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DEPARTMENT OF NATURAL RESOURCES

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# Flint River Assessment Appendix

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**MICHIGAN DEPARTMENT OF NATURAL RESOURCES  
FISHERIES DIVISION**

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Appendix**

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Appendix 1

Water Quality Sampling Data

Water quality sampling results for sites on the Flint River and select tributaries. Data from Alexander (1997), Walterhouse (unpublished data), and MDEQ (1994). Blank indicates no data. Data codes: k = actual value is less than value given, if present is below detection limit, HT = recommended laboratory holding time exceeded for sample, A = mean value of two or more samples, DL = sample analyzed using dilution.



Appendix 1.

	SMNTP Ecoregion Mean	Pine Creek Hunter Ck Rd.	Pine Creek Peppermill Rd.	Hunter Creek Newark Rd.	Hunter Creek Turrill Rd.	Farmers Creek Baldwin Rd.	Farmers Creek Mitchell Rd.	Farmers Creek Merwin Rd.	Farmers Creek Lippincott Rd.	Plum Creek Fish Lake Rd.	Plum Creek Velentine Rd.
Ortho phosphate (mg P/l)		0.006	0.005	0.026	0.007	0.025	0.008	0.017	0.032	0.009	0.009
Total phosphorus (mg P/l)	0.058	0.031	0.022	0.051	0.088	0.051	0.046	0.077	0.116	0.055	0.062
Suspended solids (mg/l)	15	59	5	k4.0	39	6	11	44	42	24	24A
Total dissolved solids (mg/l)		440	460	440	420	340	260	300	320	280	360
Nitrite (mg NO <sub>2</sub> /l)		0.005	0.006	0.006	0.003	0.007	0.002	0.013	0.016	0.007	0.011
Nitrate + nitrite (mg N/l)		1.23HT	0.42HT	0.26HT	0.002HT	0.23	0.014	0.126	0.36	0.15	0.24
Ammonia (mg N/l)	0.042	0.02HT	0.21HT	0.036HT	0.016HT	0.024	0.065	0.101	0.138	0.037	0.053
Kjeldahl nitrogen (mg N/l)		0.37	0.38	0.59	1.15	0.41	0.7	0.75	0.92	0.66	0.8
Silver (ug/l)	k0.5							k0.5	k0.5		
Alkalinity (mg CaCO <sub>3</sub> /l)	222							238	261		
Carbonate alkalinity (mg CaCO <sub>3</sub> /l)								k5.0	k5.0		
Bicarbonate alkalinity (mg CaCO <sub>3</sub> /l)								238	261		
Arsenic (ug/l)	1.2							8.9	8.2		
Barium (ug/l)								76	87		
Calcium (ug/l)	65							57	55.7		
Cadmium (ug/l)	k0.2							k0.2	k0.2		
Chloride (mg/l)	41							29	29		
Hex chromium (ug/l)								k5.0	k5.0		
Chromium (ug/l)	k1.0							k1.0	1.3		
Copper (ug/l)	1.4							k1.0	1.1		
Hardness (mg/l)	246							255	245		
Mercury (mg/l)	k0.2							k0.2	k0.2		
Magnesium (mg/l)	20							27.4	25.1		
Nickel (ug/l)	k2.0										
Lead (ug/l)	k1.0							1.1	1.1		
Selenium (ug/l)	k1.0							k1.0	k1.0		
Sulfate (mg/l)								14	16		
Zinc (ug/l)	10							6	7		
COD (mg/l)											
TOC (mg/l)											
BOD 5 day carb (mg/l)											
BOD 5 day total (mg/l)											

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Appendix 1.–Continued.

	S. Branch Flint Oakwood Rd.	S. Branch Flint Wilder Rd.	S. Branch Flint Greenwood Rd	S. Branch Flint Mayfield Rd.	S. Branch Flint Norway Lk. Rd.	Cedar Creek Willis Rd.	Cedar Creek Cedar Ck. Rd.	North Branch Jefferson Rd.	Bottom Creek Jefferson Rd.	Bottom Creek Gravel Ck. Rd.	N. Branch Flint M 90
Ortho phosphate (mg P/l)	0.002HT	0.02	0.014	0.072	0.035	0.038HT	0.008HT		0.004HT	0.005HT	0.006HT
Total phosphorus (mg P/l)	0.017	0.04	0.041	0.153	0.091	0.072	0.051	0.06	0.015	0.013	0.048
Suspended solids (mg/l)	k4.0	4	6	50	34	k4.0	9		5	k4.0	19
Total dissolved solids (mg/l)	450	420	440	360	340	310	360		410	470	460
Nitrite (mg NO <sub>2</sub> /l)	0.002	0.004	0.004	0.01	0.005	0.012HT	0.003HT		0.004HT	0.005HT	0.006HT
Ammonia (mg N/l)	0.072HT	0.175HT	0.23HT	0.43	0.33	0.13HT	0.021	0.24	0.44HT	0.9HT	0.163
Nitrate + nitrite (mg N/l)	0.013	0.017HT	0.028HT	0.044	0.042	0.059HT	0.017HT	0.084	0.019HT	0.011HT	0.053
Kjeldahl nitrogen (mg N/l)	0.28	0.37	0.43	0.69	0.62	0.55	0.61	0.78	0.2	0.17	0.48
Silver (ug/l)				k0.5							
Alkalinity (mg CaCO <sub>3</sub> /l)				228							
Carbonate alkalinity (mg CaCO <sub>3</sub> /l)				k5.0							
Bicarbonate alkalinity (mg CaCO <sub>3</sub> /l)				228							
Arsenic (ug/l)				6							
Barium (ug/l)				79							
Calcium (ug/l)				66.5							
Cadmium (ug/l)				k0.2							
Chloride (mg/l)				44							
Hex chromium (ug/l)				k5.0							
Chromium (ug/l)				1							
Copper (ug/l)				1.5							
Hardness (mg/l)				290							
Mercury (mg/l)				k0.2							
Magnesium (mg/l)				30							
Nickel (ug/l)											
Lead (ug/l)				1.9							
Selenium (ug/l)				k1.0							
Sulfate (mg/l)				39							
Zinc (ug/l)				12							
COD (mg/l)								18			
TOC (mg/l)								8.0			
BOD 5 day carb (mg/l)											
BOD 5 day total (mg/l)											

Appendix 1.–Continued.

	Crystal Creek Barnes Lk. Rd.	N. Branch Flint Castle Rd.	Henry Drain Mt. Morris Rd.	Hasler Creek Lippincott Rd.	Flint River M 15	Powers-Cullen Drn. Carpenter Rd.	Butternut Creek Irish Rd.	Butternut Creek Vassar Rd.	Kearsley Creek Kipp Rd.	Kearsley Creek Atherton Rd.	Gilkey Creek East Court St.
Ortho phosphate	0.038HT	0.029HT	0.002HT	0.031HT	0.005HT	0.005HT	0.034HT		0.013 HT	0.009 HT	0.028HT
Total phosphorus (mg P/l)	0.1	0.09	0.092	0.089	0.075	0.033	0.135	0.08	0.029	0.034	0.09
Suspended solids (mg/l)	13	27	42	47	9	6	48		k4.0	10	11
Total dissolved solids (mg/l)	410	490	440	460	340	480	280		470	380	184
Nitrite (mg NO <sub>2</sub> /l)	0.003HT	0.009HT	0.016HT	0.016HT	0.006HT	0.01	0.025HT		0.004HT	0.002HT	0.043HT
Nitrate + nitrite (mg N/l)	0.008HT	0.23	2.6	0.125	0.043	0.28	0.39	1.4	0.30HT	0.019HT	0.83
Ammonia (mg N/l)	0.104	0.05	0.019	0.088	0.07	0.025	0.091	0.07	0.012HT	0.018 HT	0.07
Kjeldahl nitrogen (mg N/l)	0.72	0.52	1.03	0.82	0.88	0.5	1.01	0.67	0.39	0.53	0.67
Silver (ug/l)											
Alkalinity(mg CaCO <sub>3</sub> /l)											
Carbonate alkalinity (mg CaCO <sub>3</sub> /l)											
Bicarbonate alkalinity (mg CaCO <sub>3</sub> /l)											
Arsenic (ug/l)											
Barium (ug/l)											
Calcium (ug/l)											
Cadmium (ug/l)											
Chloride (mg/l)											
Hex chromium (ug/l)											
Chromium (ug/l)											
Copper (ug/l)											
Hardness (mg/l)											
Mercury (mg/l)											
Magnesium (mg/l)											
Nickel (ug/l)											
Lead (ug/l)											
Selenium (ug/l)											
Sulfate (mg/l)											
Zinc (ug/l)											
COD (mg/l)								18			
TOC (mg/l)								6.8			
BOD 5 day carb (mg/l)											
BOD 5 day total (mg/l)											



Appendix 1.–Continued.

	Thread Creek Baldwin Rd.	Thread Creek Bristol Rd.	Swartz Creek Cook Rd.	Swartz Creek Fenton Rd.	Swartz Creek Grand Blanc Rd.	Swartz Creek Miller Rd. & US 23	Flint River Mill Rd.	Mud Creek Potter Rd.	Flint River Flushing/Linden Rd.	Flint river Riverview park	Flint River Mt. Morris Rd.
Ortho phosphate	0.012	0.016	0.01	0.01	0.015	0.019	0.008	0.024	0.1	0.04	
Total phosphorus (mg P/l)	0.031HT	0.041HT	0.045HT	0.039HT	0.052HT	0.082HT	0.113HT	0.048HT		0.23HT	0.01
Suspended solids (mg/l)	4	4	5	16	19	36	37	12	11	60	
Total dissolved solids (mg/l)	370	480	340	330	320	390	380	380	420	400	
Nitrite (mg NO <sub>2</sub> /l)	0.003	0.004	0.002	0.004	0.01	0.014	0.003	0.007	0.02	0.006	
Nitrate + nitrite (mg N/l)	0.052HT	0.094HT	0.009HT	0.017HT	0.099HT	0.2HT	0.005 HT	0.36 HT		0.9HT	1.6
Ammonia (mg N/l)	0.018HT	0.027HT	0.6HT	0.022HT	0.041HT	0.088HT	0.013HT	0.019HT		0.019HT	0.03
Kjeldahl nitrogen (mg N/l)	0.51HT	0.64HT	0.9HT	0.7HT	0.79HT	0.88HT	1.06HT	0.58HT		1.39HT	0.15
Silver (ug/l)			k0.5	k0.5	k0.5						
Alkalinity(mg CaCO <sub>3</sub> /l)			276	186	169						
Carbonate alkalinity (mg CaCO <sub>3</sub> /l)			k5.0	k5.0	k5.0						
Bicarbonate alkalinity (mg CaCO <sub>3</sub> /l)			276	186	169						
Arsenic (ug/l)			14.1	3	3.1						
Barium (ug/l)			215	51	62						
Calcium (ug/l)			49.7	48.9	44.4						
Cadmium (ug/l)			k0.2	k0.2	k0.2						
Chloride (mg/l)			41	43	49						
Hex chromium (ug/l)			k5.0	k5.0	k5.0						
Chromium (ug/l)			k1.0	k1.0	k1.0						
Copper (ug/l)			k1.0	k1.0	1.3						
Hardness (mg/l)			245	215	195						
Mercury (mg/l)			k0.2	k0.2	k0.2						
Magnesium (mg/l)			29.2	23.2	20.4						
Nickel (ug/l)											
Lead (ug/l)			k1.0	1.3	1.2						
Selenium (ug/l)			k1.0	k1.0	k1.0						
Sulfate (mg/l)			INT	6	11						
Zinc (ug/l)			k4.0	k4.0	k4.0						
COD (mg/l)											<5
TOC (mg/l)											2
BOD 5 day carb (mg/l)									2		
BOD 5 day total (mg/l)									3		

Appendix 1.–Continued.

	Flint River Vienna Rd.	Flint River Ragnone WWTP Outfall	Flint River E. Burt Rd.	Brent Run Creek Stanley Rd.	Brent Run Creek Webster Rd.	Flint River Moorseville Rd.	Pine Run Creek Webster Rd.	Runnels Drain Dixie Highway	Silver Creek Moorish Rd.	Flint River Sheridan Rd.	Mistguay Creek Johnstone Rd.
Ortho phosphate	0.064	0.23	0.04	0.077	0.04	0.077	0.041	0.019	0.071	0.094	0.023
Total phosphorus (mg P/l)	0.179HT	0.53DLHT	0.15	0.114	0.069	0.138HT	0.07	0.088	0.124	0.17HT	0.061HT
Suspended solids (mg/l)	22	7	25	k4.0	6	13	10	27	7	14	11
Total dissolved solids (mg/l)	380	760	460	320	380	440	380	1830HT	410	480	440
Nitrite (mg NO <sub>2</sub> /l)	0.012	0.16	0.02	0.007	0.023	0.015	0.022	0.007	0.022	0.027	0.002
Nitrate + nitrite (mg N/l)	1.76HT	15.0HT	1.6	0.032HT	0.47HT	2.5HT	0.31HT	0.013HT	0.34HT	3.2HT	0.017HT
Ammonia (mg N/l)	0.021HT	0.4HT	0.04	0.046HT	0.072HT	0.022HT	0.113HT	0.074HT	0.091HT	0.02HT	0.017HT
Kjeldahl nitrogen (mg N/l)	1.15HT	2.3HT	1.3	0.53	0.45	0.95HT	0.45	1.45	0.95	1.19HT	0.83HT
Silver (ug/l)	k0.5	k0.5				k0.5		k0.5	k0.5	k0.5	
Alkalinity (mg CaCO <sub>3</sub> /l)	158	174				161		168	115	179	
Carbonate alkalinity (mg CaCO <sub>3</sub> /l)	40	k5.0				k5.0		k5.0	k5.0	28	
Bicarbonate alkalinity (mg CaCO <sub>3</sub> /l)	118	174				161		168	115	179	
Arsenic (ug/l)	4.2	3				3.9		2.3	2.5	4	
Barium (ug/l)	50	27				44		140	38	47	
Calcium (ug/l)	48.2	56.8				47		261	38.9	51.7	
Cadmium (ug/l)	k0.2	k0.2				k0.2		k0.2	k0.2	k0.2	
Chloride (mg/l)	58	206				80		280	113	79	
Hex chromium (ug/l)	k5.0	k5.0				k5.0		k5.0	k5.0	k5.0	
Chromium (ug/l)	k1.0	k1.0				k1.0		k1.0	k1.0	k1.0	
Copper (ug/l)	1.7	2				1.4		2.5	1.8	1.5	
Hardness (mg/l)	215	225				205		885	139	230	
Mercury (mg/l)	k0.2	k0.2				k0.2		k0.2	k0.2	k0.2	
Magnesium (mg/l)	22.7	19.9				21.3		57	10.1	24.1	
Nickel (ug/l)								2.2	2		
Lead (ug/l)	2.2	k1.0				k1.0		1	k1.0	2.1	
Selenium (ug/l)	k1.0	k1.0				k1.0		k1.0	k1.0	k1.0	
Sulfate (mg/l)	24	41				32		635	38	32	
Zinc (ug/l)	10	15				50		k4.0	k4.0	50	
COD (mg/l)			28								
TOC (mg/l)			8.9								
BOD 5 day carb (mg/l)			2								
BOD 5 day total (mg/l)			3								



Appendix 2.

Sediment Sampling Data

Sediment sampling from the Flint River and select tributaries. Blanks indicate no data measurement. Data from Alexander (1997), M. Walterhouse (unpublished), and MDEQ (1999). Data codes: nd = not detected, k = actual value less than value given, if present is below detection limit.



Appendix 2.

	SMNITP Ecoregion Mean value	Farmers Creek Merwin Rd.	Farmers Creek Lippincott Rd.	South Branch Mayfield Road	North Branch Castle Rd.	Flint River MI 5	Swartz Creek Cook Rd.	Swartz Creek Grand Blanc Rd.	Swartz Creek Fenton Rd.	Flint River Mill Rd.	Flint River Linden Rd.	Flint River Riverview Park	Flint River Mt. Morris Rd	Flint River Burt Rd.	Silver Creek Moorish Rd.	Runnels Drain Dixie Highway
Silver mg/kg (dry)	0.14	k0.25	k0.25	k0.25		k0.25	k0.25	0.3	k0.25	k0.25		0.4			k0.25	k0.25
Aluminum mg/kg (dry)	2600	3460	2530	2430		2900	4800	10800	7350	1700		2290			3560	6900
Arsenic mg/kg (dry)	5.5	12	8.4	4.9	27	20	42	13	13	2.9	4.2	4.2	7.8	6	3.6	6
Barium mg/kg (dry)	40	28	24	20		59	119	91	65	22		29			37	82
Beryllium mg/kg (dry)	0.14	k0.20	k0.20	k0.20		k0.20	0.26	0.57	0.39	k0.20		k0.20			0.2	0.4
Calcium mg/kg (dry)	34000	11400	10900	14500		17500	135000	3110	26700	15300		17500			11900	37100
Cadmium mg/kg (dry)	1.05	k2.0	k2.0	k2.0	<2	k2.0	k2.0	k2.0	k2.0		<2	k2.0	<2	<2	k2.0	k2.0
Cobalt mg/kg (dry)	3.9	5	k5.0	k5.0		k5.0	11	12	8.5	k5.0		k5.0			5.5	9
Chromium mg/kg (dry)	6.7	7	5	6	15	6	9	18	14	8	11	11	26	16	7	13
Copper mg/kg (dry)	5.7	5.5	4	5	15	4.5	13	21	14	9.5	14	11	27	20	8	18
Iron mg/kg (dry)	8100	8700	7330	6350		8000	17500	21300	15400	4700		6750			8650	15700
Mercury mg/kg (dry)	nd	k0.1	k0.1	k0.05	<0.1	k0.05	k0.05	k0.20	k0.15	k0.05	<0.1	k0.05	<0.1	<0.1	k0.05	k0.1
Potassium mg/kg (dry)	280	390	240	310		350	915	1590	1050	181		310			450	865
Lithium mg/kg (dry)	3.3	5.5	3.5	3.5		4.5	8.5	17	13	3		4			6	11
Magnesium mg/kg (dry)	6300	5350	3600	6050		4600	13100	14900	10100	4700		5250			5150	10900
Manganese mg/kg (dry)	370	170	180	190		955	380	705	605	110		220			280	505
Molybdenum mg/kg (dry)	nd	k5.0	k5.0	k5.0		k5.0	k5.0	k5.0	k5.0	k5.0		k5.0			k5.0	k5.0
Sodium mg/kg (dry)	110	130	90	90		110	170	190	170	150		130			140	280
Nickel mg/kg (dry)	5.4	7.5	6.4	6.5	16	8	21	23	17	7.5	7.9	11	15	10	10	19
Lead mg/kg (dry)	11	10	8.4	13	7.8	11	27	27	19	29	37	26	59	52	17	29
Selenium mg/kg (dry)	0.31	k0.5	k0.5	k0.5	<0.5	k0.5	k0.5	k0.5	k0.5	k0.5	<0.5	k0.5	<0.5	<0.5	k0.5	0.73
Strontium mg/kg (dry)	35	19	13	15		20	112	44	54	19		24			37	82
Titanium mg/kg (dry)	80	123	71	119		78	64	94	73	104		83			50	62
Thallium mg/kg (dry)	nd	k1.0	k1.0	k1.0		k1.0	k1.0	k1.0	k1.0	k1.0		k1.0			k1.0	k1.0
Total solids, inorganic % TS	50.4	47.0	47.7	68.5	30	61.2	54.3	23.8	30.8	69.2	58	66.9	43	59	54	42.3
Vanadium mg/kg (dry)	7.7	9	7	8		10	14	73	17	6		8			11	18
Zinc mg/kg (dry)	34	24	20	27	69	31	45	95	75	57	62	82.5	150	99	45	82.5