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**Sediment and Benthic  
Macroinvertebrate Metals Data for  
Red Devil Creek and Reference  
Creeks and Biota Sediment  
Accumulation Factors**



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***F Sediment and Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks and Biota Sediment Accumulation Factors***

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## Appendix F

### Sediment and Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks and Biota Sediment Accumulation Factors

This appendix includes metals data for benthic macroinvertebrates and sediment collected from Red Devil Creek and nearby reference creeks in June 2010 by the Bureau of Land Management (BLM), Alaska State Office, Anchorage, Alaska, and uses the data to calculate biota-sediment accumulation factors (BSAFs). Results for benthic macroinvertebrates and sediment are provided in Tables F-1 and F-2, respectively. Figure F-1 shows the locations of the reference creeks and Red Devil Creek.

BSAFs were calculated as follows:

$$\text{BSAF} = C_b/C_s$$

Where:

BSAF = Biota-sediment accumulation factor (unitless)

$C_b$  = Benthic macroinvertebrate metal concentration (mg/kg wet weight, except mercury and methylmercury [ $\mu\text{g}/\text{kg}$  wet weight])

$C_s$  = Sediment metal concentration (mg/kg dry weight, except mercury and methylmercury [ $\mu\text{g}/\text{kg}$  dry weight])

BSAFs are provided in Tables F-3 to F-7.



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***F Sediment and Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks and Biota Sediment Accumulation Factors***

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**Table F-1. Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks (June 2010 Samples)**

Lab ID	Client Sample ID	Arsenic		Antimony		Mercury		Methylmercury		Barium		Beryllium		Cadmium		Chromium		Cobalt	
		(ug/ wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ng/wet g)	QA Qual.	(ug/ wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/ wet g)	QA Qual.
197	NONAME CK #2/Macro	0.621		0.077		0.02		57.5		8.379		0.025	U	0.276		0.906		--	
215	DOWNEY 1/Macro	1.102		0.036	J	0.03		14.6		6.349		0.025	U	0.453		0.487		--	
216	DOWNEY 2/Macro	0.878		0.03	J	0.02		18.8		5.884		0.025	U	0.407		0.46		--	
217	DOWNEY 3/Macro	0.815		0.028	J	0.03		17.5		4.926		0.025	U	0.436		0.416		--	
244	ICE CK 1/Macro	1.065		0.095		0.05		23		23.408		0.025	U	0.963		1.696		--	
245	ICE CK 2/Macro	0.749		0.054		0.02		12.3		10.07		0.025	U	0.608		0.733		--	
246	ICE CK3/Macro	1.35		0.204		0.01		9.8		12.306		0.025	U	0.562		0.797		--	
263	RED DEVIL 1/Macro	81.238		20.389		2.01		23.8		4.843		0.025	U	0.116		0.441		--	
264	RED DEVIL 2/Macro	98.798		18.953		2.38		59.4		5.907		0.025	U	0.082		0.327		--	
265	RED DEVIL 3/Macro	126.444		21.437		1.6		50.4		6.612		0.025	U	0.097		0.368		--	
300	FULLER CK 1/Macro	1.373		0.097		0.03		10.8		31.151		0.032		0.666		1.596		--	
301	FULLER CK 2/Macro	1.63		0.098		0.03		8.1		44.997		0.042		0.874		2.188		--	
319	VR A/Macro	0.626		0.425		0.08		41.8		9.742		0.025	U	0.038		0.337		--	
320	VR B/Macro	0.903		0.113		0.04		9.4		16.054		0.025	U	0.029		1.468		--	
321	VR C/Macro	0.614		0.06		0.03		11.6		12.275		0.025	U	0.026		1.07		--	
322	VR D/Macro	0.661		0.058		0.02		8.7		10.815		0.025	U	0.025	U	0.92		--	
349	McCally CK 1/Macro	1.908		0.328		0.03		13		2.955		0.025	U	0.144		0.378		--	
350	McCally CK 2/Macro	1.95		0.367		0.02		10.1		3.612		0.025	U	0.213		0.328		--	
366	California CK 1/Macro	0.482		0.125		0.01		6.3		11.263		0.025	U	0.204		0.944		--	

Source: Matz et al. (2017)

**Key:**

BLM = Bureau of Land Management

QA Qual = Quality Assurance Qualifier

	Average (Arithmetic Mean) As (ug/ wet g)	Sb (ug/wet g)	Hg (ug/wet g)	MeHg (ng/wet g)	Ba (ug/ wet g)	Be (ug/wet g)	Cd (ug/wet g)	Cr (ug/wet g)	Co (ug/wet g)
No Name Creek	0.62	0.077	0.020	57.500	8.38	0.025	0.276	0.906	--
Downey Creek	0.93	0.031	0.027	16.967	5.72	0.025	0.432	0.454	--
Ice Creek	1.05	0.118	0.027	15.033	15.26	0.025	0.711	1.075	--
Red Devil Creek	102.16	20.260	1.997	44.533	5.79	0.025	0.098	0.379	--
Fuller Creek	1.50	0.098	0.030	9.450	38.07	0.037	0.770	1.892	--
Vreeland Creek	0.70	0.164	0.043	17.875	12.22	0.025	0.030	0.949	--
California	0.48	0.125	0.010	6.300	11.26	0.025	0.204	0.944	--
Geometric Mean	As (ug/ wet g)	Sb (ug/wet g)	Hg (ug/wet g)	MeHg (ng/wet g)	Ba (ug/ wet g)	Be (ug/wet g)	Cd (ug/wet g)	Cr (ug/wet g)	Co (ug/wet g)
No Name Creek	0.62	0.077	0.020	57.500	8.38	0.025	0.276	0.906	--
Downey Creek	0.92	0.031	0.026	16.873	5.69	0.025	0.432	0.453	--
Ice Creek	1.02	0.102	0.022	14.048	14.26	0.025	0.690	0.997	--
Red Devil Creek	100.49	20.234	1.971	41.457	5.74	0.025	0.097	0.376	--
Fuller Creek	1.50	0.097	0.030	9.353	37.44	0.037	0.763	1.869	--
Vreeland Creek	0.69	0.114	0.037	14.111	12.00	0.025	0.029	0.835	--
California	0.48	0.125	0.010	6.300	11.26	0.025	0.204	0.944	--

**Table F-1. Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks (June 2010 Samples)**

Lab ID	Client Sample ID	Copper		Lead		Manganese		Nickel		Selenium		Silver		Thallium		Vanadium		Zinc	
		(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.	(ug/wet g)	QA Qual.
197	NONAME CK #2/Macro	9.097		0.322		39.223		1.012		3.27		--		--		1.222		29.04	
215	DOWNEY 1/Macro	9.594		0.143		42.145		1.455		2.238		--		--		0.732		46.659	
216	DOWNEY 2/Macro	8.569		0.134		31.229		1.206		1.921		--		--		0.695		41.496	
217	DOWNEY 3/Macro	8.327		0.159		29.322		1.089		2.112		--		--		0.495		43.858	
244	ICE CK 1/Macro	14.115		0.528		31.522		1.488		3.442		--		--		3.326		44.361	
245	ICE CK 2/Macro	11.851		0.178		40.893		0.713		3.675		--		--		1.453		41.232	
246	ICE CK3/Macro	11.34		0.235		63.177		0.699		3.255		--		--		1.648		36.556	
263	RED DEVIL 1/Macro	6.564		0.146		27.841		0.557		1.002		--		--		0.397		22.551	
264	RED DEVIL 2/Macro	10.384		0.131		41.995		1.257		3.386		--		--		0.433		40.575	
265	RED DEVIL 3/Macro	12.405		0.154		50.779		1.409		4.046		--		--		0.472		44.92	
300	FULLER CK 1/Macro	9.563		0.501		84.883		1.57		1.448		--		--		3.103		44.483	
301	FULLER CK 2/Macro	11.949		0.691		150.562		2.004		1.822		--		--		4.305		53.395	
319	VR A/Macro	10.837		0.094		11.933		0.37		1.425		--		--		0.549		64.188	
320	VR B/Macro	6.163		0.326		42.829		1.591		0.493		--		--		2.383		10.637	
321	VR C/Macro	7.269		0.222		31.141		1.134		0.415		--		--		1.772		10.386	
322	VR D/Macro	5.793		0.239		42.915		1.195		0.458		--		--		1.396		9.09	
349	McCally CK 1/Macro	8.97		0.1		10.782		0.426		2.512		--		--		0.646		35.812	
350	McCally CK 2/Macro	8.022		0.112		13.676		0.484		3.372		--		--		0.697		38.606	
366	California CK 1/Macro	20.014		0.274		61.998		0.606		1.013		--		--		1.048		21.886	

Source: Matz et al. (2017)

**Key:**

BLM = Bureau of Land Management

QA Qual = Quality Assurance Qualifier

Average (Arithmetic Mean)	Cu (ug/wet g)	Pb (ug/wet g)	Mn (ug/wet g)	Ni (ug/wet g)	Se (ug/wet g)	Ag (ug/wet g)	Tl (ug/wet g)	V (ug/wet g)	Zn (ug/wet g)
No Name Creek	9.097	0.322	39.223	1.012	3.270	--	--	1.222	29.040
Downey Creek	8.830	0.145	34.232	1.250	2.090	--	--	0.641	44.004
Ice Creek	12.435	0.314	45.197	0.967	3.457	--	--	2.142	40.716
Red Devil Creek	9.784	0.144	40.205	1.074	2.811	--	--	0.434	36.015
Fuller Creek	10.756	0.596	117.723	1.787	1.635	--	--	3.704	48.939
Vreeland Creek	7.516	0.220	32.205	1.073	0.698	--	--	1.525	23.575
California	20.014	0.274	61.998	0.606	1.013	--	--	1.048	21.886
Geometric Mean	Cu (ug/wet g)	Pb (ug/wet g)	Mn (ug/wet g)	Ni (ug/wet g)	Se (ug/wet g)	Ag (ug/wet g)	Tl (ug/wet g)	V (ug/wet g)	Zn (ug/wet g)
No Name Creek	9.097	0.322	39.223	1.012	3.270	--	--	1.222	29.040
Downey Creek	8.813	0.145	33.793	1.241	2.086	--	--	0.631	43.954
Ice Creek	12.379	0.281	43.345	0.905	3.453	--	--	1.997	40.588
Red Devil Creek	9.456	0.143	39.011	0.995	2.394	--	--	0.433	34.511
Fuller Creek	10.690	0.588	113.049	1.774	1.624	--	--	3.655	48.736
Vreeland Creek	7.282	0.201	28.748	0.945	0.604	--	--	1.341	15.934
California	20.014	0.274	61.998	0.606	1.013	--	--	1.048	21.886

**Table F-2. Sediment Data for Arsenic, Antimony, Mercury, and Other Metals for Red Devil Creek and Reference Creeks Along the Middle Kuskokwim River (June 2010 BLM Samples)<sup>a</sup>**

Sample Date	Time	Creek Name	Locale	Arsenic (mg/kg dry)	Antimony (mg/kg dry)	Mercury (µg/kg dry)	Methyl Hg (µg/kg dry)	Barium (mg/kg dry)	Beryllium (mg/kg dry)	Cadmium (mg/kg dry)	Chromium (mg/kg dry)	Cobalt (mg/kg dry)	Copper (mg/kg dry)	Lead (mg/kg dry)	Manganese (mg/kg dry)	Nickel (mg/kg dry)	Selenium (mg/kg dry)	Silver (mg/kg dry)	Thallium (mg/kg dry)	Vanadium (mg/kg dry)	Zinc (mg/kg dry)
Jun 20 2010	1150	Red Devil Creek	Site	3900	10000	232000	51	1500	2	0.5	150	23	69	40	1500	71	1	0.2	1.1	140	110
Jun 20 2010	1200	Red Devil Creek	Site	4000	9300	210000	22	1400	2	0.4	140	25	77	38	1700	70	1.1	0.2	1	140	110
Jun 21 2010	0950	Vreeland Creek	Ref.	9.5	1.1	200	2.2	890	2.2	0.2	66	12	25	9.4	470	39	0.9	0.1	0.5	110	86
Jun 21 2010	1000	Vreeland Creek	Ref.	10	1.3	216	1.7	870	1.8	0.2	67	12	26	10	490	39	0.9	0.1	0.5	110	86
Jun 21 2010	1530	Fuller Creek	Ref.	13	3.6	127	0.4	980	1.4	0.1	56	13	24	10	630	38	0.6	0.1	0.5	100	82
Jun 21 2010	1540	Fuller Creek	Ref.	11	1.7	123	0.72	950	1.7	0.1	54	12	21	10	710	34	0.7	0.1	0.5	96	79
Jun 22 2010	1310	Downey Creek	Ref.	11	2.8	6950	2	800	1.3	0.2	66	13	20	7	550	43	0.8	0.1	0.3	110	85
Jun 22 2010	1320	Downey Creek	Ref.	11	6.5	229	1.2	800	1.2	0.2	60	12	17	6.4	380	39	0.7	0.1	0.4	100	86
Jun 22 2010	1120	California Creek	Ref.	15	9	123	0.64	700	1.2	0.1	66	16	20	7.3	460	42	0.4	0.1	0.3	120	83
Jun 22 2010	1130	California Creek	Ref.	12	4.9	113	1.6	760	1.5	0.1	64	14	20	8.6	600	38	0.7	0.1	0.4	100	80
Jun 24 2010	1400	Ice Creek	Ref.	9.1	1.3	122	0.84	930	1.4	0.2	60	12	18	8.3	630	36	0.6	0.1	0.4	100	74
Jun 24 2010	1410	Ice Creek	Ref.	12	1.3	115	1	950	1.6	0.2	61	12	20	9.8	630	37	0.8	0.1	0.5	100	79
Jun 22 2010	1540	No Name Creek	Ref.	9.4	1.4	971	0.86	950	1.6	0.2	67	12	22	10	430	36	0.9	0.1	0.5	110	85
Jun 22 2010	1550	No Name Creek	Ref.	9.5	1.5	122	0.81	940	1.7	0.2	70	12	23	11	510	38	0.7	0.1	0.5	110	89

Source: A. Matz, U.S. Fish and Wildlife Service, Fairbanks, AK and M. Varner, BLM Alaska State Office, Anchorage, AK.

Key: Ref.= Reference, BLM = Bureau of Land Management, RDC = Red Devil Creek.

Note: a = Two sediment samples were collected at each location.

Max. (RDC) or Min. (Reference)	Arsenic (mg/kg dry)	Antimony (mg/kg dry)	Mercury (µg/kg dry)	Methyl Hg (µg/kg dry)	Barium (mg/kg dry)	Beryllium (mg/kg dry)	Cadmium (mg/kg dry)	Chromium (mg/kg dry)	Cobalt (mg/kg dry)	Copper (mg/kg dry)	Lead (mg/kg dry)	Manganese (mg/kg dry)	Nickel (mg/kg dry)	Selenium (mg/kg dry)	Silver (mg/kg dry)	Thallium (mg/kg dry)	Vanadium (mg/kg dry)	Zinc (mg/kg dry)
Red Devil Creek (RDC)	4000	10000	232000	51	1500	2	0.5	150	25	77	40	1700	71	1.1	0.2	1.1	140	110
Vreeland Creek	9.5	1.1	200	1.7	870	1.8	0.2	66	12	25	9.4	470	39	0.9	0.1	0.5	110	86
Fuller Creek	11	1.7	123	0.4	950	1.4	0.1	54	12	21	10	630	34	0.6	0.1	0.5	96	79
Downey Creek	11	2.8	229	1.2	800	1.2	0.2	60	12	17	6.4	380	39	0.7	0.1	0.3	100	85
California Creek	12	4.9	113	0.64	700	1.2	0.1	64	14	20	7.3	460	38	0.4	0.1	0.3	100	80
Ice Creek	9.1	1.3	115	0.84	930	1.4	0.2	60	12	18	8.3	630	36	0.6	0.1	0.4	100	74
No Name Creek	9.4	1.4	122	0.81	940	1.6	0.2	67	12	22	10	430	36	0.7	0.1	0.5	110	85



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***F Sediment and Benthic Macroinvertebrate Metals Data for Red Devil Creek and Reference Creeks and Biota Sediment Accumulation Factors***

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**Table F-3. Arsenic, Antimony, Mercury, and Methylmercury in Co-located Samples of Benthic Macroinvertebrates and Sediment and Biota-Sediment Accumulation Factors.**

Creek Name	Locale	Sediment <sup>a</sup>				Benthic Macroinvertebrates <sup>b</sup>					BSAF <sup>c</sup>			
		Arsenic (mg/kg)	Antimony (mg/kg)	Mercury (µg/kg)	Methyl Hg (µg/kg)	Arsenic (mg/kg)	Antimony (mg/kg)	Mercury (µg/kg)	Methyl Hg (µg/kg)	% Methyl Hg	Arsenic	Antimony	Mercury	Methyl Hg
California Creek	Ref.	12	4.9	113	0.64	0.48	0.13	10.0	6.3	63%	0.040	0.026	0.088	9.8
Downey Creek	Ref.	11	2.8	229	1.2	0.92	0.03	26.2	16.9	64%	0.084	0.011	0.114	14.1
Fuller Creek	Ref.	11	1.7	123	0.4	1.50	0.10	30.0	9.4	31%	0.136	0.057	0.244	23.4
Ice Creek	Ref.	9.1	1.3	115	0.84	1.02	0.10	21.5	14.0	65%	0.113	0.078	0.187	16.7
No Name Creek	Ref.	9.4	1.4	122	0.81	0.62	0.08	20.0	57.5	~100%	0.066	0.055	0.164	71.0
Vreeland Creek	Ref.	9.5	1.1	200	1.7	0.69	0.11	37.2	14.1	38%	0.073	0.103	0.186	8.3
Red Devil Creek	Site	4000	10000	232000	51	100	20.2	1971	41.5	2%	0.025	0.002	0.008	0.8

Key:

BSAF = biota-sediment accumulation factor

Ref. = Reference

Geometric Mean BSAF for Reference Creeks	Arsenic	Antimony	Mercury	Methyl Hg
Red Devil Creek BSAF	0.025	0.002	0.008	0.81
Reference-to-Site Ratio	3.2	22	18	22

a = Maximum of duplicate samples for Red Devil Creek and minimum of duplicate samples from reference creeks collected in June 2010 (see Table F-2).

b = Geometric Mean of up to four samples from each creek collected in June 2010 (see Table F-1).

c = (Benthic macroinvertebrate concentration [wet]) / (sediment concentration [dry]). Percent moisture data not available for benthic macroinvertebrate samples.

**Table F-4. Barium, Beryllium, Cadmium, and Chromium in Co-located Samples of Benthic Macroinvertebrates and Sediment and Biota-Sediment Accumulation Factors.**

Creek Name	Locale	Sediment <sup>a</sup>				Benthic Macroinvertebrates <sup>b</sup>				BSAF <sup>c</sup>			
		Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Barium	Beryllium	Cadmium	Chromium
California Creek	Ref.	700	1.2	0.1	64	11.3	0.013 U	0.20	0.94	0.016	0.010	2.040	0.015
Downey Creek	Ref.	800	1.2	0.2	60	5.7	0.013 U	0.43	0.45	0.007	0.010	2.158	0.008
Fuller Creek	Ref.	950	1.4	0.1	54	37.4	0.037	0.76	1.87	0.039	0.026	7.629	0.035
Ice Creek	Ref.	930	1.4	0.2	60	14.3	0.013 U	0.69	1.00	0.015	0.009	3.452	0.017
No Name Creek	Ref.	940	1.6	0.2	67	8.4	0.013 U	0.28	0.91	0.009	0.008	1.380	0.014
Vreeland Creek	Ref.	870	1.8	0.2	66	12.0	0.013 U	0.024	0.84	0.014	0.007	0.122	0.013
Red Devil Creek	Site	1500	2	0.5	150	5.7	0.013 U	0.10	0.38	0.004	0.006	0.195	0.003

**Key:** Geometric Mean BSAF for Reference Creeks Barium Beryllium Cadmium Chromium  
 BSAF = biota-sediment accumulation factor Red Devil Creek BSAF 0.004 0.006 0.195 0.003  
 Ref. = Reference Reference-to-Site Ratio 3.7 1.7 8.4 5.9

**Notes:**

- a = Maximum of duplicate samples for Red Devil Creek and minimum of duplicate samples from reference creeks collected in June 2010 (see Table F-2).
- b = Geometric Mean of up to four samples from each creek collected in June 2010 (see Table F-1).
- c = (Benthic macroinvertebrate concentration [wet]) / (sediment concentration [dry]). Percent moisture data not available for benthic macroinvertebrate samples.

**Table F-5. Cobalt, Copper, Lead, and Manganese in Co-located Samples of Benthic Macroinvertebrates and Sediment and Biota-Sediment Accumulation Factors.**

Creek Name	Locale	Sediment <sup>a</sup>				Benthic Macroinvertebrates <sup>b</sup>				BSAF <sup>c</sup>			
		Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Manganese (mg/kg dry)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Manganese (mg/kg wet)	Cobalt	Copper	Lead	Manganese
California Creek	Ref.	14	20	7.3	460	--	20.0	0.27	62	--	1.00	0.038	0.135
Downey Creek	Ref.	12	17	6.4	380	--	8.8	0.14	34	--	0.52	0.023	0.089
Fuller Creek	Ref.	12	21	10	630	--	10.7	0.59	113	--	0.51	0.059	0.179
Ice Creek	Ref.	12	18	8.3	630	--	12.4	0.28	43	--	0.69	0.034	0.069
No Name Creek	Ref.	12	22	10	430	--	9.1	0.32	39	--	0.41	0.032	0.091
Vreeland Creek	Ref.	12	25	9.4	470	--	7.3	0.20	29	--	0.29	0.021	0.061
Red Devil Creek	Site	25	77	40	1700	--	9.5	0.14	39	--	0.12	0.004	0.023

**Key:**

-- = no data

BSAF = biota-sediment accumulation factor

Ref. = Reference

**Notes:**

a = Maximum of duplicate samples for Red Devil Creek and minimum of duplicate samples from reference creeks collected in June 2010 (see Table F-2).

b = Geometric Mean of up to four samples from each creek collected in June 2010 (see Table F-1).

c = (Benthic macroinvertebrate concentration [wet]) / (sediment concentration [dry]). Percent moisture data not available for benthic macroinvertebrate samples.

Geometric Mean BSAF for Reference Creeks	Cobalt	Copper	Lead	Manganese
Red Devil Creek BSAF	--	0.12	0.004	0.023
Reference-to-Site Ratio	--	4.3	9.0	4.2

**Table F-6. Nickel, Selenium, Silver, and Thallium in Co-located Samples of Benthic Macroinvertebrates and Sediment and Biota-Sediment Accumulation Factors.**

Creek Name	Locale	Sediment <sup>a</sup>				Benthic Macroinvertebrates <sup>b</sup>				BSAF <sup>c</sup>			
		Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Nickel	Selenium	Silver	Thallium
California Creek	Bkgd	38	0.4	0.1	0.3	0.61	1.01	--	--	0.016	2.53	--	--
Downey Creek	Bkgd	39	0.7	0.1	0.3	1.24	2.09	--	--	0.032	2.98	--	--
Fuller Creek	Bkgd	34	0.6	0.1	0.5	1.77	1.62	--	--	0.052	2.71	--	--
Ice Creek	Bkgd	36	0.6	0.1	0.4	0.91	3.45	--	--	0.025	5.76	--	--
No Name Creek	Bkgd	36	0.7	0.1	0.5	1.01	3.27	--	--	0.028	4.67	--	--
Vreeland Creek	Bkgd	39	0.9	0.1	0.5	0.95	0.60	--	--	0.024	0.67	--	--
Red Devil Creek	Site	71	1.1	0.2	1.1	1.00	2.39	--	--	0.014	2.18	--	--

**Key:**

-- = no data

BSAF = biota-sediment accumulation factor

Ref. = Reference

**Notes:**

a = Maximum of duplicate samples for Red Devil Creek and minimum of duplicate samples from reference creeks collected in June 2010 (see Table F-2).

b = Geometric Mean of up to four samples from each creek collected in June 2010 (see Table F-1).

c = (Benthic macroinvertebrate concentration [wet]) / (sediment concentration [dry]). Percent moisture data not available for benthic macroinvertebrate samples.

Geometric Mean BSAF for Reference Creeks	Nickel	Selenium	Silver	Thallium
Red Devil Creek BSAF	0.014	2.18	--	--
Reference-to-Site Ratio	2.0	1.2	--	--

**Table F-7. Vanadium and Zinc in Co-located Samples of Benthic Macroinvertebrates and Sediment and BSAFs.**

Creek Name	Locale	Sediment <sup>a</sup>		Benthic Macroinvertebrates <sup>b</sup>		BSAF <sup>c</sup>	
		Vanadium (mg/kg dry)	Zinc (mg/kg dry)	Vanadium (mg/kg wet)	Zinc (mg/kg wet)	Vandium	Zinc
California Creek	Bkgd	100	80	1.05	21.9	0.010	0.274
Downey Creek	Bkgd	100	85	0.63	44.0	0.006	0.517
Fuller Creek	Bkgd	96	79	3.65	48.7	0.038	0.617
Ice Creek	Bkgd	100	74	2.00	40.6	0.020	0.548
No Name Creek	Bkgd	110	85	1.22	29.0	0.011	0.342
Vreeland Creek	Bkgd	110	86	1.34	15.9	0.012	0.185
Red Devil Creek	Site	140	110	0.43	34.5	0.003	0.314

**Key:**

BSAF = biota-sediment accumulation factor

Ref. = Reference

Geometric Mean BSAF for Reference Creeks    Vandium    Zinc

Red Devil Creek BSAF    0.003    0.314

Reference-to-Site Ratio    4.5    1.2

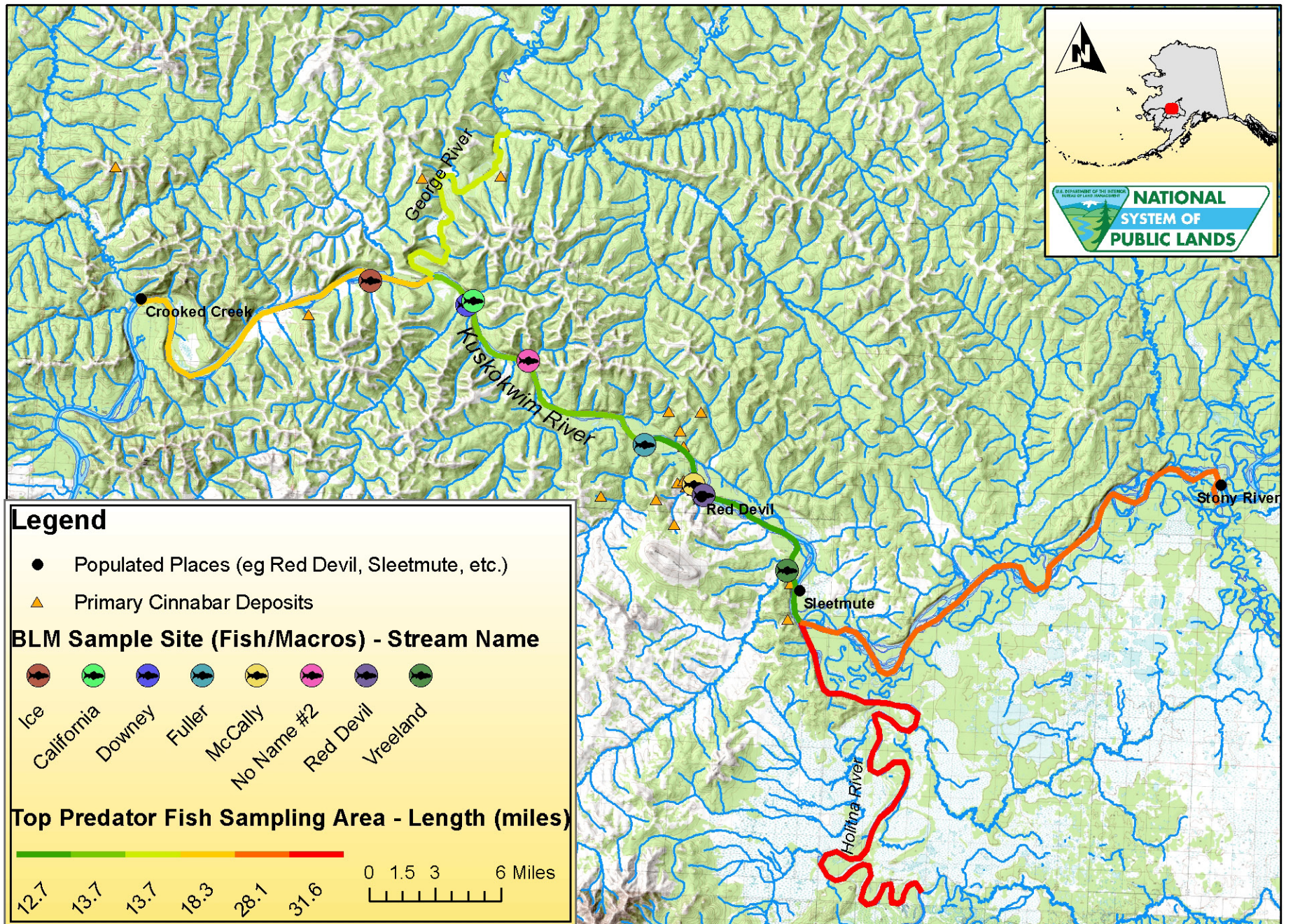
**Notes:**

a = Maximum of duplicate samples for Red Devil Creek and minimum of duplicate samples from reference creeks collected in June 2010 (see Table F-2).

b = Geometric Mean of up to four samples from each creek collected in June 2010 (see Table F-1).

c = (Benthic macroinvertebrate concentration [wet]) / (sediment concentration [dry]). Percent moisture not available for benthic macroinvertebrate samples.





Source: BLM Alaska Field Office, Anchorage, AK (2012)

**Figure F-1** River Reaches Sampled for Gamefish and Tributaries Sampled for Sculpin and Benthos