VI. POLLUTANT LOADINGS

A. INTRODUCTION

Pollutant loadings from point and nonpoint sources of pollution to the St. Louis River AOC are discussed in this chapter. Most of the information used to calculate pollutant loadings was taken from discharge monitoring reports for point source dischargers in Minnesota and Wisconsin. No estimate of nonpoint loadings were done at this time due to the limited data available and the variety of sources. Nonpoint sources of pollution include runoff from urban areas, construction sites, industrial sites, and agricultural land. The point sources of pollution can be traced to a pipe or outfall from a municipal or industrial facility.

1. Point Sources

There are four major discharges to the St. Louis River AOC of which two are municipal sewage treatment plants and two are industrial facilities. The discharges from these facilities are described in Table VI.1. Loadings are broken down by Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Phosphorous. Average monthly discharge flows are given in million gallons per day (mgd). The tables are based on discharge monitoring reports from 1989 and 1990. These reports list the average monthly discharge loadings and flows that are monitored periodically by each facility.

Total pollutant loadings for conventional pollutants from all point sources are described in Table VI.2. This includes all permitted facilities that monitor for conventional pollutants. Loadings were calculated from monthly averages so the actual loadings could vary significantly in a given period from estimates given in the report. Four of these facilities do not have a continuous discharge throughout the year so the loadings listed are estimated based on the months they actually discharged. Facilities that discharge noncontact cooling water only have not been included in this report.

Pollutant loadings for toxic parameters have been estimated for those parameters where there are sufficient data (Table VI.3). Loadings estimates from point sources were not made for parameters with only one or two samples. Priority pollutant scans for permit reissuance were a major source of these data. In many cases however, there have been only one or two recent tests for a toxic parameter. Past discharge monitoring for heavy metals and most organics has not been done on a continuous basis, consequently an accurate estimate cannot be made at this time for many parameters. The process of permit reissuance is underway for Murphy Oil USA, The City of Superior, and Superior Fiber Products, the three major dischargers on the Wisconsin side of the AOC. These permits will require monitoring for and will limit discharge of many parameters, including bioaccumulating substances.

Mercury is known to be a concern in the discharge from the Western Lake Superior Sanitary District. Elevated concentrations have been found in the water and sediments of the St. Louis River near the discharge from the WLSSD. This discharge is due to mercury removal from the incinerator stack by a wet scrubbing process. The discharge permit for WLSSD was reissued in August 1990 and will require continuous monitoring for a range of toxic parameters.

The WLSSD Regional plant in Duluth was constructed in the late 1970's to treat waste from virtually all the industrial and municipal discharges in the area. Since that time dramatic improvements have occurred in general water quality as a result of BOD and Phosphorus reductions to the river. Concentrations of toxics in the sediments and water column are still at levels of concern leading to fish consumption advisories and the biological effects.

2. Nonpoint Sources

The St. Louis River AOC receives nonpoint pollution from a variety of sources due to the many types of land uses in the watershed. The most obvious source is the red clay erosion from tributaries such as the Nemadji River, Pokegama, Little Pokegama, and Red Rivers. These rivers contribute a seasonally heavy load of sediments to the St. Louis River and Superior Bay causing turbidity and sedimentation. The Red Clay project study conducted in the 1970's found that a large amount of erosion was due to naturally occurring bank slumpage. However, land use practices in the watersheds can contribute significantly to erosion. In addition to sediment input it was found that nutrients can attach to sediment particles causing excess nutrient loading.

The heavy concentration of industries located adjacent to the River and Bay on both the Wisconsin and Minnesota side contribute a variety of pollutants through storm water runoff. This type of runoff typically contains heavy metals, volatile organic chemicals (VOCs), oil, grease and a variety of organic and inorganic contaminants. Research has shown that shock loadings from stormwater events can have a greater effect than point source discharges. Storm sewers from Duluth and Superior discharge to the St. Louis River contributing the types of contaminants previously mentioned. Pollutant loadings from the Superior combined overflow #2 are described in Table VI.1. This indicates the significance of stormwater runoff in the area.

Table VI.1 Monthly Average Loadings for 1989-1990 from Facilities Discharging to the St. Louis River AOC

Western Lake Superior Sanitary District Effluent - 1989-90 - Average

Month	Flow (mgd)		*BOD_5(lbs/day)		TSS (lbs/day)		Total Phosphorus (lbs/day)	
	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.
January	29.61	33.57	1053	1251	2475	3077	183	380
February	29.64	32.93	1155	1444	2100	2792	178	305
March	35.09	72.49	1406	2820	1906	3915	158	462
April	42.17	77.33	2011	4263	3789	8699	159	717
May	38.24	61.47	1490	2380	2141	5427	164	1343
June	36.12	42.15	1554	2116	2850	4669	193	366
July	32.54	40.61	1501	1974	4702	6954	201	551
August	36.82	76.68	1985	3524	6289	11827	262	889
September	42.37	94.27	1523	3299	6067	20,253	242	1480
October	38.00	55.16	1261	2759	1878	4254	203	390
November	32.99	37.03	996	1317	1514	2606	1397	341
December	30.76	33.12	1009	1239	1187	1665	190	282
Ave.	35.36	54.70	1412	2353	3075	6345	294	626

*Reported as Carbonaceous BOD

Table VI.1 cont. Monthly Average Loadings for 1989-1990 from Facilities Discharging to the St. Louis River AOC

City of Superior Effluent - 1989-1990 - Average

Month	Flow (mgd)		BOD_5(lbs/day)		TSS (lbs/day)		Total Phosphorus (lbs/day)	
	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.
January	3.49	4.20	426	1081	303	791	16	39
February	3.63	4.46	498	1066	256	647	15	42
March	3.96	5.43	629	1399	349	1205	16	38
April	4.03	5.48	525	1481	326	1193	11	40
May	4.12	5.02	658	1466	378	1621	13	44
June	3.58	5.10	669	1504	251	1594	9	40
July	3.61	4.88	695	1820	291	1253	12	37
August	3.74	4.99	478	1230	203	864	10	29
September	4.40	5.23	418	1001	272	618	12	32
October	3.77	4.83	388	1323	226	749	9	31
November	3.45	4.43	549	1394	202	684	9	22
December	2.51	3.21	440	930	134	301	9	26
Ave.	3.68	4.77	531	1308	266	960	12	35

Table VI.1 cont. Monthly Average Loadings for 1989-1990 from Facilities Discharging to the St. Louis River AOC

City of Superior Effluent - Combined Sewer Overflow #2 - 1989-90 - Average

Month	Flow (mgd)		BOD_5(lbs/day)		TSS (lbs/day)		Total Phosphorus (lbs/day)	
	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.
January	4.60		544		822		22	
February	ND	--	--	--	--	--	--	--
March	12.02	18.28	1865	4028	3488	9031	85	232
April	10.76	20.56	1107	3143	1800	4876	48	110
May	9.10	14.78	989	3314	1247	4736	29	63
June	7.67	9.49	748	1019	889	1379	13	20
July	8.28	10.60	424	906	1276	4723	15	21
August	19.08	32.80	3346	11,727	5952	15,628	85	216
September	11.33	42.34	904	3061	1972	9351	51	164
October	13.54	30.10	1119	1866	2998	5204	60	96
November	8.79	--	440	--	807	--	45	--
December	ND	--	--	--	--	--	--	--
Ave.	10.52	18.47	1149	2961	2125	5575	44	94

ND - No Discharge

NOTE: The averages represented in this table are calculated only for the days of actual discharge. These discharges occur intermittently. The averages would be significantly lower if they were calculated as an average daily discharge on a monthly basis which assumes 30 days of discharge per month.

Table VI.1 Cont. Monthly Average Loadings for 1989-1990 from Facilities Discharging to the St. Louis River AOC

Superior Fiber Products Effluent - 1989-1990 Average

Month	Flow (mgd) Ave.	Flow (mgd) Max.	BOD_5 (lbs/day) Ave.	BOD_5 (lbs/day) Max.	TSS (lbs/day) Ave.	TSS (lbs/day) Max.
January	.667	.714	2633	4386	197	369
February	.667	.712	2836	3786	109	360
March	.697	.734	1880	3038	168	259
April	.677	.733	1980	5764	193	258
May	.657	.742	2161	5225	158	331
June	.668	.697	2760	4327	222	331
July	.685	.750	2545	4547	205	602
August	.697	.745	2320	4166	182	338
September	.680	.740	2441	5114	209	482
October	.688	.741	2531	3792	218	471
November	.665	.735	2755	3905	204	286
December	.665	.721	2843	5389	190	324
Average	.676	.730	2473	4453	188	368

Table VI.1 Cont. Monthly Average Loadings for 1989-1990 from Facilities Discharging to the St. Louis River AOC

Murphy Oil Company Effluent - 1989-1990 Average

Month	Flow (mgd) Ave.	Flow (mgd) Max.	BOD_5 (lbs/day) Ave.	BOD_5 (lbs/day) Max.	TSS (lbs/day) Ave.	TSS (lbs/day) Max.
January	.302	.424	72	106	25	42
February	.209	.252	64	82	16	29
March	.322	.596	77	128	30	61
April	.376	.896	76	163	29	72
May	.340	.721	61	167	24	57
June	.319	.576	43	90	16	37
July	.280	.520	35	84	18	57
August	.314	.864	36	61	19	55
September	.388	.900	31	74	31	148
October	.313	.632	93	105	23	60
November	.221	.480	69	83	19	30
December	.237	.328	86	97	22	42
Average	.302	.599	62	103	23	58

Table VI.2 Total Annual Loadings of Conventional Pollutants from Point Sources to the St. Louis River AOC for 1989 and 1990

Average Annual Loadings in lbs.

Facility	BOD_5	Total Suspended Solids	Total Phosphorus	Ave. Monthly Discharge (mgd) Flow
Western Lake Superior Sanitary District	515,380	1,122,375	107,310	35.36
City of Superior	193,724	96,937	4,121	3.68
City of Superior CSO) #2	50,468	88,441	1,816	10.52[1]
Superior Fiber Products	901,886	72,270	--	.676
Murphy Oil	22,630	8,212	--	.302
Burlington Northern[1]	--	953	--	.16[2]
Chicago & Northwestern[2]	--	395	--	.019[3]
Duluth Winnipeg and Pacific	1017	153	--	.006
Village of Superior[3]	146	630	--	.279[4]

[1]This represents the average flow when the facility is actually discharging. Discharge occurred approximately 37 days each year in 1989 and 1990.

[2]Burlington Northern discharged in 7 months each year in 1989-90. This represents an average flow for those months.

[3]Chicago and Northwestern discharged 8 months each year in 1989-90. This represents an average flow for those months.

[4]The Village of Superior operates a fill and draw lagoon system which is usually drained in the spring and fall. Since no discharge occurred in 1989 this represents the average flow of the two drawdowns in 1990 over a 16 day and 28 day period.

Table VI.3 Annual Mass Loadings Estimates - Toxic Substances
Point Source Discharges Into the St. Louis River AOC

Facility	Flow mgd	Dates of Samples	Substance	Estimated lbs/yr discharge	Total number samples
Murphy Oil	.285 ave. discharge	2/89 - 9/90	Cr^{+3}	2.8	174
			Cr^{+6}	<0.7	174
			Cu	5.5	25
			Ni	8.5	25
			Zn	30.1	25
			CN	97.2	25
			total phenols	43.8	104 (from 2C application)
			Hg	(0.06)[1]	25 (3 detects)
			PCBs	no data	
			dioxin*	----	*detected in process
			pentachlorophenol	----	1
			NH_3-N	588	174
			[1] Hg loading estimate very tenuous, sporadic detections		
Superior Fiber	.68 ave. discharge	7/86 - 1988	Hg	1.28	19 (13 detects)
			Zn	255.	32
			Cu	21.7	30 (29 detects)
			PCBs	not detected	1
			dioxin	no data	
			pentachlorophenol	not detected	1
			total phenols	994.	12 (from 2C application-1986)

Table VI.3 cont. Annual Mass Loadings Estimates - Toxics Substances
Point Source Discharges Into the St. Louis River AOC

Facility	Flow mgd	Dates of Samples	Substances	Estimated lbs/yr discharge	Total number samples
City of Superior	5 mgd design flow	1990 - 91	Insufficient data to estimate loadings 1990 Priority pollutant scan: 1 set metals data, organics pending		
Burlington Northern	.0645 ave. discharge	4/88-10/89	Cu	0.29	17 (4 detects)
			Zn	0.77	17 (9 detects)
			Cd	not detected	3
			Cr	not detected	3
			Pb	not detected	3
WLSSD	36 mgd av. discharge		Cd	324.85	
			Cr	2555	
			Cu	3452.9	
			Pb	4164.65	
			Hg	21.9	
			Ni	3766.8	
			Se	3682.85	
			Zn	10227.30	
			Acetone	1825	
			2-Butanone	1095	
			Carbon Disulfide	2190	
			2,4-Dimethylphenol	0	
			Phenol	262.8	
			Benzyl Alcohol	365	
			Benzoic Acid	2190	
			2,4,5-Trichlorophenol	365	
			2,4,6-Trichlorophenol	0	
			Bis(2-ethylhexyl) Phthalate	7544.55	
			Butybenzyl Phthlate	0	
			Chloroform	11300.4	

Methylene Chloride	1752
Hepyachlor Epoxide	0
2,3,7,8 TCDD	0.00006205
2,3,7,8 TCDF	0.0000949

Figure VI.1 Biochemical Oxygen Demand Loadings from Major Point Sources