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ROSE LAKE TRANSECT STUDY

CLEAN WATER

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHWEST REGION
PORTLAND, OREGON

ROSE LAKE TRANSECT STUDY

Station No. 153007

September 23 and 24, 1969

Prepared by

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A Working Paper presents results of investigations which are to some extent limited or incomplete. Therefore, conclusions or recommendations--expressed or implied--are tentative.

CONTENTS

	Page
INTRODUCTION	
Purpose	1
Objectives	1
Authority	3
Sampling Program	3
SUMMARY	
Findings	4
Conclusions	8
Recommendations	11
STUDY AREA	
Station Location and Description	12
SAMPLING AND ANALYTICAL METHODS	
Sampling Methods and Schedule	13
Analytical Procedures	13
DISCUSSION	15
REFERENCES	17
APPENDIX	18

FIGURES

Figure No.		Page No.
1	General Location Map	2
2	pH and Total Coliform Diurnal Values Cross-Section Aveage)	5
3	Temperature and Conductivity Diurnal Values	6
4	Dissolved Oxygen and Percent Saturation Diurnal Values (Cross-Section Average)	7

TABLES

Table No.		Page No.
1	Rose Lake Stream Survey Data 9/23-24/69	9
2	Quarterly Report of FWPCA Water Quality Monitoring Stations, Dalene River at Rose Lake, Station No. 153007	11

INTRODUCTION

Purpose

The Federal Water Pollution Control Administration (FWPCA), Pollution Surveillance Branch, maintains a system of water quality sampling stations on interstate waters in the Northwest Region. Throughout the year water samples are collected at these stations and analyzed, and the data are used to evaluate water quality. Knowledge of conditions peculiar to each station is helpful in the evaluation of the data obtained. This study documents conditions at Station No. 153007 located at river mile 153.4 on the Coeur d'Alene River approximately five miles below the confluence of the North and South Forks (Fig. 1). Diurnal and spatial variances at the station were observed during a 24-hour period.

A similar study was performed on April 1, 2 and 3, 1969. The report on that study is available in the files of the Pollution Surveillance Branch.

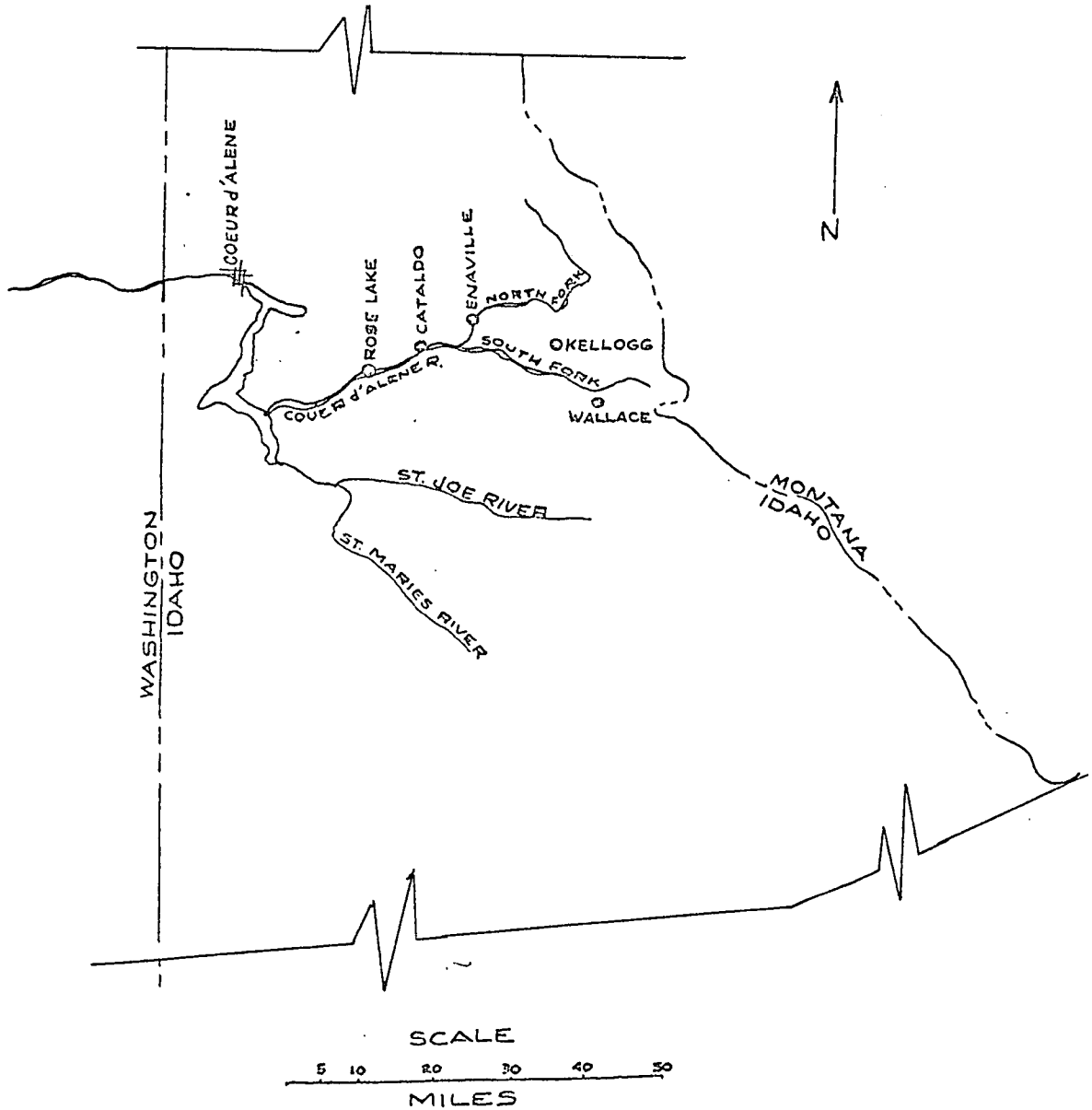
Objectives

The objectives of the survey were to determine:

1. What is the optimum sampling point in the stream cross-section?

2. What are the diurnal changes occurring in physical, chemical, biochemical, and bacteriological water quality at the sampling site?

3. What factors influence water quality at the sampling site?



General Location Map

FIGURE 1

Authority

Authorization for this study was from the Federal Water Pollution Control Act (33 U.S.C. et seq.) as amended. The study was performed by the Technical Assistance and Investigations Branch of the Office of Technical Programs as requested by the Pollution Surveillance Branch.

Sampling Program

1. Six water samples were collected every two hours for a 24-hour period. The initial sample collection was at 1300 hours (1:00 pm) on September 23, 1969, with the final samples obtained at 1100 hours (11:00 am) on September 24, 1969.

2. Three equally spaced sampling points were selected across the river on the bridge. Two samples were taken from each point, one at the five-foot depth and another five feet above the bottom.

3. The following analyses were performed on the samples: pH, specific conductivity, dissolved oxygen, total alkalinity, total coliform, and temperature.

SUMMARY

Findings

1. The total coliform concentrations show a minimum value[1/] of 45 total coliforms per 100 milliliters (TC/100 ml) at 1500 hours through 1700 hours. The peak of 406 TC/100 ml occurred at 2300 hours. By 0700 hours the concentrations had dropped again to 60 TC/100 ml (Fig. 2).

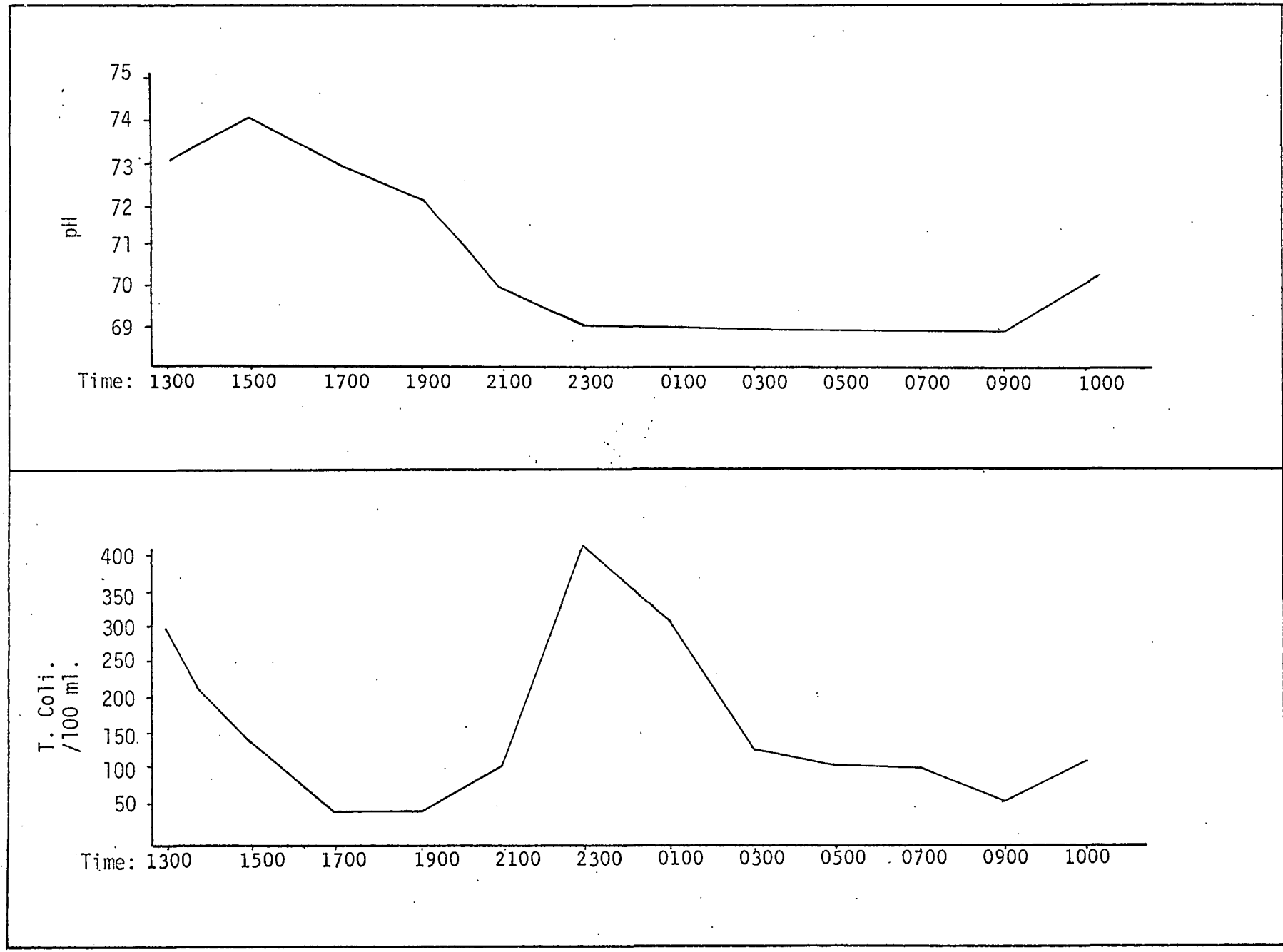
2. The only fecal coliform organisms detected were at 1300 hours and at 0100 hours. The concentrations were <5 fecal coliforms per 100 milliliters (FC/100 ml).

3. The diurnal temperature fluctuation was only 0.5° C.; temperatures registered 13° C at 1300 hours through 2100 hours, then gradually decreased to 12.5° at 0300, and remained at this value for the remaining eight hours (Fig. 3).

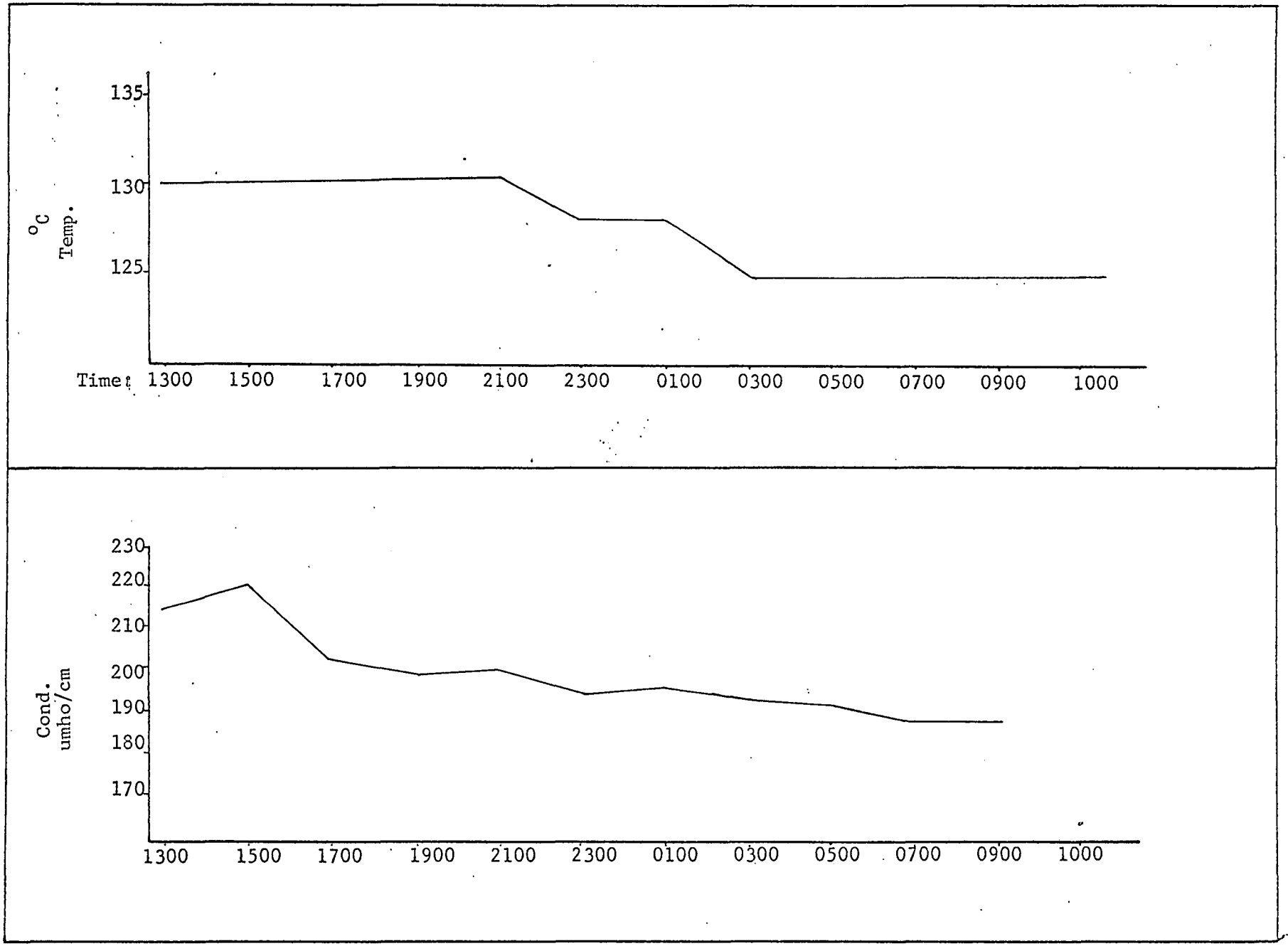
4. At 1300 hours dissolved oxygen (DO) and percent saturation were 9.0 milligrams per liter (mg/l) and 91 percent respectively. The high values of 9.5 mg/l DO and 96 percent saturation occurred at 2300 hours, and then decreased gradually (Fig. 4).

5. The specific conductivity and pH values displayed similar diurnal patterns. The maximum values recorded at 1500 hours were 7.4 pH and 200 micromhos per centimeter (μmho/cm) conductivity.

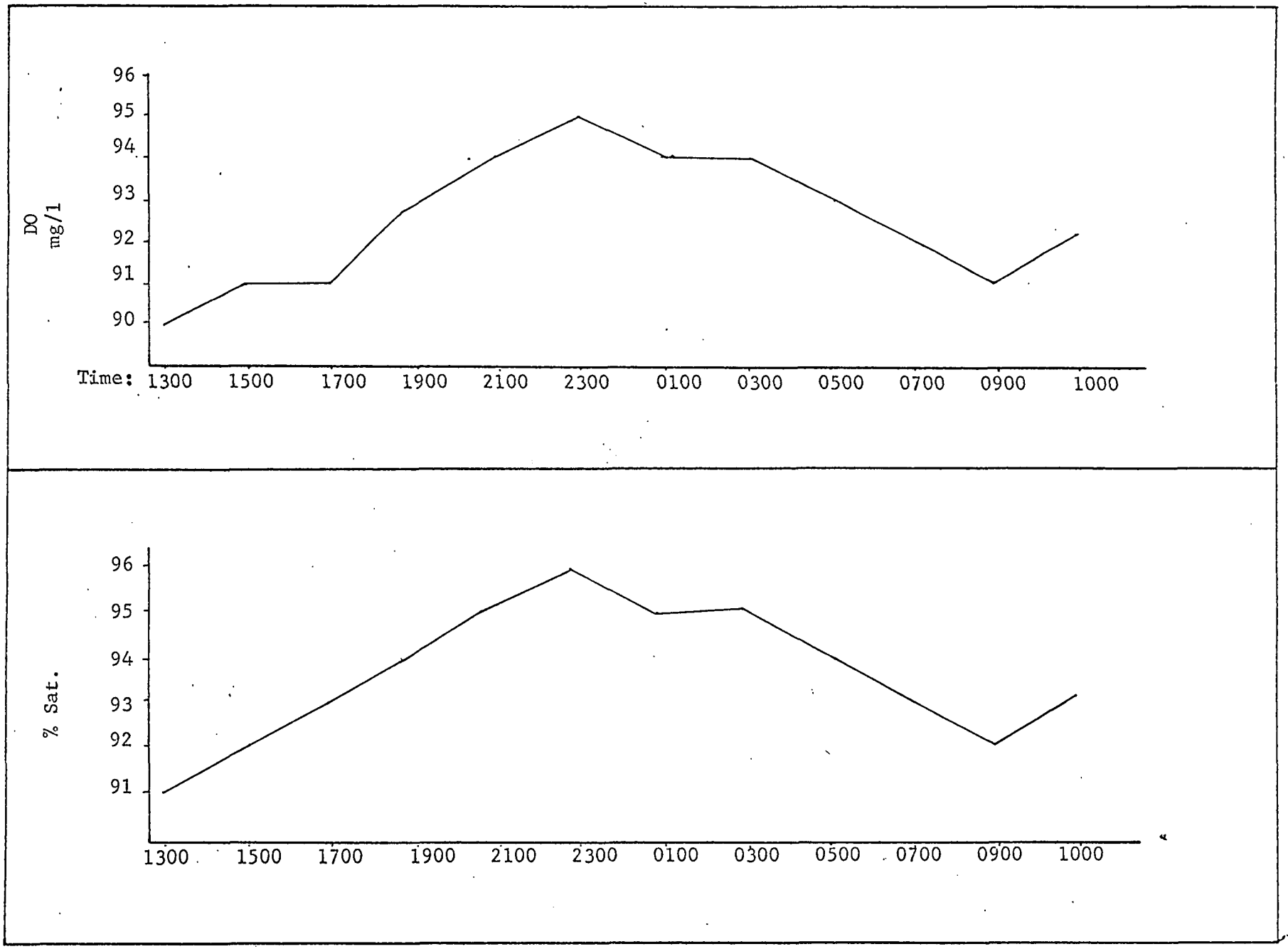
1/ All values quoted in the Findings, with the exception of flow data and metals concentrations, are bi-hourly averages for the entire cross-section.



pH and Total Coliform Diurnal Values (Cross-Section Average)
FIGURE 2



Temperature and Conductivity Diurnal Values
FIGURE 3



Dissolved Oxygen and Percent Saturation Diurnal Values (Cross-Section Average)
FIGURE 4

The values steadily decreased until 0900 hours the next day, when pH was 6.9 and conductivity was 189 µmho/cm (Fig. 2 and 4).

6. The alkalinity concentrations remained steady throughout the 24-hour period at 25 to 30 mg/l total alkalinity.

7. The quarterly STORET retrieval from the Pollution Surveillance Branch shows metals concentrations for the first day of the survey (9/23) were: copper--3 micrograms per liter (µg/l), total iron--650 µg/l, dissolved lead--55 µg/l, zinc--100,000 µg/l (Table 2).

8. The mean daily discharges recorded by the U.S. Geological Survey at Cataldo were 438 cubic feet per second (cfs) for 9/23/69 and 494 cfs on 9/24/69.

Conclusions

1. Generally speaking, transverse and vertical variations in pattern values were essentially nonexistent (Table 1).

2. Sample collection may be at any point in the main cross-section to obtain a representative specimen.

3. The upstream factors that influence water quality at the station are:

a. The South Fork of the Coeur d'Alene River receives untreated wastes from mine tailings, acid industrial wastes from zinc and lead smelter operations, phosphoric acid wastes, and wastes from an antimony plant on Big Creek. The mine and smelter wastes contain heavy loads of suspended sediments and biologically toxic concentrations of lead and zinc.

TABLE 1

ROSE LAKE STREAM SURVEY DATA
9/23-24/69

TIME / STATION	TEMPERATURE °C			pH			CONDUCTIVITY			DISSOLVED OXYGEN			% SATURATION			TOTAL COLIFORM		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1300	13.0	13.0	13.0	7.2	7.5	7.5	205	218	220	8.9	9.1	9.1	89	92	92	640	110	125
1500	13.0	13.0	13.0	7.6	7.4	7.3	220	220	223	9.1	9.1	9.1	92	92	92	178	160	180
1700	13.0	13.0	13.0	7.3	7.3	7.4	210	199	199	9.0	9.2	9.2	93	93	93	50	50	30
1900	13.0	13.0	13.0	7.3	7.3	7.1	209	185	200	9.4	9.3	9.3	95	94	94	40	55	40
2100	13.0	12.8	12.8	7.0	7.1	7.1	205	195	203	9.4	9.5	9.5	95	96	96	165	65	55
2300	12.8	12.8	12.8	7.0	6.9	7.0	195	196	198	9.5	9.5	9.5	96	96	96	330	440	450
0100	13.0	13.0	12.8	6.9	7.0	6.9	200	187	204	9.5	9.4	9.4	95	95	95	610	180	165
0300	12.5	12.5	12.5	6.9	6.9	6.9	191	199	197	9.4	9.5	9.4	95	96	95	215	85	100
0500	12.5	12.5	12.5	6.9	7.0	6.9	195	187	197	9.3	9.3	9.3	94	94	94	90	50	165
0700	12.5	12.5	12.5	6.9	7.0	7.0	199	184	188	9.2	9.2	9.2	93	93	94	85	110	90
0900	12.5	12.5	12.5	6.9	6.9	6.9	197	191	187	9.1	9.2	9.2	92	93	93	80	60	65
1100	12.5	12.5	12.5	6.9	7.0	7.1	165	170	159	9.2	9.3	9.3	93	94	94	145	110	110

TABLE 2

QUARTERLY REPORT OF FWPCA WATER QUALITY MONITORING STATIONS
DALENE RIVER AT ROSE LAKE
STATION NO. 153007

DATE FROM TO	TIME OF DAY	SWL PBI mg/1	COPPER CU ug/1	IRON TOTAL ug/1	LEAD PB,DISS ug/1	SILICA DISSOLVED mg/1	ZINC ZN,DISS ug/1	COLOR PT-CO UNITS	COLIFORM DLY ENDO MF/100ML
69/07/08	1800		12	340	50	9.6	2110		
69/08/05	1300		12	670	93	11.0	3850	5	25
69/08/26	1730		3	275	30	12.0	5700	15	1750
69/09/23	1615		3	650	55	11.0	10000		

b. Raw municipal waste is discharged into upstream waters from the communities of Wallace, Mullan, Osburn, Silverton, Smelterville, and the Burke-Male-Gem area. The city of Kellogg also discharges lagoon-treated municipal wastes.

Recommendations

1. Dissolved oxygen analyses should be performed using both the Winkler (Azide) Method and a dissolved oxygen probe to determine if the Winkler Method is distorted by the heavy metals concentrations in the water. This procedure is recommended for all routine sampling stations that monitor waters from the South Fork of the Coeur d'Alene River.

2. The routine samples should always be collected at approximately the same time of day. If possible, the upstream industrial schedule should be obtained for the day previous to and the day of sampling.

3. A 24-hour survey at the sampling station should be conducted on a quarterly basis.

4. An extensive survey should be conducted in the area, concentrating on the effects of heavy metals and the origin of bacteriological contamination.

STUDY AREA

Station Location and Description

The Rose Lake Station No. 153007 is located at river mile 153.4 on the Coeur d'Alene River approximately 15 miles below the town of Cataldo and approximately 25 miles above the entry of the Coeur d'Alene River into Coeur d'Alene Lake (Fig. 1).

The specific location is: lat $47^{o}32'13"$ N, long $116^{o}28'16"$ W.

SAMPLING AND ANALYTICAL METHODS

Sampling Methods and Schedule

Water samples were collected every two hours during the 24-hour period. Collection was made at three predetermined cross-section points, with two vertical profile samples taken at each of the three points. The samples were obtained using a Kemmerer[1/] Sampler. A single "haul" provided enough water to fill containers for chemical (dissolved oxygen, conductivity, pH, and alkalinity), and bacteriological (total and fecal coliform) analyses.

Dissolved oxygen samples were chemically stabilized at the time of collection for titration upon return to the field laboratory.

Temperatures were noted and recorded at the time of sampling using a hand thermometer.

All of the analyses were performed in a 17-foot enclosed laboratory trailer stationed near the sampling point.

Analytical Procedures

The following laboratory methods were used for analysis:

pH was determined with a Beckman Zeromatic Model pH meter.

Specific conductivity analyses were performed using a Beckman Model RB 3-327 conductivity bridge.

1/ The mention of brand names is for identification only, and constitutes no endorsement by the United States Department of the Interior, Federal Water Pollution Control Administration.

Dissolved oxygen samples were titrated for quantity, using the Alsterberg (Azide) modification of the Winkler Method as found in "Standard Methods" (1).

Alkalinity was determined by titration with a Hach Model DL-ER portable laboratory.

Fecal coliform determinations were conducted using the membrane filter method according to the procedures as described by Geldreich (2). In studies by Geldreich (3) this method was confirmed as comparable to the most probable numbers method for fecal coliform as described in "Standard Methods" (1)

All the bacteriological samples were incubated and counted in the field.

DISCUSSION

The diurnal parameter patterns are illustrated in Figures 2, 3, and 4. It is noted that a sharp rise in total coliform, dissolved oxygen, and percent saturation values and a decrease in pH and conductivity occurred at 2300 hours. This phenomenon is apparently caused by waters from the daily mining and domestic activities of upstream communities converging on the sampling point. A consistent flow of 438 cfs was recorded on September 21, 22, and 23, and the flow increased to 494 cfs on September 24. This increase in flow, combined with the lack of algal activity and the possibility of analytical interference due to high iron concentrations[2/] could account for the increased dissolved oxygen values recorded at 2300 hours.

Because of the extreme seasonal and daily variability in water quality conditions, and the numerous factors that influence the patterns (flow, industrial and domestic activities, rainfall, etc.), the instigation of a quarterly 24-hour cross-section sampling program would yield more interpretive data.

Mining and smelter wastes contribute heavy loads of suspended sediments and biologically toxic concentrations of lead, copper, zinc,

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2/ It is stated in "Standard Methods": (1) "The Alsterberg modification is used for most sewage, effluents and streams if they contain not more than 1 mg/l ferrous F_e. Other reducing or oxidizing materials should be absent."

and arsenic to the South Fork of the Coeur d'Alene River. As a result, the South Fork has become biologically sterile. Both the South Fork and the Main Stem have been destroyed for water uses except waste disposal. Farm lands along the river must provide dikes, flood gates, and pumps to prevent these toxic wastes from reaching the fields.

Although insufficiently treated municipal discharges introduce high bacteriological concentrations into the South Fork, the prime cause of pollution is the presence of toxic concentrations of heavy metals. The South Fork of the Coeur d'Alene River sewer district has completed an engineering study on sewage collection and treatment, and is in the process of securing financing.

The State of Idaho reports the mining operations are installing tailing ponds to remove silt and sand from mine washings, and are studying treatment procedures for the reduction of contaminants from metal processing operations and significant sources of mine drainage.

Field Data

The appended material contains all field and laboratory bench data obtained during the study.

REFERENCES

(1) American Public Health Assoc., Inc. Standard methods for the examination of water and wastewater, 12th ed. 1962.

(2) Geldreich, Edwin E., et al. Fecal coliform organisms medium for membrane filter technique. Journal American Water Works Assoc. 57:2, 208-214 1965.

(3) Geldreich, Edwin E., Sanitary significance of fecal coliforms in the environment. Water Pollution Control Research Series Publication No. WP-20-3. U. S. Department of the Interior, Federal Water Pollution Control Administration, 1966.

APPENDIX

STREAM SURVEY DATA

STATION NO. 153007

STREAM SURVEY DATA

9/23/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE)									STATISTICS		
		A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 1300	TEMP °C	13.0	13.0	13.0	13.0	13.0	13.0						
	COND. µmho	190	220	215	220	225	215						
	pH	7.1	7.3	7.4	7.5	7.5	7.5						
	ALK. mg/l. TITRANT ml. VALUE	30	30	30	30	30	35						
	D.O. mg/l. TITRANT ml. VALUE	8.7	9.0	9.1	9.1	8.9	9.2						
	T. Coli.	1100	180	120	100	150	100						
	Fecal Coli.	0	0	0	0	2	2						
TIME 1500	TEMP °C	13.0	13.0	13.0	13.0	13.0	13.0						
	COND. µmho	220	220	220	220	220	225						
	pH	7.5	7.7	7.3	7.6	7.5	7.1						
	ALK. mg/l. TITRANT ml. VALUE	25	30	30	25	30	30						
	D.O. mg/l. TITRANT ml. VALUE	9.1	9.1	9.1	9.1	9.0	9.1						
	T. Coli.	180	170	120	200	60	100						
	Fecal Coli.	0	0	0	0	2	2						

STATION NO. 153007

STREAM SURVEY DATA

9/23/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE) A	B	C	D	E	F				STATISTICS MAX.	MIN.	AVG.
TIME 1700	TEMP °C	13.0	13.0	13.0	13.0	13.0	13.0						
	COND. μmho	220	200	198	200	200	198						
	pH	7.2	7.3	7.2	7.4	7.4	7.4						
	ALK. mg/l. TITRANT ml. VALUE	25	25	25	25	25	25						
	D.O. mg/l. TITRANT ml. VALUE	8.8	9.2	9.2	9.1	9.2	9.2						
	T. Coli.	50	50	70	30	50	10						
	Fecal Coli.	0	0	0	0	0	0						
TIME 1900	TEMP. °C	13.0	13.0	13.0	13.0	13.0	13.0						
	COND. μmho	210	200	190	180	195	210						
	pH	7.2	7.3	7.3	7.3	6.9	7.2						
	ALK. mg/l. TITRANT ml. VALUE	30	30	30	30	30	25						
	D.O. mg/l. TITRANT ml. VALUE	9.3	9.5	9.2	9.4	9.3	9.3						
	T. Coli.	40	40	30	80	60	20						
	Fecal Coli.	0	0	0	0	0	0						

STATION NO. 153007

STREAM SURVEY DATA

9/23/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)									STATISTICS		
		A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 2100	TEMP °C	13.0	13.0	12.8	12.8	12.8	12.8						
	COND. μmho	210	200	200	190	195	210						
	pH	6.8	7.1	7.0	7.1	7.1	7.1						
	ALK. mg/l. TITRANT ml. / VALUE	25	25	25	25	25	25						
	D.O. mg/l. TITRANT ml. / VALUE	9.4	9.4	9.4	9.5	9.4	9.5						
	T. Coli.	80	250	40	90	130	80						
	Fecal Coli.	0	0	0	0	0	0						
TIME 2300	TEMP. °C	12.8	12.8	12.8	12.8	12.8	12.8						
	COND. μmho	200	190	198	192	188	208						
	pH	7.0	7.0	6.9	6.9	7.0	7.0						
	ALK. mg/l. TITRANT ml. / VALUE	25	30	30	30	25	30						
	D.O. mg/l. TITRANT ml. / VALUE	9.4	9.5	9.4	9.5	9.4	9.5						
	T. Coli.	280	380	470	410	330	570						
	Fecal Coli.	0	0	0	0	0	0						

STATION NO. 153007

STREAM SURVEY DATA

9/24/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)									STATISTICS		
		A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 0100	TEMP °C	13.0	13.0	13.0	13.0	12.8	12.8						
	COND. µmho	200	200	185	190	200	207						
	pH	6.9	6.9	7.0	6.9	6.9	6.9						
	ALK. mg/l. TITRANT ml. / VALUE	25	25	25	25	25	30						
	D.O. mg/l. TITRANT ml. / VALUE	9.4	9.5	9.4	9.4	9.3	9.4						
	T. Coli.	470	750	200	160	100	230						
	Fecal Coli.	0	0	0	0	2	0						
TIME 0300	TEMP °C	12.5	12.5	12.5	12.5	12.5	12.5						
	COND. µmho	192	190	188	200	200	194						
	pH	6.8	6.9	6.9	6.9	6.9	6.9						
	ALK. mg/l. TITRANT ml. / VALUE	30	30	30	25	25	25						
	D.O. mg/l. TITRANT ml. / VALUE	9.4	9.4	9.4	9.5	9.4	9.4						
	T. Coli.	270	160	50	120	70	130						
	Fecal Coli.	0	0	0	0	0	0						

STATION NO. 153007

STREAM SURVEY DATA

9/24/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)									STATISTICS		
		A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 0500	TEMP. °C	12.5	12.5	12.5	12.5	12.5	12.5						
	COND. μmho	200	190	185	188	192	200						
	pH	6.9	6.9	7.0	7.0	6.8	6.9						
	ALK. mg/l. (TITRANT ml. / VALUE)	25	25	25	25	25	25						
	D.O. mg/l. (TITRANT ml. / VALUE)	9.3	9.3	9.2	9.3	9.2	9.3						
	T. Coli.	60	130	60	40	140	190						
	Fecal Coli.	0	0	0	0	0	0						
TIME 0700	TEMP. °C	12.5	12.5	12.5	12.5	12.5	12.5						
	COND. μmho	188	200	180	188	194	182						
	pH	6.8	6.9	6.9	7.0	6.9	7.0						
	ALK. mg/l. (TITRANT ml. / VALUE)	25	25	25	25	25	25						
	D.O. mg/l. (TITRANT ml. / VALUE)	9.1	9.3	9.2	9.2	9.1	9.2						
	T. Coli.	90	100	120	100	80	100						
	Fecal Coli.	0	0	0	2	0	0						

STATION NO. 153007

STREAM SURVEY DATA

9/24/70

	PARAMETER	LOCATION IN CROSS SECTION (SEE KEY ON PAGE:)									STATISTICS		
		A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 0900	TEMP °C	12.5	12.5	12.5	12.5	12.5	12.5						
	COND. μmho	198	195	195	187	175	178						
	pH	6.8	6.9	6.9	6.9	6.9	6.9						
	ALK. mg/l. TITRANT ml. / VALUE	25	25	25	25	25	25						
	D.O. mg/l. TITRANT ml. / VALUE	9.0	9.1	9.2	9.1	9.2	9.1						
	T. Coli.	50	40	60	60	30	100						
	Fecal Coli.	0	0	0	0	0	0						
TIME 1100	TEMP. °C	12.5	12.5	12.5	12.5	12.5	12.5						
	COND. μmho	160	170	170	169	158	160						
	pH	6.9	6.9	7.0	6.9	7.1	7.0						
	ALK. mg/l. TITRANT ml. / VALUE	25	25	25	25	25	25						
	D.O. mg/l. TITRANT ml. / VALUE	9.2	9.2	9.2	9.3	9.2	9.3						
	T. Coli.	160	130	120	100	70	130						
	Fecal Coli.	0	0	0	0	0	0						