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U. S. Army Corps of Engineers

St. Louis Riverfront - Meramec River Ecosystem Restoration Feasibility Study with Integrated Environmental Assessment

Draft - 2018

Appendix F

Water Quality

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1. IMPAIRED WATER

TOTAL MAXIMUM DAILY LOADS (TMDL) FOR BIG RIVER AND FLAT RIVER CREEK (JEFFERSON, ST. FRANCOIS AND WASHINGTON COUNTIES), 2008-2010

USEPA's 303(d) Program assists states, territories and authorized tribes in submitting lists of impaired waters and developing total maximum daily loads (TMDLs). A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point for restoring water quality.

Figure 1-1 shows impaired waters within the study area (areas highlighted in yellow). Designation as an impaired water indicates that the waterway does not meet the water quality standards established by the State for protection of aquatic life.

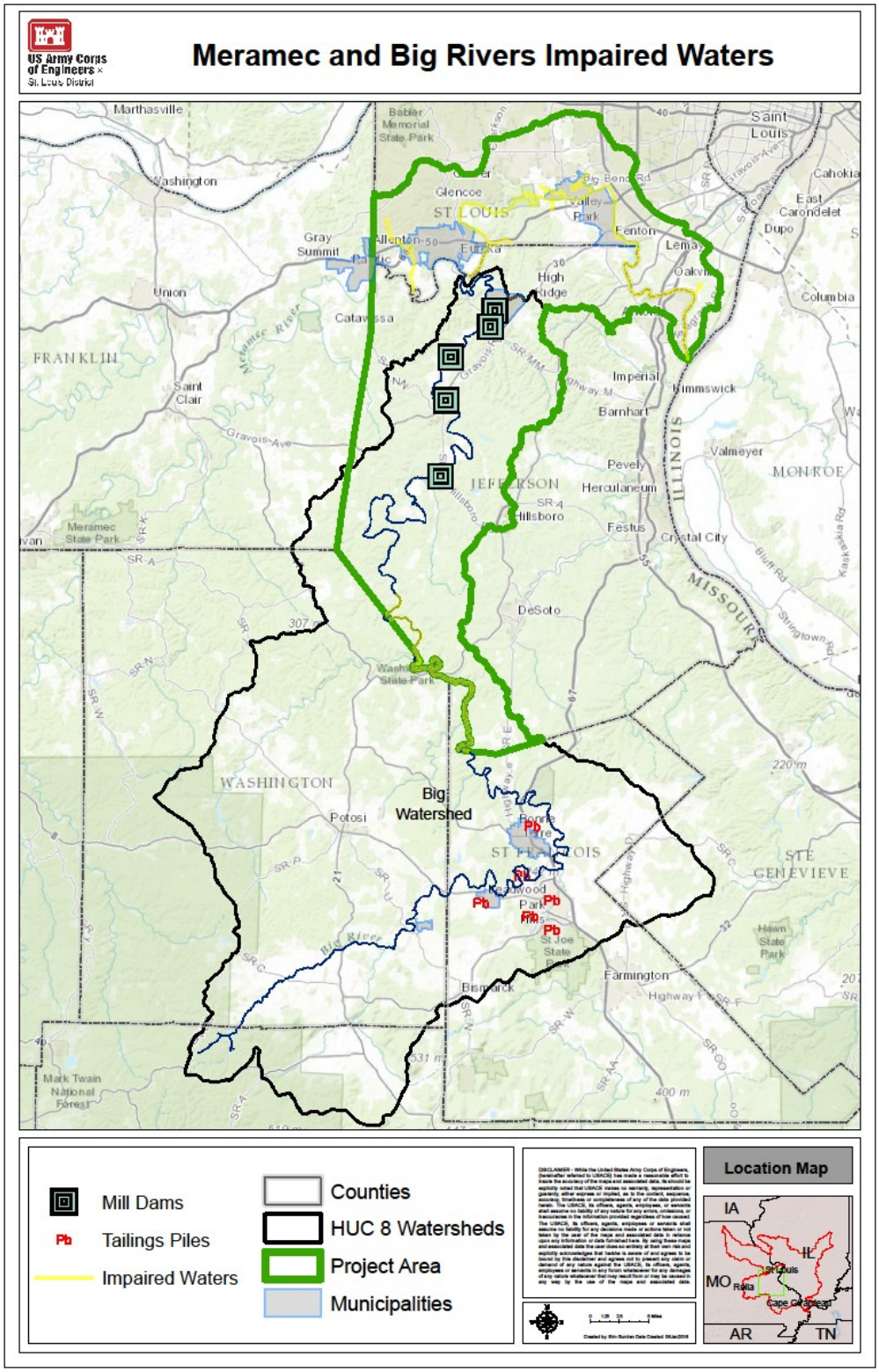

Figure 1-1. Impaired Water for Big River and Meramec River (EPA)

The TMDL for Big River, Flat River Creek and Shaw Branch was approved by the USEPA on March 24, 2010. Shaw Branch is a tributary to Flat River Creek, which is a tributary to Big River. The impaired portions of Big River, Flat River Creek and Shaw Branch are located in the "Old Lead Belt" region of southeast Missouri. Pollutants currently identified in the TMDL are lead and nonvolatile suspended solids. In addition, zinc is an identified pollutant for only Flat River Creek. The water quality targets for metals are based on chronic criteria and thus aquatic life protected from acute and chronic toxicity. Current lead and zinc standards are expressed in dissolved form; those numbers are 5 µg/L for lead and 193 µg/L for zinc. Missouri has no numeric standard for nonvolatile suspended solids. Excessive deposits of sediment, in particular nonvolatile suspended solids, in waters of the State are interpreted as violations of the general criteria of the Water Quality Standards. Nonvolatile suspended solids data is not available; therefore, total suspended solids (TSS) was used as a surrogate with a calculated target of 5 mg/L. This target represents suspended clean sediment free of pollutants including metals. Big River and Meramec River are identified as impaired waters and are discussed in the draft MDNR 2018 TMDL Prioritization and Development Schedule. TMDL for cadmium and zinc located in sediment for the Big River, and lead and E. coli for the Meramec River is currently scheduled for 2023.

2. WATER QUALITY STANDARDS

SPECIFIC CRITERIA

LEAD AND ZINC

The Code of State Regulations of Missouri, title 10 CSR 20-7.031 Water Quality Standards (WQS) purpose is to identify the uses of waters of the State, criteria to protect those uses and defines the anti-degradation policy. It is developed in response to the Missouri Clean Water Law and the federal Clean Water Act, Section 303(c) (1) and (2) which requires that state water quality standards be reviewed at least once every three (3) years. These revisions are pursuant to the national goal of protection of fish, shellfish and wildlife and recreation in and on the water as outlined in Section 101(a) (2) of the Act. Table 2-1 shows the current lead and zinc WQS for the protection of aquatic life use in dissolved form for Missouri.

Table 2-1. Dissolved Lead and Zinc WQS for the Protection of Aquatic Life Use

Metals	Concentration (µg/L)	Hardness
Lead	5	136
Zinc	193	211

NON-VOLATILE SUSPENDED SOLIDS (NVSS)

Missouri has no numeric sediment for NVSS. Excessive deposits of sediment in water of Missouri are interpreted as violations of the general criteria of the WQS. The general criteria states that:

- Waters shall be free from substances in sufficient amount to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
- Water shall be free from substances in sufficient amounts to cause unsightly color, turbidity, offensive odor or prevent full maintenance of beneficial uses.
- Water shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

BIG RIVER WATERSHED TREND ANALYSIS

The findings below reflect the trend analysis from the following reports:

- Water Quality Sampling Big River, Jefferson County (2014-2015)
- Assessment of Metal-Contaminated Sediments from the Southeast Missouri (SEMO) Mining District using Sediment Toxicity Tests with Amphipods and Freshwater Mussels, (USGS), 2009
- Big River (Lower) Irondale to Washington State Park (MoDNR), 2002-2003

WATER QUALITY SAMPLING, BIG RIVER (JEFFERSON COUNTY)

Water quality samples acquired on the Big River from 2014 and 2015 within Jefferson County, Missouri. Table 2-2. summarizes the water quality parameters measured.

Table 2-2. Measured Parameters in the Big River, Jefferson County - 2014-2015

Parameters	Mean	Units
Conductivity	314	umhos/cm
Hardness as CaCO3	204	mg/L
Oxidation-Reduction Potential	127	mV
pH	8	SU
Temperature	16	Deg C
Dissolved Oxygen	8	mg/L

ASSESSMENT OF METAL-CONTAMINATED SEDIMENTS FROM THE SOUTHEAST MISSOURI (SEMO) MINING DISTRICT USING SEDIMENT TOXICITY TESTS WITH AMPHIPODS AND FRESHWATER MUSSELS, 2009

The USGS assessed sediment and water quality in the following locations of the Big River:

- 15 sites downstream of the St. Francois County mining area
- One site in Mineral Fork (a Big River tributary that drains the Washington County mining area)
- Two sites in the Meramec River (upstream and downstream of the mouth of the Big River)
- One site in the Bourbeuse River (unaffected by mining activity)

Pore waters extracted from bulk sediment samples by centrifugation were filtered and analyzed for dissolved metals, nickel(Ni), copper(Cu), zinc(Zn), cadmium(Cd), and lead(Pb), by semi-quantitative inductively-coupled plasma-mass spectrometry and routine water quality parameters (Table 2-3).

Table 2-3. USGS SEMO Sample Location Sites

Site ID	Site Description	Date Sampled	River Mile
SEMO-1	Big River above Irondale	9-Sep-08	129
SEMO-2	Big River at MDC Leadwood access	9-Sep-08	113
SEMO-3	Big River at Hwy 67	9-Sep-08	103
SEMO-4	Big River at Hwy K	9-Sep-08	97
SEMO-5	Big River at Cherokee Landing	9-Sep-08	90
SEMO-6	Big River at Hwy EE	9-Sep-08	88
SEMO-7	Big River at Hwy CC	9-Sep-08	76
SEMO-8	Mineral Fork Creek near mouth	10-Sep-08	--
SEMO-9	Big River at Mammoth MDC Access	9-Sep-08	63
SEMO-10	Big River at Brown's Ford MDC Access	9-Sep-08	51
SEMO-11	Big River above Cedar Hill Dam	9-Sep-08	21
SEMO-12	Big River below Cedar Hill Dam	9-Sep-08	20
SEMO-13	Big River above Rockford Beach dam	10-Sep-08	11
SEMO-14	Big River below Rockford Beach dam	10-Sep-08	10
SEMO-15	Big River at Byrne's Mill Dam	10-Sep-08	8.2
SEMO-17	Big River at Hwy W	10-Sep-08	1.3

Site ID	Site Description	Date Sampled	River Mile
SEMO-18	Big River above confluence w/	10-Sep-08	0.3
SEMO-19	Meramec River upstream; Pacific	10-Sep-08	--
SEMO-20	Meramec River downstream; Route 66	10-Sep-08	--
SEMO-21	Bourbeuse River near Choteau access	11-Sep-08	--

Table 2-4. Water Quality of Centrifuged and Filtered Pore Waters from SEMO Sediments

Site ID	pH	Conductivity	Hardness	Alkalinity	Ammonia	Dissolved Organic Compound
		(µS/cm)	(as CaCO3)		(mg N/L)	
FL (Control)	6.23	2340	200	68	1.7	115
SEMO-1	7.53	319	180	156	0.3	7.1
SEMO-2	7.9	390	230	184	0.33	6.3
SEMO-3	7.76	468	300	268	1.16	20.8
SEMO-4	7.9	474	288	208	ND	9.2
SEMO-5	7.82	522	300	270	0.9	11.5
SEMO-6	7.41	556	320	324	0.5	21.6
SEMO-7	7.51	534	320	300	0.9	16.1
SEMO-8	7.68	410	250	230	0.46	5.4
SEMO-9	7.63	527	322	302	1.22	14.3
SEMO-10	7.71	421	260	222	0.41	16.2
SEMO-11	7.79	474	284	270	0.68	24
SEMO-12	7.88	574	350	340	0.39	20.1
SEMO-13	7.74	558	330	320	1.62	22.2
SEMO-14	7.75	542	300	290	0.66	18.2
SEMO-15	7.93	408	230	200	0.46	12
SEMO-17	7.77	384	250	202	0.35	7.6
SEMO-18	7.93	633	390	370	ND	26.5
SEMO-19	7.73	446	280	260	0.55	21.4
SEMO-20	8.02	443	ND	ND	0.39	15.2
SEMO-21	7.46	348	224	190	0.54	18.9

Site ID	pH	Conductivity	Hardness	Alkalinity	Ammonia	Dissolved Organic Compound
		(µS/cm)	(as CaCO3)		(mg N/L)	
SEMO-22	7.95	347	226	183	0.26	7.9
SEMO-23	7.71	381	240	200	0.3	4.8

Table 2-5. Metal Concentrations (µg/L) in Pore Waters of SEMO Sediments Prepared by Centrifuged and Filtered Samples

Site ID	Ni	Cu	Zn	Cd	Pb
FL Control	4	9	20	<0.1	1
SEMO-1	3	<1	<1	<0.1	1
SEMO-2	3	<1	20	0.1	20
SEMO-3	10	2	100	1	100
SEMO-4	10	4	60	0.5	60
SEMO-5	8	2	20	0.2	50
SEMO-6	9	<1	8	<0.1	20
SEMO-7	4	<1	5	<0.1	20
SEMO-8	2	<1	9.5	<0.1	5
SEMO-9	6	6	20	0.2	100
SEMO-10	6	10	30	0.6	100
SEMO-11	5	10	60	1	400
SEMO-12	7	9	40	0.8	300
SEMO-13	8	8	40	0.8	300
SEMO-14	9	9	20	0.5	100
SEMO-15	4	10	30	1	200
SEMO-17	4	2	10	0.1	70
SEMO-18	10	10	40	1	300
SEMO-19	7	10	20	0.3	30
SEMO-20	6	3	9	0.1	30
SEMO-21	7	8	10	0.1	20

SUMMARY OF RESULTS

Table 2-4 (shown above) displays the outputs from the routine water quality parameters collected in the pore water samples. Table 2-5 (shown above) displays the metal concentrations found in the collected in the pore water samples. Lead was above the USEPA regional screening level in almost all samples.

BIG RIVER (LOWER) IRONDALE TO WASHINGTON STATE PARK (MDNR), 2002-2003

Water quality samples were collected upstream of the USACE study area. These samples were used to identify dissolved metals and nutrients from nine Big River and two Courtois Creek stations. From September to October of 2002, dissolved barium, lead and zinc were found. Dissolved barium was more than two-fold higher downstream at Courtois Creek as was found at all stations upstream. Dissolved lead was below detectable levels at the controls and at Leadwood but increased more than three-fold downstream at Desloge. Dissolved zinc increased at Leadwood and quadrupled at Desloge before declining. Zinc declined to less than detectable levels by just upstream of Washington State Park. In April 2003, samples of dissolved barium, lead and zinc were found in water quality samples. Dissolved barium was high in Courtois Creek and downstream of Washington State Park. Between Irondale to upstream of Mill Creek concentration levels of barium were low and stable. Dissolved lead increased downstream from the Flat River confluence and was its highest concentration downstream of Washington State Park. Dissolved zinc increased downstream of Leadwood and reached a high downstream of Bonne Terre, St. Francois County, Missouri.

Although there were substantial increases in dissolved barium, lead and zinc from the controls to test stations, water quality samples for dissolved metals concentrations from 2002 and 2003 did not exceed WQS.

MERAMEC WATERSHED TREND ANALYSIS

The finding below summarizes the following reports:

- Meramec River Watershed Demonstration Project, (EPA), 1998

MERAMEC RIVER WATERSHED DEMONSTRATION PROJECT, 1998

According to MDNR Water Quality Standards, all streams within the basin are designated for aquatic life protection, fishing, and livestock and wildlife watering. From the mouth of Big River to Meramec State Park, residents use the Meramec River for drinking water supply and industrial uses. Drinking water is considered adequate. Current threats to beneficial uses are:

- Excessive discharge from sewage treatment plants,
- Cattle in streams, and
- Dioxin and chlordane

3. CONCLUSIONS

Based on the data reviewed and information gathered, the Big River is affected by the historical mining activities and erosion of tailing piles, as it poses a potential threat to stream water quality as it flows downstream to the Meramec River. Cattle grazing, urbanization, land disturbance and runoff, in general, affect the Meramec River.

Best management practices will be employed during construction at the Authorized Study Area to avoid the suspension of sediment and the release of any contamination into the water column.

- An erosion control plan will be created and implemented to control the entry of sediments into the Big River and/or tributaries and their migration downstream of the work area.
- Construction will occur during low water level to avoid the introduction of sediment into the water column.