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SNAKE RIVER TRANSECT STUDY

CLEAN WATER

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHWEST REGION
PORTLAND, OREGON

SNAKE RIVER TRANSECT STUDY

Station No. 153018

July 29 and 30, 1969

Prepared by

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Working Paper
No. 74

Technical Assistance and Investigations Branch
Office of Technical Programs
Federal Water Pollution Control Administration
Northwest Region
Portland, Oregon

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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.

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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 the water samples are collected at these stations and analyzed, and the data are used to evaluate water quality. Knowledge of conditions peculiar to these stations is valuable in the evaluation of the data obtained. This study documents conditions at Station No. 153018 located on the Snake River seven miles downstream from the Lewiston-Clarkston bridge (Fig. 1). Diurnal and spatial variances occurring at the station were observed during a 24-hour period.

On February 25 through 29, 1969, a similar study was conducted at the station which was then located two miles upstream from the present Station No. 153018. This survey showed that an incomplete mixing condition is present at that location. As a result, the station was relocated at the present site to allow more mixing time and to take advantage of more homogenous sampling conditions.

Objectives

The objectives of the study were to answer the following questions:

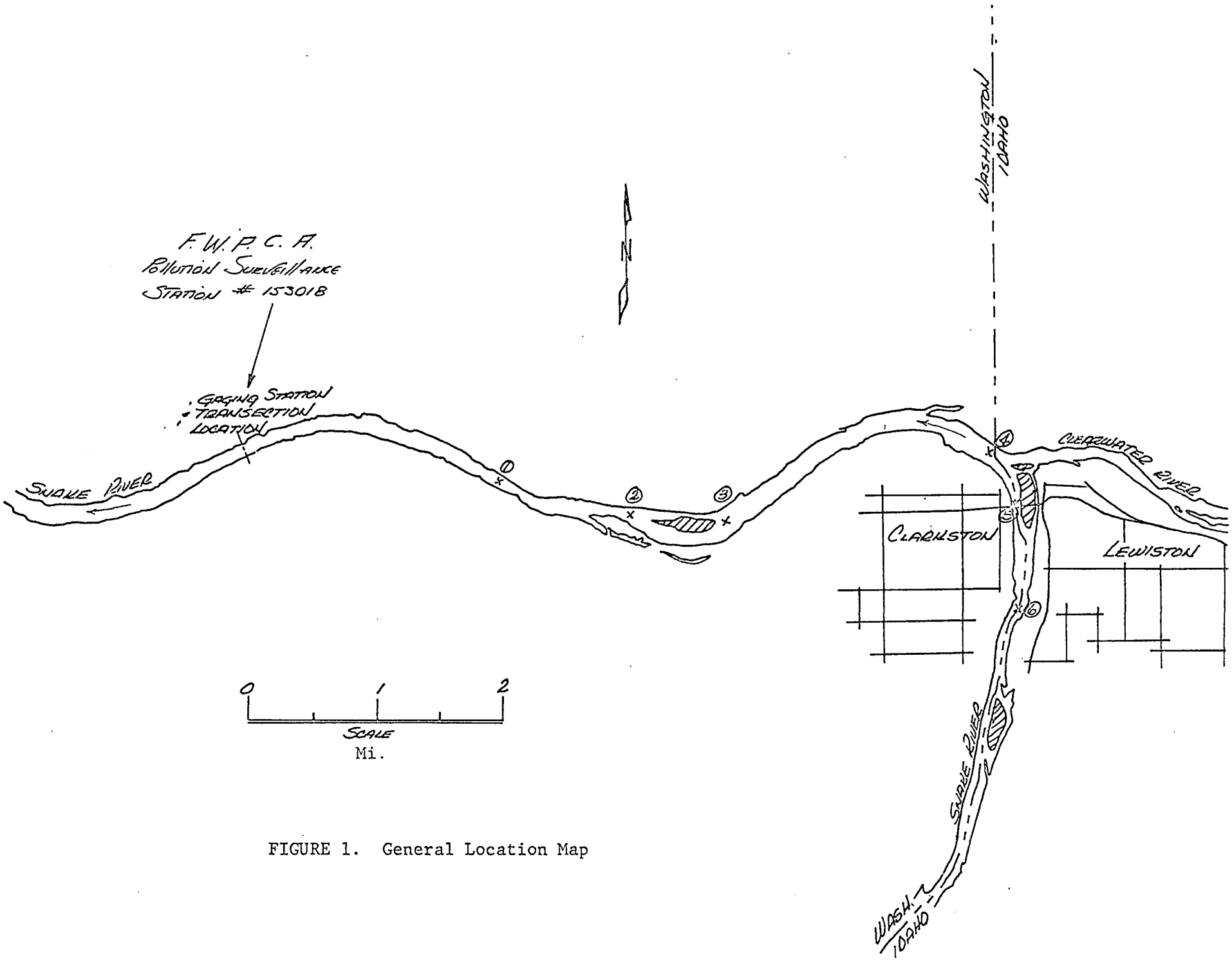


FIGURE 1. General Location Map

1. Does a uniform cross-section pattern exist at the sampling site?

2. What are the diurnal changes occurring in water quality at the station?

3. What are the influencing factors on water quality at this location?

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 1200 hours (noon) on July 29, 1969, with the final samples taken at 1200 hours on July 30, 1969. Samples were also taken at six sites extending upstream from Station No. 153018 to above the confluence of the Clearwater River (Fig. 1).

2. Pre-survey soundings confirmed that the cross-section at Station No. 153018 had a uniform depth of 17.0 feet. Three equally-spaced sampling points were selected across the river. The sampling

points were located by means of airplane markers on a gauging car wire extended across the site. Samples were taken at 5-foot and 15-foot depths at each of these sampling points.

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

SUMMARY

Findings

1. The river had a uniform depth of 17 feet at the transection location.

2. The only discrepancy in cross-section station parameter values occurred in bacteriological concentrations and turbidity measurements.

3. The diurnal temperatures ranged from a high at 1200 hours (noon) of 23.5° C[1/] to a low of 19.1° C at 0600 hours (Fig. 2).

4. The percent dissolved oxygen saturation values displayed a high of 115 percent at 1800 hours, decreasing to a low of 86 percent at 0600 hours, and then rising again (Fig. 3).

5. The dissolved oxygen concentration pattern indicated a high of 10.0 milligrams per liter (mg/l) at 1800 hours, then dropped to a low of 7.8 mg/l at 0600 hours (Fig. 2).

6. The pH ranged from 7.5 to 8.5. Two maximum peaks occurred, the first at 1600 hours with an 8.4 value, and the second at 1800 hours with a value of 8.5. The minimum was 7.5 at 1200 hours (Fig. 4).

7. Specific conductivity values ranged from a maximum of 190 micromhos per centimeter (μmho/cm) at 1400 hours, to a low of 158 μmho/cm at 0600 hours (Fig. 4).

8. The bacteriological concentration count was the only parameter that did not display the general pattern of higher values occur-

1/ All parameter values quoted in the Findings are bi-hourly averages for the six cross-section samples.

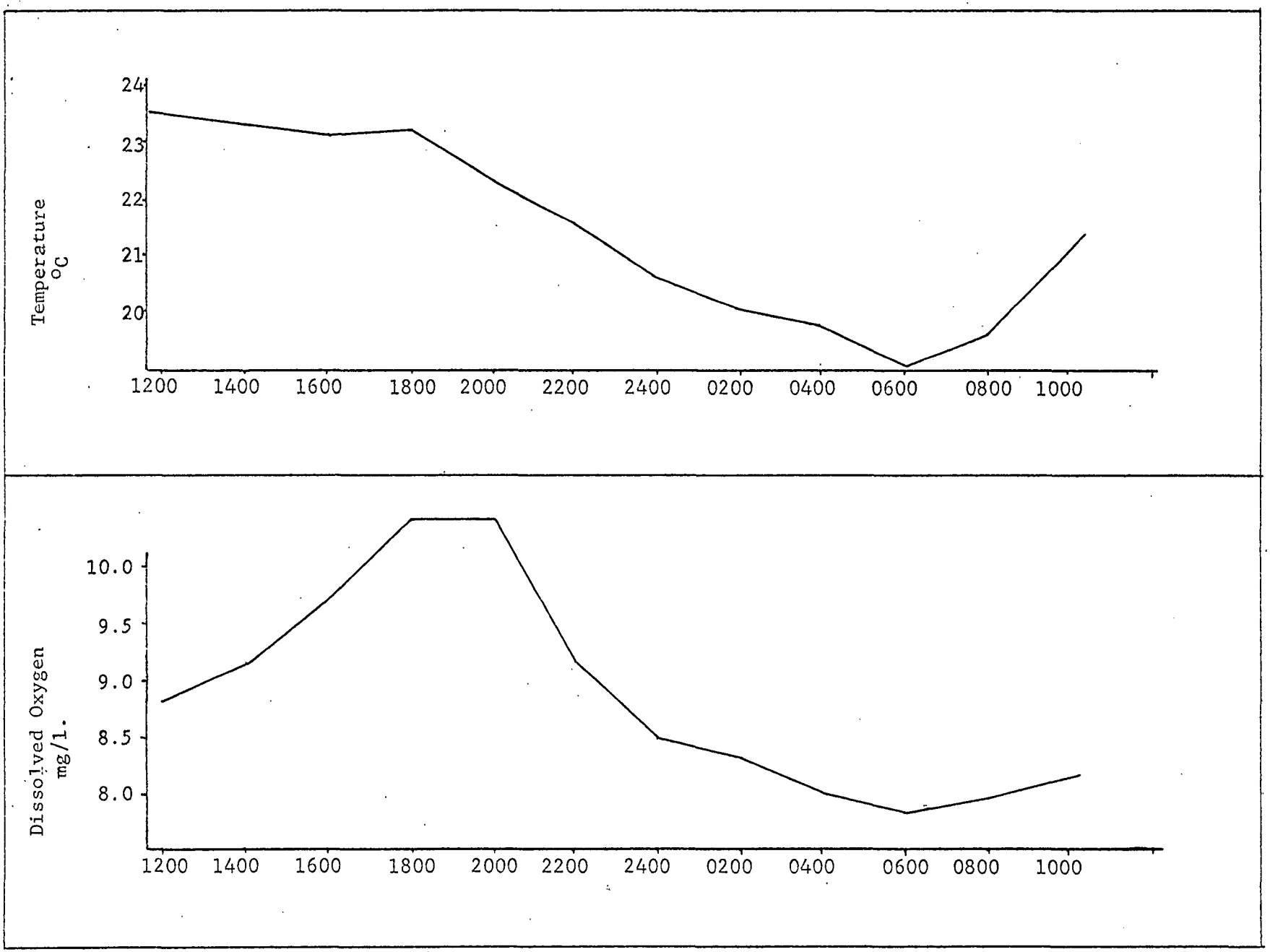


FIGURE 2. Temperature and Dissolved Oxygen Diurnal Values (Cross-Section Average)

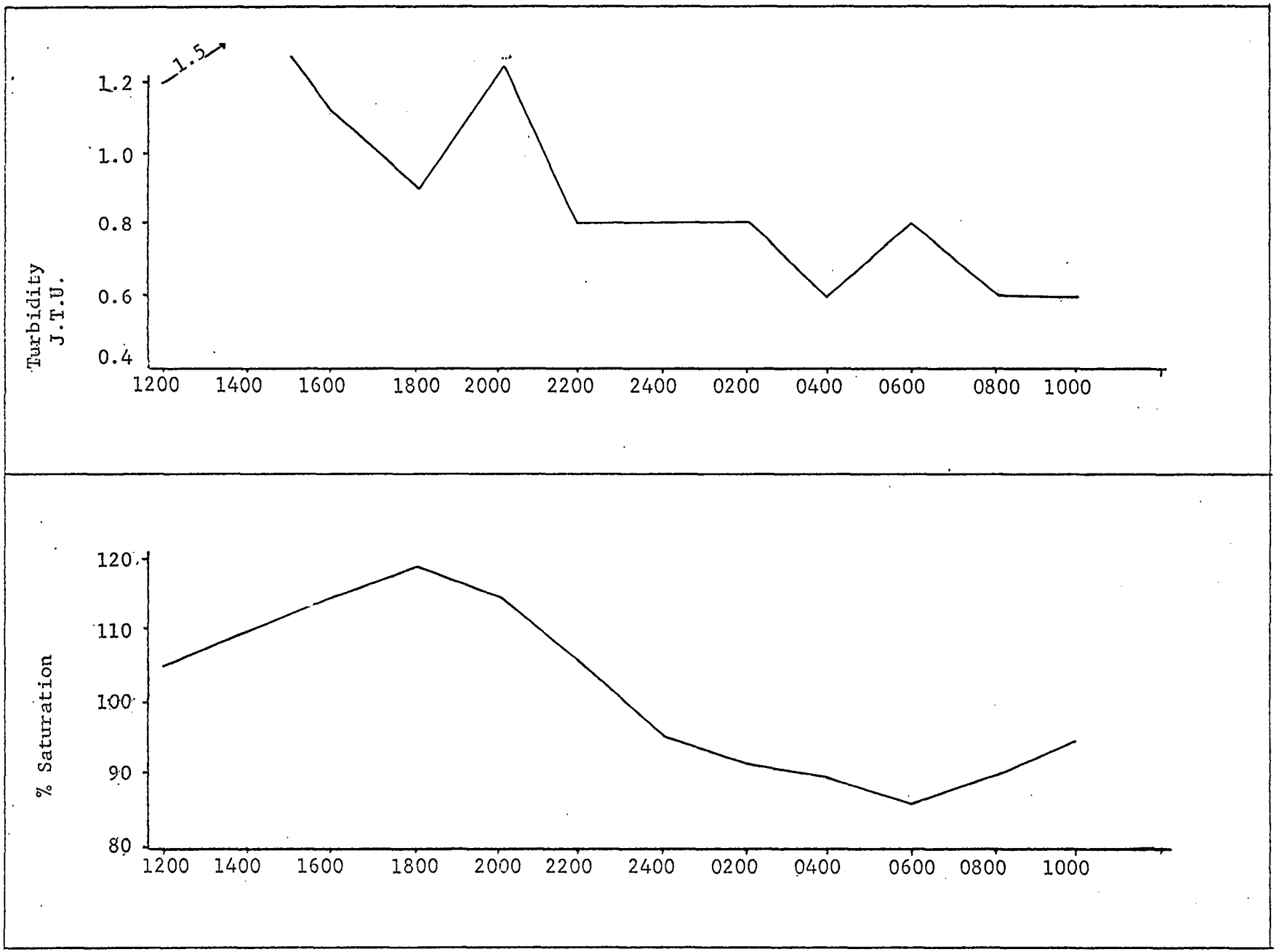


FIGURE 3. Turbidity and Percent Saturation Diurnal Values (Cross-Section Average)

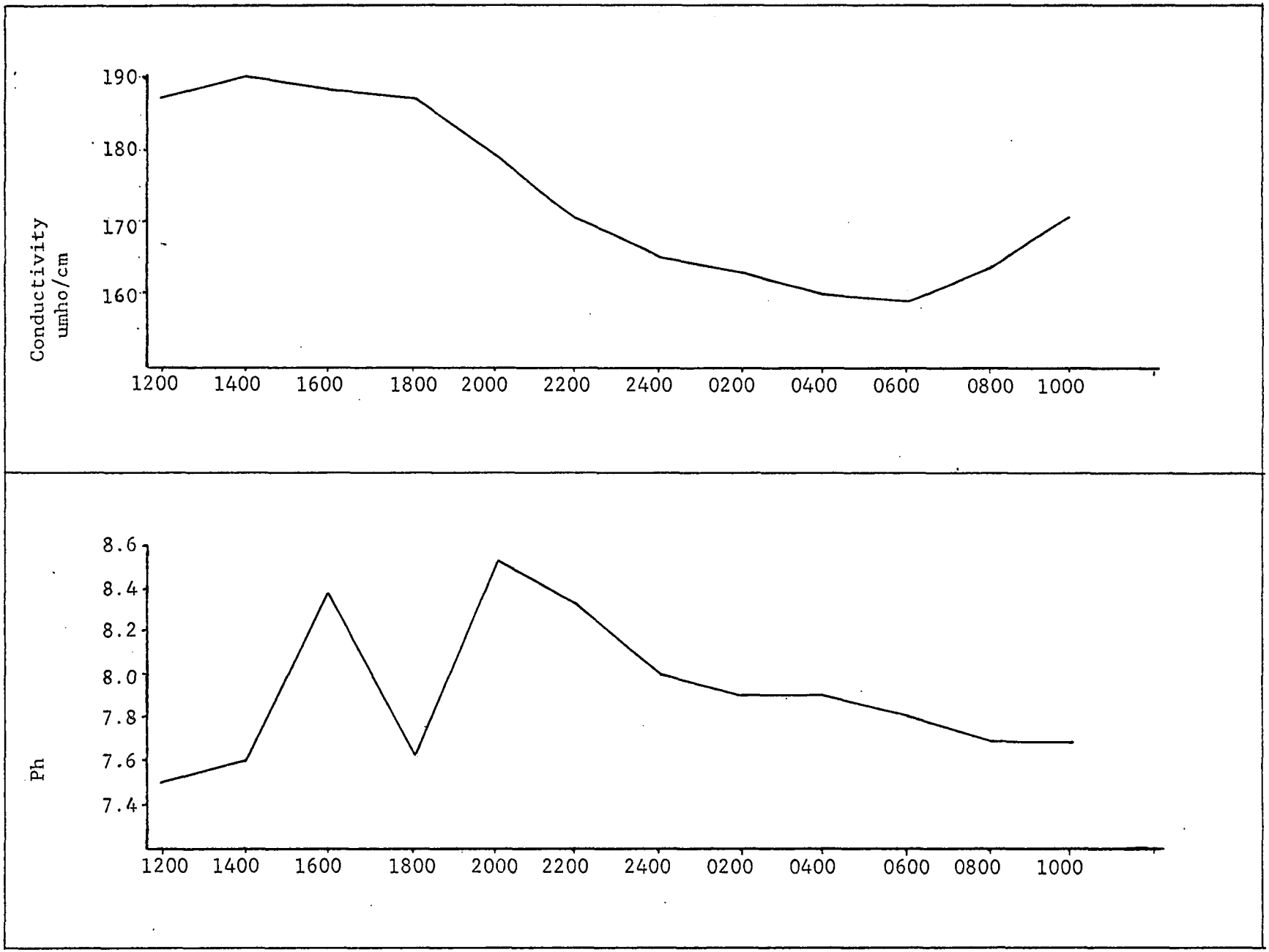


FIGURE 4. pH and Conductivity Diurnal Values (Cross-Section Average)

ring from 1200 hours to 2400 hours, with the lower values present during late night and early morning (Fig. 5).

9. The total and fecal coliform densities displayed two maximum peaks--one of 3300 total coliforms per 100 milliliters (TC/100 ml), and 160 fecal coliforms per 100 milliliters (FC/100 ml) at 2400 hours, and another at 0600 hours with values of 3880 TC/100 ml and 196 FC/100 ml (Fig. 5). The increases were both 100 times the low values of 333 TC/100 ml and 1 FC/100 ml recorded at 1600 hours.

10. The flow measurements for the study period show an average hourly flow of 22,500 cubic feet per second (cfs). The data, as obtained from the U. S. Geological Survey, are shown in Table 1.

Conclusions

1. The sampling station is located far enough downstream from pollution sources to allow sufficient mixing to produce optimum sampling conditions.

2. The differences in the diurnal values for coliforms and turbidity among the three cross-section sampling locations indicate incomplete mixing of solids. Data from previous surveys indicate this condition exists for an undetermined distance downstream from the sampling station.

3. With the exception of the bacteriological counts, the diurnal parameter patterns displayed higher values between 1200 hours and 2000 hours. The minimum recorded values appeared between the hours of 2400 and 1000.

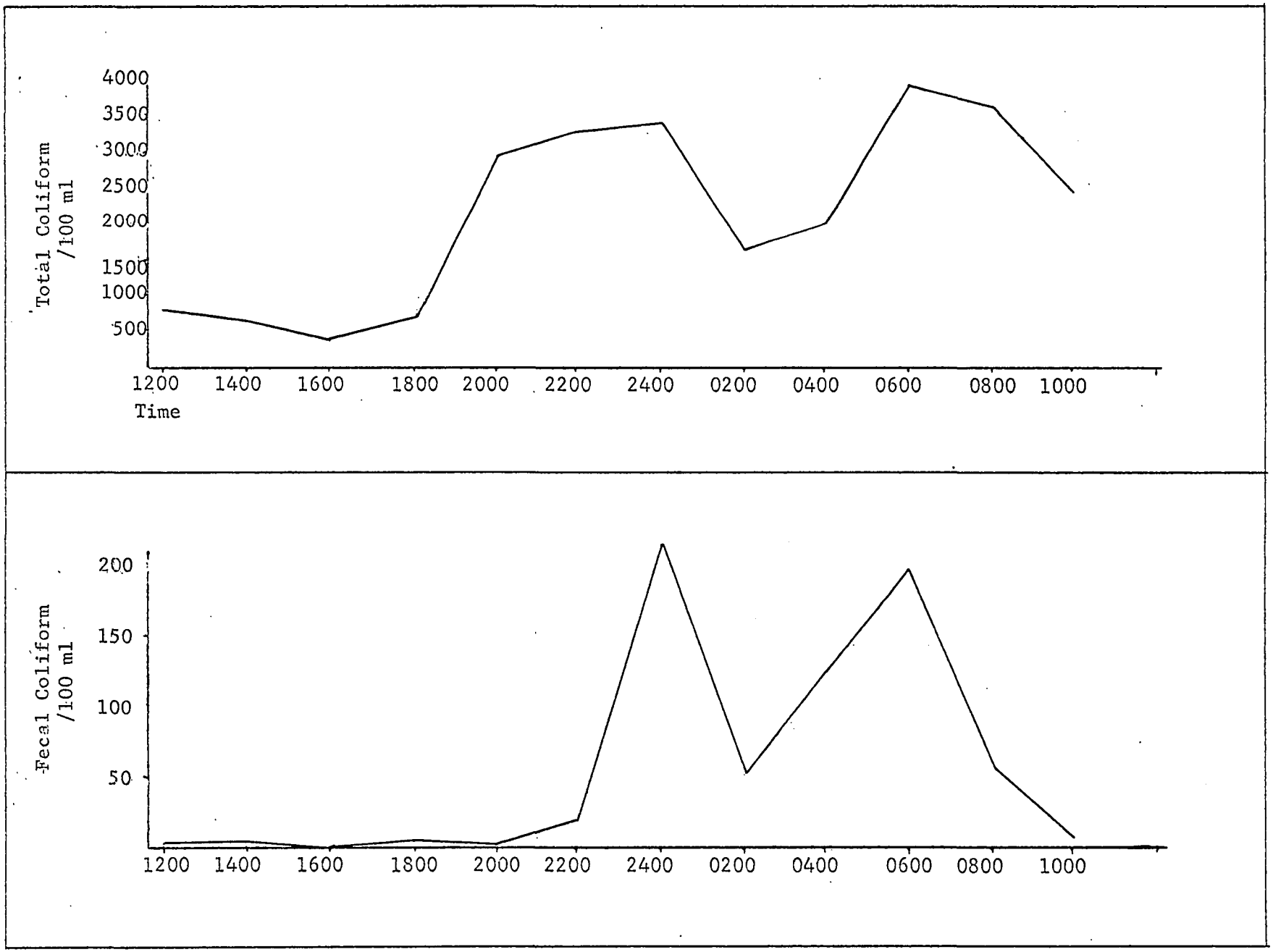


FIGURE 5. Total and Fecal Coliform Diurnal Values (Cross-Section Average)

TABLE 1

FLOW MEASUREMENTS
SNAKE RIVER NEAR CLARKSTON, WASHINGTON

Date	Time	Gage Height	Discharge (cfs)	
July 29, 1969	1200	11.52	22,600	
	1400	11.51	22,500	
	1600	11.52	22,600	
	1800	11.52	22,600	
	2000	11.50	22,500	
	2200	11.48	22,400	
	2400	11.49	22,500	
July 30, 1969	0200	11.50	22,500	
	0400	11.50	22,500	
	0600	11.50	22,500	
	0800	11.49	22,500	
	1000	11.48	22,400	

AVERAGE 22,500

4. The upstream factors that would have an influence on water quality are:

a. Potlatch Forest, Inc., manufacturers of lumber, pulp, paper, and fuel products, discharges effluent into the Snake River a quarter of a mile above the confluence of the Clearwater River.

b. The Lewiston city sewage treatment plant discharges effluent into the Clearwater River 0.8 miles above its confluence with the Snake River.

c. The Clarkston city sewage plant is located on the Snake River, one mile below the confluence of the Clearwater River.

d. Asotin sewage treatment plant discharges into Asotin Creek, just upstream from the mouth.

e. Seabrook Farms Co. and Smith Frozen Foods, both processors of peas, are located in Lewiston and both have discharges into the Snake River.

f. Meats, Inc., and Bristol Packing Co., located in Clarkston, discharge floor drainage and kill blood directly into the Snake River.

g. A few feedlots are located adjacent to the rivers above and below the cities of Lewiston-Clarkston.

Recommendations

1. Sampling Station No. 153018 should be maintained as a permanent water quality monitoring station.

2. The samples should be collected on the south side of the transect station to provide better access and decrease travel time.

3. To maintain consistency, samples should be collected between mid-morning and mid-afternoon.

4. If feasible, during the low-flow periods, two samples (one on the north side and one on the south side) should be collected to confirm river mixing conditions.

5. An extensive study should be conducted, concentrating on the significance of bacteriological contributors located upstream from the sampling site.

STATION LOCATION AND DESCRIPTION

The station is located at river mile 132.9 of the Snake River, seven miles below the towns of Lewiston, Idaho and Clarkston, Washington. At this point, the Snake River turns westward after flowing through Hells Canyon (Fig. 1).

The specific location is: lat 46°25'30", long 117°10'30".

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 pre-determined 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, alkalinity, and turbidity) and bacteriological (total and fecal coliform) analyses.

Turbidity samples were shipped to the Federal Water Pollution Control Administration Laboratory in Portland, Oregon for analysis.

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

With the exception of turbidity measurements, 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 with an Industrial Instruments Model RC-16-B2 conductivity bridge.

Dissolved oxygen samples were titrated for quantity, using the

---

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

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.

Turbidity was measured at the Portland Laboratory with a Hach Model 1860-A Turbiditimeter.

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

Total coliform densities were measured by the membrane filter method technique in "Standard Methods" (1).

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

DISCUSSION

The cross-section parameter values for the sampling points are given in Figures 6 through 9. With the exception of bacteriological and turbidity values, the transect discrepancy is minimal. The cross-section pattern shows no location preference as to high or low values.

The cross-section averages for total and fecal coliform concentrations (Fig. 8) show the increasing values beginning at 2000 hours, then dropping again to a low at 1000 hours the next day. The patterns also indicate both values decreasing at 0200 hours. This pattern could be attributed to treatment plant operations upstream, with the daytime loads being detained in the plant system and flushed out with the evening high flows. The times of high concentrations (considering flow time), also coincide with clean-up operations from upstream meat and industrial processors.

The conductivity, pH, temperature, dissolved oxygen and percent saturation values all displayed an average (cross-section) diurnal pattern of higher values occurring between 0800 hours and 2200 hours (Fig. 6, 7 and 9). This pattern reflects the daytime schedule of industrial activities and the processes of photosynthetic organisms present in the river.

Examination of the data reveals that at times during the study total coliforms, dissolved oxygen, and temperature did not meet the Washington State Water Quality Standards[4] which state:

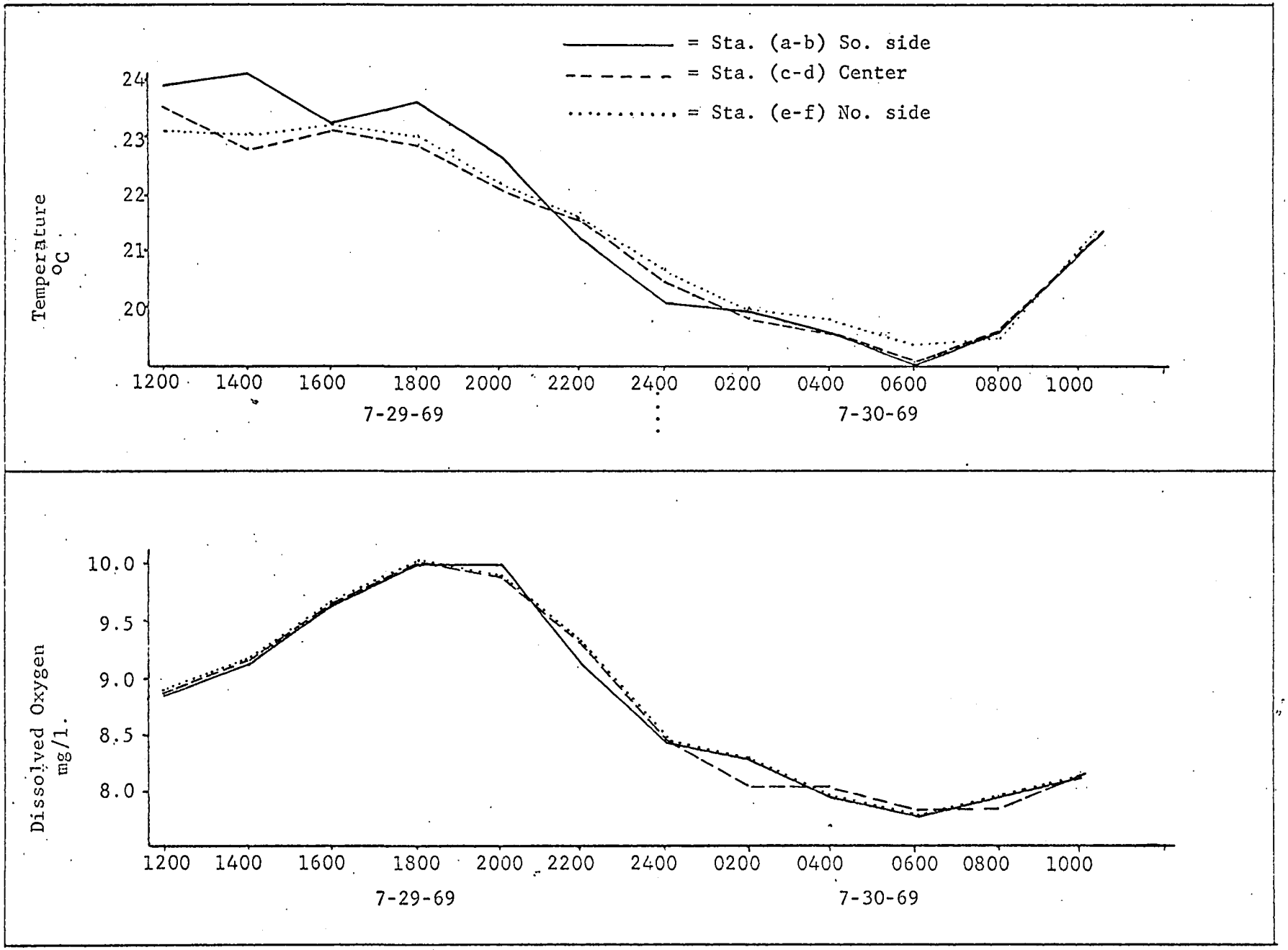


FIGURE 6. Temperature and Dissolved Oxygen Diurnal Values (by station)

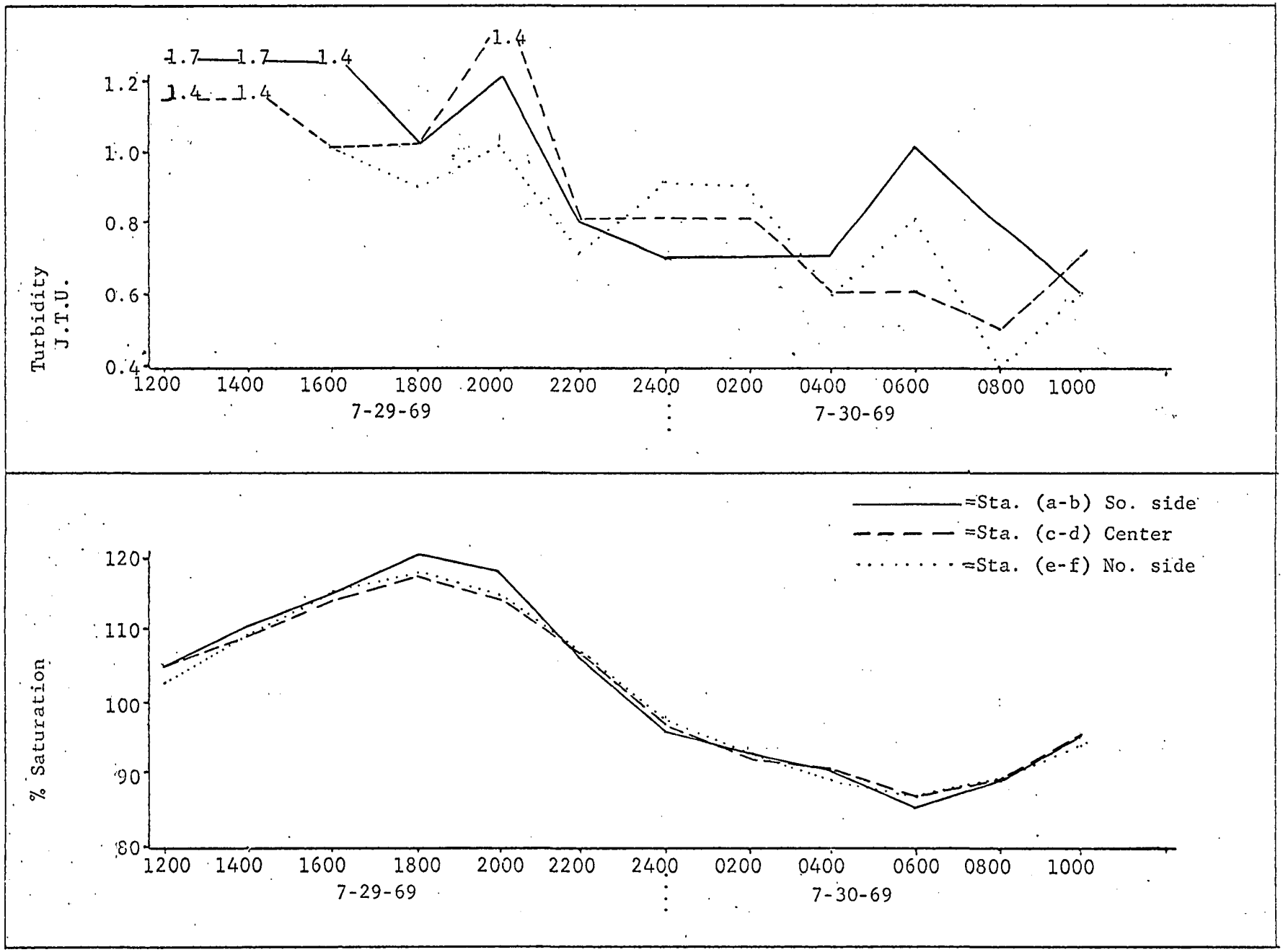


FIGURE 7. Turbidity and Percent Saturation Diurnal Values (by station)

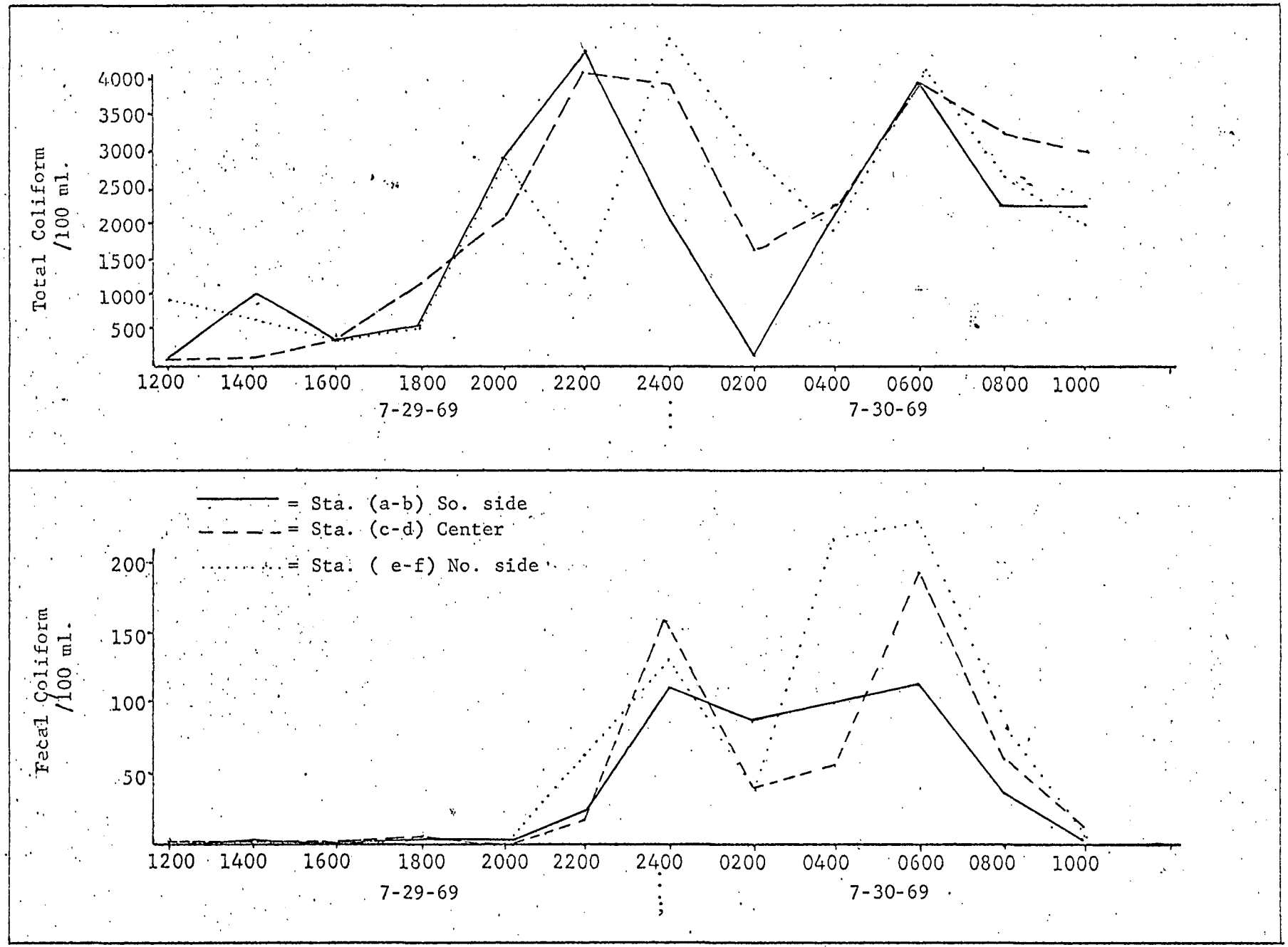


FIGURE 8. Total and Fecal Coliform Diurnal Values (by station)

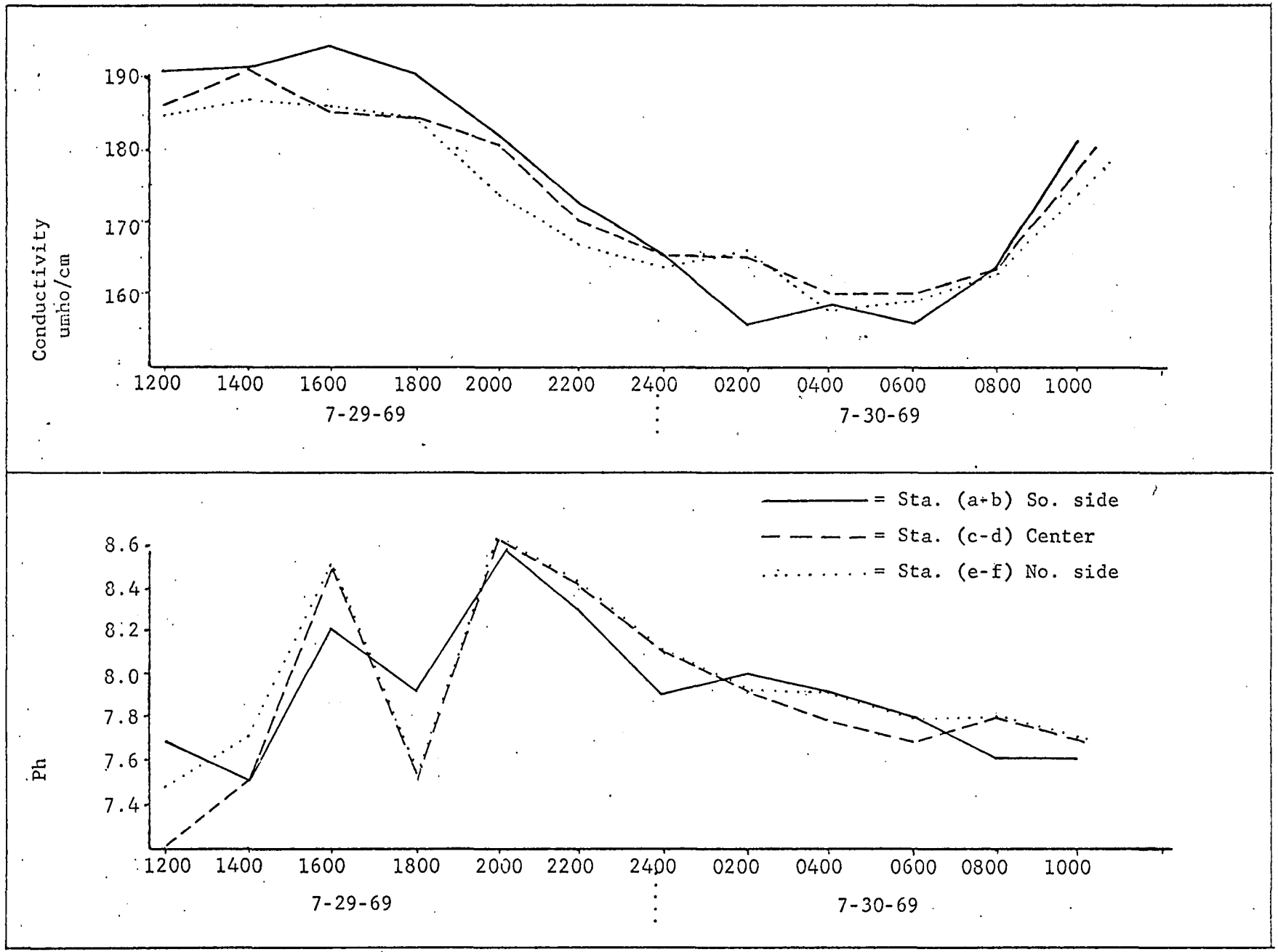


FIGURE 9. pH and Conductivity Diurnal Values (by station)

> Total coliform organisms shall not exceed median values of 240...with less than 20% of samples exceeding 1,000 when associated with any fecal source....
>
> Dissolved oxygen shall exceed 8.0 mg/1....
>
> Temperature. No measurable increases shall be permitted... which result in water temperatures exceeding 68° F...

The dissolved oxygen values were below the Washington State Standards for only one sampling period. The total coliform concentrations were in excess of the Washington State Standards during the entire study. Temperature was in violation of the Standards during 75 percent of the study period.

Municipal waste sources in the lower Snake basin are concentrated in the Lewiston service area, where primary is the prevailing level of waste treatment. A total organic waste load equivalent to that from a population of 34,900 is discharged from the service area. The city of Lewiston accounts for about 30,000 population equivalents (PE). The Idaho Water Quality Standards (5) call for secondary waste treatment at Lewiston by June 30, 1970. In addition, the Washington Water Quality Standards (4) require installation of secondary treatment, disinfection facilities, and proper outfalls at Clarkston and Asotin by March 31, 1970.

The most significant source of waste in the area is the Potlatch Forest Industries plant located in Lewiston. A complex of manufacturing operations, the plant includes a large lumber mill, a plywood plant, wood fabricating facilities, and an integrated pulp, paper, and paperboard mill. The pulp and paper plant provides no treatment

of wastes, and available information on plant operations indicates that it has a waste-to-product ratio well above the norm for modern sulfate pulping plants. A total organic load of about 432,000 PE is discharged to the Snake River. The Idaho Water Quality Standards[5] require that Potlatch Industries provide primary treatment.

Seabrook farms, Inc., a pea and potato processing plant at Lewiston, also discharges without waste treatment. An organic load of about 50,000 PE is discharged into the Clearwater River. The Idaho State Water Quality Standards[5] require that primary treatment be installed and connected to the city collection system by June 30, 1970.

Two meat packing plants in Clarkston, Washington have inadequate treatment. Bristol Packing Co. and Meats, Inc., discharge a total organic load of about 5,300 PE to the Snake River. The Washington State Standards[4] call for primary treatment at these plants by March 31, 1970.

Agricultural animal waste discharges in the Lower Snake are a significant source of coliform bacteria and a source of some of the biochemical oxygen demand. The estimated organic waste potential of the animal population is equivalent to that from a population of 3.2 million people. An estimated 95 percent of the wastes generated are reduced by deposit to the land and natural decomposition, so that about 160,000 PE eventually reach waterways. Grazing and feeding farm animals are considered to be a major waste source, but their

impact on water quality is difficult to determine. Stream bank feedlots and dairies are situated at a number of points, providing an unrestrained source of serious bacterial contamination. Less concentrated but significant influences are pasture and grazing areas along the water courses and drainage ditches. In many areas the stream banks are not fenced, allowing the animals unrestricted access to the water.

The data obtained from the upstream survey is shown in Table 2.

The appended data contains all the field data obtained on the survey.

TABLE 2

DATA FROM UPSTREAM SURVEY

Station No.*	Conductivity μmho	pH	D.O. mg/l	Turbidity JTU
1	217	8.5	9.6	0.6
2	244	8.7	9.6	0.6
3	190	7.6	9.2	0.3
4	255	8.5	10.4	0.5
5	250	8.4	10.6	0.7
6	249	8.8	10.4	0.7

* Station locations shown in Figure 1.

REFERENCES

(1) American Public Health Assoc., Inc. Standard Methods 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.

(4) Washington Pollution Control Commission. A regulation relating to water quality standards for interstate and coastal waters of the State of Washington and a plan for implementation and enforcement of such standards. December 4, 1967.

(5) Idaho State Department of Health. Implementation, enforcement and surveillance plan for the rules and regulations for standards of water quality for the interstate waters of Idaho. June 1967.

APPENDIX

STREAM SURVEY DATA

STREAM SURVEY DATA

STATION NAME Snake River below Clarkston, Washington

STATION NO. 543016 LAB. NOS. _____

DATES OF SURVEY July 29-30, 1969

FIELD CREW D. Bodien WEATHER Hot & Dry

G. Burns AIR TEMP _____

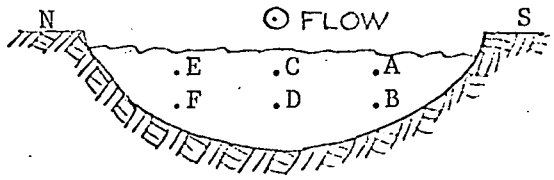
M. Grady ALK. FACTOR _____

_____ D.O. FACTOR 1.0

pH METER NO. HWG - 20070

COND. BRIDGE NO. 85563

CURRENT METER NO. -----



KEY TO LOCATION IN CROSS SECTION.

REMARKS A & B taken under 1st Bell

C & D taken between 2 & 3 Bell

E & F taken under 4th Bell

A,C & E 1M below surface

B,D,& F 15' below surface River 17' deep at all 3 points

CHANNEL CROSS SECTION

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)								STATISTICS		
			A	B	C	D	E	F			MAX.	MIN.	AVG.
TIME 1200	TEMP. °C		23.8	24.0	23.4	23.8	23.2	23.0			24.0	23.0	23.5
	COND. µmho		189	193	185	189	185	182			182	193	187
	pH		7.4	7.9	7.3	7.3	7.5	7.4			7.3	7.9	7.5
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.8	8.7	8.8	8.8	8.8	8.7			8.8	8.7	8.8
	TURB. #		415	430	395	397	608	393					
	TURB.		1.7	1.8	0.8	1.4	1.0	1.7			1.8	0.8	1.2
TIME 1400	TEMP. °C		25.2	22.8	22.6	23.0	22.8	23.2			25.2	22.8	23.3
	COND. µmho		193	189	193	188	186	188			193	188	190
	pH		7.5	7.5	7.4	7.5	7.6	7.8			7.8	7.4	7.6
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	9.1	9.2	9.2	9.2	9.2	9.2			9.1	9.2	9.2
	TURB. #		209	105	181	32	267	38					
			1.7	1.7	1.6	1.3	1.3	1.4			1.7	1.3	1.5

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)								STATISTICS		
			A	B	C	D	E	F			MAX.	MIN.	AVG.
TIME 1600	TEMP. °C		23.4	23.2	23.0	23.0	23.0	23.2			23.4	23.0	23.1
	COND. µmho		194	188	186	186	184	188			194	184	188
	pH		8.0	8.4	8.4	8.5	8.5	8.5			8.5	8.0	8.4
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	9.7	9.7	9.7	9.7	9.7	9.7			9.7	9.7	9.7
	TURB. #		43	37	42	208	205	198					
			1.4	1.4	1.1	0.8	1.2	0.8			1.4	0.8	1.1
TIME 1800	TEMP. °C		23.8	23.2	22.8	22.8	23.0	23.0			23.8	22.8	23.1
	COND. µmho		190	188	187	183	182	185			190	182	186
	pH		8.3	7.4	7.5	7.4	7.5	7.7			8.3	7.4	7.6
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	10.0	10.0	9.9	10.0	9.9	10.0			10.0	9.9	10.0
	TURB. #		324	139	219	139	217	264					
			1.1	0.8	1.1	0.8	0.8	1.0			1.1	0.8	0.9

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)									STATISTICS		
			A	B	C	D	E	F				MAX.	MIN.	AVG.
TIME 2000	TEMP. °C		22.8	22.4	22.4	21.8	22.2	22.4				22.8	21.8	22.3
	COND. µmho		182	182	180	180	176	172				182	172	179
	pH		8.3	8.6	8.6	8.5	8.6	8.6				8.6	8.3	8.5
	ALK. mg/l.	TITRANT ml.												
		VALUE												
	D.O. mg/l.	TITRANT ml.												
		VALUE	9.9	10.0	9.8	9.8	9.8	9.9				10.0	9.8	9.9
	TURB. #		250	128	201	206	222	216						
			1.1	1.2	1.3	1.4	1.1	0.8				1.4	0.8	1.2
TIME 2200	TEMP. °C		21.0	21.4	21.6	21.4	21.6	21.8				21.8	21.0	21.5
	COND. µmho		172	174	171	169	165	168				174	165	170
	pH		8.2	8.3	8.4	8.4	8.4	8.3				8.4	8.2	8.3
	ALK. mg/l.	TITRANT ml.												
		VALUE												
	D.O. mg/l.	TITRANT ml.												
		VALUE	9.2	9.2	9.3	9.2	9.3	9.2				9.3	9.2	9.2
	TURB. #		207	202	212	195	217	203						
			0.8	0.8	0.8	0.8	0.8	0.6				0.8	0.6	0.8

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)								STATISTICS		
			A	B	C	D	E	F			MAX.	MIN.	AVG.
TIME 2400	TEMP. °C		20.6	20.4	20.4	20.6	20.6	21.0			21.0	20.4	20.6
	COND. µmho		168	164	165	167	165	163			168	163	165
	pH		7.6	8.1	8.1	8.0	8.1	8.1			8.1	7.6	8.0
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.3	8.5	8.5	8.5	8.5	8.5			8.5	8.3	8.5
	TURB. #		208	213	218	183	204	209					
			0.7	0.7	0.6	1.0	1.0	0.7			1.0	0.6	0.8
TIME 0200	TEMP. °C		20.2	19.6	19.8	19.8	19.8	20.2			20.2	19.6	19.9
	COND. µmho		164	148	164	167	168	164			168	148	163
	pH		8.0	8.0	7.9	7.9	7.9	7.9			8.0	7.9	7.9
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.4	8.2	8.0	8.3	8.4	8.2			8.4	8.0	8.3
	TURB. #		214	193	224	205	210	215					
			0.6	0.8	0.8	0.7	1.0	0.7			1.0	0.6	0.8

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)								STATISTICS		
			A	B	C	D	E	F			MAX.	MIN.	AVG.
TIME 0400	TEMP. °C		19.6	19.6	19.4	19.8	19.8	19.8			19.8	19.4	19.7
	COND. µmho		157	159	160	161	158	158			161	157	159
	pH		7.9	7.9	7.8	7.8	7.9	7.8			7.9	7.8	7.9
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.0	8.0	8.1	8.0	8.0	8.0			8.1	8.0	8.0
	TURB. #		184	225	4	34	43	57					
			0.8	0.6	0.6	0.5	0.5	0.7			0.8	0.5	0.6
TIME 0600	TEMP. °C		18.6	19.0	18.8	19.2	19.2	19.6			19.6	18.6	19.1
	COND. µmho		153	159	159	160	159	159			160	153	158
	pH		7.8	7.8	7.7	7.7	7.8	7.7			7.8	7.7	7.8
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	7.7	7.7	7.9	7.8	7.9	7.7			7.9	7.7	7.8
	TURB. #		92	4	26	41	56	91					
			1.2	0.7	0.7	0.4	0.8	0.8			1.2	0.4	0.8

STATION NO. 543016

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)								STATISTICS		
			A	B	C	D	E	F			MAX.	MIN.	AVG.
TIME 0800	TEMP. °C		19.4	19.6	19.5	19.6	19.6	19.4			19.6	19.4	19.5
	COND. µmho		172	154	162	164	164	160			172	154	163
	pH		7.5	7.7	7.8	7.8	7.8	7.8			7.8	7.5	7.7
	ALK. mg/l.	TITRANT ml.											
		VALUE											
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.0	7.9	7.9	7.9	8.0	7.9			8.0	7.9	7.9
	TURB. #		3	25	38	54	90	1					
			0.8	0.7	0.4	0.6	0.4	0.4			0.8	0.4	0.6
TIME 1000	TEMP. °C		21.2	20.8	20.8	21.2	21.0	21.0			21.2	20.8	21.0
	COND. µmho		182	179	177	176	172	175			182	172	177
	pH		7.5	7.7	7.6	7.7	7.6	7.8			7.8	7.5	7.7
	ALK. mg/l.	TITRANT ml.											
		VALUE	8.2	8.2	8.2	8.2	8.2	8.2			8.2	8.2	8.2
	D.O. mg/l.	TITRANT ml.											
		VALUE	8.2	8.2	8.2	8.2	8.2	8.2			8.2	8.2	8.2
	TURB. #		21	38	50	62	1	6					
			0.5	0.7	0.6	0.8	0.7	0.5			0.8	0.5	0.6

STATION NO. Special Run

STREAM SURVEY DATA

	PARAMETER		LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)									STATISTICS		
			1	2	3	4	5	6				MAX.	MIN.	AVG.
TIME	TEMP. °C		-------	------	-------	-------	------	----						
	COND. µmho		217	244	190	255	250	249						
	pH		8.5	8.7	7.6	8.5	8.4	8.8						
	ALK. mg/l.	TITRANT ml.												
		VALUE												
	D.O. mg/l.	TITRANT ml.												
		VALUE	9.6	9.6	9.2	10.4	10.6	10.4						
	TURB. #		216	550	706	13	4	695						
			0.6	0.5	0.3	0.5	0.7	0.7						
TIME	TEMP. °C													
	COND. µmho		½ mile below Rapids 2' deep mid channel	½ mile above Rapids 2' deep so. side channel	Boat landing by golf course 2' deep no. side	¼ mile below clearwater mid-stream 2' deep PFI effluent	Under highway 12 bridge mid-channel	Public Boat Ramp and channel						
	pH													
	ALK. mg/l.	TITRANT ml.												
		VALUE												
	D.O. mg/l.	TITRANT ml.												
		VALUE												

STREAM SURVEY DATA

TOTAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBER /100 ml.
	A				B				C				
	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	
1200	28			56		14		140			09	900	
1400			13	1300			07	700		18		180	
1600		42		420		22		220	12			24	
1800	09			18			10	1000		36		360	
2000			33	3300			24	2400			10	1000	
2200			66	6600			25	2500			17	1700	
2400			05	500			35	3500			64	6400	
0200		17		170		11		110			14	1400	
0400		25		250			38	3800			30	3000	
0600			22	2200			56	5600			38	3800	
0800			22	2200			22	2200			30	3000	
1000			22	2200			22	2200			27	2700	
AVERAGE				1601				2031				2039	

STREAM SURVEY DATA

TOTAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBER /100 ml. FOR A-F
	D				E				F				
	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	
1200			17	1700			8	800			10	1000	766
1400		10		100		16 ✓		60		117		1170	585
1600		07		700	12			24		61		610	333
1800			20	2000		20		200		50		500	680
2000			30	3000			33	3300			43	4200	2867
2200			63	6300		21		210			22	2200	3252
2400			13	1300			49	4900				-	3320
0200			19	1900			07	700			51	5100	1564
0400			15	1500		07		70			29	2900	1920
0600			37	3700			30	3000			50	5000	3884
0800			35	3500			32	3200			20	2000	2684
1000			33	3300			23	2300			16	1600	2384
AVERAGE				2417				1564				2389	2020

STREAM SURVEY DATA

FECAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBERS /100 ml.
	A				B				C				
	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	
1200	0			-	0			-	0			-	
1400	1			2	3			6	0			-	
1600	0			-	0			-	0			-	
1800	0			-	2			4	0			-	
2000	2			4	0			-	0			-	
2200	5			10	14			28	8			16	
2400	45			90	61			122	76			152	
0200	54			108	29			58	22			44	
0400	42			84		11		110	33			66	
0600	71			142	47			94		15		150	
0800	16			32	20			40	18			36	
1000	0			-	4			8	3			6	
AVERAGE				39				39				39	

STREAM SURVEY DATA

FECAL COLIFORMS

STATION NO. 543016

TIME	LOCATION IN CROSS SECTION (SEE KEY ON PAGE 1)												AVERAGE NUMBER /100 ml, A-F
	D				E				F				
	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	50 ml.	10 ml.	1 ml.	number /100 ml.	
1200	1			2	0			-	1			2	1
1400	1			2	0			-	0			-	2
1600	0			-	0			-	0			-	-
1800	5			10	1			2	0			-	3
2000	0			-	1			2	0			-	1
2200	12			24	12			24	50			100	19
2400	80			160		26		260				-	157
0200	18			36	25			50	16			32	55
0400	22			44	100			200	127			254	126
0600		22		220		30		300		27		270	196
0800	41			82	42			84	41			82	59
1000	6			12	0			-	3			6	6
AVERAGE				49				77				62	52