
ANNUAL MONITORING REPORT

October 1987 - September 1988

USS DULUTH WORKS SITE

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Barr Engineering Co.
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ANNUAL MONITORING REPORT
OCTOBER, 1987 - SEPTEMBER, 1988
USS DULUTH WORKS SITE

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1.0 INTRODUCTION

The site of the former Duluth Works is located in the southern portion of the City of Duluth in St. Louis County, Minnesota. The Duluth Works was an integrated steel mill (coke production, steel production and finishing, and materials storage) that ended operation in May, 1979. The site is located adjacent to the St. Louis River estuary. A small stream with a 2.8 square mile drainage area flows through the northern portion of the site, immediately north of the former coke plant. The valley of this stream was used as a settling basin to dispose of wastes from operations at the coke plant. A small settling basin in the southern portion of the site was used to dispose of wastes from operations at the wire mill.

Routine water quality monitoring at the USS Duluth Works site began in September, 1985 in accordance with the Monitoring Plan contained in the May, 1985 document entitled "Plans Submitted Pursuant to Part IV and Part V, Task A to Exhibit A, March 26, 1985 Response Order by Consent, U.S. Steel Duluth Works Site" and as amended in the recommendations of the October, 1986 - September, 1987 Annual Monitoring Report. The following sections summarize the results of water quality monitoring during the period from October, 1987 to September, 1988.

2.0 HYDROGEOLOGIC CONDITIONS

The geologic and hydrogeologic setting of the USS Duluth Works Site is summarized in the May, 1985 Barr Engineering Co. report.

As part of the annual monitoring program, water levels were measured in the monitoring wells prior to purging of the wells and collection of samples. The groundwater elevations at the monitoring wells are shown in Table 1. Surficial groundwater contours were constructed from water level

data collected in June, 1988 (Table 1). Groundwater flow under the site is generally to the east toward the St. Louis River estuary. However, the stream that flows through the northern portion of the site also acts as a groundwater discharge zone for the northern portion of the site.

3.0 WATER QUALITY MONITORING PROGRAM

Sampling of monitoring wells and surface water stations at the USS Duluth Works Site was conducted in accordance with the procedures specified in the Quality Assurance/Quality Control Plan in the May, 1985 report and as amended in the recommendations of the October, 1986 - September, 1987 Annual Monitoring Report. The sampling locations are shown in Figure 2.

Samples were collected quarterly (December, March, June, September) at Surface Stations CP-1, CP-2, CP-3, WM-1 and Seep 1. The bottle containing the March PAH sample from CP-3 was broken at the laboratory and not analyzed. Samples were collected in June at Monitoring Wells W-6, W-7, W-8, W-9 and W-10. During June, 1988 there was no flow from Seep 2, therefore no samples were collected at Seep 2 during the monitoring period.

Samples collected from the monitoring wells and surface stations were analyzed for the parameters in Table 2. Monitoring for phenolic compounds continued at Seep 1 and CP-3 during the third quarter of 1988. Samples collected in June, 1988 at Wells W-11, W-12 and W-13 were also analyzed for chloride.

Specific conductance, temperature, and pH were measured in the field immediately after collection of each sample.

4.0 ANALYTICAL RESULTS

Laboratory data reports for the analysis of samples collected at the USS Duluth Works Site during the period from October, 1987 to September, 1988 are in Appendix A.

4.1 PAH and Phenolic Compounds

The results of analysis of samples for PAH and phenolic compounds are presented in Table 3. The geographical distribution of PAH compounds at monitoring wells and surface stations in June, 1988 is shown in Figure 3. Geographical distributions for the analytical program parameters are shown for the June sampling event because this was the only sampling event where all monitoring wells were sampled.

PAH compounds included in the monitoring program are divided into two groups, List 1 and List 2. The List 1 compounds are suspected carcinogens and the List 2 are not suspected carcinogens. The highest concentrations of List 1 and List 2 PAH compounds were found in Monitoring Wells W-6 and Surface Stations CP-2, CP-3, Seep 1 and WM-1. For the groundwater samples the concentration of List 1 compounds in W-6, W-9 and Seep 1 exceeded the Recommended Allowable Limits (RALs) for drinking water. The monitoring wells in the vicinity of the demolition landfill contained low concentrations of List 1 compounds (<0.012 ug/L), and List 2 compounds (<0.2 ug/L).

Phenolic compounds were not detected in either of the samples collected during the monitoring period (CP-3 and Seep 1).

Graphs illustrating the concentration of List 1 and List 2 PAH compounds in the surficial aquifer and surface waters during the period from 1985 to 1987 are shown in Appendix B. There has not been an apparent change in concentrations of List 1 or List 2 compounds in any of the monitoring wells or surface stations during the last 4 years.

4.2 General Parameters

General parameters in the monitoring program included total organic carbon, ammonia-nitrogen, cyanide, sulfate, and thiocyanate for all stations. Wells W-11, W-12 and W-13 were also analyzed for oxygen demand and total dissolved solids. The results of analysis of samples for general parameters are presented in Table 4. The geographic distribution of five

general parameters (ammonia-nitrogen, total cyanide, thiocyanate, sulfate, total organic carbon) at monitoring wells and surface stations in June, 1988 are shown in Figure 4.

The concentrations of most general parameters in samples collected from monitoring stations at the site were low and demonstrated little spatial or temporal variability. The water quality standard for total cyanide in surface waters was exceeded at Surface Station CP-3 during one out of four sampling events. Sulfate levels in samples collected from Monitoring Well W-12 was higher than sulfate levels at other monitoring wells and surface stations.

Thiocyanate and sulfate were selected as indicator parameters for purposes of determining changes in contaminant concentrations with time. These parameters are considered possible indicators of groundwater and surface water contamination at the site for the following reasons: 1) the parameters have been consistently detected at elevated levels at the surface stations and monitoring wells at the site and, 2) thiocyanate and sulfate were major constituents of waste generated at the former steel mill. Graphs illustrating the concentrations of thiocyanate and sulfate in the surficial aquifer and surface waters during the period from 1985 to 1988 are shown in Appendix B. There were no apparent changes in concentrations of sulfate and thiocyanate at the monitoring stations during the period from 1985 to 1988. The one possible exception is an increase in sulfate in the coke plant stream concentration of sulfate. This possible increase has been observed in both the upstream (CP-1) station and the downstream stations (CP-2 and CP-3) and is therefore likely not related to the site.

4.3 Metals

Metals included in the monitoring program were filtered metals and unfiltered or total metals. Both filtered and unfiltered samples were collected for analysis of metals at the surface stations in December, 1987. After December 1987 only unfiltered metal samples here were collected at the surface stations. The collection and analysis of filtered samples was

discontinued because it was determined that the sediments were having a limited influence on the concentration of metals in the surface water.

The analytical results of samples for metals are presented in Table 5. The geographical distribution of five filtered metals (arsenic, chromium, lead, nickel, zinc) at monitoring wells and surface stations in June, 1988 are shown in Figure 5.

The concentration of metals in samples collected at the site during the monitoring periods were below the RALs for drinking water.

4.4 Field Data

Results of field analysis of samples for specific conductance, temperature and pH are in Table 6.

5.0 QUALITY CONTROL REVIEW

Quality control procedures used in the collection and analysis of samples are described in the Quality Assurance/Quality Control Plan in the May, 1985 report. A review of the quality control data was conducted to assess the integrity of the sampling procedures and analytical results for samples collected during the annual monitoring program at the USS Duluth Works Site.

Field blank samples were collected during each sampling event and analyzed for PAH compounds and metals. The result of analysis of field blank samples for PAH compounds and metals are presented in Tables 7 and 8, respectively. Detectable levels of metals and PAH compounds in the field blanks were used to determine possible false positive values in the water quality monitoring data. Potential false positive values in the data were defined as concentrations less than or equal to the amount detected in the field blank. These values are footnoted with an "s" in the water quality monitoring data tables.

A blind duplicate or masked sample was collected at one monitoring station during each sampling event. The duplicate samples were analyzed for PAH compounds. Table 9 shows the analytical results of blind duplicate samples. Coefficients of variation were computed for each duplicate pair and are shown in Table 10. A coefficient of variation less than 0.25 is generally considered an indication of acceptable reproducibility of analytical results by the laboratory.

6.0 RECOMMENDED MONITORING PLAN FOR 1989

During 1989 it is anticipated that the Response Action Plan (RAP) for the site will be prepared. Part of the RAP is a recommended long-term monitoring plan for the site. Because the scope of the monitoring program will be evaluated as part of the RAP no modifications to the existing plan will be prepared as part of this annual data report.

The monitoring program as specified in the May, 1985 Barr Engineering Co. report with the modifications recommended and approved in the October, 1986 - September, 1987 Annual Monitoring Report will continue to be the routine water quality monitoring plan for the USS Duluth Works Site during 1989 until the long-term monitoring plan is prepared as part of the RAP for the site.

Tables

TABLE 1
GROUNDWATER ELEVATIONS
JUNE 1988

Feet MSL

Well	6/7 - 6/8/88
W-6	606.13
W-7	619.59
W-8	617.63
W-9	618.11
W-10	613.43
W-11	614.15
W-12	608.88
W-13	621.67

TABLE 2
ANALYTICAL PROGRAM PARAMETERS

PAH and Heterocycles

benzo(a)anthracene	anthracene
dibenzo(ah)anthracene	fluoranthene
benzo(b)fluoranthene*	pyrene
benzo(a)pyrene	benzo(k)fluoranthene*
quinoline	benzo(e)pyrene
indeno(1,2,3-dc)pyrene	perylene
chrysene*	acridine
benzo(ghi)perylene	carbazole
indene	2,3-benzofuran
2,3-dihydroindene	dibenzofuran
naphthalene	benzo(b)thiophene
1-methylnaphthalene	dibenzothiophene
2-methylnaphthalene	indole
biphenyl	3-methylcholanthrene
acenaphthylene	triphenylene*
acenaphthene	phenanthridine
fluorene	isoquinoline
phenanthrene	

Phenols

phenol	4-nitrophenol
o-cresol	2,4-dinitrophenol
m-cresol and p-cresol*	4,6-dinitro-o-cresol
2-nitrophenol	2,4-dimethylphenol

Metals

chromium (total)
lead
nickel
zinc
arsenic

General Parameters

sulfate
ammonia
cyanide
thiocyanate
total organic carbon

*These compounds coelute and are structural isomers (benzo(b)fluoranthene with benzo(k)fluoranthene; chrysene with triphenylene; and m-cresol with p-cresol) and therefore cannot be individually quantified.

TABLE 3

WATER QUALITY MONITORING DATA
PAH AND PHENOLIC COMPOUNDS

(concentrations in ug/L)

	CP 1				CP 2			
	12/16/87	03/29/88	06/06/88	09/06/88	12/16/87	03/29/88	06/06/88	09/06/88
Quinoline	0.0026	<0.001	<0.0010	<0.0010	<6 p	0.073	<0.0060	<0.0020
Benzo(a)anthracene	0.0016	0.0015	<0.0010	0.0022	<6	0.057	0.41	0.22
Chrysene	0.0035 c	0.0027 c	<0.0010	0.0037 c	<6	0.060 c	0.45 c	0.18 c
Benzo(b)fluoranthene	<0.0010	0.0045 c	<0.0010	0.0042 c	<6	0.066 c	<0.0060	0.12 c
Benzo(a)pyrene	<0.0010	0.0013	<0.0010	0.0018	<6	0.047	<0.0060	0.10
Indeno(1,2,3,cd)pyrene	<0.0017	<0.0017	<0.0017	<0.0017	<6	0.033	<0.010	0.062
Dibenzo(ah)anthracene	<0.0014	<0.0014	<0.0014	<0.0014	<6	<0.014	<0.0084	0.018
Benzo(ghi)perylene	<0.0010	<0.001	<0.0010	<0.0010	<6	0.019	<0.0060	0.052
Sum List 1	0.0077	0.010	ND	0.012	ND	0.36	0.86	0.75
2,3-Benzofuran	DLND	0.0023	DLND	DLND	<6	0.041	DLND	0.012
2,3-Dihydroindene	0.16	0.016	0.0056	0.0088	<6	0.054	<0.0084	0.012
Indene	0.040	0.0043	0.026	0.010	<6	0.064	0.046	0.032
Naphthalene	0.043	0.010	0.0053 s	0.0071	<6	<0.019	0.034	0.015
Benzo(b)thiophene	0.011	0.0012	0.0013	<0.0010	<6 p	0.21	0.064	0.011
Isoquinoline	0.0037	0.0033	DLND	DLND	<6 p	0.27	DLND	0.037
Indole	<0.0029	<0.0029	<0.0029	<0.0029	<6	<0.029	<0.017	0.0048
2-Methylnaphthalene	0.0088	0.0033	0.0032	<0.0020	<6	<0.020	<0.012	0.0067
1-Methylnaphthalene	0.0097	0.0048	0.0035	<0.0010	<6 p	0.18	<0.0060	0.017
Biphenyl	0.0031	0.001	0.0066	<0.0010	<6 p	0.060	<0.0060	0.007
Acenaphthylene	0.011	0.001	0.011	0.0033	<6 p	1.1	0.028	0.020
Acenaphthene	0.0089	0.0047	0.0067	0.0051	<6 p	0.47	0.027	0.28
Dibenzofuran	0.0069	0.0027	0.0085	0.0045	<6 p	0.67	0.058	0.038
Fluorene	0.013	0.0023	0.029	0.0066	<6 p	0.65	0.17	0.063
Dibenzothiophene	0.0033	DLND	DLND	0.003	<6	DLND	0.071	0.027
Phenanthrene	0.010	0.0077	0.018	0.0072	<6	0.067	0.26	0.15
Anthracene	<0.0010	<0.001	<0.0010	<0.0010	<6 p	0.13	0.12	0.067
Acridine	<0.0018	<0.0018	<0.0018	<0.0018	<6 p	0.30	<0.011	0.14
Phenanthridine	<0.0014	<0.0014	<0.0014	<0.0014	<6 p	0.20	0.12	0.014
Carbazole	0.0087 s	0.0095 s	0.021 s	0.011 s	<6 p	0.36	<0.0066	0.034
Fluoranthene	0.011	0.0072	0.012	0.013	<6 p	0.70	2.9	0.93
Pyrene	0.0098	0.0061	<0.0010	0.011	<6 p	0.45	1.7	0.63
Triphenylene	0.0035 c	0.0027 c	<0.0010	0.0037 c	<6	0.060 c	0.45 c	0.18 c
Benzo(k)fluoranthene	<0.0010	0.0045 c	<0.0010	0.0042 c	<6	0.066 c	<0.0060	0.12 c
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	DLND	<6	DLND	DLND	DLND
Benzo(e)pyrene	<0.0010	0.0016	<0.0010	0.0017	<6	0.030	<0.0060	0.061
Perylene	<0.0010	<0.001	<0.0010	<0.0010	<6	<0.010	<0.0060	0.019
3-Methylcholanthrene	DLND	DLND	DLND	DLND	<6	DLND	DLND	DLND
Sum List 2	0.36	0.089	0.16	0.092	ND	6.0	5.5	2.6

c Coeluting isomer. Concentration reported is total of the coeluting compound.
p Small peak in chromatogram below method detection limit.
s Possible false positive value based on review of quality control data.
ND None detected.
DLND Not detected. Detection limit not determined.

.001

TABLE 3 (cont.)

WATER QUALITY MONITORING DATA
PAH AND PHENOLIC COMPOUNDS

(concentrations in ug/L)

	CP 3			WM 1			
	12/16/87	06/07/88	09/06/88	12/16/87	03/29/88	06/07/88	09/06/88
Quinoline	0.18	0.0043	<0.0010	<6	0.0025	0.0092	<0.0010
Benzo(a)anthracene	0.63	0.079	0.037	<6	0.024	0.034	<0.0010
Chrysene	0.054 c	0.12 c	0.051 c	<6	0.038 c	0.053 c	0.0055 c
Benzo(b)fluoranthene	<0.020	0.25 c	0.018 c	<6	0.018 c	0.052 c	<0.0010
Benzo(a)pyrene	<0.020	0.055	0.010	<6	0.0085	0.018	<0.0010
Indeno(1,2,3,cd)pyrene	<0.034	0.040	0.0099	<6	0.010	<0.0034	<0.0017
Dibenzo(ah)anthracene	<0.028	0.019	<0.0014	<6	<0.0028	<0.0028	<0.0014
Benzo(ghi)perylene	<0.020	0.042	0.008	<6	0.0072	<0.0020	<0.0010
Sum List 1	0.86	0.61	0.13	ND	0.11	0.17	0.0055
2,3-Benzofuran	0.053	DLND	0.013	<6	0.049	DLND	0.021
2,3-Dihydroindene	0.069	<0.0028	0.0092	<6 p	0.14	0.10	0.12
Indene	0.083	0.073	0.031	<6	0.16	0.039	0.080
Naphthalene	<0.038	0.021	0.0061	<6 p	0.005 s	0.0065	0.052
Benzo(b)thiophene	0.99	0.027	0.0042	<6 p	0.0049	0.0063	0.027
Isoquinoline	1.7	0.030	0.030	<6	0.0085	DLND	DLND
Indole	<0.058	<0.0058	<0.0029	<6	<0.0058	<0.0058	<0.0029
2-Methylnaphthalene	<0.040	0.0048	0.0021	<6	<0.004	0.0083	<0.0020
1-Methylnaphthalene	<0.020	0.0033	0.0055	<6 p	0.0035	0.0053	0.019
Biphenyl	0.28	0.0042	0.012	<6 p	0.0041	0.012	0.0055
Acenaphthylene	0.36	0.015	0.025	<6	0.050	0.022	0.018
Acenaphthene	0.77	0.014	0.041	31	0.35	0.13	0.54
Dibenzofuran	1.5	0.0094	0.017	12	0.22	0.14	0.16
Fluorene	1.9	0.017	0.10	13	0.45	0.34	0.14
Dibenzothiophene	0.17	0.035	0.021	<6	0.023	0.043	0.0066
Phenanthrene	<0.020	0.067	0.063	6.4	0.068	0.059	0.026
Anthracene	0.49	0.035	0.030	<6	0.030	0.038	0.005
Acridine	2.5	0.20	<0.0018	<6	<0.0036	<0.0036	<0.0018
Phenanthridine	1.4	0.047	0.090	<6	0.013	0.054	<0.0014
Carbazole	<0.022	0.013 s	0.019 s	12	0.13	<0.0022	0.073
Fluoranthene	1.7	0.92	0.34	<6	0.13	0.29	0.051
Pyrene	0.86	0.65	0.20	<6	0.11	0.12	0.034
Triphenylene	0.054 c	0.12 c	0.051 c	<6	0.038 c	0.053 c	0.0055 c
Benzo(k)fluoranthene	<0.020	0.25 c	0.018 c	<6	0.018 c	0.052 c	<0.0010
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	<6	DLND	DLND	DLND
Benzo(e)pyrene	<0.020	0.044	0.014	<6	0.018	0.021	<0.0010
Perylene	<0.020	0.015	0.0031	<6	<0.002	<0.0020	<0.0010
3-Methylcholanthrene	DLND	DLND	DLND	<6	DLND	DLND	DLND
Sum List 2	15	2.2	1.1	74	2.0	1.4	1.4
Phenol	--	--	<6	--	--	--	--
2-Chlorophenol	--	--	<6	--	--	--	--
2-Nitrophenol	--	--	<6	--	--	--	--
2,4-Dimethylphenol	--	--	<6	--	--	--	--
Benzoic Acid	--	--	<29	--	--	--	--
2,4-Dichlorophenol	--	--	<6	--	--	--	--
4-Chloro-3-methylphenol	--	--	<6	--	--	--	--
2,4,6-Trichlorophenol	--	--	<6	--	--	--	--
2,4-Dinitrophenol	--	--	<29	--	--	--	--
4-Nitrophenol	--	--	<29	--	--	--	--
2-Methyl-4,6-dinitrophenol	--	--	<29	--	--	--	--
Pentachlorophenol	--	--	<6	--	--	--	--
O-Cresol	--	--	<6	--	--	--	--
M-Cresol	--	--	--	--	--	--	--
P-Cresol	--	--	<6	--	--	--	--

c Coeluting isomer. Concentration reported is total of the coeluting compound.

p Small peak in chromatogram below method detection limit.

s Possible false positive value based on review of quality control data.

DLND Not detected. Detection limit not determined.

-- Not analyzed.

TABLE 3 (cont.)

WATER QUALITY MONITORING DATA
PAH AND PHENOLIC COMPOUNDS

(concentrations in ug/L)

	SEEP 1				W6	W7	W8
	12/16/87	03/29/88	06/06/88	09/06/88			
Quinoline	<0.020	<0.010	<0.0040	<0.010	0.0032	<0.0010	<0.0010
Benzo(a)anthracene	<0.020	<0.010	0.022	0.086	0.21	<0.0010	0.0026
Chrysene	<0.020	<0.010	0.095 c	0.18 c	0.25 c	<0.0010	0.0035 c
Benzo(b)fluoranthene	<0.020	<0.010	<0.0040	0.078 c	0.89 c	<0.0010	0.0077 c
Benzo(a)pyrene	<0.020	<0.010	<0.0040	0.050	0.36	<0.0010	0.0025
Indeno(1,2,3,cd)pyrene	<0.034	<0.017	<0.0068	<0.017	0.36	<0.0017	<0.0017
Dibenzo(ah)anthracene	<0.028	<0.014	<0.0056	<0.014	0.17	<0.0014	<0.0014
Benzo(ghi)perylene	<0.020	<0.010	<0.0040	<0.010	0.41	<0.0010	<0.0010
Sum List 1	ND	ND	0.12	0.39	2.7	ND	0.016
2,3-Benzofuran	DLND	DLND	DLND	DLND	DLND	DLND	DLND
2,3-Dihydroindene	0.090	0.10	0.25	0.40	0.006	0.0021 s	0.0044
Indene	<0.020	0.011	0.018	<0.010	0.034	0.005	0.0019
Naphthalene	<0.038	<0.019	0.026	<0.019	0.083	0.0055 s	0.014
Benzo(b)thiophene	0.091	0.057	0.16	0.16	0.019	<0.0010	0.0021
Isoquinoline	DLND	DLND	DLND	DLND	0.0047	DLND	DLND
Indole	<0.058	<0.029	0.12	0.18	<0.0058	<0.0029	<0.0029
2-Methylnaphthalene	<0.040	<0.020	<0.0080	<0.020	0.032	0.0041	0.0097
1-Methylnaphthalene	<0.020	<0.010	<0.0040	0.014	0.013	0.0023	0.0072
Biphenyl	<0.020	<0.010	<0.0040	<0.010	0.023	0.0011	0.0014
Acenaphthylene	0.041	0.067	0.16	0.044	0.041	<0.0010	0.0048
Acenaphthene	0.20	0.25	0.28	1.2	0.021	<0.0013	0.0021
Dibenzofuran	0.17	0.14	0.43	0.86	0.048	<0.0020	0.0055
Fluorene	0.20	0.14	1.4	1.4	0.048	<0.0014	0.011
Dibenzothiophene	0.14	0.034	0.54	0.84	0.022	0.0014	0.0023
Phenanthrene	<0.020	<0.010	<0.0040	0.19	0.29	0.0036	0.0082
Anthracene	<0.020	0.035	0.24	<0.010	0.070	0.0033	0.0038
Acridine	<0.036	<0.018	1.2	0.046	0.013	<0.0018	<0.0018
Phenanthridine	<0.028	0.094	0.86	0.84	0.014	<0.0014	<0.0014
Carbazole	<0.022	0.015 s	<0.0044	<0.011	0.035	<0.0011	0.011 s
Fluoranthene	0.058	0.029	0.21	0.32	0.38	0.0037 s	0.016
Pyrene	0.16	0.066	0.53	0.44	0.39	0.0078	0.011
Triphenylene	<0.020	<0.010	0.095 c	0.18 c	0.25 c	<0.0010	0.0035 c
Benzo(k)fluoranthene	<0.020	<0.010	<0.0040	0.078 c	0.89 c	<0.0010	0.0077 c
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	DLND	DLND	DLND	DLND
Benzo(e)pyrene	<0.020	<0.010	<0.0040	0.094	0.24	<0.0010	0.002
Perylene	<0.020	<0.010	<0.0040	0.024	0.13	<0.0010	<0.0010
3-Methylcholanthrene	DLND	DLND	DLND	DLND	DLND	DLND	DLND
Sum List 2	1.2	1.0	6.4	7.1	2.0	0.040	0.12
Phenol	--	--	--	<6	--	--	--
2-Chlorophenol	--	--	--	<6	--	--	--
2-Nitrophenol	--	--	--	<6	--	--	--
2,4-Dimethylphenol	--	--	--	<6	--	--	--
Benzoic Acid	--	--	--	<29	--	--	--
2,4-Dichlorophenol	--	--	--	<6	--	--	--
4-Chloro-3-methylphenol	--	--	--	<6	--	--	--
2,4,6-Trichlorophenol	--	--	--	<6	--	--	--
2,4-Dinitrophenol	--	--	--	<29	--	--	--
4-Nitrophenol	--	--	--	<29	--	--	--
2-Methyl-4,6-dinitrophenol	--	--	--	<29	--	--	--
Pentachlorophenol	--	--	--	<6	--	--	--
O-Cresol	--	--	--	<6	--	--	--
M-Cresol	--	--	--	<6	--	--	--
P-Cresol	--	--	--	<6	--	--	--

c Coeluting isomer. Concentration reported is total of the coeluting compound.

s Possible false positive value based on review of quality control data.

ND None detected.

DLND Not detected. Detection limit not determined.

-- Not analyzed.

TABLE 3 (cont.)

WATER QUALITY MONITORING DATA
PAH AND PHENOLIC COMPOUNDS

(concentrations in ug/L)

	W9	W10	W11	W12	W13
	-----	-----	-----	-----	-----
	06/08/88	06/08/88	06/07/88	06/08/88	06/08/88
Quinoline	<0.0010	<0.0010	<0.0010	0.0043	<0.0010
Benzo(a)anthracene	0.0069	0.0048	<0.0010	0.0034	0.0016
Chrysene	0.0079 c	0.0073 c	<0.0010	0.0046 c	0.0022 c
Benzo(b)fluoranthene	0.016 c	0.011 c	<0.0010	<0.0010	<0.0010
Benzo(a)pyrene	0.0059	<0.0010	<0.0010	<0.0010	<0.0010
Indeno(1,2,3,cd)pyrene	0.0038	<0.0017	<0.0017	<0.0017	<0.0017
Dibenzo(ah)anthracene	<0.0014	<0.0014	<0.0014	<0.0014	<0.0014
Benzo(ghi)perylene	0.0031	<0.0010	<0.0010	<0.0010	<0.0010
Sum List 1	0.044	0.023	ND	0.012	0.0038
2,3-Benzofuran	DLND	DLND	DLND	DLND	DLND
2,3-Dihydroindene	0.0018 s	0.0021 s	0.0045	0.0022 s	0.0023 s
Indene	0.0022	0.0027	0.0058	0.007	0.0023
Naphthalene	0.0059 s	0.0064	0.026	0.030	0.0064
Benzo(b)thiophene	<0.0010	<0.0010	0.012	0.092	0.0012
Isoquinoline	DLND	DLND	DLND	DLND	DLND
Indole	<0.0029	<0.0029	<0.0029	<0.0029	<0.0029
2-Methylnaphthalene	0.0034	0.0038	0.035	0.0026	0.0029
1-Methylnaphthalene	0.0018	0.0023	0.017	0.0027	0.0017
Biphenyl	<0.0010	<0.0010	0.0018	0.0041	0.0012
Acenaphthylene	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Acenaphthene	<0.0013	<0.0013	<0.0013	0.0031	<0.0013
Dibenzofuran	<0.0020	<0.0020	<0.0020	0.0022	<0.0020
Fluorene	0.0015	<0.0014	<0.0014	<0.0014	<0.0014
Dibenzothiophene	0.0012	DLND	DLND	DLND	DLND
Phenanthrene	0.008	0.0034	<0.0010	0.015	0.004
Anthracene	0.0034	0.0013	<0.0010	0.018	0.001
Acridine	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018
Phenanthridine	<0.0014	0.0015	<0.0014	<0.0014	<0.0014
Carbazole	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Fluoranthene	0.018	0.0051 s	<0.0010	0.012	0.004 s
Pyrene	0.016	0.006	<0.0010	0.0081	0.003
Triphenylene	0.0079 c	0.0073 c	<0.0010	0.0046 c	0.0022 c
Benzo(k)fluoranthene	0.016 c	0.011 c	<0.0010	<0.0010	<0.0010
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	DLND	DLND
Benzo(e)pyrene	0.0048	0.0043	<0.0010	<0.0010	<0.0010
Perylene	0.0028	<0.0010	<0.0010	<0.0010	<0.0010
3-Methylcholanthrene	DLND	DLND	DLND	DLND	DLND
Sum List 2	0.071	0.044	0.10	0.20	0.030

c Coeluting isomer. Concentration reported is total of the coeluting compound.
s Possible false positive value based on review of quality control data.
ND None detected.
DLND Not detected. Detection limit not determined.
-- Not analyzed.

.001

TABLE 4

WATER QUALITY MONITORING DATA
GENERAL PARAMETERS

(concentrations in mg/L)

	CP 1				CP 2			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
Ammonia Nitrogen	<0.1	<0.1	0.2	0.4	0.9	0.3	<0.1	<0.1
Chloride	--	--	--	--	--	--	--	--
Cyanide, total	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	0.02	<0.01
Sulfate	70	74	85	70	110	86	88	98
Thiocyanate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chemical Oxygen Demand	--	--	--	--	--	--	--	--
Total Dissolved Solids	--	--	--	--	--	--	--	--
Total Organic Carbon	--	7.6	15	<0.5	--	6.9	7.3	5.9

	CP 3				WM 1			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
Ammonia Nitrogen	0.8	0.2	<0.1	<0.1	0.3	0.2	<0.1	<0.1
Chloride	--	--	--	--	--	--	--	--
Cyanide, total	<0.01	0.02	0.04	0.02	<0.01	<0.01	<0.01	<0.01
Sulfate	110	87	100	130	240	150	510	230
Thiocyanate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chemical Oxygen Demand	--	--	--	--	--	--	--	--
Total Dissolved Solids	--	--	--	--	--	--	--	--
Total Organic Carbon	--	6.8	7.1	6.7	--	6.3	12	8.0

	SEEP 1				W6	W7	W8	W9
	12/16/87	03/29/88	06/10/88	09/06/88	06/10/88	06/10/88	06/10/88	06/10/88
Ammonia Nitrogen	50	50	50	50	50	50	50	50
Chloride	0.4	0.3	0.3	<0.1	<0.1	1.5	1.3	0.4
Cyanide, total	<0.01	0.01	0.01	0.01	0.06	0.02	<0.01	<0.01
Sulfate	160	230	190	180	130	490	69	130
Thiocyanate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chemical Oxygen Demand	--	--	--	--	--	--	--	--
Total Dissolved Solids	--	--	--	--	--	--	--	--
Total Organic Carbon	--	4.6	9.7	7.2	4.2	3.3	15	3.2

	W10	W11	W12	W13
	06/10/88	06/10/88	06/10/88	06/10/88
Ammonia Nitrogen	<0.1	1.4	<0.1	<0.1
Chloride	--	6	9	8
Cyanide, total	<0.01	<0.01	0.02	<0.01
Sulfate	160	210	800	180
Thiocyanate	<1.0	<1.0	<1.0	<1.0
Chemical Oxygen Demand	--	7	16	7
Total Dissolved Solids	--	740	1700	670
Total Organic Carbon	2.7	2.8	5.9	2.6

-- Not analyzed.

TABLE 5

WATER QUALITY MONITORING DATA
METALS

(concentrations in ug/L, unless noted otherwise)

	CP 1				CP 2			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
Arsenic, filtered	<1	--	--	--	<1	--	--	--
Cadmium, filtered	--	--	--	--	--	--	--	--
Chromium, filtered	<1	--	--	--	<1	--	--	--
Lead, filtered	<1	--	--	--	<1	--	--	--
Nickel, filtered	<1	--	--	--	<1	--	--	--
Zinc, filtered, mg/L	<0.01	--	--	--	<0.01	--	--	--
Arsenic	<1	<1	<2	<2	<1	<1	<2	<2
Cadmium	--	--	--	--	--	--	--	--
Chromium, total	<1	<1	<1	<1	<1	1	<1	<1
Lead	<1	<1	<1	<1	<1	7	1	<1
Nickel	<1	<2	<1	<1	<1	<2	<1	<1
Zinc, mg/L	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	0.09	<0.01
	CP 3				WM 1			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
Arsenic, filtered	<1	--	--	--	5	--	--	--
Cadmium, filtered	--	--	--	--	--	--	--	--
Chromium, filtered	<1	--	--	--	<1	--	--	--
Lead, filtered	<1	--	--	--	<1	--	--	--
Nickel, filtered	<1	--	--	--	<1	--	--	--
Zinc, filtered, mg/L	<0.01	--	--	--	0.02	--	--	--
Arsenic	<1	<1	<2	<2	7	<1	<2	<2
Cadmium	--	--	--	--	--	--	--	--
Chromium, total	<1	<1	<1	<1	<1	4	1	2
Lead	<1	4	<1	<1	<1	3	2	2
Nickel	<1	<2	<1	<1	<1	<2	<1	<1
Zinc, mg/L	<0.01	<0.01	0.12	<0.01	0.02	0.22	0.11	<0.01

-- Not analyzed.

.002

TABLE 5 (Cont.)

WATER QUALITY MONITORING DATA
METALS

(concentrations in ug/L, unless noted otherwise)

	SEEP 1				W6	W7	W8	W9
	12/16/87	03/29/88	06/10/88	09/06/88	06/10/88	06/10/88	06/10/88	06/10/88
Arsenic, filtered	<1	--	--	--	2	<2	<2	<2
Cadmium, filtered	--	--	--	--	--	--	--	--
Chromium, filtered	1	--	--	--	5	6	<1	2
Lead, filtered	<1	--	--	--	<1	<1	<1	<1
Nickel, filtered	<1	--	--	--	<1	<1	6	<1
Zinc, filtered, mg/L	<0.01	--	--	--	<0.01	0.01	<0.01	<0.01
Arsenic	<1	<1	<2	<2	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--
Chromium, total	<1	1	<1	1	--	--	--	--
Lead	<1	<1	<1	<1	--	--	--	--
Nickel	<1	<2	<1	<1	--	--	--	--
Zinc, mg/L	0.08	0.01	0.23	<0.01	--	--	--	--
	W10	W11	W12	W13				
	06/10/88	06/10/88	06/10/88	06/10/88				
Arsenic, filtered	<2	<2	<2	<2				
Cadmium, filtered	--	0.2	<0.1	<0.1				
Chromium, filtered	1	<1	2	2				
Lead, filtered	<1	<1	<1	<1				
Nickel, filtered	<1	30	3	<1				
Zinc, filtered, mg/L	0.03	0.01	0.01	<0.01				
Arsenic	--	--	--	--				
Cadmium	--	--	--	--				
Chromium, total	--	--	--	--				
Lead	--	--	--	--				
Nickel	--	--	--	--				
Zinc, mg/L	--	--	--	--				

-- Not analyzed.

TABLE 6

WATER QUALITY MONITORING DATA
FIELD PARAMETERS

	CP 1				CP 2			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
pH, standard units	7.2	7.0	7.6	7.3	7.2	7.3	7.1	7.5
Specific Conductance, uhmos/cm @25oC	630	280	600	390	1500	510	750	700
Temperature, oC	2.0	4.0	26.0	17.0	3.0	2.0	29.0	19.0

	CP 3				WM 1			
	12/16/87	03/29/88	06/10/88	09/06/88	12/16/87	03/29/88	06/10/88	09/06/88
pH, standard units	7.5	7.3	7.1	8.9	7.0	6.9	7.0	7.8
Specific Conductance, uhmos/cm @25oC	1200	560	700	700	1000	1000	1200	750
Temperature, oC	0.5	3.5	27.0	24.0	2.0	2.0	28.0	21.0

	SEEP 1				W6	W7	W8	W9
	12/16/87	03/29/88	06/10/88	09/06/88	06/10/88	06/10/88	06/10/88	06/10/88
pH, standard units	7.3	7.1	7.0	7.8	7.3	7.1	7.2	7.2
Specific Conductance, uhmos/cm @25oC	950	1000	1100	1000	700	1600	1200	650
Temperature, oC	4.0	10.0	20.0	15.0	13.0	19.0	15.0	11.0

	W10	W11	W12	W13
	06/10/88	06/10/88	06/10/88	06/10/88
pH, standard units	7.2	7.3	7.3	7.3
Specific Conductance, uhmos/cm @25oC	900	1100	1900	1100
Temperature, oC	10.0	12.0	10.0	10.0

.....
.004

TABLE 7

QUALITY CONTROL DATA
FIELD BLANK SAMPLES

(concentrations in ug/L)

	FIELD BLANKS			
	12/16/87	03/29/88	06/08/88	09/06/88
Quinoline	<0.001	<0.001	<0.0010	<0.0010
Benzo(a)anthracene	<0.001	<0.001	<0.0010	<0.0010
Chrysene	<0.001	<0.001	<0.0010	<0.0010
Benzo(b)fluoranthene	<0.001	<0.001	<0.0010	<0.0010
Benzo(a)pyrene	<0.001	<0.001	<0.0010	<0.0010
Indeno(1,2,3,cd)pyrene	<0.0017	<0.0017	<0.0017	<0.0017
Dibenzo(ah)anthracene	<0.0014	<0.0014	<0.0014	<0.0014
Benzo(ghi)perylene	<0.001	<0.001	<0.0010	<0.0010
2,3-Benzofuran	DLND	DLND	DLND	DLND
2,3-Dihydroindene	<0.0014	<0.0014	<0.0014	0.0022
Indene	<0.001	<0.001	<0.0010	<0.0010
Naphthalene	<0.0019	0.0021	0.0039	0.0025
Benzo(b)thiophene	<0.001	<0.001	<0.0010	<0.0010
Isoquinoline	DLND	DLND	DLND	DLND
Indole	<0.0029	<0.0029	<0.0029	<0.0029
2-Methylnaphthalene	<0.002	<0.002	<0.0020	<0.0020
1-Methylnaphthalene	<0.001	<0.001	<0.0010	<0.0010
Biphenyl	<0.001	<0.001	<0.0010	<0.0010
Acenaphthylene	<0.001	<0.001	<0.0010	<0.0010
Acenaphthene	<0.0013	<0.0013	<0.0013	<0.0013
Dibenzofuran	<0.002	<0.002	<0.0020	<0.0020
Fluorene	<0.0014	<0.0014	<0.0014	<0.0014
Dibenzothiophene	DLND	DLND	DLND	DLND
Phenanthrene	<0.001	<0.001	<0.0010	<0.0010
Anthracene	<0.001	<0.001	<0.0010	<0.0010
Acridine	<0.0018	<0.0018	<0.0018	<0.0018
Phenanthridine	<0.0014	<0.0014	<0.0014	<0.0014
Carbazole	<0.0011	0.016	<0.0011	<0.0011
Fluoranthene	<0.001	<0.001	0.0015	<0.0010
Pyrene	<0.001	<0.001	0.0012	<0.0010
Triphenylene	<0.001	<0.001	<0.0010	<0.0010
Benzo(k)fluoranthene	<0.001	<0.001	<0.0010	<0.0010
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	DLND
Benzo(e)pyrene	<0.001	<0.001	<0.0010	<0.0010
Perylene	<0.001	<0.001	<0.0010	<0.0010
3-Methylcholanthrene	DLND	DLND	DLND	DLND

DLND Not detected. Detection limit not determined.

.005

TABLE 8

QUALITY CONTROL DATA
FIELD BLANK SAMPLES

(concentrations in ug/L, unless noted otherwise)

	FIELD BLANKS		
	12/16/87	03/29/88	09/06/88
Arsenic, filtered	<1	--	--
Chromium, filtered	<1	--	--
Lead, filtered	<1	--	--
Nickel, filtered	<1	--	--
Zinc, filtered, mg/L	<0.01	--	--
Arsenic	--	<1	<2
Chromium, total	--	<1	<1
Lead	--	<1	<1
Nickel	--	<2	<1
Zinc, mg/L	--	<0.01	<0.01

-- Not analyzed.

.007

TABLE 9

QUALITY CONTROL DATA
BLIND DUPLICATE SAMPLES

(concentrations in ug/L)

	SEEP 1		CP 2		WM 1		W11	
	12/16/87 Sample	12/16/87 Duplicate	03/29/88 Sample	03/29/88 Duplicate	09/06/88 Sample	09/06/88 Duplicate	06/07/88 Sample	06/07/88 Duplicate
Quinoline	<0.020	<0.010	0.073	0.064	<0.0010	<0.0010	<0.0010	<0.0010
Benzo(a)anthracene	<0.020	<0.010	0.057	0.025	<0.0010	<0.0010	<0.0010	<0.0010
Chrysene	<0.020	<0.010	0.060 c	0.030 c	0.0055 c	0.0075 c	<0.0010	<0.0010
Benzo(b)fluoranthene	<0.020	<0.010	0.066 c	0.025 c	<0.0010	<0.0010	<0.0010	<0.0010
Benzo(a)pyrene	<0.020	<0.010	0.047	0.021	<0.0010	<0.0010	<0.0010	<0.0010
Indeno(1,2,3,cd)pyrene	<0.034	<0.017	0.033	<0.017	<0.0017	<0.0017	<0.0017	<0.0017
Dibenzo(ah)anthracene	<0.028	<0.014	<0.014	<0.014	<0.0014	<0.0014	<0.0014	<0.0014
Benzo(ghi)perylene	<0.020	<0.010	0.019	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
Sum List 1	ND	ND	0.36	0.17	0.0055	0.0075	ND	ND
2,3-Benzofuran	DLND	DLND	0.041	0.023	0.021	0.051	DLND	DLND
2,3-Dihydroindene	0.090	0.024	0.054	0.046	0.12	0.098	0.0045	0.0043
Indene	<0.020	<0.010	0.064	0.058	0.080	0.14	0.0058	0.0048
Naphthalene	<0.038	<0.019	<0.019	<0.019	0.052	0.048	0.026	0.017
Benzo(b)thiophene	0.091	0.072	0.21	0.21	0.027	0.030	0.012	0.011
Isoquinoline	DLND	DLND	0.27	0.30	DLND	DLND	DLND	DLND
Indole	<0.058	<0.029	<0.029	<0.029	<0.0029	<0.0029	<0.0029	<0.0029
2-Methylnaphthalene	<0.040	<0.020	<0.020	<0.020	<0.0020	<0.0020	0.035	0.0047
1-Methylnaphthalene	<0.020	<0.010	0.18	0.16	0.019	0.015	0.017	0.0026
Biphenyl	<0.020	<0.010	0.060	0.049	0.0055	0.0049	0.0018	0.0012
Acenaphthylene	0.041	0.030	1.1	0.94	0.018	0.021	<0.0010	<0.0010
Acenaphthene	0.20	0.040	0.47	0.41	0.54	0.56	<0.0013	<0.0013
Dibenzofuran	0.17	<0.020	0.67	0.59	0.16	0.17	<0.0020	<0.0020
Fluorene	0.20	<0.014	0.65	0.55	0.14	0.12	<0.0014	<0.0014
Dibenzothiophene	0.14	0.085	DLND	0.039	0.0066	0.0056	DLND	DLND
Phenanthrene	<0.020	<0.010	0.067	0.011	0.026	0.025	<0.0010	0.0023
Anthracene	<0.020	<0.010	0.13	0.11	0.005	0.0082	<0.0010	<0.0010
Acridine	<0.036	<0.018	0.30	0.22	<0.0018	<0.0018	<0.0018	<0.0018
Phenanthridine	<0.028	<0.014	0.20	0.14	<0.0014	<0.0014	<0.0014	<0.0014
Carbazole	<0.022	<0.011	0.36	0.24	0.073	0.070	<0.0011	<0.0011
Fluoranthene	0.058	0.026	0.70	0.52	0.051	0.061	<0.0010	<0.0010
Pyrene	0.16	0.093	0.45	0.33	0.034	0.044	<0.0010	<0.0010
Triphenylene	<0.020	<0.010	0.060 c	0.030 c	0.0055 c	0.0075 c	<0.0010	<0.0010
Benzo(k)fluoranthene	<0.020	<0.010	0.066 c	0.025 c	<0.0010	<0.0010	<0.0010	<0.0010
7,12-Dimethylbenz(a)anthracene	DLND	DLND	DLND	DLND	DLND	DLND	DLND	DLND
Benzo(e)pyrene	<0.020	<0.010	0.030	0.016	<0.0010	<0.0010	<0.0010	<0.0010
Perylene	<0.020	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.0010	<0.0010
3-Methylcholanthrene	DLND	DLND	DLND	DLND	DLND	DLND	DLND	DLND
Sum List 2	1.2	0.37	6.0	5.0	1.4	1.5	0.10	0.048

c Coeluting isomer. Concentration reported is total of the coeluting compound.

ND None detected.

DLND Not detected. Detection limit not determined.

.008

TABLE 10
STATISTICAL ANALYSIS
BLIND DUPLICATE SAMPLES
PAH COMPOUNDS

<u>Station</u>	<u>Sampling Date</u>	<u>Coefficient of Variation</u>
SEEP-1	12/16/87	0.25
CP-2	03/29/88	0.48
W-11	06/07/88	0.30
WM-1	09/06/88	0.16

Figures

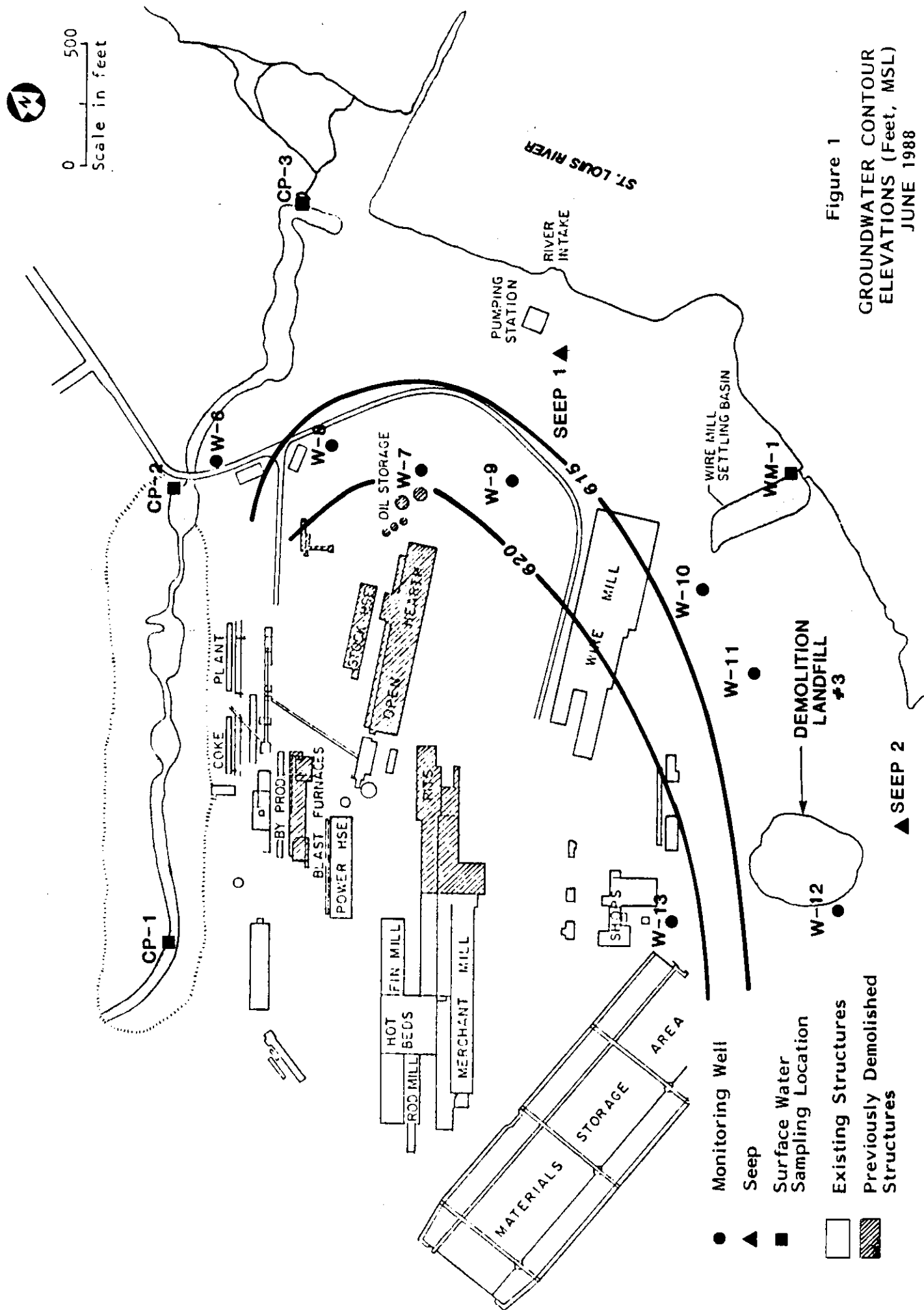


Figure 1
 GROUNDWATER CONTOUR
 ELEVATIONS (Feet, MSL)
 JUNE 1988

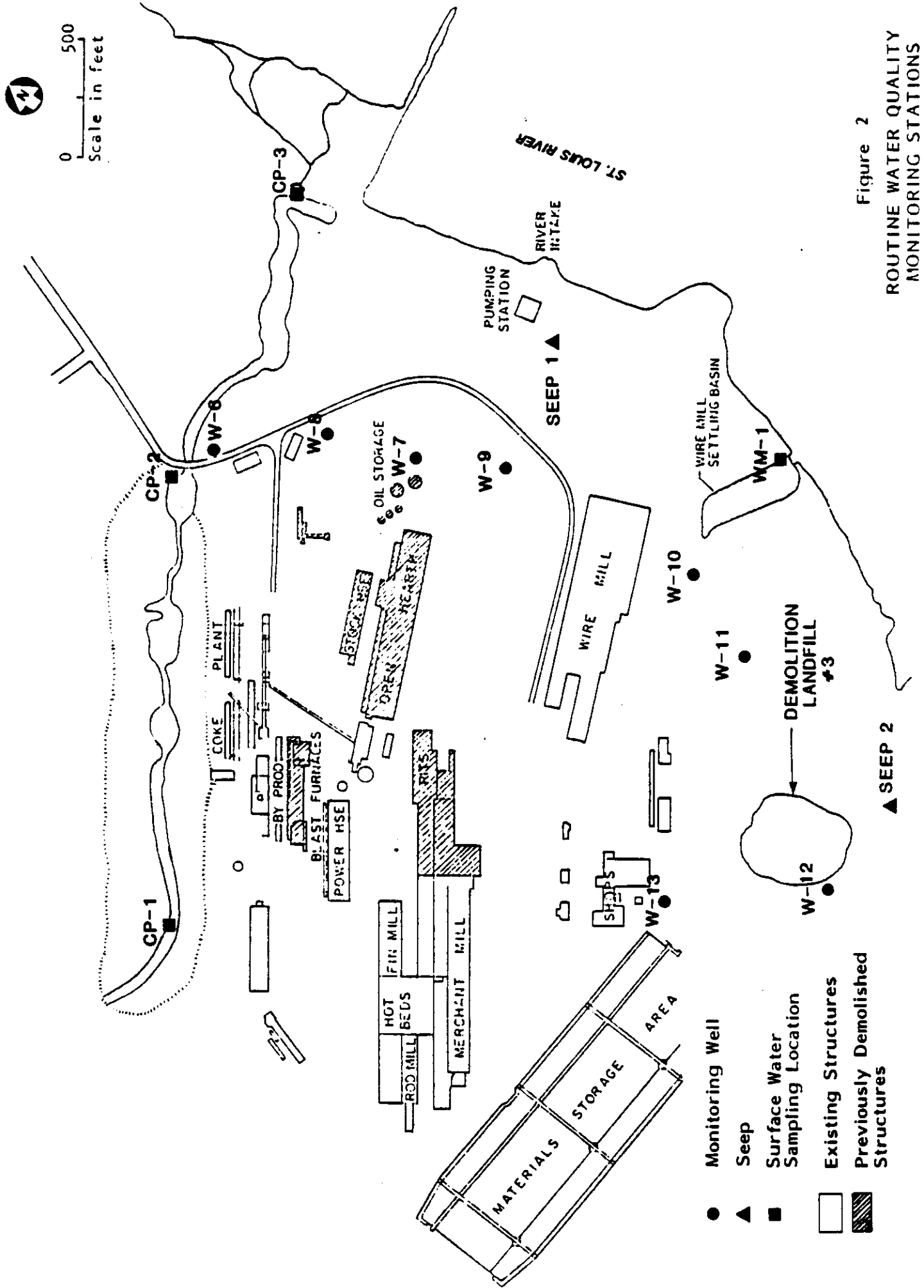
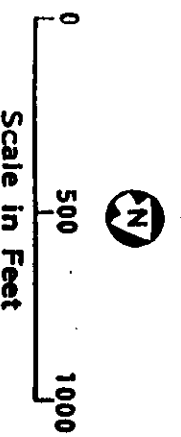
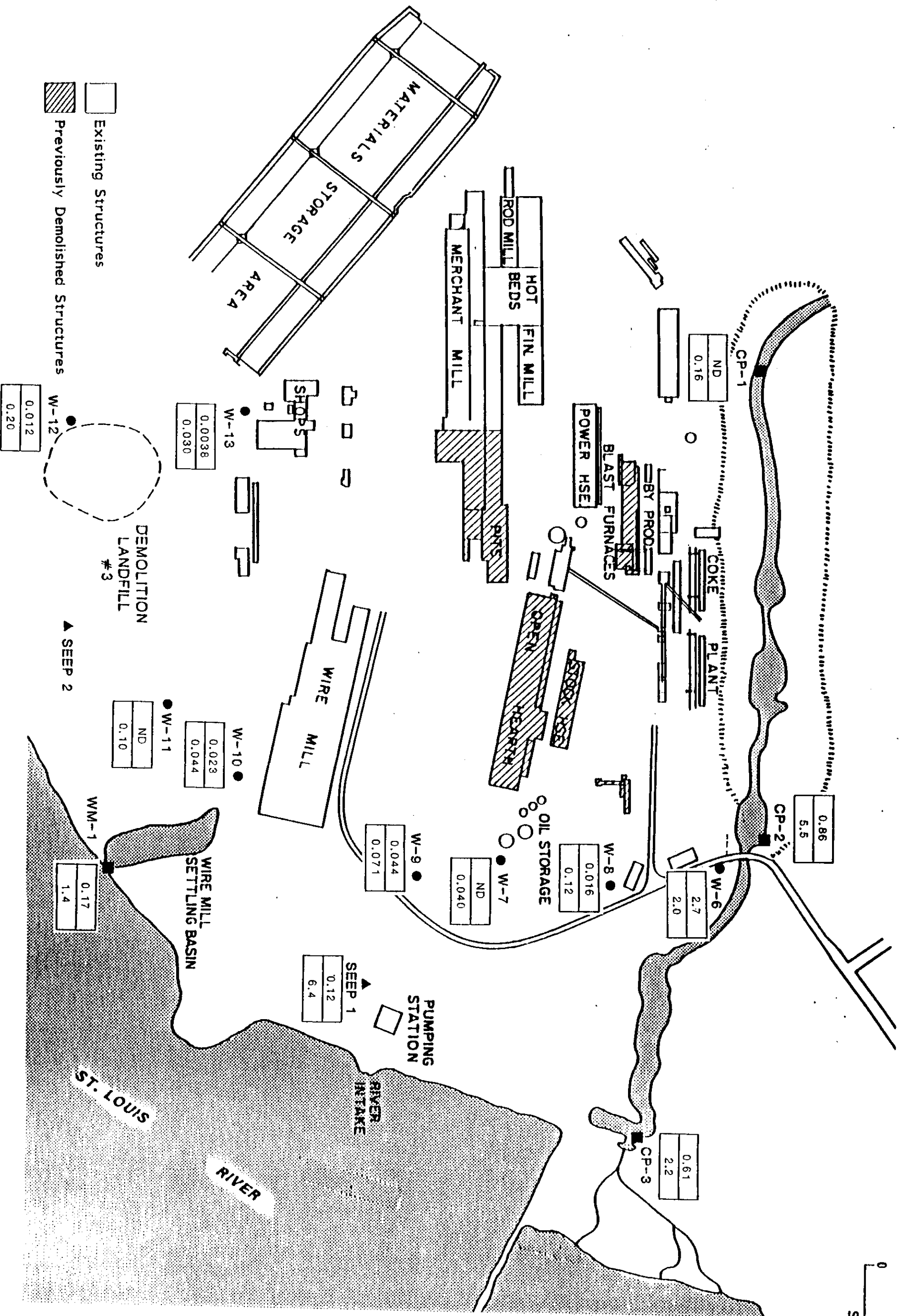


Figure 2
ROUTINE WATER QUALITY
MONITORING STATIONS

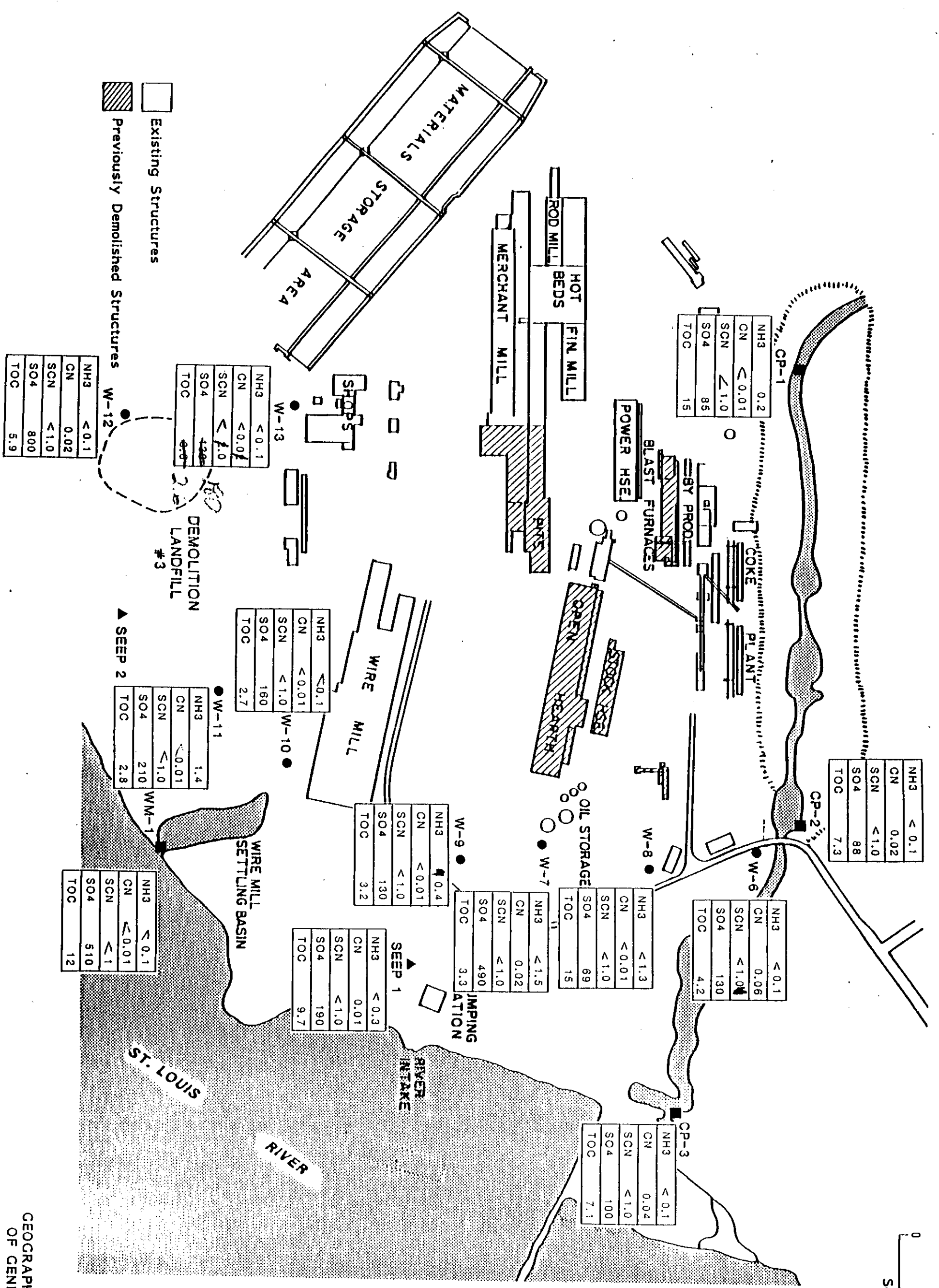


Sum List 1 Compounds (ug/L)
 Sum List 2 Compounds (ug/L)
 ND Not Detected

Figure 3
 GEOGRAPHICAL DISTRIBUTION
 OF PAH COMPOUNDS
 June, 1988



0 500 1000
Scale in Feet

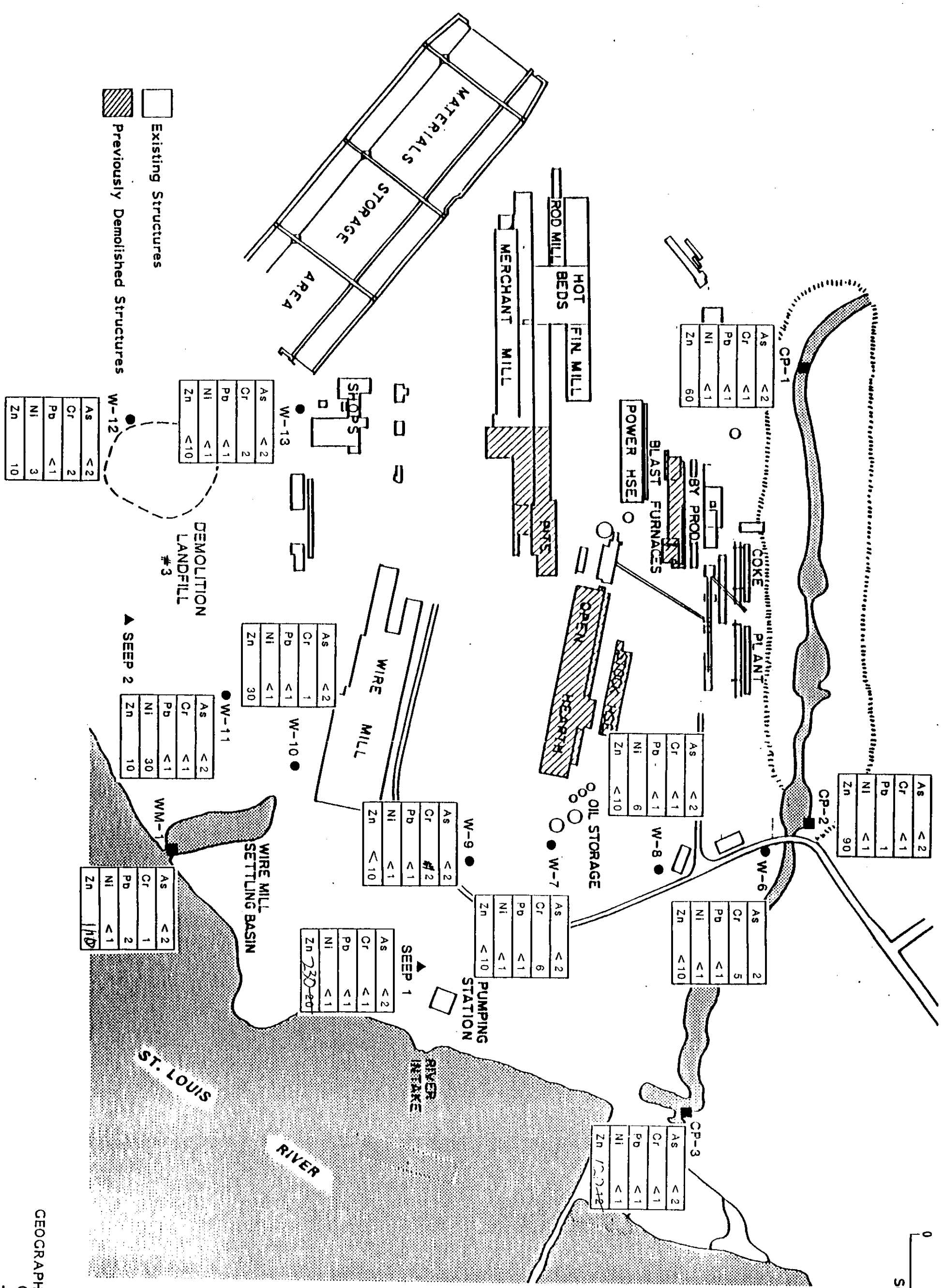


NH3 = Ammonia-Nitrogen
CN = Total Cyanide
SCN = Thiocyanate
SO4 = Sulfate
TOC = Total Organic Carbon
Concentration in mg/L

Figure 4
GEOGRAPHICAL DISTRIBUTION
OF GENERAL PARAMETERS
June, 1988



0 500 1000
Scale in Feet



As=	Arsenic
Cr=	Chromium
Pb=	Lead
Ni=	Nickel
Zn=	Zinc

Concentration in ug/L

Existing Structures
Previously Demolished Structures

As	< 2
Cr	2
Pb	< 1
Ni	3
Zn	10

As	< 2
Cr	2
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	30

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

As	< 2
Cr	1
Pb	< 1
Ni	< 1
Zn	< 10

Figure 5
GEOGRAPHICAL DISTRIBUTION
OF METALS
June, 1988