Water Quality Status Report

LINDSAY CREEK

(Nez Perce County)

1976-1977

Department of Health & Welfare
Division of Environment
Boise, ID 83720

August 1978

Report No. WQ-34

WATER QUALITY STATUS REPORT

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(Nez Perce County)

1976-1977

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Department of Health & Welfare
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Statehouse
Boise, Idaho 83720

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ABSTRACT

A water quality survey was conducted on Lindsay Creek, Nez Perce County, between May 1976 and November 1977. Samples were collected approximately on a monthly frequency at one station at the mouth in Lewiston, Idaho.

Total coliform bacteria and fecal coliform bacteria exceeded Idaho water quality standards for Class A streams. Nutrients and organic material were high in concentration and produce nuisance slime growths in the stream. Nitrate-nitrogen averaged 3.6 mg/l and total phosphorus averaged 0.24 mg/l. Because of these high bacteria and nutrient concentrations, Lindsay Creek should be classified as water quality limiting.

Two minor point sources discharge to the stream. Nonpoint sources which have a major effect on the stream include runoff from farming land, livestock feeding and grazing, and individual sewage disposal systems. The high fecal coliform concentrations (geometric mean of 1,330/100 ml) are probably due to septic tank and drainfield systems located along the lower mile of Lindsay Creek.

I. INTRODUCTION

A limited survey was conducted on Lindsay Creek to acquire water quality data to classify the stream as either Water Quality Limiting or Effluent Limiting. Information is needed to determine if Lindsay Creek meets requirements for Class A waters listed in Idaho's Water Quality Standards and Wastewater Treatment Requirements. The study plan is included as Appendix A.

Lindsay Creek is located in the Clearwater River Basin and empties into the Clearwater River (RM 2.4) at Lewiston (Figure 1). The creek flows through grass covered upland hills which border the Clearwater River. Soils are silty on gently sloping to steep loess-mantled basalt plateaus with moderately low rainfall.

Most land in the drainage is privately owned. The upper section of the drainage is used as dryland farming of wheat and peas with the lower section for cattle grazing. Low density individual housing is scattered along the lower mile of the stream. Levee construction associated with the Lower Granite Reservoir project necessitated modification of the creek below the sampling station in 1974. Modification included construction of a concrete outlet structure and pump station. These facilities and the low seasonal stream flows preclude sustaining a fishery in Lindsay Creek.

II. MATERIALS AND METHODS

The sample station was located at the mouth of Lindsay Creek on the Main Street Bridge in Lewiston. STORET number for the station is 2020001, latitude is 46°25'05", longitude is 116°59'30". Monthly samples were collected in May, June, July, and August of 1976 and from December 1976 to November 1977. Samples were collected on August 30 and 31, 1976, to coincide with an intensive survey by the U.S. Army Corps of Engineers on Lower Granite Reservoir.

Temperature and dissolved oxygen were measured in the field with a Yellow Springs Instruments Dissolved Oxygen Meter, Model 54A. pH was measured with a Model 404 Orion pH meter. Flows were estimated by timing a float and measuring the cross-sectional area since the water was too shallow for use of a flow meter.

Samples for laboratory analysis were collected in approximately one liter cubitainers. Samples for nutrients were preserved with sulphuric acid, samples for metals with nitric acid, and samples for minerals and solids were untreated and put on ice according to the Idaho Department of Health and Welfare, Division of Environment, Technical Procedures Manual. Laboratory analyses were performed according to EPA, Methods for Chemical Analysis of Water and Wastes.

Field and laboratory analyses were:

Flow	Nitrite-N	Specific Conductance
Temperature	Ammonia-N	Alkalinity
Dissolved Oxygen	Total Kjeldahl Nitrogen	Chloride
pH	Total Phosphorus	Total Mercury
Total Coliform	Ortho-Phosphate (as P)	Total Lead
Fecal Coliform	Turbidity	Total Zinc
Fecal Streptococcus	Total Solids	Total Cadmium
Nitrate-N	Suspended Solids	Total Copper

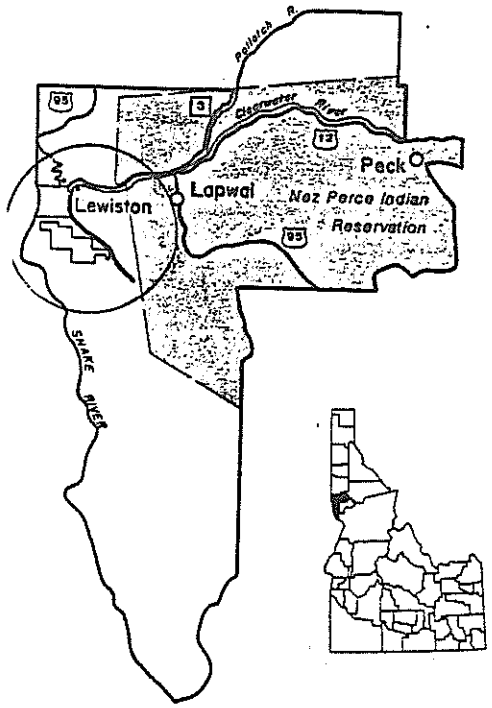

Figure 1. Location of sampling station on Lindsay Creek, Nez Perce County, Idaho.

O Station

C Clearwater Beverage

L Lewiston Orchards Irrigation District

III. WASTE SOURCES

Point Sources:

1) Clearwater Beverages, Inc., Lewiston, Idaho ID-000085-0 (see Figure 1)

Clearwater Beverages operates a facility for mixing and bottling carbonated soft drinks. The discharge consist of rinse water and backwash for the sand and gravel filter and carbon filter. Daily average waste flow is 718 gallons. As a temporary measure, the discharge to Lindsay Creek was discontinued by construction of septic tank and drainfield system in June 1977. This discharge is scheduled to be connected to the Lewiston sewage treatment plant when the Lindsay Creek interceptor is completed.

2) Lewiston Orchards Irrigation District ID-002297-7 (see Figure 1)

The LOID operates a 1 mgd water treatment plant that serves approximately 15,000 people. Discharges from the facility consist of sludge pumped from the coagulation basin and backwash water from the filters. Filters are backwashed approximately once a day with 4,500 to 7,000 gallons of water.

Nonpoint Sources:

Along the upper section, Lindsay Creek flows through dryland farms which are a source of sediments during runoff conditions. Throughout the year cattle and horses are grazed along the creek. In the winter, the East Fork of Lindsay Creek along Old Lapwai Road is the site of several concentrated cattle feeding operations. Housing along the lower mile of the creek utilizes individual sewage systems. Drainage from failing septic systems are considered a source of pollutants to Lindsay Creek.

IV. RESULTS

Idaho Water Quality Standards and Wastewater Treatment Requirements include specific instream standards for total and fecal coliform bacteria, dissolved oxygen, and pH. The other parameter categories fall into the "General Water Quality Standards" section and are evaluated according to EPA Quality Criteria for Water and other sources. The rationale for the criteria used are listed in Appendix D. Raw data, means, and variance are listed in STORET printouts in Appendix B. Figures of parameters versus time in months are shown in Appendix C.

Temperature: (Figure 2, Appendix C)

Parameter	Criteria	Number	Mean	Range	Criteria Exceeded-%	Protected Uses Affected
Temperature deg. C^{o}	19^{o} max.	14	13.1^{o}	7.0^{o}-20.2^{o}	7%	Fisheries

The temperature was generally within the range recommended for cold water biota. The 19^{o}C criteria was exceeded only slightly in August of 1976.

Dissolved Oxygen: (Figure 3, Appendix C)

Parameter	Criteria	Number	Mean	Range	% Violation	Protected Uses Affected
Concentration mg/l	6 mg/l min.	11	10.6	8.5-14.0	0%	None
Percent Saturation %	90% min.	11	103%	87-118%	7%	None

Dissolved oxygen exceeded Idaho water quality minimum standards a majority of the time only dropping slightly below 90% saturation on one occasion.

pH: (Figure 4, Appendix C)

Parameter	Criteria	Number	Mean	Range	% Violation	Protected Uses Affected
pH	6.5-9.0	14	--	7.8-8.9	0%	None

pH was within Idaho water quality standards of 6.5-9.0 for all sampling dates.

Bacteria*: (Figure 5-7, Appendix C)

Parameter	Criteria	Number	Mean	Range	% Violation	Protected Uses Affected
Total Coliform	240	17	14,700	600-114,000	100%	Drinking Water Supplies & Contact Recreation
Fecal Coliforms	50	17	1,330	120-24,400	100%	
Fecal Streptococcus	--	17	721	78-10,000	--	

Bacteria concentrations are high and exceed geometric means and single sample water quality standards for primary and secondary contact recreation.

For recent fecal contamination, a fecal coliform/fecal streptococcus ratio above 4 is considered indicative of a human source, whereas animal sources are characterized by a ratio which does not exceed .7 (Claussen, 1977). Since all the monthly ratios exceed 1.4 (ratios average 5.9), there is strong evidence that the bacterial contamination is due to a human source. However,

*Total coliform Class A_2 standard is a geometric mean of 240/100 ml, Class B standard is geometric mean of 1000/100 ml. Fecal coliform Class A_2 standard is geometric mean of 50/100 ml, single sample of 500/100 ml; Class B standard is geometric mean of 200/100 ml, single sample of 800/100 ml.

these ratios are highly variable. For example, on August 30, 1976, estimated densities for these bacteria give a fecal coliform/fecal streptococcus ratio of 1.8 compared to a ratio of 20 on August 31 when fecal coliforms were estimated at 24,400/100 ml. For this reason these ratios may be subject to differing interpretation. The bacterial loads may also be due to a mixture of human and animal wastes.

Trophic: (Figures 8-14, Appendix C)

Parameter	Criteria	Number	Mean	Range	Criteria Exceeded-%	Protected Uses Affected
Nitrate-N mg/l	.3	17	3.6	1.8-4.9	100%	Recreation
Nitrite-N mg/l	--	17	0.01	0-.22	--	--
Total Kjeldahl Nitrogen	--	17	1.5	.8-2.9	--	--
Ammonia Nitrogen mg/l	.20	17	0.05	.01-.11	0%	None
Total Phosphorus mg/l (P)	.05	17	0.24	.09-.71	100%	Recreation
Ortho-Phosphate mg/l (as P)	.025	17	0.12	.04-.33	100%	Recreation
Chemical Oxygen Demand mg/l	--	11	24.8	2-71	--	--

Nitrates, total phosphorus, and ortho-phosphate exceeded recommended criteria based on preventing excess algal growth throughout the sampling period. Nitrates did not vary significantly throughout the year. Total phosphorus peaked both years at the end of August. Samples for chemical oxygen demand indicate a high concentration of organic material.

These high organic loads and nutrient concentrations may stimulate nuisance growths of algae and fungi in Lindsay Creek. Also, Lindsay Creek is a source of these nutrients to Lower Granite Reservoir.

Aesthetic: (Figure 15, Appendix C)

Parameter	Criteria	Number	Mean	Range	Criteria Exceeded-%	Protected Uses Affected
Turbidity JTU	25	17	9.8	0.8-43	6%	--

Turbidity was generally below 25 JTU's throughout the year. Peaks in turbidity (Figure 15) usually occurred after storms indicating the relation of turbidity to runoff. Precipitation on August 30, 1977, when turbidity peaked at 43 JTU's was .89 inches (NOAA).

Solids: (Figures 16-18, Appendix C)

Parameter	Criteria	Number	Mean	Range	Criteria Exceeded-%	Protected Uses Affected
Total Solids	--	17	590	127-787	--	--
Suspended Solids	80	12	43.6	2-161	17%	--
Conductivity (umhos/cm)	750	17	835	286-919	88%	Drinking Water
Total Alkalinity	--	17	366	300-800	--	--
Chloride	--	14	23.7	6.2-43.7	--	--

Suspended solids as with turbidity increased following storms exceeding recommended maximum of 80 mg/l for aquatic life on two sampling dates.

Dissolved solids exceeded the desirable concentration for domestic water use (indicated by conductivity above 750 umhos/cm) the majority of the time.

Inorganic Toxicity:

Quarterly samples for cadmium, copper, lead, mercury, and zinc were below detection limits or below recommended criteria.

V. OBSERVATIONS

Brown, filimentous slime growths were observed at the station during both summers. These bacterial or fungal mats are formed in response to the high organic and nutrient concentrations.

The stream was noticeably turbid following any precipitation. Observed turbidity corresponded to peaks in measured turbidity over 10 JTU's shown in Figure 15.

VI. CONCLUSIONS

1) Lindsay Creek meets instream Idaho water quality standards for dissolved oxygen and pH.

2) Fecal coliform bacteria exceed standards for primary and secondary contact recreation throughout the year. High bacterial concentrations are derived from fecal contamination. Analysis of the bacterial ratios would strongly indicate that this is due to a human source which is assumed to be from failing septic systems located along the lower section of the stream.

3) Nitrate-nitrogen and phosphorus concentrations exceed acceptable levels. These nutrients stimulate nuisance growths in the creek and are a source of nutrients to Lower Granite Reservoir.

4) Because of the bacteria and nutrient violations, Lindsay Creek should be classified as water quality limiting. Lindsay Creek does not presently meet Class A_2 standards for primary contact recreation.

5) Dissolved solids are high as indicated by conductivity values which exceed acceptable levels for domestic water supplies.

6) Turbidity increases substantially following storms. The major source of this turbidity is probably silts washed from dryland farm areas.

7) Nonpoint sources degrade the water quality of Lindsay Creek. Nonpoint sources which may be responsible for this degradation include farming practices, livestock feeding and grazing, construction, urban runoff, and individual sewage disposal systems.

VII. RECOMMENDATIONS

Lindsay Creek is classified as water quality limiting because of bacteria and nutrient violations attributable to nonpoint sources. Sampling at one station does not allow for certain identification of specific pollution sources. However, the following general recommendations can be made:

1) Failing septic tank and drainfield systems should be identified and replaced or hooked to a community sewerage system. Construction of the Lindsay Creek interceptor this year should allow access to the Lewiston sewage treatment plant.

2) As Best Management Practices are identified in the 208 program, they should be applied to reduce erosion from the dryland farms and reduce pollutants from summer livestock grazing.

3) Animal confinement methods along the East Fork of Lindsay Creek should be modified to reduce contamination of the stream from this source.

4) The conductivity readings for Lindsay Creek are higher than expected for a stream in the Clearwater River Basin. This should be investigated to determine if it is a natural characteristic of the drainage or a result of man-made degradation.

LITERATURE CITED

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Environmental Protection Agency, United States, July 1976. Quality Criteria for Water, U.S. Government Printing Office 1977 0-222-904, 256 p.

Idaho Department of Environmental and Community Services, June 1973. Water Quality Standards and Wastewater Treatment Requirements, 19 p., and Appendix.

National Oceanic and Atmospheric Administration, Aug. 1977, Environmental Data Service, Climatological Data-Idaho, Volume 89, Number 8.

APPENDIX A

Final Draft of Study Plans

LINDSAY CREEK
(Nez Perce County)
STUDY PLAN

PURPOSE:

To acquire water quality data to classify the stream segment.

BACKGROUND:

The uses to be protected must be specified and a classification of water quality limiting or effluent limiting must be designated.

STUDY PERIOD:

Monthly samples will be collected for a period of 12 months beginning in January, 1977.

SAMPLING STATION:

The creek will be sampled at the Main Street bridge (Lewiston) near the mouth. The STORET number for this station is 202001.

FIELD AND LABORATORY ANALYSES:

Field: Flow, D.O., pH, temperature

Laboratory: Specific conductance, alkalinity, turbidity, total solids, suspended solids, COD, total phosphorus, ortho-phosphate, nitrate, nitrite, ammonia, total kjeldhal nitrogen, chloride, total coliform, fecal coliform, fecal strep.

In addition to the above monthly analyses the following trace metals will be determined quarterly: total mercury, total lead, total zinc, total cadmium, total copper.

MANPOWER REQUIREMENTS:

One Environmental Quality Specialist for two hours per month will be required. A total of three man-days will be required for field work and two additional man-days for report preparation. One and one-half man-days will be expended in FY 77 and 3 1/2 man-days in FY 78.

SPECIAL EQUIPMENT REQUIREMENTS:

None.

REPORT:

A stream segment status report should be drafted in February of 1978 discussing whether or not the stream segment meets the State's Class A water quality standards.

APPENDIX B

Raw Data: STORET Retrieval and Inventory

STORET DATE 78/11/28

2020001
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH
16069 IDAHO
PACIFIC NORTHWEST

/TYPA/AMBNT/STREAM

21IDSURV 760810
0000 CLASS 00

INDEX 1310001 002740
MILES 0324.30 0002.40

PARAMETER				NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT	14	13.1000	18.0969	4.25405	.324737	1.13694	20.2000	7.00000	76/05/17	77/11/29
00061	STREAM	FLOW,	INST-CFS	8	6.44999	12.9544	3.59922	.558019	1.27252	11.3000	1.20000	77/03/31	77/11/29
00070	TURB	JKSN	JTU	17	9.75882	125.826	11.2172	1.14945	2.72058	43.0000	.800000	76/05/17	77/11/29
00095	CNDUCTVY	AT 25C	MICROMHO	17	835.059	21948.6	148.151	.177413	35.9318	919.000	286.000	76/05/17	77/11/29
00300	DO		MG/L	11	10.6364	2.93262	1.71249	.161003	.516335	14.0000	8.50000	76/05/17	77/11/29
00335	COD	LOWLEVEL	MG/L	14	26.7500	336.351	18.3399	.738661	4.90154	71.0000	3.00000	76/05/17	77/10/25
00400	PH		SU	14	8.37856	.108023	.328668	.039227	.087840	8.90000	7.80000	76/05/17	77/11/29
00403	LAB	PH	SU	16	8.32499	.067350	.259519	.031173	.064880	8.60000	7.50000	76/05/17	77/11/29
00410	T ALK	CACO3	MG/L	17	365.882	12852.4	113.368	.309849	27.4958	800.000	300.000	76/05/17	77/11/29
00425	HCO3 ALK	CACO3	MG/L	11	320.727	233.400	15.2774	.047634	4.60632	341.000	286.000	77/01/24	77/11/29
00430	CO3 ALK	CACO3	MG/L	10	9.70000	79.5667	8.92002	.919589	2.82076	27.0000	.000000	77/01/24	77/11/29
00500	RESIDUE	TOTAL	MG/L	17	590.294	17312.6	131.577	.222901	31.9122	787.000	127.000	76/05/17	77/11/29
00505	RESIDUE	TOT VOL	MG/L	2	137.500	60.5000	7.77817	.056569	5.50000	143.000	132.000	76/08/30	76/08/31
00530	RESIDUE	TOT NFLT	MG/L	12	43.5833	2406.45	49.0556	1.12556	14.1611	161.000	2.00000	76/12/08	77/11/29
00535	RESIDUE	VOL NFLT	MG/L	2	4.50000	12.5000	3.53553	.785674	2.50000	7.00000	2.00000	76/08/30	76/08/31
00610	NH3-N	TOTAL	MG/L	17	.045136	.000660	.025691	.569193	.006231	.113000	.012000	76/05/17	77/11/29
00615	NO2-N	TOTAL	MG/L	17	.022396	.002608	.051068	2.28025	.012386	.219000	.001000	76/05/17	77/11/29
00620	NO3-N	TOTAL	MG/L	17	3.62556	.656651	.810340	.223507	.196536	4.90000	1.78781	76/05/17	77/11/29
00625	TOT KJEL	N	MG/L	17	1.47823	.262558	.512404	.346633	.124276	2.90000	.800000	76/05/17	77/11/29
00650	T PO4	PO4	MG/L	4	1.02250	.508427	.767090	.750211	.383545	2.08000	.360000	76/06/24	76/08/31
00665	PHOS-TOT		MG/L P	17	.244117	.028551	.168970	.692167	.040981	.710000	.090000	76/05/17	77/11/29
00669	PHOS-TOT	HYDRO	MG/L P	3	.386667	.104633	.323471	.836563	.186756	.750000	.130000	77/03/31	77/11/29
00680	T ORG C	C	MG/L	5	9.66000	37.3280	6.10966	.632471	2.73232	20.5000	5.90000	77/03/31	77/10/25
00900	TOT HARD	CACO3	MG/L	1	200.000					200.000	200.000	77/08/30	77/08/30
00940	CHLORIDE	CL	MG/L	14	23.7214	67.0691	8.18957	.345240	2.18875	43.7000	6.20000	76/05/17	77/11/29
01002	ARSENIC	AS,TOT	UG/L	1	10.0000					10.0000	10.0000	77/09/29	77/09/29
01007	BARIUM	BA,TOT	UG/L	1	100.000					100.000	100.000	77/09/29	77/09/29
01027	CADMIUM	CD,TOT	UG/L	3	2.33333	5.33334	2.30940	.989744	1.33333	5.00000	1.00000	77/01/24	77/09/29
01034	CHROMIUM	CR,TOT	UG/L	1	10.0000					10.0000	10.0000	77/09/29	77/09/29
01042	COPPER	CU,TOT	UG/L	3	10.0000	.000000	.000000		.000000	10.0000	10.0000	77/01/24	77/09/29
01051	LEAD	PB,TOT	UG/L	3	36.6667	533.334	23.0940	.629838	13.3333	50.0000	10.0000	77/01/24	77/09/29
01055	MANGNESE	MN	UG/L	1	20.0000					20.0000	20.0000	77/09/29	77/09/29
01077	SILVER	AG,TOT	UG/L	1	1.00000					1.00000	1.00000	77/09/29	77/09/29
01092	ZINC	ZN,TOT	UG/L	3	5.33333	56.3333	7.50555	1.40729	4.33333	14.0000	1.00000	77/01/24	77/09/29
01147	SELENIUM	SE,TOT	UG/L	1	10.0000					10.0000	10.0000	77/09/29	77/09/29
31501	TOT COLI	MFIMENCO	/100ML	17	32100.0	.115E+10	33995.5	1.05905	8245.11	114000	600.000	76/05/17	77/11/29
31616	FEC COLI	MFM-FCER	/100ML	17	3862.35	.347E+08	5895.50	1.52640	1429.87	24400.0	120.000	76/05/17	77/11/29
31679	FECSTREP	MF M-ENT	/100ML	17	1382.23	5340496	2310.95	1.67189	560.468	10000.0	78.0000	76/05/17	77/11/29
70507	PHOS-T.	ORTHO	MG/L P	17	.119708	.006280	.079248	.662013	.019221	.326000	.036000	76/05/17	77/11/29
71900	MERCURY	HG,TOTAL	UG/L	3	2.00000	6.75000	2.59808	1.29904	1.50000	5.00000	.500000	77/01/24	77/09/29

STORET RETRIEVAL DATE 78/12/06

2020001
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH
16069 IDAHO
PACIFIC NORTHWEST

/TYPA/AMBNT/STREAM

21IDSURV 76C810
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00061 STREAM FLOW, INST-CFS	00300 DO MG/L	00335 COD LOWLEVEL MG/L	00400 PH SU	00403 LAB PH SU	31501 TOT COLI MFIMENDO /100ML	31616 FEC COLI MFM-FCBR /100ML	31679 FECSTREP MF M-ENT /100ML	00625 TOT KJEL N MG/L
76/05/17			12.6		11.7	33.6	8.20	7.5	600L	600L	200L	1.000
76/06/24								8.2	8500	600L	800	1.600
76/07/27						33.0		8.2	13200	2960	1290	1.500
76/08/30			20.2		8.5	12.0	8.80	8.4	24700J	5000J	2850J	1.340
76/08/31			19.8		8.7	31.0	8.50	8.5	114000	24400	1200	1.040
76/12/08	14	00	7.2			3.0	8.90	8.3	80000	1700	660	2.230
77/01/24						32.0	8.40		27000	7700	560	1.600
77/02/28			9.0		11.1	32.0	8.50	8.4	72000	4300	840	1.000
77/03/31	09	30	7.0	9	14.0	29.0	8.60	8.3	17000	830	78	0.930
77/04/14	10	00	10.5	8	12.8		8.60	8.4	20000	1000	730	0.800
77/05/24			15.1	8	10.6	11.0	8.40	8.4	21900	120L	840	1.300
77/06/15	11	45	18.0	1	10.8	18.0	8.50	8.6	4200	910	360	1.600
77/07/18	11	30	14.0	3	9.5	12.0	8.20	8.6	8000L	600L	1000L	1.430
77/08/30	14	10	15.0			71.0		8.5	85000	8200	10000L	2.900
77/09/29	10	20	13.2	9		42.0	7.80	8.5	35000	5200	1360	1.500
77/10/25	10	55	11.9	11	9.2	15.0	7.80	8.2	3100	1420	560	1.790
77/11/29	12	30	9.9	3	10.1		8.10	8.2	11500	120L	170	1.570

STORET RETRIEVAL DATE 78/12/06

2020001
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH
16069 IDAHO
PACIFIC NORTHWEST

/TYPE/AMBNT/STREAM

211DSURV 760810
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00610 NH3-N TOTAL MG/L	00615 NO2-N TOTAL MG/L	00620 NO3-N TOTAL MG/L	00650 T PO4 PO4 MG/L	70507 PHOS-T ORTHO MG/L P	00665 PHOS-TOT MG/L P	00669 PHOS-TOT HYDRO MG/L P	00680 T ORG C C MG/L	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO
76/05/17			0.030	0.016	3.521		0.088	0.130			9.5	870
76/06/24			0.039	0.027	1.788	0.57	0.078	0.200			23.0	848
76/07/27			0.062	0.011	3.783	0.36	0.095	0.140			4.7	880
76/08/30			0.039	0.004	3.609	1.08	0.241	0.350			5.0	286
76/08/31			0.031	0.012	3.515	2.08	0.326	0.710			3.7	919
76/12/08	14	00	0.030	0.007	4.270		0.039	0.150			2.3	848
77/01/24			0.050	0.007	4.900		0.105	0.220			18.0	902
77/02/28			0.030	0.001K	4.350		0.082	0.140			13.0	858
77/03/31	09	30	0.028	0.011	3.871		0.036	0.160	0.130	5.9	1.0	827
77/04/14	10	00	0.030	0.016	3.860		0.040	0.140			1.8	895
77/05/24			0.030	0.013	2.680		0.097	0.210	0.750		22.0	879
77/06/15	11	45	0.012	0.013	3.397		0.093	0.090			3.4	913
77/07/18	11	30	0.045	0.011	4.330		0.129	0.200		6.5	1.4	918
77/08/30	14	10	0.088	0.014	3.290		0.239	0.600		20.5	43.0	742
77/09/29	10	20	0.036	0.003	2.150		0.120	0.210		7.7	9.3	870
77/10/25	10	55	0.113	0.004	4.380		0.077	0.180		7.7	0.8	880
77/11/29	12	30	0.075	0.219	3.940		0.150	0.320	0.280		4.0	821

SILRET RETRIEVAL DATE 78/12/06

2020001
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH
16069 IDAHO
PACIFIC NORTHWEST

/TYPE/AMBNT/STREAM

21IDSURV 760810
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	70300 RESIDUE DISS-180 C MG/L	00530 RESIDUE TOT NFLT MG/L	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00535 RESIDUE VOL NFLT MG/L	00900 TOT HARD CACO3 MG/L	00410 T ALK CACO3 MG/L	00425 HCO3 ALK CACO3 MG/L	00430 CO3 ALK CACO3 MG/L	00940 CHLORIDE CL MG/L
76/09/17					574				300			44
76/10/24					642				336			27
76/11/27					600				350			25
76/10/30					590	143	7		344			
76/10/31					637	132	2		396			
76/12/08	14 00			15	574				342			
77/01/24				73	669				336	326	10	13
77/02/28				44	606				338	330		24
77/03/31	09 30			2K	556				341	341	1K	23
77/04/14	10 00			22	575				337	325	12	25
77/05/24				107	646				327	313	14	21
77/06/15	11 45			9	603				326	309	27	24
77/07/18	11 30			4	127				346	314	0	6
77/08/30	14 10			161	787			200	800	286	14	29
77/09/29	10 20			30	621				334	317	17	24
77/10/25	10 55			2K	564				334	334	1K	24
77/11/29	12 30			54	664				333	333	1K	23

STORET RETRIEVAL DATE 78/12/06

2020001
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH
16069 IDAHO
PACIFIC NORTHWEST

/TYPE//AMBNT/STREAM

211DSURV 760810
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	01045 IRON FE,TOT UG/L	74010 IRON FE MG/L	01055 MANGANESE MN UG/L	01C27 CADMIUM CD,TOT UG/L	01042 COPPER CU,TOT UG/L	01051 LEAD PB,TOT UG/L	01092 ZINC ZN,TOT UG/L	71900 MERCURY HG,TOTAL UG/L
77/01/24						5K	10K	10K	14	5.0K
77/05/24						1K	10	50K	1	0.5K
77/09/29	10	20			20.0	1K	10K	50K	1	0.5K

APPENDIX C

Figures 2-18

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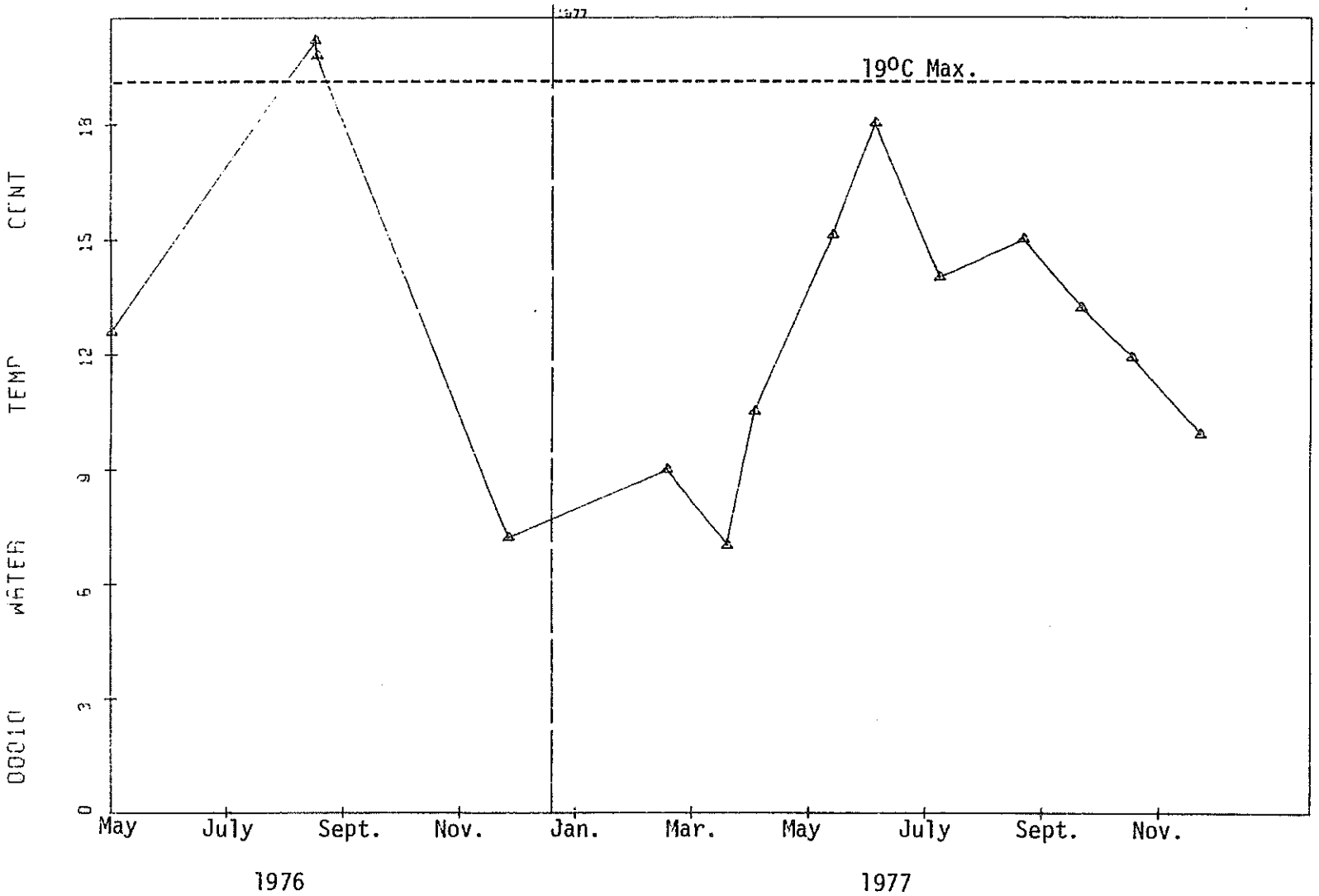
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 2. Water Temperature Deg. C.



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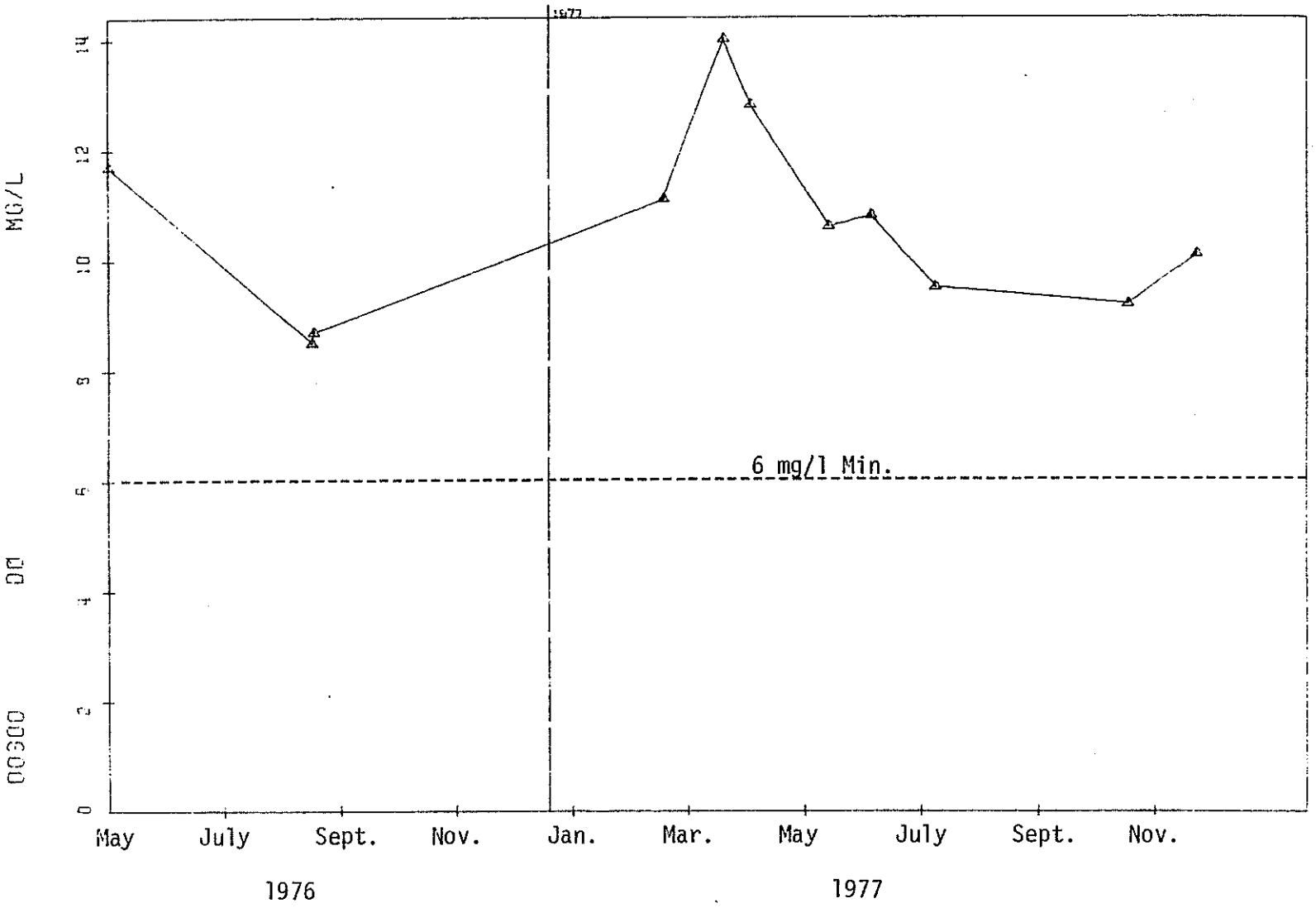
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 3. Dissolved Oxygen mg/l



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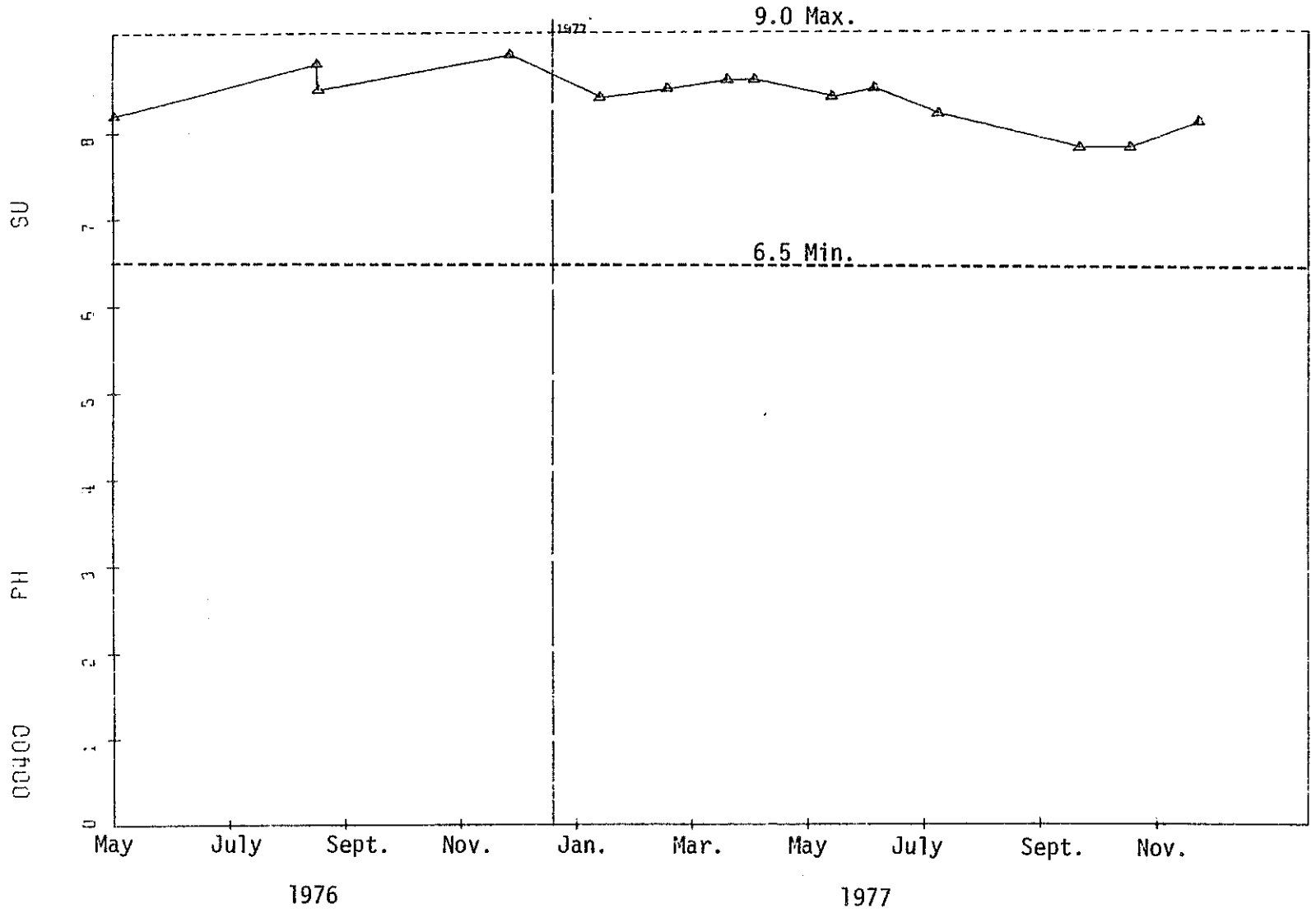
LINDSAY CREEK AT MOUTH

Figure 4. pH in Standard Units



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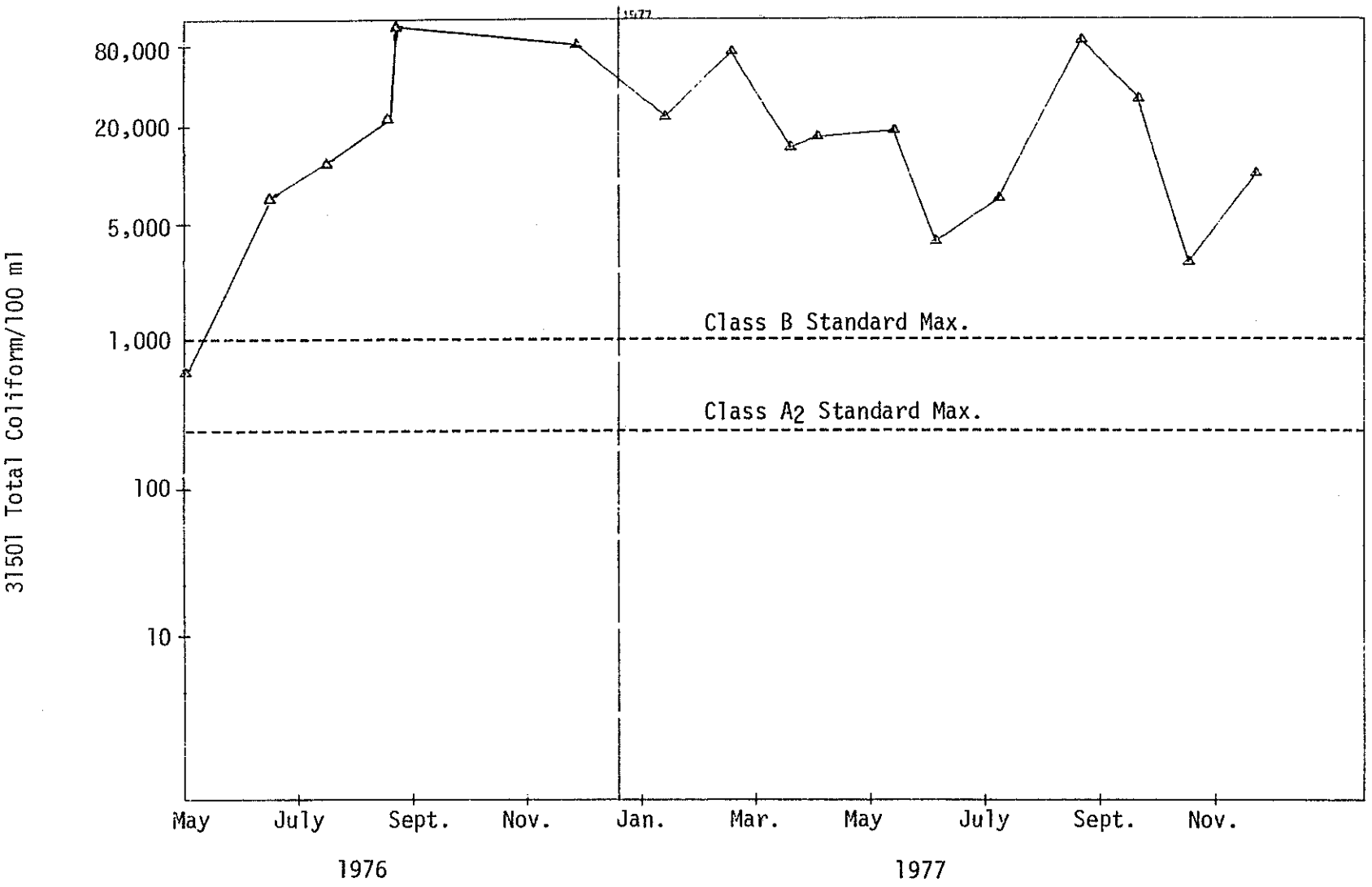
LINDSAY CREEK AT MOUTH

Figure 5. Total Coliform, number/100 ml



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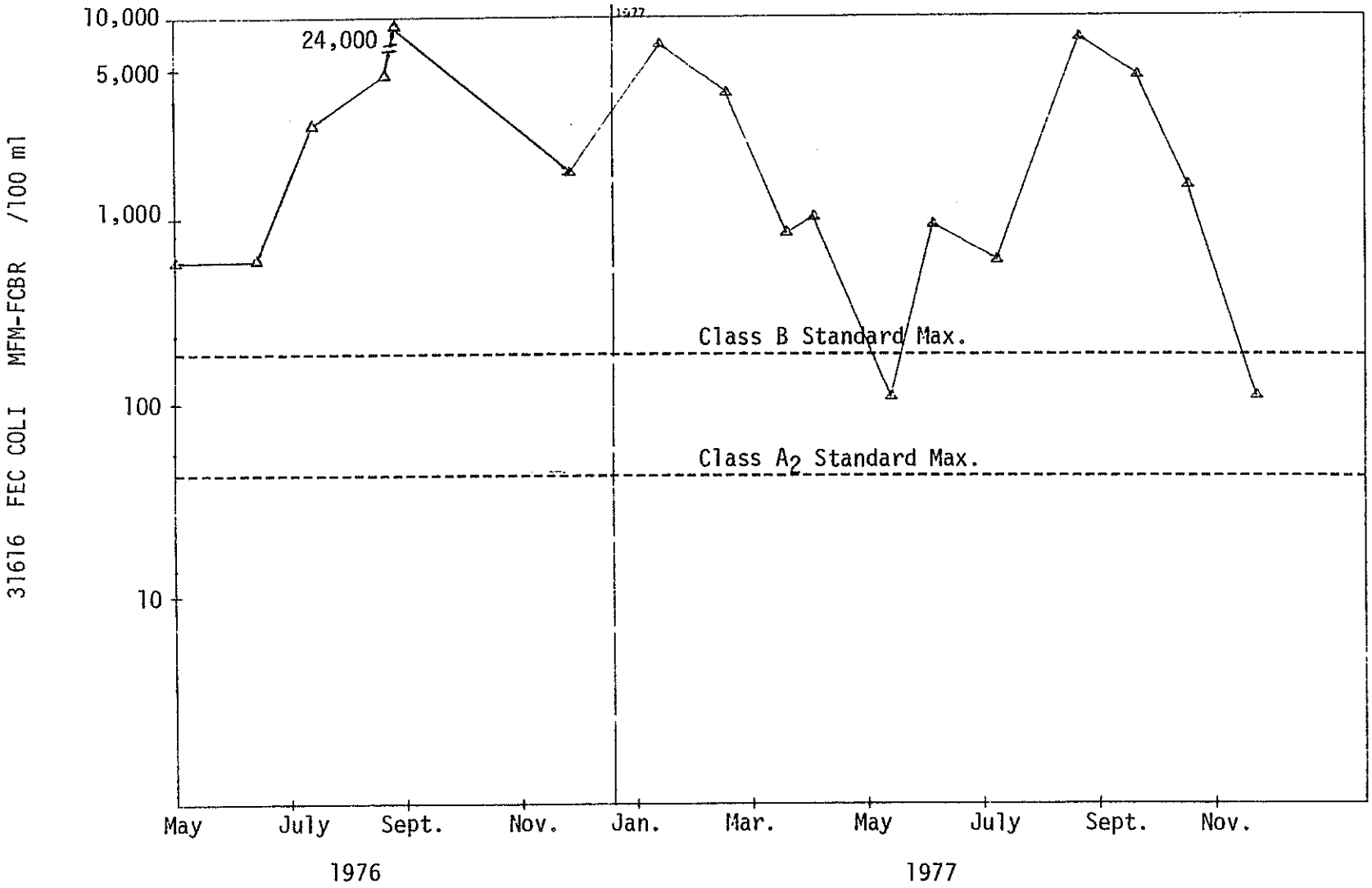
LINDSAY CREEK AT MOUTH

Figure 6. Fecal Coliform, number/100 ml



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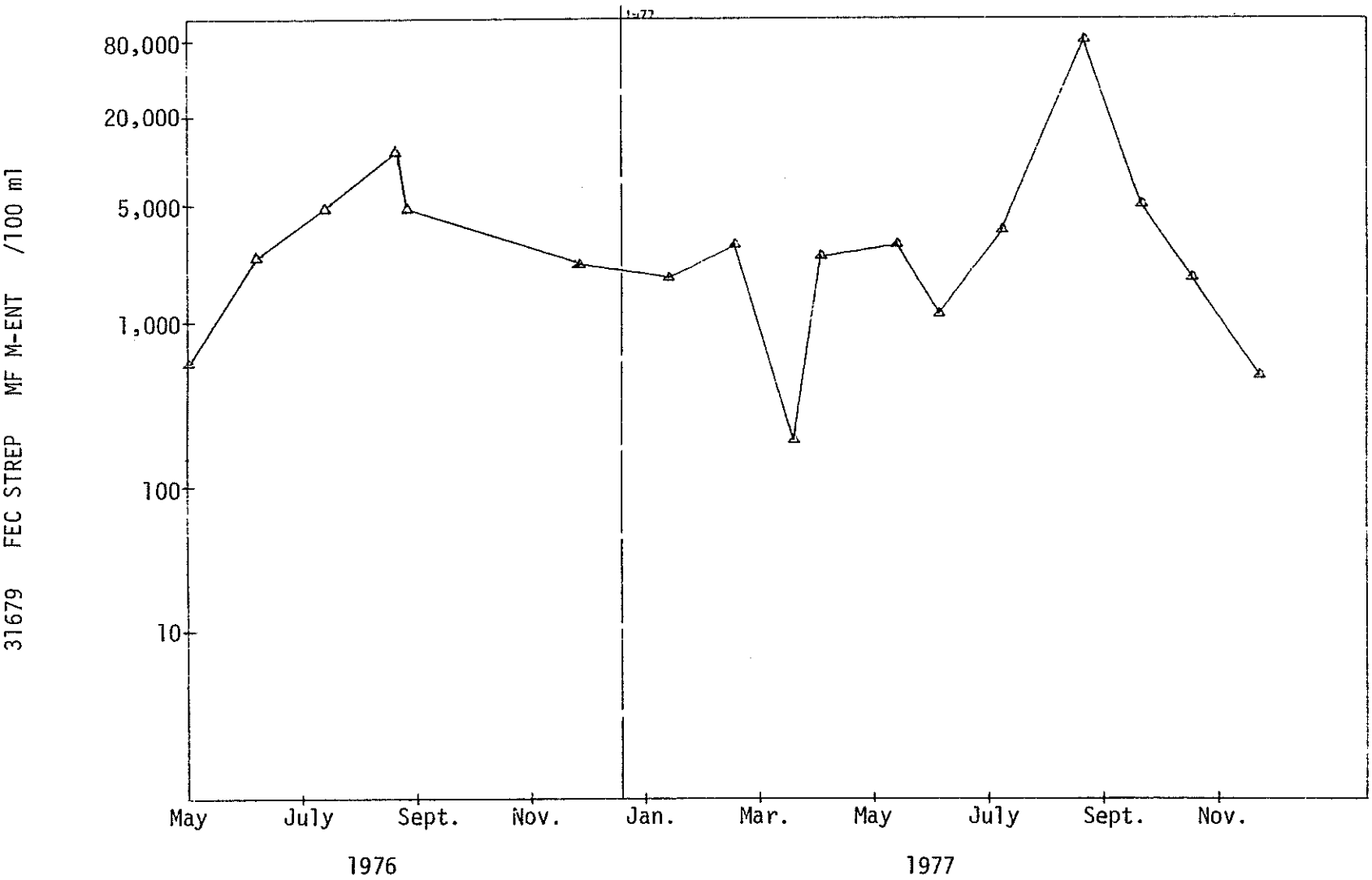
. 46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 7. Fecal Streptococcus, number/100 ml



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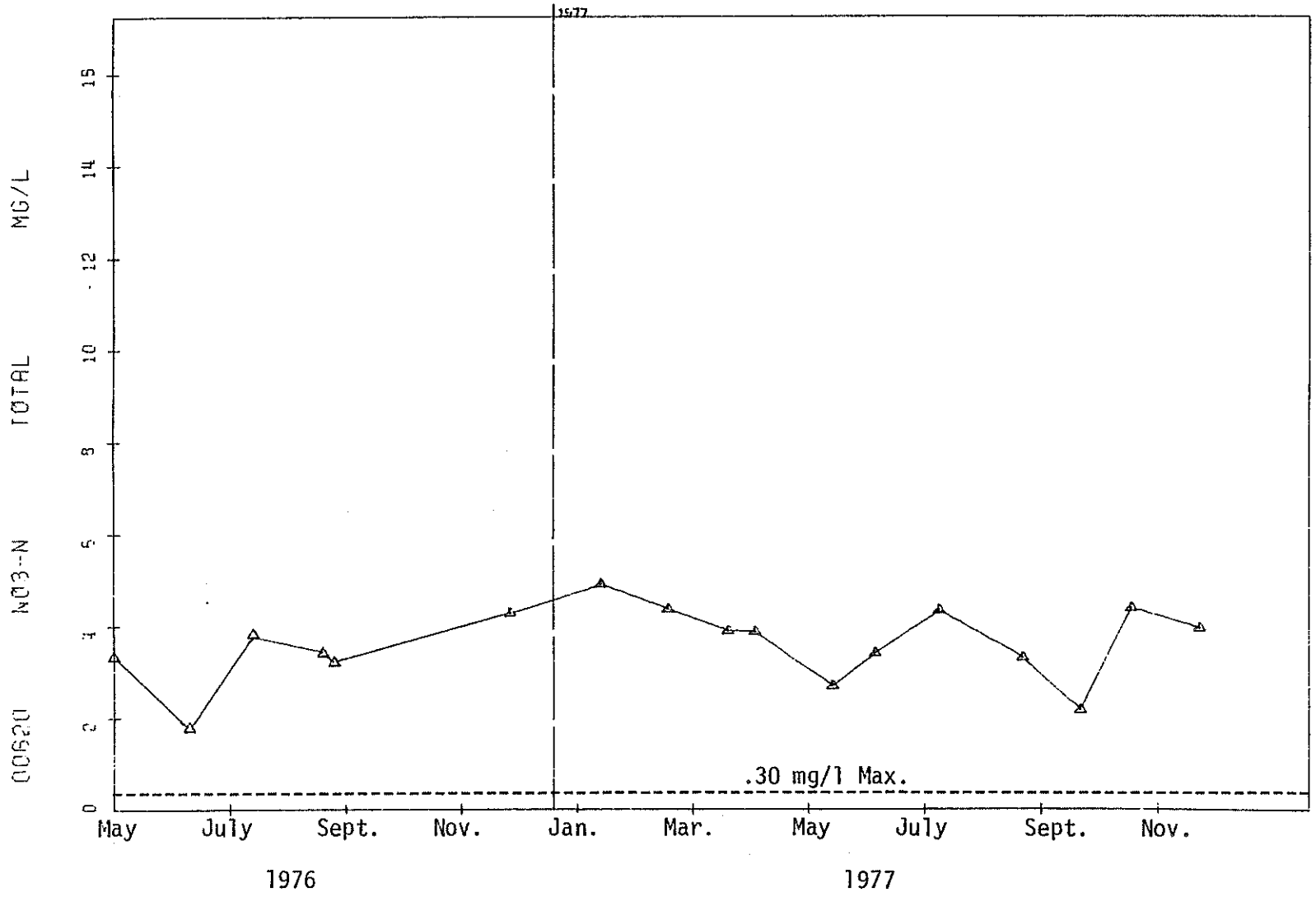
LINDSAY CREEK AT MOUTH

Figure 8. Nitrate-Nitrogen, mg/l



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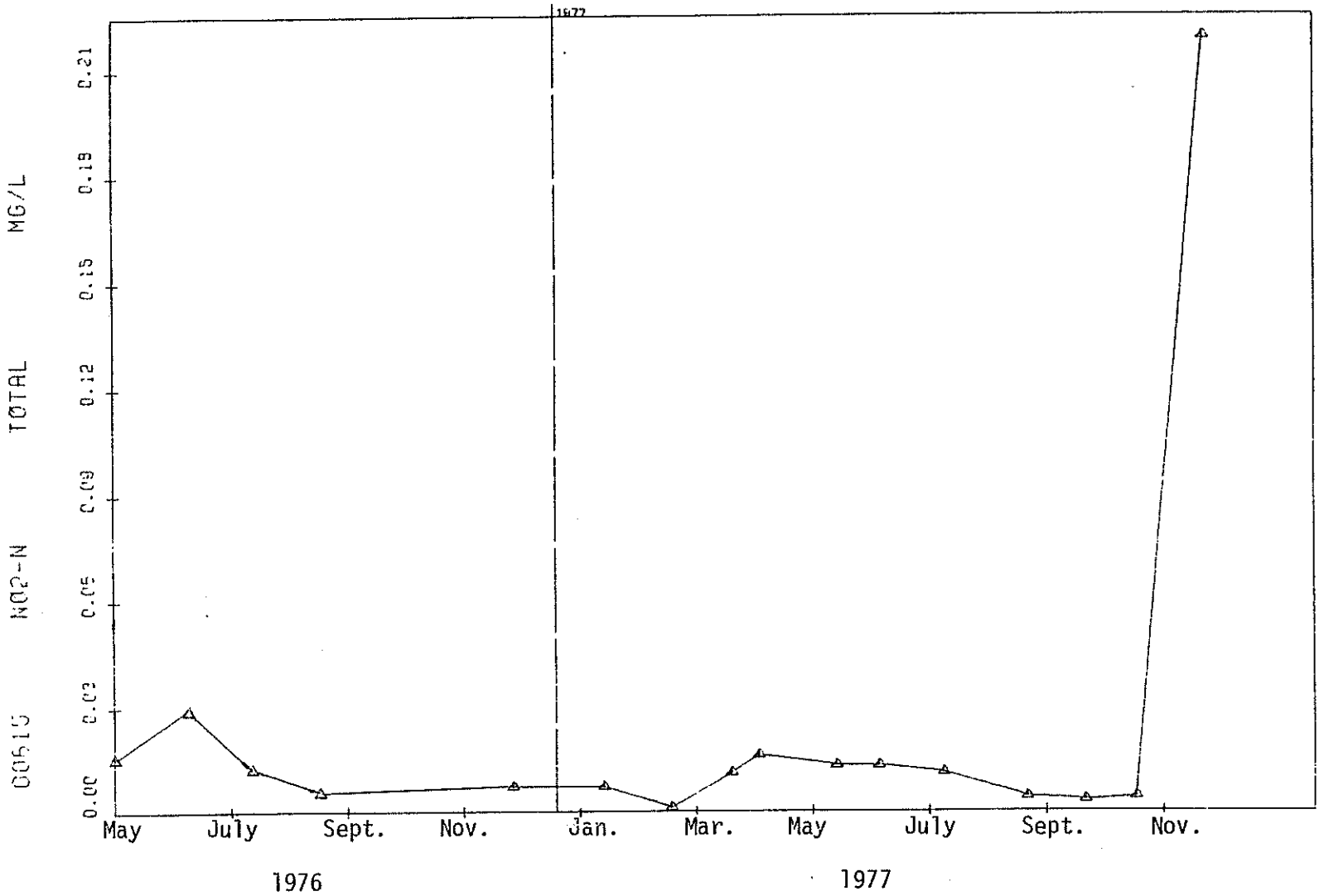
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 9. Nitrite-Nitrogen mg/l



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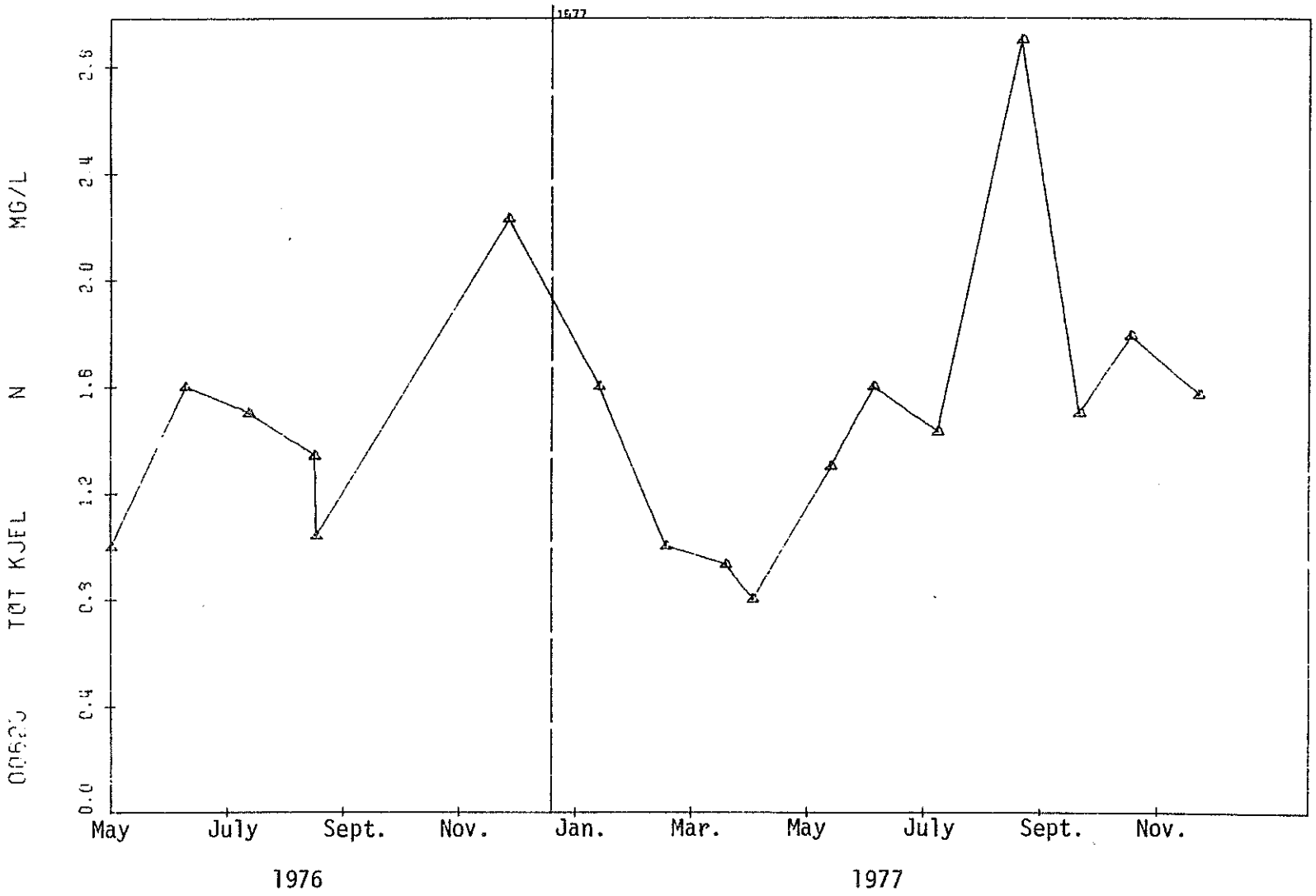
LINDSAY CREEK AT MOUTH

Figure 10. Total Kjeldahl Nitrogen, mg/l



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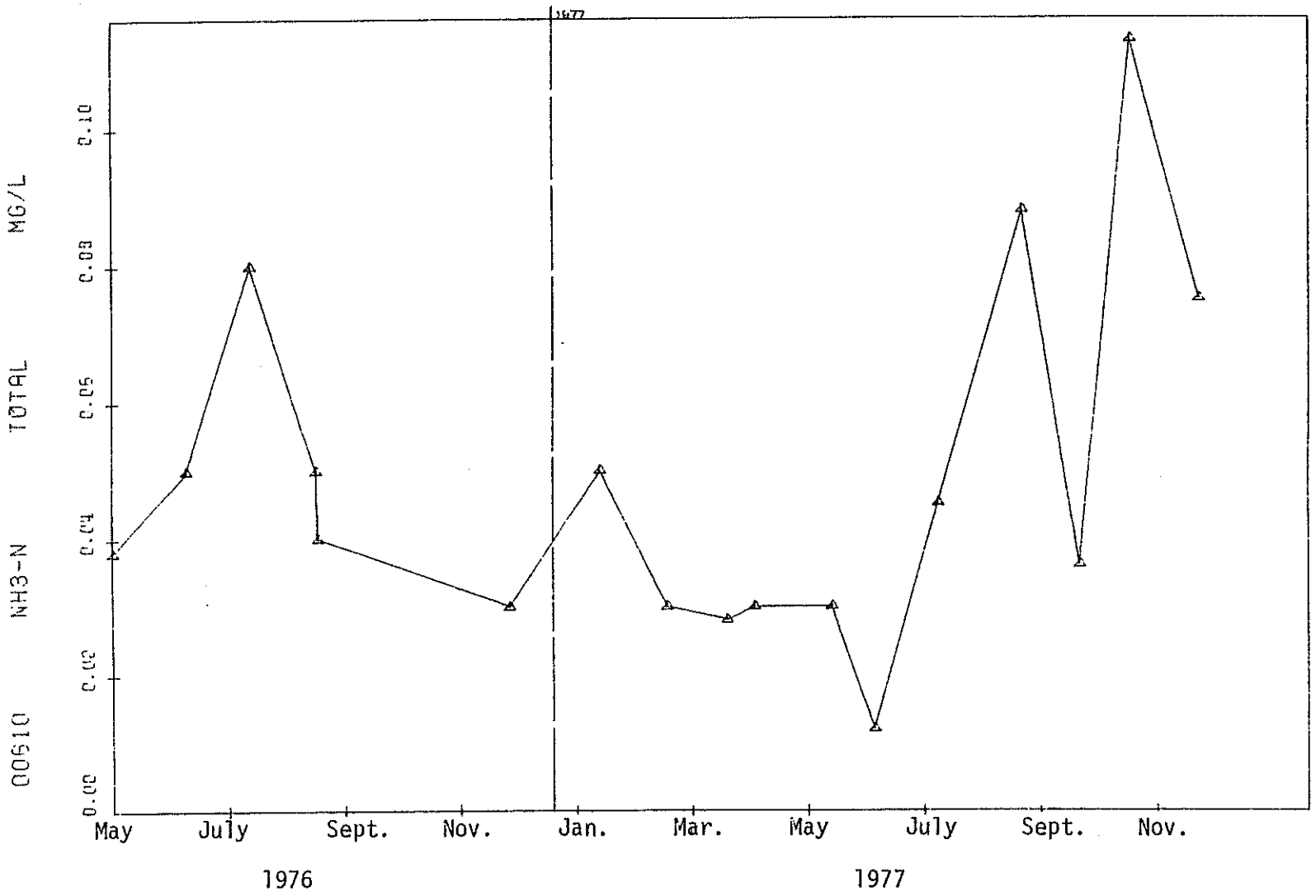
LINDSAY CREEK AT MOUTH

Figure 11. Ammonia-Nitrogen, mg/l



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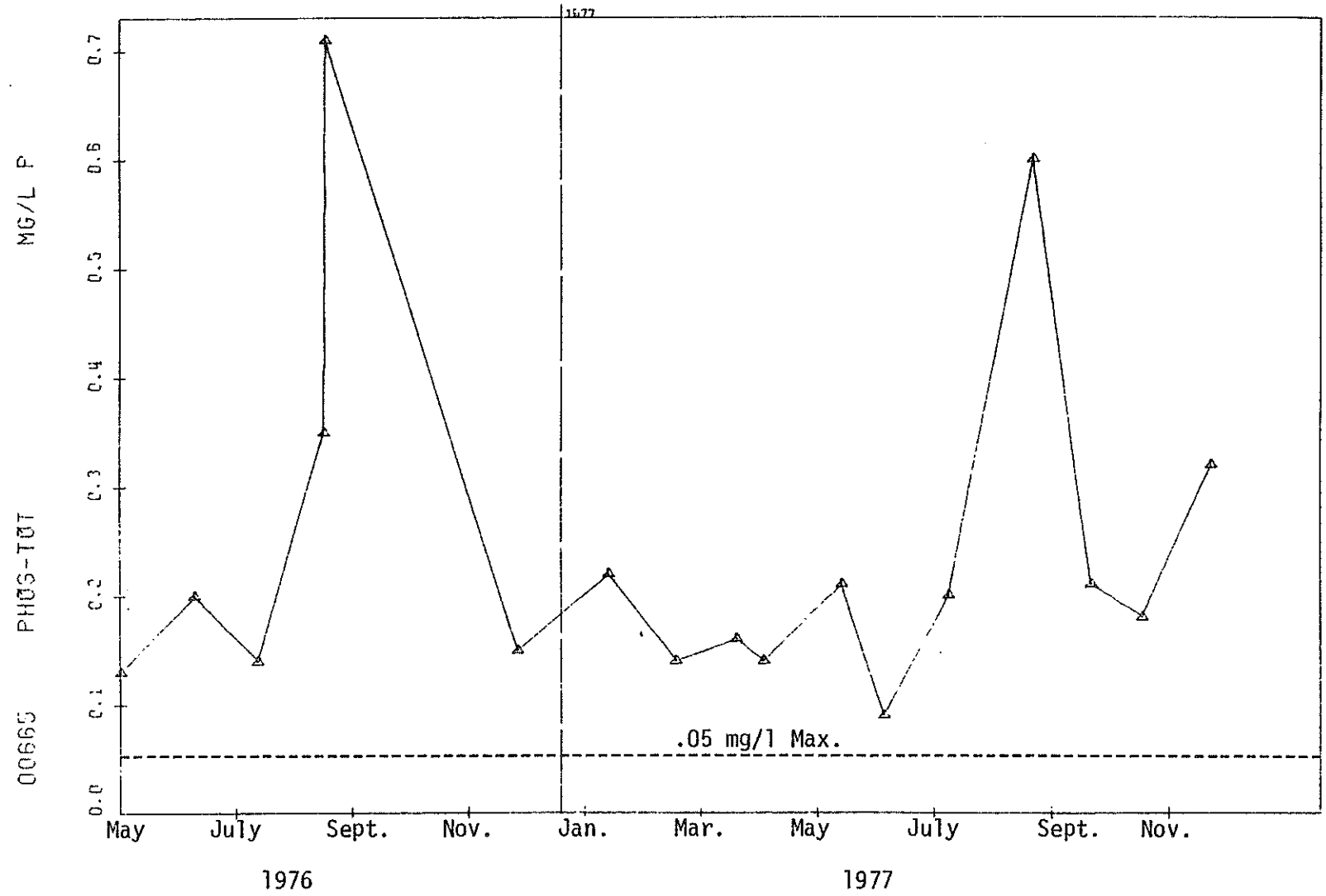
LINDSAY CREEK AT MOUTH

Figure 12. Total Phosphorus, mg/l



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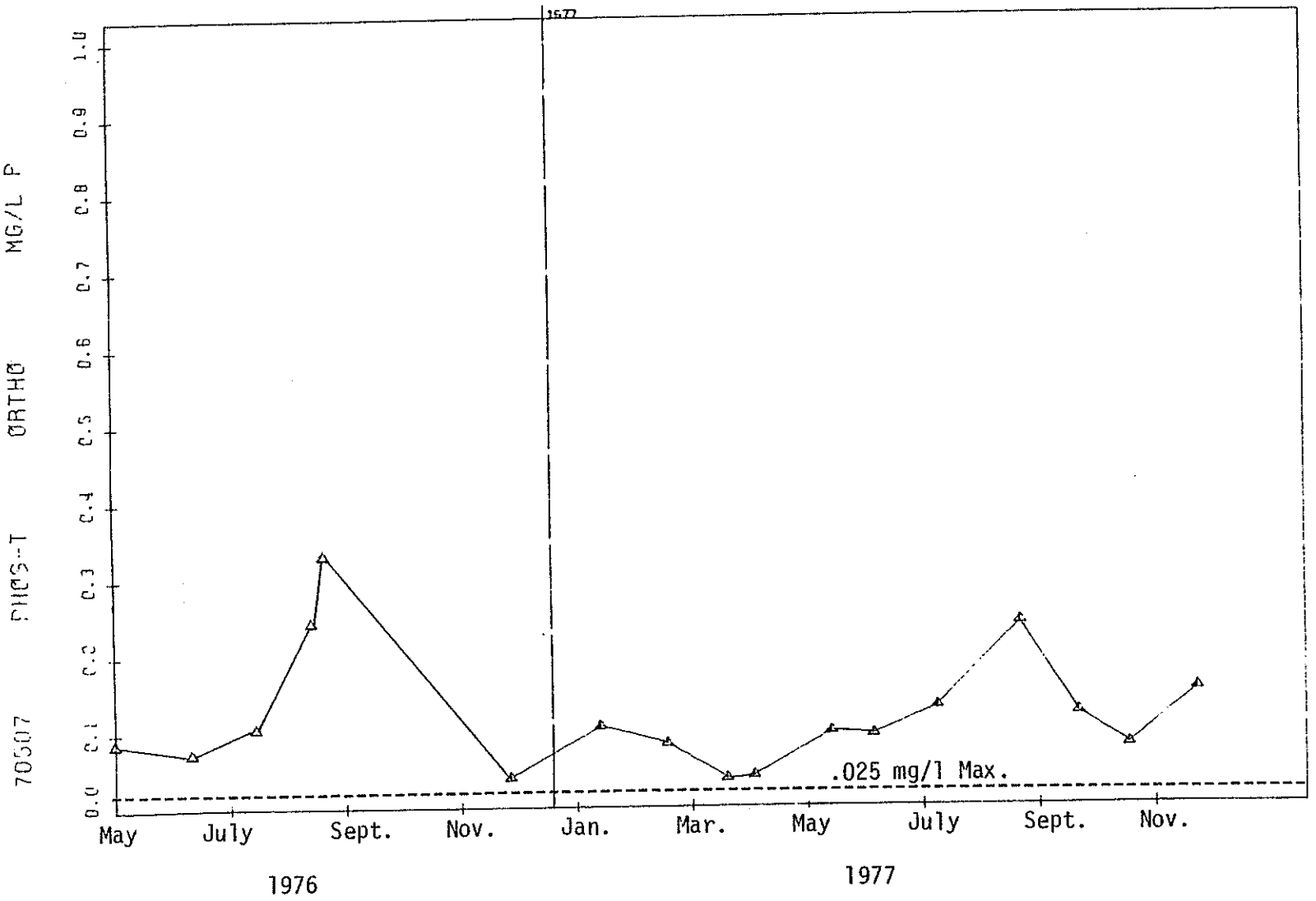
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 13. Ortho-phosphate, mg/l (P)



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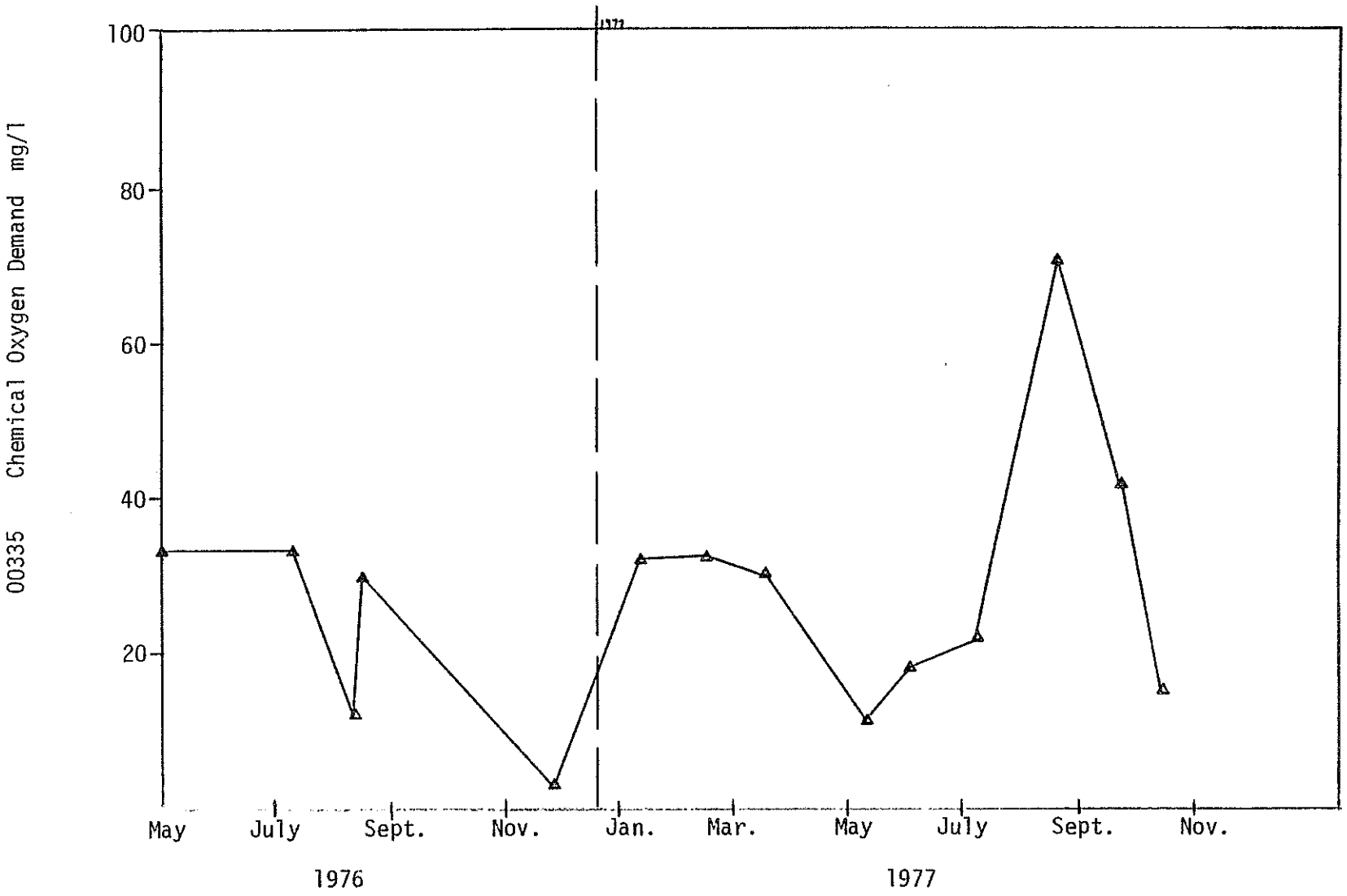
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 14. Chemical Oxygen Demand, mg/l



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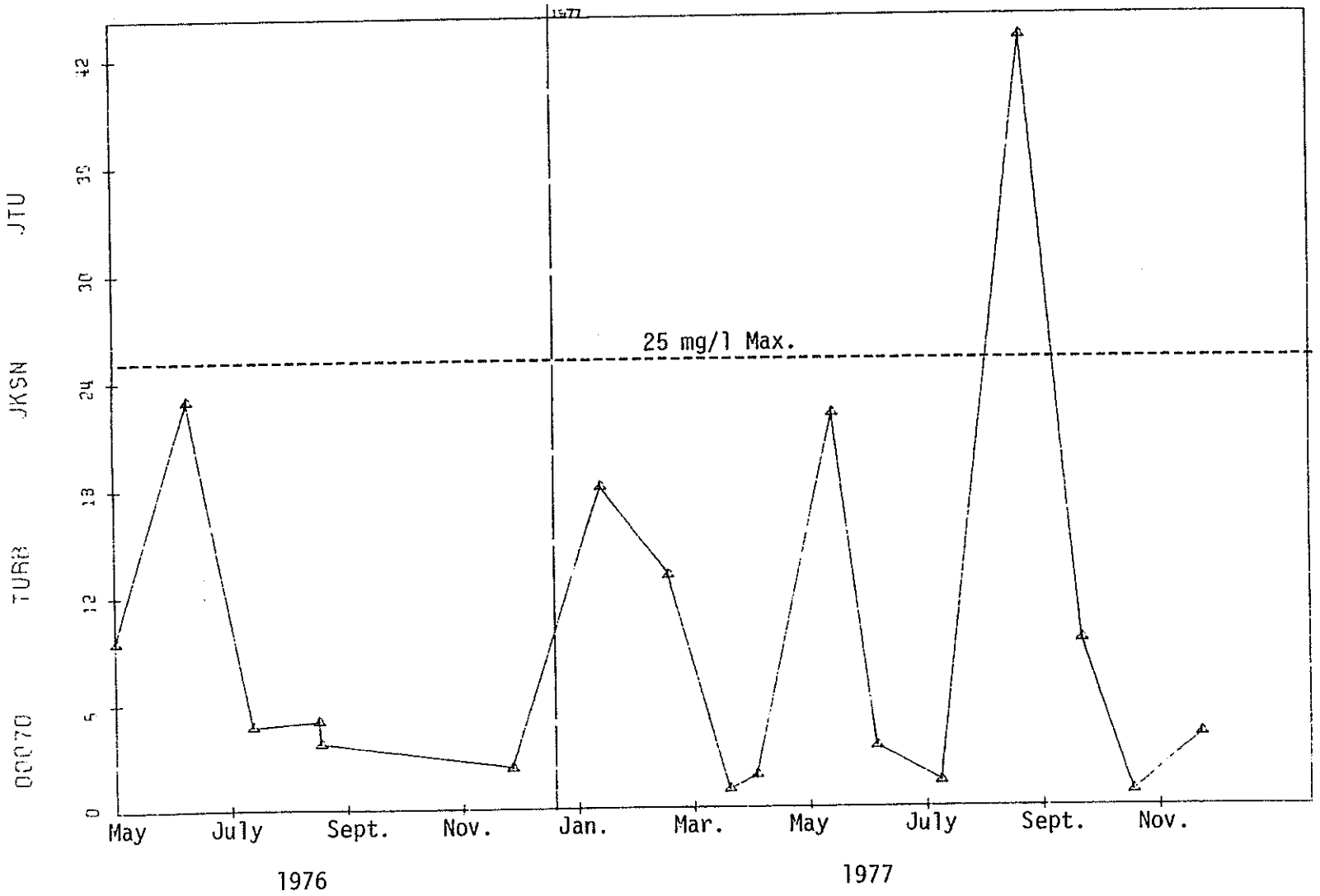
LINDSAY CREEK AT MOUTH

Figure 15. Turbidity, JTU



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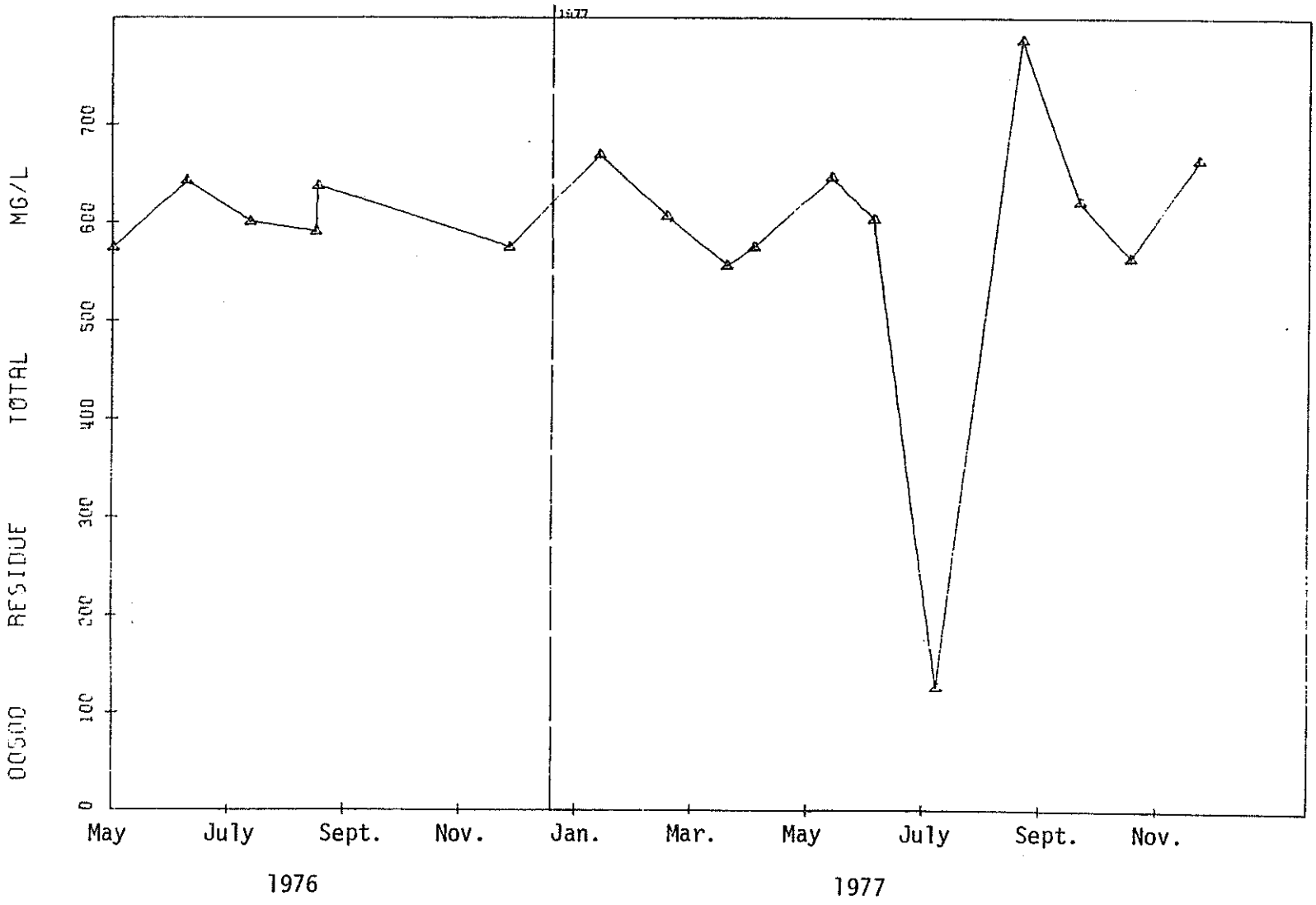
LINDSAY CREEK AT MØUTH

Figure 16. Total Residue, mg/l



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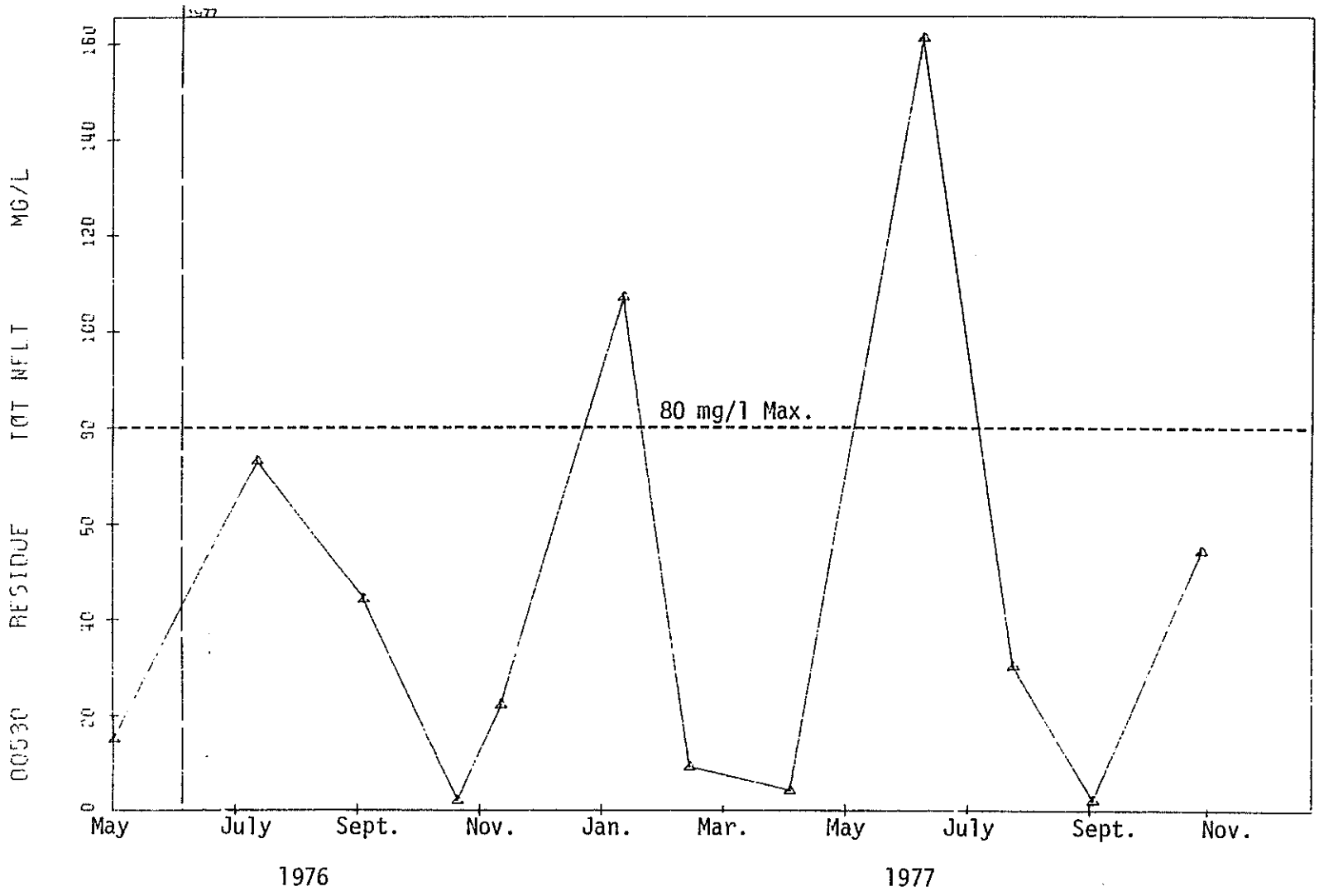
LINDSAY CREEK AT MOUTH

Figure 17. Suspended Solids (Non-filterable Residue), mg/l



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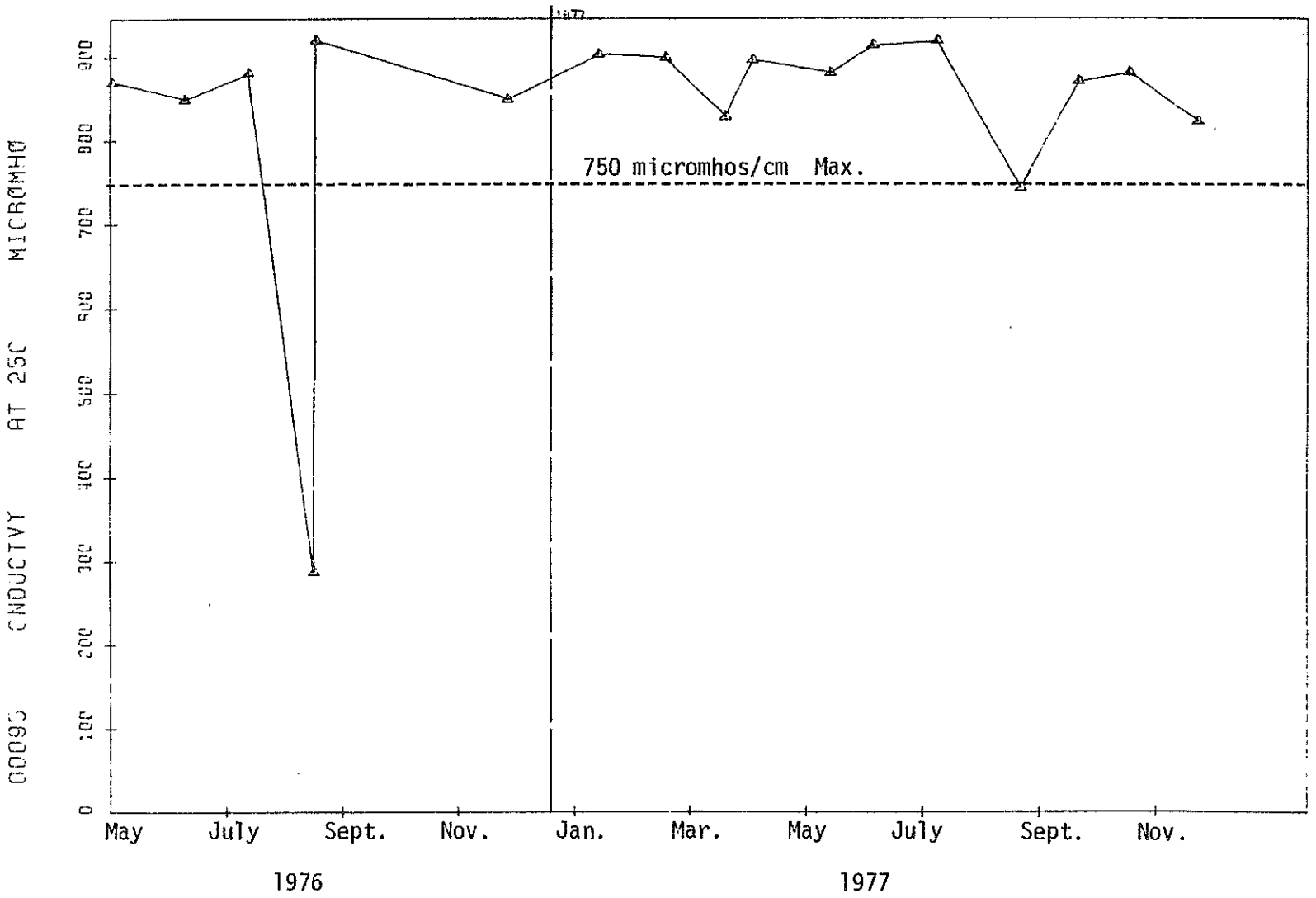
46 25 05.0 116 59 30.0 5
LINDSAY CREEK AT MOUTH

Figure 18. Conductivity, micromhos/cm



APPENDIX D

Idaho Water Quality Standards and Appropriate Criteria

III. GENERAL REQUIREMENTS

A. Interstate Compacts, Court Decrees and Adjudicated Water Rights

It shall be the policy of the Board that the adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the State of Idaho through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators in the utilization of the water appropriations which have been granted to them under the statutory procedure or to interfere with water quality criteria established by mutual agreement of the participants in interstate water pollution control enforcement procedures.

B. Waters of the State Protected

All waters of the State to be protected for appropriate beneficial use shall include all recreational use in and/or on the water surface and for preservation and propagation of desirable species of aquatic biota shall include all natural streams and lakes, reservoirs or impoundments on natural streams and other specified waterways unless excepted on the basis of existing irreparable conditions which preclude such uses. Man-made waterways, unless otherwise specified, shall be protected for the use for which the waterways were developed.

C. Highest and Best Practicable Treatment and Control Required

Notwithstanding the water quality standards contained herein, where a higher standard can be achieved, the highest and best practicable treatment and/or control of wastewaters, activities and flows shall be provided so as to maintain dissolved oxygen at the highest desirable levels and overall water quality as good as possible, and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest desirable levels. Such policy to apply not only to existing wastewater sources but to future wastewater sources as they may develop, and for such other streams not listed herein.

D. Antidegradation of State Waters

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at their existing high quality. These and other waters of Idaho will not be lowered in quality unless and until it has been affirmatively demonstrated to the Department and the Federal Environmental Protection Agency that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public or private project or development which would constitute a new source of water pollution or an increased source

of water pollution to high quality waters will be required, as part of the initial project design, to provide the highest and best degree of wastewater treatment available under existing technology, and, since there are also Federal standards, these wastewater treatment requirements will be developed cooperatively.

IV. RESTRICTIONS ON THE DISCHARGE OF SEWAGE AND INDUSTRIAL WASTEWATERS AND HUMAN ACTIVITIES WHICH AFFECT WATER QUALITY IN THE WATERS OF THE STATE

A. No wastewaters shall be discharged and no activities shall be conducted in such a way that said wastewaters or activities either alone or in combination with other wastewaters or activities will violate or can reasonably be expected to violate the water quality standards contained herein.

B. It is noted that from time to time certain short-term activities which are deemed necessary to accommodate essential activities and protect the public interest may be authorized by the Department under such conditions as the Department may prescribe, even though such activities may result in a reduction of water quality below the standards contained herein.

V. MAINTENANCE OF STANDARDS OF QUALITY

A. The degree of sewage or wastewater treatment required to restore and maintain the standards of quality shall be determined in each instance by the Board and shall be based upon the following:

1. The uses which are or may likely be made of the receiving stream.

2. The size and nature of flow of the receiving stream.

3. The quantity and quality of the sewage or wastewater to be treated.

4. The presence or absence of other sources of water pollution on the same watershed.

B. The water quality standards are subject to revision (following public hearings and concurrence of the Administrator of the EPA) as technical data, surveillance programs, and technological advances make such revisions desirable. Further, public hearings for the purpose of reviewing water quality standards shall be initiated in accordance with Title 67, Chapter 52, Idaho Code.

C. Established water quality standards shall not be applicable in the receiving waters within the mixing zone of limited size adjacent to and/or surrounding a wastewater discharge outfall as defined by specific mixing zone boundaries. Aesthetic values of receiving waters shall be protected irrespective of mixing zone boundaries.

Receiving water quality outside the mixing zone will be maintained at water quality standards contained herein, or existing water quality levels, whichever is higher.

D. In the application of the use classification, the most stringent criterion of a multiple criteria shall apply.

E. Sample collection, preservation and analytical procedures to determine compliance with these standards shall conform to the procedures prescribed by the latest edition of Standard Methods For The Examination Of Water And Wastewater, and other superseding methods published by the Department following consultation with adjacent states, and the concurrence of the Environmental Protection Agency.

VI. WATER USE CLASSIFICATION

The designated use(s) for which the waters of the State are to be protected shall include, but not necessarily limited to domestic and industrial water supply, irrigation and stock watering, recreation and/or aesthetic qualities. (See appendix, USES TO BE PROTECTED.) Recreational waters are further divided into two classes: (1) primary contact, and (2) secondary contact. Primary contact recreational waters (Class A) are for uses where the human body may come in direct contact with the raw water to the point of complete submergence. The raw water may be accidently ingested and certain sensitive organs such as eyes, ears, nose, etc. may be exposed to the water. These waters may be used for swimming, water skiing, skin diving, support and propagation of fish, aquatic and semi-aquatic life, and other forms of wildlife.

Primary contact recreational waters are further divided into sub-classes A_1 and A_2. Class A_1 is restricted to lakes and impoundments in which exceptionally high water quality exists. Waters of all lakes and impoundments shall be class A_1 unless otherwise excepted. In the instances where a flowing stream is classified and subsequently becomes an impoundment, that impoundment shall carry the same classification as the flowing stream. Class A_2 includes the remainder of the primary contact recreational waters.

Secondary contact recreational waters (Class B) are for uses in which the raw water supply is suitable for support and propagation of fish and other aquatic and semi-aquatic life, and other forms of wildlife. These waters may be used for boating, wading and other activities where ingestion of the raw water is not probable.

Waters classified as excepted (Class E) are waters in which, due to natural and/or man-made cause, the quality is not compatible with recreational uses. These waters are protected for the use(s) specified. The numerical value of the various parameters for specific Water Quality Standards contained herein under Section VIII shall apply to all Class E waters unless an alternate value for a given parameter is specified in Section IX for the waters under consideration.

Natural tributaries to the stream reaches are classified as primary recreational waters, Class A_2, unless otherwise specified. Waterways defined as a point source in Section 502(14), Public Law 92-500, are a means of conveyance for waters with no use classification. Canals and other man-made waterways excluded as a point source are protected for agricultural uses and aesthetic qualities and may be protected for other uses when specified.

In the instance where a flowing stream is classified and subsequently becomes an impoundment, that impoundment shall carry the same classification as the flowing stream. The criteria established for the various use-classifications may be modified by the Administrator for limited periods when receiving waters fall below their assigned water quality standards due to natural causes or if, in the opinion of the Administrator, the protection of the overall interest and welfare of the public requires such a modification.

VII. GENERAL WATER QUALITY STANDARDS FOR WATERS OF THE STATE

The following general water quality standards will apply to waters of the State, both surface and underground, in addition to the water quality standards set forth for specifically classified waters. Waters of the State shall not contain:

A. Toxic chemicals of other than natural origin in concentrations found to be of public health significance or to adversely affect the use for which the waters have been classified.*

B. Deleterious substances of other than natural origin in concentrations that cause tainting of edible species of fish or tastes and odors to be imparted to drinking water supplies.

C. Radioactive materials or radioactivity other than of natural origin which

   1. Exceed 1/3 of the values listed in Column 2, Table II, Appendix A, Idaho Radiation Control Regulations as adopted by the Board on May 9, 1973.

   2. Exceed the concentrations specified in the 1962 U. S. Public Health Service Drinking Water Standards for waters used for domestic supplies.

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* Guides such as the Water Quality Criteria published by the State of California Water Quality Control Board (Second Edition, 1963) and more recent research papers will be used in evaluating the tolerances of the various toxic chemicals for the use indicated.

3. Have a demonstrable effect on aquatic life.

The concentration of radioactive materials in these waters shall be less than those required to meet the Radiation Protection Guides for maximum exposure of critical human organs recommended by the former Federal Radiation Council in the case of foodstuffs harvested from these waters for human consumption.

D. Floating or submerged matter not attributable to natural causes.

E. Excess nutrients of other than natural origin that cause visible slime growths or other nuisance aquatic growths.

F. Visible concentrations of oil, sludge deposits, scum, foam or other material that may adversely affect the use indicated.

G. Objectionable turbidity which can be traced to a man-made source.

VIII. SPECIFIC WATER QUALITY STANDARDS

No wastewaters shall be discharged and/or no activity shall be conducted in waters of the State which either alone or in combination with other wastewaters or activities will cause in waters of any specified reach, lake or impoundment, or in general surface waters of the State

A. The organism concentrations of the coliform group

1. In waters of lakes and impoundments (A_1), except the following, which are classified as A_2 waters:

American Falls Reservoir	R.M. 738.0 to R.M. 714.0
Lake Walcott	
Milner Lake	R.M. 675.0 to R.M. 640.0
Murtaugh Lake	R.M. 690.0 to R.M. 675.0
Crane Falls Reservoir	
C. J. Strike Reservoir	R.M. 514.0 to R.M. 492.0
Lake Lowell	
Brownlee Reservoir	R.M. 338.0 to R.M. 285.0
Oxbow Reservoir	R.M. 285.0 to R.M. 273.0
Hells Canyon Reservoir	R.M. 273.0 to R.M. 247.0

a. Total coliform concentrations where associated with a fecal source(s) to exceed a geometric mean of 50/100 ml., nor shall more than 20 percent of total samples during any 30-day period exceed 200/100 ml. (as determined by multiple-tube fermentation or membrane filter procedures and based on not less than 5 samples for any 30-day period).

b. Fecal coliform concentrations to exceed a geometric mean of 10/100 ml., nor shall more than 10 percent of total samples during any 30-day period exceed 20/100 ml,; or greater than 50/100 ml. for any single sample.

Coliform criteria for shoreline waters shall conform with that of Class A_2 waters. Shoreline water waters shall be defined as the 100 feet of water surface as measured from the shoreline.

2. In waters protected for primary contact recreation (A_2)

a. Total coliform concentrations where associated with a fecal source(s) to exceed a geometric mean of 240/100 ml., nor shall more than 20 percent of total samples during any 30-day period exceed 1000/100 ml. (as determined by multiple-tube fermentation or membrane filter procedures and based on not less than 5 samples for any 30-day period).

b. Fecal coliform concentrations to exceed a geometric mean of 50/100 ml., nor shall more than 10 percent of total samples during any 30-day period exceed 200/100 ml.; or greater than 500/100 ml. for any single sample.

3. In waters protected for secondary contact recreation (B)

a. Total coliform concentrations where associated with a fecal source(s) to exceed a geometric mean of 1000/100 ml., nor shall more than 20 percent of total samples during any 30-day period exceed 2400/100 ml. (as determined by multiple-tube fermentation or membrane filter procedures and based on not less than 5 samples for any 30-day period).

b. Fecal coliform concentrations to exceed a geometric mean of 200/100 ml., nor shall more than 10 percent of total samples during any 30-day period exceed 400/100 ml.; or greater than 800/100 ml. for any single sample.

B. Dissolved Oxygen

The DO concentration to be less than 6 mg/l or 90 percent of saturation, whichever is greater.

1. The DO standard shall apply to all flowing waterways.

2. The DO standard shall apply to the waters of all natural lakes and reservoirs except as excluded below:

a. In depths of water less than 100 feet in natural lakes or reservoirs, the bottom 20 percent of water depth shall

be excluded from application of the DO standard. In water depths greater than 100 feet, the bottom 20 feet of water depth shall be excluded for application of the DO standard.

b. Waters below a thermocline in stratified lakes or impoundments shall be excluded from application of the DO standard.

c. No wastewaters shall be discharged and/or no activity shall be conducted in waters excluded by a. and b. above, which either alone or in combination with other wastewaters or activities will cause the DO concentration in these waters to be less than 4 mg/l.

3. Notwithstanding exclusion of a. and b. above, the DO standard shall always apply to the top two feet of any lake or reservoir.

C. Hydrogen Ion Concentration (pH)

The pH values to be outside the range of 6.5 to 9.0. The induced variations shall not be more than 0.5 pH units.

D. Temperature

1. Any measurable increase when water temperatures are 66°F or above, or more than 2°F increase other than from natural causes when water temperatures are 64°F or less (unless otherwise specified).

2. Any increase exceeding 0.5°F due to any single source, or 2°F due to all sources combined.

For purposes of determining compliance, a "measurable increase" means no more than 0.5°F rise in temperature of the receiving water as measured immediately outside of an established mixing zone. Where mixing zone boundaries have not been defined, cognizance will be given to the opportunity for admixture of wastewater with the receiving water.

3. Any measurable increase when water temperatures are 68°F or above, or more than 2°F increase other than from natural causes when the water temperatures are 66°F or less in the following waters:

a. The main stem of the Snake River from the Oregon-Idaho border (R.M. 407) to the interstate line at Lewiston, Idaho (R.M. 139).

b. The Spokane River from Coeur d'Alene Lake outlet to the Idaho-Washington border.

c. The Palouse River from Princeton to the Idaho-Washington border.

d. The Pend Oreille River from the Pend Oreille Lake outlet to the Idaho-Washington border.

E. Turbidity

The turbidity other than of natural origin to exceed 5 Jackson Turbidity Units (JTU). Whenever the receiving water is greater than 5 JTU, due to conditions other than those caused by man, then no discharge and/or activity either alone or in combination with other wastewater or activity shall cause an increase of more than 5 JTU.

F. Total Dissolved Gas

The total concentration of dissolved gas shall not exceed 110 percent of saturation at atmospheric pressure at the point of sample collection due to non-natural causes. (In compliance with this standard Paragraph C, Section III, General Requirements shall apply.)

IX. SPECIFIC WATER QUALITY STANDARDS FOR CLASS E WATERS

Specific water quality standards contained herein under Section VIII shall apply to all Class E waters except as enumerated in this Section.

A. No wastewater shall be discharged and/or no activity shall be conducted which either alone or in combination with other wastewaters will cause the organism concentration of the coliform group in waters of the South Fork Coeur d'Alene River, Mullan to Enaville, or Paradise Creek, upper reaches to State line.

1. The <u>total coliform</u> concentrations where associated with a fecal source(s) to exceed a geometric mean of 240/100 ml., nor shall more than 20 percent of total samples during any 30-day period exceed 1000/100 ml. (as determined by multiple-tube fermentation or membrane filter procedures and based on not less than 5 samples for any 30-day period); or greater than 2400/100 ml. for any single sample.

2. The <u>fecal coliform</u> concentrations to exceed a geometric mean of 50/100 ml., nor shall more than 10 percent of total samples during any 30-day period exceed 200/100 ml.; or greater than 500/100 ml. for any single sample.

B. No wastewaters shall be discharged and/or no activity shall be conducted which either alone or in combination with other wastewaters will cause the DO concentration to be less than 75 percent of saturation in waters of Paradise Creek, upper reaches to the State line.

The states are responsible for the monitoring of and reporting data for interstate streams which include most tributaries to the major rivers.

3. PARAMETRIC COVERAGE:

The parametric coverage for the stations in the NWQSS network is shown on Table 2. At the present time there is some discrepancy among the various agencies' parametric coverage; however, negotiations are presently underway to develop a uniform parameter package. Station parameters covered by this report include a selection of those constituents which are, 1. considered significant in ambient station analysis and/or, 2. collected at each NWQSS station in the river basin under consideration.

4. REGION 10 WATER QUALITY CRITERIA:

Parameter	Criteria Level/Units	Environmental Impact and Reference
Temperature	20°C (68°F) MAX	To protect growth and migration routes of salmonids (Federal Water Pollution Control Administration (FWPCA), Water Quality Criteria, 1968).
Dissolved Oxygen	6 mg/l MIN 90% SAT MIN	For good growth and the general well-being of trout, salmon, and other species of cold water aquatic life, DO concentrations should not be below 6 mg/l (FWPCA, Water Quality Criteria, 1968). In addition, state water quality standards normally require 90% saturation for dissolved oxygen (Idaho and Oregon).
Dissolved Gas	110% SAT MAX	To prevent fish fatalities by "gas bubble disease", in which dissolved gases in their circulatory system come out of solution to form bubbles (emboli), which block the flow of blood through the capillary vessels (Environmental Protection Agency, Quality Criteria for Water, 1976).

Parameter	Criteria Level/Units	Environmental Impact and Reference
pH	6.5 MIN 8.5 MAX	The pH range of 5 to 9 is not directly lethal to fish. However, the toxicity of several common pollutants is markedly affected by pH changes within this range, and increasing acidity or alkalinity may make these poisons more toxic. Therefore, a pH range of 6.5 to 9.0 is desirable to protect freshwater aquatic life (EPA, Quality Criteria for Water, 1976). In primary contact recreation waters, the pH should be within the range of 6.5-8.3 (except when due to natural causes) to prevent the possibilities of eye irritations in humans (FWPCA, Water Quality Criteria, 1968). State pH standards range from 6.5 to 9.0 for Idaho and 6.5 to 8.5 for Oregon and Washington. In light of the above information, our criteria has been set at 6.5 to 8.5.
Turbidity	25 JTU MAX	Most state standards have a turbidity standard of "not to exceed 5 JTU over background or natural conditions". This is rather ambiguous as to what "background or natural conditions" are. Also, this type of standard does not relate to the fishable/swimmable concept. Excessive turbidity reduces photosynthesis by aquatic plant life and damages the spawning grounds of fish and habitat of aquatic invertebrates. Buck (1956) observed that maximum production in hatchery ponds and reservoirs occurred where the average turbidity was less than 25 JTU (FWPCA, Water Quality Criteria, 1968).

Parameter	Criteria Level/Units	Environmental Impact and Reference
Phosphorus	Total 0.05 mg/l-P Total 0.15 mg/l-PO_4 Ortho 0.025 mg/l-P Ortho 0.075 mg/l-PO_4 Diss. Ortho 0.01 mg/l-P	Limited studies made to date indicate that different species of algae have somewhat different phosphorus requirements, with the range of available phosphorus usually falling between 0.01 and 0.05 mg/l as P. At these levels, when other conditions are favorable, blooms may be expected. While there is no set relationship between total and available phosphorus (because the ratio varies with season, temperature, and plant growth), the total phosphorus is governing, as the reservoir supplies the available phosphorus. A desirable guideline for total phosphorus is 0.05 mg/l as P where streams enter lakes or reservoirs (FWPCA, Water Quality Criteria, 1968). The other criteria levels for different units and forms of phosphorus have been determined by unit conversion and relationships found between the phosphorus forms in Region 10. The other forms of phosphorus are used only as indicators when data for total phosphorus is lacking.
Nitrate Nitrogen	0.30 mg/l-N 1.33 mg/l-NO_3	Mackenthum (1965) cited results indicating that inorganic nitrogen at 0.30 mg/l and inorganic phosphorus at 0.01 mg/l, at the start of an active growing season, subsequently permitted algal blooms (FWPCA, Water Quality Criteria, 1968).
Ammonia Nitrogen	Unionized 0.02 mg/l-N Total 0.20 mg/l-N Total 0.26 mg/l-NH_4	The amount of unionized ammonia is very much dependent upon pH, temperature, and concentration of total ammonia. A maximum level of 0.02 mg/l as unionized ammonia is recommended to minimize toxicity to freshwater aquatic life (EPA, Quality Criteria for Water, 1976). Concentrations of total ammonia above 0.20 mg/l as N are indicative of organic pollution (Klein, River Pollution 1., Chemical Analysis, 1959).

Parameter	Criteria Level/Units	Environmental Impact and Reference
Bacteria	Total Coliform 1000/100 ml Fecal Coliform 240/100 ml	Total and fecal coliform are microbiological indicators used to determine or indicate the safety of water for drinking, swimming, and shellfish harvesting. A fecal coliform log mean of 200 per 100 ml for bathing waters and 14 per 100 ml for shellfish harvesting waters is recommended by Quality Criteria for Water, EPA, 1976. State standards range from 240 total/50 fecal per 100 ml for primary contact recreation in Idaho, 1000 total per 100 ml in Oregon for general beneficial use, and 1000 total per 100 ml in Washington for Class B general recreation. From the above discussion, the suggested criteria level based on general recreation is 1000 per 100 ml for total coliform and 240 per 100 ml for fecal coliform.
Dissolved Solids Conductivity	TDS 500 mg/l Cond. 750 umho/cm	High levels of dissolved solids are a hazard for irrigation water. A maximum level of 500 mg/l is indicated for water from which no detrimental effects will usually be noticed. For domestic water supply, the maximum level is 250 mg/l (EPA, Quality Criteria for Water, 1976). A relationship exists between dissolved solids and conductivity where total dissolved solids = .6 to .8 times the conductivity.
Boron	750 ug/l	For long term irrigation, a maximum level of 750 ug/l is recommended for sensitive crops (EPA, Quality Criteria for Water, 1976).

Parameter	Criteria Level/Units	Environmental Impact and Reference
Benthic Invertebrate Biomass	--	Is a measure of the standing crops of the benthic fauna. Typical responses of the standing crop to environmental stress are: Stress — Standing Crop Response Toxic Substance — Reduce Severe Temperature Alterations — Variable Silt — Reduce Inorganic Nutrients — Increase Organic Nutrients (high O_2 demand) — Increase (EPA Biological Field and Laboratory Methods, 1973.)
Chlorophyll a	3 mg/l 3-20 mg/l 20 mg/l	Oligotrophic Mesotrophic Eutrophic (Vollenweider, Dr. R.A., Water Management Research, Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters with Particular Reference to Nitrogen and Phosphorus as Factors in Eutrophication, DAS/CSI/68.27).
Species Diversity	<1 polluted 1-3 moderate pollution >3 unpolluted	The species diversity index reflects the response of the benthic macroinvertebrate community to pollutional stress (Wilhelm 1970).

Heavy Metals Toxicity

Metal	Criteria Level	Environmental Impact	Reference
Cadmium	30 ug/l	Aquatic life protected in hard water	1
	3 ug/l	Eggs and larvae of salmon in hard water	
Chromium	50 ug/l	Mixed aquatic populations protected	1
Copper	20 ug/l	96 hour TL_{50} to Chinook salmon in soft water was 31 ug/l at hatch and 18 ug/l at 1 month old	2
Lead	30 ug/l	Aquatic life protected	1
Mercury	0.2 ug/l	Selected species of fish and predatory aquatic organisms protected	1
Zinc	100 ug/l	96 hour TL_{50} to Chinook salmon in soft water at 1 month old	2
	80 ug/l	Algalcidal concentration for Selenastrum Capriconutum	3

References:

1. EPA R3.73.033, Ecological Research Series, Water Quality Criteria 1972, U.S. Government Printing Office, 1973.

2. EPA, Quality Criteria for Water, 1976.

3. Green, et. al., Report to Region X on the Results of the Spokane River Algal Assays, 1973.

4. Wilhelm, J.L. 1970. "Range of Diversity Index in Benthic Macroinvertebrate Populations" JWPCF, 42(S); R221-R224.

Pesticide Toxicity

The following criteria levels are recommended to protect the freshwater aquatic life (EPA, Quality Criteria for Water, 1976).

Pesticide	Criteria Level
Aldrin	.003 ug/l
Dieldrin	.003 ug/l
Chlordane	.010 ug/l
DDT	.001 ug/l
Endrin	.004 ug/l
Heptachlor	.001 ug/l
Lindane	.010 ug/l
Malathion	.100 ug/l
Parathion	.040 ug/l