	22.6	8	373.2	0.13	0.16	0.8	<3	97.6	<10	92.4
04PKHL3	MRP-05718	C-247290	3.24	315	21.9	8	580.9	0.08	0.10	0.8	<3	70.8	<10	62.8
04PKHL7	MRP-05718	C-247286	3.71	260	21.9	8	571.3	0.06	0.09	0.7	<3	128	<10	125
04PKHL9	MRP-05718	C-247302	2.90	967	21.8	8	564.0	0.42	3.54	0.1	<3	7,460	<10	8,090
04PKHL10	MRP-05718	C-247283	7.08	206	21.7	6	374.5	n.d.	0.00	n.d.	<3	2.9	<10	<50
04PKHL11	MRP-05718	C-247301	3.12	934	22	8	469.6	0.23	0.42	0.5	<3	1,510	<10	1,520
04PKHL12	MRP-05718	C-247295	2.94	583	21.8	8	537.4	1.39	3.25	0.4	<3	343	<10	339
04PKHL13	MRP-05718	C-247293	3.28	525	22	8	567.4	0.07	0.12	0.6	<3	503	<10	497
04PKHL13-B	MRP-05718	C-247297	2.84	737	22	8	536.9	1.72	5.50	0.3	<3	442	<10	461
010405Blk C1 ¹	MRP-05718	C-247279	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	<3	<2	<10	<50
010405Blk C2 ¹	MRP-05718	C-247280	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	<3	<2	<10	<50
010405Blk C1F ²	MRP-05718	C-247281	4.33	46.7	22	8	509.3	n.d.	0.00	n.d.	<3	<2	<10	<50

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.—Continued

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Element Units	As	As	B	Ba	Ba	Be	Be	Bi	Ca	Ca	Cd	Cd	Ce	Co	Co
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-AES	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-AES
Sample number															
04Smith1	<1	<100	<20	2.78	2.51	0.2	<5	<0.2	3.43	3.54	3.44	<10	2.22	41.9	46.5
04Smith2	<1	<100	<20	0.55	<1	<0.05	<5	<0.2	2.67	2.72	2.03	<10	0.21	64.2	63.9
04Smith3	<1	<100	<20	0.76	<1	<0.05	<5	<0.2	0.83	0.787	0.39	<10	0.22	4.64	<10
04Smith5	<1	<100	<20	33.5	32.6	<0.05	<5	<0.2	2.56	2.55	1.19	<10	1.34	20.2	22
04Smith6	<1	<100	<20	2.66	2.55	<0.05	<5	<0.2	1.57	1.6	<0.02	<10	0.08	0.07	<10
04Smith7	<1	<100	<20	3.88	4.09	<0.05	<5	<0.2	1.33	1.4	<0.02	<10	0.05	0.09	<10
04PKHL1	<1	<100	<20	0.85	<1	<0.05	<5	<0.2	48.3	48.7	1.23	<10	4.08	7.89	<10
04PKHL2	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	3.76	3.84	0.66	<10	0.19	11.1	14.9
04PKHL3	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	0.55	0.543	0.66	<10	0.1	3.53	<10
04PKHL7	<1	<100	<20	0.68	<1	<0.05	<5	<0.2	24.4	24	22.1	21.6	1.1	81	82
04PKHL9	<1	<100	<20	4.44	4.1	0.2	<5	<0.2	54.9	61.6	10.2	<10	30.7	1,020	1,020
04PKHL10	<1	<100	<20	3.82	3.81	<0.05	<5	<0.2	35.2	36.2	23	21.9	<0.01	1.06	<10
04PKHL11	<1	<100	<20	0.3	<1	0.05	<5	<0.2	120	127	3.5	<10	9.94	53.7	46.8
04PKHL12	<1	<100	<20	0.88	<1	<0.05	<5	<0.2	2.58	2.74	0.6	<10	2.08	30.8	33.1
04PKHL13	<1	<100	<20	0.73	<1	<0.05	<5	<0.2	50.8	52.5	2.41	<10	2.65	6.45	11.1
04PKHL13-B	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	3.63	3.79	2.53	<10	2.1	46.9	49
010405Bik C1 ¹	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	<0.2	<0.1	<0.02	<10	<0.01	<0.02	<10
010405Bik C2 ¹	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	<0.2	<0.1	<0.02	<10	<0.01	<0.02	<10
010405Bik C1F ²	<1	<100	<20	<0.2	<1	<0.05	<5	<0.2	<0.2	<0.1	<0.02	<10	<0.01	<0.02	<10

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.—Continued

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Element Units	K		La		Li		Lu		Mg		Mn		Mo		Na		Nb	
	mg/L	ICP-MS	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	mg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	mg/L	ICP-AES	µg/L	ICP-MS
Sample number																		
04Smith1	0.41		0.337	1.35	1.2	<10	<0.1	0.73	0.752	900	862	<2	<20	<0.5	<0.1	<0.2		
04Smith2	0.2		0.113	0.1	<0.9	<10	<0.1	0.46	0.477	221	220	<2	<20	<0.5	<0.1	<0.2		
04Smith3	0.3		0.214	0.12	<0.9	<10	<0.1	0.44	0.429	66.4	62.2	<2	<20	<0.5	<0.1	<0.2		
04Smith5	0.2		0.156	0.65	4.5	<10	<0.1	1.82	1.84	898	869	<2	<20	<0.5	<0.1	<0.2		
04Smith6	0.79		0.647	0.1	<0.9	<10	<0.1	0.16	0.158	42.5	41.2	<2	<20	<0.5	<0.1	<0.2		
04Smith7	0.52		0.447	0.05	<0.9	<10	<0.1	0.13	0.136	28.6	28.5	<2	<20	<0.5	<0.1	<0.2		
04PKHL1	0.3		0.222	1.71	1.5	<10	<0.1	0.57	0.589	66.1	63.1	<2	<20	<0.5	<0.1	<0.2		
04PKHL2	0.46		0.405	0.08	<0.9	<10	<0.1	0.27	0.282	33	32.6	<2	<20	<0.5	<0.1	<0.2		
04PKHL3	0.48		0.412	0.04	<0.9	<10	<0.1	0.25	0.25	24.8	22.8	<2	<20	<0.5	<0.1	<0.2		
04PKHL7	0.39		0.309	0.64	<0.9	<10	<0.1	1.01	1.06	1,020	992	<2	<20	<0.5	<0.1	<0.2		
04PKHL9	<0.03		<0.1	6.52	3.6	<10	<0.1	3.25	3.64	251	271	<2	<20	<0.5	<0.1	<0.2		
04PKHL10	0.53		0.439	<0.01	<0.9	<10	<0.1	0.17	0.176	38.5	37.9	<2	<20	<0.5	<0.1	<0.2		
04PKHL11	0.2		0.152	3.27	<0.9	<10	<0.1	1.1	1.18	95.7	84.2	<2	<20	<0.5	<0.1	<0.2		
04PKHL12	0.4		0.291	0.91	1	<10	<0.1	0.37	0.388	42.2	42.2	<2	<20	<0.5	<0.1	<0.2		
04PKHL13	0.38		0.317	0.99	<0.9	<10	<0.1	0.49	0.502	52.6	52.9	<2	<20	<0.5	<0.1	<0.2		
04PKHL13-B	0.2		0.108	0.88	<0.9	<10	<0.1	0.48	0.514	56.5	57.8	<2	<20	<0.5	<0.1	<0.2		
010405Bik C1 ¹	<0.03		<0.1	<0.01	<0.9	<10	<0.1	<0.01	<0.1	<0.2	<10	<2	<20	<0.5	<0.1	<0.2		
010405Bik C2 ¹	<0.03		<0.1	<0.01	<0.9	<10	<0.1	<0.01	<0.1	<0.2	<10	<2	<20	<0.5	<0.1	<0.2		
010405Bik C1F ²	<0.03		<0.1	<0.01	<0.9	<10	<0.1	<0.01	<0.1	<0.2	<10	<2	<20	<0.5	<0.1	<0.2		

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.—Continued

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Element Units	Nd		Ni		P		Pb		Pr		Rb		Sb		Sc		Se		SiO ₂		
	µg/L	ICP-MS	µg/L	ICP-AES	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-MS	mg/L	ICP-AES	
Sample number																					
04Smith1	0.87	10.2	<10	<10	<0.1	<0.01	0.1	<0.1	0.23	9.7	<0.3	<100	<0.6	<1	<1	1	<0.6	<1	1.04	1.04	
04Smith2	0.12	15.2	13.6	<10	<0.1	<0.01	<0.05	<0.1	0.03	4.32	<0.3	<100	<0.6	<1	<1	1.6	<0.6	<1	1.63	1.63	
04Smith3	0.09	1.5	<10	<10	<0.1	<0.01	0.4	<0.1	0.03	5.33	<0.3	<100	<0.6	<1	<1	1.7	<0.6	<1	1.67	1.67	
04Smith5	0.66	9.3	<10	<10	<0.1	<0.01	0.5	<0.1	0.15	3.66	<0.3	<100	0.6	<1	<1	3.8	0.6	<1	3.8	3.8	
04Smith6	0.13	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	0.03	4.65	<0.3	<100	<0.6	<1	<1	1.1	<0.6	<1	1.18	1.18	
04Smith7	0.06	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	0.02	3.91	<0.3	<100	<0.6	<1	<1	1.5	<0.6	<1	1.61	1.61	
04PKHL1	1.63	0.8	<10	<10	<0.1	<0.01	1	<0.1	0.43	5.04	<0.3	<100	<0.6	2.6	2.6	1.6	<0.6	2.6	1.52	1.52	
04PKHL2	0.09	1.4	<10	<10	<0.1	<0.01	<0.05	<0.1	0.02	5.7	<0.3	<100	<0.6	1.5	1.5	1.6	<0.6	1.5	1.58	1.58	
04PKHL3	0.04	0.7	<10	<10	<0.1	<0.01	0.2	<0.1	0.01	5.27	<0.3	<100	<0.6	1	1	2.3	<0.6	1	2.19	2.19	
04PKHL7	0.44	23.9	19.4	<10	<0.1	<0.01	2.2	<0.1	0.12	6.29	<0.3	<100	<0.6	2	2	1.9	<0.6	2	2.05	2.05	
04PKHL9	7.5	44	43.3	<10	<0.1	<0.01	0.72	<0.1	1.8	1.5	<0.3	<100	1.2	9.1	9.1	2.4	1.2	9.1	2.63	2.63	
04PKHL10	<0.01	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	<0.01	3.74	<0.3	<100	<0.6	<1	<1	1	<0.6	<1	1.05	1.05	
04PKHL11	4.58	3.6	<10	<10	<0.1	<0.01	1.2	<0.1	1.14	4.09	<0.3	<100	<0.6	5.8	5.8	2.2	<0.6	5.8	1.96	1.96	
04PKHL12	0.94	5.8	<10	<10	<0.1	<0.01	1.8	<0.1	0.24	4.16	<0.3	<100	0.6	<1	<1	3.2	0.6	<1	3.3	3.3	
04PKHL13	1.1	0.5	<10	<10	<0.1	<0.01	0.87	<0.1	0.28	6.19	<0.3	<100	<0.6	2.2	2.2	1.4	<0.6	2.2	1.37	1.37	
04PKHL13-B	0.95	7.5	<10	<10	<0.1	<0.01	0.76	<0.1	0.23	6.56	<0.3	<100	<0.6	<1	<1	1.5	<0.6	<1	1.62	1.62	
010405Blk C1 ¹	<0.01	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	<0.01	<0.01	<0.3	<100	<0.6	<1	<1	<0.2	<0.6	<1	<0.1	<0.1	
010405Blk C2 ¹	<0.01	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	<0.01	<0.01	<0.3	<100	<0.6	<1	<1	<0.2	<0.6	<1	<0.1	<0.1	
010405Blk C1F ²	<0.01	<0.4	<10	<10	<0.1	<0.01	<0.05	<0.1	<0.01	<0.01	<0.3	<100	<0.6	<1	<1	<0.2	<0.6	<1	<0.1	<0.1	

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.—Continued

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Element Units	Sm µg/L	SO ₄ mg/L	Sr µg/L	Sr µg/L	Ta µg/L	Tb µg/L	Th µg/L	Ti µg/L	Ti µg/L	Tl µg/L	Tm µg/L	U µg/L	V µg/L	V µg/L	W µg/L	
																ICP-MS
Sample number																
04Smith1	0.17	41	4.54	4.56	< 0.02	0.02	< 0.2	1.8	< 50	0.1	0.008	0.13	< 0.5	< 0.5	< 0.5	
04Smith2	0.02	32	2.91	2.98	< 0.02	0.007	< 0.2	1.6	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04Smith3	0.02	38	2.34	2.19	< 0.02	< 0.005	< 0.2	1.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04Smith5	0.12	48	19.4	19.7	< 0.02	0.02	< 0.2	1.7	< 50	0.1	0.007	0.1	< 0.5	< 0.5	< 0.5	
04Smith6	0.01	4	9.9	10	< 0.02	< 0.005	< 0.2	< 0.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04Smith7	0.02	5	10	10.8	< 0.02	< 0.005	< 0.2	< 0.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL1	0.28	163	10.2	10.3	< 0.02	0.04	< 0.2	5.3	< 50	< 0.1	0.02	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL2	0.02	44	1.62	1.62	< 0.02	< 0.005	< 0.2	2.1	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL3	0.02	33	1.47	1.33	< 0.02	< 0.005	< 0.2	1.6	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL7	0.08	81	18.8	19.5	< 0.02	0.02	< 0.2	2.2	< 50	< 0.1	0.01	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL9	1.39	294	26.7	29.1	< 0.02	0.14	0.49	10.4	< 50	< 0.1	0.059	0.56	< 0.5	< 0.5	< 0.5	
04PKHL10	< 0.01	83	14.8	15.7	< 0.02	< 0.005	< 0.2	2.4	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL11	0.84	370	27.7	29	< 0.02	0.086	< 0.2	10.5	< 50	< 0.1	0.03	0.11	< 0.5	< 0.5	< 0.5	
04PKHL12	0.18	83	7.13	7.71	< 0.02	0.02	< 0.2	2.5	< 50	< 0.1	0.006	0.14	< 0.5	< 0.5	< 0.5	
04PKHL13	0.21	156	9.76	10	< 0.02	0.03	< 0.2	4.8	< 50	0.2	0.01	< 0.1	< 0.5	< 0.5	< 0.5	
04PKHL13-B	0.17	97	6.7	6.94	< 0.02	0.02	< 0.2	2.9	< 50	< 0.1	0.01	0.14	< 0.5	< 0.5	< 0.5	
010405Bik C1 ¹	< 0.01	4	< 0.5	< 1	< 0.02	< 0.005	< 0.2	< 0.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
010405Bik C2 ¹	< 0.01	6	< 0.5	< 1	< 0.02	< 0.005	< 0.2	< 0.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	
010405Bik C1F ²	< 0.01	7	< 0.5	< 1	< 0.02	< 0.005	< 0.2	< 0.5	< 50	< 0.1	< 0.005	< 0.1	< 0.5	< 0.5	< 0.5	

Appendix 2. Analytical results of leachate tests on solid samples from the Pike Hill mines study area.—Continued

[sp. cond., specific conductance; temp., temperature; DO, dissolved oxygen; ORP, oxidation-reduction potential; µg/L, micrograms per liter; mg/L, milligrams per liter; mV, millivolts; n.d., not determined; <, less than; Hach, colorimetric method using Hach spectrophotometer; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; filtered acidified splits used for AES and MS and filtered unacidified splits used for IC]

Characteristic/Element Units	Y		Yb		Zn		Zn		Zr		Job number		Lab number		Cl		F		NO ₃		SO ₄		
	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	IC	IC	IC	IC	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	mg/L IC-Aq	
Sample number																							
04Smith1	0.86	0.05	0.05	710	710	691	<0.2	<0.2	<0.2	MRP-05719	C-247315	3.8	<.08	1.5	110								
04Smith2	0.11	0.008	0.008	205	205	199	<0.2	<0.2	<0.2	MRP-05719	C-247316	3.8	<.08	1.5	117								
04Smith3	0.09	0.006	0.006	77.9	77.9	76.1	<0.2	<0.2	<0.2	MRP-05719	C-247319	6.2	<.08	1.6	167								
04Smith5	0.34	0.04	0.04	380	380	366	<0.2	<0.2	<0.2	MRP-05719	C-247318	3.8	0.14	1.5	142								
04Smith6	0.11	0.02	0.02	0.6	0.6	<10	<0.2	<0.2	<0.2	MRP-05719	C-247311	1.2	1	1.2	4								
04Smith7	0.06	0.005	0.005	0.7	0.7	<10	<0.2	<0.2	<0.2	MRP-05719	C-247310	1.3	<.08	1.2	3.5								
04PKHL1	1.02	0.12	0.12	146	146	146	<0.2	<0.2	<0.2	MRP-05719	C-247325	6.2	<.08	1.6	350								
04PKHL2	0.08	0.02	0.02	82.6	82.6	80.3	<0.2	<0.2	<0.2	MRP-05719	C-247320	6.2	<.08	1.6	175								
04PKHL3	0.05	0.006	0.006	86.5	86.5	82.7	<0.2	<0.2	<0.2	MRP-05719	C-247321	6.3	<.08	1.7	160								
04PKHL7	0.69	0.07	0.07	3340	3340	3,210	<0.2	<0.2	<0.2	MRP-05719	C-247317	3.8	0.12	1.5	142								
04PKHL9	2.96	0.35	0.35	955	955	1,070	<0.2	<0.2	<0.2	MRP-05719	C-247333	12.6	<.08	2.3	690								
04PKHL10	<0.01	<0.005	<0.005	700	700	679	<0.2	<0.2	<0.2	MRP-05719	C-247314	3.6	<.08	1.5	91								
04PKHL11	2.21	0.19	0.19	318	318	301	<0.2	<0.2	<0.2	MRP-05719	C-247332	12.3	<.08	2.2	718								
04PKHL12	0.44	0.04	0.04	79.9	79.9	76	<0.2	<0.2	<0.2	MRP-05719	C-247326	6.2	<.08	1.7	261								
04PKHL13	0.85	0.09	0.09	110	110	116	<0.2	<0.2	<0.2	MRP-05719	C-247324	6.3	<.08	1.7	329								
04PKHL13-B	0.51	0.06	0.06	263	263	259	<0.2	<0.2	<0.2	MRP-05719	C-247328	6.5	<.08	1.9	312								
010405Blk C1 ¹	<0.01	<0.005	<0.005	<0.5	<0.5	<10	<0.2	<0.2	<0.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
010405Blk C2 ¹	<0.01	<0.005	<0.005	<0.5	<0.5	<10	<0.2	<0.2	<0.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
010405Blk C1F ²	<0.01	<0.005	<0.005	0.9	0.9	<10	<0.2	<0.2	<0.2	MRP-05719	C-247312	1.2	<.08	1.1	3.1								

¹ Eastern synthetic precipitation (ESP) from two carboys (carboy 1 is C1 and carboy 2 is C2) used for leach tests.

² Filtered ESP from carboy 1 used for leach tests.

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill mines study.

The accuracy of the results was assessed by submitting USGS reference waters with known chemical compositions along with water samples for chemistry determinations; the precision of the results was evaluated by analyzing duplicate samples, and blank-water samples were processed in the field to monitor contamination. The analytical results of the USGS reference waters and the expected concentrations and standard deviations are given in the following table. One-half of the values for reference waters with known calcium concentrations were over two standard deviations higher than expected based on ICP-AES results. The concentrations of magnesium and sodium from ICP-AES in most of the reference waters are at least one standard deviation higher than that reported for the round robin. The concentrations of most elements in duplicate water samples are very similar. For a few elements, a discrepancy exists for duplicates, more commonly in the unfiltered water samples. This is likely due to variations in the composition of particulates within the sample. Most of the field-blank samples had concentrations of elements below or near their respective detection limits. The concentrations of sodium in

field blanks collected and submitted for chemistry in October 2004 are slightly high at approximately 0.3 mg/L with a detection limit of 0.01 by ICP-MS, but they were reported as less than the detection limit of 0.1 mg/L by ICP-AES. The ICP-AES method is preferred rather than ICP-MS for major elements including sodium. The concentrations of zinc reported by ICP-MS in all blank samples are slightly high and range from 1 to 5.3 µg/L, although minimal compared to the concentration of zinc in many water samples from the site.

Two chemistry jobs were rerun due to anomalous results. Rare earth elements determined by ICP-MS in October 2004 for jobs MRP-05620 and MRP-05621 were high in the water samples and reference waters and, therefore, analyses were rerun in July 2005 and the new results were used for this report. In addition, sulfate values from IC for job MRP-05633 were high for samples with sulfate concentrations greater than 200 mg/L. These water samples were reanalyzed by IC and the new values are used in this report. Old erroneous values are given in parentheses and red text.

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Er
	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS
USGS reference waters									
M-100	145	<0.02	<0.01 (0.16) ¹	0.12	5.6	<0.02	2.7	<0.005 (0.095)	<0.005
M-100 <i>round robin</i>	n.d. 180±8	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M-130	20.6	0.08	<0.01 (0.03)	0.03	3.6	0.99	<0.5	<0.005	<0.005 (0.15)
M-130	19.8	0.16	<0.01	<0.02	2.9	0.96	0.82	<0.005	<0.005
M-130 <i>round robin</i>	19.8 21.2±1	0.11	<0.01	0.03	3.8	0.8	<0.5	<0.005	<0.005
M-150	7.1	0.03	0.01	0.03	1.4	<0.02	<0.5	<0.005	<0.005
M-150 <i>round robin</i>	6.82±0.41	-	-	-	-	-	-	-	-
M-158	36.8	<0.02	<0.01	<0.02	5	<0.02	<0.5	<0.005	<0.005
M-158 <i>round robin</i>	38.1±1.59	-	-	-	-	-	-	-	-
T-135	10.4	51.7	0.03 (2.62)	41.8	83.1	<0.02	67.5	0.007 (0.17)	0.081
T-135	10.2	52.5	0.03	34.5	68.4	<0.02	59.1	<0.005	0.007
T-135 <i>round robin</i>	10.4±0.6	50.5±3.2	-	40.0±2.6	79.0±5.5	-	62.0±4.2	-	-
T-137	35.5	6.71	0.04 (2.43)	0.17	20.1	0.02	1.8	0.009 (0.53)	0.006 (0.29)
T-137	35	7.01	0.04	0.1	18.2	0.02	1.9	0.005	0.006
T-137	34.8	7.02	0.04	0.16	18.2	0.02	1.8	0.006	0.007
T-137 <i>round robin</i>	38.1±1.5	6.80±0.52	-	-	19.4±2.0	-	1.9±1.2	-	-
Field blanks									
FB102004 FA	<0.2	<0.02	<0.01	<0.02	<1	<0.02	0.77	<0.005	<0.005
FB102004 RA	<0.2	<0.02	<0.01	<0.02	<1	<0.02	0.68	<0.005	<0.005
FB080305 FA	<0.2	<0.02	<0.01	<0.02	<1	<0.02	<0.5	<0.005	<0.005
FB080305 RA	<0.2	<0.02	<0.01	<0.02	<1	<0.02	0.5	<0.005	<0.005

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element	Eu	Fe	Ga	Gd	Ge	Ho	K	La	Li	Lu
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
USGS reference waters										
M-100	<0.005	<50	<0.05	<0.005	<0.05	<0.005 (0.094)	4.01	<0.01	99.4	<0.1
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
<i>round robin</i>	-	-	-	-	-	-	4.5±0.7	-	-	-
M-130	<0.005 (0.11)	<50	<0.05	<0.005	<0.05	<0.005 (0.077)	2.95	<0.01 (0.15)	17.7	<0.1
M-130	<0.005	<50	<0.05	<0.005	<0.05	<0.005	2.72	<0.01	18.2	<0.1
M-130	<0.005	<50	<0.05	<0.005	<0.05	<0.005	2.72	<0.01	15.3	<0.1
<i>round robin</i>	-	-	-	-	-	-	3±0.23	-	-	-
M-150	<0.005	<50	<0.05	<0.005	<0.05	<0.005	1.12	0.01	0.9	<0.1
<i>round robin</i>	-	-	-	-	-	-	1.12±0.09	-	-	-
M-158	<0.005	<50	<0.05	<0.005	<0.05	<0.005	1.64	<0.01	0.7	<0.1
<i>round robin</i>	-	-	-	-	-	-	1.71±0.119	-	-	-
T-135	<0.005	207	<0.05	0.006 (0.45)	<0.05	<0.005 (0.089)	1.01	0.03 (1.6)	76.8	<0.1
T-135	0.01	122	<0.05	0.01	<0.05	<0.005	0.9	0.02	65	<0.1
<i>round robin</i>	-	228±11	-	-	-	-	0.96±0.09	-	73.7±5.2	-
T-137	0.006 (0.23)	<50	<0.05	0.01 (0.84)	<0.05	<0.005 (0.12)	1.13	0.04 (2.55)	9.2	<0.1
T-137	<0.005	<50	<0.05	0.009	<0.05	<0.005	1.12	0.04	7.6	<0.1
T-137	0.01	<50	<0.05	0.01	<0.05	<0.005	1.08	0.03	6.9	<0.1
<i>round robin</i>	-	71±9	-	-	-	-	1.19±0.13	-	8.7±1.5	-
Field blanks										
FB102004 FA	<0.005	<50	<0.05	<0.005	<0.05	<0.005	0.03	<0.01	<0.1	0.1
FB102004 RA	<0.005	<50	<0.05	<0.005	<0.05	<0.005	0.03	<0.01	<0.1	0.1
FB080305 FA	<0.005	<50	<0.05	<0.005	<0.05	<0.005	<0.03	<0.01	<0.1	<0.1
FB080305 RA	<0.005	<50	<0.05	<0.005	<0.05	<0.005	<0.03	<0.01	0.2	<0.1

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	Mg mg/L	Mn µg/L	Mo µg/L	Na mg/L	Nb µg/L	Nd µg/L	Ni µg/L	P mg/L	Pb µg/L	Pr µg/L	
											ICP-MS
USGS reference waters											
M-100	89.3	<0.2	8	269	0.2	<0.01	2.2	<0.01	<0.05	<0.01	
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
<i>round robin</i>	98±5	-	-	281±12	-	-	-	0.01±0.01	-	-	
M-130	5.64	0.4	22.5	34.9	0.23	<0.01 (0.54)	0.9	<0.01	<0.05	<0.01 (0.05)	
M-130	5.44	0.3	19.9	33.9	<0.2	<0.01	0.7	<0.01	<0.05	<0.01	
M-130	4.78	<0.2	21.3	29.5	0.3	<0.01	1.2	<0.01	<0.05	<0.01	
<i>round robin</i>	5.9±0.27	-	-	35.8±1.6	-	-	-	0.085±0.140	-	-	
M-150	1.22	2.5	<2	16	<0.2	0.01	0.4	<0.01	<0.05	<0.01	
<i>round robin</i>	1.43±0.09	-	-	17.5±1.0	-	-	-	-	-	-	
M-158	11.1	<0.2	<2	67	0.41	<0.01	0.7	0.2	<0.05	<0.01	
<i>round robin</i>	11.8±0.48	-	-	71.7±2.22	-	-	-	0.190±0.013	-	-	
T-135	2.06	449	56.8	32.1	<0.2	0.03 (1.65)	67.7	0.02	104	<0.01 (0.51)	
T-135	1.99	386	45.3	31	<0.2	0.02	60	0.02	99.6	<0.01	
<i>round robin</i>	2.00±0.09	423±20	63.0±5.1	30.8±1.2	-	-	65.6±5.0	-	103±7	-	
T-137	9.7	91.4	6.5	21.2	<0.2	0.04 (0.89)	15.8	0.05	5.9	<0.01 (0.43)	
T-137	9.81	88	8.6	20.9	<0.2	0.02	13.9	0.04	6.2	<0.01	
T-137	10.1	81.9	4.8	21.8	<0.2	0.03	15.6	0.06	5.7	<0.01	
<i>round robin</i>	10.1±0.5	98±5	8.9±1.8	22.0±1.1	-	-	15.0±2.5	-	6.3±1.0	-	
Field blanks											
FB102004 FA	<0.01	<0.2	<2	0.29	<0.2	<0.01	<0.4	<0.01	0.1	<0.01	
FB102004 RA	<0.01	<0.2	<2	0.28	<0.2	<0.01	<0.4	<0.01	0.2	<0.01	
FB080305 FA	<0.01	<0.2	<2	0.01	<0.2	<0.01	<0.4	<0.01	<0.05	<0.01	
FB080305 RA	<0.01	<0.2	<2	<0.01	<0.2	<0.01	<0.4	<0.01	0.05	<0.01	

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	Rb µg/L	Sb µg/L	Sc µg/L	Se µg/L	SiO ₂ mg/L	Sm µg/L	SO ₄ mg/L	Sr µg/L	Ta µg/L	Tb µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
USGS reference waters										
M-100	1.1	0.3	1.1 (97.8)	12.9	10.6	<0.01	1060	3,350	0.08	<0.005 (0.01)
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
<i>round robin</i>	-	-	-	-	10.2±1	-	-	3,450±170	-	-
M-130	8.17	<0.3	1.2 (22.7)	<1	9.8	<0.01	52	186	0.09	<0.005 (0.008)
M-130	8.34	<0.3	1.6	<1	10.8	<0.01	53	169	0.08	<0.005
M-130	7.9	0.79	1.2	<1	9.2	<0.01	48	169	0.05	<0.005
<i>round robin</i>	-	-	-	-	9.2±0.55	-	58±2.6	180±10	-	-
M-150	0.34	<0.3	1.7	<1	11.9	<0.01	4	48.9	<0.02	<0.005
<i>round robin</i>	-	-	-	-	12.6±0.8	-	5.50±0.54	51.0±2.5	-	-
M-158	0.31	0.46	1.9	<1	16.2	<0.01	103	58.7	0.1	<0.005
<i>round robin</i>	-	-	-	-	15.0±0.67	-	105±3.7	63.6±1.85	-	-
T-135	0.63	77.4	1.7	9.8	4.3	<0.01	6	47.8	0.04	<0.005 (0.02)
T-135	0.69	83.8	0.6	11.5	4.4	<0.01	6	41.9	<0.02	<0.005
<i>round robin</i>	-	76.3±8.7	-	10.0±1.4	4.28±0.31	-	-	46.0±2.3	-	-
T-137	0.8	15.5	0.7 (16.9)	<1	6.6	<0.01	45	230	0.05	<0.005 (0.079)
T-137	0.82	16.6	1.1	<1	6.8	<0.01	48	228	<0.02	<0.005
T-137	0.76	17.5	1	<1	7.6	<0.01	41	214	<0.02	<0.005
<i>round robin</i>	-	15.5±2.7	-	-	6.96±0.56	-	-	230±14	-	-
Field blanks										
FB102004 FA	0.02	<0.3	<0.6	2.5	<0.2	<0.01	<2	<0.5	<0.02	<0.005
FB102004 RA	0.04	<0.3	<0.6	2	<0.2	<0.01	<2	<0.5	<0.02	<0.005
FB080305 FA	<0.01	<0.3	<0.6	<1	<0.2	<0.01	<2	<0.5	<0.02	<0.005
FB080305 RA	<0.01	<0.3	<0.6	<1	<0.2	<0.01	<2	<0.5	<0.02	<0.005

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Zr
	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS
USGS reference waters											
M-100	<0.2	11.3	<0.1	<0.005	30.1	1.9	0.61	0.02 (11.4)	<0.005	2.2	<0.2
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
<i>round robin</i>	-	-	-	-	-	<i>11.6±7.6</i>	-	-	-	-	-
M-130	<0.2	0.6	<0.1	<0.005 (0.05)	1.16	0.6	0.66	<0.01 (0.36)<0.005 (0.28)	<0.005	15.2	<0.2
M-130	<0.2	1.5	<0.1	<0.005	4.31	0.8	<0.5	<0.01	<0.005	25.4	<0.2
M-130	<0.2	0.7	<0.1	<0.005	0.89	1.1	1.85	<0.01	<0.005	16.3	<0.2
<i>round robin</i>	-	-	-	-	-	-	-	-	-	-	-
M-150	<0.2	<0.5	<0.1	<0.005	<0.1	20.3	<0.5	<0.01	<0.005	2.3	<0.2
<i>round robin</i>	-	-	-	-	-	<i>31.0±1.9</i>	-	-	-	-	-
M-158	<0.2	1.5	<0.1	<0.005	<0.1	9.7	1.15	<0.01	<0.005	<0.5	<0.2
<i>round robin</i>	-	-	-	-	-	<i>11.3±0.82</i>	-	-	-	-	-
T-135	<0.2	<0.5	1.2	<0.005 (0.06)	0.31	57.2	<0.5	0.03 (2.21)	0.01 (0.32)	52.4	<0.2
T-135	<0.2	<0.5	<0.1	<0.005	0.29	47.5	<0.5	0.03	0.008	50.3	<0.2
<i>round robin</i>	-	-	-	-	-	<i>52.8±3.6</i>	-	-	-	<i>48.2±4.7</i>	-
T-137	<0.2	0.9	157	<0.005 (0.076)	9.99	14	<0.5	0.06 (3.43)	0.01 (0.94)	50.2	<0.2
T-137	<0.2	1.3	169	<0.005	9.93	12.8	<0.5	0.06	0.01	47.2	<0.2
T-137	<0.2	0.9	167	<0.005	9.66	13.1	<0.5	0.05	0.009	50.2	<0.2
<i>round robin</i>	-	-	<i>162±23</i>	-	<i>10.0±0.5</i>	<i>14.0±1.6</i>	-	-	-	<i>49.5±4.2</i>	-
Field blanks											
FB102004 FA	<0.2	<0.5	<0.1	<0.005	<0.1	<0.5	<0.5	<0.01	<0.005	5.3	<0.2
FB102004 RA	<0.2	<0.5	<0.1	<0.005	<0.1	0.5	<0.5	<0.01	<0.005	4.1	<0.2
FB080305 FA	<0.2	<0.5	<0.1	<0.005	<0.1	<0.5	<0.5	<0.01	<0.005	1.4	<0.2
FB080305 RA	<0.2	<0.5	<0.1	<0.005	<0.1	<0.5	<0.5	<0.01	<0.005	1	<0.2

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	Ag µg/L	Al µg/L	As µg/L	B µg/L	Ba µg/L	Be µg/L	Ca mg/L	Cd µg/L	Co µg/L	Cr µg/L	
											ICP-AES
USGS reference waters											
M-100	<1	127	<100	417	16	<10	177	<5	10	<10	
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
<i>round robin</i>	-	-	-	425±36	-	-	-	-	-	-	
M-130	<1	32	<100	<5	36	<10	26.8	<5	<10	<10	
M-130	<10	<50	<100	<20	36.2	<5	24.4	<10	<10	<10	
M-130	<1	25	<100	<5	36	<10	25.2	<5	<10	<10	
<i>round robin</i>	-	-	-	8.87±8.23	-	-	21.2±1	-	-	-	
M-150	<1	<10	<100	<5	22	<10	7.9	<5	<10	<10	
<i>round robin</i>	-	-	-	-	-	-	6.82±0.41	-	-	-	
M-158	<1	<10	<100	22	24	<10	44.9	<5	<10	<10	
<i>round robin</i>	-	-	-	23.4±3.45	-	-	38.1±1.59	-	-	-	
T-135	5.7	10	<100	9.5	62	60	10.2	57	36	82	
T-135	9.2	<10	<100	8.4	67	58	10.6	53	41	81	
<i>round robin</i>	9.81±1.05	10.5±6.8	10.0±1.1	-	67.8±4.3	59.0±2.6	10.4±0.6	50.5±3.2	40.0±2.6	79.0±5.5	
T-137	<1	32	<100	14	64	<10	39.7	8	<10	22	
T-137	<10	<50	<100	<20	59.8	<5	35.8	<10	<10	15.2	
T-137	<1	27	<100	13	66	<10	39.2	6.7	<10	22	
<i>round robin</i>	-	30.5±6.9	-	-	65.0±4.8	5.2±0.5	38.1±1.5	6.80±0.52	-	19.4±2.0	
Field blanks											
FB102004 FA	<1	<10	<100	<5	<1	<10	<0.1	<5	<10	<10	
FB102004 RA	<1	<10	<100	<5	<1	<10	<0.1	<5	<10	<10	
FB080305 FA	<1	<10	<100	<5	<1	<10	<0.1	<5	<10	<10	
FB080305 RA	<1	<10	<100	<5	<1	<10	<0.1	<5	<10	<10	

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
	µg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES
USGS reference waters									
M-100	<10	40	4.7	81	107	<10	<20	309	16
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
<i>round robin</i>	-	-	4.5±0.7	-	98±5	-	-	281±12	-
M-130	<10	<20	3.8	6.3	7.2	<10	<20	44.7	<10
M-130	<10	<20	3.44	21.2	6.74	<10	<20	42.6	<10
M-130	<10	<20	3.6	20	6.6	<10	<20	42.3	<10
<i>round robin</i>	-	-	3±0.23	-	5.9±0.27	-	-	35.8±1.6	-
M-150	<10	<20	1.3	1.5	1.5	<10	<20	19.6	<10
<i>round robin</i>	-	-	1.12±0.09	-	1.43±0.09	-	-	17.5±1.0	-
M-158	<10	<20	2	1.8	13.8	<10	<20	89.3	<10
<i>round robin</i>	-	-	1.71±0.119	-	11.8±0.48	-	-	71.7±2.22	-
T-135	60	210	0.86	70	2.1	422	40	30.9	66
T-135	65	225	0.96	73	2.1	440	36	32	72
<i>round robin</i>	62.0±4.2	228±11	0.96±0.09	73.7±5.2	2.00±0.09	423±20	63.0±5.1	30.8±1.2	65.6±5.0
T-137	<10	49	1.2	3.5	10.8	93	<20	22.8	20
T-137	<10	59.8	1.04	<10	9.12	86.8	<20	20.1	<10
T-137	<10	58	1.2	9.2	10.7	105	<20	22.9	18
<i>round robin</i>	1.9±1.2	71±9	1.19±0.13	8.7±1.5	10.1±0.5	98±5	8.9±1.8	22.0±1.1	15.0±2.5
Field blanks									
FB102004 FA	<10	<20	<0.1	<1	<0.1	<10	<20	<0.1	<10
FB102004 RA	<10	<20	<0.1	<1	<0.1	<10	<20	<0.1	<10
FB080305 FA	<10	<20	<0.1	<1	<0.1	<10	<20	<0.1	<10
FB080305 RA	<10	<20	<0.1	<1	<0.1	<10	<20	<0.1	<10

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	P mg/L ICP-AES	Pb µg/L ICP-AES	Sb µg/L ICP-AES	SiO ₂ mg/L ICP-AES	Sr µg/L ICP-AES	Ti µg/L ICP-AES	V µg/L ICP-AES	Zn µg/L ICP-AES
M-100	<0.1	<50	<50	11.8	3500	<50	12	<10
M-100	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
<i>round robin</i>	<i>0.01±0.01</i>	-	-	<i>10.2±1</i>	<i>3450±170</i>	-	<i>11.6±7.6</i>	-
M-130	<0.1	<50	<50	12.1	217	<50	<10	60
M-130	<0.1	<100	<100	11.4	222	<50	<10	56
M-130	<0.1	<50	<50	10.6	210	<50	<10	52
<i>round robin</i>	<i>0.085±0.104</i>	-	-	<i>9.2±0.55</i>	<i>180±2.6</i>	-	-	-
M-150	<0.1	<50	<50	13.2	55	<50	25	<10
<i>round robin</i>	-	-	-	<i>12.6±0.8</i>	<i>51.0±2.5</i>	-	<i>31.0±1.9</i>	-
M-158	0.2	<50	<50	17.3	71	<50	<10	<10
<i>round robin</i>	<i>0.190±0.013</i>	-	-	<i>15.0±0.67</i>	<i>63.6±1.85</i>	-	<i>11.3±0.82</i>	-
T-135	<0.1	92	88	4.4	45	<50	57	54
T-135	<0.1	81	75	4.6	48	<50	57	51
<i>round robin</i>	-	<i>103±7</i>	<i>76.3±8.7</i>	<i>4.28±0.31</i>	<i>46.0±2.3</i>	-	<i>52.8±3.6</i>	<i>48.2±4.7</i>
T-137	<0.1	<50	<50	7.6	235	<50	17	52
T-137	<0.1	<100	<100	6.58	219	<50	12.1	44
T-137	<0.1	<50	<50	7.5	237	<50	14	61
<i>round robin</i>	-	<i>6.3±1.0</i>	<i>15.5±2.7</i>	<i>6.96±0.56</i>	<i>230±14</i>	-	<i>14.0±1.6</i>	<i>49.5±4.2</i>
Field blanks								
FB102004 FA	<0.1	<50	<50	<0.1	<1	<50	<10	<10
FB102004 RA	<0.1	<50	<50	<0.1	<1	<50	<10	<10
FB080305 FA	<0.1	<50	<50	<0.1	<1	<50	<10	<10
FB080305 RA	<0.1	<50	<50	<0.1	<1	<50	<10	<10

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	IC	Cl		F		NO ₃		SO ₄	
		mg/L	IC	mg/L	IC	mg/L	IC	mg/L	IC
Methods	IC	IC	IC	IC	IC	IC	IC	IC	IC
USGS reference waters									
M-100	MRP-056333	C-245083	78.8	2	4.5	1,190 (1,543)			
M-100	MRP-05720	C-247346	90	0.84	3.3	1,602			
<i>round robin</i>	-	-	79±2	0.89±0.07	-	1180±55			
M-130	MRP-05633	C-245071	21.7	1.2	9.1	58			
M-130	MRP-05719	C-247322	24.3	1.2	9.5	59			
M-130	MRP-06205	C-260139	21	1.1	7.2	57.6			
<i>round robin</i>	-	-	21.4±1.9	1.23±0.09	-	58±2.6			
M-150	MRP-06205	C-260120	17	1	7.1	5.6			
<i>round robin</i>	-	-	17.0±1.5	1.00±0.07	-	5.50±0.54			
M-158	MRP-06205	C-260142	89.3	0.37	0.8	104			
<i>round robin</i>	-	-	90.7±2.74	0.350±0.045	-	105±3.7			
T-135	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.			
T-135	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.			
<i>round robin</i>	-	-	-	-	-	-			
T-137	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.			
T-137	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.			
T-137	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.			
<i>round robin</i>	-	-	-	-	-	-			
Field blanks									
FB102004 FU	MRP-05633	C-245045	1.3	<.08	<.08	<1.6			
FB080305 FU	MRP-06205	C-260119	<.08	<.08	<.08	<1.6			
-	-	-	-	-	-	-			

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; RA, raw acidified; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red] in italics from <http://bqs.usgs.gov/srs/>

Element	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Er
Units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Replicate samples									
PKHL-10-2 FA	76.6	9.61	32.7	170	1.6	1.04	2400	2.08	1.18
PKHL-10-2 D FA	76.9	9.48	39	172	1.6	1.04	2250	2.03	1.12
PKHL-10-2 RA	73.5	9.26	34.5	166	1.5	1.04	2310	2.14	1.16
PKHL-10-2 D RA	73.3	9.17	34.9	163	1.5	1.03	2300	2.21	1.2
01139830Aug FA	70.7	8.11	28.2	186	1.2	1.42	1940	1.73	0.95
01139830AugD FA	72.1	8.01	29.1	187	1.2	1.42	1990	1.7	0.93
01139830Aug RA	71.8	7.95	28.8	186	1.6	1.46	1990	1.72	0.94
01139830AugD RA	72.7	8	29.6	189	1.2	1.44	2010	1.77	0.98

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; RA, raw acidified; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element	Eu	Fe	Ga	Gd	Ge	Ho	K	La	Li	Lu
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Replicate samples										
PKHL-10-2 FA	0.51	8860	0.21	2.56	0.07	0.39	4.11	15	10.6	9.7
PKHL-10-2 D FA	0.52	8830	0.2	2.78	0.09	0.36	4.09	17.2	10.3	9.5
PKHL-10-2 RA	0.54	9240	0.21	2.66	0.07	0.4	3.94	15.7	10.2	9.2
PKHL-10-2 D RA	0.55	9180	0.22	2.78	0.06	0.43	3.98	15.9	9.7	9.5
01139830Aug FA	0.44	10400	0.32	2.32	0.07	0.31	5.02	11.9	13.2	0.1
01139830Aug D FA	0.46	10800	0.35	2.4	0.08	0.31	5.18	12.3	12.6	0.1
01139830Aug RA	0.45	15800	0.43	2.38	0.08	0.31	5.17	12.2	13	0.1
01139830Aug D RA	0.46	11400	0.35	2.37	0.09	0.32	5.21	12.4	12.3	0.1

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb	Pr
	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS
Replicate samples										
PKHL-10-2 FA	8.42	958	< 2	1.75	< 0.2	14.7	23	< 0.01	1.9	3.76
PKHL-10-2 D FA	8.43	953	< 2	1.75	< 0.2	16.8	22.9	< 0.01	1.9	4.1
PKHL-10-2 RA	8.11	930	< 2	1.69	< 0.2	15.4	22.2	< 0.01	1.9	3.94
PKHL-10-2 D RA	8.1	911	< 2	1.68	< 0.2	15.6	22.6	< 0.01	1.9	4.01
01139830Aug FA	7.7	888	< 2	1.67	< 0.2	12.6	24.4	< 0.01	2.7	3.12
01139830AugD FA	7.57	903	< 2	1.66	< 0.2	13.2	25	< 0.01	2.7	3.18
01139830Aug RA	7.68	890	< 2	1.68	< 0.2	12.9	24.8	< 0.01	3.5	3.13
01139830AugD RA	7.59	902	< 2	1.67	< 0.2	13.3	25.2	< 0.01	2.8	3.29

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	Rb	Sb	Sc	Se	SiO ₂	Sm	SO ₄	Sr	Ta	Tb
	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	mg/L ICP-MS	µg/L ICP-MS	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS
Replicate samples										
PKHL-10-2 FA	22.5	<0.3	3.1	<1	32.3	2.61	282	219	<0.02	0.36
PKHL-10-2 D FA	22.3	<0.3	3.3	<1	32.2	2.93	281	218	<0.02	0.34
PKHL-10-2 RA	21.9	<0.3	2.9	<1	30.9	2.87	270	213	<0.02	0.37
PKHL-10-2 D RA	21.7	<0.3	3.5	<1	31.2	2.9	266	210	<0.02	0.4
01139830Aug FA	30.3	<0.3	5.1	2	38	2.35	268	210	<0.02	0.28
01139830AugD FA	30.8	<0.3	4.8	1.4	38.4	2.42	270	212	<0.02	0.3
01139830Aug RA	31.1	<0.3	5.2	2.4	39.3	2.42	264	210	<0.02	0.29
01139830AugD RA	31	<0.3	4.9	1.6	37.5	2.45	267	214	<0.02	0.3

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn	Zr
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
PKHL-10-2 FA	15.4	3.8	0.1	0.16	0.67	<0.5	<0.5	10.2	1.08	2,100	<0.2
PKHL-10-2 D FA	14.3	3.6	0.1	0.14	0.69	<0.5	<0.5	10.7	1.02	2,060	<0.2
PKHL-10-2 RA	14.4	3.6	0.1	0.16	0.67	<0.5	<0.5	10.8	1.07	2,020	<0.2
PKHL-10-2 D RA	15.5	4.1	0.1	0.17	0.69	<0.5	<0.5	11.1	1.16	2,020	<0.2
01139830Aug FA	0.3	4.6	0.1	0.12	0.64	<0.5	<0.5	8.1	0.84	2,230	<0.2
01139830AugD FA	0.2	4.5	0.1	0.12	0.65	<0.5	<0.5	8.1	0.88	2,290	<0.2
01139830Aug RA	0.32	21.3	0.1	0.12	0.66	0.7	<0.5	8.12	0.84	2,220	<0.2
01139830AugD RA	0.2	6	0.1	0.13	0.64	<0.5	<0.5	8.15	0.84	2,300	<0.2

Replicate samples

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	Ag		Al		As		B		Ba		Be		Ca		Cd		Co		Cr	
	µg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES	mg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES	µg/L	ICP-AES
PKHL-10-2 FA	<1		8,420		<5		15		<10		77.8		11		185		<10		<10	
PKHL-10-2 D FA	<1		8,310		<5		15		<10		80.8		13		196		<10		<10	
PKHL-10-2 RA	<1		8,360		<5		15		<10		81		13		174		<10		<10	
PKHL-10-2 D RA	<1		8,440		<5		15		<10		80.3		11		161		<10		<10	
01139830Aug FA	<1		6,620		<5		24		<10		77.1		7		184		<10		<10	
01139830AugD FA	<1		6,340		<5		24		<10		73.8		6.8		176		<10		<10	
01139830Aug RA	<1		6,580		<5		25		<10		73.7		7.2		181		<10		<10	
01139830AugD RA	<1		6,420		<5		24		<10		73.8		6.6		180		<10		<10	

Replicate samples

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni
	µg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES	µg/L ICP-AES	mg/L ICP-AES	µg/L ICP-AES
PKHL-10-2 FA	2,570	9,590	4.4	<1	9.2	1,020	<20	3.8	28
PKHL-10-2 D FA	2,530	9,270	4.3	<1	9.6	1,000	<20	4.8	37
PKHL-10-2 RA	2,540	10,100	4.4	<1	9.6	1,010	<20	4	28
PKHL-10-2 D RA	2,580	10,300	4.5	<1	9.6	1,020	<20	4.1	32
01139830Aug FA	1,890	10,600	5.8	13	9.6	921	<20	2.1	27
01139830AugD FA	1,880	10,200	5.9	14	9.2	912	<20	2	23
01139830Aug RA	1,930	15,800	6	14	9.1	922	<20	2	23
01139830AugD RA	1,880	11,000	5.7	13	9.1	914	<20	2	22

Replicate samples

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element	P	Pb	Sb	SiO ₂	Sr	Ti	V	Zn
Units	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
Methods	ICP-AES	ICP-AES	ICP-AES	ICP-AES	ICP-AES	ICP-AES	ICP-AES	ICP-AES
	Replicate samples							
PKHL-10-2 FA	<0.1	<50	<50	36.8	193	<50	<10	2,390
PKHL-10-2 D FA	<0.1	<50	<50	37	199	<50	<10	2,450
PKHL-10-2 RA	<0.1	<50	<50	36.8	200	<50	<10	2,360
PKHL-10-2 D RA	<0.1	<50	<50	37.4	200	<50	<10	2,430
01139830Aug FA	<0.1	<50	<50	40	219	<50	<10	1,980
01139830AugD FA	<0.1	<50	<50	39.6	210	<50	<10	1,950
01139830Aug RA	<0.1	<50	<50	40.7	208	<50	<10	1,950
01139830AugD RA	<0.1	<50	<50	39.7	208	<50	<10	2,080

Appendix 3. Standard reference-water, field-blank, and replicate samples submitted with water and leachate chemistry as quality assurance/quality control for the Pike Hill study.—Continued

[µg/L, micrograms per liter; mg/L, milligrams per liter; n.d., not determined; <, less than; -, not applicable; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; round robin results in italics from <http://bqs.usgs.gov/srs/>; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; erroneous values from previous jobs are red]

Element Units Methods	IC	Cl		F		NO ₃		SO ₄	
		mg/L IC	mg/L IC	mg/L IC	mg/L IC	mg/L IC	mg/L IC		
Replicate samples									
PKHL-10-2 FU	MRP-05633	C-245075	4.2	1.6	<.08	298	(512)	-	-
PKHL-10-2 D FU	MRP-05633	C-245074	4.2	1.6	<.08	295	(507)	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
01139830Aug FU	MRP-06205	C-260148	2.7	0.3	0.4	342	-	-	-
01139830AugD FU	MRP-06205	C-260149	2.7	0.3	<.08	351	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

¹REE reran for MRP-05621 by ICP-MS and sulfate greater than 200 mg/L reran for MRP-05633 by IC because original results anomalous (shown in red and parentheses).

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.

[$\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; $\mu\text{g}/\text{L}$, micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Characteristic	Site location	Collection date	Collection time	Specific conductance	pH	Temperature	Dissolved oxygen	Alkalinity	Oxidation-reduction potential	Dissolved organic carbon
Units				$\mu\text{S}/\text{cm}$		degrees Celsius	mg/L	mg/L CaCO_3	mV	mg C/L
CKBK-1-2 FA	CKBK-1	10/19/2004	15:31	169.8	7.97	7.6	8	110.4	487.9	n.d.
CKBK-1-2 RA	CKBK-1	10/19/2004	15:31	169.8	7.97	7.6	8	110.4	487.9	n.d.
CKBK-2-2 FA	CKBK-2	10/19/2004	16:18	394	4.40	9.5	6	n.d.	504.3	n.d.
CKBK-2-2 RA	CKBK-2	10/19/2004	16:18	394	4.40	9.5	6	n.d.	504.3	n.d.
CKBK-3-2 FA	CKBK-3	10/19/2004	16:33	143	7.60	9.2	9	84.5	521.2	n.d.
CKBK-3-2 RA	CKBK-3	10/19/2004	16:33	143	7.60	9.2	9	84.5	521.2	n.d.
CKBK-4-2 FA	CKBK-4	10/19/2004	16:48	111.9	6.71	6.6	0	56.0	336.9	n.d.
CKBK-4-2 RA	CKBK-4	10/19/2004	16:48	111.9	6.71	6.6	0	56.0	336.9	n.d.
CKBK-5-2 FA	CKBK-5	10/19/2004	17:06	449	3.42	7.6	5	n.d.	585.4	n.d.
CKBK-5-2 RA	CKBK-5	10/19/2004	17:06	449	3.42	7.6	5	n.d.	585.4	n.d.
PKHL-1-2 FA	PKHL-1	10/20/2004	9:26	1336	2.89	4.6	10	n.d.	642.6	n.d.
PKHL-1-2 RA	PKHL-1	10/20/2004	9:26	1336	2.89	4.6	10	n.d.	642.6	n.d.
PKHL-2-2 FA	PKHL-2	10/20/2004	12:43	635	3.29	8.8	10	n.d.	684.6	n.d.
PKHL-2-2 RA	PKHL-2	10/20/2004	12:43	635	3.29	8.8	10	n.d.	684.6	n.d.
PKHL-4-2 FA	PKHL-4	10/20/2004	9:45	294	5.85	7.5	8	0.0	642.7	n.d.
PKHL-4-2 RA	PKHL-4	10/20/2004	9:45	294	5.85	7.5	8	0.0	642.7	n.d.
PKHL-5-2 FA	PKHL-5	10/20/2004	10:26	268	6.97	7.2	8	n.d.	538.2	n.d.
PKHL-5-2 RA	PKHL-5	10/20/2004	10:26	268	6.97	7.2	8	n.d.	538.2	n.d.
PKHL-6-2 FA	PKHL-6	10/20/2004	10:52	219	7.59	7.5	8	64.2	606.7	n.d.
PKHL-6-2 RA	PKHL-6	10/20/2004	10:52	219	7.59	7.5	8	64.2	606.7	n.d.
PKHL-7-2 FA	PKHL-7	10/20/2004	12:14	615	3.44	11.5	0	n.d.	566.7	n.d.
PKHL-7-2 RA	PKHL-7	10/20/2004	12:14	615	3.44	11.5	0	n.d.	566.7	n.d.
PKHL-8-2 FA	PKHL-8	10/20/2004	12:06	685	3.20	10.7	0	n.d.	603.6	n.d.
PKHL-8-2 RA	PKHL-8	10/20/2004	12:06	685	3.20	10.7	0	n.d.	603.6	n.d.

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Iron speciation Fe ²⁺ /Fe _{total} Hach	Job Number	Lab No.	Ag		Al		As		B		Ba	
				µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES		
CKBK-1-2 FA	n.d.	MIRP-05620	C-244744	<3	<1	18.5	12	<1	<100	<5	<5	18.9	19
CKBK-1-2 RA	n.d.	MIRP-05620	C-244745	<3	<1	22.1	16	<1	<100	<5	<5	19.1	20
CKBK-2-2 FA	n.d.	MIRP-05621	C-244797	<3	<1	15,900	18,200	<1	<100	<5	<5	19	18
CKBK-2-2 RA	n.d.	MIRP-05621	C-244798	<3	<1	18,800	20,200	<1	<100	<5	<5	21.1	18
CKBK-3-2 FA	n.d.	MIRP-05620	C-244740	<3	<1	2.9	<10	<1	<100	<5	<5	34.3	35
CKBK-3-2 RA	n.d.	MIRP-05620	C-244741	<3	<1	9	18	<1	<100	<5	<5	34.5	34
CKBK-4-2 FA	0.81	MIRP-05620	C-244730	<3	<1	91.4	75	<1	<100	19	19	18.9	19
CKBK-4-2 RA	0.81	MIRP-05620	C-244731	<3	<1	113	85	<1	<100	18	18	28.1	27
CKBK-5-2 FA	0.13	MIRP-05621	C-244799	<3	<1	5,370	5,700	<1	<100	<5	<5	7.59	6.7
CKBK-5-2 RA	0.13	MIRP-05621	C-244800	<3	<1	5,630	6,560	<1	<100	<5	<5	8.07	7.6
PKHL-1-2 FA	0.13	MIRP-05621	C-244819	<3	<1	34,600	39,700	2	<100	<5	<5	5.52	5.2
PKHL-1-2 RA	0.13	MIRP-05621	C-244820	<3	<1	34,500	40,000	3	<100	<5	<5	5.97	5.3
PKHL-2-2 FA	0.47	MIRP-05621	C-244811	<3	<1	11,000	11,400	<1	<100	<5	<5	15.3	14
PKHL-2-2 RA	0.47	MIRP-05621	C-244812	<3	<1	10,400	11,500	<1	<100	<5	<5	15	14
PKHL-4-2 FA	0.14	MIRP-05621	C-244780	<3	<1	1,110	1,170	2	<100	<5	<5	23.2	19
PKHL-4-2 RA	0.14	MIRP-05621	C-244781	<3	<1	2,920	3,280	2	<100	<5	<5	22.7	20
PKHL-5-2 FA	n.d.	MIRP-05620	C-244764	<3	<1	4	18	<1	<100	<5	<5	27.1	28
PKHL-5-2 RA	n.d.	MIRP-05620	C-244765	<3	<1	106	79	<1	<100	<5	<5	28.9	28
PKHL-6-2 FA	n.d.	MIRP-05620	C-244754	<3	<1	8	11	<1	<100	<5	<5	31.2	32
PKHL-6-2 RA	n.d.	MIRP-05620	C-244755	<3	<1	20.1	<10	<1	<100	<5	<5	32	32
PKHL-7-2 FA	0.96	MIRP-05621	C-244809	<3	<1	7,030	8,060	<1	<100	<5	<5	15.2	14
PKHL-7-2 RA	0.96	MIRP-05621	C-244810	<3	<1	7,220	8,540	<1	<100	<5	<5	15.6	14
PKHL-8-2 FA	0.95	MIRP-05621	C-244813	<3	<1	9,240	10,600	<1	<100	<5	<5	11.9	11
PKHL-8-2 RA	0.95	MIRP-05621	C-244814	<3	<1	9,220	10,500	<1	<100	<5	<5	12.7	12

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L, micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Be		Bi		Ca		Ca		Cd		Ce		Co		Cr		Cs		Cu	
	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	mg/L ICP-MS	mg/L ICP-AES	mg/L ICP-MS	mg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES
CKBK-1-2 FA	<0.05	<10	<0.2	<0.2	43.5	49.9	0.11	<5	0.02	0.21	<10	<1	<10	0.26	<10	5.2	<10	5.2	<10	
CKBK-1-2 RA	<0.05	<10	<0.2	<0.2	43.6	49.6	0.11	<5	0.05	0.2	<10	<1	<10	0.25	<10	5.6	<10	5.6	<10	
CKBK-2-2 FA	1	<10	<0.2	<0.2	47.9	51.6	16.2	20	110	186	197	3.8	<10	2.32	<10	5,030	<10	5,030	5,890	
CKBK-2-2 RA	1.1	<10	<0.2	<0.2	46.3	48	15.4	19	120	181	178	11.5	10	2.36	10	4,900	10	4,900	5,370	
CKBK-3-2 FA	<0.05	<10	<0.2	<0.2	36.5	40.6	<0.02	<5	<0.01	0.03	<10	<1	<10	0.31	<10	<0.5	<10	<0.5	<10	
CKBK-3-2 RA	<0.05	<10	<0.2	<0.2	36.1	38.6	<0.02	<5	0.03	0.03	<10	<1	<10	0.31	<10	0.85	<10	0.85	<10	
CKBK-4-2 FA	<0.05	<10	<0.2	<0.2	15.3	18.9	<0.02	<5	1.38	0.64	<10	<1	<10	0.11	<10	2.9	<10	2.9	<10	
CKBK-4-2 RA	<0.05	<10	<0.2	<0.2	15.4	17.6	0.06	<5	1.67	0.65	<10	<1	<10	0.11	<10	9.3	<10	9.3	<10	
CKBK-5-2 FA	0.2	<10	<0.2	<0.2	55.5	54.6	4.36	5.9	32	97.3	98	2.9	<10	0.94	<10	992	<10	992	1,010	
CKBK-5-2 RA	0.3	<10	<0.2	<0.2	56.1	61.9	4.5	6	34.4	102	115	3.2	<10	0.97	<10	1,030	<10	1,030	1,130	
PKHL-1-2 FA	2.5	<10	<0.2	<0.2	231	259	10.5	11	340	218	232	2.4	<10	1.09	<10	1,980	<10	1,980	2,150	
PKHL-1-2 RA	2.8	<10	<0.2	<0.2	225	253	10.6	12	353	217	230	2.2	<10	1.12	<10	1,970	<10	1,970	2,180	
PKHL-2-2 FA	0.7	<10	<0.2	<0.2	88	90.4	11.7	14	48	226	210	2.6	<10	1.08	<10	2,910	<10	2,910	3,070	
PKHL-2-2 RA	0.7	<10	<0.2	<0.2	80.4	88.7	11.6	14	46.6	218	214	2.7	<10	1.09	<10	2,900	<10	2,900	3,160	
PKHL-4-2 FA	0.4	<10	<0.2	<0.2	57.3	57.3	6.95	8.1	41.1	95.2	98	<1	<10	0.8	<10	4,950	<10	4,950	5,170	
PKHL-4-2 RA	0.5	<10	<0.2	<0.2	56	59.2	6.84	8.2	41.3	92.9	87	<1	<10	0.77	<10	4,980	<10	4,980	5,420	
PKHL-5-2 FA	<0.05	<10	<0.2	<0.2	59.1	67.1	4.15	6.9	16.6	55.9	47	<1	<10	0.55	<10	1,800	<10	1,800	1,960	
PKHL-5-2 RA	<0.05	<10	<0.2	<0.2	61	67.3	4.33	6.2	17	57.7	43	<1	<10	0.61	<10	1,970	<10	1,970	2,040	
PKHL-6-2 FA	<0.05	<10	<0.2	<0.2	52.2	62.3	0.8	<5	0.04	1.22	<10	<1	<10	0.31	<10	44.1	<10	44.1	46	
PKHL-6-2 RA	<0.05	<10	<0.2	<0.2	52.6	60.5	0.84	<5	0.14	1.28	<10	<1	<10	0.3	<10	55.7	<10	55.7	57	
PKHL-7-2 FA	0.5	<10	<0.2	<0.2	83.6	92.8	3.08	<5	29.2	135	159	2.3	<10	1	<10	107	<10	107	107	
PKHL-7-2 RA	0.5	<10	<0.2	<0.2	81.9	93	3.1	<5	31.6	131	154	3	<10	0.99	<10	200	<10	200	227	
PKHL-8-2 FA	0.6	<10	<0.2	<0.2	82	90.9	5.73	7.4	39.2	181	200	2.9	<10	1.16	<10	205	<10	205	202	
PKHL-8-2 RA	0.6	<10	<0.2	<0.2	81.5	90	5.59	7.1	37.7	178	200	2.9	<10	1.24	<10	208	<10	208	204	

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Dy		Er		Eu		Fe		Fe		Ga		Gd		Ge		Ho		K		La		Li	
	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	mg/L ICP-AES	mg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES
CKBK-1-2 FA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<20	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	1.96	2.2	0.03	0.03	<0.1	<0.1
CKBK-1-2 RA	0.007	<0.005	0.005	<0.005	<0.005	<0.005	<20	<0.05	0.007	<0.005	<0.05	<0.05	<0.005	<0.005	<0.05	<0.05	<0.005	<0.005	1.95	2.2	0.04	0.04	<0.1	<0.1
CKBK-2-2 FA	7.94	4.28	2.03	<0.005	<0.005	<0.005	<20	0.41	10.7	1.37	0.2	0.2	1.37	3.28	3.28	0.2	1.37	3.28	3.28	3.8	54.6	54.6	19.6	9.7
CKBK-2-2 RA	9.18	4.84	2.47	<0.005	<0.005	<0.005	708	0.7	12.4	1.53	0.2	0.2	1.53	3.26	3.26	0.2	1.53	3.26	3.26	3.5	56.2	56.2	20.3	11
CKBK-3-2 FA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<20	<0.05	<0.005	<0.005	<0.05	<0.05	<0.005	2.3	2.3	<0.05	<0.005	2.3	2.6	<0.01	<0.01	0.8	<0.1	
CKBK-3-2 RA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<20	<0.05	<0.005	<0.005	<0.05	<0.05	<0.005	2.29	2.29	<0.05	<0.005	2.29	2.4	0.02	0.02	<0.1	<0.1	
CKBK-4-2 FA	0.075	0.03	0.02	0.02	0.02	13,300	13,200	<0.05	0.1	0.05	0.05	0.05	0.01	6.63	6.63	0.05	0.01	6.63	7.8	0.6	0.6	1.2	<0.1	
CKBK-4-2 RA	0.074	0.03	0.02	0.02	0.02	14,500	14,000	<0.05	0.12	0.06	0.06	0.01	6.57	6.57	0.06	0.01	6.57	7.5	0.74	0.74	0.9	0.9	1.4	
CKBK-5-2 FA	1.84	0.82	0.55	0.57	0.57	6,300	6,390	0.2	2.79	<0.05	<0.05	<0.05	3.34	3.34	<0.05	<0.05	3.34	3.4	13.6	13.6	11.3	11.3	5.8	
CKBK-5-2 RA	1.93	0.85	0.57	0.57	0.57	8,140	9,040	0.2	2.95	0.05	0.05	0.31	3.32	3.32	0.05	0.31	3.32	3.7	14.6	14.6	12	12	<0.1	
PKHL-1-2 FA	16	7.98	4.25	90,300	90,300	90,300	99,300	1.3	21.8	0.22	0.22	2.94	3.74	3.74	0.22	2.94	3.74	4.6	147	147	39.2	39.2	21	
PKHL-1-2 RA	16.1	8.02	4.39	90,200	90,200	90,200	98,200	1.4	22.2	0.3	0.3	2.92	3.76	3.76	0.3	2.92	3.76	4.7	149	149	38.4	38.4	26	
PKHL-2-2 FA	3.02	1.67	0.77	22,200	22,200	23,200	23,200	0.31	3.82	<0.05	<0.05	0.56	4.4	4.4	<0.05	0.56	4.4	4.7	22	22	16	16	6	
PKHL-2-2 RA	2.96	1.59	0.73	21,900	21,900	23,900	23,900	0.31	3.71	<0.05	<0.05	0.56	4.1	4.1	<0.05	0.56	4.1	4.8	21.3	21.3	14.4	14.4	4	
PKHL-4-2 FA	2.99	1.77	0.61	<0.005	<0.005	<0.005	20	0.22	3.75	0.06	0.06	0.54	3.26	3.26	0.06	0.54	3.26	3.6	29.6	29.6	1	1	<0.1	
PKHL-4-2 RA	3.23	1.88	0.66	<0.005	<0.005	<0.005	34	0.2	4.11	0.07	0.07	0.57	3.24	3.24	0.07	0.57	3.24	3.7	29.5	29.5	0.6	0.6	<0.1	
PKHL-5-2 FA	0.73	0.4	0.17	<0.005	<0.005	<0.005	<20	0.1	1.16	<0.05	<0.05	0.14	3.3	3.3	<0.05	0.14	3.3	3.7	15.2	15.2	0.3	0.3	<0.1	
PKHL-5-2 RA	0.85	0.48	0.19	<0.005	<0.005	<0.005	<20	0.1	1.3	<0.05	<0.05	0.16	3.48	3.48	<0.05	0.16	3.48	3.8	15.4	15.4	0.5	0.5	<0.1	
PKHL-6-2 FA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<20	<0.05	<0.005	<0.05	<0.05	<0.005	3.12	3.12	<0.05	<0.005	3.12	3.6	0.05	0.05	0.3	0.3	<0.1	
PKHL-6-2 RA	0.007	0.005	0.005	<0.005	<0.005	<0.005	56	<0.05	0.01	<0.05	<0.05	<0.005	3.14	3.14	<0.05	<0.005	3.14	3.6	0.12	0.12	<0.1	<0.1	<0.1	
PKHL-7-2 FA	1.74	0.94	0.47	45,400	45,400	53,800	53,800	0.24	2.29	0.07	0.07	0.32	4.25	4.25	0.07	0.32	4.25	4.8	13	13	12.4	12.4	3.4	
PKHL-7-2 RA	1.92	1.02	0.48	47,000	47,000	57,300	57,300	0.73	2.49	0.1	0.1	0.35	4.31	4.31	0.1	0.35	4.31	5	14.1	14.1	12.8	12.8	6.8	
PKHL-8-2 FA	2.43	1.26	0.64	33,800	33,800	38,500	38,500	0.27	3.15	<0.05	<0.05	0.45	4.13	4.13	<0.05	0.45	4.13	4.8	17.8	17.8	15.3	15.3	<0.1	
PKHL-8-2 RA	2.26	1.22	0.62	35,500	35,500	40,600	40,600	0.27	3.05	0.05	0.05	0.41	4.19	4.19	0.05	0.41	4.19	4.9	17.2	17.2	15.7	15.7	<0.1	

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L, micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Lu		Mg		Mn		Mn		Mo		Mo		Na		Na		Nb		Nd		Ni		Ni		P	
	µg/L	ICP-MS	mg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES	mg/L	ICP-AES	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	mg/L	ICP-MS
CKBK-1-2 FA	<0.1	1.93	2.2	12.5	12	<2	<20	0.74	0.89	<0.2	0.02	0.8	<0.01	<0.01												
CKBK-1-2 RA	0.1	1.97	2.3	13	13	<2	<20	0.73	0.42	<0.2	0.04	0.8	<0.01	<0.01												
CKBK-2-2 FA	34.8	10.9	12.3	1,870	2,010	<2	<20	2.8	4	<0.2	60.5	61.8	69	<0.01												
CKBK-2-2 RA	40.9	10.8	11.5	1,900	1,920	<2	<20	2.68	3.5	<0.2	70.2	59.5	65	0.05												
CKBK-3-2 FA	<0.1	1.45	1.7	4.3	<10	<2	<20	0.73	0.55	<0.2	<0.01	<0.4	<10	<0.01												
CKBK-3-2 RA	<0.1	1.44	1.6	6.6	<10	<2	<20	0.73	0.48	<0.2	0.01	0.4	<10	<0.01												
CKBK-4-2 FA	0.2	2.02	2.4	871	921	<2	<20	0.66	0.41	<0.2	0.58	0.5	<10	<0.01												
CKBK-4-2 RA	0.2	1.98	2.3	880	883	<2	<20	0.63	0.26	<0.2	0.65	0.5	<10	<0.01												
CKBK-5-2 FA	4.2	7.17	7.6	1,320	1,300	<2	<20	1.18	2.5	<0.2	14.7	25.9	30	0.02												
CKBK-5-2 RA	4.3	7.37	8.3	1,370	1,480	<2	<20	1.2	3.1	<0.2	15.2	27	39	<0.01												
PKHL-1-2 FA	55.8	27.2	31.9	6,980	7,170	<2	<20	3.94	7	<0.2	131	38.3	50	<0.01												
PKHL-1-2 RA	55.7	27.6	31.7	7,010	7,200	<2	<20	3.96	6.5	<0.2	136	38.6	41	<0.01												
PKHL-2-2 FA	13.6	11.4	12.3	1,400	1,380	<2	<20	2.1	4.5	<0.2	21.7	31.1	35	<0.01												
PKHL-2-2 RA	13.3	10.7	12.1	1,340	1,380	<2	<20	1.96	4.2	<0.2	21.4	30.4	37	<0.01												
PKHL-4-2 FA	13.5	8.81	9.3	629	634	<2	<20	1.73	2.7	<0.2	22	22.6	26	<0.01												
PKHL-4-2 RA	16.2	8.72	9.6	608	650	<2	<20	1.73	3.1	<0.2	22.6	22.4	26	<0.01												
PKHL-5-2 FA	1.7	6.53	8.2	383	384	<2	<20	1.49	2.9	<0.2	7.89	15.9	22	<0.01												
PKHL-5-2 RA	2.7	6.83	8	394	373	<2	<20	1.56	3	<0.2	8.27	16.7	19	<0.01												
PKHL-6-2 FA	<0.1	2.83	3.5	42.4	45	<2	<20	0.99	1.6	<0.2	0.03	2	<10	<0.01												
PKHL-6-2 RA	<0.1	2.83	3.4	44.9	46	<2	<20	1.01	1.7	<0.2	0.07	2.2	<10	<0.01												
PKHL-7-2 FA	7.4	9.32	11	1,080	1,150	<2	<20	1.82	3.5	<0.2	13.2	16.8	24	<0.01												
PKHL-7-2 RA	7	9.33	11.2	1,060	1,190	<2	<20	1.85	3.6	<0.2	14.2	16.6	24	0.02												
PKHL-8-2 FA	9	9.85	11.7	1,170	1,220	<2	<20	1.89	4.8	<0.2	18.9	23.2	33	<0.01												
PKHL-8-2 RA	9.2	9.73	11.6	1,170	1,220	<2	<20	1.9	4.6	<0.2	17.8	22.7	35	<0.01												

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Characteristic	Site location	Collection date	Collection time	Specific conductance	pH	Temperature	Dissolved oxygen	Alkalinity	Oxidation-reduction potential	Dissolved organic carbon
Units				µS/cm		degrees Celsius	mg/L	mg/L CaCO ₃	mV	mg C/L
PKHL-9-2 FA	PKHL-9	10/20/2004	12:20	466	3.50	6.8	8	n.d.	597.5	n.d.
PKHL-9-2 RA	PKHL-9	10/20/2004	12:20	466	3.50	6.8	8	n.d.	597.5	n.d.
PKHL-10-2 FA	PKHL-10	10/20/2004	14:45	465	3.84	7.8	8	n.d.	678.7	n.d.
PKHL-10-2 RA	PKHL-10	10/20/2004	14:45	465	3.84	7.8	8	n.d.	678.7	n.d.
PKHL-10-2 D FA	PKHL-10	10/20/2004	14:47	465	3.84	7.8	8	n.d.	678.7	n.d.
PKHL-10-2 D RA	PKHL-10	10/20/2004	14:47	465	3.84	7.8	8	n.d.	678.7	n.d.
PKHL-11-2 FA	PKHL-11	10/20/2004	14:38	139.4	8.39	8.6	10	93.5	231.7	n.d.
PKHL-11-2 RA	PKHL-11	10/20/2004	14:38	139.4	8.39	8.6	10	93.5	231.7	n.d.
PKHL-12-2 FA	PKHL-12	10/20/2004	15:45	152.9	7.68	7.2	10	61.1	505.7	n.d.
PKHL-12-2 RA	PKHL-12	10/20/2004	15:45	152.9	7.68	7.2	10	61.1	505.7	n.d.
PKHL-13-2 FA	PKHL-13	10/20/2004	16:00	133.7	7.97	6.9	10	71.1	476.4	n.d.
PKHL-13-2 RA	PKHL-13	10/20/2004	16:00	133.7	7.97	6.9	10	71.1	476.4	n.d.
PKHL-14-2 FA	PKHL-14	10/20/2004	16:16	136.5	7.71	6.7	10	66.2	465.6	n.d.
PKHL-14-2 RA	PKHL-14	10/20/2004	16:16	136.5	7.71	6.7	10	66.2	465.6	n.d.
PKHL-15-2 FA	PKHL-15	10/20/2004	16:30	132.2	8.61	7	8	83.5	445.3	n.d.
PKHL-15-2 RA	PKHL-15	10/20/2004	16:30	132.2	8.61	7	8	83.5	445.3	n.d.
01139940Aug FA	CKBK-1	8/2/2005	9:42	214	7.94	14.9	7	124	527.3	n.d.
01139940Aug RA	CKBK-1	8/2/2005	9:42	214	7.94	14.9	7	124	527.3	n.d.
CKBK-2-3 FA	CKBK-2	8/2/2005	10:57	215	6.598	14.7	8	33.6	370.2	n.d.
CKBK-2-3 RA	CKBK-2	8/2/2005	10:57	215	6.598	14.7	8	33.6	370.2	n.d.
CKBK-3-3 FA	CKBK-3	8/2/2005	11:04	166.2	7.191	16.8	8	96	368.2	n.d.
CKBK-3-3 RA	CKBK-3	8/2/2005	11:04	166.2	7.191	16.8	8	96	368.2	n.d.
CKBK-4-3 FA	CKBK-4	8/2/2005	10:38	263	6.483	17.7	2	50	196	n.d.
CKBK-4-3 RA	CKBK-4	8/2/2005	10:38	263	6.483	17.7	2	50	196	n.d.
CKBK-5-3 FA	CKBK-5	8/2/2005	10:27	340	3.63	11.4	8	n.d.	595.9	n.d.

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Iron speciation Fe ²⁺ /Fe _{total} Hach	Job Number	Lab No.	Ag		Al		As		B		Ba	
				µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES		
PKHL-9-2 FA	0.42	MIRP-05621	C-244807	<3	<1	9,580	11,100	1	<100	<5	16	14	
PKHL-9-2 RA	0.42	MIRP-05621	C-244808	<3	<1	9,660	11,000	<1	<100	<5	16.6	15	
PKHL-10-2 FA	0.45	MIRP-05621	C-244805	<3	<1	7,500	8,420	1	<100	<5	17.4	15	
PKHL-10-2 RA	0.45	MIRP-05621	C-244806	<3	<1	7,170	8,360	1	<100	<5	16.7	15	
PKHL-10-2 D FA	0.44	MIRP-05621	C-244803	<3	<1	7,440	8,310	<1	<100	<5	17	15	
PKHL-10-2 D RA	0.44	MIRP-05621	C-244804	<3	<1	7,170	8,440	1	<100	<5	16.7	15	
PKHL-11-2 FA	n.d.	MIRP-05620	C-244738	<3	<1	41.2	43	<1	<100	<5	20.8	22	
PKHL-11-2 RA	n.d.	MIRP-05620	C-244739	<3	<1	4	16	<1	<100	<5	20.7	20	
PKHL-12-2 FA	n.d.	MIRP-05620	C-244742	<3	<1	8.9	<10	<1	<100	<5	16.7	16	
PKHL-12-2 RA	n.d.	MIRP-05620	C-244743	<3	<1	60	47	<1	<100	<5	15.5	17	
PKHL-13-2 FA	n.d.	MIRP-05620	C-244734	<3	<1	5.6	<10	<1	<100	<5	14.9	15	
PKHL-13-2 RA	n.d.	MIRP-05620	C-244735	<3	<1	10.8	<10	<1	<100	<5	14.7	16	
PKHL-14-2 FA	n.d.	MIRP-05620	C-244736	<3	<1	4.7	<10	<1	<100	<5	15.8	15	
PKHL-14-2 RA	n.d.	MIRP-05620	C-244737	<3	<1	8.4	16	<1	<100	<5	15.8	16	
PKHL-15-2 FA	n.d.	MIRP-05620	C-244732	<3	<1	5.6	<10	<1	<100	<5	9.97	9.8	
PKHL-15-2 RA	n.d.	MIRP-05620	C-244733	<3	<1	14.2	23	<1	<100	<5	9.9	10	
01139940Aug FA	n.d.	MIRP-06206	C-260171	<3	<1	30.1	11	<1	<100	<5	21.2	21	
01139940Aug RA	n.d.	MIRP-06206	C-260172	<3	<1	32.4	14	<1	<100	<5	21.5	21	
CKBK-2-3 FA	n.d.	MIRP-06206	C-260173	<3	<1	17.8	<10	<1	<100	<5	23.2	24	
CKBK-2-3 RA	n.d.	MIRP-06206	C-260174	<3	<1	3,660	3,140	<1	<100	<5	23	23	
CKBK-3-3 FA	n.d.	MIRP-06206	C-260163	<3	<1	5.2	<10	<1	<100	<5	33.8	34	
CKBK-3-3 RA	n.d.	MIRP-06206	C-260164	<3	<1	42.2	28	<1	<100	<5	34.7	35	
CKBK-4-3 FA	n.d.	MIRP-06206	C-260191	<3	<1	45.9	37	<1	<100	12	28	28	
CKBK-4-3 RA	n.d.	MIRP-06206	C-260192	<3	<1	75.3	64	<1	<100	11	29.4	28	
CKBK-5-3 FA	0.08	MIRP-06206	C-260202	<3	<1	2,390	2,330	<1	<100	<5	5.88	6	

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Be		Bi		Ca		Ca		Cd		Ce		Co		Cr		Cs		Cu	
	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	mg/L ICP-MS	mg/L ICP-AES	mg/L ICP-MS	mg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES
PKHL-9-2 FA	0.8	<10	<0.2	90.6	93.9	22.2	31	54.2	190	216	<1	<10	1.11	<10	6,470	7,480				
PKHL-9-2 RA	0.8	<10	<0.2	90.8	98.6	22.3	28	55.8	189	194	<1	<10	1.12	<10	6,480	7,350				
PKHL-10-2 FA	0.4	<10	<0.2	76.6	77.8	9.61	11	32.7	170	185	1.6	<10	1.04	<10	2,400	2,570				
PKHL-10-2 RA	0.5	<10	<0.2	73.5	81	9.26	13	34.5	166	174	1.5	<10	1.04	<10	2,310	2,540				
PKHL-10-2 D FA	0.5	<10	<0.2	76.9	80.8	9.48	13	39	172	196	1.6	<10	1.04	<10	2,250	2,530				
PKHL-10-2 D RA	0.4	<10	<0.2	73.3	80.3	9.17	11	34.9	163	161	1.5	<10	1.03	<10	2,300	2,580				
PKHL-11-2 FA	<0.05	<10	<0.2	37.9	42.5	<0.02	<5	0.12	0.07	<10	<1	<10	0.15	<10	1	<10				
PKHL-11-2 RA	<0.05	<10	<0.2	37	41.5	<0.02	<5	<0.01	0.03	<10	<1	<10	0.16	<10	0.55	<10				
PKHL-12-2 FA	<0.05	<10	<0.2	37.8	42.8	0.76	<5	0.04	10.6	<10	<1	<10	0.2	<10	13.7	11				
PKHL-12-2 RA	<0.05	<10	<0.2	34.4	42	0.72	<5	0.35	9.96	<10	<1	<10	0.17	<10	34.6	38				
PKHL-13-2 FA	<0.05	<10	<0.2	29.9	37.3	0.14	<5	0.03	1.08	<10	<1	<10	0.07	<10	11.8	10				
PKHL-13-2 RA	<0.05	<10	<0.2	29.7	37.2	0.14	<5	0.05	1.17	<10	<1	<10	0.08	<10	7	<10				
PKHL-14-2 FA	<0.05	<10	<0.2	30.6	36.6	0.11	<5	0.03	1.04	<10	<1	<10	0.07	<10	9.4	<10				
PKHL-14-2 RA	<0.05	<10	<0.2	32.7	37	0.11	<5	0.04	1.15	<10	<1	<10	0.26	<10	<0.5	<10				
PKHL-15-2 FA	<0.05	<10	<0.2	32.2	39.2	<0.02	<5	<0.01	0.03	<10	<1	<10	0.26	<10	1.4	<10				
PKHL-15-2 RA	<0.05	<10	<0.2	31.6	39.7	<0.02	<5	0.03	0.04	<10	<1	<10	0.3	<10	3.6	<10				
01139940Aug FA	<0.05	<10	<0.2	53.8	51.1	0.1	<5	<0.01	0.12	<10	1	<10	0.3	<10	4.1	<10				
01139940Aug RA	<0.05	<10	<0.2	52.8	51.7	0.1	<5	0.01	0.13	<10	<1	<10	0.3	<10	608	588				
CKBK-2-3 FA	<0.05	<10	<0.2	40.7	39.5	3.61	<5	5.79	39	40	<1	<10	0.69	<10	1,150	1,080				
CKBK-2-3 RA	0.2	<10	<0.2	40.8	39.5	3.79	<5	18	39.5	40	<1	<10	0.69	<10	<0.5	<10				
CKBK-3-3 FA	<0.05	<10	<0.2	37.2	36.2	<0.02	<5	<0.01	0.06	<10	<1	<10	0.32	<10	0.92	<10				
CKBK-3-3 RA	<0.05	<10	<0.2	38.1	37.8	<0.02	<5	0.1	0.04	<10	1.1	<10	0.35	<10	1.2	<10				
CKBK-4-3 FA	<0.05	<10	<0.2	16	17.4	<0.02	<5	0.45	4.93	<10	<1	<10	0.06	<10	3.2	<10				
CKBK-4-3 RA	<0.05	<10	<0.2	16.1	16.6	<0.02	<5	0.63	0.29	<10	<1	<10	0.06	<10	3.2	<10				
CKBK-5-3 FA	0.1	<10	<0.2	50.7	53.2	2.25	<5	11.9	49	52	<1	<10	0.56	<10	597	588				

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Dy		Er		Eu		Fe		Ga		Gd		Ge		Ho		K		La		Li	
	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	mg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES
PKHL-9-2 FA	3.79	2.13	0.93	0.93	1,230	1,230	1,480	1,480	0.24	4.82	0.1	0.75	4.68	5.3	27.9	8.8	<1	<1				
PKHL-9-2 RA	3.99	2.21	0.92	0.92	1,210	1,210	1,300	1,300	0.26	4.97	0.1	0.74	4.7	5.3	28.7	8.6	<1	<1				
PKHL-10-2 FA	2.08	1.18	0.51	0.51	8,860	8,860	9,590	9,590	0.21	2.56	0.07	0.39	4.11	4.4	15	10.6	<1	<1				
PKHL-10-2 RA	2.14	1.16	0.54	0.54	9,240	9,240	10,100	10,100	0.21	2.66	0.07	0.4	3.94	4.4	15.7	10.2	<1	<1				
PKHL-10-2 D FA	2.03	1.12	0.52	0.52	8,830	8,830	9,270	9,270	0.2	2.78	0.09	0.36	4.09	4.3	17.2	10.3	<1	<1				
PKHL-10-2 D RA	2.21	1.2	0.55	0.55	9,180	9,180	10,300	10,300	0.22	2.78	0.06	0.43	3.98	4.5	15.9	9.7	<1	<1				
PKHL-11-2 FA	0.008	0.005	<0.005	<0.005	<50	<50	43	43	<0.05	0.009	<0.05	<0.005	1.79	2	0.06	<0.1	<1	<1				
PKHL-11-2 RA	<0.005	<0.005	<0.005	<0.005	<50	<50	<20	<20	<0.05	<0.005	<0.05	<0.005	1.77	1.9	<0.01	0.2	<1	<1				
PKHL-12-2 FA	<0.005	<0.005	<0.005	<0.005	<50	<50	31	31	<0.05	<0.005	<0.05	<0.005	2.64	2.9	0.03	1.2	<1	<1				
PKHL-12-2 RA	0.02	0.01	0.009	0.009	173	173	209	209	<0.05	0.02	<0.05	<0.005	2.46	2.9	0.19	1.5	<1	<1				
PKHL-13-2 FA	<0.005	<0.005	<0.005	<0.005	189	189	233	233	<0.05	0.007	0.05	<0.005	2.35	2.8	0.02	0.3	<1	<1				
PKHL-13-2 RA	0.006	<0.005	<0.005	<0.005	248	248	295	295	<0.05	<0.005	0.07	<0.005	2.31	2.9	0.03	0.3	<1	<1				
PKHL-14-2 FA	<0.005	<0.005	<0.005	<0.005	282	282	311	311	<0.05	<0.005	0.06	<0.005	2.35	2.7	0.02	0.2	<1	<1				
PKHL-14-2 RA	0.006	<0.005	<0.005	<0.005	461	461	476	476	<0.05	0.006	<0.05	<0.005	2.5	2.7	0.03	1.2	<1	<1				
PKHL-15-2 FA	<0.005	<0.005	<0.005	<0.005	<50	<50	28	28	<0.05	<0.005	0.08	<0.005	1.3	1.6	<0.01	1.7	1	1				
PKHL-15-2 RA	<0.005	<0.005	<0.005	<0.005	<50	<50	35	35	<0.05	<0.005	<0.05	<0.005	1.29	1.6	0.02	1.9	<1	<1				
01139940Aug FA	<0.005	<0.005	<0.005	<0.005	<50	<50	<20	<20	<0.05	<0.005	<0.05	<0.005	2.03	2.1	0.02	0.7	<1	<1				
01139940Aug RA	<0.005	<0.005	0.005	0.005	<50	<50	<20	<20	<0.05	<0.005	<0.05	<0.005	2.05	2.1	0.02	1.8	1	1				
CKBK-2-3 FA	0.21	0.13	0.05	0.05	<50	<50	<20	<20	0.07	0.35	<0.05	0.04	2.08	2.2	4.78	4.8	5	5				
CKBK-2-3 RA	1.84	1.06	0.39	0.39	<50	<50	21	21	0.24	2.41	0.06	0.35	1.8	1.8	9.53	4.8	4.9	4.9				
CKBK-3-3 FA	<0.005	<0.005	0.006	0.006	<50	<50	26	26	<0.05	<0.005	<0.05	<0.005	2.33	2.3	<0.01	0.4	<1	<1				
CKBK-3-3 RA	0.01	0.006	0.006	0.006	<50	<50	30	30	<0.05	0.007	<0.05	<0.005	2.34	2.4	0.05	0.4	<1	<1				
CKBK-4-3 FA	0.02	0.01	0.01	0.01	9,380	9,380	8,970	8,970	<0.05	0.04	<0.05	0.005	5.72	6.1	0.18	1.2	1.7	1.7				
CKBK-4-3 RA	0.03	0.02	0.01	0.01	12,900	12,900	11,800	11,800	<0.05	0.058	<0.05	0.006	5.91	6.1	0.26	0.9	1.7	1.7				
CKBK-5-3 FA	0.82	0.37	0.23	0.23	732	732	750	750	0.2	1.23	<0.05	0.14	2.85	3.1	5.29	5.9	6.4	6.4				

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Lu		Mg		Mn		Mn		Mo		Mo		Na		Na		Nb		Nd		Ni		Ni		P		
	µg/L	ICP-MS	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES	mg/L	ICP-AES	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	mg/L
PKHL-9-2 FA	18	10.9	12.2	1,360	1,480	< 2	< 20	2.3	5.5	< 0.2	26.9	35	52	< 0.01													
PKHL-9-2 RA	17.6	10.9	12.5	1,350	1,470	< 2	< 20	2.32	4.7	< 0.2	27.8	34.8	43	< 0.01													
PKHL-10-2 FA	9.7	8.42	9.2	958	1,020	< 2	< 20	1.75	3.8	< 0.2	14.7	23	28	< 0.01													
PKHL-10-2 RA	9.2	8.11	9.6	930	1,010	< 2	< 20	1.69	4	< 0.2	15.4	22.2	28	< 0.01													
PKHL-10-2 D FA	9.5	8.43	9.6	953	1,000	< 2	< 20	1.75	4.8	< 0.2	16.8	22.9	37	< 0.01													
PKHL-10-2 D RA	9.5	8.1	9.6	911	1,020	< 2	< 20	1.68	4.1	< 0.2	15.6	22.6	32	< 0.01													
PKHL-11-2 FA	0.2	1.33	1.5	21.6	22	< 2	< 20	1.16	1	< 0.2	0.05	0.4	< 10	< 0.01													
PKHL-11-2 RA	< 0.1	1.32	1.5	11.4	11	< 2	< 20	1.15	0.92	< 0.2	< 0.01	< 0.4	< 10	< 0.01													
PKHL-12-2 FA	< 0.1	2.55	2.9	118	120	< 2	< 20	1.64	1.6	< 0.2	0.02	2.5	< 10	< 0.01													
PKHL-12-2 RA	0.1	2.32	2.9	112	119	< 2	< 20	1.5	1.5	< 0.2	0.16	2.3	< 10	< 0.01													
PKHL-13-2 FA	0.1	1.73	2.1	67.6	72	< 2	< 20	4.23	4.8	< 0.2	0.02	0.6	< 10	< 0.01													
PKHL-13-2 RA	< 0.1	1.69	2.1	69	74	< 2	< 20	4.21	4.8	< 0.2	0.03	0.6	< 10	< 0.01													
PKHL-14-2 FA	< 0.1	1.76	2.1	120	121	< 2	< 20	4.82	5.2	< 0.2	0.02	0.5	< 10	< 0.01													
PKHL-14-2 RA	< 0.1	1.86	2.1	128	128	< 2	< 20	5.01	5.3	< 0.2	0.02	0.6	< 10	< 0.01													
PKHL-15-2 FA	0.1	1.28	1.5	4.8	< 10	< 2	< 20	4.24	4.5	< 0.2	< 0.01	< 0.4	< 10	< 0.01													
PKHL-15-2 RA	< 0.1	1.27	1.5	6.7	< 10	< 2	< 20	4.23	4.6	< 0.2	0.02	0.4	< 10	< 0.01													
01139940Aug FA	< 0.1	2.03	2	20.6	22	< 2	< 20	0.86	0.75	< 0.2	0.02	1.4	< 10	< 0.01													
01139940Aug RA	< 0.1	2.08	2	21.2	23	< 2	< 20	0.86	0.8	< 0.2	0.02	1.2	< 10	< 0.01													
CKBK-2-3 FA	< 0.1	4.09	4.1	411	417	< 2	< 20	1.1	1	< 0.2	2.52	17.8	16	< 0.01													
CKBK-2-3 RA	0.1	4.04	4	420	415	< 2	< 20	1.07	1	< 0.2	11.8	18.2	14	< 0.01													
CKBK-3-3 FA	< 0.1	1.28	1.4	20	22	< 2	< 20	0.8	0.69	< 0.2	< 0.01	0.8	< 10	< 0.01													
CKBK-3-3 RA	< 0.1	1.35	1.4	22.2	26	< 2	< 20	0.85	0.74	< 0.2	0.04	0.8	< 10	< 0.01													
CKBK-4-3 FA	< 0.1	1.69	1.8	699	720	< 2	< 20	0.61	0.63	< 0.2	0.19	1.7	< 10	< 0.01													
CKBK-4-3 RA	< 0.1	1.66	1.8	707	682	< 2	< 20	0.58	0.52	< 0.2	0.28	0.7	< 10	< 0.01													
CKBK-5-3 FA	< 0.1	4.69	5.1	849	906	< 2	< 20	0.81	0.83	< 0.2	5.74	15.4	15	< 0.01													

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Job Number	Lab No.	Field No.	Cl	F	NO ₃	SO ₄
PKHL-9-2 FA	MRP-05633	C-245076	PKHL-9-2 FU	4.2	1.5	0.8	333 (588)
PKHL-9-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-10-2 FA	MRP-05633	C-245075	PKHL-10-2 FU	4.2	1.6	<08	298 (512)
PKHL-10-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-10-2 D FA	MRP-05633	C-245074	PKHL-10-2 D FU	4.2	1.6	<08	295 (507)
PKHL-10-2 D RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-11-2 FA	MRP-05633	C-245050	PKHL-11-2 FU	1.8	<08	0.2	8.7
PKHL-11-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-12-2 FA	MRP-05633	C-245052	PKHL-12-2 FU	2.5	<08	0.3	50.7
PKHL-12-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-13-2 FA	MRP-05633	C-245048	PKHL-13-2 FU	7.6	<08	0.7	16.8
PKHL-13-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-14-2 FA	MRP-05633	C-245049	PKHL-14-2 FU	8.8	<08	0.5	15
PKHL-14-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-15-2 FA	MRP-05633	C-245047	PKHL-15-2 FU	5.8	<08	0.4	7.5
PKHL-15-2 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
01139940Aug FA	MRP-06205	C-260125	01139940Aug FU	1.5	0.08	0.3	11.6
01139940Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
CKBK-2-3 FA	MRP-06205	C-260126	CKBK-2-3 FU	1.6	0.13	1.1	88
CKBK-2-3 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
CKBK-3-3 FA	MRP-06205	C-260121	CKBK-3-3 FU	1.4	<08	<08	7.5
CKBK-3-3 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
CKBK-4-3 FA	MRP-06205	C-260135	CKBK-4-3 FU	2.6	0.3	<08	3.8
CKBK-4-3 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
CKBK-5-3 FA	MRP-06205	C-260141	CKBK-5-3 FU	2.7	0.2	0.8	180

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[$\mu\text{S/cm}$, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; $\mu\text{g/L}$ micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Characteristic	Site location	Collection date	Collection time	Specific conductance	pH	Temperature	Dissolved oxygen	Alkalinity	Oxidation-reduction potential	Dissolved organic carbon
Units				$\mu\text{S/cm}$		degrees Celsius	mg/L	mg/L CaCO_3	mV	mg C/L
CKBK-5-3 RA	CKBK-5	8/2/2005	10:27	340	3.63	11.4	8	n.d.	595.9	n.d.
PKHL-1-3 FA	PKHL-1	8/2/2005	12:51	1357	2.936	9.5	10	n.d.	714.8	n.d.
PKHL-1-3 RA	PKHL-1	8/2/2005	12:51	1357	2.936	9.5	10	n.d.	714.8	n.d.
PKHL-2-3 FA	PKHL-2	8/2/2005	14:20	1062	3.109	27.7	8	n.d.	639.1	n.d.
PKHL-2-3 RA	PKHL-2	8/2/2005	14:20	1062	3.109	27.7	8	n.d.	639.1	n.d.
PKHL-4-3 FA	PKHL-4	8/2/2005	10:34	300	5.458	11.4	8	0	452.1	n.d.
PKHL-4-3 RA	PKHL-4	8/2/2005	10:34	300	5.458	11.4	8	0	452.1	n.d.
PKHL-5-3 FA	PKHL-5	8/2/2005	13:38	217	6.797	7.9	8	29	434.5	n.d.
PKHL-5-3 RA	PKHL-5	8/2/2005	13:38	217	6.797	7.9	8	29	434.5	n.d.
PKHL-6-3 FA	PKHL-6	8/2/2005	13:54	286	6.864	16.2	7	57.2	433.4	n.d.
PKHL-6-3 RA	PKHL-6	8/2/2005	13:54	286	6.864	16.2	7	57.2	433.4	n.d.
PKHL-7-3 FA	PKHL-7	8/2/2005	14:05	571	6.292	11.4	0	0	455.3	n.d.
PKHL-7-3 RA	PKHL-7	8/2/2005	14:05	571	6.292	11.4	0	0	455.3	n.d.
PKHL-9-3 FA	PKHL-9	8/2/2005	14:11	650	4.157	22	7	n.d.	457.4	n.d.
PKHL-9-3 RA	PKHL-9	8/2/2005	14:11	650	4.157	22	7	n.d.	457.4	n.d.
01139830Aug FA	PKHL-10	8/2/2005	15:04	739	3.212	20.2	8	n.d.	620.3	n.d.
01139830Aug RA	PKHL-10	8/2/2005	15:04	739	3.212	20.2	8	n.d.	620.3	n.d.
01139830Aug D FA	PKHL-10	8/2/2005	15:05	739	3.212	20.2	8	n.d.	620.3	0.76
01139830Aug D RA	PKHL-10	8/2/2005	15:05	739	3.212	20.2	8	n.d.	620.3	0.76
011398302Aug FA	PKHL-11	8/2/2005	14:56	182.6	6.847	15.8	5	108	381.8	n.d.
011398302Aug RA	PKHL-11	8/2/2005	14:56	182.6	6.847	15.8	5	108	381.8	n.d.
01139832Aug FA	01139832	8/3/2005	8:41	247	6.765	16.4	8	45.3	597.2	0.71
01139832Aug RA	01139832	8/3/2005	8:41	247	6.765	16.4	8	45.3	597.2	0.71
01139833Aug FA	PKHL-12	8/3/2005	8:49	211	6.862	16.4	8	72	590.3	n.d.
01139833Aug RA	PKHL-12	8/3/2005	8:49	211	6.862	16.4	8	72	590.3	n.d.

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Iron speciation Fe ²⁺ /Fe _{total} Hach	Job Number	Lab No.	Ag		Al		As		B		Ba	
				µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES		
CKBK-5-3 RA	0.08	MIRP-06206	C-260203	<3	<1	2,420	2,430	<1	<100	<5	6.64	6.7	
PKHL-1-3 FA	0.05	MIRP-06207	C-260227	<3	<1	35,100	36,100	<1	<100	<5	4.35	4.2	
PKHL-1-3 RA	0.05	MIRP-06207	C-260228	<3	<1	34,800	35,500	<1	<100	<5	4.34	3.8	
PKHL-2-3 FA	0.66	MIRP-06207	C-260225	<3	<1	8,930	9,200	<1	<100	<5	18	18	
PKHL-2-3 RA	0.66	MIRP-06207	C-260226	<3	<1	9,070	9,150	<1	<100	<5	18.6	18	
PKHL-4-3 FA	0.60	MIRP-06206	C-260197	<3	<1	659	670	<1	<100	<5	22	23	
PKHL-4-3 RA	0.60	MIRP-06206	C-260198	<3	<1	1,810	1,830	<1	<100	<5	22	23	
PKHL-5-3 FA	0.75	MIRP-06206	C-260175	<3	<1	6.6	<10	<1	<100	<5	23.2	24	
PKHL-5-3 RA	0.75	MIRP-06206	C-260176	<3	<1	138	132	<1	<100	<5	23.8	23	
PKHL-6-3 FA	n.d.	MIRP-06206	C-260195	<3	<1	13.8	<10	<1	<100	<5	33.6	36	
PKHL-6-3 RA	n.d.	MIRP-06206	C-260196	<3	<1	23.3	<10	<1	<100	<5	34.3	36	
PKHL-7-3 FA	0.99	MIRP-06206	C-260205	<3	<1	6,360	6,250	<1	<100	<5	14.2	15	
PKHL-7-3 RA	0.99	MIRP-06206	C-260206	<3	<1	6,110	6,360	<1	<100	<5	14.3	15	
PKHL-9-3 FA	0.4	MIRP-06206	C-260207	<3	<1	6,250	6,920	<1	<100	<5	17.1	18	
PKHL-9-3 RA	0.4	MIRP-06206	C-260208	<3	1.2	6,670	6,960	<1	<100	<5	17	18	
01139830Aug FA	0.59	MIRP-06207	C-260215	<3	<1	6,030	6,620	<1	<100	<5	23.4	24	
01139830Aug RA	0.59	MIRP-06207	C-260216	<3	<1	6,200	6,580	<1	<100	<5	24.8	25	
01139830AugD FA	0.59	MIRP-06207	C-260217	<3	<1	5,950	6,340	<1	<100	<5	23.5	24	
01139830AugD RA	0.59	MIRP-06207	C-260218	<3	<1	5,800	6,420	<1	<100	<5	23.6	24	
011398302Aug FA	n.d.	MIRP-06206	C-260165	<3	<1	2.5	<10	<1	<100	<5	25.5	26	
011398302Aug RA	n.d.	MIRP-06206	C-260166	<3	<1	972	864	<1	<100	<5	31.9	33	
01139832Aug FA	0.5	MIRP-06206	C-260187	<3	<1	14.8	<10	<1	<100	<5	18.7	20	
01139832Aug RA	0.5	MIRP-06206	C-260188	<3	<1	55.8	54	<1	<100	<5	18.4	20	
01139833Aug FA	0	MIRP-06206	C-260169	<3	<1	15.2	<10	<1	<100	<5	19.2	19	
01139833Aug RA	0	MIRP-06206	C-260170	<3	<1	31	14	<1	<100	<5	19.5	18	

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L, micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Be		Bi		Ca		Ca		Cd		Ce		Co		Cr		Cs		Cu	
	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	mg/L ICP-MS	mg/L ICP-AES	mg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-AES
CKBK-5-3 RA	0.1	<10	<0.2	49.1	54	2.27	<5	12	49.1	51	<1	<10	0.58	<10	575					
PKHL-1-3 FA	2.4	<10	<0.2	247	244	12	10	236	240	204	2.5	<10	0.83	<10	2,310					
PKHL-1-3 RA	2.5	<10	<0.2	248	250	11.8	9.5	234	239	197	2.6	<10	0.84	<10	2,200					
PKHL-2-3 FA	0.8	<10	<0.2	77.5	80.6	9.3	7.4	39.2	233	228	1.8	<10	1.43	<10	1,980					
PKHL-2-3 RA	0.7	<10	<0.2	78.6	83.1	9.34	8.6	40.2	236	226	1.7	<10	1.44	<10	2,020					
PKHL-4-3 FA	0.3	<10	<0.2	50.8	54.6	6.51	5.2	27.6	88.2	94	<1	<10	0.66	<10	4,870					
PKHL-4-3 RA	0.4	<10	<0.2	51.4	55.7	6.84	5.4	27.6	90.4	99	<1	<10	0.66	<10	4,970					
PKHL-5-3 FA	<0.05	<10	<0.2	52.9	51.5	2.93	<5	5.68	39.3	40	<1	<10	0.41	<10	1,120					
PKHL-5-3 RA	<0.05	<10	<0.2	52.5	47.8	3.07	<5	6.45	39.7	38	<1	<10	0.42	<10	1,200					
PKHL-6-3 FA	<0.05	<10	<0.2	54.1	59	0.95	<5	0.04	0.48	<10	<1	<10	0.3	<10	64.2					
PKHL-6-3 RA	<0.05	<10	<0.2	55.4	57.6	1.02	<5	0.1	0.57	<10	<1	<10	0.32	<10	69.8					
PKHL-7-3 FA	0.5	<10	<0.2	72.4	74.9	3.3	<5	21.9	191	164	2.4	<10	1.02	<10	2.9					
PKHL-7-3 RA	0.5	<10	<0.2	72.6	74.3	3.31	<5	21.2	190	157	2.8	<10	1.04	<10	20					
PKHL-9-3 FA	0.7	<10	<0.2	94.2	91.4	22.9	21	43.8	188	188	<1	<10	1.06	<10	6,790					
PKHL-9-3 RA	0.7	<10	<0.2	95.7	90.6	23	21	44.3	188	190	<1	<10	1.06	<10	6,790					
01139830Aug FA	0.5	<10	<0.2	70.7	77.1	8.11	7	28.2	186	184	1.2	<10	1.42	<10	1,940					
01139830Aug RA	0.5	<10	<0.2	71.8	73.7	7.95	7.2	28.8	186	181	1.6	<10	1.46	<10	1,990					
01139830AugDFA	0.5	<10	<0.2	72.1	73.8	8.01	6.8	29.1	187	176	1.2	<10	1.42	<10	1,990					
01139830AugDRA	0.5	<10	<0.2	72.7	73.8	8	6.6	29.6	189	180	1.2	<10	1.44	<10	2,010					
011398302Aug FA	<0.05	<10	<0.2	40.9	42.6	<0.02	<5	<0.01	0.03	<10	<1	<10	0.16	<10	1.5					
011398302Aug RA	0.06	<10	<0.2	42.8	42	0.13	<5	2.16	1.04	<10	2.7	<10	0.34	<10	17.7					
01139832Aug FA	<0.05	<10	<0.2	44.9	48.5	1.61	<5	0.04	21.6	24	<1	<10	0.46	<10	26					
01139832Aug RA	<0.05	<10	<0.2	45.4	50.7	1.65	<5	0.46	21.5	25	<1	<10	0.45	<10	64.3					
01139833Aug FA	<0.05	<10	<0.2	45.1	43.5	0.83	<5	0.02	5.26	<10	<1	<10	0.27	<10	15.5					
01139833Aug RA	<0.05	<10	<0.2	45.1	40.2	0.86	<5	0.1	5.45	<10	<1	<10	0.28	<10	27.7					

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; *italics* text are approximate values; erroneous values from previous jobs are red]

Element	Dy	Er	Eu	Fe	Fe	Ga	Gd	Ge	Ho	K	K	La	Li	Li
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-AES
CKBK-5-3 RA	0.83	0.37	0.24	2630	2600	0.21	1.23	< 0.05	0.14	2.94	3.3	5.37	6.3	6.5
PKHL-1-3 FA	1.2	6.08	3.14	71,000	68,200	2	16.9	0.39	2.07	3.5	3.8	96	32.6	33
PKHL-1-3 RA	11.9	6.07	3.13	72,200	70,200	2	16.8	0.38	2.06	3.4	3.7	95.7	33.6	32
PKHL-2-3 FA	2.43	1.35	0.62	23,100	23,300	0.42	3.3	0.1	0.44	4.49	5.1	15.9	16.5	17
PKHL-2-3 RA	2.51	1.36	0.65	23,700	23,800	0.44	3.39	0.1	0.44	4.52	5.1	16.7	16.4	17
PKHL-4-3 FA	2.09	1.25	0.46	<50	34	0.3	2.79	0.08	0.42	3.09	3.6	20.9	0.5	1.4
PKHL-4-3 RA	2.2	1.31	0.45	<50	70	0.31	2.84	0.08	0.44	3.18	3.5	20.7	<0.1	1
PKHL-5-3 FA	0.28	0.16	0.065	<50	<20	0.07	0.44	< 0.05	0.056	3.03	3.1	5	1.3	1.2
PKHL-5-3 RA	0.37	0.2	0.081	<50	65	0.1	0.54	< 0.05	0.075	3.15	3.1	5.39	1.2	1.1
PKHL-6-3 FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	3.45	3.9	0.05	0.5	< 1
PKHL-6-3 RA	0.005	0.005	0.008	< 50	30	< 0.05	0.007	< 0.05	< 0.005	3.24	3.8	0.08	< 0.1	< 1
PKHL-7-3 FA	1.26	0.7	0.36	34,400	32,400	0.33	1.85	0.08	0.24	4.04	4.4	9.58	14.9	15
PKHL-7-3 RA	1.22	0.69	0.37	39,500	37,400	0.35	1.87	0.09	0.24	4.07	4.7	9.23	16.3	16
PKHL-9-3 FA	3.08	1.75	0.79	625	717	0.5	4.24	0.1	0.6	4.7	5.3	21.7	7.2	7.8
PKHL-9-3 RA	3.2	1.79	0.84	666	733	0.48	4.39	0.1	0.63	4.68	5.4	22	7	8.3
01139830Aug FA	1.73	0.95	0.44	10,400	10,600	0.32	2.32	0.07	0.31	5.02	5.8	11.9	13.2	13
01139830Aug RA	1.72	0.94	0.45	15,800	15,800	0.43	2.38	0.08	0.31	5.17	6	12.2	13	14
01139830AugD FA	1.7	0.93	0.46	10,800	10,200	0.35	2.4	0.08	0.31	5.18	5.9	12.3	12.6	14
01139830AugD RA	1.77	0.98	0.46	11,400	11,000	0.35	2.37	0.09	0.32	5.21	5.7	12.4	12.3	13
011398302Aug FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	2.34	2.5	< 0.01	< 0.1	< 1
011398302Aug RA	0.15	0.079	0.04	848	797	0.26	0.19	< 0.05	0.03	2.9	3	1.06	2.2	2.4
01139832Aug FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	3.35	4.1	0.04	2.7	3.1
01139832Aug RA	0.02	0.01	0.009	147	208	< 0.05	0.04	< 0.05	0.005	3.39	4	0.24	2.2	3
01139833Aug FA	< 0.005	< 0.005	< 0.005	< 50	59	< 0.05	< 0.005	< 0.05	< 0.005	2.93	3	0.02	1.9	2.2
01139833Aug RA	0.009	< 0.005	0.005	144	155	< 0.05	0.01	< 0.05	< 0.005	2.94	2.8	0.06	2.5	2.1

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Lu		Mg		Mn		Mn		Mo		Mo		Na		Na		Nb		Nd		Ni		Ni		P		
	µg/L	ICP-MS	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES	mg/L	ICP-AES	mg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	mg/L
CKBK-5-3 RA	<0.1	4.64	5.2	840	902	<2	<20	0.86	0.98	<0.2	5.81	16	18	<0.01													
PKHL-1-3 FA	0.8	22.1	25.9	6,350	6,150	<2	<20	3.18	3.6	<0.2	91.9	43.3	40	<0.01													
PKHL-1-3 RA	0.8	22.1	25.9	6,350	6,200	<2	<20	3.18	3.6	<0.2	93.1	42.6	41	<0.01													
PKHL-2-3 FA	0.2	10.3	11.3	1,230	1,270	<2	<20	1.88	2	<0.2	18.1	30.5	33	<0.01													
PKHL-2-3 RA	0.2	10.4	11.5	1,250	1,280	<2	<20	1.86	2	<0.2	18.4	31	28	<0.01													
PKHL-4-3 FA	0.2	7.57	8.6	616	667	<2	<20	1.38	1.6	<0.2	15.6	24.3	24	<0.01													
PKHL-4-3 RA	0.2	7.54	8.6	626	677	<2	<20	1.39	1.7	<0.2	15.6	24.7	25	<0.01													
PKHL-5-3 FA	<0.1	4.58	4.9	273	289	<2	<20	1.14	1.2	<0.2	2.76	12.7	11	<0.01													
PKHL-5-3 RA	<0.1	4.88	4.7	287	273	<2	<20	1.3	1.3	<0.2	3.34	13.2	10	<0.01													
PKHL-6-3 FA	<0.1	2.62	3.2	28.9	35	<2	<20	0.95	1.1	<0.2	0.02	3	<10	<0.01													
PKHL-6-3 RA	<0.1	2.73	3.1	33.2	37	<2	<20	0.99	1.2	<0.2	0.04	3.2	<10	<0.01													
PKHL-7-3 FA	<0.1	8.03	9.1	977	1010	<2	<20	1.55	1.9	0.43	10	23.2	24	<0.01													
PKHL-7-3 RA	<0.1	7.66	9.2	972	1020	<2	<20	1.51	1.9	0.22	9.9	23.4	22	0.02													
PKHL-9-3 FA	0.3	8.87	11.6	1320	1410	<2	<20	1.74	2.3	<0.2	22.6	34.3	34	<0.01													
PKHL-9-3 RA	0.2	9.48	11.9	1340	1410	<2	<20	1.76	2.4	<0.2	23.2	34.6	34	<0.01													
01139830Aug FA	0.1	7.7	9.6	888	921	<2	<20	1.67	2.1	<0.2	12.6	24.4	27	<0.01													
01139830Aug RA	0.1	7.68	9.1	890	922	<2	<20	1.68	2	<0.2	12.9	24.8	23	<0.01													
01139830AugD FA	0.1	7.57	9.2	903	912	<2	<20	1.66	2	<0.2	13.2	25	23	<0.01													
01139830AugD RA	0.1	7.59	9.1	902	914	<2	<20	1.67	2	<0.2	13.3	25.2	22	<0.01													
011398302Aug FA	<0.1	1.39	1.4	3.1	<10	<2	<20	2.71	2.8	<0.2	<0.01	0.9	<10	<0.01													
011398302Aug RA	<0.1	1.79	1.9	221	225	<2	<20	2.73	2.8	<0.2	1.01	2.4	<10	0.01													
01139832Aug FA	<0.1	3.39	3.8	233	245	<2	<20	1.68	2	<0.2	0.02	5.2	<10	<0.01													
01139832Aug RA	<0.1	3.1	3.9	230	252	<2	<20	1.63	2.1	<0.2	0.18	5.1	<10	<0.01													
01139833Aug FA	<0.1	2.85	2.9	94	94	<2	<20	2.05	2.1	<0.2	0.01	2.8	<10	<0.01													
01139833Aug RA	<0.1	2.78	2.7	95.6	91	<2	<20	2.01	1.9	<0.2	0.05	3	<10	<0.01													

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[μ S/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; μ g/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Tb		Th		Ti		Ti		Tm		U		V		V		W		Y		Yb		Zn		Zr	
	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS	μ g/L ICP-MS
CKBK-5-3 RA	0.17	<0.2	8.5	<0.1	0.04	0.3	<0.5	<10	<0.5	<0.5	3.55	0.26	953	880	<0.2											
PKHL-1-3 FA	2.08	1.86	14.5	<0.1	0.74	3.66	<0.5	<10	<0.5	56	5.08	7,360	6,510	<0.2												
PKHL-1-3 RA	2.05	1.84	15.9	<0.1	0.75	3.63	<0.5	<10	<0.5	55.5	4.98	7,250	6,730	<0.2												
PKHL-2-3 FA	0.41	0.24	5.8	0.1	0.17	0.92	<0.5	<10	<0.5	11.3	1.23	2,940	2,590	<0.2												
PKHL-2-3 RA	0.43	0.24	6.2	0.1	0.18	0.95	<0.5	<10	<0.5	11.6	1.24	2,960	2,650	<0.2												
PKHL-4-3 FA	0.39	<0.2	2.6	0.2	0.15	0.59	<0.5	<10	<0.5	12.2	1.05	712	665	<0.2												
PKHL-4-3 RA	0.4	<0.2	3.3	0.2	0.16	0.66	<0.5	<10	<0.5	12.6	1.15	724	736	<0.2												
PKHL-5-3 FA	0.052	<0.2	1.6	<0.1	0.02	<0.1	<0.5	<10	<0.5	2.21	0.1	314	289	<0.2												
PKHL-5-3 RA	0.067	<0.2	4.7	<0.1	0.02	<0.1	<0.5	<10	<0.5	2.56	0.17	321	269	<0.2												
PKHL-6-3 FA	<0.005	<0.2	1.2	<0.1	<0.005	<0.1	<0.5	<10	<0.5	0.03	<0.005	96.1	93	<0.2												
PKHL-6-3 RA	<0.005	<0.2	1.5	<0.1	<0.005	<0.1	<0.5	<10	<0.5	0.04	<0.005	97.8	89	<0.2												
PKHL-7-3 FA	0.25	0.22	5.6	<0.1	0.087	0.29	<0.5	<10	<0.5	6.21	0.61	2,030	1,690	<0.2												
PKHL-7-3 RA	0.25	0.42	10.4	<0.1	0.085	0.31	0.8	<10	<0.5	6.33	0.61	2,030	1,710	<0.2												
PKHL-9-3 FA	0.59	<0.2	4.6	0.3	0.23	1.35	<0.5	<10	<0.5	14.6	1.59	3,570	3,160	<0.2												
PKHL-9-3 RA	0.62	<0.2	5	0.3	0.23	1.41	<0.5	<10	<0.5	14.7	1.61	3,560	3,260	<0.2												
01139830Aug FA	0.28	0.3	4.6	0.1	0.12	0.64	<0.5	<10	<0.5	8.1	0.84	2,230	1,980	<0.2												
01139830Aug RA	0.29	0.32	21.3	0.1	0.12	0.66	0.7	<10	<0.5	8.12	0.84	2,220	1,950	<0.2												
01139830AugD FA	0.3	0.2	4.5	0.1	0.12	0.65	<0.5	<10	<0.5	8.1	0.88	2,290	1,950	<0.2												
01139830AugD RA	0.3	0.2	6	0.1	0.13	0.64	<0.5	<10	<0.5	8.15	0.84	2,300	2,080	<0.2												
011398302Aug FA	<0.005	<0.2	<0.5	<0.1	<0.005	<0.1	<0.5	<10	<0.5	<0.01	<0.005	1.8	<10	<0.2												
011398302Aug RA	0.02	<0.2	39.3	<0.1	0.01	0.17	2.2	<10	<0.5	0.72	0.07	16.7	13	<0.2												
01139832Aug FA	<0.005	<0.2	1.2	<0.1	<0.005	<0.1	<0.5	<10	<0.5	0.03	<0.005	247	223	<0.2												
01139832Aug RA	<0.005	<0.2	1.3	<0.1	<0.005	<0.1	<0.5	<10	<0.5	0.14	0.01	257	240	<0.2												
01139833Aug FA	<0.005	<0.2	0.6	<0.1	<0.005	0.23	<0.5	<10	<0.5	0.02	<0.005	99.9	86	<0.2												
01139833Aug RA	<0.005	<0.2	0.7	<0.1	<0.005	0.2	<0.5	<10	<0.5	0.04	<0.005	108	89	<0.2												

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[$\mu\text{S/cm}$, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; $\mu\text{g/L}$ micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Characteristic	Site location	Collection date	Collection time	Specific conductance $\mu\text{S/cm}$	pH	Temperature degrees Celsius	Dissolved oxygen mg/L	Alkalinity mg/L CaCO_3	Oxidation-reduction potential mV	Dissolved organic carbon mg C/L
Units Methods										
01139838Aug FA	PKHL-13	8/3/2005	9:09	236	7.25	20.3	8	105.6	569.2	3.00
01139838Aug RA	PKHL-13	8/3/2005	9:09	236	7.25	20.3	8	105.6	569.2	3.00
01139839Aug FA	PKHL-14	8/3/2005	10:30	240	7.436	22.7	8	103.2	521.1	3.18
01139839Aug RA	PKHL-14	8/3/2005	10:30	240	7.436	22.7	8	103.2	521.1	3.18
01139826Aug FA	PKHL-15	8/3/2005	11:15	203	8.451	21.2	8	92	384	1.58
01139826Aug RA	PKHL-15	8/3/2005	11:15	203	8.451	21.2	8	92	384	1.58
01139840Aug FA	01139840	8/3/2005	11:38	238	8.297	20.1	8	108.8	391	n.d.
01139840Aug RA	01139840	8/3/2005	11:38	238	8.297	20.1	8	108.8	391	n.d.
01139841Aug FA	01139841	8/3/2005	11:56	221	8.506	23	8	96.8	391.6	1.60
01139841Aug RA	01139841	8/3/2005	11:56	221	8.506	23	8	96.8	391.6	1.60
PKHL-16-3 FA	PKHL-16	8/3/2005	8:19	285	6.769	16.5	8	33	592.1	n.d.
PKHL-16-3 RA	PKHL-16	8/3/2005	8:19	285	6.769	16.5	8	33	592.1	n.d.
PKHL-17-3 FA	PKHL-17	8/3/2005	9:51	337	8.179	16	8	138	549.9	2.80
PKHL-17-3 RA	PKHL-17	8/3/2005	9:51	337	8.179	16	8	138	549.9	2.80

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Iron speciation	Job Number	Lab No.	Ag		Al		As		B		Ba	
				µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS	µg/L	ICP-AES	µg/L	ICP-MS
Units	Fe ²⁺ /Fe _{total}	(MS & AES)	(MS & AES)	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES
Methods	Hach	(MS & AES)	(MS & AES)	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES
01139838Aug FA	0	MIRP-06206	C-260181	<3	<1	12.6	<10	<1	<100	<5	19.2	<1	20
01139838Aug RA	0	MIRP-06206	C-260182	<3	<1	18.3	<10	<1	<100	<5	19.6	<1	20
01139839Aug FA	0.05	MIRP-06206	C-260185	<3	<1	4	<10	<1	<100	<5	19.9	<1	21
01139839Aug RA	0.05	MIRP-06206	C-260186	<3	<1	7.8	<10	<1	<100	<5	19.9	<1	21
01139826Aug FA	n.d.	MIRP-06206	C-260167	<3	<1	16.3	<10	<1	<100	<5	10.4	<1	10
01139826Aug RA	n.d.	MIRP-06206	C-260168	<3	<1	25.4	<10	<1	<100	<5	10.4	<1	10
01139840Aug FA	0	MIRP-06206	C-260183	<3	<1	5.9	<10	<1	<100	<5	16.1	<1	17
01139840Aug RA	0	MIRP-06206	C-260184	<3	<1	15.5	<10	<1	<100	<5	16.1	<1	17
01139841Aug FA	n.d.	MIRP-06206	C-260177	<3	<1	16.6	<10	<1	<100	<5	12	<1	12
01139841Aug RA	n.d.	MIRP-06206	C-260178	<3	<1	21.6	<10	<1	<100	<5	11.8	<1	11
PKHL-16-3 FA	n.d.	MIRP-06206	C-260193	<3	1	14.9	<10	<1	<100	<5	22.2	<1	23
PKHL-16-3 RA	n.d.	MIRP-06206	C-260194	<3	<1	805	840	<1	<100	<5	22.3	<1	24
PKHL-17-3 FA	n.d.	MIRP-06206	C-260200	<3	<1	6.7	<10	<1	<100	<5	32.1	<1	33
PKHL-17-3 RA	n.d.	MIRP-06206	C-260201	<3	<1	15	<10	<1	<100	<5	32.2	<1	33

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L, micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Be		Bi		Ca		Ca		Cd		Ce		Co		Cr		Cs		Cu	
	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	mg/L ICP-MS	mg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES
01139838Aug FA	<0.05	<10	<0.2	<0.2	39.8	43	0.13	<5	0.01	0.89	<10	<1	<10	0.1	<10	8.2	<10	<10	<10	
01139838Aug RA	<0.05	<10	<0.2	<0.2	40.5	40.2	0.17	<5	0.05	1.06	<10	<1	<10	0.1	<10	12.5	<10	<10	12	
01139839Aug FA	<0.05	<10	<0.2	<0.2	39	42.7	0.14	<5	0.02	0.94	<10	<1	<10	0.11	<10	7.2	<10	<10	<10	
01139839Aug RA	<0.05	<10	<0.2	<0.2	39.4	42	0.18	<5	0.04	1.2	<10	<1	<10	0.11	<10	9	<10	<10	<10	
01139826Aug FA	<0.05	<10	<0.2	<0.2	39.5	38.7	<0.02	<5	<0.01	0.03	<10	1	<10	0.35	<10	0.5	<10	<10	<10	
01139826Aug RA	<0.05	<10	<0.2	<0.2	38.6	38	<0.02	<5	0.03	0.04	<10	1	<10	0.35	<10	1.1	<10	<10	<10	
01139840Aug FA	<0.05	<10	<0.2	<0.2	39.4	42.1	0.04	<5	<0.01	0.05	<10	<1	<10	0.11	<10	5.8	<10	<10	<10	
01139840Aug RA	<0.05	<10	<0.2	<0.2	39.1	41.2	0.07	<5	0.03	0.27	<10	<1	<10	0.11	<10	7.1	<10	<10	<10	
01139841Aug FA	<0.05	<10	<0.2	<0.2	37.9	38.4	<0.02	<5	<0.01	0.03	<10	<1	<10	0.32	<10	0.97	<10	<10	<10	
01139841Aug RA	<0.05	<10	<0.2	<0.2	38.7	37.3	<0.02	<5	0.02	0.06	<10	1	<10	0.31	<10	0.71	<10	<10	<10	
PKHL-16-3 FA	<0.05	<10	<0.2	<0.2	52.5	55.4	2.6	<5	0.11	44.8	50	<1	<10	0.58	<10	43.9	<10	<10	44	
PKHL-16-3 RA	0.08	<10	<0.2	<0.2	51.5	55.8	2.76	<5	3.99	45.2	49	<1	<10	0.58	<10	391	<10	<10	400	
PKHL-17-3 FA	<0.05	<10	<0.2	<0.2	57.9	59.8	<0.02	<5	<0.01	0.03	<10	<1	<10	<0.02	<10	<0.5	<10	<10	<10	
PKHL-17-3 RA	<0.05	<10	<0.2	<0.2	58.1	59.5	<0.02	<5	0.02	0.03	<10	<1	<10	<0.02	<10	<0.5	<10	<10	<10	

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Dy	Er	Eu	Fe	Fe	Ga	Gd	Ge	Ho	K	K	La	Li	Li
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L
Methods	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-MS	ICP-AES
01139838Aug FA	< 0.005	< 0.005	< 0.005	< 50	130	< 0.05	< 0.005	< 0.05	< 0.005	2.37	2.8	0.01	1.1	2
01139838Aug RA	0.005	< 0.005	0.005	266	300	< 0.05	0.005	< 0.05	< 0.005	2.5	2.6	0.03	1.3	1.8
01139839Aug FA	< 0.005	< 0.005	0.005	109	163	< 0.05	< 0.005	< 0.05	< 0.005	2.3	2.9	0.01	1	1.9
01139839Aug RA	< 0.005	0.005	0.006	336	393	< 0.05	0.006	< 0.05	< 0.005	2.36	2.7	0.03	1.1	1.7
01139826Aug FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	1.47	1.5	< 0.01	4.7	4
01139826Aug RA	< 0.005	< 0.005	< 0.005	< 50	27	< 0.05	< 0.005	< 0.05	< 0.005	1.46	1.4	0.02	4.3	3.8
01139840Aug FA	< 0.005	< 0.005	< 0.005	< 50	52	< 0.05	< 0.005	< 0.05	< 0.005	2.44	2.7	< 0.01	1.6	2.1
01139840Aug RA	0.005	< 0.005	< 0.005	65	112	< 0.05	< 0.005	< 0.05	< 0.005	2.5	2.8	0.02	1.4	2
01139841Aug FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	1.6	1.7	< 0.01	3.9	3.6
01139841Aug RA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	1.61	1.6	0.02	4.3	3.4
PKHL-16-3 FA	< 0.005	< 0.005	< 0.005	< 50	< 20	< 0.05	0.005	< 0.05	< 0.005	3.9	4.3	0.12	3.7	3.9
PKHL-16-3 RA	0.25	0.14	0.064	1,780	1,780	0.05	0.34	< 0.05	0.04	4	4.4	1.79	3.2	4
PKHL-17-3 FA	< 0.005	< 0.005	0.007	< 50	< 20	< 0.05	< 0.005	< 0.05	< 0.005	3.46	3.9	< 0.01	2.6	2.9
PKHL-17-3 RA	< 0.005	< 0.005	0.006	< 50	254	< 0.05	0.007	< 0.05	< 0.005	3.5	3.8	0.02	2.6	2.7

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[μ S/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; μ g/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Lu	Mg	Mg	Mn	Mn	Mo	Mo	Na	Na	Nb	Nd	Ni	Ni	P
Units	μ g/L	mg/L	mg/L	μ g/L	μ g/L	μ g/L	μ g/L	mg/L	mg/L	μ g/L	μ g/L	μ g/L	μ g/L	mg/L
Methods	ICP-MS	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-MS	ICP-AES	ICP-AES	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
01139838Aug FA	< 0.1	1.73	2.1	98.2	106	< 2	< 20	6.44	8.2	< 0.2	0.02	1.2	< 10	< 0.01
01139838Aug RA	< 0.1	1.8	2	103	106	< 2	< 20	6.55	7.6	< 0.2	0.02	1.2	< 10	< 0.01
01139839Aug FA	< 0.1	1.83	2.2	240	260	< 2	< 20	6.33	7.7	< 0.2	0.01	1.2	< 10	< 0.01
01139839Aug RA	< 0.1	1.77	2.1	260	279	< 2	< 20	6.14	7.5	< 0.2	0.02	1.2	< 10	< 0.01
01139826Aug FA	< 0.1	1.31	1.4	4	< 10	< 2	< 20	6.19	6.4	< 0.2	< 0.01	0.8	< 10	< 0.01
01139826Aug RA	< 0.1	1.29	1.4	8.8	10	< 2	< 20	6.2	6.3	< 0.2	0.02	1.1	< 10	< 0.01
01139840Aug FA	< 0.1	1.9	2.3	0.7	< 10	< 2	< 20	8.22	10.3	< 0.2	< 0.01	1.1	< 10	< 0.01
01139840Aug RA	< 0.1	1.94	2.3	17.5	20	< 2	< 20	8.46	9.9	< 0.2	0.02	1	< 10	< 0.01
01139841Aug FA	< 0.1	1.58	1.6	7.1	< 10	< 2	< 20	7.41	7.3	< 0.2	< 0.01	0.9	< 10	< 0.01
01139841Aug RA	< 0.1	1.6	1.5	11	12	< 2	< 20	7.24	7.4	< 0.2	0.02	0.9	< 10	< 0.01
PKHL-16-3 FA	< 0.1	4.03	4.6	410	440	< 2	< 20	1.63	2	< 0.2	0.04	8.3	< 10	< 0.01
PKHL-16-3 RA	< 0.1	3.91	4.6	415	444	< 2	< 20	1.64	2	< 0.2	1.72	8.5	< 10	< 0.01
PKHL-17-3 FA	< 0.1	2.44	2.8	16	18	< 2	< 20	18.8	20.4	0.25	0.01	1.3	< 10	< 0.01
PKHL-17-3 RA	< 0.1	2.44	2.8	33.1	42	< 2	< 20	18.8	21.1	< 0.2	0.02	1.4	< 10	< 0.01

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	P		Pb		Pb		Pr		Rb		Sb		Sb		Sc		Se		SiO ₂		SiO ₂		Sm		SO ₄		Sr		Sr		Ta	
	mg/L ICP-AES	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS		
01139838Aug FA	<0.1	<0.05	<50	<0.01	6.03	0.3	<50	1.1	<1	7.5	8.3	<0.01	4	173	184	<0.02																
01139838Aug RA	<0.1	0.06	<50	<0.01	6.09	<0.3	<50	1.2	<1	7.5	8	<0.01	4	175	172	<0.02																
01139839Aug FA	<0.1	<0.05	<50	<0.01	6.65	<0.3	<50	0.9	<1	6.1	6.9	<0.01	2	171	182	<0.02																
01139839Aug RA	<0.1	<0.05	<50	<0.01	6.52	<0.3	<50	0.9	<1	5.9	6.8	<0.01	3	166	179	<0.02																
01139826Aug FA	<0.1	<0.05	<50	<0.01	5.91	<0.3	<50	1	<1	8	7.4	<0.01	6	135	146	<0.02																
01139826Aug RA	<0.1	0.1	<50	<0.01	5.92	<0.3	<50	1	<1	8.1	7.4	<0.01	6	133	144	<0.02																
01139840Aug FA	<0.1	<0.05	<50	<0.01	6.97	<0.3	<50	0.9	<1	6.3	6.8	<0.01	4	171	178	<0.02																
01139840Aug RA	<0.1	<0.05	<50	<0.01	7.04	<0.3	<50	0.9	<1	6.2	6.9	<0.01	4	170	174	<0.02																
01139841Aug FA	<0.1	<0.05	<50	<0.01	6.18	<0.3	<50	1	<1	8.2	7.2	<0.01	7	138	150	<0.02																
01139841Aug RA	<0.1	<0.05	<50	<0.01	6.12	<0.3	<50	1	<1	8.3	6.9	<0.01	7	136	145	<0.02																
PKHL-16-3 FA	<0.1	<0.05	<50	<0.01	20.3	<0.3	<50	2	<1	14.3	15	<0.01	104	171	183	<0.02																
PKHL-16-3 RA	<0.1	0.3	<50	0.44	20.4	<0.3	<50	2	<1	15.2	16.1	0.31	112	171	182	<0.02																
PKHL-17-3 FA	<0.1	<0.05	<50	<0.01	2.73	<0.3	<50	1.4	<1	10.1	10.1	<0.01	7	307	307	0.2																
PKHL-17-3 RA	<0.1	<0.05	<50	<0.01	2.73	<0.3	<50	1.4	<1	10.6	10.4	<0.01	7	306	315	0.03																

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element	Tb		Th		Ti		Ti		Tm		U		V		V		W		Y		Yb		Zn		Zr	
	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-MS	µg/L ICP-AES	µg/L ICP-MS	µg/L ICP-MS
01139838Aug FA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.38	< 0.5	< 10	< 0.5	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2
01139838Aug RA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.37	< 0.5	< 10	< 0.5	0.03	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139839Aug FA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.3	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139839Aug RA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.32	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	21	< 0.2	< 0.2	< 0.2
01139826Aug FA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	1.38	< 0.5	< 10	< 0.5	0.01	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139826Aug RA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	1.32	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139840Aug FA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.44	< 0.5	< 10	< 0.5	< 0.01	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139840Aug RA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	0.45	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139841Aug FA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	1.05	< 0.5	< 10	< 0.5	0.01	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
01139841Aug RA	< 0.005	< 0.2	< 0.5	< 0.5	< 0.1	< 0.005	1.08	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
PKHL-16-3 FA	< 0.005	< 0.2	1.6	1.6	< 0.1	< 0.005	< 0.1	< 0.5	< 10	< 0.5	< 0.06	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	424	< 0.2	< 0.2	< 0.2
PKHL-16-3 RA	0.04	< 0.2	1.9	1.9	< 0.1	0.02	0.13	< 0.5	< 10	< 0.5	1.16	0.11	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	504	< 0.2	< 0.2	< 0.2
PKHL-17-3 FA	< 0.005	< 0.2	0.5	0.5	< 0.1	< 0.005	0.7	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2
PKHL-17-3 RA	< 0.005	< 0.2	0.6	0.6	< 0.1	< 0.005	0.66	< 0.5	< 10	< 0.5	0.02	< 0.005	< 10	< 0.5	< 0.5	< 0.005	< 10	< 0.5	< 0.005	< 0.005	< 0.005	< 10	< 10	< 0.2	< 0.2	< 0.2

Appendix 4. Field measurements and concentrations of elements in water samples from the Pike Hill mines study area.—Continued

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; mV, millivolts; µg/L micrograms per liter; mg/L, milligrams per liter; mg C/L, milligrams of carbon per liter; n.d., not determined; <, less than; IC, ion chromatography; ICP-AES or AES, inductively coupled plasma-atomic emission spectrometry; ICP-MS or MS, inductively coupled plasma-mass spectrometry; D, field replicate sample; FA, filtered acidified; RA, raw acidified; FU, filtered unacidified; italics text are approximate values; erroneous values from previous jobs are red]

Element/Lab information	Job Number	Lab No.	Field No.	Cl	F	NO ₃	SO ₄
01139838Aug FA	MRP-06205	C-260130	01139838Aug FU	11.4	0.09	0.9	8
01139838Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
01139839Aug FA	MRP-06205	C-260132	01139839Aug FU	10.3	0.09	0.4	5.7
01139839Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
01139826Aug FA	MRP-06205	C-260123	01139826Aug FU	8	0.08	0.7	6.7
01139826Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
01139840Aug FA	MRP-06205	C-260131	01139840Aug FU	12.5	0.09	0.6	6.7
01139840Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
01139841Aug FA	MRP-06205	C-260128	01139841Aug FU	9.5	0.08	0.62	7
01139841Aug RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-16-3 FA	MRP-06205	C-260136	PKHL-16-3 FU	2.6	0.2	0.5	125
PKHL-16-3 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
PKHL-17-3 FA	MRP-06205	C-260140	PKHL-17-3 FU	32.4	<.08	4.8	11
PKHL-17-3 RA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

¹ Sulfate reran by IC in January 2006 because original values high for sulfate less than 200 mg/L. Corrected values given in black and original 'high' values shown in red and parentheses.

Appendix 5. Concentrations of elements in stream sediment from the Pike Hill mines study area.

[mg/kg, milligrams per kilogram; %, percent; n.d., not determined; <, less than; ICP, combination of inductively coupled plasma-atomic emission spectrometry and inductively coupled plasma-mass spectrometry except chemistry replicate sample analyzed by inductively coupled plasma-mass spectrometry; HG, continuous-flow hydride-generation atomic absorption spectrophotometry; R, chemistry replicate sample; Dup, field replicate sample]

Information/Element Units Methods	Location description	Job number		Lab number		Al	Ag	As	Ba	Be	Bi	Ca	Cd	Ce
		ICP & HG	ICP & HG	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg
01139826-SD	Waits River upstream of Pike Hill Brook at Rt. 25.	MRP-06687	C-271433	3.8	<1	<1	184	2.5	0.14	2.15	0.1	31.8		
011398302-SD	Pike Hill tributary at Richardson Road.	MRP-06687	C-271425	5.76	<1	2	270	2.8	0.28	2.42	0.5	34.8		
01139830-SD	Pike Hill Brook above Richardson Road. Orange precipitate on rocks.	MRP-06687	C-271426	3.03	5	8	123	1.3	2.79	1.02	5.8	11.1		
01139830-SD-R	Pike Hill Brook above Richardson Road. Orange precipitate on rocks. Replicate for chemistry.	MRP-06686	C-271420	2.67	5.58	23	147	1.1	2.84	0.853	5	11.3		
01139830-SD-BC	Downstream of Pike Hill Brook and clean tributary confluence where white and orange flocc precipitates.	MRP-06687	C-271427	3.51	6	9	158	1.4	2.87	1.08	5.4	14.4		
01139832-SD	Pike Hill Brook at Carpenter Place	MRP-06687	C-271428	5.08	1	7	195	2.9	0.82	2.02	3.2	38		
01139833-SD	Pike Hill Brook at Pike Hill Road, West Crossing, culvert under bridge.	MRP-06687	C-271429	4.96	1	22	184	2.9	0.64	2.28	4.8	37.4		
01139833-SD Dup	Pike Hill Brook at Pike Hill Road, West Crossing, culvert under bridge. Replicate.	MRP-06687	C-271430	4.93	1	3	176	2.8	0.71	2.27	5.6	35.2		
01139838-SD	Pike Hill Brook at Pike Hill Road between wetlands.	MRP-06687	C-271431	5.36	<1	<1	217	3.4	0.21	2.39	1.6	33.4		
01139839-SD	Pike Hill Brook at Miller Road downstream of wetlands.	MRP-06687	C-271432	4.62	<1	<1	186	3	0.14	2.19	0.9	21.3		
01139840-SD	Pike Hill Brook at mouth.	MRP-06687	C-271434	4.29	<1	<1	210	3.2	0.18	2.1	1.4	19.6		
01139841-SD	Waits River at Village Road.	MRP-06687	C-271435	4.06	1	1	224	2.6	0.23	2.08	0.1	17.6		
01139940-SD	Cookville Brook tributary downstream of Smith mine.	MRP-06687	C-271424	4.74	<1	<1	171	2.2	0.13	2.5	1.5	28.5		

Appendix 5. Concentrations of elements in stream sediment from the Pike Hill mines study area.—Continued

[mg/kg, milligrams per kilogram; %, percent; n.d., not determined; <, less than; ICP, combination of inductively coupled plasma-atomic emission spectrometry and inductively coupled plasma-mass spectrometry except chemistry replicate sample analyzed by inductively coupled plasma-mass spectrometry; HG, continuous-flow hydride-generation atomic absorption spectrophotometry; R, chemistry replicate sample; Dup, field replicate sample]

Element	Co	Cr	Cs	Cu	Fe	Ga	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
Units	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg
Methods	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
01139826-SD	4.4	40	3.08	7.7	2.04	8.46	0.02	0.99	16.1	49	0.98	920	0.21	1.18	12.3	13.5	480
011398302-SD	19	75	5.26	262	3.36	13.3	0.05	1.05	17.6	60	1.75	2,530	0.86	1.29	8.5	32.3	820
01139830-SD	43.2	31	1.26	8,070	21.5	8.78	0.63	0.9	5.1	11	0.62	686	22.7	0.7	6.3	7.9	840
01139830-SD-R	51.1	28.8	1	6,200	20	8.6	n.d.	0.788	5.4	7.2	0.56	613	11.6	0.545	7.2	9.8	350
01139830-SD-BC	46.6	36	1.65	6,550	20.8	9.66	0.6	0.99	6.6	17	0.74	574	13.8	0.75	5.9	9.7	800
01139832-SD	74.4	48	3.42	3,530	7.64	10.4	0.22	1.03	19	44	1.19	1,100	4.71	1.15	7.3	20.5	860
01139833-SD	147	51	3.16	3,540	6.67	10.4	0.17	1	18.4	44	1.14	1,830	2.43	1.24	9.7	24.1	920
01139833-SD Dup	138	50	3.15	3,490	6.73	10.3	0.18	0.99	17.7	45	1.16	1,750	3.18	1.2	10.5	23.9	890
01139838-SD	49.5	49	3.5	298	2.72	11.2	0.04	1.2	16.7	45	0.95	1,540	0.5	1.65	12.1	19.5	690
01139839-SD	23.3	34	2.61	119	1.84	9.42	0.02	1.2	10.9	37	0.79	1,300	0.22	1.59	9.1	13.8	480
01139840-SD	22.1	27	2.87	98.1	1.4	9.29	<0.02	1.22	9.9	36	0.71	1,380	0.19	1.55	7.3	12.2	390
01139841-SD	4.6	32	3.06	8	1.35	8.48	<0.02	1.11	9.1	47	0.9	667	0.16	1.32	8.9	11.2	440
01139940-SD	35.5	53	2.55	539	2.43	9.15	0.03	0.71	16.7	39	1.42	1,650	0.45	0.98	8.1	31.4	870

Appendix 5. Concentrations of elements in stream sediment from the Pike Hill mines study area.—Continued

[mg/kg, milligrams per kilogram; %, percent; n.d., not determined; <, less than; ICP, combination of inductively coupled plasma-atomic emission spectrometry and inductively coupled plasma-mass spectrometry except chemistry replicate sample analyzed by inductively coupled plasma-mass spectrometry; HG, continuous-flow hydride-generation atomic absorption spectrophotometry; R, chemistry replicate sample; Dup, field replicate sample]

Element	Pb	Rb	S	Sb	Sc	Se	Sn	Sr	Te	Th	Ti	Ti	Ti	U	V	W	Y	Zn
Units	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Methods	ICP	ICP	ICP	ICP	ICP	HG	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
01139826-SD	16.5	44.7	0.01	0.08	5.6	<0.2	2.5	259	<0.1	5.5	0.6	0.3	1.6	47	0.5	15.4	44	
011398302-SD	25.6	51.6	0.06	0.13	11.5	0.5	4.5	286	<0.1	4.9	0.34	0.5	1.8	91	0.6	19.3	134	
01139830-SD	59	32.7	2.12	1.28	4.8	49.8	8.2	97.1	0.7	3.2	0.22	0.5	0.9	61	0.6	9	1,070	
01139830-SD-R	61	30	n.d.	1.3	5	52.1	n.d.	86.4	n.d.	3.2	0.22	0.5	0.88	51.9	n.d.	9.8	981	
01139830-SD-BC	61.9	35.4	1.61	1.34	5.6	52	10.4	112	0.7	3.3	0.21	0.6	1.1	67	0.5	9.6	1,010	
01139832-SD	31.1	47.8	0.41	0.39	6.9	8.7	4.2	262	0.1	4	0.29	0.4	2.3	60	0.6	19.9	675	
01139833-SD	25.5	47.4	0.41	0.35	7.2	6.8	2.9	288	<0.1	3.9	0.41	0.4	2.1	61	0.9	22.3	834	
01139833-SD Dup	25.5	46.4	0.46	0.28	7.3	6	3.3	283	0.1	4.1	0.46	0.4	2.1	59	0.6	22	907	
01139838-SD	21.3	56.8	0.04	0.07	7.3	0.3	2.6	336	<0.1	5.2	0.62	0.4	2.4	57	0.6	20.5	283	
01139839-SD	18.9	50.7	0.02	0.05	5.2	<0.2	1.6	280	<0.1	3.5	0.49	0.4	1.1	42	0.3	16	191	
01139840-SD	21.8	56.1	0.02	0.06	4.4	<0.2	2.9	258	<0.1	3.1	0.29	0.4	1.5	34	0.3	14	224	
01139841-SD	18.2	48.4	0.01	0.07	4.5	0.2	2.4	266	<0.1	2.6	0.27	0.3	1.1	36	0.5	11.3	43	
01139940-SD	13.1	31.4	0.04	0.06	7.4	<0.2	2.1	346	<0.1	3.6	0.4	0.2	1.3	60	0.6	20.1	685	