WATER QUALITY STATUS REPORT

Aquatic Monitoring
South Fork
Coeur d'Alene River Basin
Industrial Source Evaluation
&
Receiving Water Survey

Division of Environment
Idaho Dept. of Health & Welfare
Coeur d'Alene, Idaho

March 1975

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INTRODUCTION

The South Fork Coeur d'Alene River has been studied by the Idaho Department of Health and Welfare, Division of Environment, in the past with numerous water quality surveys. Survey data prior to 1973 primarily addressed qualitative pollutant loading The quantitative determination of total pollutant loading was not assessed in studies prior to 1973. In order to determine the quantitative point source additions of critical heavy metals and nutrients, comprehensive water quality studies were conduct in 1973 and 1974. Point source loadings were determined for the major industrial discharges in the South Fork basin. River sampling to assess receiving water impact was studied in conjunction with the point source determinations. The Environmental Services Division has conducted surveys on water quality that date back as far as December 1962 to as recent as March 1975. Since March 1972 three permanent river monitoring stations are sampled monthly in the basin. Limited and incomplete flow data in past studies prevents any meaningful interpretation of quantitative loading from previous studies.

Point Sources

Point source evaluations included major industries involved with the mining, milling and smelting of primarily lead, zinc, silver and antimony. Six major industrial facilities were monitored and included Hecla Mining Company with five discharges, ASARCO Company with one discharge, Sunshine Mining Company with one discharge, Bunker Hill Company with six discharges in 1973 and four discharges in 1974, Day Mines with one discharge, and Rex Mine and Mill with one discharge.

Hecla operates a number of mines and milling operations in the upper reaches of the SF Coeur d'Alene River valley. They are involved in the mining and milling of hard rock lead and zinc ores. Major milling operations are located at the Lucky Friday and Star Mines. Milling involves the flotation-concentration process and constitute

the major water use for the Hecla facilities. Two tailing pond areas are currently being utilized to treat the mill waste streams from the Lucky Friday operation. A series of tailing ponds (Star Ponds) is currently in use to treat the waste streams from the Hecla mill. Mine water drainage from the Lucky Friday and Star-Morning min is routed to the tailing ponds. Mine drainage from the Morning Tunnel #6 is discha to Slaughter House Creek. Treatment involves settling and the use of various floccu ating agents to facilitate metal precipitation. Hecla maintains the Consolidated Silver Mine which is currently inactive. Consolidated Silver has a mine water discharge that enters the SF Coeur d'Alene at Terror Gulch. The consolidated silver discharge receives no treatment.

Day Mine & Mill and the Rex Mine and Mill on the upper reaches of 9-mile Creek. Bot operations mine and mill hard rock lead-zinc ores and utilize tailing ponds for thei mill and mine wastewater. Treatment involves settling and the use of flocculation agents to facilitate metal precipitation.

Sunshine Mining Company operates the largest silver producer in the United States. The operation involves hard rock silver-lead-zinc mining. The milling process involves the flotation-concentration process. The major wastewater volumes arise from the milling operation and an antimony plant that processes concentrated materia The wastewaters are routed to a large tailings pond located near the mouth of Big Cr Treatment involves settling and flocculating agents are added to precipitate heavy metals.

American Smelting and Refining Company (ASARCO) operate mines and a mill on Lake Creek. They process hard rock-silver ores in a flotation concentration mill. Major waste water sources arise from the milling process and mine waters. The wastewaters are routed to the Galena tailings ponds located on Lake Creek and to a new tailings pond located on the SF Coeur d'Alene near Osburn. Treatment involves only settling and no additional treatment has been incorporated.

Bunker Hill Company is the major mining, milling and smelting operation in the SF Coeur d'Alene valley. They operate several mines as hard rock, lead, zinc and other metal sources. A large lead smelter, zinc smelter, zinc plant, and phosphate plant are operated by Bunker Hill in addition to mining operations. The lead and zinc smelters are the only facilities of this nature in the area and are used to smelt concentrates from other mills in the valley as well as other sources. Major wastewa sources arise from the zinc & lead mills and the phosphate plant. Significant mine waters arise from the Reed Tunnel, the Main Mine Portal, and the Crescent Mine. Crescent Mine waters are routed to the Sunshine tailings pond and the other waste-waters, with the exception of the Zinc Plant drainage, are routed to the Central Impounding Area (CIA). The CIA functions as a large tailings pond for mine and process wastewaters. Discharge from the CIA is treated with a lime flocculation process followed by clarification with PH adjustment and sludge removal.

Sampling Stations:

Point Source Stations	Parameter Analysis			
HECLA FACILITIES				
Lucky Friday Mine	Heavy Metals,		Nutrients,	Flow
Lucky Friday Tailing Ponds #1 & 2	"	"	"	"
Morning Mine Tunnel #6	"	"	"	"
Star Tailing Ponds	"	"	"	"
Consolidated Silver Mine	"	"	"	"
ASARCO FACILITIES				
Galena Tailing Pond	"	"	"	"
SUNSHINE FACILITIES				
Sunshine Tailing Pond	Heavy Metals, Flow, Antimony		Nutrients,	Arsenic,
BUNKER HILL FACILITIES				
Crescent Mine	Heavy Metals,		Nutrients,	Flow
Zinc Plant Cement Pipe	"	"	"	"
Reed Tunnel	"	"	"	"
Sweeney Ponds	"	"	"	"
CIA Effluent	"	"	"	"
DAY MINE				
Tailing Pond	"	"	"	"
REX MINE & MILL				
Tailing Pond	"	"	"	"

In the 1973 and 1974 studies an assessment of river loadings was determined at select stations for heavy metals and nutrients in order to assess the impact on the SF Coeur d'Alene River.

STREAM STATION

SF Coeur d'Alene above Mullan

SF Coeur d'Alene above Wallace

Canyon Creek

9-Mile Creek

SF Coeur d'Alene above Lake Creek

Lake Creek

SF Coeur d'Alene above Big Creek

Big Creek

SF Coeur d'Alene above Bunker Hill Tailing Ponds

Bunker Creek

Silver King Creek

SF Coeur d'Alene at Smelterville USGS Station

Pine Creek

SF Coeur d'Alene at Enaville (mouth)

Coeur d'Alene River at Enaville

Coeur d'Alene River at Cataldo

The purpose of this continuing surveillance program is to determine the pollutant loading of individual discharges and to assess the load to the free flowing river. The studies completed to date will provide a base of comparison of water quality effects from point sources and be used to differentiate point source and non point source loading within the basin. They will also provide a base to compare point sc efficiency and compliance with effluent discharge permits.

METHODS

Water samples for routine chemical analysis were collected in one-liter nalgene bottles at each stream station. Heavy metals were collected in 150 Ml. nitric acic rinsed glass bottles and preserved with 2 ml. of nitric acid. During both surveys grab samples were utilized for the routine and heavy metal analysis.

Water samples for routine chemistry were analyzed for turbidity (Turb.), acidity (P total solids (TS), ammonia (NH_3), nitrite (NO_2), ortho phosphate ($O\text{-}PO_4$), specific conductance (Sp. Cond.), alkalinity (Alk.), iron (Fe), sodium (NA), chloride (Cl), sulphate (SO_4), potassium (K), suspended solids (SS), settable solids (Set.S), and total phosphorus (TP).

Total concentrations of metals zinc (Zn), lead (Pb), cadmium (Cd), antimony (Sb), copper (Cu), and silver (Ag) were determined by the use of atomic absorption techniques and all other ions were analyzed with wet chemistry according to Standar Methods. All samples for chemical and metal analysis were determined at the state analytical laboratory in Boise.

In the 1973 survey the point source samples were determined based on flows submitt in NPDES field worksheets on data submitted by the respective dischargers. In 197 point source flows were determined by measurement and calculation of established weirs or conventional methods where measuring weirs were not present. Stream flow measurements were determined in 1973 from USGS stream flow records in the main ste South Fork and by standard gaging and flow methods in the tributaries. In 1974 st flow measurements were determined at all stream stations by the use of gaging and current meters.

Bacteriological water quality was determined for selected river stations. Samples were analyzed for total and fecal coliforms. Bacteriological samples were collect in sterile 125 ml. sterilized glass containers, iced and analyzed within 8 hours a collection. The bacteriological samples were analyzed in the regional laboratory Coeur d'Alene.

RESULT AND DISCUSSION

Point Source Effluent Chemistry

Heavy metal concentrations arising from mining activities have been identified as the major water quality pollutants in the SF Coeur d'Alene River basin. This report addresses those heavy metals of major significance and include concentrations and loading of zinc (Zn), lead (Pb), cadmium (Cd), and antimony.

Nutrients in the form of nitrates (NO_3) and phosphates ($O\text{-}PO_4$) were determined for each of the industrial point sources. The results of the heavy metal and nutrient analysis for each point source discharge sampled are shown in Table 1 and 1A for the 1973 survey and in Tables II and IIA for the 1974 survey. The concentration in part per million (PPM) and the pounds per day (#/day) loading are indicated on the respective tables.

A comparison of total load (Tables III & IV) from all point sources in the survey shows a net improvement in pounds of pollutants discharged. This can be accounted for by the significant reductions at the major discharger Bunker Hill for zinc, lead and cadmium and Sunshine for antimony. Total basin load from all the point sources shows a net reduction in 1974 of 94.6% for zinc, 86.6% for lead, 75.8% for cadmium and 51.1% for antimony.

Nutrient reductions from all point sources show a net reduction in total nitrates and phosphates. Significant nitrate reductions are noted from Sunshine and Bunker Hill operations. O-phosphate net reductions for all point sources show a net reduction of 99.6%. Bunker Hill facilities account for 99.7% of the total O-phospha removal. In the 1974 survey the nutrient load from point sources amounted to 607.5 pounds of nitrates and 40.8 pounds of o-phosphates with respective net improvements 1973 of 84.4% and 99.6% respectively. Bunker initiated treatment in April of 1974 the operation of a lime flocculating and clarification system.

1973 SURVEY

	Zn		Pb		Cd		Sb		NO3		O-PO4		Flow (MGD)
	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	
Hecla Facilities													
Lucky Friday Mine Eff.	.288	.93	2.48	8.05	.001	.003	.02	.06	25.0	81.1	.01	.03	.389
Lucky Friday Tailing Pond	.109	.72	.30	1.98	.001	.007	.02	.13	3.9	25.7	.62	4.1	.790
Morning Mine Tunnel #6	1.799	2.40	1.50	2.00	.001	.001	.10	.13	2.2	2.9	1.04	1.39	.16
Star Ponds Effluent	.503	9.61	.29	5.54	.001	.019	.02	.38	17.0	325	.01	.19	2.29
Consolidated Silver. Eff.	.005	.04	.01	.07	.001	.007	.02	.14	2.0	14.4	.07	.50	.864
ASARCO Facility													
Galena Mine & Mill Pond Tailing	.021	.20	.01	.09	.001	.009	.02	.19	21	203	.02	.19	1.16
Sunshine													
Sunshine Tailing Pond	.005	.06	.01	.13	.001 As 10.67	.012 137.9	35.3	456.3	190	2,456	1.26	16.3	1.55
Leakage	.001		.01		.001 As 6.00		28.4		-		-		

1973 SURVEY

	Zn		Pb		Cd		Sb		NO_3		O-PO_4		Flow (MGD)
	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	ppm	#/day	
Bunker Hill													
Crescent Mine	.034	.20	.16	.96	.001	.006	.02	.12	18.5	111.1	.01	.06	.72
Reed Tunnel	66.90	273.4	3.14	12.8	.138	.56	.02	.08	10.5	42.9	.19	.78	.49
Zinc Plant Cement Pipe	556.2	6679.7	1.21	14.5	2.670	32.1	.40	4.8	3.5	42.0	.76	9.13	1.44
Zinc Plant Cement Plant Slug	727.2	8733.4	.16	1.9	2.711	32.2	.28	3.4	-	-	-	-	1.44
Sweeney Pond	467.4	15,865	3.85	130.7	3.257	110.5	.92 (Hg 48.0)	31.2 (1629)	1.5	50.9	.01	.34	4.07
CIA Effluent	98,8	3,658	1.49	55.2	1.018	37.7	.22 (Hg.24)	8.1 (8.9)	14.0	518	274	10.146	4.44
Day-Rock Mine													
Tailing Pond	.088	.21	.01	.02	.001	.002	.02	.048	7.8	18.9	.01	.02	.29
Rex Mine & Mill													
Effluent	9.60	8.0	.01	.008	.001	.0001	.02	.02	-		-		.10

POINT SOURCES

1974 SURVEY

	Zn ppm	Zn #/day	Pb ppm	Pb #/day	Cd ppm	Cd #/day	Sb ppm	Sb #/day	NO_3 ppm	NO_3 #/day	O-PO_4 ppm	O-PO_4 #/day	Flow (MGD)
Hecla Facilities													
Lucky Friday Tailing Pond #2	.113	.009	.54	.05	.005	Nil	.1	.008	12.7	1.06	.09	.008	.01
Lucky Friday Tailing Pond #1	.157	.59	.18	.67	.004	.015	.1	.38	4.6	17.3	.09	.34	.45
Morning Mine Tunnel #6	2.59	2.59	.25	.25	.011	.01	.1	.10	4.9	4.9	.08	.08	.12
Star Pond Effluent	2.32	44.5	.42	8.06	.034	.65	Nil	Nil	12	230	.04	.77	2.3
Consolidated Silver	.005	.02	.01	.03	.002	.006	.1	.32	1.2	3.8	.01	.03	.38
Asarco Facility													
Galena Mine & Mill Pond	.026	.06	.01	.02	.001	.002	.1	.23	22.7	51.1	.01	.02	.27
Sunshine													
Sunshine Tailing Pond	.028	.40	.01	.14	.001	.014	16.4 As .10	236.6 30.3	1.0	14.4	2.0	28.8	1.73
So. Seep	.48		.01		.001		5.0 As 5.80						
No. Seep	.018		.01		.001		0.5 As 1.90						

POINT SOURCES

1974 SURVEY

	Zn ppm	Zn #/day	Pb ppm	Pb #/day	Cd ppm	Cd #/day	Sb ppm	Sb #/day	NO_3 ppm	NO_3 #/day	O-PO_4 ppm	O-PO_4 #/day	Flow (MGD)
Bunker Hill													
Crescent Mine	.014	.014	.01	.01	.001	.001	.1	.1	-		-		.12
Reed Tunnel	No Discharge - to CIA												-
Zinc Plant Cement Pipe	98.1	1759	.81	14.5	2.67	47.9	.1	1.79	2.74	49.4	.21	3.77	2.15
Sweeney Ponds	No Discharge - to CIA												-
Water Reservoir	25.1	33.5	.01	.013	.055	.07	.1	.13	-		-		.16
CIA Effluent	1.09	84	.10	7.7	.038	2.93	.1	7.7	3.06	235.8	.09	6.9	9.24
Day Rock Mine	No Discharge												-
Rex Mine & Mill	No Sample												

TABLE III

POINT SOURCE LOADING

POUNDS/DAY

	1973 Survey						1974 Survey					
	Zn	Pb	Cd	Sb	NO_3	O-PO_4	Zn	Pb	Cd	Sb	NO_3	O-PO_4
Hecla Facilities	13.70	17.64	.04	.84	449	6.21	47.7	9.06	.68	.81	257	1.23
Asarco Facilities	.20	.09	Nil	.19	203	.19	.06	.02	Nil	.23	51.1	.02
Sunshine Facilities	.06	.13	.012 (As 137.9)	456.3	2,456	16.3	.40	.14	.014 (As 30.3)	236.6	14.4	28.8
Bunker Hill Facilities	35,210	216.1	213.1 (Hg 1,638)	47.7	765	10,156	1,878	22.2	50.9 (Hg .08)	9.72	285	10.7
Day Rock Facility	.21	.02	Nil	.048	18.9	.02	No Discharge					
Rex Mine & Mill	9.60	Nil	Nil	.02	-	-	Not Sampled					
Total Load	35,234	213.2	213.2	506	3,892	10,179	1,926	31.4	51.6	247.4	607.5	40.8

POINT SOURCE

COMPARATIVE LOADINGS

POUNDS/DAY

	Zn	Pb	Cd	Sb	NO_3	PO_4
Hecla Facilities						
1973	13.7	17.64	.04	.84	449	6.21
1974	47.7	9.06	.68	.81	257	1.23
% Change	-71.3	51.3	-94.2	3.6	43.8	80.2
Asatco Facilities						
1973	.20	.09	Nil	.19	203	.19
1974	.06	.02	Nil	.23	51.1	.02
% Change	70	78	-	-17.4	74.9	89.5
Sunshine Facilities						
1973	.06	.13	.012 (As 137.9)	456.3	2456	16.3
1974	.40	.14	.014 (As 30.3)	236.6	14.4	28.8
% Change	-85	-8	-14.3 (78.1)	49.2	99.5	-43.5
Bunker Hill Facilities						
1973	35,210	216.1	213.1 (Hg 1,638)	47.7	765	10,156
1974	1,878	22.2	50.9 (Hg .08)	9.72	285	10.7
% Change	95.5	89.8	76.2 99.9	79.7	62.8	99.9
Day Rock						
1973	.21	.02	Nil	.02	18.9	-
1974	-	-	-	-		-
Rex Mine & Mill						
1973	9.60	Nil	Nil	.02	-	-
1974	-	-	-	-	-	-
Total Load						
1973	35,234	234	213.2	506	3,892	10,179
1974	1,926	31.4	51.6	247.4	607.5	40.8
% Change	94.6	86.6	75.8	51.1	84.4	99.6

RIVER SAMPLING

Physical data relating temperature (T), acidity (PH), turbidity (Turb) and specific conductance (Sp. Cond.) were determined for fourteen surface water stations in 1974 and are shown in Table V. River stations show a gradually increasing temperature moving downstream from the SF at Mullan to Cataldo. Ambient river temperature almo doubles by the time it reaches the SF mouth. PH values show a fairly constant valu in the main river but noted differences occur in some tributary streams. Lake Cree and Silver King show extremes of 8.1 and 4.9 respectively. Turbidity values remain fairly constant with the exception of the South Fork above Wallace and the tributar of Bunker Creek and Silver King Creeks which showed high turbidity levels. Specifi conductance levels are low in the station above Mullan and gradually increase at successive downstream stations to above Bunker Hill. Specific conductance increase significantly at stations below Bunker Hill and Silver King and Bunker Creeks which account for a majority of the increase. Specific conductance levels are appreciabl reduced by the dilution of the main Coeur d'Alene River by the time it reaches Cata

Heavy metal and nutrient load were calculated for the fourteen surface water statio and are shown in Tables VI and VII for 1973 and 1974. Concentrations and load in pounds per day were calculated for zinc, lead, cadmium, antimony, and nutrients. A basin profile using eight SF rivers stations was determined for each of the heavy metals (Zn, Pb, Cd) and the nutrients (NO_3 and $O\text{-}PO_4$). Basin profiles for individu metals comparing 1973 and 1974 data are shown in Figure I for zinc, Figure II for lead and Figure III for cadmium. In the SF the metals all show the same general trend in terms of concentration. Metal levels in the headwaters of the SF are low until the entry of Canyon and 9-mile Creeks where a moderate increase occurs. Meta

TABLE V

RIVER STATIONS

1974 SURVEY

Station	Temp. (C°)	pH	Turb.	Sp. Cond.
SF Above Mullan	7.2	7.3	3.5	34
SF Above Wallace	9.0	7.1	8	66
Canyon Creek	9.7	7.0	2	96
9-Mile Creek	10.3	6.8	2.5	70
SF Above Lake Creek	10.4	7.2	3	81
Lake Creek	12.2	8.1	3	120
SF Above Big Creek	12.5	7.2	4	86
Big Creek	11.2	7.6	3	77
SF Above Bunker Hill	12.5	7.6	3	89
Silver King Creek	18.0	4.9	15	650
Bunker Creek	19.5	6.5	30	2,300
SF at Smelterville U.S.G.S. Station	13.3	6.9	4.5	230
SF at Mouth	13.5	7.1	4	210
CDA River at Cataldo	14.0	6.7	2.5	97

RIVER STATIONS

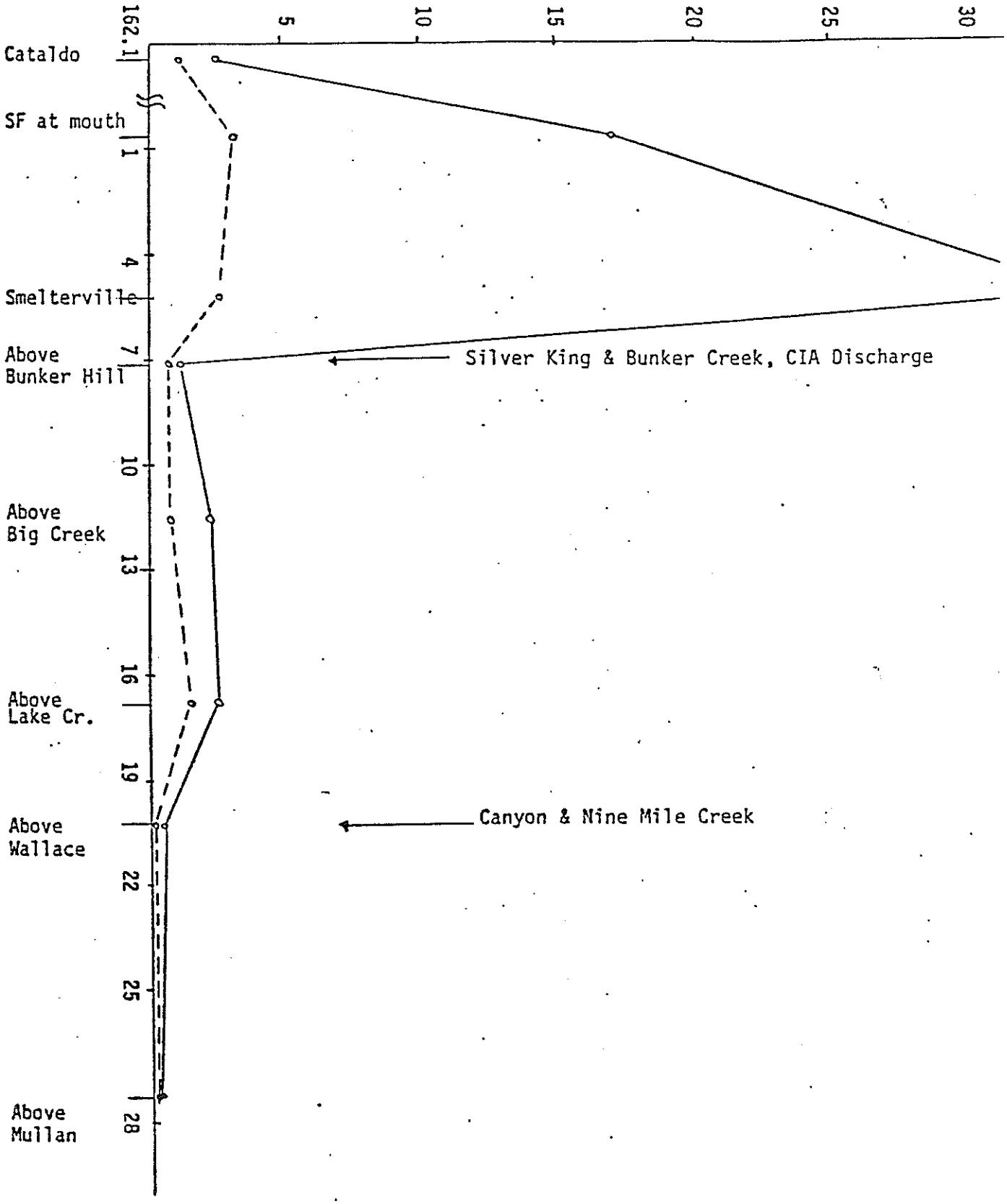
1973 SURVEY

Station	Zn ppm	Zn #/day	Pb ppm	Pb #/day	Cd ppm	Cd #/day	Sb ppm	Sb #/day	NO_3 ppm	NO_3 #/day	O-PO_4 ppm	O-PO_4 #/day	Flow (cfs)
SF Above Mullan	.037	11.2	.01	3.0	.001	.3	-	-	.1	30.2	.06	18.1	36.2
SF Above Wallace	.332	121.5	.01	3.7	.001	.37	-	-	-		-		43.9
Canyon Creek	9.45	457.1	.22	10.6	.036	1.74	.24	11.6	3.9	188.6	.10	.48	5.8
9-Mile Creek	6.05	50.5	.16	2.56	.013	.21	.02	.32	3.9	62.4	.02	.32	1.92
SF Above Lake Creek	2.5	1,078	.01	4.3	.01	4.3	-	-	-		-		51.7
Lake Creek	.034	.87	.01	.26	.001	.03	.02	.52	-		-		3.1
SF Above Big Creek	2.24	1,048	.01	4.7	.01	4.7	.02	9.4	-		-		56.1
Big Creek	Not Sampled												
SF Above Bunker Hill Ponds	1.21	1,019	.05	42.1	.01	8.4	.01	8.4	-		-		101
Bunker Creek	119.5	1,914	.88	14.1	1.267	20.3	1.02	16.3	4.3	68.9	1.40	22.4	1.92
Silver King Creek	63.59	4,773	2.83	212.4	1.950	146.4	.50	37.5	3.5	262.7	2.30	358.7	9.0
Smelterville U.S.G.S Station	38.48	29,974	.62	483	.299	233	-		.9	701	1.79	1,394	93.4
Pine Creek	Not Sampled												
SF At Mouth	17.05	16,167	.48	455	.173	164	.02	18.8	.6	569	1.92	1,821	113.7
CDA at Enaville	.013	43.2	.01	33.3	.001	Nil	-	-	.1	333	.08	266	399
CDA at Cataldo	2.83	12,509	.13	575	.009	39.8	-	-	.1	442	.14	619	530

RIVER STATIONS

1974 SURVEY

Station	Zn ppm	Zn #/day	Pb ppm	Pb #/day	Cd ppm	Cd #/day	Sb ppm	Sb #/day	NO3 ppm	NO3 #/day	O-PO4 ppm	O-PO4 #/day	Flow (MGD)
SF Above Mullan	.009	8.26	.01	9.17	.001	.92	.01	9.1	.05	45.9	.09	82.5	110
SF Above Wallace	.130	171	.01	13.2	.001	1.32	.1	132	.16	211	.04	52.7	158
Canyon Creek	1.760	1,403	.18	144	.014	11.2	.1	79.7	.05	39.9	.04	31.9	95.6
9-Mile Creek	1.970	319	.17	27.5	.012	1.9	.1	16.2	.05	8.1	.04	6.5	19.4
SF Above Lake Cr.	.780	1,808	.06	139	.007	16.3	.1	232	.02	46.4	.09	209	278
Lake Creek	.028	1.1	.01	.37	.001	.04	.1	3.8	1.80	67.6	.06	2.3	4.5
SF Above Big Cr.	.983	2,357	.09	216	.007	16.8	.1	240	.05	120	.08	192	287.5
Big Creek	.010	5.7	.01	5.7	.001	.57	.52 As.063	297 36	.09	51.4	.10	57.1	68.5
SF Above Bunker Hill Ponds	.916	2,764	.09	271.5	.001	3.0	.1	302	.08	241	.06	181	361.8
Bunker Creek	9.870	638	.53	34.3	.094	6.1	.1	6.5	2.61	168.7	.29	45.3	7.75
Silver King Cr.	49.600	1,861	.38	14.3	1.125	42.2	.1	3.8	3.16	118.6	.30	11.3	4.5
SF Smelterville U.S.G.S. Station	2.880	9,007	.08	250	.025	78.2	.1	312.8	.20	625.5	.12	375.3	375
Pine Creek	.136	64.4	.01	4.7	.001	.47	.1	47.4	.01	4.7	.07	33.1	56.8
SF at Enaville	3.195	11,876	.15	557.5	.027	100.4	.1	372	.04	148.7	.09	334.5	445.7
CDA at Enaville	.004	24.7	.01	61.7	.002	12.3	.01	61.7	.05	308.6	.07	432	739.7
CDA at Cataldo	1.140	11,266	.03	45.4	.012	118.6	.01	98.8	.26	2,570	.07	692	1,185


5
10
15
20
25
30
162.1
Cataldo
SF at mouth
1
4
Smelterville
7
Above
Bunker Hill
Silver King & Bunker Creek, CIA Discharge
10
Above
Big Creek
13
16
Above
Lake Cr.
19
Canyon & Nine Mile Creek
Above
Wallace
22
25
Above
Mullan
28

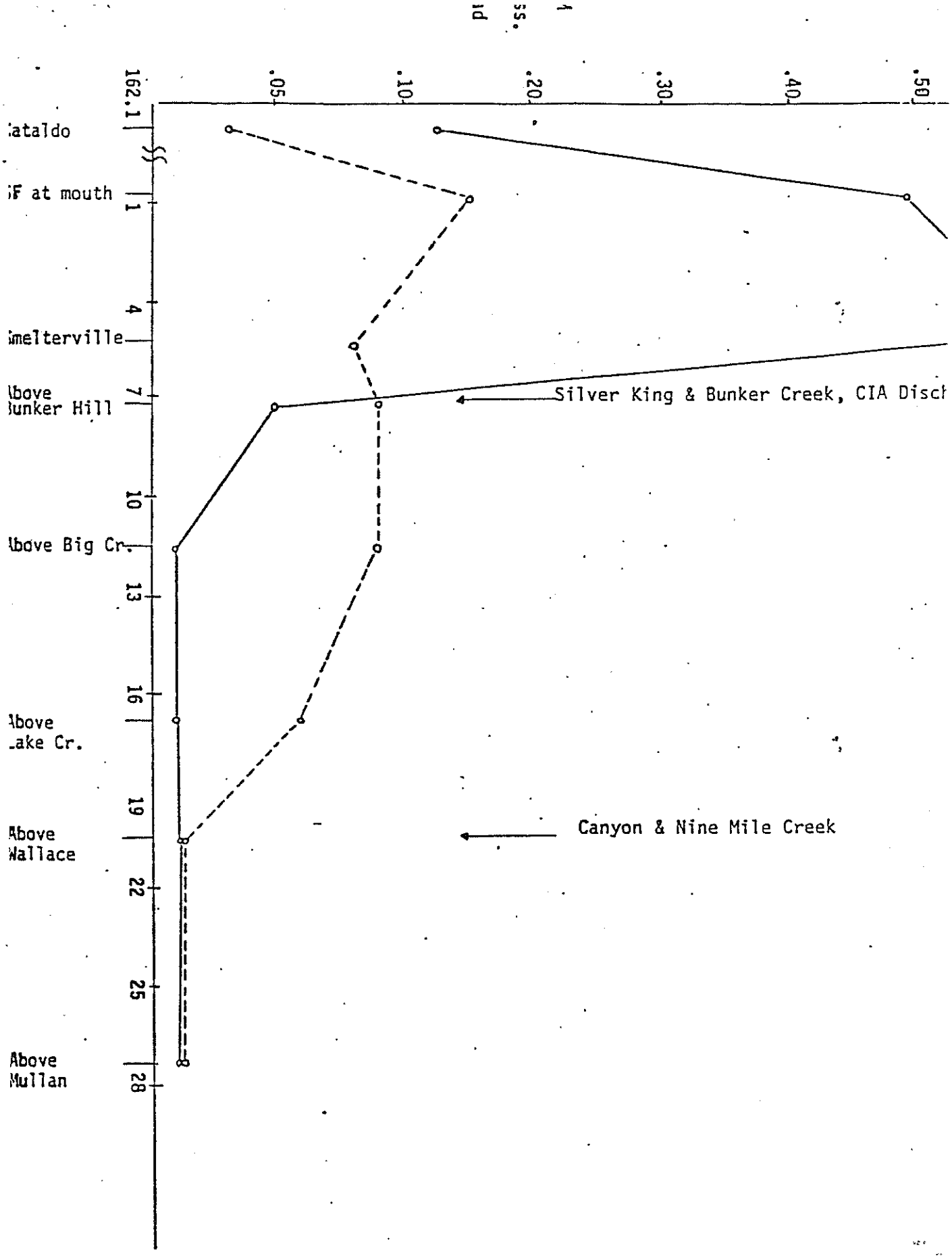
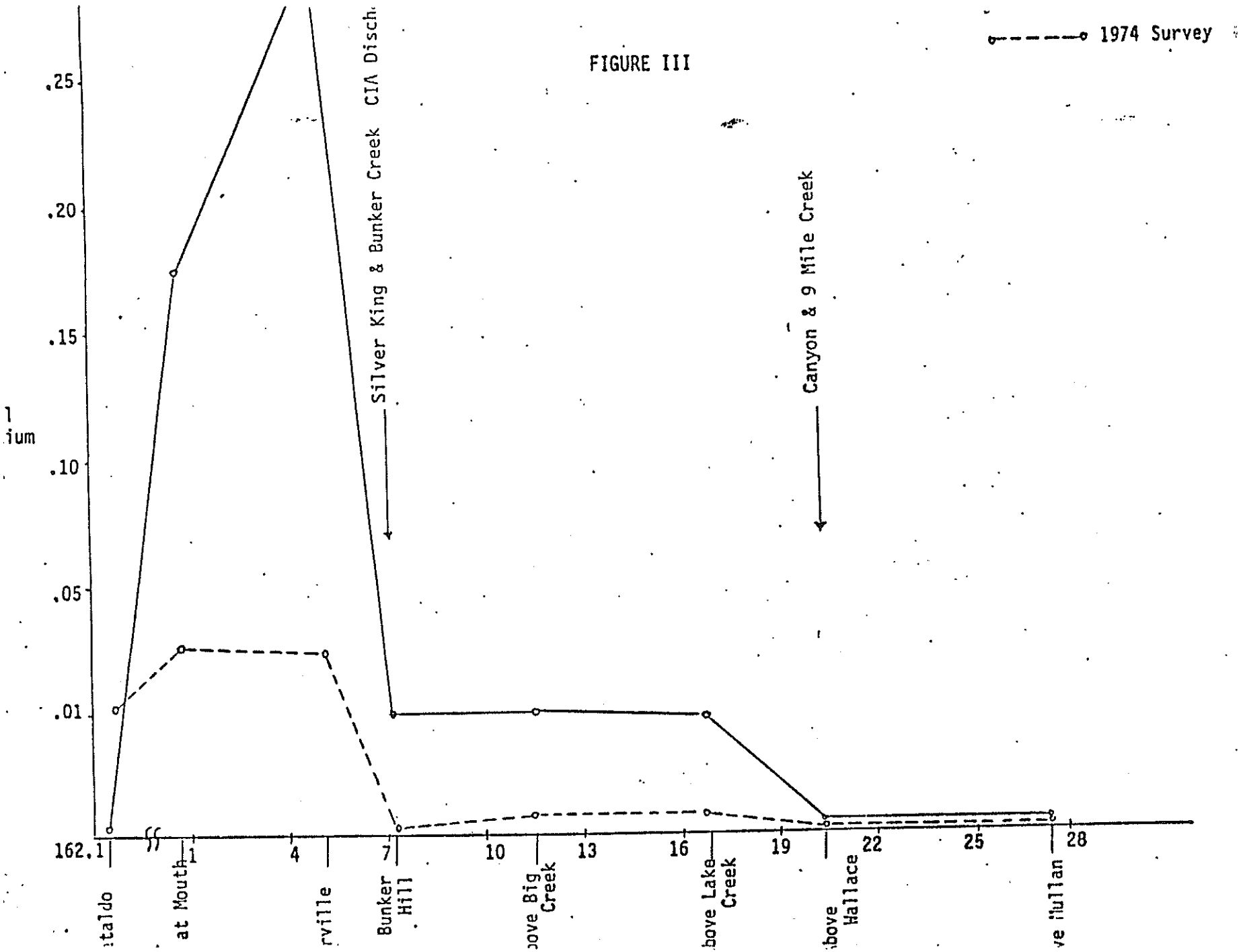

.05
.10
.20
.30
.40
.50
162.1
1
4
7
10
13
16
19
22
25
28
ataldo
F at mouth
melterville
bove
unker Hill
bove Big Cr.
bove
ake Cr.
Above
Wallace
Above
Mullan
Silver King & Bunker Creek, CIA Disch
Canyon & Nine Mile Creek

FIGURE III


1974 Survey
Silver King & Bunker Creek CIA Disch.
Canyon & 9 Mile Creek
.25
.20
.15
.10
.05
.01
ium
162.1
1
4
7
10
13
16
19
22
25
28
at Mouth
Bunker Hill
Creek
Lake Creek
Hallace
Hullan

concentrations then tend to level off from Wallace to above Bunker Hill. River stations below Bunker Hill show a dramatic increase. The entry of Silver King and Bunker Creeks with high heavy metal concentrations and the Bunker Hill discharges account for the increases. Heavy metal concentrations at Cataldo show an appreciabl reduction by the dilution of the main Coeur d'Alene River at Enaville. A comparison of 1973 and 1974 metal concentrations in Figures I, II and III indicate significant reduction in 1974. This can be accounted for by the incorporation of treatment requirements implemented by waste discharge permits and effluent discharge limitatic implemented in 1974 for all of the major point source discharges in the basin.

A comparison of past sampling is included on the SF Coeur d'Alene at the Smeltervill station. This station was located adjacent to a U.S.G.S. stream flow station and samples have been collected at this station periodically since 1970. The concentrat and load in pounds per day for zinc, lead and cadmium plotted with flow for this station are shown in Table VI and Figures IV, V and VI. The general trend indicates that in most cases heavy metal concentrations increase and decrease proportionate to flow however, there are several samplings that show an inverse relationship to fl Since point source loadings were not conducted with most of these surveys the discr ancies cannot be accounted for as arising from point sources or non-point sources.

Nutrient concentrations in terms of nitrates and phosphates for 1974 is shown in Figure VII. It appears that nutrient levels are sufficiently high in all river stations to enhance algae productivity. Values of .05 ppm PO_4 has been determined to be the limiting concentration for algae bloom potential. In all but one station PO_4 levels exceed the limiting value. Phosphate levels have not readily enhanced algae production in the river due to heavy metal toxicity and short residence time.

Phosphate levels do impact Coeur d'Alene Lake to a significant degree by the enhancement of algae production in a lake environment.

A number of comprehensive sanitary surveys have been conducted in regards to bacteriological loading in the SF Coeur d'Alene River basin. Data for these surveys is not included in this report however trends indicate that after the SF Sewer District went on line in the summer of 1974, bacteriological levels were significantly reduced in the South Fork. Future sanitary surveys will provide adequate data for an analysis of bacteriological improvements within the basin when compared with past surveys.

This report indicates substantial improvements in the reductions of point source heavy metal loading over the last year. Studies conducted subsequent to this repor have identified in the Bunker Hill Company area significant non point source loadin of heavy metals. A study on the SF shows 1528 pounds/day of heavy metals Zn, Pb, C entering the river from the Bunker Hill CIA dike leakage.

Another study conducted on Silver King Creek shows 1161 pounds/day of non-point source zinc entering from the zinc plant site to the mouth of the creek. Significa levels of florides have also been identified from these non-point sources.

The Idaho Department of Health & Welfare, Division of Environment has planned continuing studies to further assess the loading characteristics of point and non-p sources within the basin. Future efforts will be directed toward permit compliance assurance and better identification of non-point sources within the Basin.

TABLE VI
PAST SAMPLING
SF Coeur d'Alene River - Smelterville Station
Zinc, Lead & Cadmium

ate	Zinc		Lead		Cadmium		Flow
	PPM	Pounds/Day	PPM	Pounds/Day	PPM	Pounds/Day	MGD
-26-70	2.55	29,391	0.87	10,028	.020	231	1382
-19-70	16.125	14,793	0.13	119	.212	195	110
2-16-70	9.82	10,073	0.83	851	.252	259	123
-16-71	11.49	22,807	3.70	7344	.240	476	238
-12-71	12.78	32,615	0.07	179	.480	1225	306
-1-72	3.57	18,460	-	-	-	-	620
-27-72	3.45	37,175	0.60	6465	-	-	1292
-22-72	12.57	11,378	1.59	1419	.186	166	107
-19-72	16.40	11,489	1.18	827	.400	280	84
-13-73	38.48	29,974	0.62	483	.299	233	93.4
-13-74	5.36	24,200	4.71	3967	.543	457	101
-11-74	2.88	9,000	0.08	250	.025	78	347.7
)-4-74	11.6	3580	.122	38	.40	123	37
)-30-74	8.73	4077	0.10	47	.092	43	56
10-30-74	9.12	3499	.02	7.7	.085	33	46

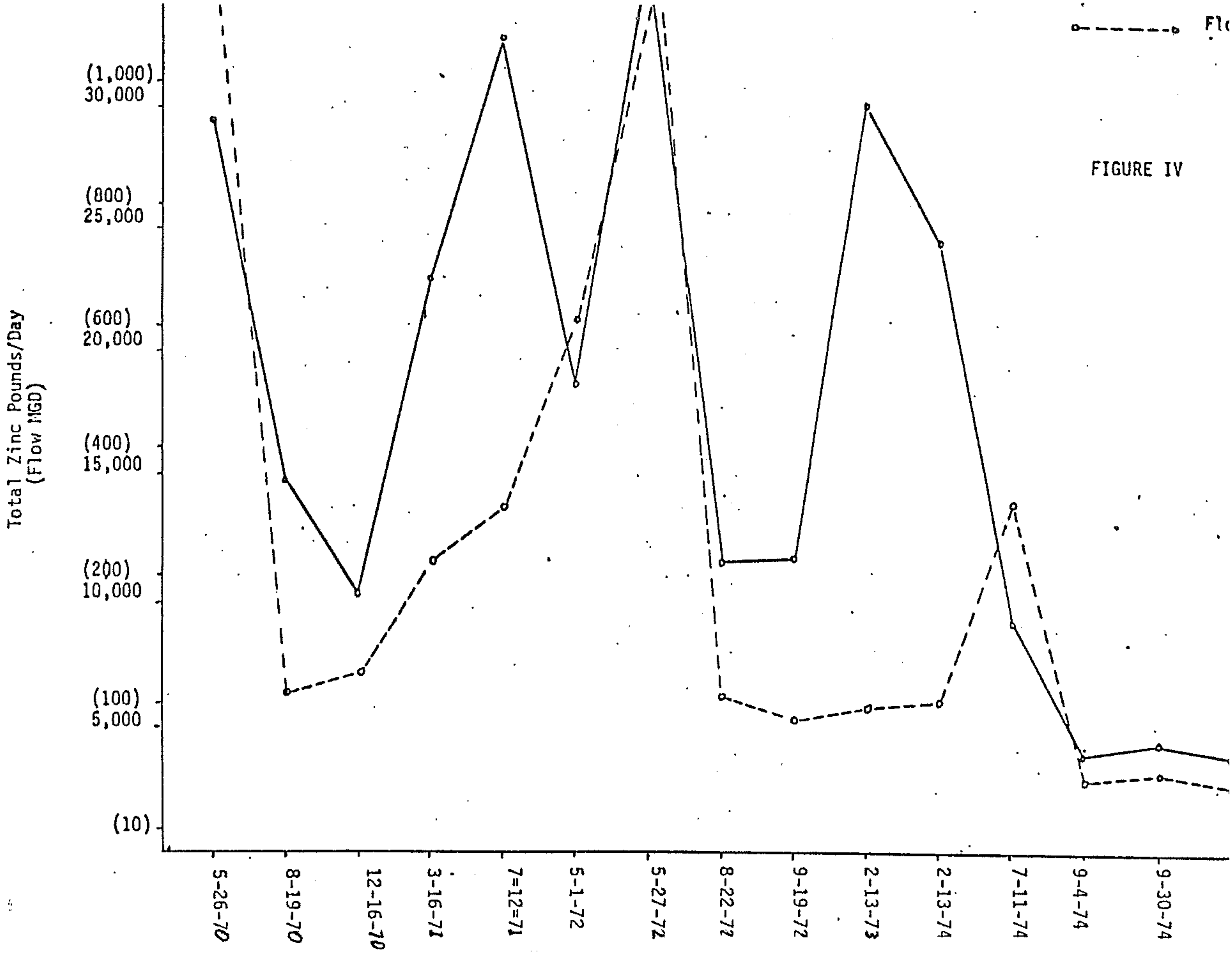
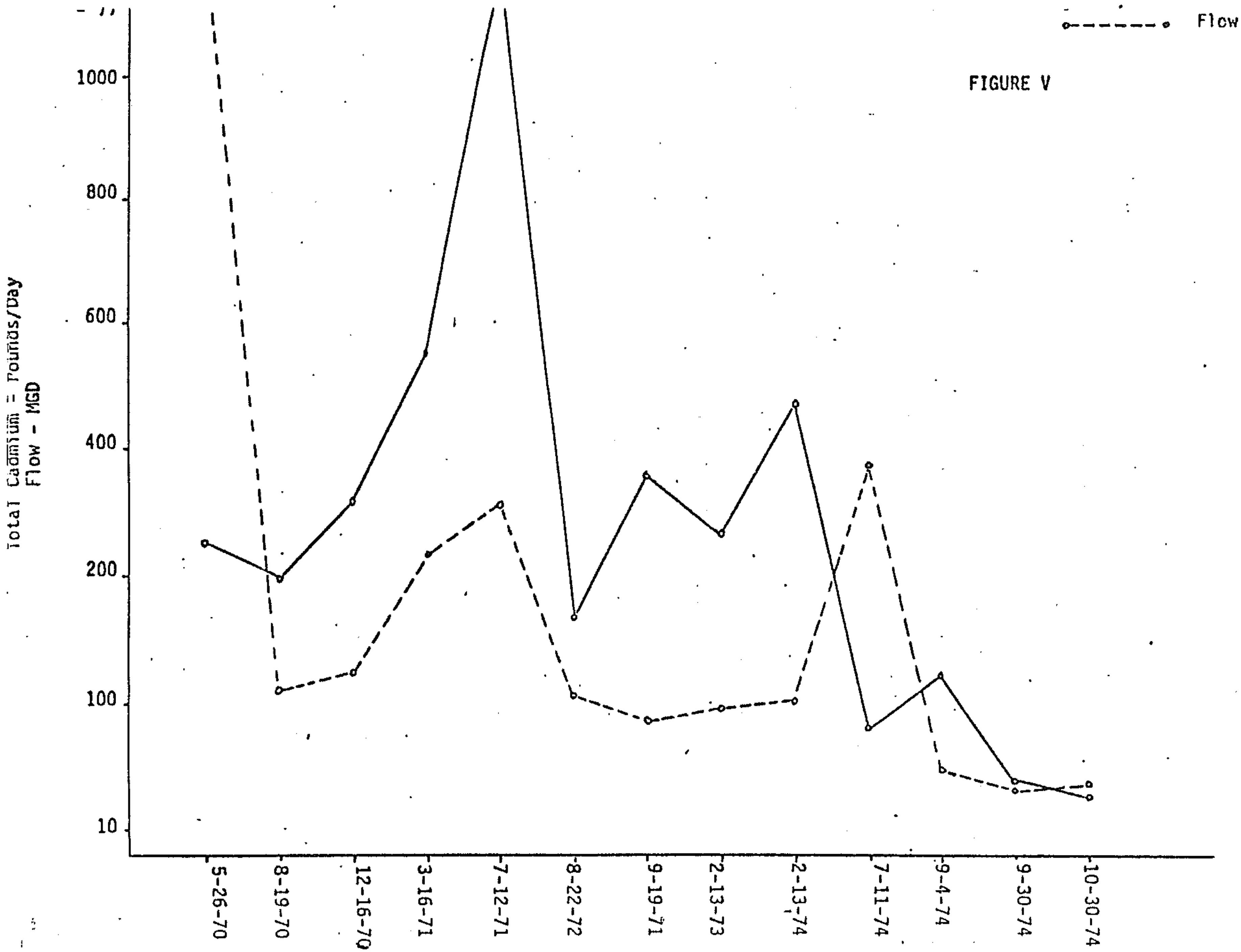

Total Zinc Pounds/Day
(Flow MGD)
(1,000)
30,000
(800)
25,000
(600)
20,000
(400)
15,000
(200)
10,000
(100)
5,000
(10)
5-26-70
8-19-70
12-16-70
3-16-71
7=12=71
5-1-72
5-27-72
8-22-72
9-19-72
2-13-73
2-13-74
7-11-74
9-4-74
9-30-74

FIGURE IV

FIGURE V


Flow
Total Cadmium = Pounds/Day
Flow - MGD
1000
800
600
400
200
100
10
5-26-70
8-19-70
12-16-70
3-16-71
7-12-71
8-22-72
9-19-71
2-13-73
2-13-74
7-11-74
9-4-74
9-30-74
10-30-74

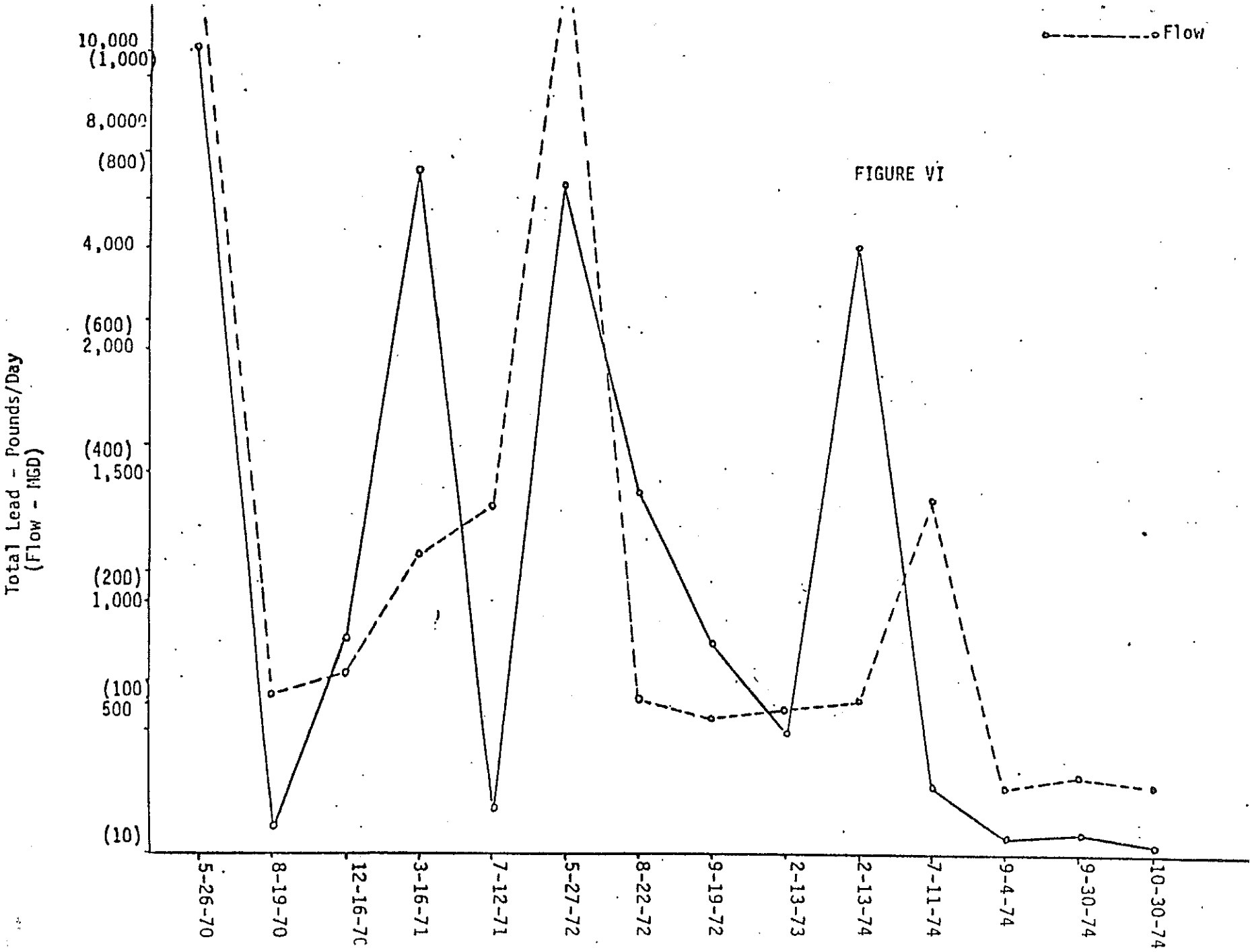
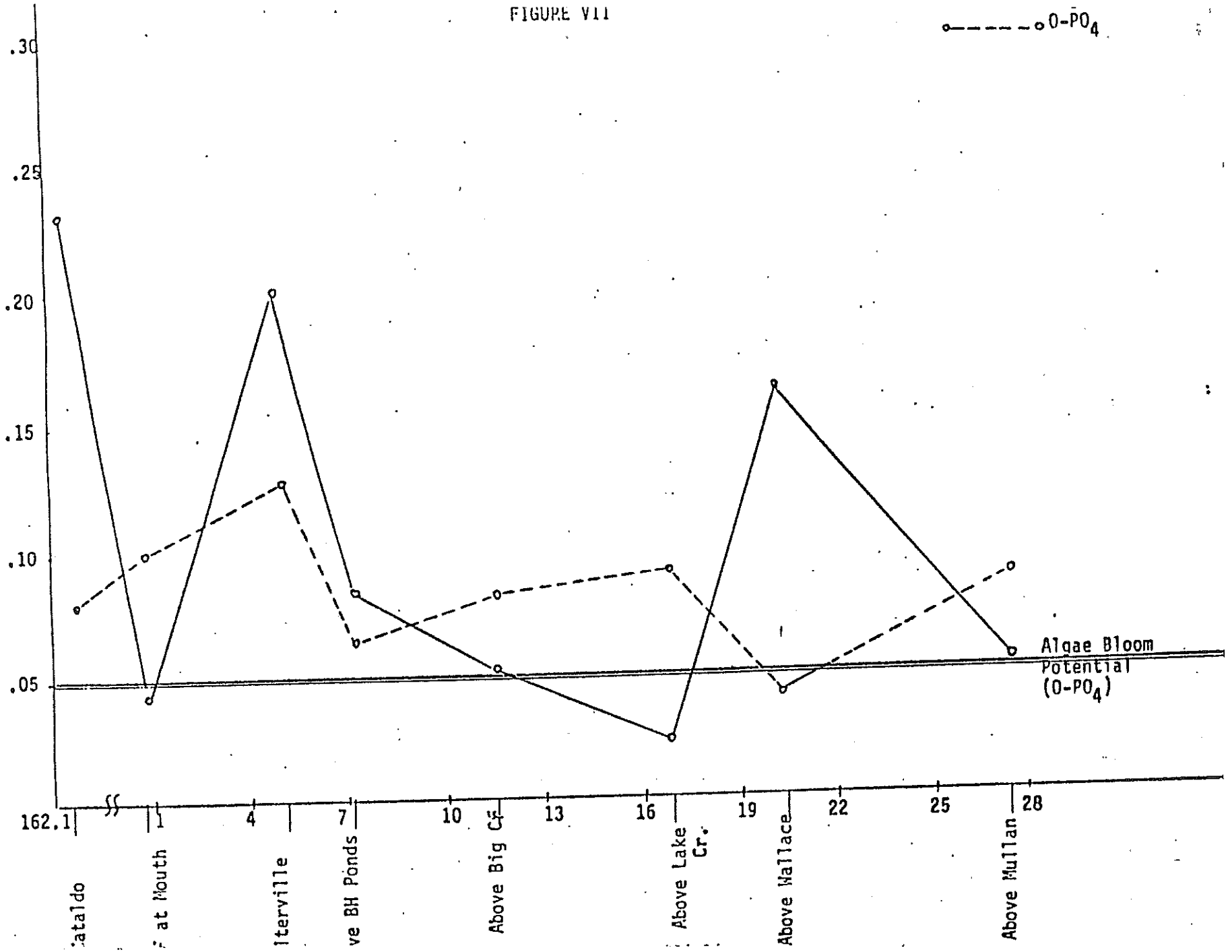

Flow
Total Lead - Pounds/Day
(Flow - MGD)
10,000
(1,000)
8,000
(800)
4,000
(600)
2,000
(400)
1,500
(200)
1,000
(100)
500
(10)
5-26-70
8-19-70
12-16-70
3-16-71
7-12-71
5-27-72
8-22-72
9-19-72
2-13-73
2-13-74
7-11-74
9-4-74
9-30-74
10-30-74

FIGURE VI

FIGURE VII


O-PO4
.30
.25
.20
.15
.10
.05
Algae Bloom Potential (O-PO4)
162.1
1
4
7
10
13
16
19
22
25
28
ataldo
at Mouth
terville
ve BH Ponds
Above Big Cr.
Above Lake Cr.
Above Wallace
Above Mullan

SUMMARY

1. Toxic heavy metal concentrations of zinc, lead, cadmium and antimony create the most serious water quality problems in the SF Basin.
2. Bunker Hill Company, in 1973, contributed 98.7% of the total heavy metal load to the Basin and in 1974 it contributed 95% of the total load.
3. Comparative heavy metal reductions in 1974 over 1973 from all point sources wer significant. Total load for zinc was reduced 94.6% for lead 86.6%, for cadmium 75.8% and for antimony 51.1%.
4. Bunker Hill incorporated treatment in March 1974 and dramatic reductions were realized from this system. Zinc was reduced by 95.5%, lead by 89.9%, cadmium b 76.2%, antimony by 79.7% and mercury by 99.9%.
5. Sunshine Mining Co. had significant reductions in antimony and arsenic in 1974. Antimony levels had a net reduction of 49.2% and arsenic 78.1%.
6. Point source nutrient levels showed a net reduction in 1974 of 84.4% for nitrat and 99.6% for ortho-phosphates.
7. SF River stations and tributaries show that significant loadings for heavy meta arise from Canyon and Nine Mile Creeks and Bunker and Silver King Creeks.
8. Inadequate sampling did not allow for a determination of non-point source load however, studies subsequent to this report have identified major non-point sour arising from Bunker Hill CIA dike seepage and unidentified sources along Silver King Creek. Dike seepage arising from Sunshine Tailings ponds has also been identified.
9. The USGS gaging station and sampling site at Smelterville indicates diverse me loading for a number of studies. Zinc levels ranged from a high of 37,175 pou per day to a low of 10,073 pounds per day before 1974.

10. Heavy metals and nutrient concentrations are reduced appreciably by the dilution of the main Coeur d'Alene River at Enaville and it is reflected at the Cataldo station.

11. Although significant reductions in heavy metal concentrations have been realized the point and non-point source additions will cause chronic toxicity to aquatic biota and adverse water quality effects in the South Fork.