SPOKANE RIVER BASIN MODEL PROJECT

Volume II - Data Report

by

E. John Finnemore, Ph.D.

John L. Shepherd

Systems Control, Inc., Palo Alto, California

for the

ENVIRONMENTAL PROTECTION AGENCY

Contract No. 68-01-0756

October 1974

EPA Review Notice

This report has been reviewed by the Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ABSTRACT

Three existing mathematical models, capable of representing water quality in rivers and lakes, have been modified and adapted to the Spokane River Basin in Washington and Idaho. The resulting models were named the Steady-state Stream Model, the Dynamic Stream Model, and the Stratified Reservoir Model. They are capable of predicting water quality levels resulting from alternative basinwide wastewater management schemes, and are designed to assist EPA, State, and local planning organizations to evaluate water quality management strategies and to establish priorities and schedules for investments in abatement facilities in the basin.

Physical data and historical hydrologic, water quality and meteorologic data were collected, assessed and used for the model calibrations and verifications.

The modified models are all capable of simulating the behavior of various subsets of up to sixteen different water quality constituents. Sensitivity analyses were conducted with all three models to determine the relative importance of a number of individual model parameters.

The models were provided to the EPA as computer source card decks in FORTRAN IV language, with accompanying data decks. All development work on, and applications made with, these models were fully documented so as to permit their easy utilization and duplication of historical simulations by other potential users. A user's manual with a complete program listing was prepared for each model.

This report was submitted in fulfillment of Contract No. 68-01-0756 under the sponsorship of the Environmental Protection Agency.

The titles and identifying numbers of the final report volumes are:

Title	EPA Report No.
SPOKANE RIVER BASIN MODEL PROJECT Volume I - Final Report	_____ DOC __/74
SPOKANE RIVER BASIN MODEL PROJECT Volume II - Data Report	_____ DOC __/74
SPOKANE RIVER BASIN MODEL PROJECT Volume III - Verification Report	_____ DOC __/74
SPOKANE RIVER BASIN MODEL PROJECT Volume IV - User's Manual for Steady-state Stream Model	_____ DOC __/74
SPOKANE RIVER BASIN MODEL PROJECT Volume V - User's Manual for Dynamic Stream Model	_____ DOC __/74
SPOKANE RIVER BASIN MODEL PROJECT Volume VI - User's Manual for Stratified Reservoir Model	_____ DOC __/74

CONTENTS

FIGURES (Continued)

TABLES

TABLES (Continued)

SECTION I

INTRODUCTION

Under the sponsorship of the Environmental Protection Agency, Systems Control, Inc. has modified and adapted to the principal rivers and lakes of the Spokane River Basin three existing mathmatical water quality models.

This Data Report, Volume II in a series of six volumes documenting the project, describes the data assembly, assessment, categorization, and processing techniques used.

PRESENTATION FORMAT

This report is organized into four main sections. The first section describes the data assembly phase of the project including data needs for the models, the procedure employed in collecting data throughout the study area and the availability of data which resulted from this collection. The data particularly sought was that required to verify the DOSAG and Storm Water Management Models (SWMM), and the Deep Reservoir Model (DRM). In addition to the STORET data which was readily obtained, a large quantity of miscellaneous information and data on the Spokane River Basin was received.

The second section of the report deals with the assessment of the data. An assessment determined that there were several reports which contributed useful information in addition to that entered on STORET. Some documents of importance to planners, though not to this project, were received as well and have been included in the Bibliography. Once the assessment was completed, a selection of the simulation periods for each region based primarily on water quality and stream flow data availability was made.

The third section of the report describes the data processing techniques and results. A categorized bibliography of all data-related information received on the Spokane River Basin has been included as the fourth report section. This bibliography indicates those documents which were found to be useful on this project and will likely be of value to future users of the improved models.

Since this report was a deliverable required during the earlier stages of the project, it was written in January 1973.

BACKGROUND

As concern about environmental problems has grown in recent years there has been a great expansion in efforts to collect and tabulate streamflow and water quality data. Consequently, it is now becoming practicable to use mathematical models to simulate water quality with presently available data. These models use mathematical relations to describe both the river's flow and the interrelationships between water quality constituents throughout the river.

The area included in this study consists of all or portions of the Spokane, Little Spokane, Hangman Creek, Coeur d'Alene, St. Joe, and St. Maries Rivers, and Long Lake, Coeur d'Alene Lake, and the Spokane arm of Roosevelt Lake. Within this area, the South Fork Coeur d'Alene River and the Spokane River in the vicinity of Spokane have the most severe water quality problems.

The South Fork of the Coeur d'Alene River traverses a large mining, smelting, and refining area. The lead and silver mines in the basin have operated for over 30 years and have been a major source of pollution for the downstream portions of the river basin. Since 1968, this pollution has been somewhat curbed by the installation of tailings ponds at all active mining operations. Domestic sewage, discharged to the river without treatment, creates a serious health problem. Considerable improvement of the water quality of the South Fork and consequently of the whole area is still needed. The ultimate impact on the ecological system due to further reduction of metals cannot be precisely determined. Among other effects, algae populations suppressed by the toxic metals may increase substantially.

A number of municipal waste treatment facilities in and around Spokane are located adjacent to and discharge into the Spokane River.

In addition to the municipal wastes, there are a number of industries which deposit wastes in the river. Although there is not presently a serious problem in the immediate Spokane region, the water, which is already substandard coming from Idaho, is further polluted while passing through the region.

This study has been undertaken to prepare models of the water quality in the Spokane River Basin for use in planning the abatement of water pollution in the study area. This report, dealing specifically with data, has been prepared to document the large volume of information presently available on the Spokane River Basin and to describe the means employed in selecting those data to be used for model verification. The resulting data inventory indicates that important information, particularly effluent and physical data, is lacking in some regions. This shortcoming is expected to impair the reliability and accuracy of the models ultimately developed.

SECTION II

SPOKANE RIVER NETWORK

A map of the Spokane River Basin (Figure 1) shows the location of the study region. A very simple schematic layout of the Spokane River System has been prepared (Figure 2) in order to facilitate easy recognition of the system's principal features. The system contains three major lakes, namely Coeur d'Alene Lake, Long Lake, and the Spokane arm of the Franklin D. Roosevelt Lake. The river system has been divided into five regions designated as follows:

Region	Name
1	St. Joe-St. Maries Rivers
2	Coeur d'Alene and South Fork Coeur d'Alene Rivers
3	Spokane River between Long Lake and Coeur d'Alene Lake, including Hangman Creek
4	Little Spokane River
5	Spokane River between Roosevelt Lake and Long Lake.

The schematic layouts for each region are shown in Figures 3 through 8. In addition, networks have been prepared which show the channels as modeled by SWMM (Figures 9 through 14). The channels (reaches) shown on the network diagrams are as defined for the Receiving Water Module of the Storm Water Management Program. DOSAG will model the regions using similar reaches with additional point sources. These reaches have zero length and are added wherever tributary inflow conditions, either quantity and/or quality, are known. In some cases where inflows are close together, a point reach includes more than one tributary or outfall. In general, a new reach occurs when there is a change in the physical characteristics of the river or where there is an important water quality or quantity gauge.

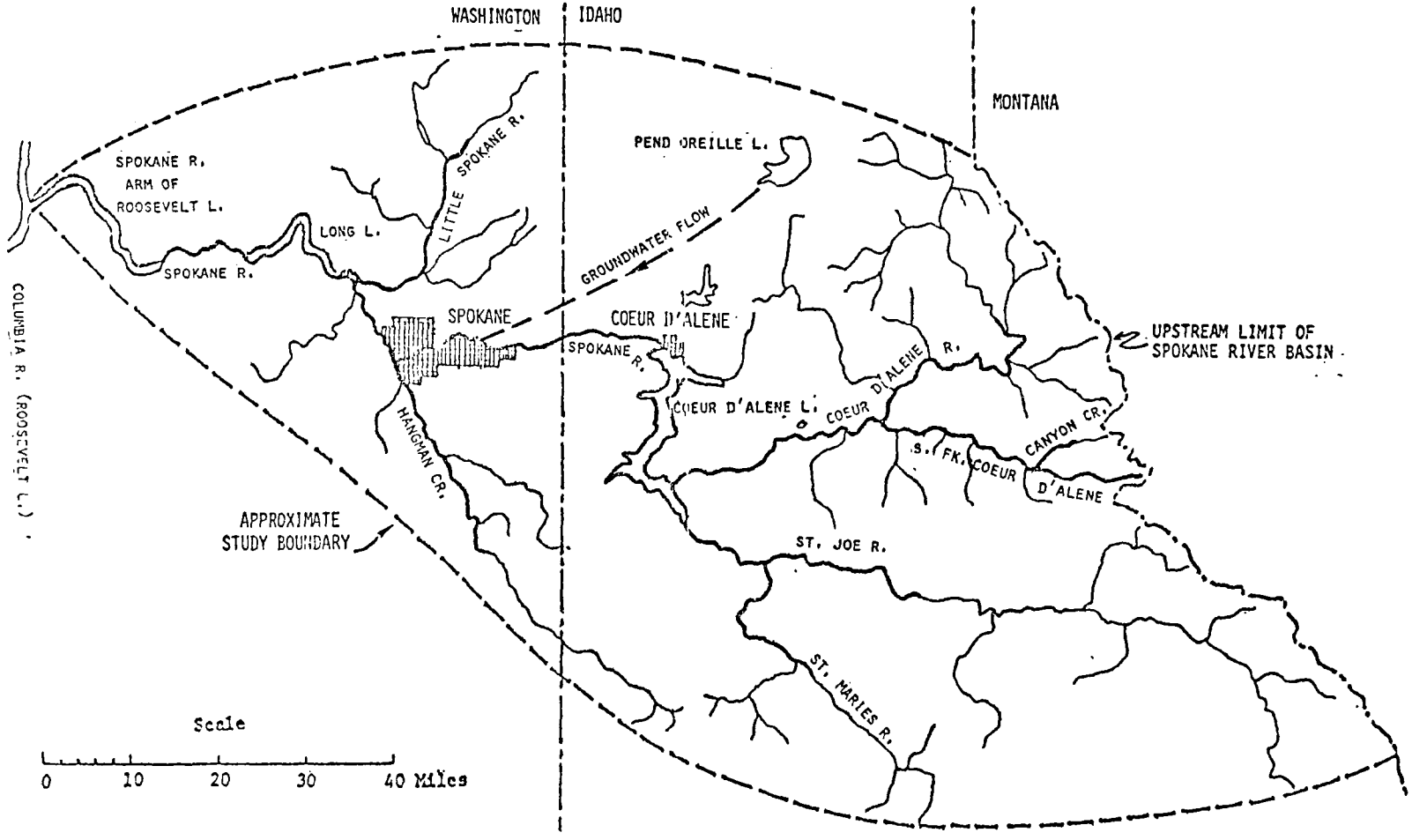
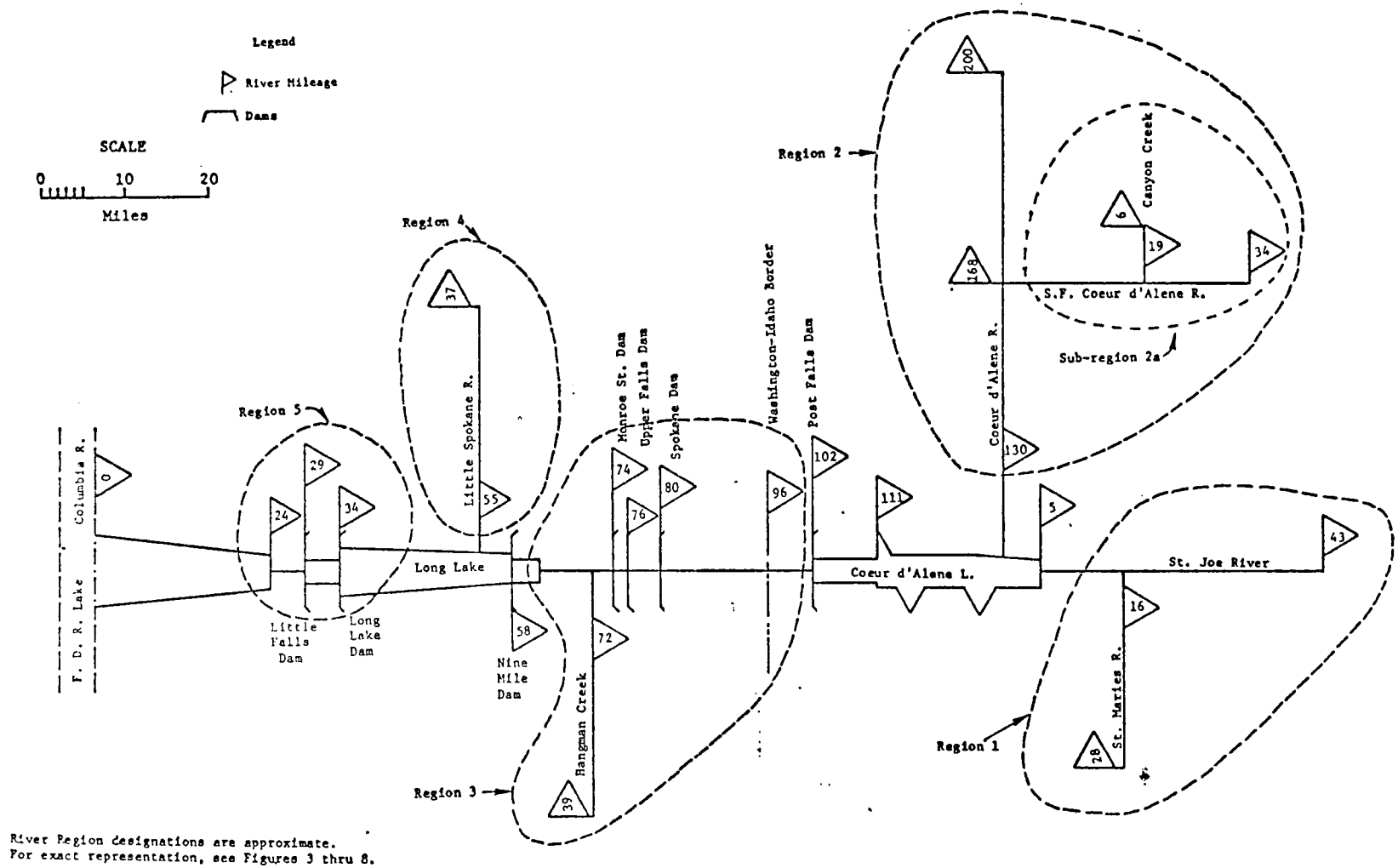


FIGURE 1. SPOKANE RIVER BASIN (PORTIONS TO BE MODELED IN BOLD)



River Region designations are approximate.
For exact representation, see Figures 3 thru 8.

FIGURE 2. LAYOUT OF SPOKANE RIVER SYSTEM

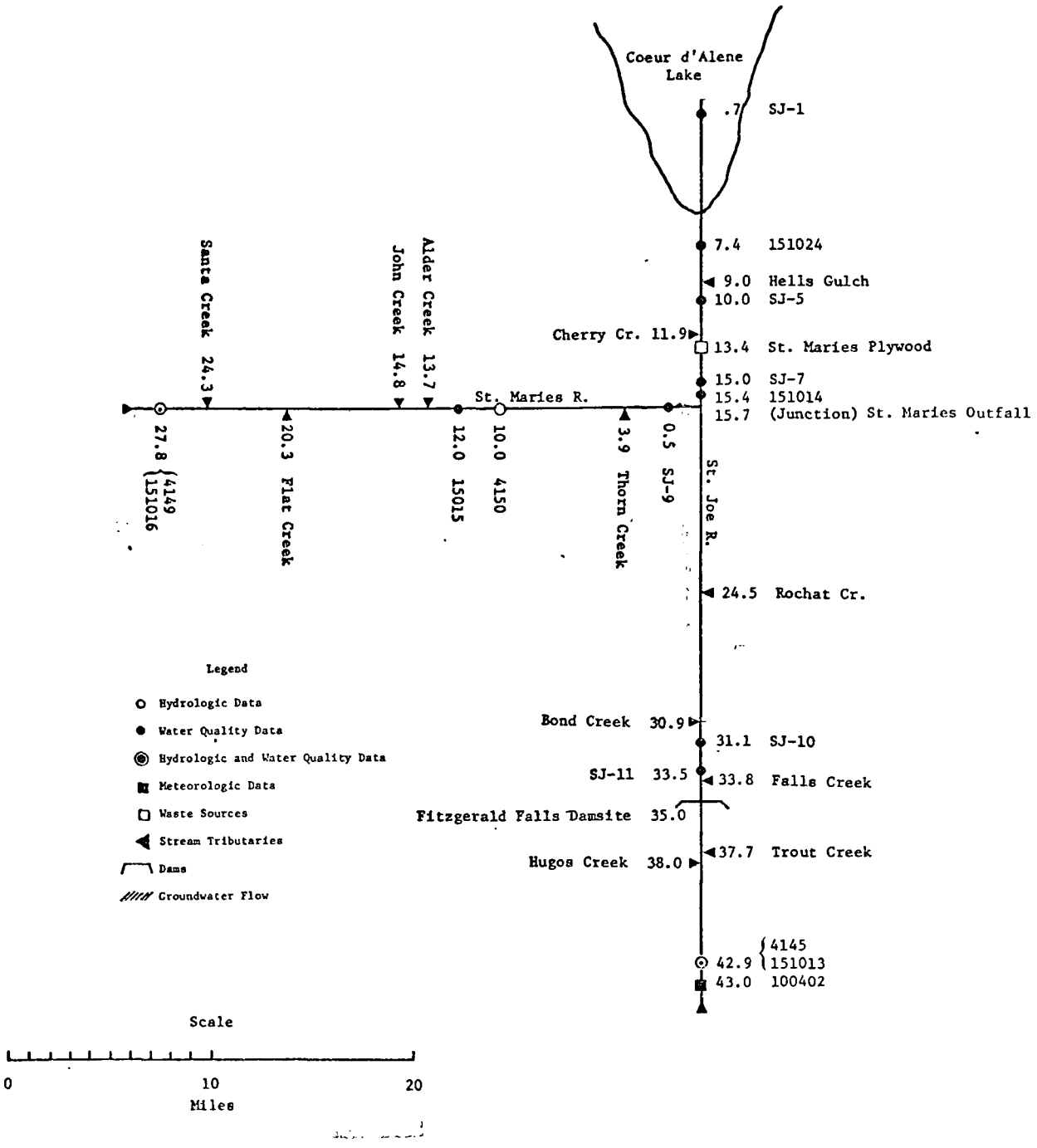


FIGURE 3. METEOROLOGIC, QUALITY AND QUANTITY DATA POINTS
RIVER REGION 1 - ST. JOE - ST. MARIES

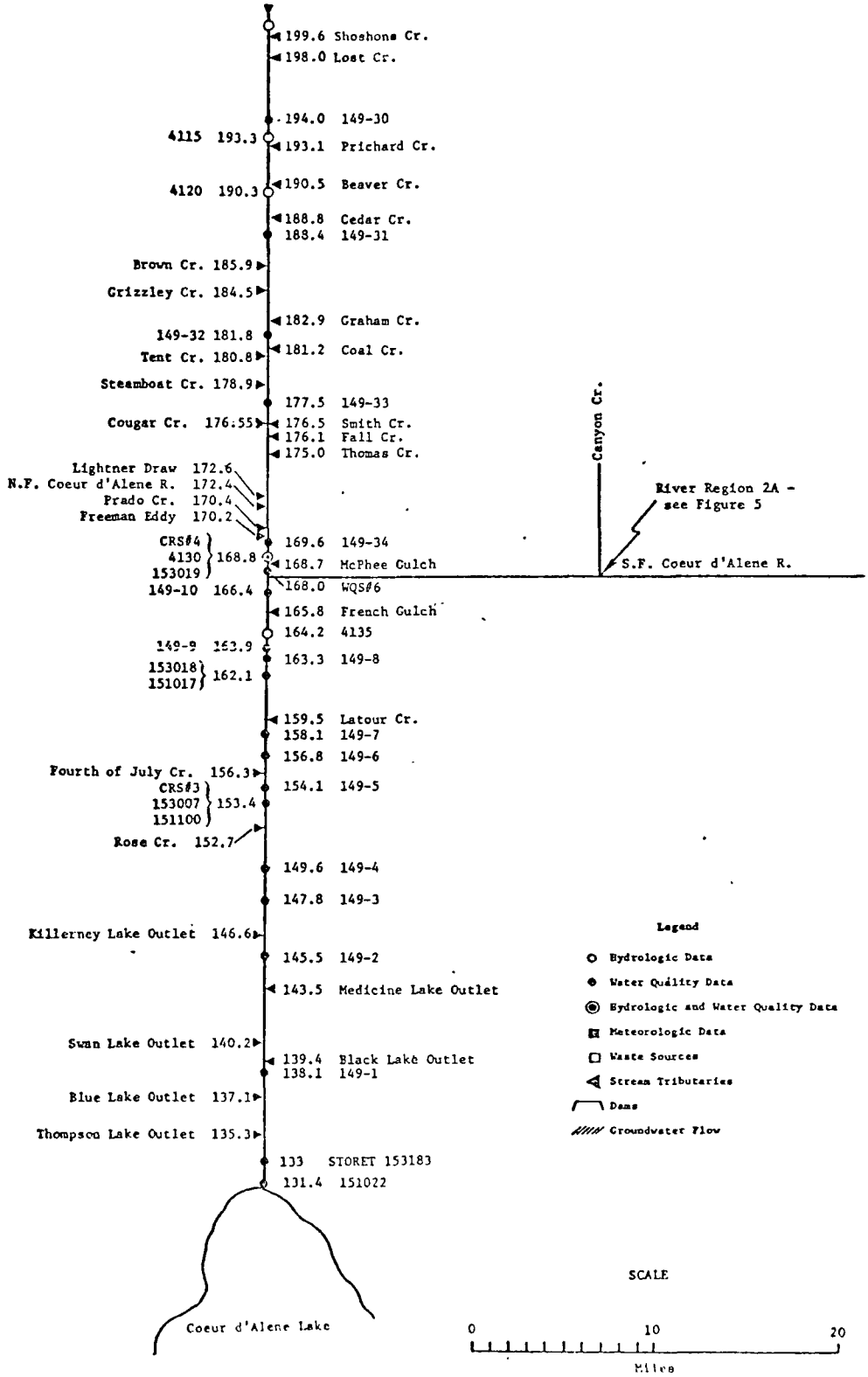


FIGURE 4. METEOROLOGICAL QUALITY AND QUANTITY DATA POINTS RIVER REGION 2 - COEUR D'ALENE R. & S.F. COEUR D'ALENE RIVER

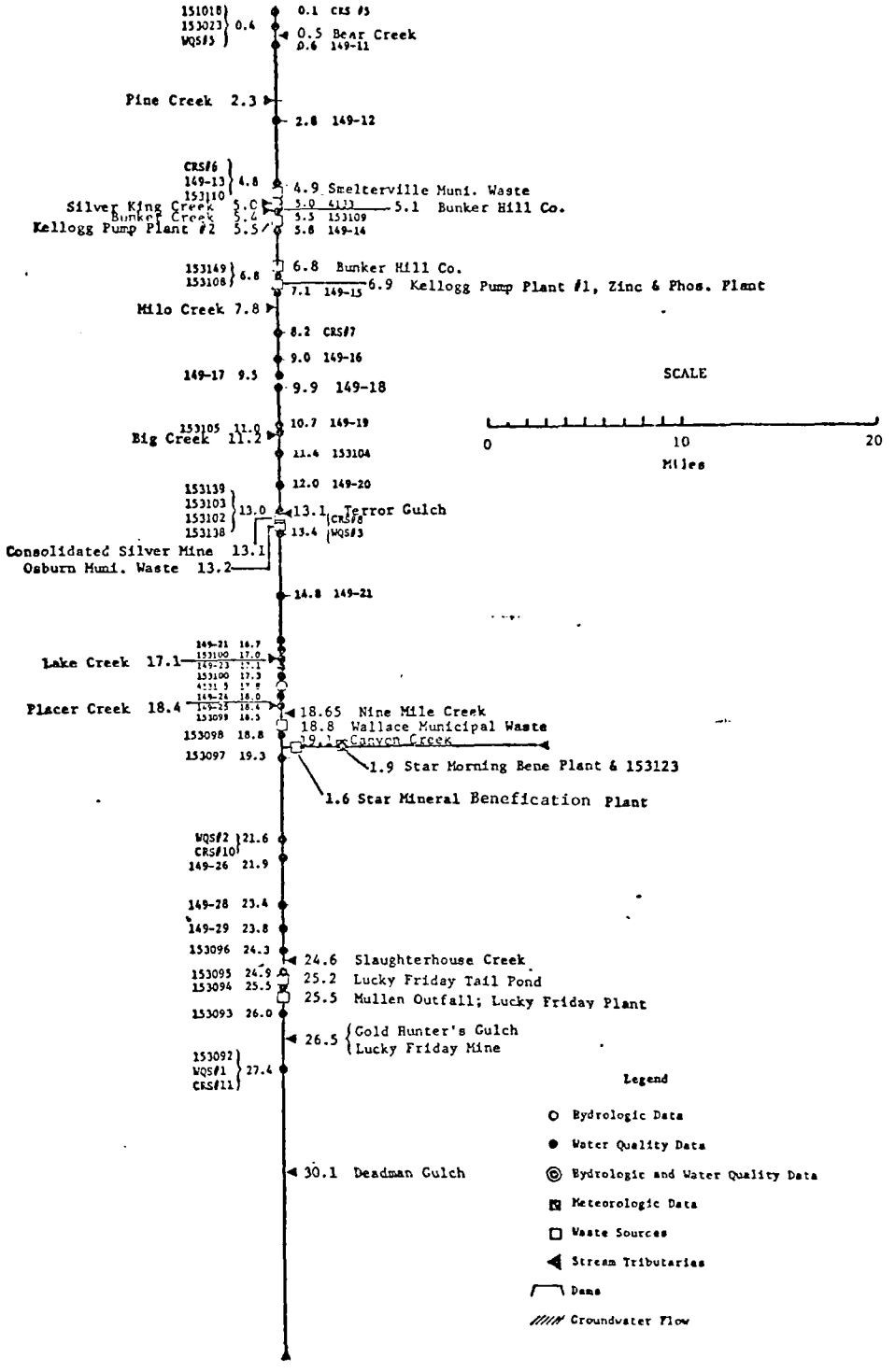


FIGURE 5. METEOROLOGIC, QUALITY AND QUANTITY REGION 2A - S.F. COEUR D'ALENE RIVER

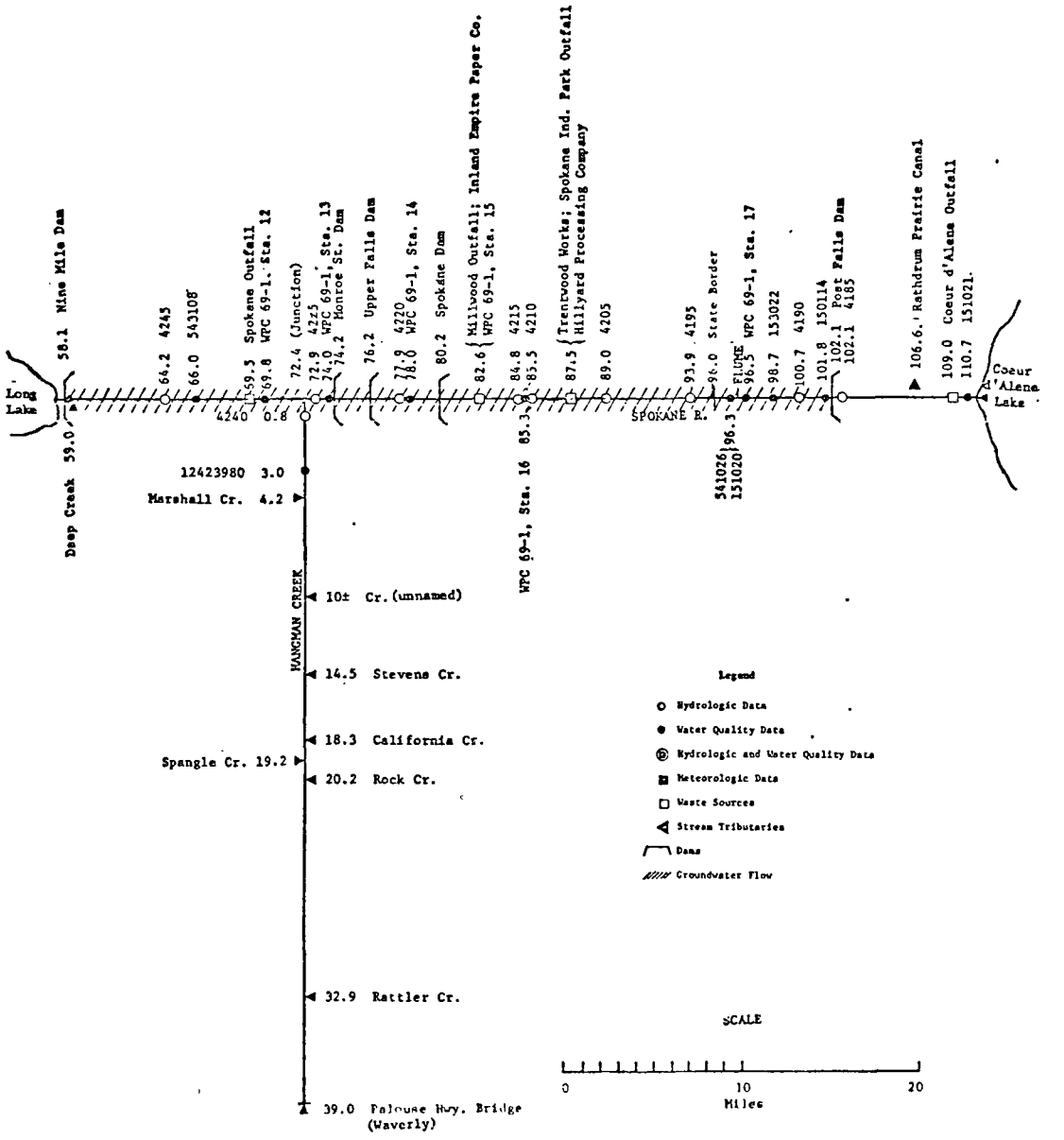


FIGURE 6. METEOROLOGICAL, QUALITY AND QUANTITY DATA POINTS RIVER REGION 3 - SPOKANE RIVER FROM LONG LAKE TO COEUR D'ALENE LAKE

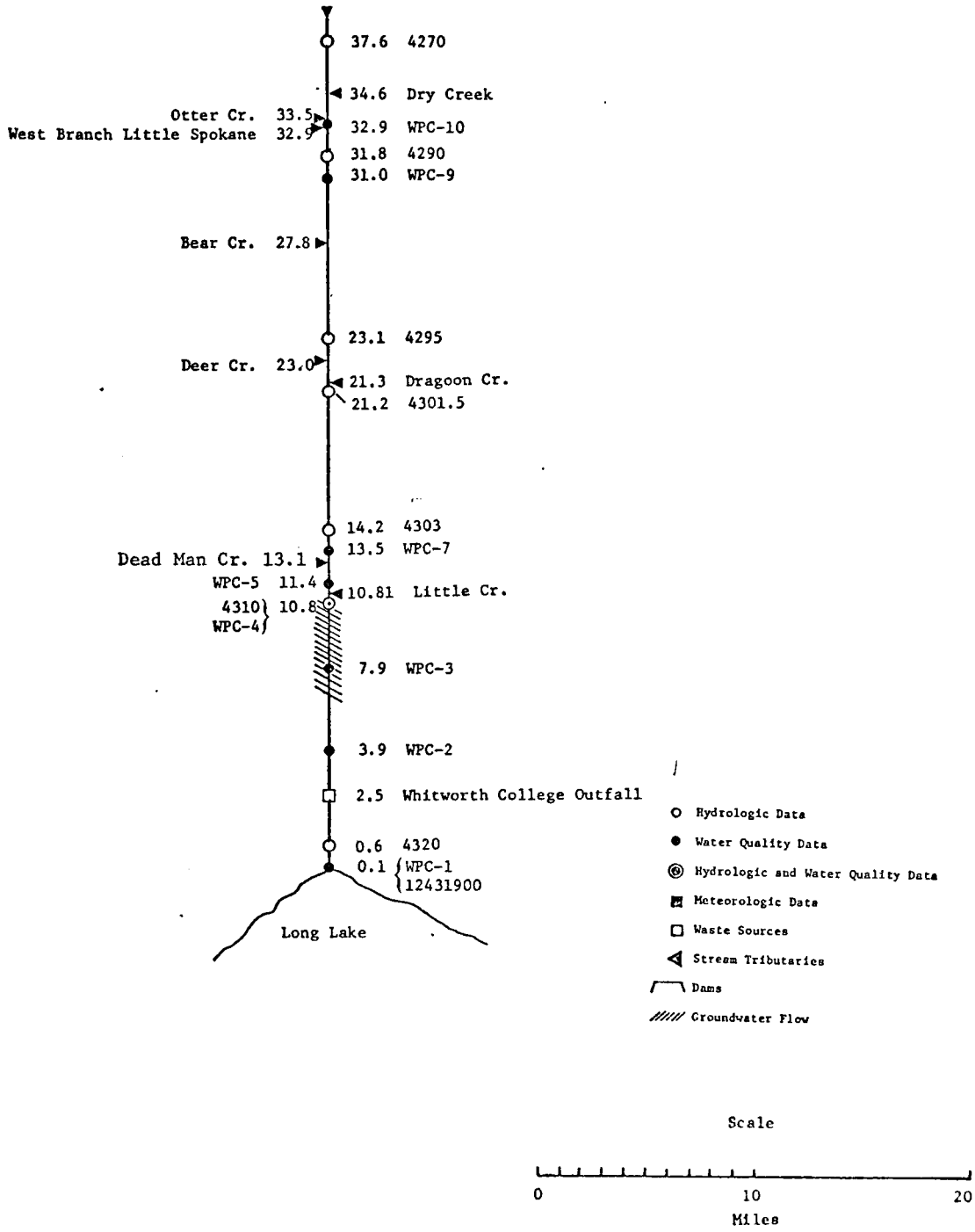


FIGURE 7. METEOROLOGIC, QUALITY AND QUANTITY DATA POINTS
REGION 4 - LITTLE SPOKANE RIVER

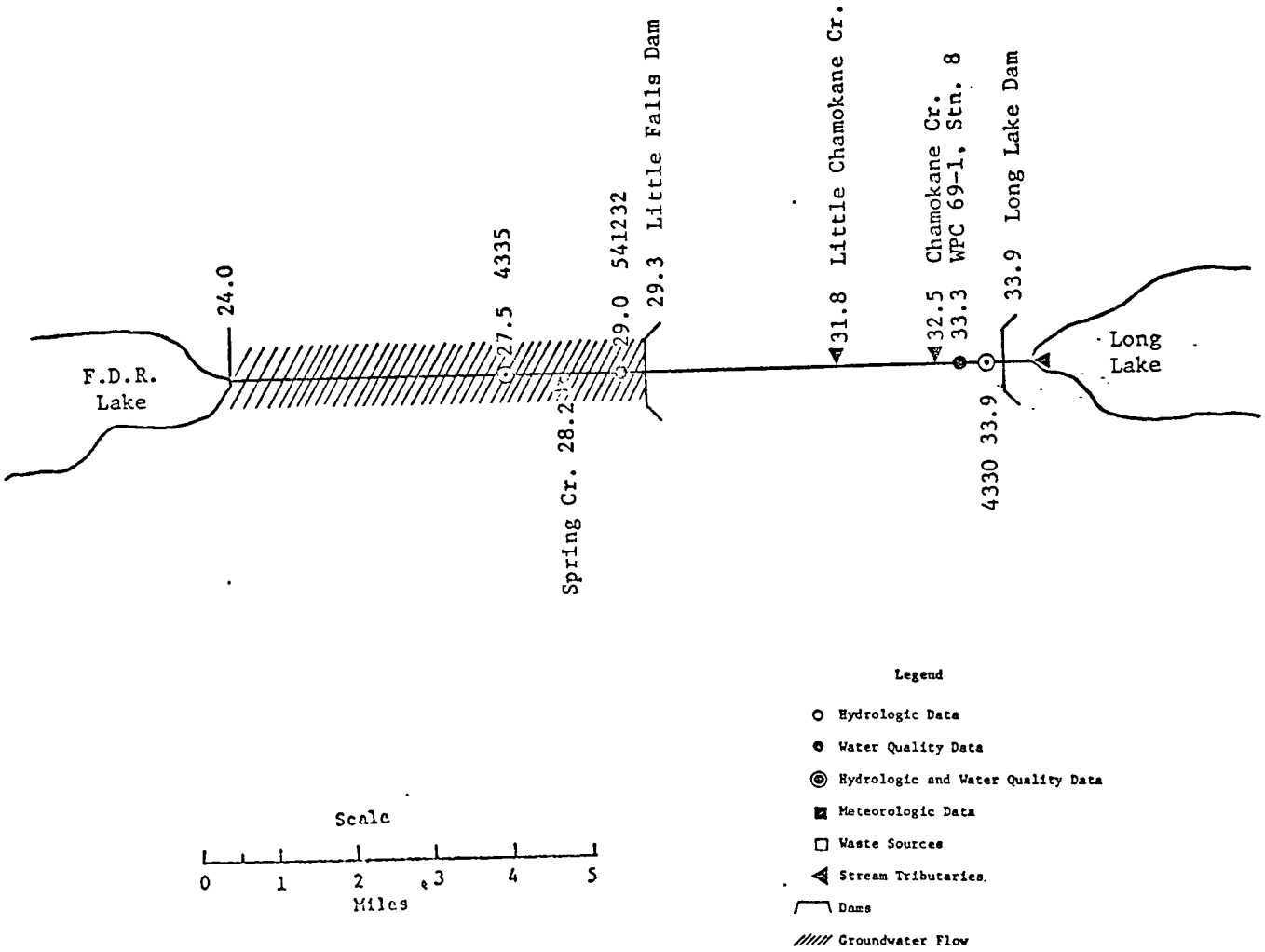


FIGURE 8. METEOROLOGIC, QUALITY AND QUANTITY DATA POINTS
REGION 5 - SPOKANE RIVER FROM ROOSEVELT L. TO LONG L.

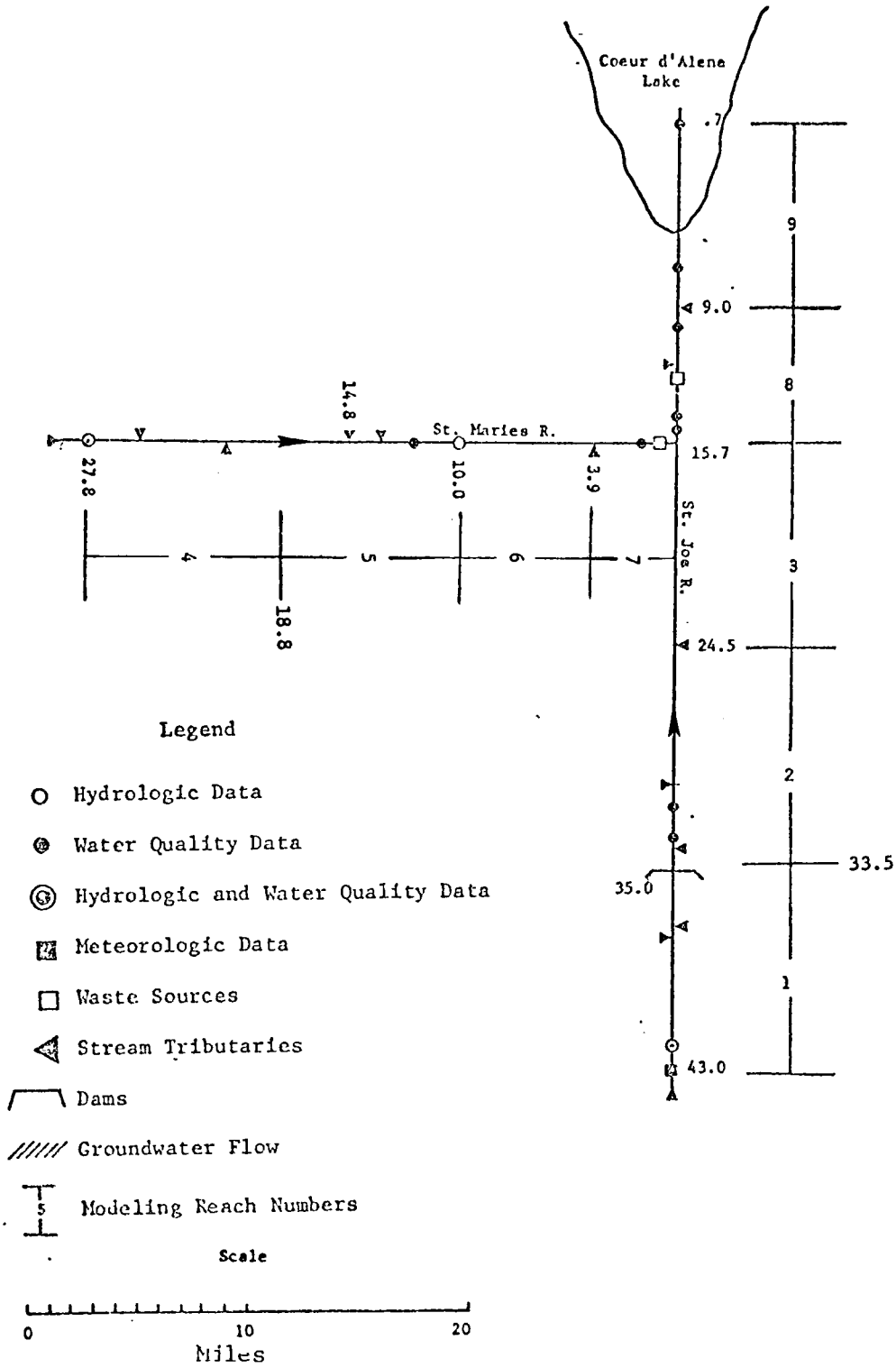


FIGURE 9. MODELING REACHES
RIVER REGION 1 -
ST. JOE - ST. MARIES

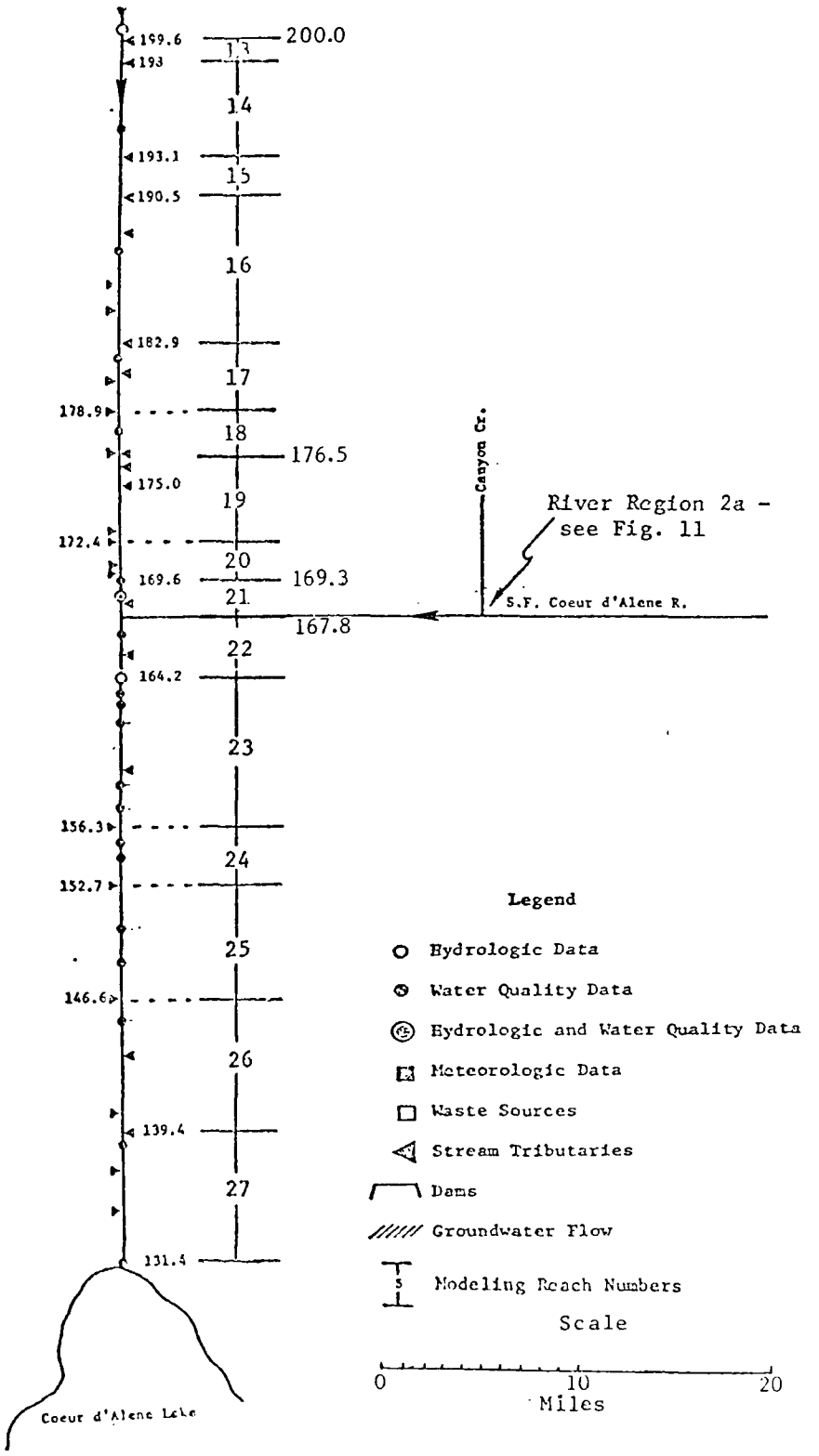


FIGURE 10. MODELING REACHES, RIVER REGION 2 - COEUR D'ALENE & S.F. COEUR D'ALENE R.

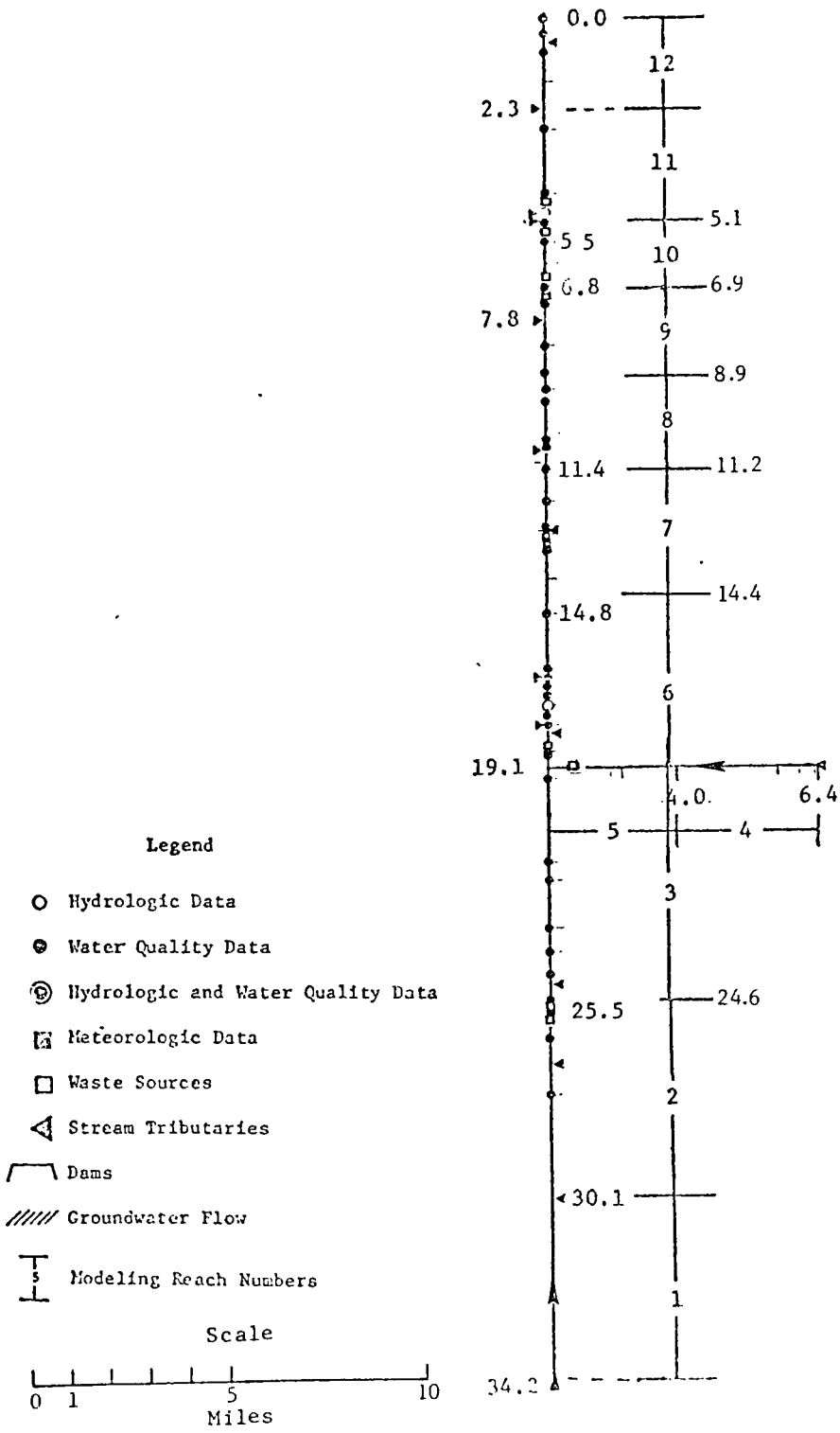


FIGURE 11. MODELING REACHES, REGION 2A - S.F. COEUR D'ALENE RIVER

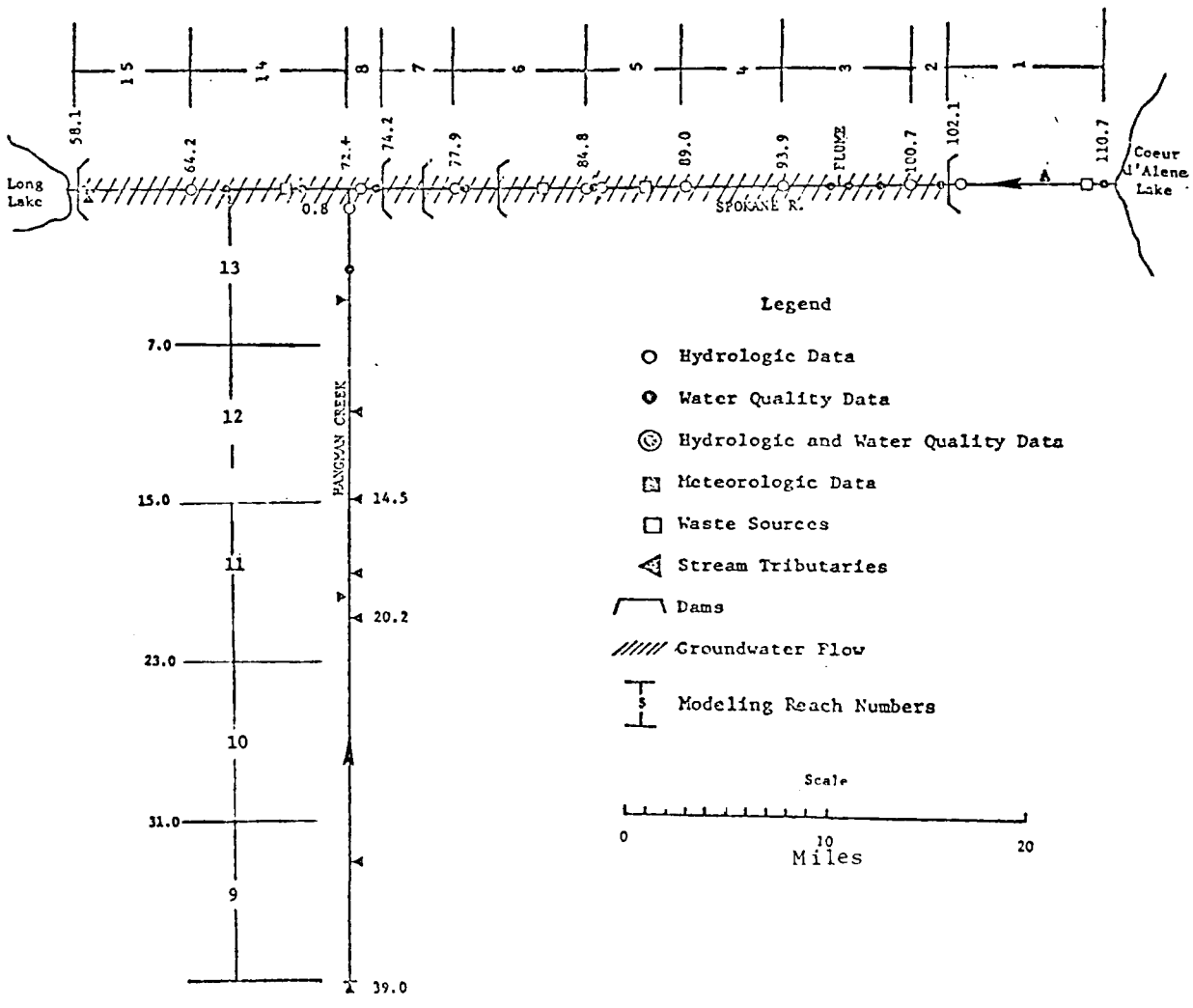


FIGURE 12. MODELING REACHES, RIVER REGION 3 - SPOKANE RIVER FROM LONG LAKE TO COEUR D'ALENE LAKE

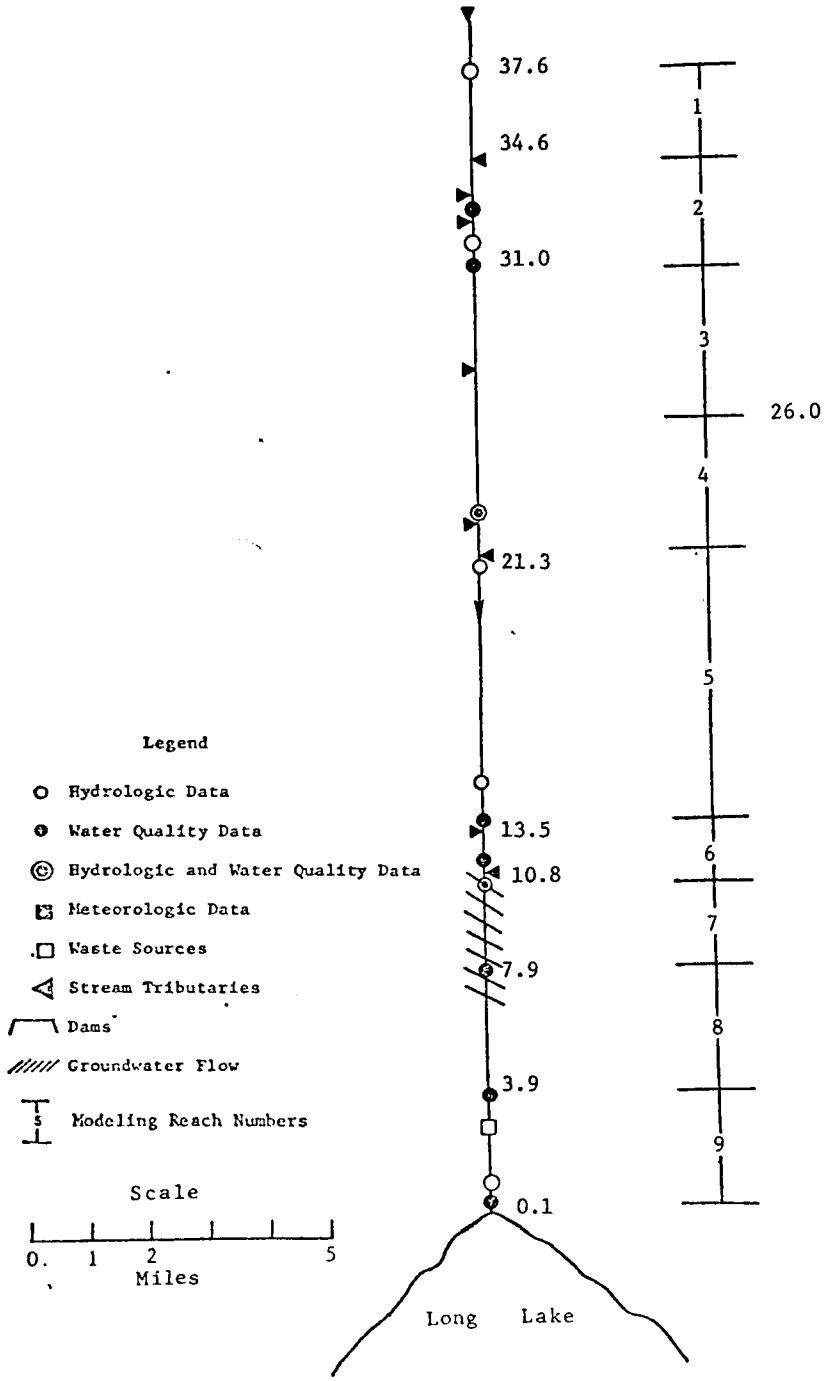


FIGURE 13. MODELING REACHES, REGION 4, LITTLE SPOKANE RIVER

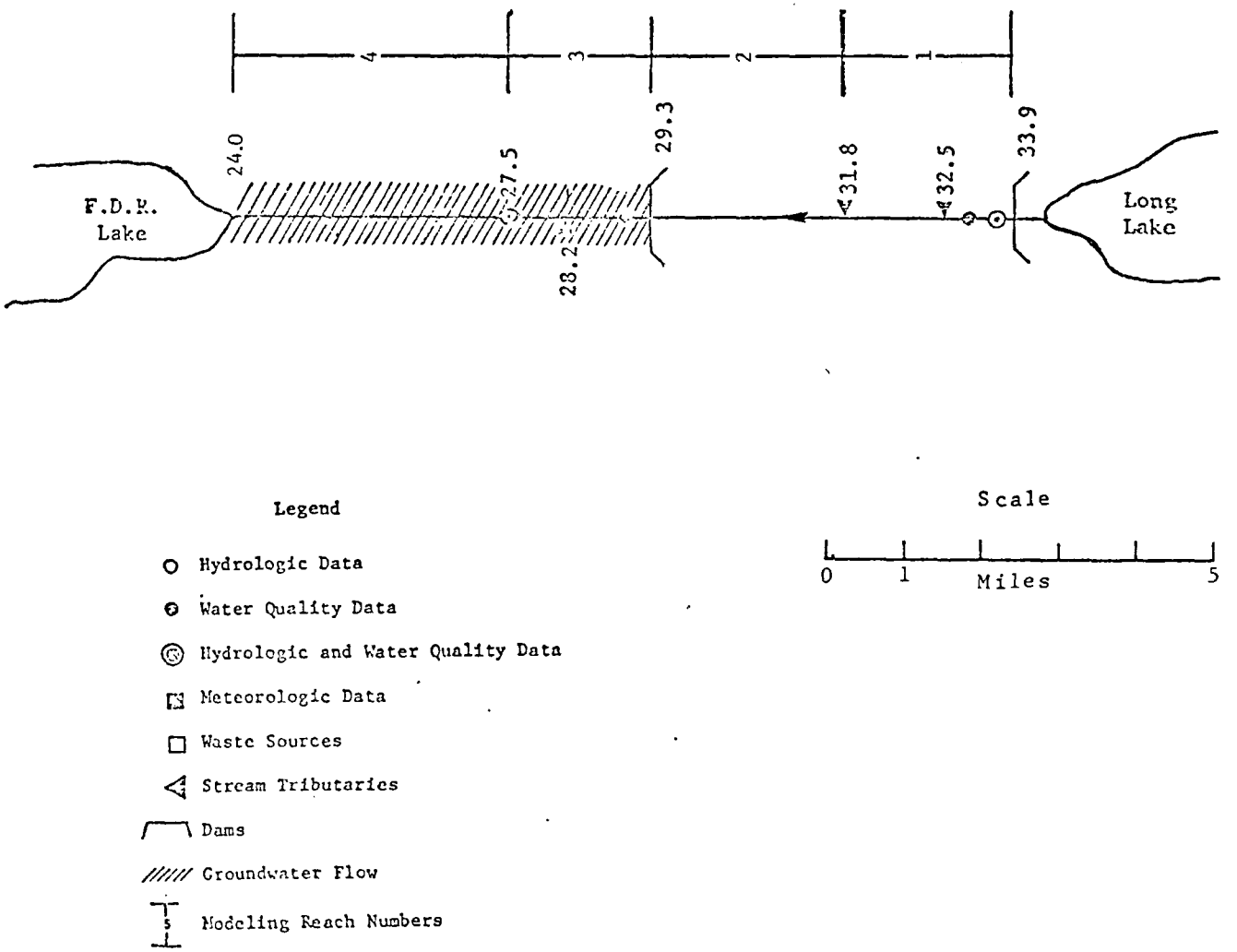


FIGURE 14. MODELING REACHES, RIVER REGION 5 - ROOSEVELT LAKE TO LONG LAKE

SECTION III

DATA REQUIREMENTS AND ACQUISITION

DATA NEEDS

The data needs for this project were determined by review of the input requirements for the DOSAG, DRM, and SWMM models. Four general types of information were needed including physical data, meteorological data, water quantity data and water quality data. Data for DOSAG and SWMM were needed for all river reaches. Data for the DRM were needed for Coeur d'Alene Lake, Long Lake and the Spokane arm of Roosevelt Lake.

The data requirements are listed below and are summarized by model in Table 1. BOD has been used in Table 1 in place of carbonaceous or nitrogeneous BOD since this was the only quantity available in the data received.

DOSAG

1. Physical locations of inflow and outflow points, and non-point sources.

2. Mean channel depths, areas, slopes, roughnesses.

3. Mean solar radiation.

4. Streamflow rates and correlations with depth and velocity; stage/discharge relations.

5. Withdrawal rates and return flows (industrial, municipal, agricultural, groundwater).

6. Pollution concentrations throughout the rivers.

7. Pollution loading rates in all inflows.

8. Water temperatures throughout the rivers and extinction depths.

9. Coefficients and parameters for pollution constituent processes.

TABLE 1. DATA SUMMARY

"P": partial; "-": not applicable

	DATA NEEDS			DATA AVAILABLE								DATA DEFICIENT							
	DOSAG	SWMM	DRM	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.
PHYSICAL																			
1. Locations: River mileages to dams, tributaries, outfalls, other inflows, diversions; general areas of non-point waste sources and groundwater accretions.	X	X	X	X	X	X	X	X	X	X	X								
2. Reservoirs: sounding maps, cross-sections for lakebed topographies; volume and surface area vs. elevation relations; full pool and dam intake elevations; spillway crest elevations, lengths, positions, types; reservoir operating schemes.	-	-	X	-	-	-	-	-	P	X	P	-	-	-	-	-	P		P
3. Channels (by reach): average depths, areas, mean slopes, average Manning's roughness coefficients.	X	X	-	X	X	X	P	X	-	-	-				P		-	-	-
METEOROLOGICAL																			
4. Solar radiation; cloud cover.	X	X	X	X	X	X	X	X	X	X	X								
5. Air temperature, humidity.	-	-	X	-	-	-	-	-	X	X	X	-	-	-	-	-			
6. Wind speeds and directions.	-	X	X	X	X	X	X	X	X	X									
7. Evaporation rates, coefficients.	-	X	X	X	X	X	X	X	X	X	X								
WATER QUANTITY																			
8. Streamflows: inflow and outflow rates; stage/discharge relations at gaging stations; discharge correlations with depth and mean velocity.	X	X	P	X	X	X	X	X	P	P	P						P	P	P
9. Withdrawals: rates and locations for irrigation, water supply, industry.	X	X	X			X													

TABLE 1. (Continued)

	DATA NEEDS			DATA AVAILABLE								DATA DEFICIENT							
	DOSAG	SWMM	DRM	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.
10. Return flows: rates and locations, e.g. for agricultural drains, industry; municipal and other wastewater outfalls; groundwater accretions.	X	X	X		P	P	P	P			X		P	P	P	P			
11. Downstream outlet conditions: weir elevations, coefficients.	-	X	-						-	-	-	X	X	X	X	X	-	-	-
12. Lakes: histories of water surface elevations.	-	-	X	-	-	-	-	-	X	X	X	-	-	-	-	-			
WATER QUALITY Water quality data will be required for: Total Nitrogen, Chlorides, Heavy metals, ions, Phosphorus; Coliforms, Ammonia, Nitrate, Nitrite; Carbonaceous BOD, Chlorophyll a, Dissolved Oxygen, Temperature 13. Concentrations of the above at various time throughout the system of rivers and lakes (other than EPA STORET data); general areas of non-point sources; past monitoring programs or stream surveys for biological and chemical data.	X	X	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
14. Concentrations and loading rates or patterns of the above mentioned constituents in all inflows into the system (in tributary flows, effluents, non-point sources, etc.); plant and process data that will enable their estimation when measurements are unavailable; land use and surface runoff data that might enable the estimation of unmeasured non-point waste loads (e.g., from mine tailings).	X	X	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

"P": partial; "-": not applicable

TABLE 1. (Continued)

	DATA NEEDS			DATA AVAILABLE								DATA DEFICIENT							
	DOSAG	SWMM	DRM	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.	RR #1	RR #2	RR #3	RR #4	RR #5	FDR L.	L. L.	Cd. A. L.
15. Past analyses of field data to determine degradation rates, reaeration coefficients, and decay coefficients for non-conservative constituents above.	X	X	X									X	X	X	X	X	X	X	X
16. Water temperatures: of rivers, tributaries, effluents; of lake interiors and release waters; depths of short wave extinctions in lakes or solar radiation extinction coefficient secchi disk measurements in lakes.	X	X	X	X	X	X	X	X	P	P	P						P	P	P

"P": partial; "-": not applicable

SWMM

1. Physical locations of inflow and outflow points, and non-point sources.

2. Channel data

   a. length, effective width, average depth

   b. Manning's coefficient

   c. initial velocity.

3. Meteorological data

   a. solar radiation

   b. wind speed and direction

   c. evaporation.

4. Junction data

   a. initial head

   b. initial constituent concentrations

   c. area contribution of one-dimensional channels

   d. inflow and outflow histories

   e. depths and mean values of Manning's coefficient

   f. inflow constituent loading rate histories

   g. water temperatures and extinction depths.

5. Coefficients and parameters for pollution constituent processes.

6. Downstream outlet conditions.

DRM

1. Reservoir latitude, longitude, elevation.

2. Lakebed topography; maximum water surface elevation.

3. Physical locations of inflow and outflow points, and non-point sources.

4. Number and types of reservoir outlets and their elevations; dam width at elevations of outlets.

5. Reservoir diffusion parameters; minimum thermal gradient considered stable.

6. Meteorological data

   a. atmospheric pressure
   b. wind speed and direction
   c. sky cover
   d. dry bulb air temperature
   e. wet bulb air temperature
   f. dew point temperature
   g. short wave solar radiation
   h. short wave extinction depths
   i. evaporation.

7. Initial water surface elevation, temperatures and constituent concentrations.

8. Inflow and outflow histories; water surface elevation histories.

9. Inflow constituent loading rate histories.

10. Coefficients and parameters for pollution constituent processes.

DATA COLLECTION

The collection of data was begun by requesting a printout of STORET data available from the Environmental Protection Agency. Additional data was solicited from federal, state and local government agencies, special purpose districts and private corporations and individuals in Washington and Idaho. A list of potential data sources (Appendix I, Attachment 2) was compiled based on review of past reports on the Spokane River Basin and through discussion with knowledgeable individuals. Data survey questionnaires were sent to each person on the initial distribution list. In addition to inquiring as to the availability of specific data, one portion of the questionnaire requested further references to other potential sources of data. All suggested data sources were solicited by way of the questionnaire to determine data availability and request further suggestions of potential sources. This iterative procedure was continued until all suggestions were exhausted. Upon return of the questionnaire, all available data pertaining to the Spokane River Basin and pertinent to the study were requested.

Data Survey

The questionnaires (Appendix I, Attachment 1) consisted of two parts. The first part was a compiled listing of data requirements for the three computer models. It requested information about the type and frequency of available data and the ease of providing this data. The second part of the questionnaire requested information about alternative data sources including the name of an individual or agency and the types of data possibly available. The completion and return of the questionnaires was accomplished only after substantial delays necessitating multiple mailings and repetitive telephone requests for action. The return of the completed questionnaires, anticipated to require one month, in fact required nearly two months during which several days were devoted to intensive telephone followup.

Note should be made of the special assistance of the Project Officer in searching agency archives and the recovery and provision of materials from EPA files.

Requests for Data

Upon collection of the completed questionnaires, a review was made to identify data of value to the study. This data was then requested by phone where possible in order to collect the data more rapidly, and by letter otherwise. The urgency of need was greatly stressed. The letter and a sample attachment are shown in Appendix I, Attachment 4. The attachment identified the data which was requested, and consisted of a reproduction of that portion of the returned questionnaire on which the desired available data had been described. The data requested was often slow in arriving and substantially delayed progress on later portions of the project. As of January 2, 1973, all data requested in this manner had been collected.

In all, 96 inquiries were made in formal questionnaires and informal phone calls. There were 90 replies, either positive or negative, most of which were received by telephone. Data was solicited from 28 sources and of these 26 returned the requested information. In spite of the large number of contacts which brought no data, the effort has been considered successful from the quantity of important information received which was not in the STORET system.

Special Solicitation of Critical Data

Once the data requested was assessed, it was determined that in some areas crucial data was still lacking. Phone calls were made to a number of agencies throughout the country in an attempt to discover sources. This additional effort met with only limited success.

DATA AVAILABILITY

Review of the data collected revealed that there was a relatively larger amount of receiving water quality, water quantity, and meteorological data available, and a minimal amount of physical and effluent data. The data points were located and plotted on the regional layout schematics to show availability. With this information, data deficiencies were determinable by river segment (Figure 15) and for lakes and are shown in Table 2. Data received on municipal and industrial outfalls are summarized in Table 3.

To aid the future user of these models, a list has also been included in Appendix IV of some planned projects and studies underway which are related to this project, and which may provide further useful information in the near future.

Type and Quality of Data Received

Data was received in many forms including reports, raw data sheets, maps, charts, and graphs. Documents were reviewed to determine the value to the project of data included therein. A bibliography has been compiled of the numerous items received (Appendix II) in which the data is classified into meteorological, physical, water quality, and water quantity categories. The listing includes a reference to the source from which the data was obtained. There were several duplications of important documents and an initial review revealed that over half of the information received was of little immediate value to the project. This was primarily because many of the items provided dealt with tributaries of upper reaches of the rivers not included in the project as other than point sources. Other information was too general to be of value or dealt with subjects not covered by the project. Data reports which proved valuable and provided usable information for the study are indicated in the bibliography (Appendix II).

Network Schematics

Once the locations of data points were established by river mile they were located on the network schematics (Figures 3 through 8) along with a note as to the type of information available at each point. Information on the time period of data availability and frequency of data collection were not included on the network schematics because of the volume of information.

Table 2 gives a listing of data shown on the networks by river segment including type of data (water quality, waste source, streamflow, or meteorological) and dates of record. The sources of these data are also included. Figure 15 shows the location and labeling of river segments by river mile.

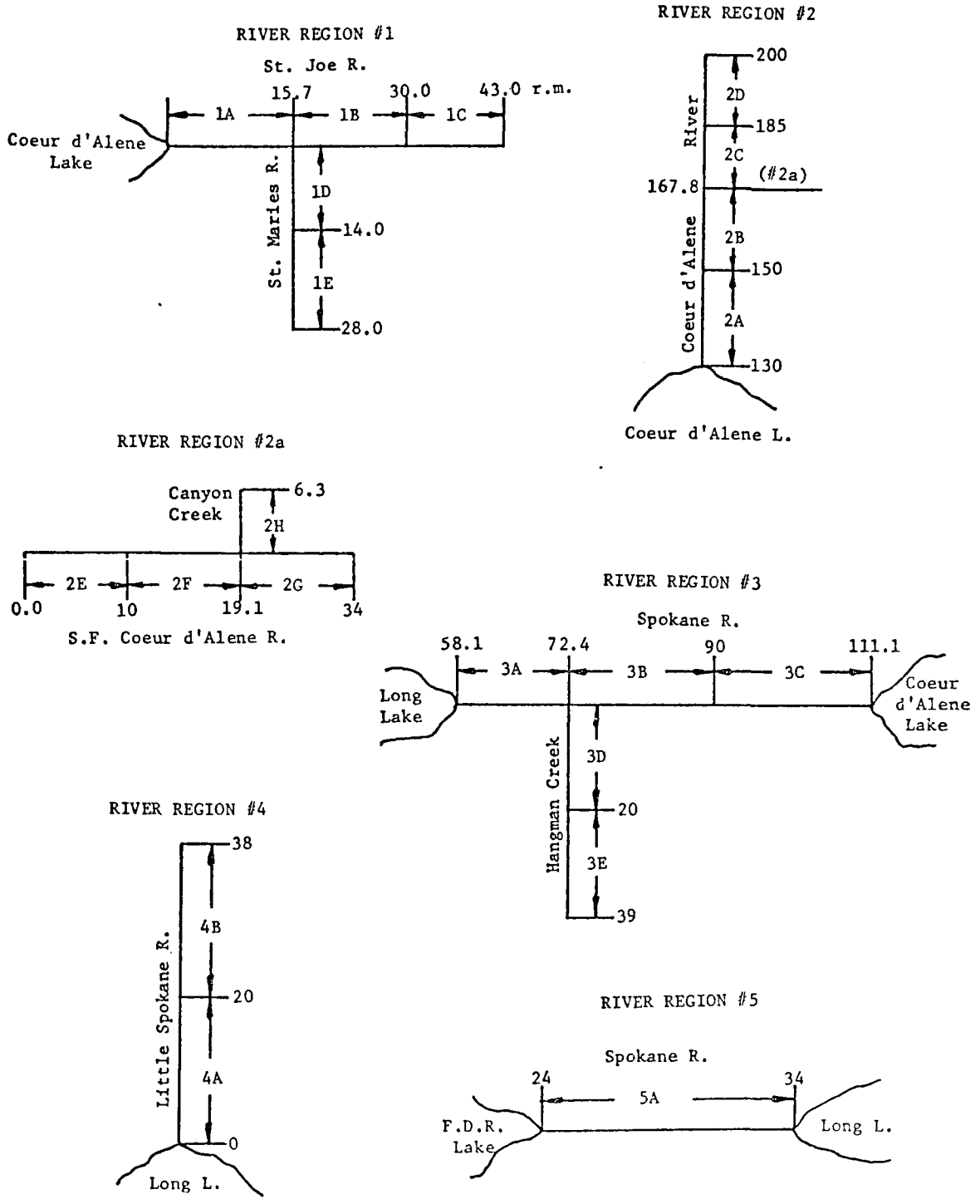


FIGURE 15. RIVER SEGMENTS (NOT TO SCALE)

TABLE 2. DATA AVAILABILITY AND DEFICIENCY BY RIVER SEGMENT

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
Region #1				
St. Joe River				
1A	STORET 151024	WQ	71/05/20 & 71/08/20	Meteorological
	St. Joe National Forest Data, Station 1	WQ	70/06/29 - 72/07/31	Stream Flow
	St. Joe National Forest Data, Station 5	WQ	70/07/02 - 72/07/31	
	St. Maries Plywood, RAPP	WS		
	St. Joe National Forest Data, Station 7	WQ	70/03/04 - 72/07/31	
	STORET 151014	WQ	69/08/19 - 71/08/20	
	St. Joe River, Water Surface Profiles	PH		
	St. Joe River Profile Points	PH	57/12	
1B	St. Joe River, Water Surface Profiles	PH		Water Quality
	St. Joe River Profile Points	PH	57/12	Stream Flow
				Meteorological
1C	St. Joe National Forest Data, Station 10	WQ	70/03/04 - 72/07/31	
	St. Joe National Forest Data, Station 11	WQ	70/03/04 - 72/07/31	
	USGS 4145	SF	11/05 - 71/09	
	STORET 151013	WQ	69/08/19 - 71/08/20	
	St. Joe National Forest Data, 100402	Met.	63/06 - 71/09	
	St. Joe River Profile Points	PH	57/12	
	Discharge Measurement Notes @ RM 42.9	PH	1971 - 1972	

Explanation of Abbreviations:

		Source No.
[1]IBMG:	Idaho Bureau of Mines and Geology, pamphlet 149	38
CRS:	Coeur d'Alene River Survey	35
WQS:	Water Quality Survey	41
WWPC:	Washington Water Pollution Control Communication TR No. 70-1	31
WWPC 69-1:	Washington Water Pollution Control Communication TR No. 69-1	30

[2]WQ: Water Quality
WS: Waste Source
SF: Stream Flow
Met.: Meteorological
PH: Physical

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
St. Maries River				
1D	St. Maries Outfall (FWQA)	WS	1963	Stream Flow
	St. Joe National Forest Data, Station 9	WQ	70/03/04 - 71/07/31	Meteorological
	USGS 4150	SF	12/07 - 66/9	
	STORET 151015	WQ	69/08/19 - 71/08/20	
	St. Maries River, Water Surface Profiles	PH		
	St. Maries River Profile Points	PH	57/12	
1E	USGS 4149	SF	68/10 - 71/9	Physical
	STORET 151016	WQ	71/05/20 & 71/08/20	Water Quality
	Discharge Measurement Notes @ RM 27.8	PH	1971 - 1972	Meteorological
Region #2				
Coeur d'Alene River				
2A	STORET 151022	WQ	71/06/16 & 71/08/25	Stream Flow
	STORET 153183	WQ	71/01/13	Physical Data
	IBMG, 149-1	WQ	68/12/17 - 70/03/20	Meteorological
	IBMG, 149-2	WQ	68/12/17 - 70/03/20	
	IBMG, 149-3	WQ	68/12/17 - 70/03/20	
	IBMG, 149-4	WQ	68/12/17 - 70/03/20	
	Coeur d'Alene River Profile Points	PH	59/09/08	
2B	CRS #3	WQ	70/05/26 - 70/09/14	Physical
	STORET 153007	WQ	68/04/18 & 72/05/03	Meteorological
	STORET 151100	WQ	70/04/02 - 71/08/25	
	IBMG, 149-5	WQ	68/12/17 - 70/03/20	
	IBMG, 149-6	WQ	68/12/17 - 70/03/20	
	IBMG, 149-7	WQ	68/12/17 - 70/03/20	
	STORET 153018	WQ	69/02/11 - 72/07/19	
	STORET 151017	WQ	69/05/06 & 71/08/25	
	WQS #7	WQ	70/08/19 - 71/07/12	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
2B	IBMG, 149-8	WQ	68/12/17 - 70/03/20	Physical
	IBMG, 149-9	WQ	68/12/17 - 70/03/20	Meteorological
	IBMG, 149-10	WQ	68/12/17 - 70/03/20	
	USGS 4135	SF	11/05/01 - 71/09/30	
	Coeur d'Alene River Profile Points	PH	56/09/08	
2C	WQS #6	WQ	70/08/19 - 71/07/14	Meteorological
	CRS #4	WQ	70/05/26 - 70/09/14	
	USGS 4130	SF	12/03/01 - 71/09/30	
	STORET 153019	WQ	69/02/11 - 72/05/03	
	IBMG, 149-34	WQ	68/12/17 - 70/03/20	
	IBMG, 149-33	WQ	68/12/17 - 70/03/20	
	IBMG, 149-32	WQ	68/12/17 - 70/03/20	
	Coeur d'Alene River Profile Points	PH	56/09/08	
	Discharge Measurement Notes	PH	1971	
2D	IBMG, 149-31	WQ	68/12/17 - 70/03/20	Meteorological
	USGS 4120	DISCONTINUED		
	USGS 4115	DISCONTINUED		
	IBMG, 149-30	WQ	68/12/17 - 70/03/20	
	USGS 4110	SF	50/10/01 - 71/09/30	
	Coeur d'Alene River Profile Points	PH	56/09/08	
	Discharge Measurement Notes	PH	1971	
South Fork Coeur d'Alene River				
2E	CRS #5	WQ	70/05/26 - 70/09/14	Meteorological
	STORET 151018	WQ	69/08/18 - 71/08/25	
	STORET 153023	WQ	70/01/14 - 72/05/03	
	WQS #5	WQ	70/05/27 - 71/07/14	
	IBMG, 149-11	WQ	68/12/17 - 70/03/20	
	IBMG, 149-12	WQ	68/12/17 - 70/03/20	
	CRS #6	WQ	70/05/26 - 70/09/14	
	IBMG, 149-13	WQ	68/12/17 - 70/03/20	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
2E	STORET 153110	WQ	70/01/14 - 71/09/22	Meteorological
	Smelterville Outfall	WS	1969	
	USGS 4133	SF & WQ	68/10/01 - 71/09/30	
	STORET 153109	WQ	71/02/18 & 71/09/23	
	Bunker Hill Co.	WS		
	Kellogg Pump Plant #2, 153193	WS	72/03	
	IBMG, 149-14	WQ	68/12/17 - 70/03/20	
	Bunker Hill Co., RAPP	WS		
	Kellogg Pump Plant #1, 153194	WS	72/03	
	Zinc and Phosphorus Plant, 153195	WS	72/03	
	STORET 153149	WQ	71/09/23 & 72/03/01	
	STORET 153108	WQ	71/01/12 - 72/07/20	
	IBMG, 149-15	WQ	68/12/17 - 70/03/20	
	CRS #7	WQ	70/05/26 - 70/09/14	
	IBMG, 149-16	WQ	68/12/17 - 70/03/20	
	IBMG, 149-17	WQ	68/12/17 - 70/03/20	
	IBMG, 149-18	WQ	68/12/17 - 70/03/20	
	Coeur d'Alene River Profile Points	PH	48/07/22	
2F	IBMG, 149-19	WQ	68/12/17 - 70/03/20	Physical
	STORET 153105	WQ	71/09/22	Meteorological
	STORET 153104	WQ	71/09/22	
	IBMG, 149-20	WQ	68/12/17 - 70/03/20	
	STORET 153139	WQ	71/09/22	
	STORET 153103	WQ	71/09/22	
	STORET 153102	WQ	71/09/22	
	STORET 153138	WQ	71/09/22	
	CRS #8	WQ	70/05/26 - 70/09/14	
	WQS #3	WQ	70/08/19 - 71/07/14	
	IBMG, 149-21	WQ	68/12/17 - 70/03/20	
	IBMG, 149-22	WQ	68/12/17 - 70/03/20	
	STORET 153101	WQ	71/09/22	
	IBMG, 149-23	WQ	68/12/17 - 70/03/20	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
2F	USGS 4131.5	SF	68/10/01 - 71/09/30	Physical
	IBMG, 149-24	WQ	68/12/17 - 70/03/20	Meteorological
	IBMG, 149-25	WQ	68/12/17 - 70/03/20	
	STORET 153098	WQ	71/09/22	
	Wallace Outfall	WS		
	STORET 153099	WQ	71/09/22	
	Coeur d'Alene River Profile Points	PH	48/07/22	
	Discharge Measurement Notes	PH	1971	
2G	STORET 153097	WQ	71/09/22	Physical
	WQS #2	WQ	70/08/19 - 71/07/14	Meteorological
	CRS #10	WQ	70/05/26 - 70/09/14	
	IBMG, 149-26	WQ	68/12/17 - 70/03/20	
	IBMG, 149-28	WQ	68/12/17 - 70/03/20	
	IBMG, 149-29	WQ	68/12/17 - 70/03/20	
	STORET 153096	WQ	71/09/22	
	STORET 153095	WQ	71/02/17 & 71/09/22	
	Mullan Outfall	WS		
	STORET 153094	WQ	71/09/22	
	Lucky Friday Benefication Plant, RAPP	WS		
	STORET 153093	WQ	71/09/22	
	Lucky Friday Tailings Pond	WS	70/11	
	STORET 153092	WQ	70/05/12 - 71/09/22	
	WQS #1	WQ	70/08/19 - 71/07/14	
	CRS #11	WQ	70/05/26 - 70/09/14	
	Coeur d'Alene River Profile Points	PH	48/07/22	
	Discharge Measurement Notes	PH	1972	
2H	STORET 153123	WQ	70/05/15 - 71/09/22	Physical
	Star Mineral Benefication Plant	WS	71/09	Meteorological
	Coeur d'Alene River Profile Point	PH	48/07/22	
	Discharge Measurement Notes	PH	1972	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
Region #3				
Spokane River				
3A	WWPC 69-1, Station 10	WQ	66/09/12 - 66/09/16	Stream Flow
	USGS 4245	DISCONTINUED		Physical
	STORET 543108	WQ	71/06/08	Meteorological
	Spokane Municipal Outfall (FWQA)	WS	1958	
	WPCC 69-1, Station 12	WQ	66/09/12 - 66/09/16	
	Soil Survey, Spokane Co.	PH	68/03	
	Spokane River Profile Points	PH	48/05/24	
3B	USGS 4225	SF	91/04/01 - 71/09/30	
	WPCC 69-1, Station 13	WQ	66/09/12 - 66/09/16	
	USGS 4220	DISCONTINUED		
	WPCC 69-1, Station 14	WQ	66/09/12 - 66/09/16	
	Millwood Outfall (FWQA)	WS	1965	
	Inland Empire Paper Co.	WS		
	WPCC 69-1, Station 15	WQ	66/09/12 - 66/09/16	
	USGS 4215	DISCONTINUED		
	WPCC 69-1, Station 16	WQ	66/09/12 - 66/09/16	
	USGS 4210	DISCONTINUED		
	Trentwood Works, RAPP	WS		
	Spokane Industrial Park Outfall, RAPP	WS		
	Hillyard Processing Co., RAPP	WS		
	USGS 4205	DISCONTINUED		
	Spokane River and tributaries, Topography	PH	1944	
	Spokane River Profile Points	PH	48/05/24	
	Soil Survey, Spokane Co.	PH	68/03	
	Discharge Measurement Notes	PH	1971	
	Climatological Data	Met.	1968 - 1972	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
3C	USGS 4195	SF	60/10/01 - 71/09/30	Meteorological
	STORET 541026	WQ	59/07/29 - 71/09/19	
	STORET 151020	WQ	69/04/08 - 71/08/27	
	STORET 543135	WQ	71/01/13 & 71/02/18	
	WPCC 69-1, Station 17	WQ	66/09/12 - 69/09/16	
	STORET 153022	WQ	69/08/20 - 71/08/25	
	USGS 4190	SF	13/02/01 - 71/09/30	
	STORET 150114	WQ	62/05/28 - 71/03/09	
	USGS 4185	SF	61/04/10 - 65/09/30	
	USGS 4180	SF	61/04/21 - 69/09/21	
	STORET 151021	WQ	69/04/08 - 71/08/27	
	Spokane River and Tributaries, Topography	PH	1944	
	Spokane River Profile Points	PH	48/05/24	
	Discharge Measurement Notes	PH	1971	
3D	USGS 4240	SF	48/04/01 - 71/09/30	Physical
	STORET 12423980	WQ	68/02/20 & 68/06/28	Stream Flow
	Hangman Creek Water Surface Profiles	PH	72/05	Water Quality
	Hangman Creek Cross Sections	PH	72/08	Meteorological
3E	No Data			Water Quality Stream Flow Physical Meteorological
Region #4 Little Spokane River				
4A	WWPC #1	WQ	68/02/13 - 68/09/10	Physical
	STORET 55B070	WQ	70/11/30 - 71/09/19	Meteorological
	STORET 12431900	WQ	70/11/30 - 71/09/19	
	USGS 4320	DISCONTINUED		

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
4A	USGS 4315	DISCONTINUED		Physical
	WWPC #2	WQ	68/02/13 - 68/09/10	Meteorological
	WWPC #3	WQ	68/02/13 - 69/09/10	
	WWPC #4	WQ	68/02/13 - 69/09/10	
	USGS 4310	SF	29/05/01 - 71/09/30	
	STORET 12431000	WQ	60/07/28 - 70/09/20	
	STORET 541025	WQ	60/07/28 - 66/04/24	
	WWPC #5	WQ	68/02/13 - 68/09/10	
	WWPC #7	WQ	68/02/13 - 68/09/10	
	USGS 4303	DISCONTINUED		
	Discharge Measurement Notes	PH	1971	
4B	USGS 4301.5	DISCONTINUED		Physical
	USGS 4295	DISCONTINUED		Meteorological
	WWPC #9	WQ	68/02/13 - 68/09/10	
	USGS 4290	DISCONTINUED		
	WWPC #10	WQ	68/02/13 - 68/09/10	
	USGS 4270	SF	48/10/01 - 71/09/31	
Region #5				
Spokane River				
5A	USGS 4335	DISCONTINUED		Physical
	STORET 541232	WQ	70/05/06 - 70/11/24	Meteorological
	USGS 4330	SF	39/04/01 - 71/09/30	
	WWPC 69-1 #8	WQ	66/09/12 - 66/09/16	
	Discharge Measurement Notes	PH	1971	
Coeur d'Alene Lake				
	USGS 4155	PH	04/08/01 - 72/09/30	Stream Flow
	STORET 151023	WQ	69/06 - 71/08	Water Quality
	STORET 151022	WQ	71/06 & 71/08	Physical
	STORET 153183	WQ	71/01	

TABLE 2. (Continued)

Segment	Data Source[1]	Type[2]	Dates	Deficiencies
Coeur d'Alene Lake				
Source 4		PH		Stream Flow
Source 43		PH	71/07 - 71/11	Water Quality
WQS		WQ	69/09/11 - 71/07/14	Physical
CRS		WQ	70/05/12 - 70/05/17	
Source 61		SF		
Source 62		SF	1954	
Climatological Data		Met.	68/07 - 72/09	
Long Lake				
USGS 4260		WQ	70/11 - 71/09	Stream Flow
STORET 543002		WQ	70/01 - 71/08	
Source 45		WQ	72/07 - 72/09	
Source 29		WQ & SF	71/07 - 71/09	
Source 30		WQ & PH	66/09	
Source 64		PH	49/11/30	
Source 4		PH		
Source 5		PH	71/08 - 72/06	
Source 75		Met.	66/06/29 - 72/08/14	
Climatological Data		Met.	68/07 - 72/09	
F. D. Roosevelt Lake				
Source 29		WQ & PH	70/06 - 71/09	Stream Flow
STORET 541226		WQ	70/05 - 70/11	
STORET 541227		WQ	70/05 - 70/11	
STORET 541228		WQ	70/05 - 70/11	
STORET 541229		WQ	70/05 - 70/11	
STORET 541230		WQ	70/05 - 70/11	
STORET 541231		WQ	70/05 - 70/11	

Table 3. EFFLUENT DATA INVENTORY

OUTFALL	RECEIVING WATERS	RIVER MILE	DATE	SOURCE	AVER. FLOW (CFS)	AVER. TEMP °F.	AVER. COLI MPN	AVERAGE DAILY CONCENTRATIONS (MG/L) BOD	N	NH_3	NO_2	NO_3	PHOS	CL	CU	FE	PB	ZN	TDS	RIV. REG.
St. Maries Mun.	St. Joe R.	15.7	63	F	.37			41.0												1
St. Maries Ply.	St. Joe R.	13.4		R	.59	76	396				0.000			1.0	.003	3.79		.39		1
Star-Morn T. Pd.	Canyon Cr.	1.9	71	B	3.00										.960		.19	.78		2
Star Mine	Canyon Cr.	1.6		R	3.35	62		10.0	1.96	2.0	0.055	1.50	.03	6.8	1.720	1.72	.20	.97	622	2
Star Mine	Canyon Cr.	1.6		R	.45	62	4000	2.0	.05	.05	.008	.05	.20	16.0	.010	1.08	.08	.09	28	2
Lucky Fri. Mine	S.F.C.d'A.R.	26.5		R	.60	78	2500	8.0	2.90	2.95	.160	1.90	.20	10.0	.010	4.00	1.24	.88	312	2
Mullan Mun.	S.F.C.d'A.R.	25.7		F	.22			204.0												2
Lucky Fri. Mine	S.F.C.d'A.R.	25.5		R	1.22	65		2.0	.51	.20	.043	1.50	.10	2.2	.021	1.02	.12	.05	126	2
Lucky Fri. T.Pd.	S.F.C.d'A.R.	25.2	70	B											.010		1.35	1.07		2
Star-Morning M.	S.F.C.d'A.R.	24.6		R	.27	67	100	16.0	.24	.20	.010	.35	.20	1.3	.030	1.60	.18	.50	590	2
Wallace Mun.	S.F.C.d'A.R.	18.8		F	.37			204.0												2
Rex Mill	S.F.C.d'A.R.	18.7		R	.16	68		17.2	.21	.25	.038		.01	4.3	.775	2.25	.50	3.60	279	2
Dayrock Plant	S.F.C.d'A.R.	18.7		R	.08	68		1.0	4.40	4.20	.100	4.05	.05	6.1	.025	3.70	.50	.39	246	2
Galena Mine	S.F.C.d'A.R.	17.1		R	1.15	66	30	10.0	6.14	6.04		5.25	.04	7.2	.150	.75	.02	.069	264	2
Osburn Mun.	S.F.C.d'A.R.	13.2		F	.16			245.0												2
Cons. Silver M.	S.F.C.d'A.R.	13.1	71	B											.003		.01	.02		2
Kellogg Mine	S.F.C.d'A.R.	11.2		R	2.40			66.8	.09	.09	.455	.01	.03	38.8		21.00		.09	525	2
Bunker Hill Co.	S.F.C.d'A.R.	11.2		R	1.12			25.0	.91	1.07		.14	.01	4.0	.194	4.43	1.14	.68	140	2
Bunker Hill Co.	S.F.C.d'A.R.	7.8		R	.76			45.0	2.89	3.02		1.82	.25	21.0	.050	29.20	1.29	24.30	430	2
Kellogg Mun.	S.F.C.d'A.R.	7.5		F	.77			200.0												2
Bunker Hill Co.	S.F.C.d'A.R.	6.8	71	B	6.00										.670		2.50	150.00		2
Bunker Hill CIA	S.F.C.d'A.R.	6.8	71	B	5.70															2
Bunker Hill Co.	S.F.C.d'A.R.	5.3		R	7.80			12.2	.93	1.04		.37	.08		.056	1.33	3.97	13.90	272	2
Bunker Hill Co.	S.F.C.d'A.R.	5.3		R	2.23			4.0	1.74	2.00		.40	.18	100.0	.343	1.93	1.35	243.00	1107	2
Bunker Hill Co.	S.F.C.d'A.R.	5.3		R	.22			6.2	112.91	135.60		4.04	.50	180.0	.190	.65	1.37	64.30	1200	2
Bunker Hill Co.	S.F.C.d'A.R.	5.3		R	2.23			6.3	.30	.18		.68	.03	50.0	.070	.12	.09	13.00	345	2
Bunker Hill Co.	S.F.C.d'A.R.	5.1		R	5.58			30.0	3.75	4.05		1.81	2.50						1360	2
Bunker Hill Co.	S.F.C.d'A.R.	5.1		R	5.58			5.0	8.68	10.00		2.00	60.00	150.0		35.30	4.12	142.10	2931	2
Smelterville M.	S.F.C.d'A.R.	4.9	69	F	.14			41.0												2
Rockford Mun.	Hangman Crk.	20.2		F	.06			39.0												3
C.d'Alene Mun.	Spokane R.	109.0		F	2.48			40.0												3
Spokane Ind. Pk.	Spokane R.	87.7		R	.84	65	2	5.3	3.12	3.40		1.42	5.90	23.0	.128	.67	.28	.16	250	3
Hillyard Pr.Co.	Spokane R.	87.5		R	.84	57		.1	1.49	1.76		.18	.01	1.7	.002		0.00	0.00	73	3
Trentwood Works	Spokane R.	87.5		R	11.60	70		1.7	1.61	2.00		.04	1.42	1.0	.010	.20		.35	40	3
Trentwood Works	Spokane R.	87.0		R	10.10	72	70	5.5	1.24	1.50		.03	.11	1.0		.30		.35	22	3
In.Emp.Paper Co.	Spokane R.	82.6		X	6.40	70	17	45.2	.02	0.00		.10	.69	16.0	.010		.01	.27	97	3
Millwood Mun.	Spokane R.	82.6	65	F	.02			72.8												3
Spokane Mun.	Spokane R.	69.5	58	F	46.50			91.0												3
Deer Park Mun.	L.Spokane R.	21.3		F	.23			44.0												4
Mead Works	L.Spokane R.	13.0		R	5.73	75	1900	.4	1.46	1.45		1.20	.22	15.4	.030		.01	.10	163	4
Northwest Ter.	L.Spokane R.	3.0		F	.06			200.0												4
Whitworth Col.	L.Spokane R.	2.5	56	F	.19			39.0												4
Potlatch For.	C.d'A. Lake			R	1.04	74	110	41.0	.27	.30	0.000	.10	.17	1.0		.33			82	
Potlatch For.	C.d'A. Lake			R	7.22	76		2.1	.19	.20	0.000	.15	.13						48	
Potlatch For.	C.d'A. Lake			R	.01	180		41.0	.51	.60	0.000	.08	.63	8.0	.240	2200.			1103	
Groundwater (Hol.Hills W.)	Spokane R.	94.0	71-72	A		12			.46		.020	2.00	.10	6.0						3

Source: A = Storet Retrieval 72/10/27
B = Storet Retrieval 72/10/25
F = FWQA Storet System Retrieval (Municipal Waste Facilities Inventory) 72/10/18
R = RAPP Retrieval 72/10/19
X = Extract from RAPP application form by EPA Seattle, about 72/10

The networks include indication of all known points of water quantity and quality data collection, the location of all waste sources for which data are available and points of confluence with small tributaries throughout the river regions. The general area of important groundwater flow in the Spokane region is shown based on available information.

Locations of data points for lakes have not in all cases been explicitly described. However, the reports which contain the available data do include figures showing sampling points. Appendix V consists of figures from these existing reports. On each figure, the approximate location of other data points has been shown.

Data Deficiencies

A summary of data deficiencies as shown by comparison of data needs with data available and acquired is shown in Table 1. They are shown there for each river region and lake. Categories of data deficiencies are shown for each river segment in Table 2. In addition to this, more detailed water quality deficiencies by component are shown in Table 4. The significant deficiencies disclosed were chlorophyll-a which was absent from all data, TDS which was absent from all but the Coeur d'Alene River Region, and BOD data absent for all rivers. The following is a list of the principal data deficiencies by region:

River Region #1 - St. Joe-St. Maries

1. physical data above r.m. 10.2, St. Maries River

River Region #2 - Coeur d'Alene River

1. physical data above r.m. 19.3, S.F. Coeur d'Alene River
2. physical data along Canyon Creek
3. water quality data along Canyon Creek

River Region #3 - Upper Spokane River

1. water quality data along Hangman Creek
2. physical data along all but 2 miles of Hangman Creek
3. water quality data from Long Lake (r.m. 58) to r.m. 93.9

River Region #4 - Little Spokane River

1. physical data along entire river

TABLE 4. DEFICIENCIES IN WATER QUALITY CONSTITUENTS DATA

	R.R.1	R.R.2	R.R.3	R.R.4	R.R.5	ALL
Temperature						
D.O.						
B.O.D.	X		X		X	
Nitrogen	X		X	X	X	
Ammonia						
Nitrite	X					
Nitrate						
Chloride						
Phosphorus						
Coliforms						
Copper						
Iron				X	X	
Lead				X		
Zinc						
Chlorophyll *a*	X	X	X	X	X	X
T.D.S.	X		X	X	X	

River Region #5 - Lower Spokane River

1. physical data except at dams
2. water quality data except at r.m. 29.0

Coeur d'Alene Lake

1. temperature profiles
2. bottom profile (The Project Officer provided lake bottom topography data and volume information on April 27, 1973; this will be incorporated in Phase III input.)
3. water quality data over a six-month period

Long Lake

1. none

Roosevelt Lake

1. temperature profiles
2. storage vs. elevation
3. subsurface water quality data over a six month period

There was also a major deficiency in the effluent data received. No quality data for constituents other than BOD were recorded for any of the municipal waste facilities (see Table 3). This, and the lack of daily or even many dated measurements at the outfalls will significantly reduce the accuracy of modeling water quality constituents.

In regions where significant data deficiencies occurred, rough estimates had to be made in order to run the models. Where point data was available, such as information on the physical characteristics of a channel in the vicinity of gauging stations, this was used to guide the preparation of estimates. The need for estimation limits the efficacy of the models and unfortunately will make them a less reliable tool than had been hoped and anticipated.

SECTION IV

DATA ASSESSMENT

The data gathered covered a wide range of subjects and areas. As described in the preceding section, an initial assessment was completed by eliminating types of information not useful to the study and information for points outside of the study area. Once the relatively large bulk of information was reduced to a manageable amount, other criteria were employed to determine the validity of the remaining data. Subsequent to the review for validity, the data was tabulated in a form useful for pre-selecting a simulation period.

VALIDITY

Once the material to be used was identified, it was carefully examined to determine whether there was any invalid data. Where available, methods of collection and measurement were studied and, if there was no mention of problems and the procedures appeared valid, the data was accepted.

A few sets of information were received as raw data without any description of collection methods. It was, therefore, impossible to assess the validity of this data except to eliminate values that appeared obviously erroneous. Otherwise, this data was used as received.

There were two areas where identification of valid data caused some additional problems. Hygro-thermograph charts for Lookout Point, 10 miles NNW of Spokane were received for years between 1966 and 1972. James Holcomb, Meteorologist, National Weather Service, U.S. Department of Commerce, reported that some of the data was erroneous due to malfunctions in the humidity element. Correction factors were also given for most days. This data was carefully analyzed and we were able to determine from it the necessary temperature information for the Deep Reservoir Model.

Another major problem occurred in the identification of valid measurements for ground water flows. Information was received from several sources which appeared equally valid but which were somewhat contradictory. This information is summarized in Table 5. In arriving at a figure for use in the study, very high or low figures were eliminated. The SCI estimate was then made based on the remaining data.

SELECTION OF SIMULATION PERIODS: RIVERS

The objective in selecting simulation periods for the river regions was to specify periods that would best represent steady state summer

TABLE 5. ESTIMATES OF GROUND WATER INFLOWS

Average cfs Over Years Indicated:	A '21-'29	A '29-'41	A '41-'51	B '50	A '51-'60	C '54-'63	D '47-'64	SCI Estimate
Post Falls to Spokane	521	417	554	900	534			600
Greenacres to Spokane						670		
Spokane to Long Lake	701	694	661		542			600
Spokane to Nine Mile				195				
Nine Mile to Long Lake				220				
Indiana St. Area						60		
Post Falls to Long Lake (Total)	1222	1111	1215	1315	1076	730		1200
Little Falls to Mouth of Spokane		320						
Little Spokane River						275		250
Above Dartford							160	
4 mi. Reach Below Dartford							60	
Discharge to Wells: Spokane	65	75	85		95	170		150
Little Spokane Area							38	
TOTAL								1600

Estimates for Table 5 were taken from the following documents:

A: (68) Spokane Ground Water by Walter E. Johnson, Hydrologist (retired) WWP Co.

B: (57) Analysis of Increments of Discharge in Spokane River, Post Falls, Idaho to Long Lake, Washington, 1951, Anon.

C: (58) Public Health Relationship of the Minnehaha Sewer District to the Greater Spokane Community, prepared for the City of Spokane by Esvelt and Saxton, Consulting Engineers, December 1964.

D: (59) Ground-Water Resources and Related Geology North-Central Spokane and Southeastern Stevens Counties of Washington by Denzel R. Cline, Washington Department of Water Resources, Water Supply Bulletin No. 27, 1969.

conditions of two months duration. From Table 2, Data Availability and Deficiency by River Segment, it was apparent that there were no significant water quality data recorded prior to 1968, and that the simulation periods would therefore fall during the summer months of 1968, 1969, 1970, or 1971. There were no water quality data recorded during the low-flow months of 1972, and minimal amounts reported in October and November 1971. The great majority of the available effluent data is undated (see Table 3), so they cannot influence the selection of simulation periods. In addition to the lesser availability of earlier quality data, a question existed as to its validity. It was reported by Mr. Michael J. McMasters of the Idaho Department of Environmental Protection and Health that "much of the material contained in reports prior to 1968 include data collected and analyses by methods other than those approved by the U.S. Public Health Service Standard Methods Procedure." With this additional information in hand, a decision was made to concentrate efforts on the 1968-1971 data.

Tables 6 through 14 show the availability of water quality data during the low flow periods of at least two months duration for each region. Whereas Figures 3 through 8 depict all known network data points met during this study, Figures 16 through 21 have been prepared to present only those stations having data during the candidate simulation periods. These latter figures therefore correspond to Tables 6 through 14, and provide easy reference to the location of alternative data points which was a selection consideration, particularly in Regions #3 and #5. The highs and lows for each low flow period are given in Table 15 for each USGS station operating in a particular year. In order to facilitate an accurate choice of simulation days it was necessary to prepare hydrographs (Figures 22 through 26) for those regions and years in which the preferred simualtion period was not an obvious choice.

Tables 16 through 21 show the stability of water quality constituent concentrations where this information was available for more than one day at a particular station.

RECOMMENDED SIMULATION PERIODS: RIVERS

The following sections discuss low flow data availability for each Region.

Region 1 - St. Joe-St. Maries

It was readily apparent from the water quality data available that the simulation period must be in 1971 in order to have two days with sufficient quality information for verification. The hydrograph for this period shows some fluctuation. However, the variation was fairly small compared to annual fluctuations (days in May 1971 exceed 20,000 cfs) and in combination with the availability of quality data was a logical choice. July and Autust 1971 were the months chosen for this region as they had significant quality data and fell during the more stable streamflow periods (see Figure 22).

WATER QUALITY DATA AVAILABILITY

TABLES 6-14

LEGEND

Symbols

■ one bit of information

● more than one bit of information

▬▬ low flow period of at least two months, at USGS station indicated

Data Collection Stations

4xxx	USGS Water Quantity and Water Quality Stations
15xxx 54xxx	STORET Data Stations
SJ-x	Forest Service Stations, St. Joe National Forest.
100402	Fire Weather Reporting Station at Calder, Idaho, St. Joe National Forest.
149-XX	Stations in Idaho Bureau of Mines and Geology pamphlet 149. Effect of Industrial and Domestic Effluent on the Water Quality of the Coeur d'Alene River.
WQS#x	Water Quality Survey, Coeur d'Alene River - Coeur d'Alene Lake, Lee W. Stokes and Gene L. Ralston.
CRS#x	Coeur d'Alene River Survey, EPA, Gary O'Neal.
WPC-x	Report on the Water Quality of the Little Spokane River, Washington Water Pollution Control Commission.

TABLE 6. WATER QUALITY DATA AVAILABILITY - REGION 1

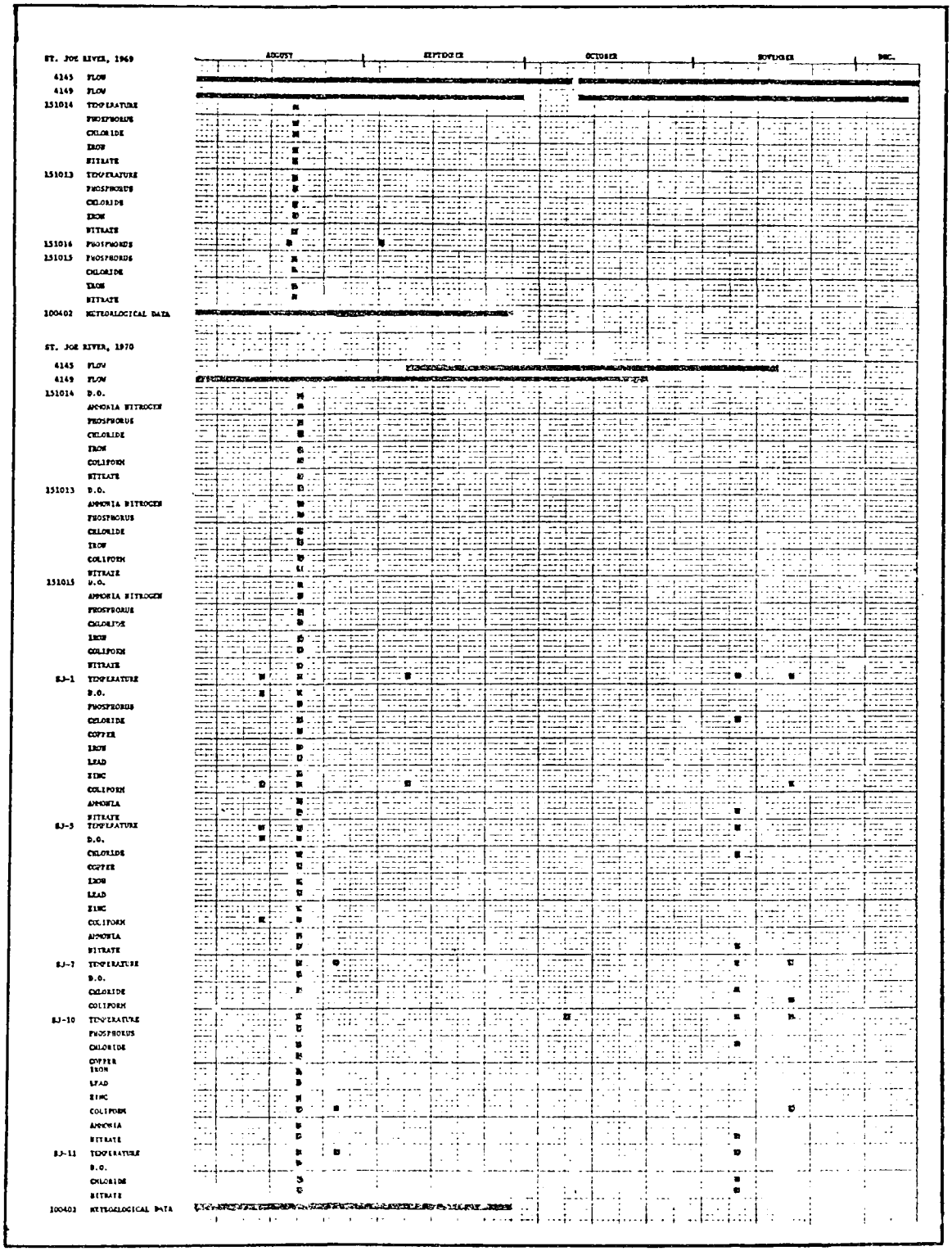


TABLE 7. WATER QUALITY DATA AVAILABILITY - REGION 1

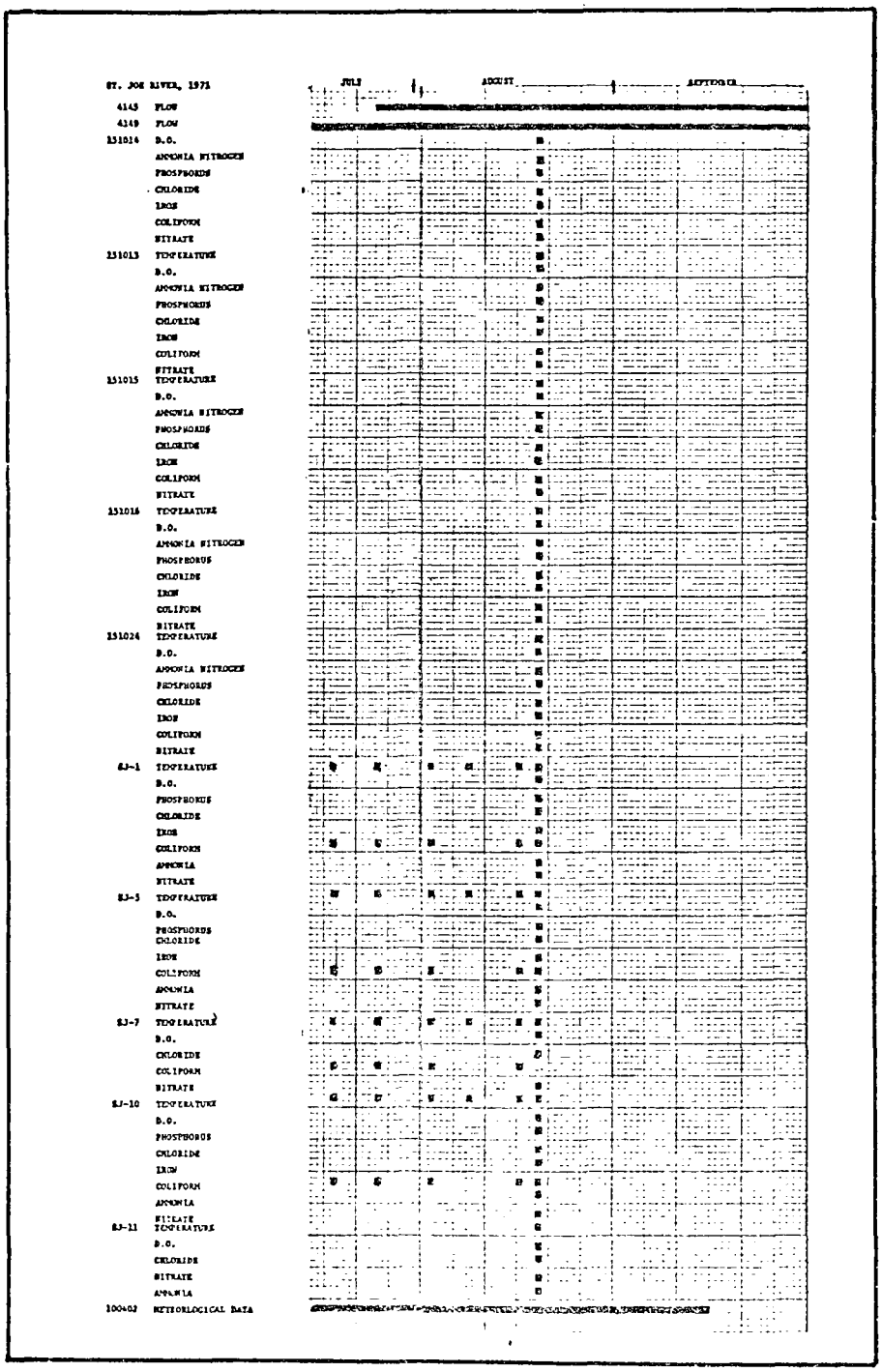


TABLE 8. WATER QUALITY DATA AVAILABILITY - REGION 2

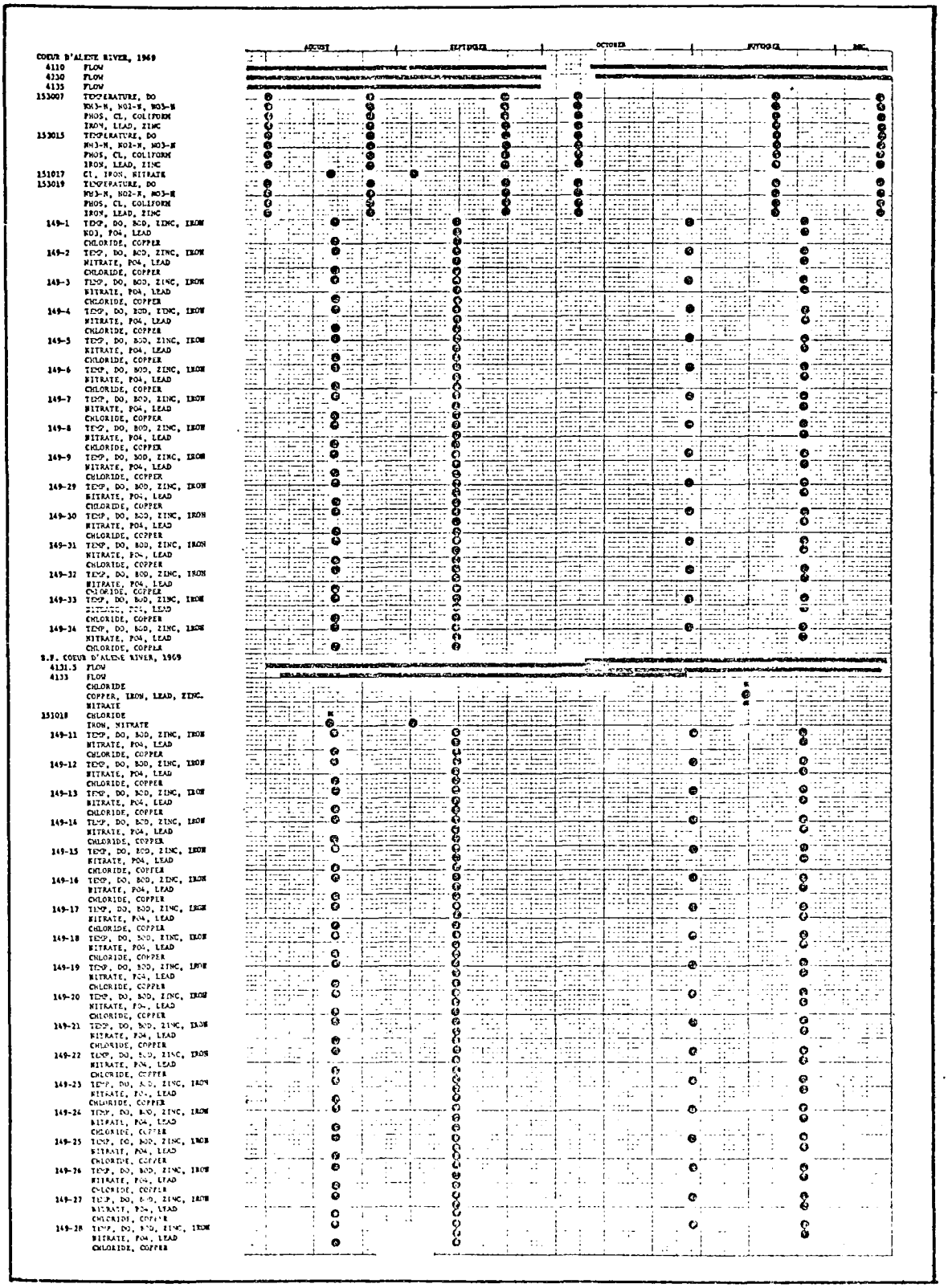


TABLE 9. WATER QUALITY DATA AVAILABILITY - REGION 2

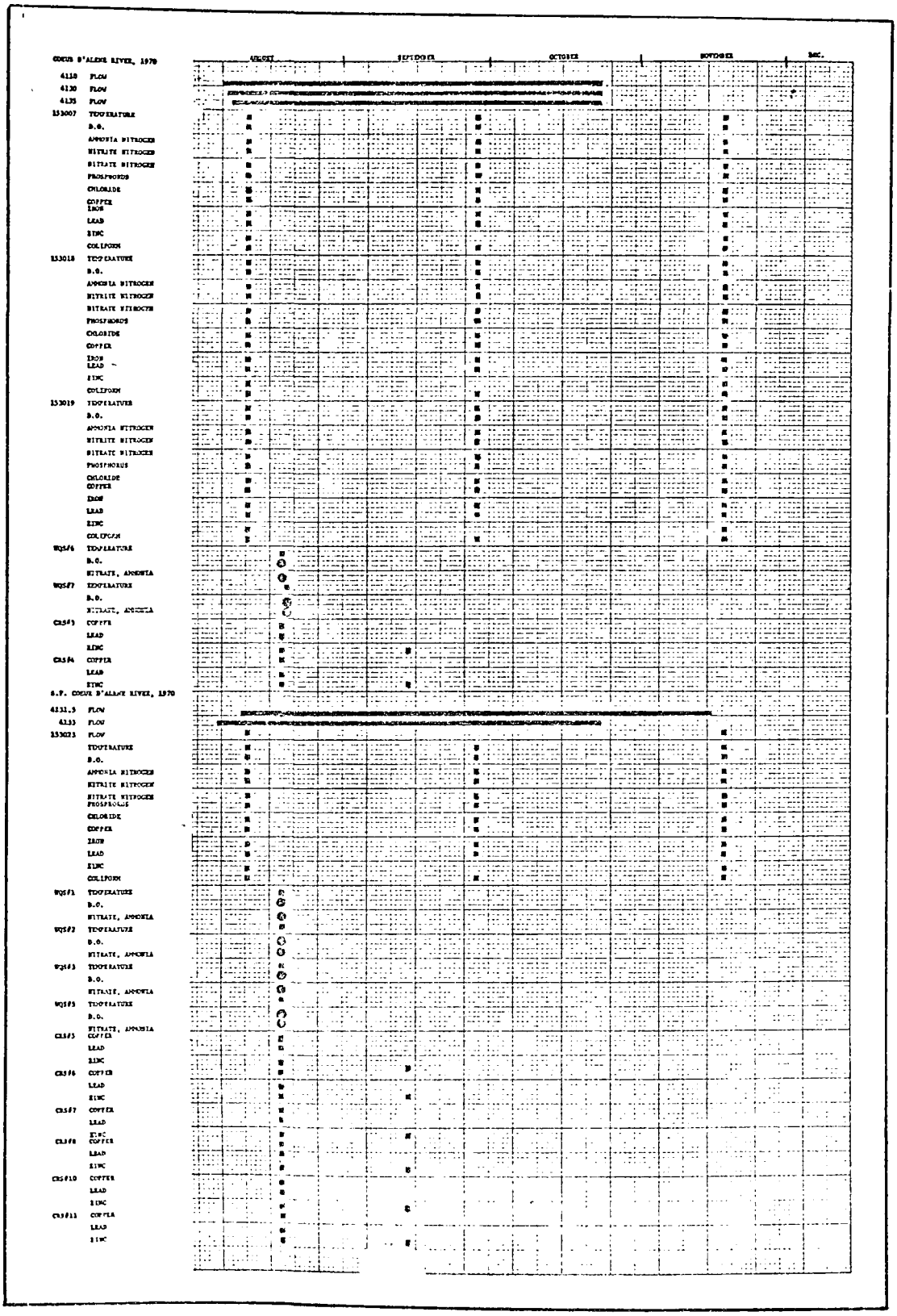


TABLE 10. WATER QUALITY DATA AVAILABILITY - REGION 2

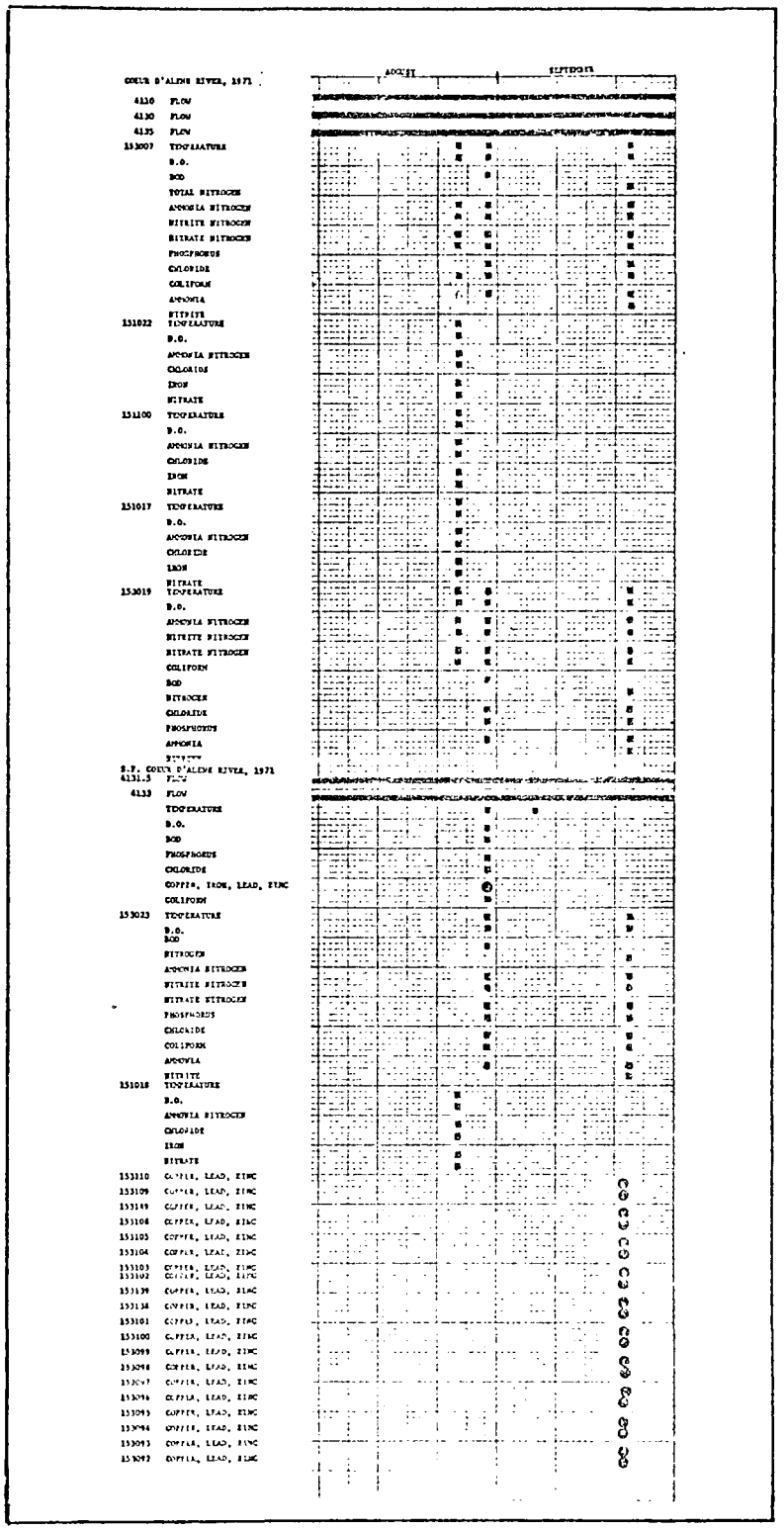


TABLE 11. WATER QUALITY DATA AVAILABILITY - REGION 3

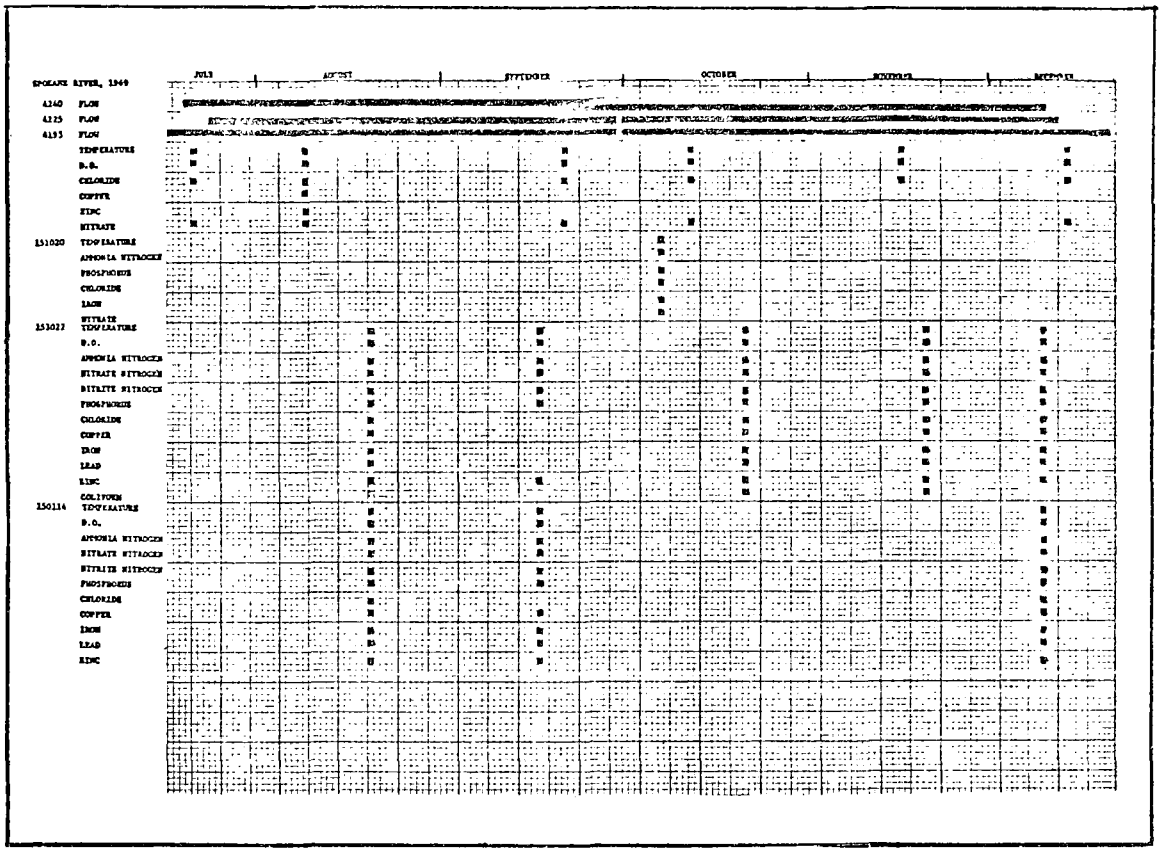


TABLE 12. WATER QUALITY DATA AVAILABILITY - REGION 3

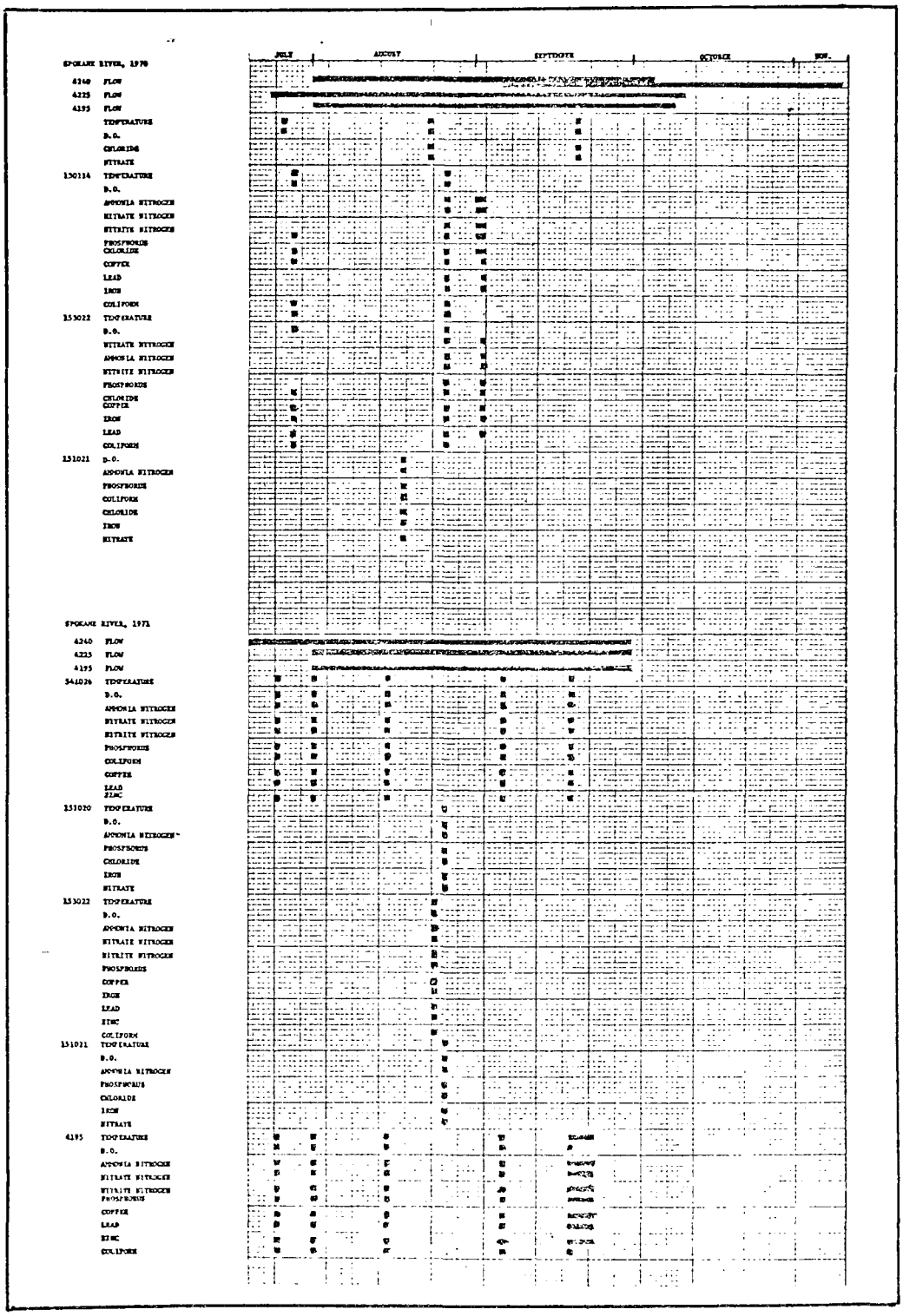


TABLE 13. WATER QUALITY DATA AVAILABILITY - REGION 4

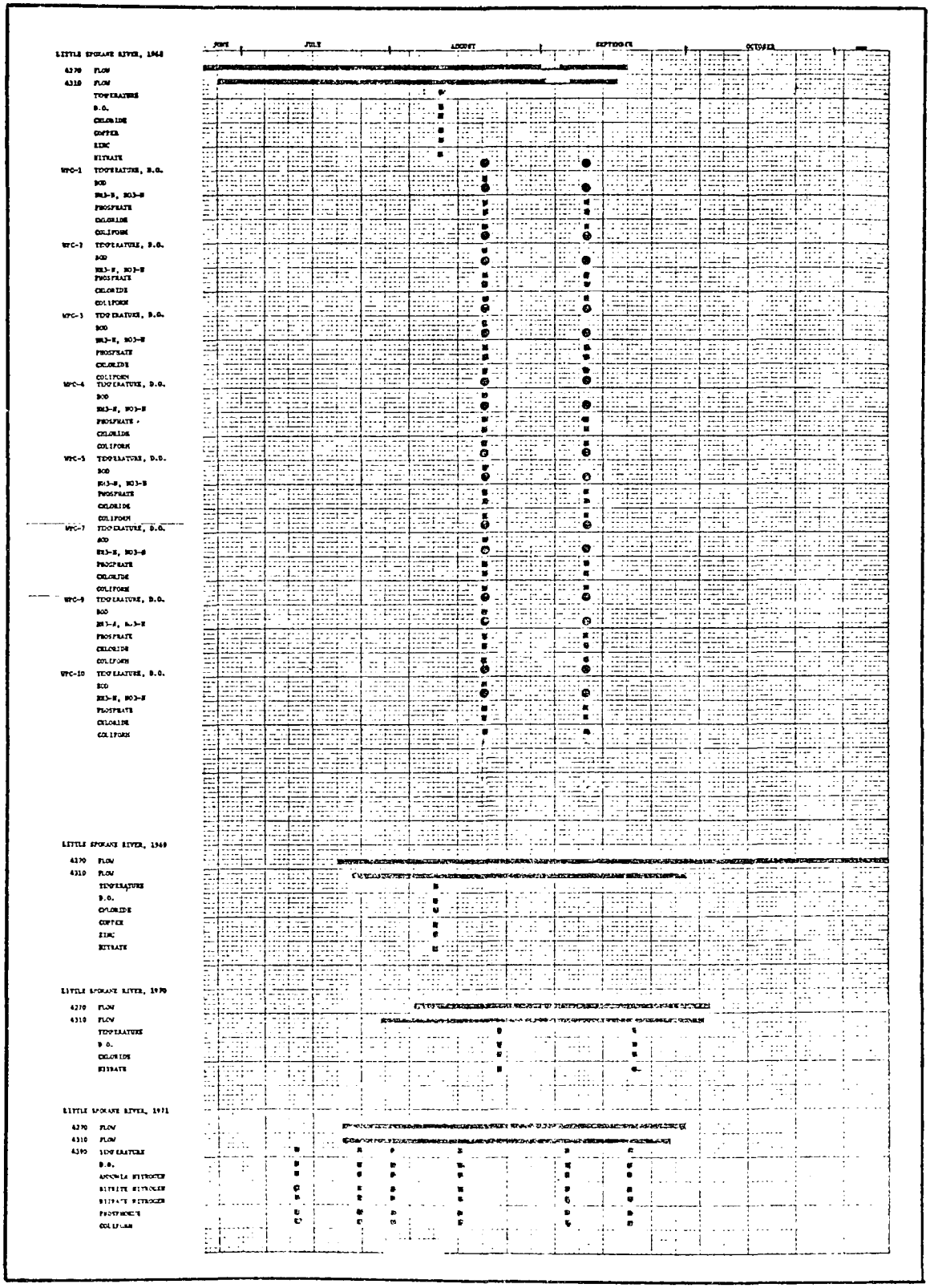
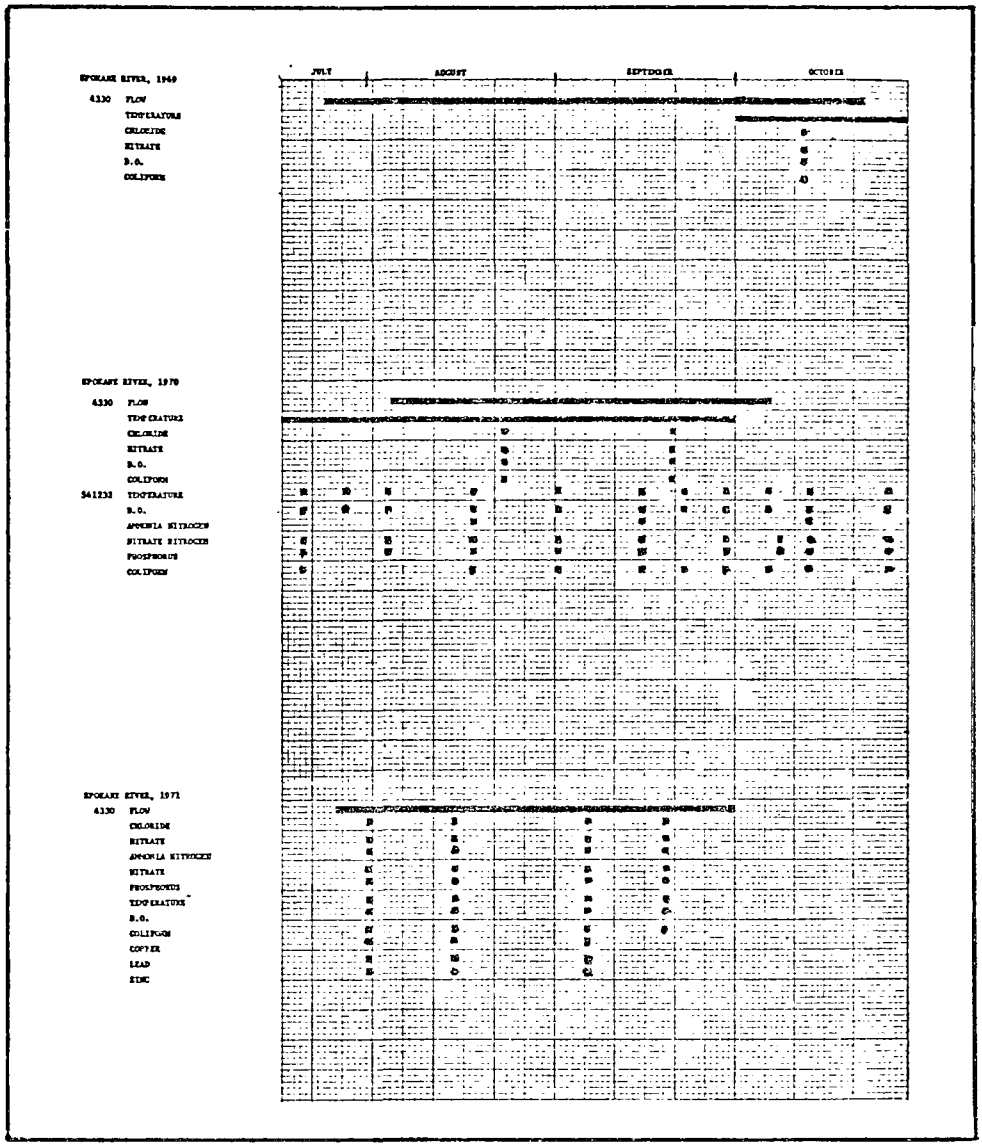


TABLE 14. WATER QUALITY DATA AVAILABILITY - REGION 5



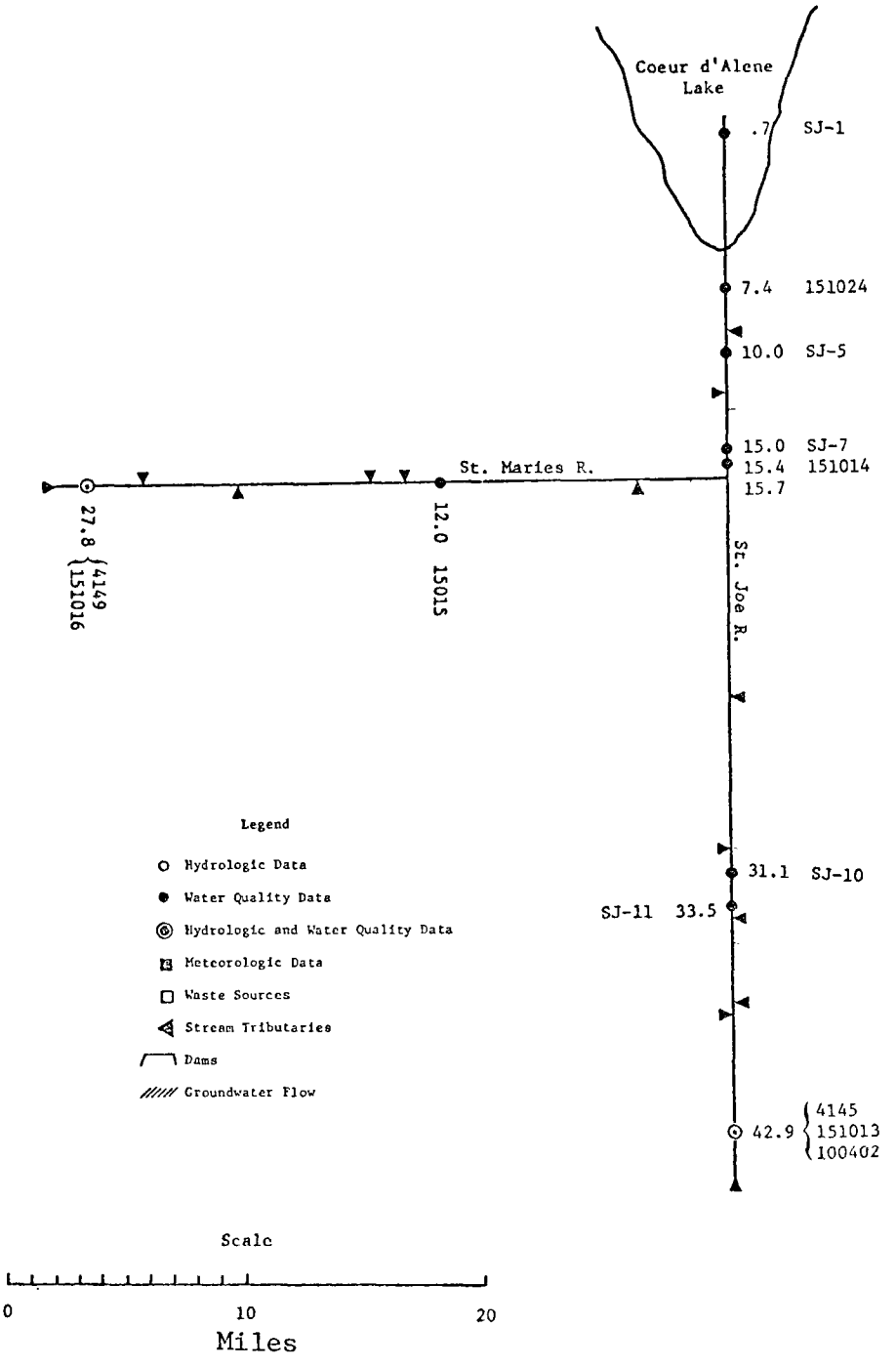


FIGURE 16. LOW FLOW DATA POINTS, RIVER REGION 1 - ST. JOE - ST. MARIES

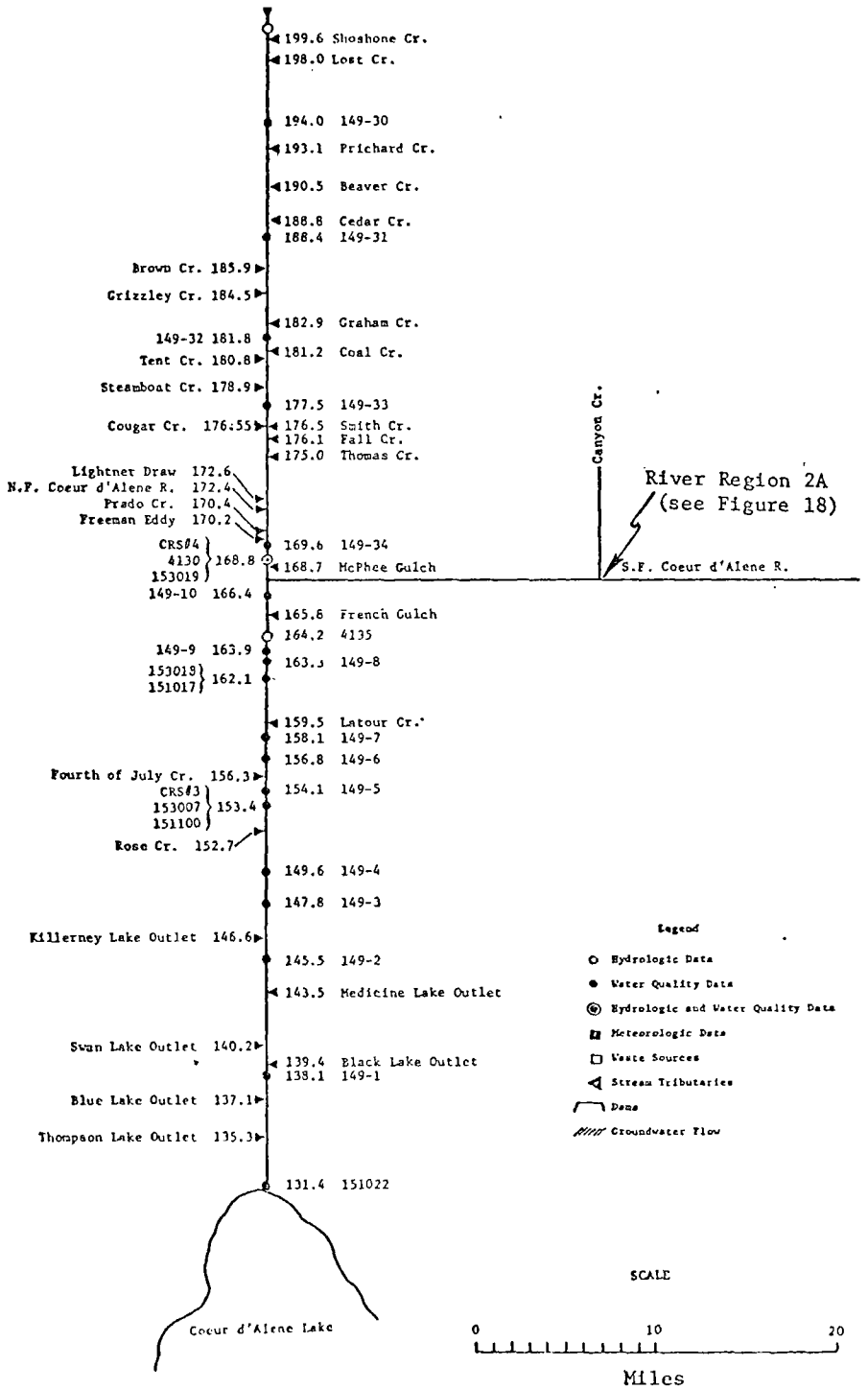


FIGURE 17. LOW FLOW DATA POINTS, RIVER REGION 2 - COEUR D'ALENE R. & S.F. COEUR D'ALENE R.

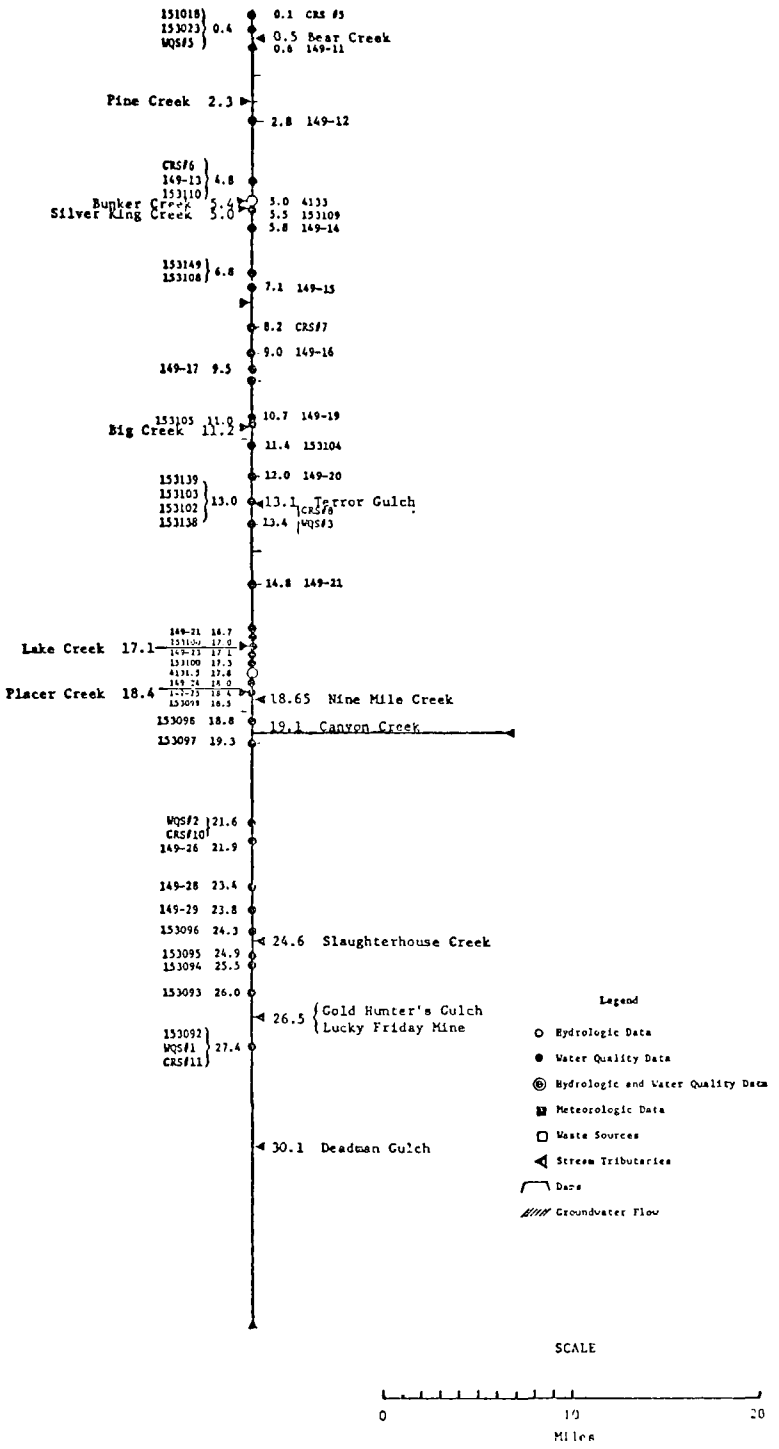


FIGURE 18. LOW FLOW DATA POINTS, REGION 2A - S.F. COEUR D'ALENE RIVER

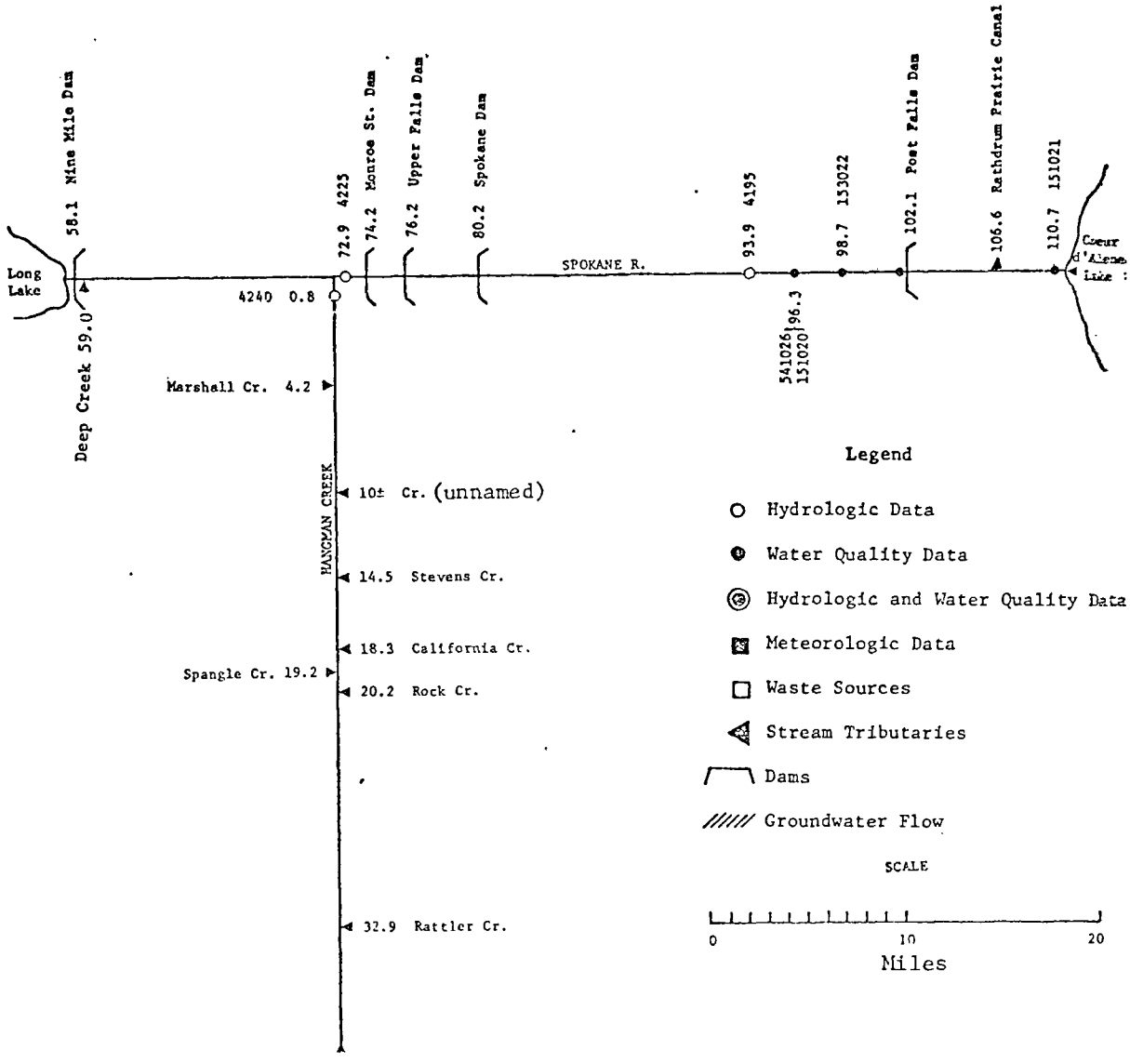


FIGURE 19. LOW FLOW DATA POINTS, REGION 3 - SPOKANE R. FROM LONG LAKE TO COEUR D'ALENE L.

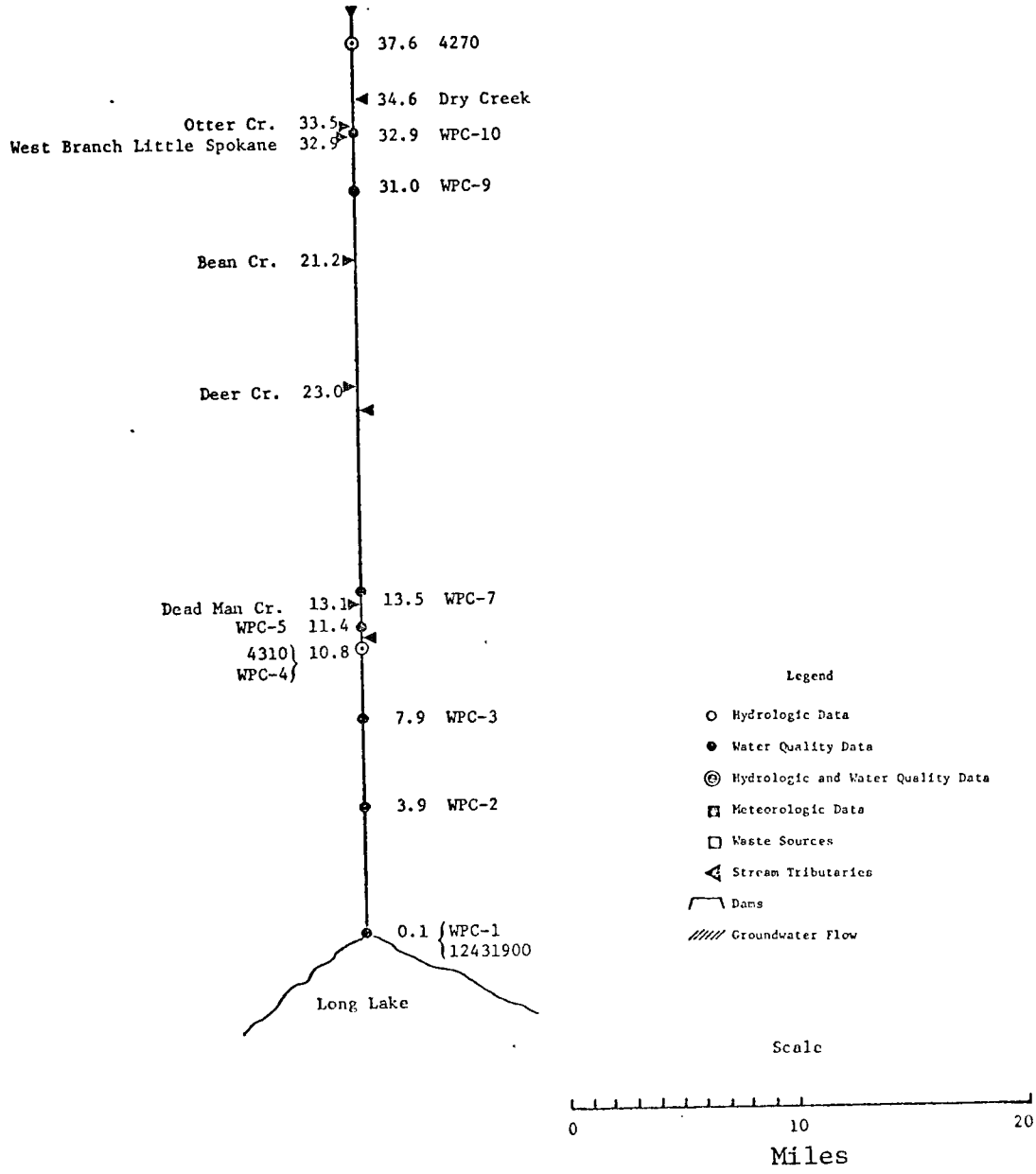


FIGURE 20. LOW FLOW DATA POINTS, REGION 4 - LITTLE SPOKANE RIVER

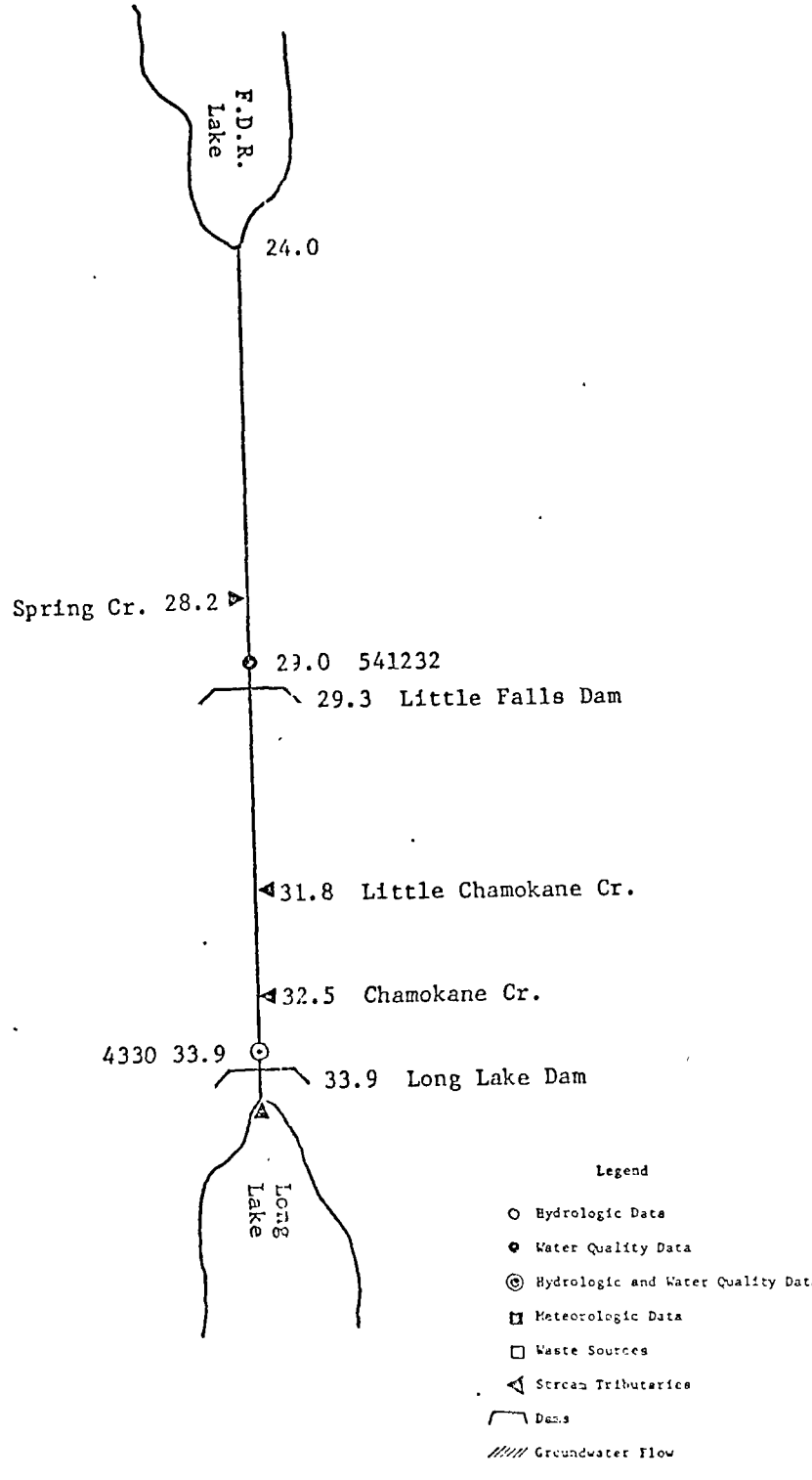


FIGURE 21. LOW FLOW DATA POINTS, REGION 5 - SPOKANE RIVER FROM ROOSEVELT L. TO LONG L.

TABLE 15. STEADY-STATE FLOW PERIODS

USGS Stn.	Year	Dates	Flows (cfs) High	Low
Region #1 - St. Joe				
4145	1969	8/1 - 10/9	622	330
		10/11 - 12/12	548	250
	1970	9/8 - 11/16	726	390
	1971	8/1 - 9/30	1200	472
4149	1969	7/27 - 9/30	86	45
		10/11 - 12/10	84	33
	1970	8/1 - 10/23	130	54
	1971	7/16 - 9/30	176	59
Region #2 - Coeur d'Alene				
4110	1969	7/30 - 10/1	152	93
		10/11 - 12/11	130	75
	1970	8/7 - 10/23	133	81
	1971	8/1 - 3/30	212	109
4130	1969	8/1 - 9/30	393	221
		10/12 - 12/12	370	170
	1970	8/8 - 10/23	407	231
	1971	8/1 - 9/30	612	246
4131.5	1969	8/5 - 10/15	73	52
		10/12 - 12/11	62	45
	1970	8/11 - 11/15	89	50
	1971	8/1 - 9/30	139	55
4133	1969	8/8 - 10/30	143	98
		10/11 - 12/10	125	81
	1970	8/6 - 10/23	158	103
	1971	8/1 - 9/30	239	117
4135	1969	8/1 - 9/30	555	332
	1970	8/9 - 10/23	527	344
	1971	8/1 - 9/30	810	445
Region #3 - Spokane				
4195	1969	7/6 - 9/29	1460	641
		10/1 - 12/21	1980	1550
	1970	8/1 - 10/8	1440	737
	1971	8/1 - 9/30	1780	403
4225	1969	7/24 - 9/29	1890	1140
		10/1 - 12/12	2400	1980
	1970	7/24 - 10/10	2110	1070
	1971	8/1 - 9/30	2380	1100
4240	1969	7/19 - 9/25	20	12
		9/21 - 12/10	24	18
	1970	8/1 - 10/4	17	7.5
		9/6 - 11/10	26	16

TABLE 15. (Continued)

Stn.	Year	Dates	Flows (cfs) High	Low
Region #4 - Little Spokane				
4270	1968	6/24 - 9/10	44	33
	1969	7/20 - 12/20	49	40
	1970	8/6 - 10/5	43	38
	1971	7/22 - 9/30	45	40
4310	1968	7/1 - 9/10	147	92
	1969	7/23 - 9/30	166	129
	1970	7/30 - 10/4	152	121
	1971	7/22 - 9/27	157	123
Region #5 - Spokane				
4330	1969	7/25 - 10/22	3160	1100
	1970	8/5 - 10/6	2910	1530
	1971	7/27 - 9/30	3870	830

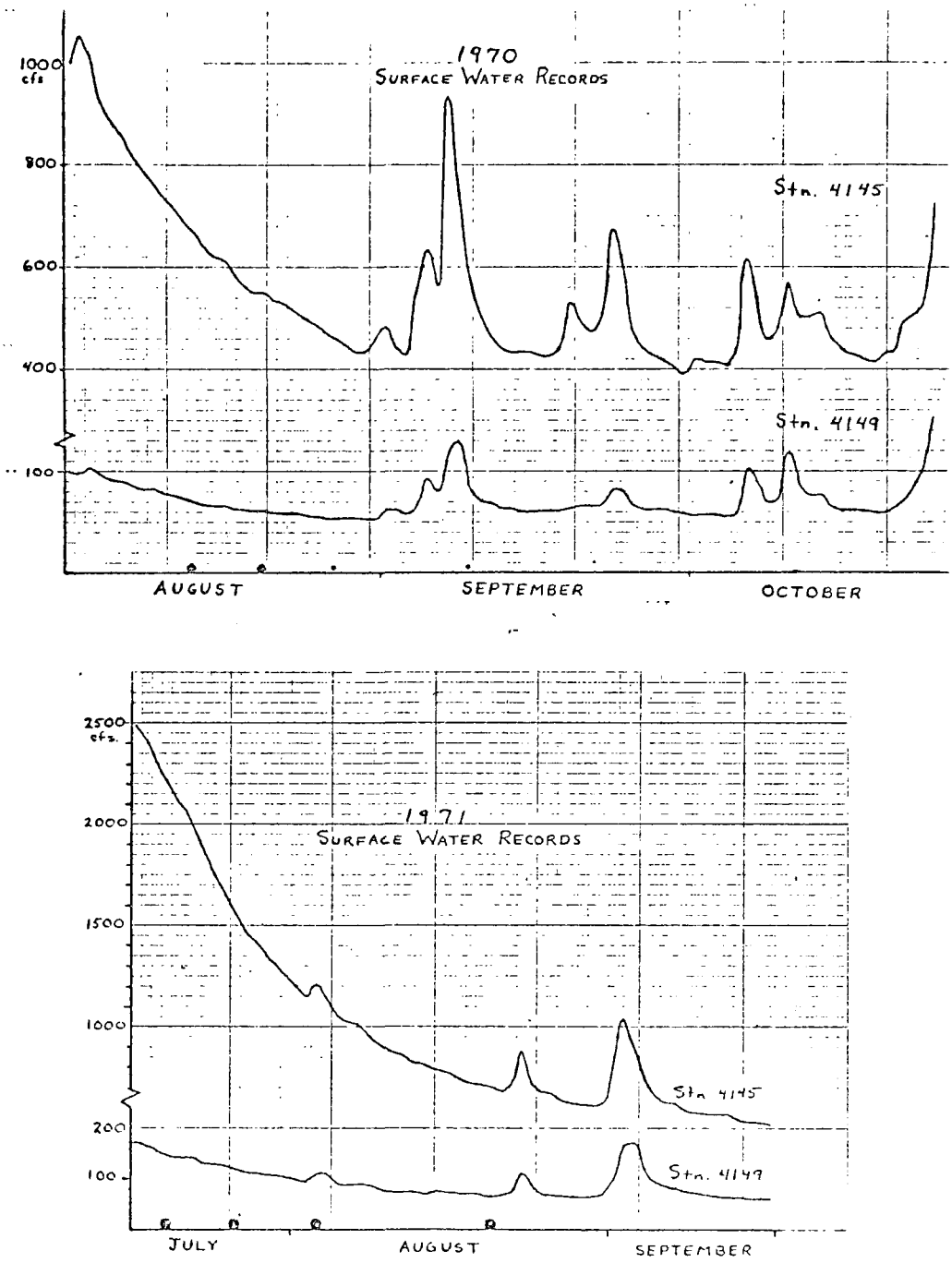


FIGURE 22. LOW FLOW HYDROGRAPH, RIVER REGION 1

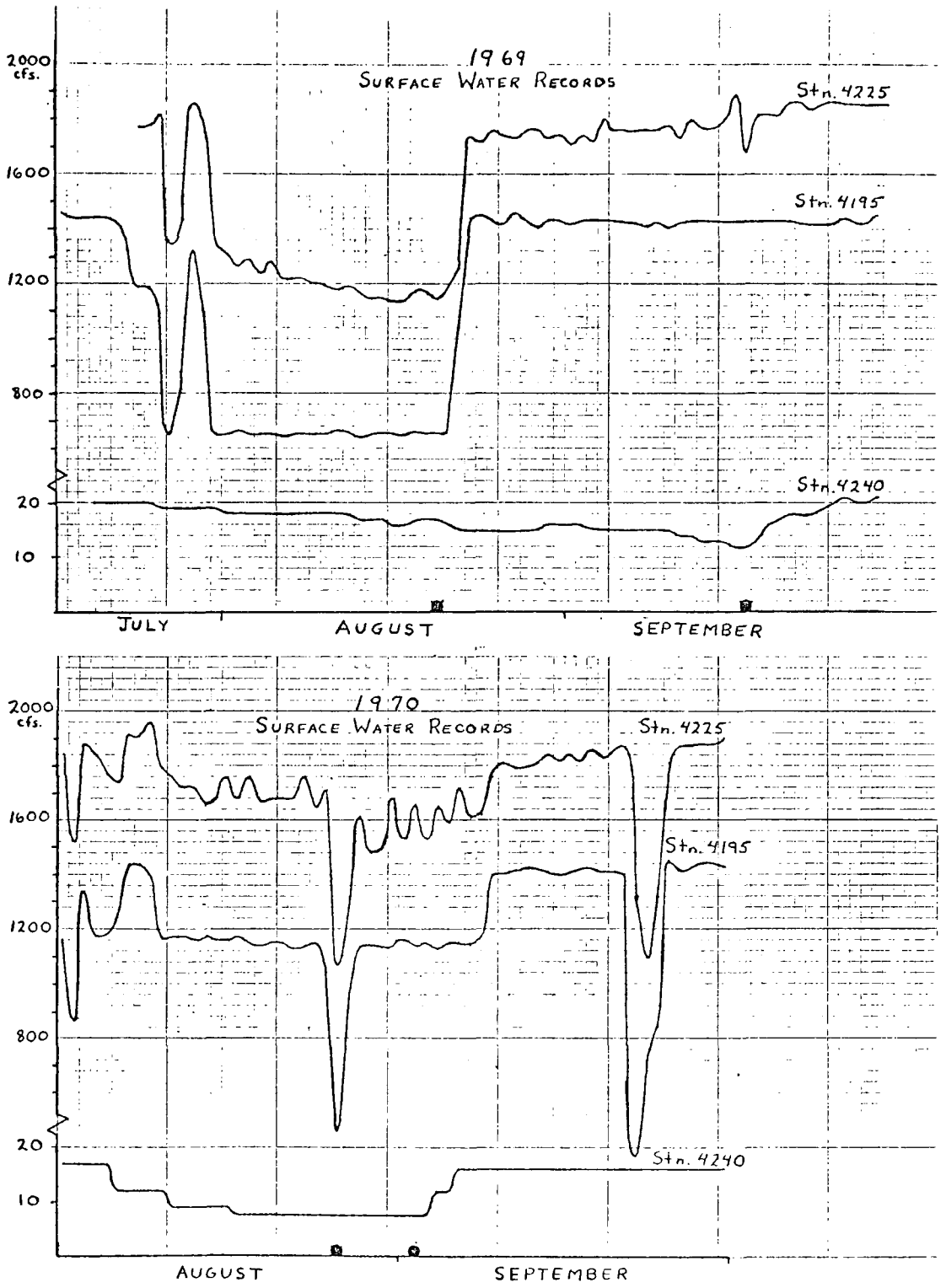


FIGURE 23. LOW FLOW HYDROGRAPH, RIVER REGION 3

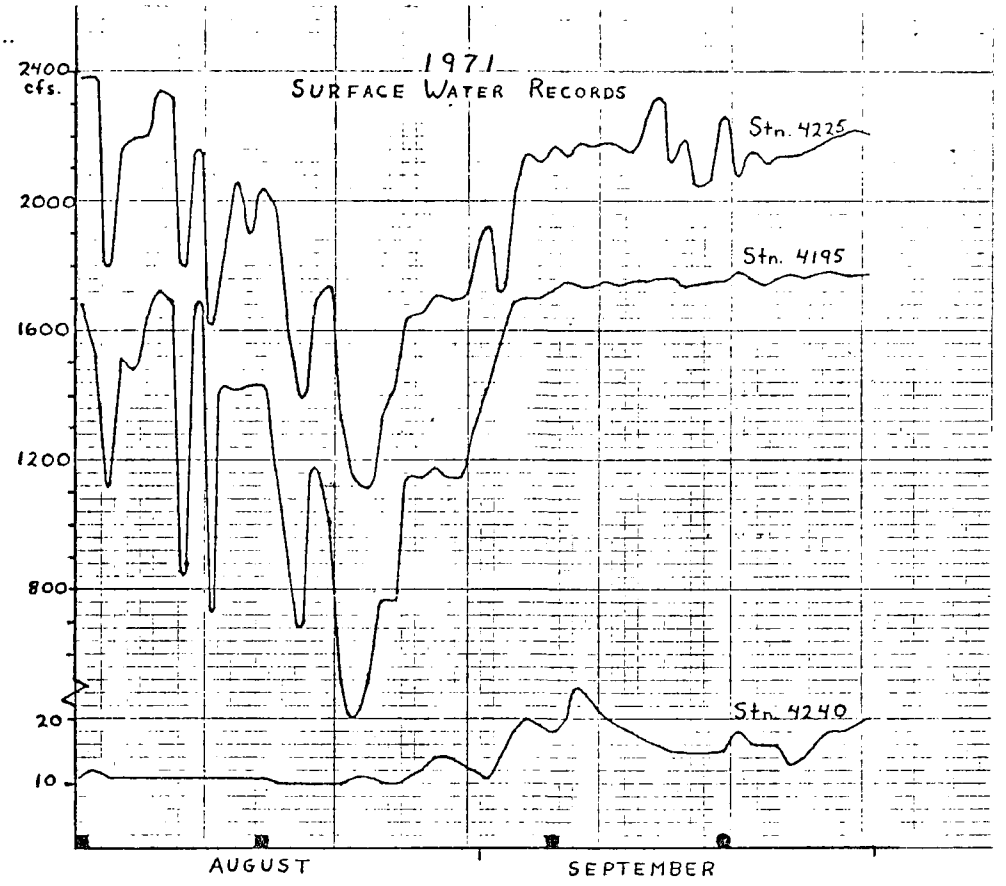


FIGURE 24. LOW FLOW HYDROGRAPH, RIVER REGION 3

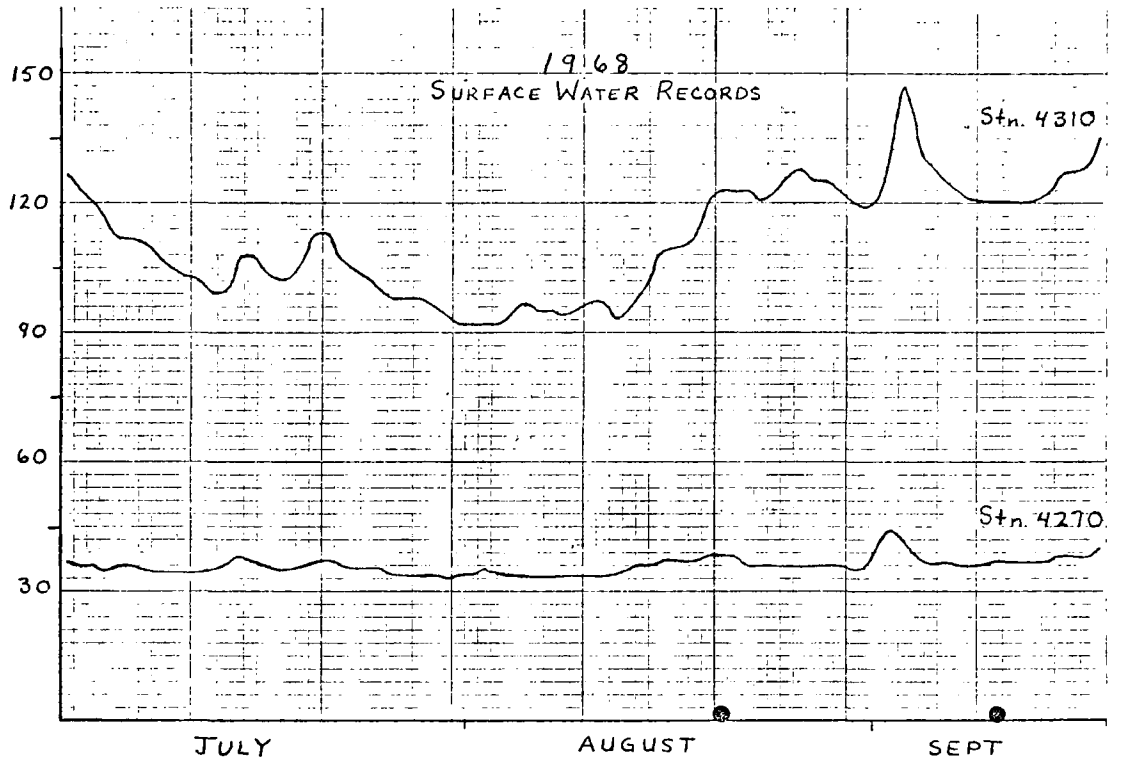


FIGURE 25. LOW FLOW HYDROGRAPH, RIVER REGION 4

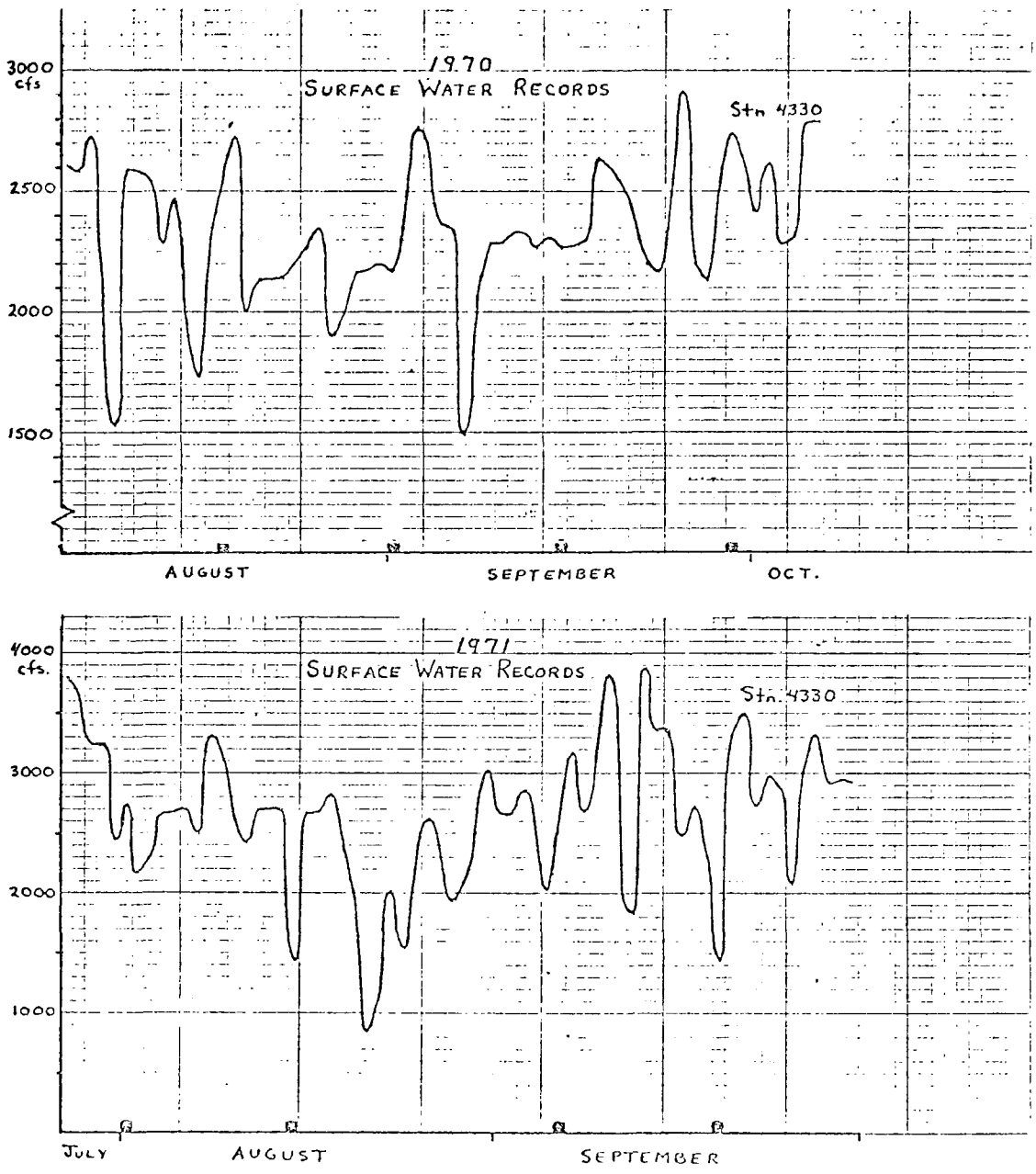


FIGURE 26. LOW FLOW HYDROGRAPH, RIVER REGION 5

TABLE 16. WATER QUALITY STABILITY, RIVER REGION #1, 1970-1971

1970		8/13	8/20	8/27	9/9
Station* (Source 47)	Constituent		Values		
SJ-1	Temp	20	20		20
	DO	8	6.4		
	Coli	5	12		28
SJ-5	Temp	22	20		
	DO	9	6.6		
	Coli	40	36		
SJ-7	Temp		20	21	
SJ-10	Coli		10	60	
SJ-11	Temp		19	20	

1971		7/19	7/26	8/3	8/9	8/17	8/20
SJ-1	Temp	18	24	26	23	20	21
	Coli	38	44	52		60	36
SJ-5	Temp	17	24	26	23	19	22
	Coli	20	20	28		24	20
SJ-7	Temp	16	22	23	23	19	20
	Coli	190	260	200		300	200
SJ-10	Temp	16	18	20	22	20	19
	Coli	20	16	48		36	52

TABLE 17. WATER QUALITY STABILITY, RIVER REGION #2-1969

Stn.	AUG 19 Temp.	SEP 13 Temp.	AUG 19 D.O.	SEP 13 D.O.	AUG 19 Cl	SEP 13 Cl	AUG 19 B.O.D.	SEP 13 B.O.D.
149-1	20.0	17.5	7.5	-	0.0	1.5	1.3	-
2	19.5	16.5	7.6	9.0	0.0	0.0	1.0	1.6
3	19.5	16.5	7.5	9.5	0.0	0.0	0.7	1.6
4	19.0	16.0	7.7	-	0.0	0.0	1.0	-
5	19.0	16.5	7.7	9.3	0.0	0.0	1.3	1.4
6	19.0	16.5	8.2	9.0	0.0	0.0	0.7	1.3
7	17.5	17.0	8.1	8.6	0.0	0.0	1.2	0.7
8	16.0	15.5	7.6	9.0	0.0	0.0	0.9	1.1
9	15.5	15.0	7.5	9.0	0.0	0.0	1.2	1.6
10	17.5	15.0	8.5	9.2	0.0	0.0	1.0	1.2
11	21.0	10.0	8.2	8.6	1.0	0.0	1.7	1.1
12	17.0	11.0	7.6	8.6	0.5	2.0	1.8	1.8
13	17.5	11.0	8.2	8.8	3.0	0.0	4.5	1.4
14	16.5	8.5	7.9	9.3	0.0	0.0	0.9	1.3
15	17.0	8.5	8.2	10.2	0.0	0.5	1.4	1.8
16	16.5	8.5	7.8	9.5	0.0	0.0	1.1	1.5
17	16.5	9.0	7.3	9.1	0.0	0.0	4.2	1.4
18	16.0	9.5	8.3	2.5	2.0	1.0	2.9	>2.5
19	18.0	8.5	8.3	10.7	0.0	0.5	6.5	2.1
20	18.0	8.5	8.2	10.3	0.0	0.5	1.7	1.6
21	16.0	9.0	8.9	10.3	6.0	1.0	2.4	1.7
22	16.0	8.5	8.6	10.0	0.0	0.0	3.4	1.3
23	17.5	8.5	7.8	10.0	0.0	0.0	1.7	1.7
24	18.5	8.0	7.9	9.8	0.0	0.0	1.7	1.3
25	18.0	8.0	7.9	9.8	0.0	0.0	1.8	1.5
26	15.0	8.0	7.9	9.5	0.0	0.0	1.9	1.6
28	15.5	8.0	8.1	9.6	0.0	0.0	1.2	1.0
29	20.5	13.5	8.1	9.0	0.0	0.0	0.9	0.9
30	19.0	13.5	8.2	9.1	0.0	0.0	0.8	1.0
31	20.0	13.5	8.0	8.9	0.0	0.0	1.0	1.0
32	17.5	13.5	8.3	9.3	0.0	0.0	1.0	1.7
33	18.5	14.0	8.1	8.8	0.0	0.0	1.0	0.5
34	19.0	14.0	7.6	8.8	0.0	0.0	0.9	0.6

TABLE 17. (Continued)

AUG 19 Cu	SEP 13 Cu	AUG 19 Zn	SEP 13 Zn	AUG 19 Fe	SEP 13 Fe
-	<0.1	2.6	2.6	0.2	<0.1
<0.1	<0.1	1.8	4.1	0.2	0.2
<0.1	<0.1	1.7	3.5	0.2	<0.1
0.0	<0.1	1.6	2.7	0.2	<0.1
<0.1	<0.1	1.7	3.0	0.2	<0.1
<0.1	<0.1	1.7	3.5	0.2	0.1
<0.1	<0.1	1.8	4.8	0.2	<0.1
0.0	<0.1	2.0	5.3	0.1	<0.1
0.0	<0.1	2.0	5.3	0.1	0.2
0.0	<0.1	1.9	4.7	0.1	<0.1
0.0	<0.1	5.1	15.0	0.1	0.4
0.0	<0.1	6.8	7.3	0.2	0.2
0.0	<0.1	6.5	21.0	0.1	0.2
0.0	<0.1	0.5	2.0	0.1	<0.1
0.0	<0.1	0.3	2.1	0.2	<0.1
0.0	<0.1	0.3	1.1	0.1	<0.1
<0.1	<0.1	0.2	1.0	0.2	<0.1
<0.1	<0.1	0.2	0.9	0.2	<0.1
0.1	<0.1	0.4	1.7	0.1	<0.1
<0.1	<0.1	0.6	1.5	0.1	<0.1
<0.1	<0.1	0.6	1.3	0.1	0.1
<0.1	<0.1	0.7	2.4	0.1	<0.1
0.0	<0.1	0.8	2.8	0.1	<0.1
0.0	<0.1	1.0	2.7	0.2	<0.1
0.0	<0.1	1.0	0.3	0.1	0.1
0.0	<0.1	<0.1	0.2	0.1	<0.1
0.0	<0.1	<0.1	<0.1	0.1	<0.1
0.0	<0.1	<0.1	<0.1	0.2	<0.1
0.0	<0.1	<0.1	<0.1	0.2	<0.1
0.0	<0.1	<0.1	<0.1	0.1	0.1
0.0	<0.1	<0.1	<0.1	0.1	<0.1
<0.1	<0.1	<0.1	<0.1	0.1	<0.1
0.0	<0.1	<0.1	<0.1	0.2	<0.1

TABLE 17. (Continued)

OCT 30 Stn.	NOV 24 Temp.	OCT 30 Temp.	NOV 24 D.O.	OCT 30 D.O.	NOV 24 B.O.D.	OCT 30 B.O.D.	NOV 24 Zn	OCT 30 Zn	NOV 30 Fe	OCT 30 Fe
149-1	8.0	5.0	10.6	11.2	1.5	2.8	5.1	3.5	0.1	0.1
2	8.0	4.5	-	11.2	-	0.3	4.8	3.6	0.1	0.1
3	8.5	4.0	-	11.5	-	2.4	5.3	3.7	0.1	0.1
4	8.0	4.0	-	11.7	-	5.4	6.4	4.5	<0.1	0.1
5	8.0	5.0	-	11.3	-	2.0	5.8	7.0	0.1	0.1
6	8.0	5.5	10.1	11.0	1.8	-	5.5	5.9	<0.1	0.1
7	8.0	5.5	-	11.0	-	1.0	5.3	5.0	0.1	0.1
8	9.0	4.5	-	11.5	-	6.3	5.3	5.3	0.1	<0.1
9	9.0	4.5	-	11.4	-	1.6	5.6	5.6	0.1	<0.1
10	9.0	4.5	10.6	11.4	1.7	1.1	5.0	5.0	0.1	0.1
11	10.0	5.0	10.1	11.2	1.7	2.0	13.0	12.0	0.1	<0.1
12	9.5	5.0	9.3	11.2	0.9	4.2	17.5	11.8	0.1	<0.1
13	10.0	5.5	9.6	11.3	1.7	4.8	17.5	13.5	<0.1	<0.1
14	7.5	3.0	10.7	11.4	1.8	-	2.7	3.4	<0.1	<0.1
15	7.5	3.0	10.5	12.3	1.4	2.7	2.4	3.4	<0.1	<0.1
16	7.0	3.0	10.2	11.9	1.3	2.3	2.2	3.4	<0.1	<0.1
17	8.0	3.0	9.6	11.6	1.5	2.6	1.2	2.6	<0.1	<0.1
18	7.5	3.0	7.4	9.4	2.5	-	0.2	3.1	<0.1	<0.1
19	7.2	2.0	10.6	12.7	2.5	3.6	2.3	4.0	0.1	<0.1
20	7.0	2.0	-	12.3	-	2.8	2.7	4.0	0.1	<0.1
21	7.0	2.0	10.7	12.4	2.8	4.5	2.6	3.3	<0.1	<0.1
22	7.0	1.5	10.6	12.7	2.3	3.5	2.8	4.0	<0.1	<0.1
23	7.0	1.5	10.8	12.3	2.9	3.8	2.9	4.2	<0.1	<0.1
24	8.0	1.5	-	12.4	-	3.9	2.9	0.5	<0.1	<0.1
25	7.5	1.0	10.6	12.4	1.7	3.3	0.2	0.2	<0.1	<0.1
26	7.2	1.0	10.7	12.5	2.9	3.1	0.1	0.1	<0.1	<0.1
28	6.5	1.0	10.5	12.0	1.0	3.0	<0.1	<0.1	<0.1	<0.1
29	7.5	3.0	-	11.9	-	3.2	<0.1	<0.1	<0.1	<0.1
30	7.0	3.0	10.9	12.1	1.2	2.6	<0.1	<0.1	<0.1	<0.1
31	8.0	3.0	-	11.8	-	1.5	<0.1	<0.1	<0.1	<0.1
32	8.0	4.0	-	11.7	-	2.0	<0.1	<0.1	<0.1	<0.1
33	8.0	4.0	-	12.2	-	3.0	<0.1	<0.1	<0.1	<0.1
34	8.5	5.0	10.4	11.4	1.0	-	<0.1	<0.1	<0.1	<0.1

TABLE 18. WATER QUALITY STABILITY, RIVER REGION #2 - 1969-1971

1969		8/5	8/26	9/23	10/8	11/18	12/10
Station	Constituent			Values			
153007	Temp	18.4	20.5	13.0	10.5	5.0	
	DO	8.9	9.0	9.0	10.0	10.4	
	NH3-N		.027	.090	.060	.060	.080
	NO2-N	.003	.010	.003	.003	.002	.004
	NO3-N	.01	.02	.08	.09	.13	.15
	Phos	.04	.03	.03	.01	.01	.01
	Cl	1	6		1	2	1
	Coli	25	1750		2800	5	40
	Iron	670	275	650	400	340	76
	Lead	93	30	55	50	45	32
	Zinc	3,850	5,700	10,000	4,400	6,040	13,200
153019	Temp	14.3	18.5	12.5	10.5	5.2	4.0
	DO	8.5	8.7	9.6	9.0	11.3	12.0
	NH3-N		.036	.20	.02	.01	.01
	NO2-N	.003	.010	.002	.001	.001	.001
	NO3-N	.02	.02	.04	.02	.01	.02
	Phos	.03	.01	.03	.01	.01	.04
	Cl	1	1	1		1	1
	Coli	130	400		520	100	50
	Iron	110	110	170	150	39	23
	Lead	12	12	10	10	9	5
	Zinc	.021	.405	.051	.088	.008	.058
153018	Temp	15.2	17.5	12.7	11.0	4.8	4.0
	DO	8.5	8.9	9.3	9.2	11.0	11.0
	NH3-N		.027	.070	.070	.070	.080
	NO2-N	.003	.010	.003	.003	.002	.003
	NO3-N	.03	.01	.10	.09	.12	.14
	Phos	.05	.03	.03	.03	.03	.04
	Chlor	1	2		1	2	1
	Iron	370	215	620	290	220	1850
	Lead	69	57	55	85	9	190
	Zinc	4,750	6,200	6,800	5,780	4,700	655
			8/8		9/4		
151017	Cl		27		30		
	Iron		10		100		
	Nitrate		.5		.2		

TABLE 18. (Continued)

1970		8/12	9/28
Station	Constituent	Values	
153007	Temp	18.2	14.0
	DO	10.1	8.5
	NH3-N	.01	.02
	NO2-N	.001	.003
	NO3-N	.001	.10
	Phos	.13	.05
	Cl	2	1
	Lead	7	1
	Zinc	3,640	3,600
	Coli	35	190
153018	Temp	17.3	14.0
	DO	8.1	8.6
	NH3-N	.01	.02
	NO2-N	.001	.003
	NO3-N	.03	.10
	Phos	.02	.05
	Cl	1	1
	Iron	360	470
	Lead	75	100
	Coli	15	5
153019	Temp	15.2	13
	DO	8.0	9.0
	NH3-N	.01	.01
	NO2-N	.001	.001
	NO3-N	.01	.01
	Phos	.12	.01
	Cl	1	1
	Iron	100	470
	Lead	28	100
	Coli	180	105
153023	Temp	13.8	16.0
	DO	8.5	8.7
	NH3-N	.29	.16
	NO2-N	.006	.015
	NO3-N	.29	.42
	Phos	.05	.19
	Cl	2	2
	Cu	50	30
	Iron	2200	2000
	Lead	433	750
	Zinc		
	Coli	1400	600

TABLE 18. (Continued)

1971		8/25	8/30	9/23
Station	Constituent		Values	
153007	Temp	17.5	20.5	13.0
	DO	9.3	10.3	11.5
	Phos	.03	.07	.40
	NH3-N	.002	.13	.06
	NO2-N	.002	0	0
	NO3-N	.02	.10	.10
	Cl		1	1
	Coli	100	4500	350
153019	Temp	17.7	18.5	10.0
	DO	9.2	9.0	10.2
	NH3-N	.012	.04	.06
	NO2-N	.001	0	0
	NO3-N	.001	0	0
	Coli	100	1200	530
	Chl		1	1
	Phos	.02	.08	.96
	Amm		.05	.1
153023	Temp		19.5	12.5
	DO		9.5	11.2
	NH3-N		.76	.53
	NO2-N		0	0
	NO3-N		.3	.3
	Phos		1.1	2.9
	Chl		2	2
	Coli		4500	1200
	Amm		1.0	.7

TABLE 19. WATER QUALITY STABILITY, RIVER REGION #3, 1969-1971

Spokane River 1969		7/21	8/9	9/21	10/12	11/16	12/14
Station	Constituent			Values			
4195	Temp	24.0	23.0	17.0	11.7	7.0	6.0
	DO	8.7	8.0	8.0	11.0	10.0	10.1
	Chl	.1	.4	.2	.2	0	.3
	Nitrate	0	1.1	.6	.6		.6
			8/20	9/17	10/21	11/20	12/10
153022	Temp		21.5	17.7	10.0	7.0	5.0
	DO		8.1	8.8	9.9	11.0	10.9
	NH3-N		.06	.02	.02	.01	.02
	NO2-N		.01	.001	.001	.001	.001
	NO3-N		.04	.04	.01	.01	.05
	Phos		.07	.06	.04	.04	.04
	Chl		1		1	2	1
	Copper		5		2	4	3
	Iron		210		98	97	164
	Lead		7		9	13	5
	Zinc		145	190	400	670	302
	Coli				180	345	
150114	Temp		21.5	17.7			5.0
	DO		8.2	8.8			10.9
	NH3-N		.04	.04			.02
	NO2-N		.01	.001			.001
	NO3-N		.05	.05			.08
	Phos		.06	.06			.04
	Cl		2				1
	Cu		3	4			4
	Iron		140	220			82
	Lead		7	10			5
	Zinc		150	190			302

TABLE 19. (Continued)

Spokane River 1970		7/26	7/28	8/23	8/26	9/2	9/20
Station	Constituent				Values		
4195	Temp	24.0		24.0			16.0
	DO	9		8.6			8.8
	Chl			.2			.1
	Nitrate			.3			.4
150114	Temp		21.9		23.0		
	DO		8.0		8.4		
	NH3-N				.01	.01	
	NO2-N				.001	.001	
	NO3-N				.03	.005	
	Phos		.01		.02	.03	
	Chl		1		1	1	
	Copper		6		20		
	Lead		6		100		
	Iron		100		40	50	
	Coli		900		100		
153022	Temp		21.8		22.0		
	DO		7.9		7.9		
	NH3-N				.02	.01	
	NO2-N				.001	.001	
	NO3-N				.03	.001	
	Phos				.03	.03	
	Chl		2		1		
	Copper		6		20	20	
	Iron		100		40	50	
	Lead		5		100		
	Coli		100		25		
Spokane River 1971							
			7/25	8/1	8/15	9/6	9/19
4195	Temp		23.4	25.2	29.2	17.8	16.4
	DO		7.6	8.0	8.2	9.8	9.8
	NH3-N		.06	.11	.05	.07	.05
	NO2-N		0	.01	0	0	0
	NO3-N		.02	.08	.01	.30	.24
	Phos		.02	.02	.02	.03	.02
	Copper		1	1	2	1	0
	Lead		7	4	3	6	6
	Zinc		120	230	120	180	160
	Coli		400	400	1600	2000	130

TABLE 20. WATER QUALITY STABILITY, RIVER REGION #4 - 1968 AND 1971

1968		8/20	9/10
Station (Source 31)	Constituent	Values	
WWPC-1	DO	9.8	8.6
	Temp	12.3	12.0
	Coli	6200	2100
	Phos	.02	.01
	NO3-N	nil	.05
	Nitrogen	.2	.34
	Chl	2.5	1.5
WWPC-2	DO	8.7	8.6
	Temp	12.5	12.0
	Coli	3600	1300
	Phos	.01	.01
	NO3-N	1.20	.23
	Nitrogen	.1	.25
	Chl	2.8	1.0
WWPC-3	DO	8.6	8.2
	Temp	12.9	12.2
	Coli	2200	5000
	Phos	.003	.01
	NO3-N	1.40	.11
	Nitrogen	.1	.25
	Chl	2.5	1.0
WWPC-4	DO	9.9	9.8
	Temp	15.0	15.0
	Coli	5200	5400
	Phos	.07	.02
	NO3-N	.66	.20
	Nitrogen	.2	.45
	Chl	3.0	1.5
WWPC-5	DO	9.4	9.6
	Temp	14.9	15.0
	Coli	5400	7000
	Phos	.01	.01
	NO3-N	1.06	1.11
	Nitrogen	.1	.50
	Chl	3.5	1.0

TABLE 20. (Continued)

1968		8/20	9/10
Station (Source 81)	Constituent	Values	
WWPC-7	DO	9.9	9.4
	Temp	14.9	14.5
	Coli	2700	3100
	Phos	.01	.01
	NO3-N	.70	nil
	Nitrogen	.1	.36
	Chl	1.2	.5
WWPC-9	DO	10.4	10.6
	Temp	16.0	16.5
	Coli	11,000	630
	Phos	.01	.01
	NO3-N	.52	.18
	Nitrogen	.2	.31
	Chl	1.2	.5
WWPC-10	DO	9.7	9.8
	Temp	15.2	15.5
	Coli	13,000	450
	Phos	.01	.01
	NO3-N	nil	nil
	Nitrogen	.3	.28
	Chl	1.2	2.0

1971		7/25	8/1	8/15	9/6	9/19
4319	Temp	15.9	15.8	13.7	12.8	9.6
	DO	8.6	8.2	9.0	10.0	10.5
	NH3-N	.02	.02	.03	.02	.01
	NO3-N	.01	.03	.01	.02	0
	NO2-N	1.3	1.2	1.3	2.1	2.0
	Phos	.04	.04	.02	.02	.02
	Coli	2500	2200	1600	800	600

TABLE 21. WATER QUALITY STABILITY, RIVER REGION #5, 1970 AND 1971

1970		7/21	7/28	8/4	8/18	8/23	9/1	9/15	9/20	9/22	9/29	10/6
Station	Constituent						Values					
4330	Coli					930			70			
	Temp					19			16			
	Cl					2.3			2.2			
	Nitrate					2.4			2.4			
	DO					4.8			5.5			
541232	Temp	21.1	18.3	21.1	19.4		19.4	17.2		16.1	14.6	13.4
	DO	8.3	7.3	8.3	5.3		5.4	5.2		3.4	5.8	5.5
	NH3-N	0			.09			0				
	NO3-N	.22		.34	.99		.34	.63			.52	.58
	Phos	.09		.03	.03		.04	.04				.02
	Coli	46			50		55	180		200	1800	2200
1971				8/1		8/15		9/1		9/19		
4330	Cl			1.4		1.9		2.8		2.0		
	Nitrite			.19		.02		.04		.01		
	NH3-N			.06		.05		.21		.01		
	Nitrate			.49		.77		1.1		.39		
	Phos			.04		.07		.10		.07		
	Temp			20.2		20.0		17.5		16.7		
	DO			6.1		3.1		3.7		5.9		
	Coli			800		500		1200		7500		
	Cu			2		0		0				
	Lead			4		0		3				
	Zinc			100		80		40				

Although there was a conspicuous lack of DO data in 1971, a review of the available values showed that DO was quite stable in August 1971, falling between 9.0 and 10.0, while values on the two days in 1970 fell between 6.4 and 9.2. Since the other constituent data was equally variable in both years (see Table 16), 1971 was still the preferred year.

Region 2 - Coeur d'Alene River

The low flow period with the most information obviously falls in August and September of 1969. The data represented was primarily taken from "Effect of Industrial and Domestic Effluents on the Water Quality of the Coeur d'Alene River Basin," by Mink, Williams and Wallace, March 1971. The months selected for this region are August and September 1969, because they have considerably more data than any other low flow period. No hydrograph was prepared for this region because flow fluctuation, as shown in Table 15 was so slight. Water quality values were also reasonably stable in 1969 (see Tables 17 and 18) as compared with 1970 and 1971.

Region 3 - Upper Spokane: Coeur d'Alene Lake to Long Lake

Hydrographs were drawn for all three years in this region since the choice of a preferred simulation period was not at all apparent from the amounts of quality data alone. Although 1971 had a few more constituents represented throughout this region, this was the year with the largest fluctuations in flow rates. Only one data (September 18) with water quality data in 1971 was preceded by a reasonable duration of near-steady flow, so this year was rejected. The low flow periods in 1969 and 1970 were periods of similar water quality data availability. Of the two water quality dates in 1970, one (August 26) coincided with a sharp local fluctuation. In 1969 there was a step change in flow level in the middle of the low flow period, but the water quality data dates (August 20 and September 17) are each preceded by at least 20 days of very steady flow (see Figure 23); water quality data stability verified the choice of 1969 as the year to simulate (see Table 19). These months are therefore preferred and recommended.

Region 4 - Little Spokane

The water quality data for two days in 1968 greatly exceeded that available in any other year; further, the 1968 quality data was the most stable (see Table 20). This year was therefore clearly preferred. The 1968 steady state flow period had one minor peak during the first days of September. This peak, however, did not occur during the days in which water quality data was available. Due to the stability and relatively large quantity of quality data on August 20 and September 10, 1968, these months were chosen for the simulation periods.

Region 5 - Lower Spokane: Long Lake to FDR Lake

The choice was clearly between 1970 and 1971 periods on the basis of quality data. During the low flow periods there were fluctuations in flow rates. However, the fluctuations are relatively minor when compared with the annual variation of flow. In both 1970 and 1971 water quality data was fairly unstable (see Table 21). Although 1970 was possibly slightly more stable, there were considerably more water quality constituents reported in 1971. August and September 1971 were chosen as being the best period overall.

Summary: Rivers

As a result of the analysis made, including review of effluent data and the steadiness of quality levels within low flow periods, it is recommended that data from the following periods be used for the model simulation of the several river regions.

River Region 1 - St. Joe - St. Maries	July 16 - Sept. 16, 1971
River Region 2 - Coeur d'Alene	Aug. 1 - Sept. 30, 1969
River Region 3 - Upper Spokane	Aug. 1 - Sept. 30, 1969
River Region 4 - Little Spokane	July 15 - Sept. 15, 1968
River Region 5 - Lower Spokane	Aug. 1 - Sept. 30, 1971

SELECTION OF SIMULATION PERIODS: LAKES

The contract called for a six month simulation period (June through November). The objective in selecting simulation periods for the lakes was to specify periods providing optimal types and quantities of needed data. In order to facilitate a decision, Tables 22 through 33 were prepared showing availability of all dated water quality, meteorological and inflow-outflow data for each of the lakes and for each year in which there was some data besides meteorological data (which is available in all years). The numbers under "Source" on these Tables refer to Bibliography references.

The great majority of the available effluent data is undated (see Table 3), so they cannot influence the selection of simulation periods. The same question existed as to the validity of earlier quality data as is noted under the corresponding section for river simulation periods.

RECOMMENDED SIMULATION PERIODS: LAKES

The following sections discuss data availability and the reasons for recommending the simulation period which was selected for each lake.

TABLE 22. DATA AVAILABILITY - LONG LAKE

Source	No. of Stations	Type of Data Recorded	1966 June	July	Aug.	Sept.	Oct.	Nov.
5	1	water surface elevations						
29	?	daily inflow						
USGS	1	daily average discharge						
46	1	discharge water temperatures						
30	7	thermal stratification						
30	8	values by depth: temp, DO, PO4 NO3-N, NO2-N, NH3-N, nitrogen						
29	6	values by depth: temp, DO, NO3-N, PO4						
USGS	1	temp, DO, N, NH3-N, NO2-N, NO3-N, PO4, coliform						
STORET	1	intensive monitoring: temp, DO, coliform, PO4, NH3-N, NO2-N, NO3-N						
STORET	1	temp, DO, PO4, Cl, NH3-N, NO2-N NO3-N, N, Zn, coliform						
29	5	temp and DO depth profile						
45	1	DO at various depths						
75	1	air temp and humidity						
NOAA	1	air temp, wind speed, sky cover, dry bulb, wet bulb averages						
NOAA	1	solar radiation						
NOAA	3	air temp						
NOAA	1	evaporation and wind						
USGS	2	inflow data: temp, DO, coliform, discharge						
USGS	1	inflow data: N, NO2-N, NO3-N, NH3-N, PO4						
USGS	1	outflow data: chloride, NO3 N, NO2, NH3, PO4, temp, DO, coliform						
USGS	1	daily inflows						

TABLE 23. DATA AVAILABILITY - LONG LAKE

Source	No. of Stations	Type of Data Recorded	1969 June	July	Aug.	Sept.	Oct.	Nov.
5	1	water surface elevations						
29	?	daily inflow						
USGS	1	daily average discharge						
46	1	discharge water temperatures						
30	7	thermal stratification						
30	8	values by depth: temp, DO, PO4 NO3-N, NO2-N, NH3-N, nitrogen						
29	6	values by depth: temp, DO, NO3-N, PO4						
USGS	1	temp, DO, N, NH3-N, NO2-N, NO3-N, PO4, coliform						
STORET	1	intensive monitoring: temp, DO, coliform, PO4, NH3-N, NO2-N, NO3-N						
STORET	1	temp, DO, PO4, Cl, NH3-N, NO2-N NO3-N, N, Zn, coliform						
29	5	temp and DO depth profile						
45	1	DO at various depths						
75	1	air temp and humidity						
NOAA	1	air temp, wind speed, sky cover, dry bulb, wet bulb averages						
NOAA	1	solar radiation						
NOAA	3	air temp						
NOAA	1	evaporation and wind						
USGS	2	inflow data: temp, DO, coliform, discharge						
USGS	1	inflow data: N, NO2-N, NO3-N, NH3-N, PO4						
USGS	1	outflow data: chloride, NO3 N, NO2, NH3, PO4, temp, DO, coliform						
USGS	1	daily inflows						

TABLE 24. DATA AVAILABILITY - LONG LAKE

Source	No. of Stations	Type of Data Recorded
5	1	water surface elevations
29	?	daily inflow
USGS	1	daily average discharge
46	1	discharge water temperatures
30	7	thermal stratification
30	8	values by depth: temp, DO, PO4 NO3-N, NO2-N, NH3-N, nitrogen
29	6	values by depth: temp, DO, NO3-N, PO4
USGS	1	temp, DO, N, NH3-N, NO2-N, NO3-N, PO4, coliform
STORET	1	intensive monitoring: temp, DO, coliform, PO4, NH3-N, NO2-N, NO3-N
STORET	1	temp, DO, PO4, Cl, NH3-N, NO2-N NO3-N, N, Zn, coliform
29	5	temp and DO depth profile
45	1	DO at various depths
75	1	air temp and humidity
NOAA	1	air temp, wind speed, sky cover, dry bulb, wet bulb averages
NOAA	1	solar radiation
NOAA	3	air temp
NOAA	1	evaporation and wind
USGS	2	inflow data: temp, DO, coliform, discharge
USGS	1	inflow data: N, NO2-N, NO3-N, NH3-N, PO4
USGS	1	outflow data: chloride, NO3 N, NO2, NH3, PO4, temp, DO, coliform
USGS	1	daily inflows

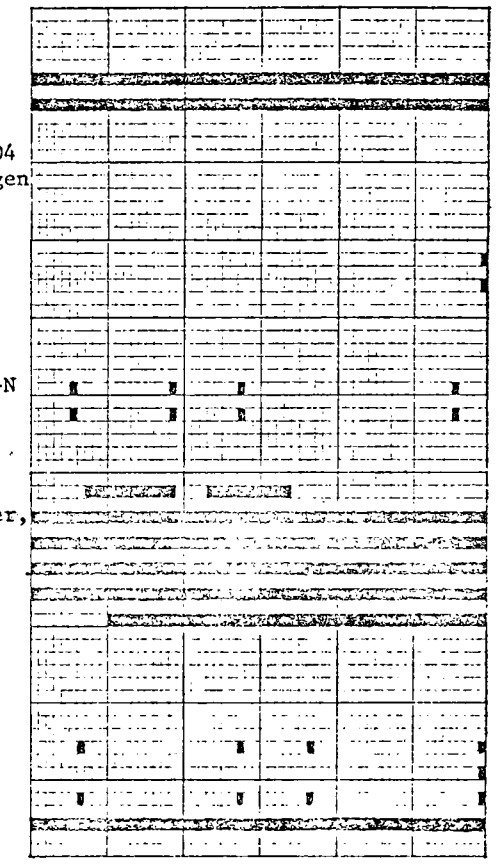


TABLE 25. DATA AVAILABILITY - LONG LAKE

Source	No. of Stations	Type of Data Recorded
5	1	water surface elevations
29	?	daily inflow
USGS	1	daily average discharge
46	1	discharge water temperatures
30	7	thermal stratification
30	8	values by depth: temp, DO, PO4 NO3-N, NO2-N, NH3-N, nitrogen
29	6	values by depth: temp, DO, NO3-N, PO4
USGS	1	temp, DO, N, NH3-N, NO2-N, NO3-N, PO4, coliform
STORET	1	intensive monitoring: temp, DO, coliform, PO4, NH3-N, NO2-N, NO3-N
STORET	1	temp, DO, PO4, Cl, NH3-N, NO2-N NO3-N, N, Zn, coliform
29	5	temp and DO depth profile
45	1	DO at various depths
75	1	air temp and humidity
NOAA	1	air temp, wind speed, sky cover, dry bulb, wet bulb averages
NOAA	1	solar radiation
NOAA	3	air temp
NOAA	1	evaporation and wind
USGS	2	inflow data: temp, DO, coliform, discharge
USGS	1	inflow data: N, NO2-N, NO3-N, NH3-N, PO4
USGS	1	outflow data: chloride, NO3 N, NO2, NH3, PO4, temp, DO, coliform
USGS	1	daily inflows

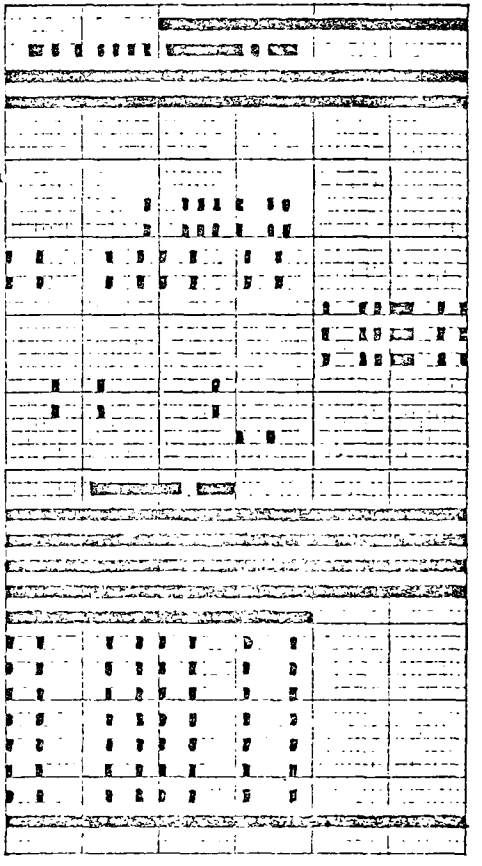


TABLE 26. DATA AVAILABILITY - LONG LAKE

Source	No. of Stations	Type of Data Recorded
5	1	water surface elevations
29	?	daily inflow
USGS	1	daily average discharge
46	1	discharge water temperatures
30	7	thermal stratification
30	8	values by depth: temp, DO, PO4 NO3-N, NO2-N, NH3-N, nitrogen
29	6	values by depth: temp, DO, NO3-N, PO4
USGS	1	temp, DO, N, NH3-N, NO2-N, NO3-N, PO4, coliform
STORET	1	intensive monitoring: temp, DO, coliform, PO4, NH3-N, NO2-N, NO3-N
STORET	1	temp, DO, PO4, Cl, NH3-N, NO2-N NO3-N, N, Zn, coliform
29	5	temp and DO depth profile
45	1	DO at various depths
75	1	air temp and humidity
NOAA	1	air temp, wind speed, sky cover, dry bulb, wet bulb averages
NOAA	1	solar radiation
NOAA	3	air temp
NOAA	1	evaporation and wind
USGS	2	inflow data: temp, DO, coliform, discharge
USGS	1	inflow data: N, NO2-N, NO3-N, NH3-N, PO4
USGS	1	outflow data: chloride, NO3 N, NO2, NH3, PO4, temp, DO, coliform
USGS	1	daily inflows

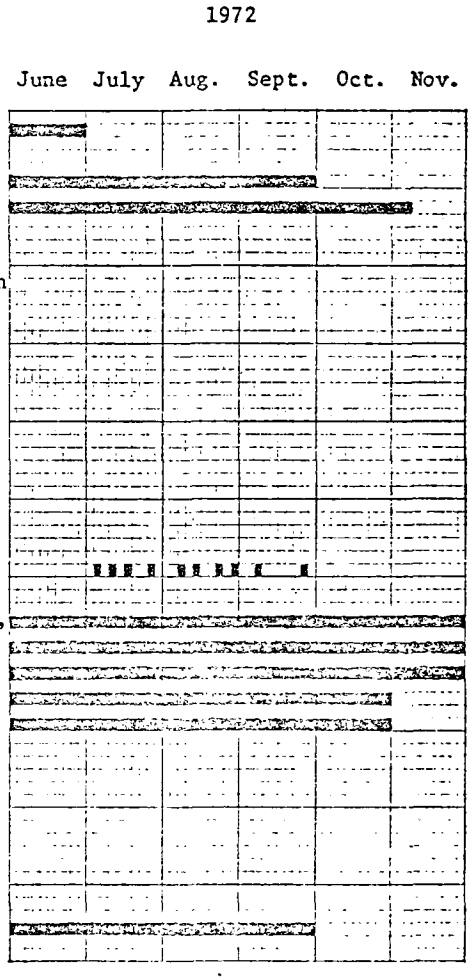
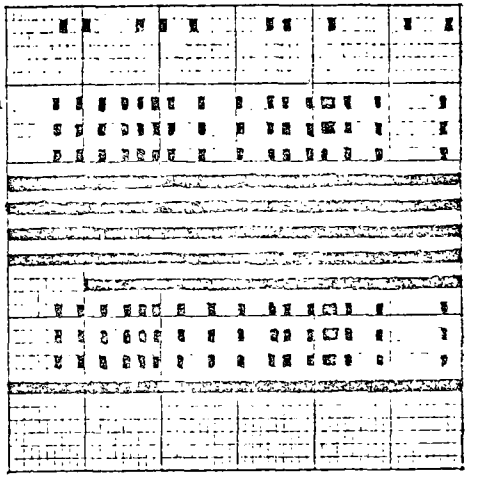


TABLE 27. DATA AVAILABILITY - SPOKANE RIVER ARM OF FDR LAKE

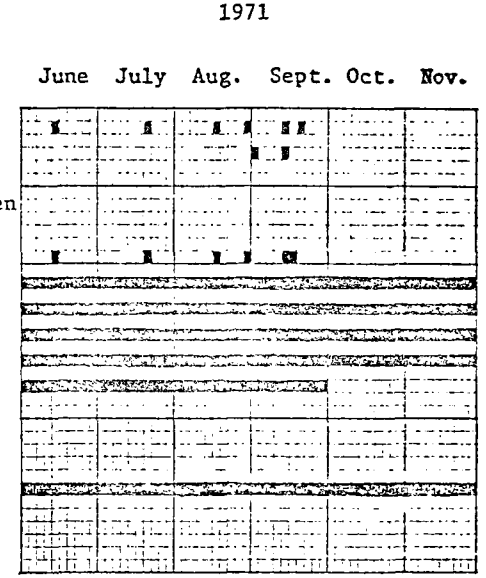
Source	No. of Stations	Type of Data Recorded
29	1	water surface elevations
29	6	temp and DO depth profiles
STORET	1	temp, DO
STORET	6	temp, DO, NH3-N, NO3-N, nitrogen PO4, coliform, secchi disc
29	6	coliform, DO, temp, PO4, NO3-N
NOAA	2	air temp
NOAA	1	*wind, sky cover, wet bulb, dry bulb, humidity
NOAA	1	solar radiation
NOAA	1	*evaporation and wind
STORET	1	inflow data: temp, DO, NH3, NO3, N, PO4, coliform, secchi disc
USGS	1	daily inflows



* data from nearest station at Spokane

TABLE 28. DATA AVAILABILITY - SPOKANE RIVER ARM OF FDR LAKE

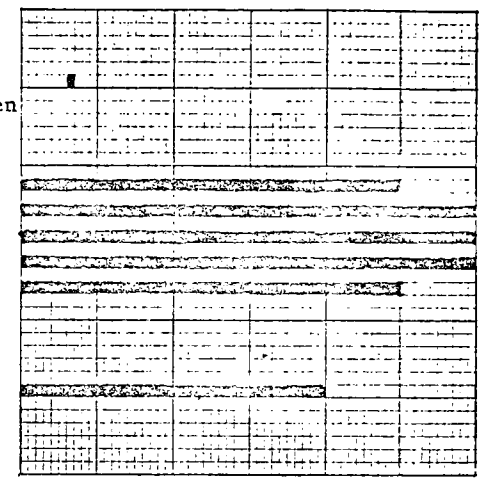
Source	No. of Stations	Type of Data Recorded
29	1	water surface elevations
29	6	temp and DO depth profiles
STORET	1	temp, DO
STORET	6	temp, DO, NH3-N, NO3-N, nitrogen PO4, coliform, secchi disc
29	6	coliform, DO, temp, PO4, NO3-N
NOAA	2	air temp
NOAA	1	*wind, sky cover, wet bulb, dry bulb, humidity
NOAA	1	solar radiation
NOAA	1	*evaporation and wind
STORET	1	inflow data: temp, DO, NH3, NO3, N, PO4, coliform, secchi disc
USGS	1	daily inflows



* data from nearest station at Spokane

TABLE 29. DATA AVAILABILITY - SPOKANE RIVER ARM OF FDR LAKE

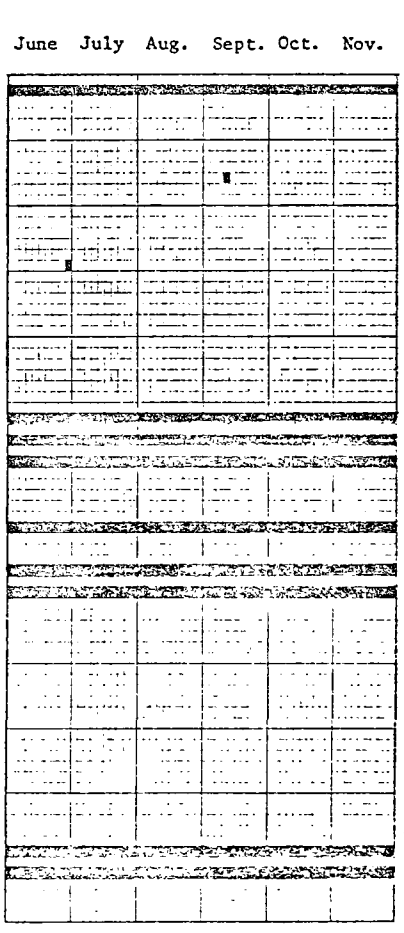
Source	No. of Stations	Type of Data Recorded
29	1	water surface elevations
29	6	temp and DO depth profiles
STORET	1	temp, DO
STORET	6	temp, DO, NH3-N, NO3-N, nitrogen PO4, coliform, secchi disc
29	6	coliform, DO, temp, PO4, NO3-N
NOAA	2	air temp
NOAA	1	*wind, sky cover, wet bulb, dry bulb, humidity
NOAA	1	solar radiation
NOAA	1	*evaporation and wind
STORET	1	inflow data: temp, DO, NH3, NO3, N, PO4, coliform, secchi disc
USGS	1	daily inflows



* data from nearest station at Spokane

TABLE 30. DATA AVAILABILITY - COEUR D'ALENE LAKE

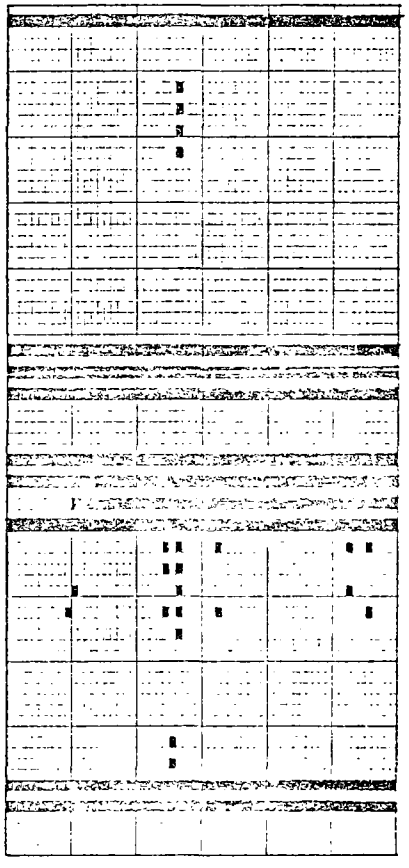
Source	No. of Stations	Type of Data Recorded
USGS	1	water surface elevations
5	1	water surface elevations
43	3	6 month average depth
41	3	temp, DO, TDS, Cl, NO3, PO4, NH3
41	2	temp, DO, TDS, Cl, NO3, PO4, NH3
STORET	1	temp, DO, NH3-N, PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N, NO3, coliform, PO4, Cl
42	?	18 month average: temp, DO, BOD, NO3, PO4, Zn, Secchi disc, coeff. ext.
43	12	6 month average DO
41	14	Zn, Cu, Pb, Cd
NOAA	2	air temp
NOAA	1	*sky cover, dry bulb, wet bulb
NOAA	1	*evaporation and wind
NOAA	1	*solar radiation
47	1	inflow data: temp DO chloride, nitrate coliform TDS, ammonia, PO4
STORET	1	inflow data: coliform, temp, DO, NH3, NO3, PO4, chloride
STORET	1	outflow data: temp DO, NH3, NO2, Cl coliform
USGS	3	daily inflows
USGS	1	daily outflows



* data from nearest station at Spokane.

TABLE 31. DATA AVAILABILITY - COEUR D'ALENE LAKE

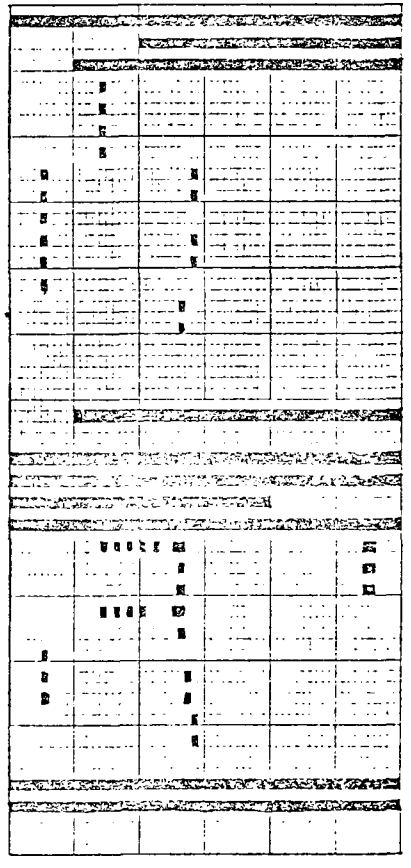
Source	No. of Stations	Type of Data Recorded
USGS	1	water surface elevations
5	1	water surface elevations
43	3	6 month average depth
41	3	temp, DO, TDS, Cl, NO3, PO4, NH3
41	2	temp, DO TDS, Cl, NO3, PO4, NH3
STORET	1	temp, DO, NH3-N, PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N, NO3, coliform, PO4, Cl
42	?	18 month average: temp, DO, BOD, NO3, PO4, Zn, Secchi disc, coeff. ext.
43	12	6 month average DO
41	14	Zn, Cu, Pb, Cd
NOAA	2	air temp
NOAA	1	*sky cover, dry bulb, wet bulb
NOAA	1	*evaporation and wind
NOAA	1	*solar radiation
47	1	inflow data: temp DO chloride, nitrate coliform TDS, ammonia, PO4
STORET	1	inflow data: coliform, temp, DO, NH3, NO3, PO4, chloride
STORET	1	outflow data: temp DO, NH3, NO2, Cl coliform
USGS	3	daily inflows
USGS	1	daily outflows



* data from nearest station at Spokane.

TABLE 32. DATA AVAILABILITY - COEUR D'ALENE LAKE

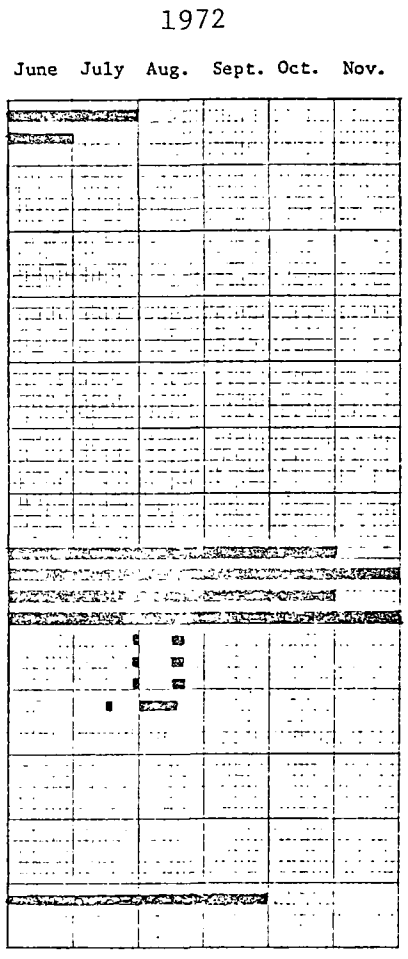
Source	No. of Stations	Type of Data Recorded
USGS	1	water surface elevations
5	1	water surface elevations
43	3	6 month average depth
41	3	temp, DO, TDS, Cl, NO3, PO4, NH3
41	2	temp, DO TDS, Cl, NO3, PO4, NH3
STORET	1	temp, DO, NH3-N, PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N, NO3, coliform, PO4, Cl
42	?	18 month average: temp, DO, BOD, NO3, PO4, Zn, Secchi disc, coeff. ext.
43	12	6 month average DO
41	14	Zn, Cu, Pb, Cd
NOAA	2	air temp
NOAA	1	*sky cover, dry bulb, wet bulb
NOAA	1	*evaporation and wind
NOAA	1	*solar radiation
47	1	inflow data: temp DO chloride, nitrate coliform TDS, ammonia, PO4
STORET	1	inflow data: coliform, temp, DO, NH3, NO3, PO4, chloride
STORET	1	outflow data: temp DO, NH3, NO2, Cl coliform
USGS	3	daily inflows
USGS	1	daily outflows



* data from nearest station at Spokane.

TABLE 33. DATA AVAILABILITY - COEUR D'ALENE LAKE

Source	No. of Stations	Type of Data Recorded
USGS	1	water surface elevations
5	1	water surface elevations
43	3	6 month average depth
41	3	temp, DO, TDS, Cl, NO3, PO4, NH3
41	2	temp, DO, TDS, Cl, NO3, PO4, NH3
STORET	1	temp, DO, NH3-N, PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N PO4, Cl, NO3, coliform
STORET	1	temp, DO, NH3-N, NO3, coliform, PO4, Cl
42	?	18 month average: temp, DO, BOD, NO3, PO4, Zn, Secchi disc, coeff. ext.
43	12	6 month average DO
41	14	Zn, Cu, Pb, Cd
NOAA	2	air temp
NOAA	1	*sky cover, dry bulb, wet bulb
NOAA	1	*evaporation and wind
NOAA	1	*solar radiation
47	1	inflow data: temp DO chloride, nitrate coliform TDS, ammonia, PO4
STORET	1	inflow data: coliform, temp, DO, NH3, NO3, PO4, chloride
STORET	1	outflow data: temp DO, NH3, NO2, Cl coliform
USGS	3	daily inflows
USGS	1	daily outflows



* data from nearest station at Spokane.

Long Lake

From Tables 22 through 26 it was readily seen that 1971 had the most available data. In this year, crucial information, such as inflows and discharges and temperature profiles, was also available. Water quality data spanned the entire period including inflow and outflow quality data. Starting conditions were also very good; 1971 is, therefore, strongly recommended for simulation on Long Lake.

Spokane Arm of F.D. Roosevelt Lake

Nineteen hundred and seventy was the obvious choice for a simulation period on the basis of data availability (see Tables 27 through 29). There was one major deficiency, namely, temperature profiles, of which only two were available in 1971. Starting conditions in 1970 were also poor but better than in any other year. Due to the scarcity of data in any year besides 1970, that year is recommended for simulation; the 1971 temperature profiles could be adapted to help fill this part of the 1970 data requirement.

Coeur d'Alene Lake

The charts of data availability (Tables 30 through 33) showed that there was more data for 1971 than in other years. A comparison with other years further reveals that there is no type of data available in other years that is not available in 1971. Unfortunately, there are no temperature profiles in any of the years.

Summary: Lakes

To summarize the above review, the following years are recommended for model simulation from June through November:

Long Lake: 1971

Spokane Arm of F. D. Roosevelt Lake: 1970

Coeur d'Alene Lake: 1971.

SECTION V

DATA PROCESSING

Processing of data did not require a major effort. For the most part, data were received in a form which was immediately adaptable to the program codes. There were a few cases, however, where data had to be interpreted in order to be useful.

In cases where recording stations were not identified by river mile, specific locations had to be estimated from the information given. On occasion, river widths and elevations had to be determined from large-scale maps where no other physical data was available. Some hydro-thermographs were received from which temperatures and humidity readings had to be extracted.

Raw data readings taken at the USGS Gauging Stations had to be processed in order to determine cross-sectional information, corresponding to particular discharge values. Interpolations were then made to estimate important physical quantities from discharge readings during the low flow periods of interest.

Except for processing identified above and some minor unit conversions, the water quality data generally was provided in readily usable forms. No other significant processing of data was required.

APPENDIX I

consisting of

ATTACHMENT 1: DATA QUESTIONNAIRE

ATTACHMENT 2: REQUEST FOR ALTERNATIVE DATA SOURCES

ATTACHMENT 3: INITIAL LIST OF DATA SOURCES

ATTACHMENT 4: FOLLOW-UP LETTER REQUESTING DATA

APPENDIX I - Continued

ATTACHMENT 1

DATA QUESTIONNAIRE

SYSTEMS CONTROL, INC.
260 SHERIDAN AVENUE
PALO ALTO, CALIFORNIA 94306

TELEPHONE (415)
327-9333

ATTACHMENT 1

Job No. 6984-02

Dear Sir:

RE: SPOKANE RIVER BASIN MODEL PROJECT - DATA SURVEY

The Environmental Protection Agency has appointed Systems Control, Inc. as project contractor (EPA Contract No. 68-01-0756) to adapt three existing general mathematical (computer) models of rivers and reservoirs to the specific characteristics of the Spokane River Basin. The adapted models will be useful in evaluating water quality management strategies, establishing priorities, and scheduling investments in pollution abatement facilities.

The extent to which these models will be uniquely applicable to the Spokane River Basin will depend on the quantity and quality of the data available for their adaptation. The purpose of this letter and attachments is to locate and survey the data available.

All data contributed to the STORET system will be obtained directly from EPA. The data now desired is that which is not entered into that system. Similarly, data available in the USGS Water Supply Records should not be identified as this will be obtained elsewhere.

The area covered by this project is the entire Spokane River Basin. Figure 1 depicts the numerous rivers to be modeled, an important ground water flow, and three lakes (Coeur D'Alene L., Long L., and the Spokane R. arm of Roosevelt L.) included in the study. The months of interest are June through November.

Attachment 1 to this letter lists our data needs under the following four catagories: physical; meteorological/climatic; water quantity; and water quality. On this you are requested to report any appropriate data you have available. Attachment 2 invites you to suggest alternative sources for these data. Even if you are unable to help us in this survey, please return Attachments 1 and 2 so stating.

These data are urgently needed immediately--during the next week or two. Upon receiving your reply, we will at once notify you which data, if any, we would like to obtain.

Thank you for your cooperation.

Sincerely yours,

James Owen

James Owen
Senior Engineer

JO:fw

Attachments (3)

ATTACHMENT 1

Spokane River Basin Model Project
DATA REQUIREMENTS

Name and address of agency responding, with branch, etc.: Officer replying: Phone:	Frequency of Records (daily, monthly)	Years of Record (dates)	Form of Record (mag. tape, reports, punched cards, etc.)	Ease of providing copies?
PHYSICAL data needs: 1. Locations: River mileages to dams, tributaries, outfalls, other inflows, diversions; general areas of non-point waste sources and groundwater accretions.				
2. Reservoirs: sounding maps, cross-sections for lakebed topographies; volume and surface area vs. elevation relations; full pool and dam intake elevations; spillway crest elevations, lengths, positions, types; reservior operating schemes.				
3. Channels (by reach): average depths, widths, areas, mean slopes, average Manning's roughness coefficients.				
METEOROLOGICAL data needs 4. Solar radiation; cloud cover. 5. Air temperature, humidity. 6. Wind speeds and directions. 7. Evaporation rates, coefficients.				

/cont.

ATTACHMENT 1 Cont'd

Attachment 1 cont.	Frequency of Records (daily, monthly)	Years of Record (dates)	Form of Record (mag. tape, reports, punched cards, etc.)	Ease of providing copies?
WATER QUANTITY data needs 8. Streamflows: inflow and outflow rates (other than USGS published Surface Water Records); stage/discharge relations at gaging stations; discharge correlations with depth and mean velocity.				
9. Withdrawals: rates and locations for irrigation, water supply, industry.				
10. Return flows: rates and locations, e.g. for agricultural drains, industry; municipal and other wastewater outfalls; groundwater accretions.				
11. Downstream outlet conditions: weir elevations, coefficients.				
12. Lakes: histories of water surface elevations.				
WATER QUALITY data needs Water quality data will be required for: Total Nitrogen, Chlorides, Heavy metals, ions, Phosphorus, Coliforms, Ammonia, Nitrite, Nitrate, Carbonaceous BOD, Chlorophyll a, Dissolved Oxygen, Temperature 13. Concentrations of the above at various times throughout the system of rivers and lakes (other than EPA STORET data); general areas of non-point sources; past monitoring programs or stream surveys for biological and chemical data.				
14. Concentrations and loading rates or patterns of the above mentioned constituents in all inflows into the system (in tributary flows, effluents, non-point sources, etc.); plant and process data that will enable their estimation when measurements are unavailable; land use and surface runoff data that might enable the estimation of unmeasured non-point waste loads (e.g., from mill tailings).				

/cont.

Attachment 1 cont.	Frequency of Records (daily, monthly)	Years of Record (dates)	Form of Record (mag. tape, reports, punched cards, etc.)	Ease of providing copies?
15. Past analyses of field data to determine degradation rates, reaeration coefficients, and decay coefficients for non-conservative constituents above.				
16. Water temperatures: of rivers, tributaries, effluents; of lake interiors and release waters; depths of short wave extinctions in lakes or solar radiation extinction coefficients; secchi disk measurements in lakes.				

ATTACHMENT 2

REQUEST FOR ALTERNATIVE DATA SOURCES

ATTACHMENT 2

Spokane River Basin Model Project

SUGGESTED ALTERNATIVE DATA SOURCES*

1. Name and address of agency responding with branch, etc.:

2. Officer replying:

3. The following agencies or institutions not listed in the distribution list (Attachment 3) should be able to provide data on some of the 16 items listed in Attachment 1 (stressing those sources less likely to be known):

Agency (address, branch, official)	For Item Nos.

* This form accompanied the initial data questionnaire.

ATTACHMENT 3

INITIAL LIST OF DATA SOURCES

INITIAL LIST OF DATA SOURCES

ATTACHMENT 3

Col. Walter O. Backus
District Engineer
U.S. Army Engineer District
1519 Alaskan Way South
Seattle, Washington 98134

Mr. E. F. Sullivan, Regional Director
U. S. Bureau of Reclamation
Federal Building, U.S. Court House
Box 043
Boise, Idaho 83702

Mr. Dick Appling, Chief
Spokane Office of Mineral Resources
Bureau of Mines
West 222 Mission Ave.
Spokane, Washington 99201

Mr. Mike McMasters
Aquatic Biologist
Environmental Protection Division
Idaho Dept. of Environmental
Protection and Health
1337 G. Street
Lewiston, Idaho 83501

Mr. Maurice A. Vogel
Area Representative
U.S. Forest Service
Room 176
U.S. Court House
Spokane, Washington

Mr. Robert T. Small
Meteorologist In Charge
Room 217, Terminal Bldg.
Spokane International Airport
Spokane, Washington

Mr. Albert L. Martin
Chief of Resource Programs
Bureau of Land Management
Room 551, U.S. Court House
Spokane, Washington

Mr. John Savini
Hydrologist-In-Charge
U.S. Geological Survey
Room 694, U.S. Court House
Spokane, Washington

Mr. Ray T. Sipinen
Area Planning Officer
P.O. Box 2225
U.S. Court House
W. 920 Riverside Avenue
Spokane, Washington 99210

Mr. Charles Chambers
Field Supervisor
Spokane Area Office
Bureau of Sports Fisheries & Wildlife
Room 317, Federal Bldg/U.S. Post Office
Spokane, Washington

State Climatologist for Washington
909 First Avenue
Seattle, Washington

Mr. Richard Wilson
Regional Office
Bureau of Outdoor Recreation
1000 Second Avenue
Seattle, Washington

Mr. Don Reese
Regional Supervisor
Fish and Wildlife Service
P.O. Box 3737
Portland, Oregon 97208

Regional Flood Forecast Center
NOAA
Portland, Oregon

Mr. Tim M. Vaughan, Manager
Environmental Affairs
Washington Water Power Co.
P.O. Box 1445
Spokane, Washington 99210

Dr. Robert D. MacNish
Hydrologist/Geologist
Water Resources Division
U.S. Geological Survey
1305 Tacoma Ave., S.
Tacoma, Washington 98402

Sandat Wassomeh
Bob Bishop
Washington Department of Ecology
P.O. Box 829
Olympia, Washington

Mr. Theodore Sullivan
Washington Department of Game
Olympia, Washington

Mr. Don Corson
U.S. Bureau of Mines
Boise, Idaho

Mr. Guy W. Nutt
State Conservationist
Soil Conservation Service
Room 345
304 North 8th Street
Boise, Idaho 83702

Mr. Calen Bridge
State Conservationist
Soil Conservation Service
W. 920 Riverside Avenue
Spokane, Washington 99201

Mr. Robert F. Vining
Pacific Northwest River Basins
Commission
1 Columbia River
Vancouver, Washington 98660
(206) 694-2581

Mr. Donald L. Winder
State Director
Farmers Home Administration
Room 418, Federal Building
304 N. Eighth Street
Boise, Idaho 83702

Mr. Michael C. Moran
State Director
Farmers Home Administration
127 S. Mission Street
Wenatchee, Washington 98801

Dr. Allen Agnew, Director
Water Research Center
Washington State University
Pullman, Washington 99163

Mr. Wayne T. Haas
Idaho Water Resource Board
Statehouse
Boise, Idaho 83707

Mr. Robert Turner
County Engineer
County of Spokane
N. 811 Jefferson
Spokane, Washington 99201

Dr. George W. Hinman, Director
Environmental Research Center
Washington State University
Pullman, Washington 99163

Mr. John Weber
Bureau of Indian Affairs
P.O. Box 3785
Portland, Oregon 97208

Mr. Roger James
Director of Public Utilities
Room 303 City Hall
Spokane, Washington 99701

Dr. Frank D. Nicol
Director of Environmental Studies
Eastern Washington State College
Cheney, Washington 98019

Mr. Arthur Van't Hul, P.E.
Regional Engineer
Environmental Improvement Div.
Idaho Department of Health
1337 G. Street
Lewiston, Idaho 83501

Mr. Vern Brossard
Soil Conservationist
Soil Conservation Service
Federal Building
St. Maries, Idaho 83861

Mr. T. C. Tollefson, Director
Washington Dept. of Fisheries
115 General Administration Bldg.
Olympia, Washington 98501

Director
Washington Department of Game
600 North Capitol Way
Olympia, Washington 98501

Mr. Emil C. Jensen
Office of Environmental Programs
Washington Dept. of Health
Olympia Airport
Olympia, Washington 98501

Mr. Roger James
Spokane Regional Office
Washington Dept. of Health
West 924 Sinto
Spokane, Washington 99201

Mr. McIntosh
Hydraulics Engineer
Washington Dept. of Highways
Highways-Licenses Bldg.
Olympia, Washington 98501

Mr. Bert L. Cole
Commissioner
Washington Department of Natural Resources
Public Lands Building
Olympia, Washington 98501

Mr. D. Rodney Mack, Planner
Interagency Committee for Outdoor Recreation
4800 Capitol Blvd.
Olympia, Washington 98501

Mr. Allen deLaubenfels
Regional Planner
Planning and Community Affairs Agency
309 Great Western Building
Spokane, Washington 99201

Mr. David W. Peyton
Thermal Power Plant Site Evaluation Council
101 General Administration Bldg.
Olympia, Washington 98501

Mr. Clyde Sacco
District Manager
Utilities & Transportation Commission
110 S. Sheridan
Spokane, Washington 99204

Mr. Marlin Green

City Engineer

Coeur D'Alene, Idaho

Mr. Dennis A. Eschliman
County Engineer
Lincoln County
Davenport, Washington

County Surveyer

Kootenai County

Coeur D'Alene, Idaho

Mr. Paul Heritage
County Engineer

Stevens County

Colville, Washington

Mr. Robert R. Lee
Director
Idaho Water Resources Board
State House
Boise, Idaho 83707

Mr. Doyle Scott
Administrative Officer
Soil Conservation Commission
Capitol Annex #1
Boise, Idaho

Dr. F. D. Koehne,
Medical Director
City-County Health Department
1455 North Orchard
Boise, Idaho

Mr. R. Keith Higginson
Director
Department of Water Administration
614 State Street
Boise, Idaho

Mr. Joseph C. Greenley,
Asst. Director
Fish & Game Department
600 South Walnut Street
Boise, Idaho

Vaughn Anderson, Director
Environmental Improvement Division
Department of Health
650 West State Street
Boise, Idaho

Mr. James Dodds, Chemist
Air Pollution Laboratory
Department of Health
650 West State Street
Boise, Idaho

Mr. Merle Maxwell, Chemist
Air & Stream Pollution Lab
Department of Health
650 West State Street
Boise, Idaho

Dr. Lee Stokes
Chief Aquatic Biologist
Water Pollution Control Section
Department of Health
650 West State Street
Boise, Idaho

ATTACHMENT 4

FOLLOW UP LETTER REQUESTING DATA

ATTACHMENT 4

November 15, 1972

Job 6984-02

Mr. Glenn K. Brackett
U. S. Fish & Wildlife Service
Div. River Basin Studies
317 Federal Bldg.
Spokane, Washington 99201

Dear Sir:

DATA REQUIREMENTS FOR SPOKANE RIVER BASIN MODELING PROJECT

Thank you for returning our recent data survey questionairre on the Spokane River Basin.

We have reviewed these replies and found certain information, which you indicated was available, of particular interest to us. These records are urgently needed so that we may proceed with the Spokane River Basin Modeling Project.

The area covered by this project is the entire Spokane River Basin. Figure 1 depicts the numerous rivers to be modeled, an important ground water flow, and three lakes (Coeur D'Alene L., Long L., and the Spokane R. arm of Roosevelt L.) included in the study.

Please send us at your earliest opportunity a copy of all pertinent data in each of the documents listed on Attachment #1, marking transmittals and any invoices for my attention and with the above job number. We need this information no later than November 27, 1972.

Thank you for your cooperation.

James Owen
Senior Engineer

JH/bec

Attachments

Attachment 1

(as noted in previous letter)

PHYSICAL data needs:				
1. Locations: River mileages to dams, tributaries, outfalls, other inflows, diversions; general areas of non-point waste sources and groundwater accretions.		1991-PRESENT	FILE NOTES	STACY
2. Reservoirs: sounding maps, cross-sections for lakebed topographies; volume and surface area vs. elevation relations; full pool and dam intake elevations; spillway crest elevations, lengths, positions, types; reservior operating schemes.		1960-PRESENT	FILE NOTES RECENTS	"

WATER QUALITY data needs Water quality data will be required for: Total Nitrogen, Coliforms, Carbonaceous BOD Chlorides, Ammonia, Chlorophyll a Heavy metals, ions, Nitrite, Dissolved Oxygen Phosphorus, Nitrate, Temperature 13. Concentrations of the above at various times throughout the system of rivers and lakes (other than EPA STORET data); general areas of non-point sources; past monitoring programs or stream surveys for biological and chemical data.	SINGLE MEASURE MEAT	1992	FILE NOTE	STACY

APPENDIX II

REPRODUCTION OF DATA USED

REPRODUCTION OF DATA USED

Data used in this study comprised a STORET retrieval current as of October, 1972, regular publications of water quantity data by the U.S. Geological Survey, and meteorological data published by NOAA. In addition to these standard data sources which are readily available to planners, a considerable volume of information was acquired from numerous plans, reports, maps, and other miscellaneous sources which contained potentially valuable data. Unlike the standard sources of data which are updated as part of ongoing programs of agencies, many of the materials collected are likely to become increasingly difficult to obtain in future years. This Appendix presents a reproduction and consolidation of salient water quality data from other sources which may be of interest to future planners. The material is reproduced directly from the source publications to avoid any errors of translation. It is presented within the Appendix as a series of Attachments. Number in parentheses following the Attachment number refers to the source as designated in APPENDIX V - Bibliography.

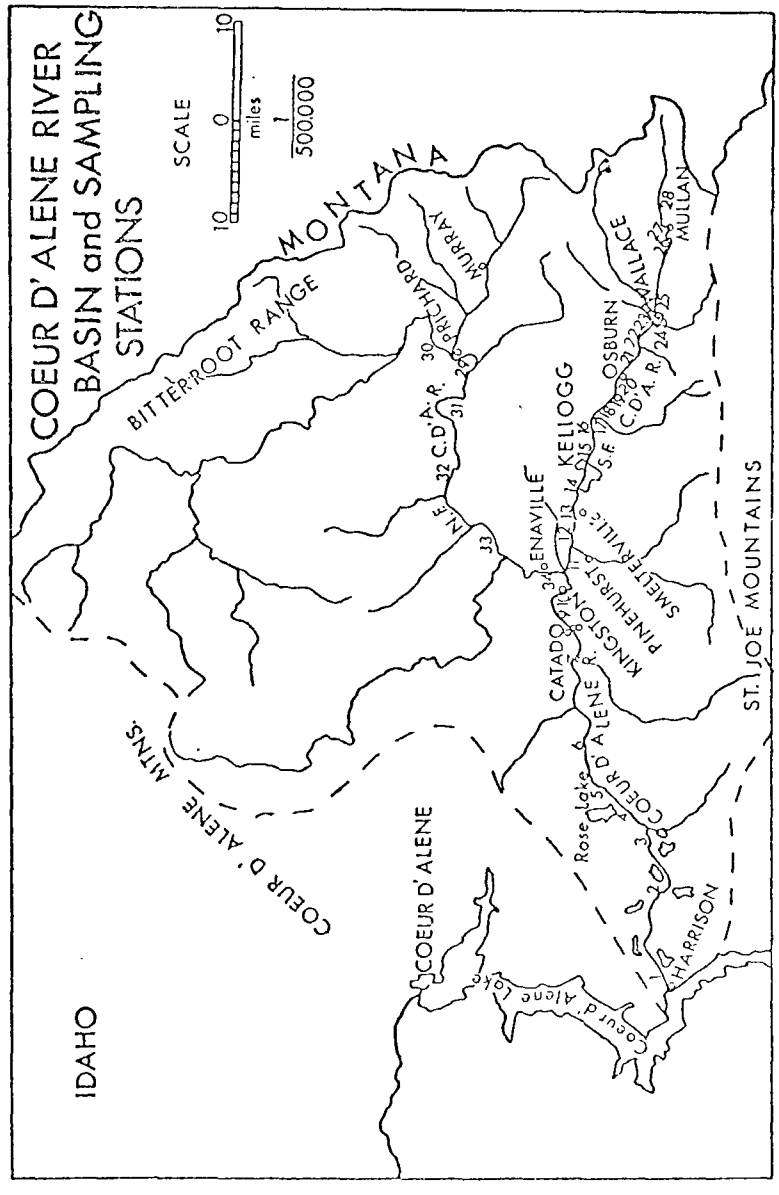


FIGURE 2. MAP OF THE COEUR D'ALENE RIVER BASIN

August 19, 1969

Sample*	Temp.	pH	E.C.	Cl	NO_3	PO_4	D.O.	B.O.D.
1	20.0	7.20	120	0.0	-	-	7.5	1.3
2	19.5	7.25	170	0.0	-	-	7.6	1.0
3	19.5	7.40	180	0.0	-	-	7.5	0.7
4	19.0	7.40	175	0.0	-	-	7.7	1.0
5	19.0	7.50	170	0.0	-	-	7.7	1.3
6	19.0	7.55	170	0.0	-	-	8.2	0.7
7	17.5	7.55	170	0.0	-	-	8.1	1.2
8	16.0	7.60	170	0.0	-	-	7.6	0.9
9	15.5	7.55	175	0.0	-	-	7.5	1.2
10	17.5	7.55	165	0.0	-	-	8.5	1.0
11	21.0	6.90	365	1.0	-	-	8.2	1.7
12	17.0	6.85	450	0.5	-	-	7.6	1.8
13	17.5	6.55	435	3.0	-	-	8.2	4.5
14	16.5	8.80	180	0.0	-	-	7.9	0.9
15	17.0	9.10	170	0.0	-	-	8.2	1.4
16	16.5	8.90	175	0.0	-	-	7.8	1.1
17	16.5	8.90	180	0.0	-	-	7.3	4.2
18	16.0	9.15	295	2.0	-	-	8.3	2.9
19	18.0	9.50	155	0.0	-	-	8.3	6.5
20	18.0	9.60	150	0.0	-	-	8.2	1.7
21	16.0	7.75	160	6.0	-	-	8.9	2.4
22	16.0	8.60	150	0.0	-	-	8.6	3.4
23	17.5	8.10	155	0.0	-	-	7.8	1.7
24	18.5	8.20	120	0.0	-	-	7.9	1.7
25	18.0	8.80	120	0.0	-	-	7.9	1.8
26	15.0	8.50	105	0.0	-	-	7.9	1.9
28	15.5	8.50	84	0.0	-	-	8.1	1.2
29	20.5	8.70	55	0.0	-		8.1	0.9
30	19.0	8.80	60	0.0	-	-	8.2	0.8
31	20.0	8.50	56	0.0	-	-	8.0	1.0
32	17.5	8.40	54	0.0	-	-	8.3	1.0
33	18.5	8.40	53	0.0	-	-	8.1	1.0
34	19.0	8.30	50	0.0	-	-	7.6	0.9

*Samples taken from corresponding stations on map.

August 19, 1969 cont.

Sample	As	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Zn
1	-	11.2	-	-	-	0.2	1.0	3.5	0.5	3.8	-	-	2.6
2	-	11.5	-	-	<0.1	0.2	0.9	3.5	0.5	3.7	-	-	1.8
3	-	14.2	-	-	<0.1	0.2	1.0	3.6	0.5	4.0	-	-	1.7
4	-	12.7	-	-	0.0	0.2	1.0	3.4	0.5	4.0	-	-	1.6
5	-	12.4	-	-	<0.1	0.2	1.0	3.5	0.5	4.2	-	-	1.7
6	-	12.5	-	-	<0.1	0.2	0.9	3.5	0.5	4.1	-	-	1.7
7	-	12.3	-	-	<0.1	0.2	1.0	3.5	0.5	4.1	-	-	1.8
8	-	12.4	-	-	0.0	0.1	1.0	3.4	0.6	4.2	-		2.0
9	-	12.7	-	-	0.0	0.1	0.9	3.4	0.5	4.2	-	-	2.0
10	-	11.7	-	-	0.0	0.1	0.9	3.2	0.5	4.4	-	-	1.9
11	-	27.8	-	-	0.0	0.1	2.2	+4.5	1.7	10.4	-	-	5.1
12	-	31.2	-	-	0.0	0.2	2.5	+4.5	2.0	13.5	-	-	6.8
13	-	29.6	-	-	0.0	0.1	2.4	+4.5	2.0	13.8	-		6.5
14	-	15.0	-	-	0.0	0.1	1.0	3.6	<0.1	7.2	-	-	0.5
15	-	14.6	-	-	0.0	0.2	1.0	3.7	<0.1	7.4	-	-	0.3
16	-	15.7	-	-	0.0	0.1	1.0	3.7	0.0	7.8	-	-	0.3
17	-	15.1	-	-	<0.1	0.2	1.1	3.7	0.0	10.2	-	-	0.2
18	-	15.3	-	-	<0.1	0.2	1.7	3.6	<0.1	-	-	-	0.2
19	-	15.1	-	-	0.1	0.1	1.0	3.7	0.0	3.4	-	-	0.4
20	-	15.0	-	-	<0.1	0.1	0.9	3.6	0.0	3.4	-	-	0.6
21	-	15.1	-	-	<0.1	0.1	1.0	3.7	0.0	3.5	-	-	0.6
22	-	14.3	-	-	<0.1	0.1	0.9	3.7	<0.1	3.6	-	-	0.7
23	-	14.7	-	-	0.0	0.1	0.9	3.6	<0.1	3.4	-	-	0.8
24	-	15.5	-	-	0.0	0.2	0.9	3.9	<0.1	2.9	-	-	1.0
25	-	13.3	-	-	0.0	0.1	0.8	3.1	0.0	2.6	-		1.0
26	-	12.9	-	-	0.0	0.1	0.5	2.6	0.0	1.8	-		<0.1
28	-	9.4	-	-	0.0	0.1	0.4	2.7	0.0	1.5	-	-	<0.1
29	-	5.9	-	-	0.0	0.2	0.4	1.8	0.0	1.4	-	-	<0.1
30	-	6.0	-	-	0.0	0.2	0.4	2.0	0.0	1.4	-	-	<0.1
31	-	5.8	-	-	0.0	0.1	0.4	1.8	<0.1	1.4	-	-	<0.1
32	-	5.7	-	-	0.0	0.1	0.3	1.7	0.0	1.4	-	-	<0.1
33	-	5.4	-	-	<0.1	0.1	0.5	1.7	0.0	1.5	-	-	<0.1
34	-	5.3	-	-	0.0	0.2	0.5	1.6	<0.1	1.5	-		<0.1

September 13, 1969

Sample	Temp.	pH	E.C.	Cl	NO_3	PO_4	D.O.	B.O.D.
1	17.5	5.75	36	1.5	0.00	0.06	-	-
2	16.5	5.95	93	0.0	0.24	0.51	9.0	1.6
3	16.5	6.00	103	0.0	0.00	0.06	9.5	1.6
4	16.0	6.01	72	0.0	0.00	0.02	-	-
5	16.5	6.01	76	0.0	0.24	0.45	9.3	1.4
6	16.5	6.15	88	0.0	0.00	0.00	9.0	1.3
7	17.0	6.15	94	0.0	0.00	0.06	8.6	0.7
8	15.5	6.20	97	0.0	0.00	0.00	9.0	1.1
9	15.0	6.20	113	0.0	0.00	0.00	9.0	1.6
10	15.0	6.20	101	0.0	0.00	0.16	9.2	1.2
11	10.0	6.15	181	0.0	0.24	1.14	8.6	1.1
12	11.0	6.15	111	2.0	1.16	0.74	8.6	1.8
13	11.0	6.20	220	0.0	0.24	0.79	8.8	1.4
14	8.5	6.35	92	0.0	0.00	0.56	9.3	1.3
15	8.5	6.65	79	0.5	0.24	0.12	10.2	1.8
16	8.5	6.70	89	0.0	0.00	0.00	9.5	1.5
17	9.0	6.80	100	0.0	0.24	0.00	9.1	1.4
18	9.5	6.95	200	1.0	0.00	0.16	2.5	>2.5
19	8.5	6.95	85	0.5	0.24	0.00	10.7	2.1
20	8.5	6.95	85	0.5	0.24	0.08	10.3	1.6
21	9.0	6.90	68	1.0	0.44	0.22	10.3	1.7
22	8.5	6.90	57	0.0	0.86	0.12	10.0	1.3
23	8.5	6.90	94	0.0	0.00	0.12	10.0	1.7
24	8.0	6.95	82	0.0	0.58	0.06	9.8	1.3
25	8.0	7.00	68	0.0	0.58	0.00	9.8	1.5
26	8.0	7.00	72	0.0	0.58	0.16	9.5	1.6
28	8.0	7.10	69	0.0	0.00	0.08	9.6	1.0
29	13.5	7.15	32	0.0	0.00	0.00	9.0	0.9
30	13.5	7.15	31	0.0	0.24	0.06	9.1	1.0
31	13.5	7.15	27	0.0	0.00	0.00	8.9	1.0
32	13.5	7.20	32	0.0	0.00	0.00	9.3	1.7
33	14.0	7.20	34	0.0	0.00	0.02	8.8	0.5
34	14.0	7.20	29	0.0	0.00	0.06	8.8	0.6

September 13, 1969 cont.

Sample	As	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	Zn
1	-	2.4	-	-	<0.1	<0.1	0.3	1.4	0.8	1.1	-	<0.1	2.6
2	-	10.7	-	-	<0.1	0.2	1.2	5.0	1.6	4.7	-	<0.1	4.1
3	-	9.4	-	-	<0.1	<0.1	1.1	4.5	1.4	4.4	-	<0.1	3.5
4	-	8.0	-	-	<0.1	<0.1	0.9	4.0	1.0	3.8	-	<0.1	2.7
5	-	7.7	-	-	<0.1	<0.1	0.9	3.7	1.3	3.6	-	<0.1	3.0
6	-	10.1	-	-	<0.1	0.1	1.2	4.6	1.5	4.5	-	<0.1	3.5
7	-	10.1	-	-	<0.1	<0.1	1.3	4.8	1.9	4.7	-	<0.1	4.8
8	-	10.7	-	-	<0.1	<0.1	1.3	5.2	2.1	5.3	-	<0.1	5.3
9	-	10.7	-	-	<0.1	0.2	1.3	5.2	2.1	5.3	-	<0.1	5.3
10	-	8.0	-	-	<0.1	<0.1	1.0	4.2	1.9	4.0	-	<0.1	4.7
11	-	30.0	-	-	<0.1	0.4	2.9	10.5	5.7	12.2	-	<0.1	15.0
12	-	12.8	-	-	<0.1	0.2	0.9	4.5	3.4	4.4	-	<0.1	7.3
13	-	28.0	-	-	<0.1	0.2	2.9	10.2	6.2	12.2	-	<0.1	21.0
14	-	11.9	-	-	<0.1	<0.1	1.5	5.1	0.2	8.5	-	<0.1	2.0
15	-	11.5	-	-	<0.1	<0.1	1.2	4.7	0.2	7.8	-	<0.1	2.1
16	-	10.1	-	-	<0.1	<0.1	1.4	5.0	0.1	8.5	-	<0.1	1.1
17	-	11.5	-	-	<0.1	<0.1	1.4	4.9	0.2	10.7	-	<0.1	1.0
18	-	11.6	-	-	<0.1	<0.1	2.0	4.7	0.6	55.0	-	<0.1	0.9
91	-	12.5	-	-	<0.1	<0.1	1.1	5.2	0.2	3.2	-	<0.1	1.7
20	-	12.5	-	-	<0.1	<0.1	1.1	5.2	0.2	3.3	-	<0.1	1.5
21	-	10.8	-	-	<0.1	0.1	0.8	4.2	0.2	2.7	-	<0.1	1.3
22	-	5.8	-	-	<0.1	<0.1	0.6	2.8	0.1	1.6		<0.1	2.4
23	-	11.8	-	-	<0.1	<0.1	1.1	5.2	0.2	3.3	-	<0.1	2.8
24	-	10.1	-	-	<0.1	<0.1	0.9	4.5	0.2	2.7	-	<0.1	2.7
25	-	11.2	-	-	<0.1	0.1	0.9	4.5	<0.1	3.1	-	<0.1	0.3
26	-	9.1	-	-	<0.1	<0.1	1.1	4.4	<0.1	3.8	-	<0.1	0.2
28	-	6.6	-	-	<0.1	<0.1	0.4	3.4	<0.1	1.3		<0.1	<0.1
29	-	3.8	-	-	<0.1	<0.1	0.4	2.4	<0.1	1.5	-	<0.1	<0.1
30	-	4.1	-	-	<0.1	<0.1	0.4	2.6	<0.1	1.3	-	<0.1	<0.1
31	-	3.9	-	-	<0.1	0.1	0.4	2.0	<0.1	1.3	-	<0.1	<0.1
32	-	3.6	-	-	<0.1	<0.1	0.4	2.1	<0.1	1.5	-	<0.1	<0.1
33	-	3.5	-	-	<0.1	<0.1	0.4	2.2	<0.1	1.5	-	<0.1	<0.1
34	-	3.4	-	-	<0.1	<0.1	0.5	2.0	<0.1	1.6	-	<0.1	<0.1

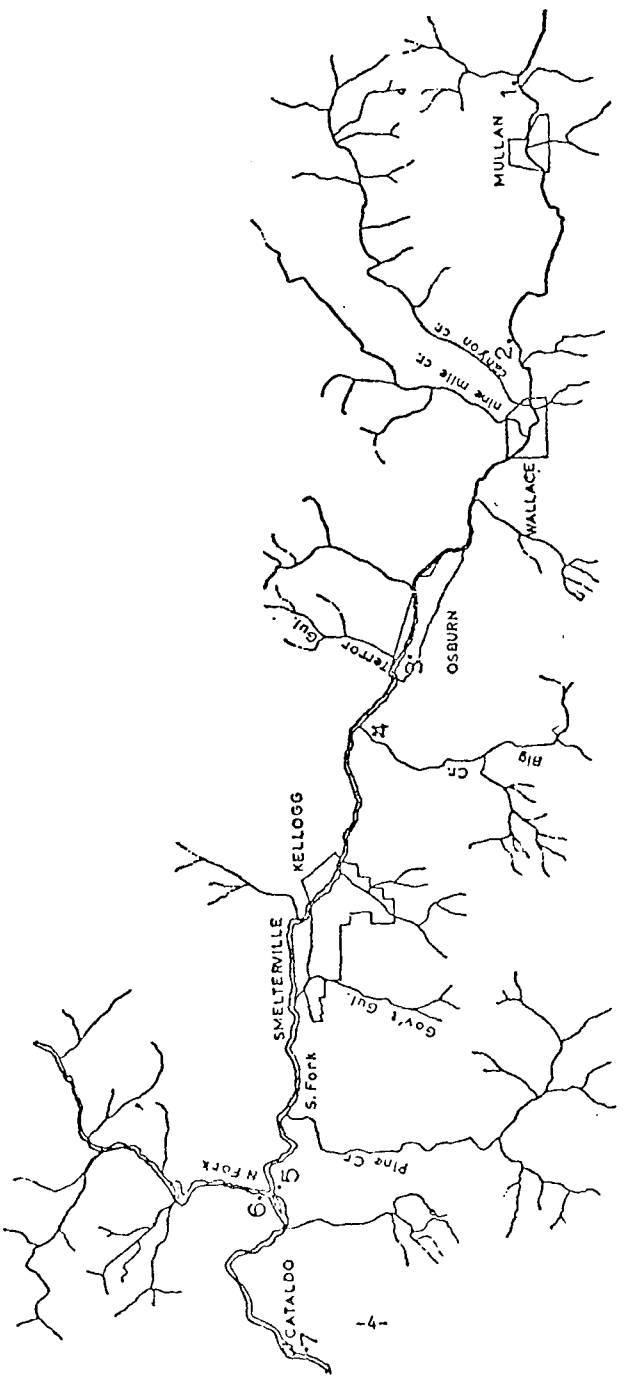


FIGURE 2

BIOLOGICAL SAMPLING STATIONS - CD'A RIVER SYSTEM

TABLE I
PHYSICAL AND CHEMICAL FACTORS[1] - COEUR D'ALENE RIVER SYSTEM

Sta.	Date	°C	pH	DO	TS[2]	TDS[3]	Alk[4]	Hard-ness	Ca	Mg	Fe	Mn	Na	Cl	SO_4	NO_3	PO_4	F	NH_3
1	8-19-70	10.0	7.3	9.4	96	79	56	56	6	10	0.01	0.02	1	7	3	0.9	0.03	0.01	0.3
	12-16-70	--	7.4	--	88	65	40	36	8	4	0.02	0.03	1	2	2	0.4	0.01	0.01	0.01
	3-16-71	2.0	7.5	12.4	140	138	52	124	16	20	*	0.05	1	9	3	0.1	0.17	*	0.1
	7-12-71	11.0	7.3	10.2	66	48	36	24	5	3	*	*	1	8	1	0.1	0.07	*	< 0.1
2	5-26-70	--	7.6	--	84	70	44	48	6	6	0.34	0.10	1	2	4	0.4	0.02	0.01	0.40
	8-19-70	14.0	8.0	9.4	116	101	56	76	13	11	0.04	0.04	2	7	5	1.1	0.17	0.01	0.3
	12-16-70	--	7.4	--	100	62	48	48	14	3	0.18	0.12	3	2	6	0.7	0.12	0.01	0.12
	3-16-71	3.0	7.5	11.6	104	105	64	84	21	8	0.17	0.09	2	11	6	0.3	0.20	*	< 0.1
	7-12-71	12.0	7.4	10.2	88	52	40	32	10	2	0.27	0.02	2	8	1	< 0.1	0.07	*	< 0.1
3	5-26-70	9.0	7.5	--	88	75	36	40	10	8	0.41	0.18	1	4	4	0.5	0.30	0.01	0.5
	8-19-70	18.2	8.3	10.6	152	118	60	72	14	9	0.10	0.06	4	7	19	1.6	0.41	0.02	0.4
	12-16-70	3.0	7.2	11.2	120	102	48	48	16	2	0.08	0.11	3	2	24	2.0	0.15	0.01	0.1
	3-16-71	4.0	7.2	11.0	132	132	52	88	21	9	*	0.11	3	9	22	3.1	0.26	*	*
	7-14-71	13.0	7.2	10.6	104	58	36	44	14	2	0.06	0.06	3	2	5	0.2	0.06	*	0.1
4	5-27-70	7.5	7.4	--	76	68	44	36	5	6	0.18	0.03	3	6	4	0.3	0.12	0.01	0.4
	8-19-70	18.2	7.2	6.7	222	174	44	156	11	7	0.08	0.12	21	7	51	1.2	1.04	0.06	0.6
	12-16-70	--	6.4	--	144	128	44	32	10	2	0.24	0.63	4	22	49	1.1	0.16	0.01	0.36
	3-16-71	5.4	9.3	10.4	236	232	40	92	13	14	0.68	0.05	27	11	90	3.9	0.50	*	3.0
	7-14-71	--	8.8	--	176	152	28	56	10	8	0.05	0.04	38	6	36	6.7	0.28	*	< 0.1
5	5-27-70	--	7.1	--	92	80	32	44	10	4	1.34	0.68	1	4	9	0.5	0.07	0.01	0.40
	8-19-70	20.4	7.1	10.2	440	371	20	120	27	13	0.84	4.85	9	7	180	1.3	0.27	1.02	0.60
	12-16-70	--	6.5	--	240	215	24	80	24	5	0.36	1.18	15	4	90	1.6	1.60	0.45	0.28
	3-16-71	4.0	6.3	10.8	356	358	28	180	42	18	1.21	2.19	5	7	125	1.9	20.00	1.44	0.20
	7-14-71	17.1	6.9	10.4	176	164	28	88	18	11	0.24	1.06	6	6	50	0.2	0.08	*	0.1
6	8-19-70	18.0	7.7	9.1	88	74	36	56	11	7	0.01	0.01	1	10	2	0.7	0.06	0.01	0.30
	12-16-70	--	7.1	--	84	73	28	40	6	6	0.27	0.69	4	4	3	0.4	0.02	0.01	0.02
	3-16-71	2.0	7.0	11.8	100	90	36	72	8	13	*	0.19	1	7	6	0.4	0.22	*	< 0.1
	7-14-71	16.0	7.4	9.6	72	56	36	44	6	7	*	0.01	1	4	2	< 0.1	0.08	*	< 0.1

TABLE I cont'd.
PHYSICAL AND CHEMICAL FACTORS[1] - COEUR D'ALENE RIVER SYSTEM

Sta	Date	°C	pH	DO	TS[2]	TDS[3]	Alk[4]	Hardness	Ca	Mg	Fe	Mn	Na	Cl	SO_4	NO_3	PO_4	P	NH_3
7	8-20-70	16.6	6.9	8.4	204	162	32	68	16	7	0.25	1.66	4	10	50	0.9	0.10	0.42	0.40
	12-16-70	—	6.9	—	108	94	28	44	11	4	0.45	0.57	3	2	20	0.6	0.48	0.01	0.24
	3-16-71	2.0	6.7	11.0	180	188	28	116	26	13	0.29	0.57	2	7	52	1.6	1.68	0.83	0.20
	7-14-71	16.2	7.0	11.2	112	88	32	64	10	10	0.05	0.35	2	6	11	0.1	0.07	0.01	< 0.10
8	5-27-70	--	7.4	--	80	72	32	36	6	5	0.31	0.05	1	4	4	0.5	0.02	0.01	0.40
	8-20-70	23.2	7.4	8.6	96	84	32	60	6	11	0.01	0.01	1	10	4	1.1	0.05	0.01	0.30
	12-15-70	4.5	7.1	10.6	88	73	24	48	8	7	1.18	0.50	3	2	5	0.6	0.05	0.01	0.10
	3-15-71	2.5	7.0	13.6	112	106	36	84	14	12	0.03	0.23	2	7	8	0.5	0.16	*	0.20
	7-13-71	17.8	7.3	9.8	68	48	28	36	10	3	0.01	0.01	1	6	1	0.1	0.07	*	*

1 - All results are reported in parts per million
2 - Total solids
3 - Total dissolved solids
4 - Alkalinity
* - Element less than 0.01 ppm

TABLE III
HEAVY METALS CONCENTRATIONS
Coeur d'Alene River System

Station	Date	Zn	Cu	Pb	Cd
		ppm			
1	5-26-70	*	0.010	*	*
	8-19-70	**	**	*	0.016
	12-16-70	0.116	**	*	**
	3-16-71	**	*	*	**
	7-12-71	0.009	**	*	**
2	5-26-70	0.040	0.010	0.03	*
	8-19-70	0.158	**	*	**
	12-16-70	0.414	**	*	**
	3-16-71	0.205	*	*	**
	7-12-71	0.059	**	*	**
3	5-26-70	0.080	0.010	0.07	*
	8-19-70	0.276	**	*	**
	12-16-70	0.566	**	*	**
	3-16-71	0.388	*	*	**
	7-12-71	0.085	**	*	**
4	5-26-70	1.190	*	2.24	0.010
	8-19-70	3.134	**	0.09	0.008
	12-16-70	4.110	**	*	0.022
	3-16-71	5.640	*	*	**
	7-12-71	1.918	**	*	**
5	5-26-70	1.980	0.840	0.28	0.010
	8-19-70	0.600	0.349	0.13	0.035
	12-16-70	0.633	1.421	*	**
	3-16-71	8.701	0.230	0.12	**
	7-12-71	6.125	0.261	0.28	0.039
6	5-26-70	2.410	0.010	0.98	0.030
	8-19-70	6.940	**	*	0.089
	12-16-70	16.410	**	0.17	0.100
	3-16-71	6.910	0.030	*	0.011
	7-12-71	2.459	**	0.12	0.015
7	5-26-70	2.580	0.010	1.23	*
	8-19-70	7.800	**	0.14	0.057
	12-16-70	15.750	**	0.18	0.063
	3-16-71	5.004	*	0.03	0.024
	7-12-71	2.350	**	0.01	0.009
8	5-26-70	*	*	*	*
	8-19-70	0.020	0.014	*	**
	12-16-70	0.117	**	*	**
	3-16-71	9.051	*	*	**
	7-12-71	0.027	0.010	*	**

TABLE III cont'd.
HEAVY METALS CONCENTRATIONS
Coeur d'Alene River System

Station	Date	Zn	Zn	Cu	Cd
		ppm			
9	5-26-70	*	*	*	*
	12-16-70	0.009	**	*	0.008
	3-16-71	**	*	*	**
	7-12-71	0.019	**	*	**
10	5-26-70	0.950	0.010	0.79	*
	8-19-70	1.733	**	*	0.017
	12-16-70	3.242	**	*	0.012
	3-16-71	2.922	*	0.02	0.009
	7-12-71	0.937	**	*	**
11	5-26-70	*	*	*	*
	8-19-70	**	**	*	**
	12-16-70	0.020	**	*	**
	3-16-71	**	*	*	**
	7-12-71	**	**	*	**
12	8-19-70	**	**	*	**
	12-16-70	0.013	**	*	**
	3-16-71	**	*	*	**
	7-12-71	**	*	*	**
13	5-26-70	0.260	0.020	0.28	*
	12-16-70	0.203	**	*	**
	3-16-71	**	*	*	**
	7-12-71	0.008	**	*	0.008
14	12-16-70	52.100	0.017	7.67	2.744
	3-16-71	107.300	0.120	7.57	3.102
	7-12-71	312.000	0.133	9.08	3.586
14A	5-26-70	168.800	0.040	2.31	1.050
	8-19-70	309.400	0.333	8.78	2.960
	12-16-70	122.900	0.216	3.68	1.605
	3-16-71	183.100	0.120	3.45	1.386
	7-12-71	967.000	0.240	6.55	1.966
14B	12-16-70	1.730	**	*	0.047
	3-16-71	**	*	*	**
	7-12-71	0.036	**	*	**
15	5-26-70	0.880	*	0.68	0.010
	8-19-70	1.685	**	0.08	**
	12-16-70	2.440	**	0.03	0.003
	7-12-71	0.996	**	*	0.014
16	5-26-70	2.550	0.010	0.87	0.020
	8-19-70	16.125	**	0.13	0.212
	12-16-70	9.820	**	0.83	0.252

TABLE III cont'd.
HEAVY METALS CONCENTRATIONS
Coeur d'Alene River System

Station	Date	Zn	Cu	Pb	Cd
		ppm			
16	3-16-71	11.490	*	3.70	0.240
(cont'd.)	7-12-71	12.780	**	0.07	0.480
17	5-26-70	1.650	0.020	0.70	0.010
	8-19-70	22.720	0.011	0.92	0.201
	12-16-70	7.160	**	0.04	0.284
	3-16-71	5.293	*	1.01	0.075
	7-12-71	8.072	**	*	0.366
18	5-26-70	*	*	*	0.010
	8-19-70	**	**	*	0.006
	12-16-70	0.002	**	*	**
	3-16-71	**	*	*	**
	7-12-71	0.086	**	*	0.002
19	8-19-70	3.940	**	0.18	0.023
	12-16-70	1.897	**	*	0.018
	3-16-71	2.196	*	*	0.018
	7-12-71	1.941	**	*	0.020
20	5-26-70	0.600	0.010	0.06	0.060
	8-19-70	3.210	**	0.18	0.021
	12-16-70	1.870	**	*	**
	3-16-71	1.589	*	*	0.025
	7-12-71	1.617	**	*	0.018
21	8-19-70	0.100	**	*	**
	3-16-71	0.423	*	0.12	**
22	5-26-70	0.230	*	*	*
	8-19-70	0.014	**	0.06	**
	12-16-70	0.403	**	*	**
	3-16-71	0.388	*	*	**
	7-12-71	0.228	**	*	**

* - less than .01 ppm

** - less than .001 ppm

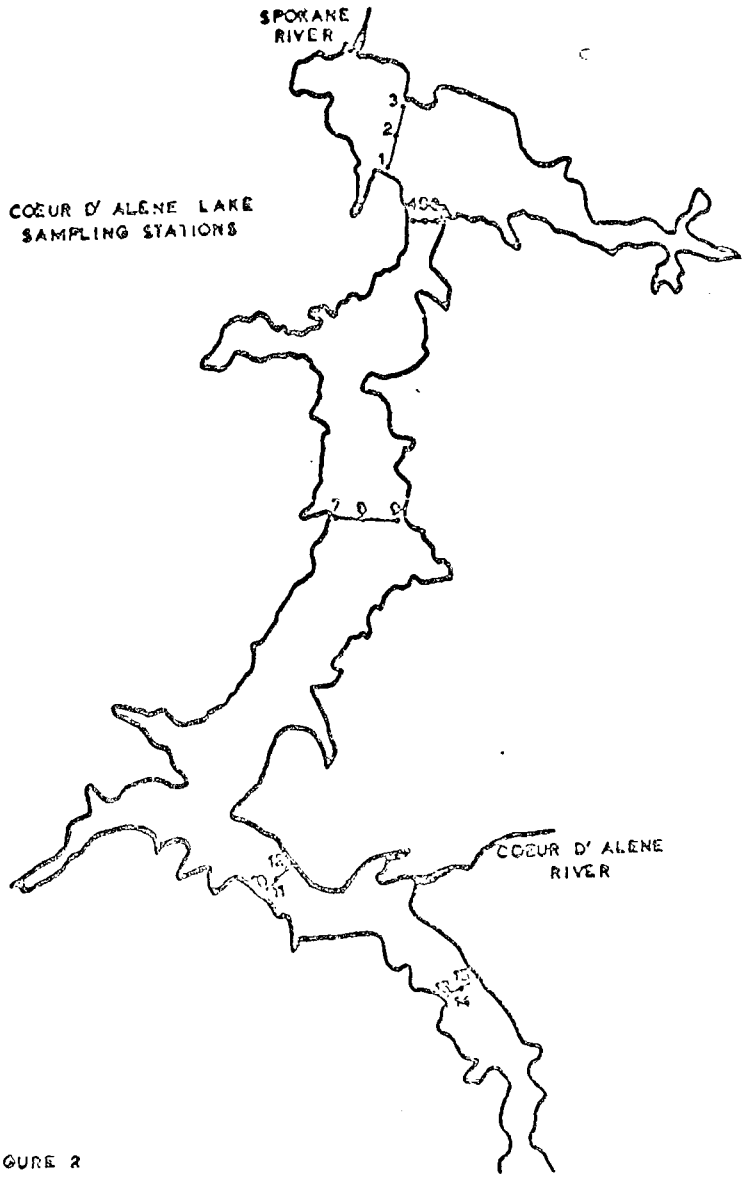

SPOKANE RIVER
3
2
1
COEUR D' ALENE LAKE SAMPLING STATIONS
COEUR D' ALENE RIVER

FIGURE 2

TABLE II
PHYSICAL AND CHEMICAL FACTORS[1] - COEUR D'ALENE LAKE

Sta.	Date	°C	pH	DO	TS[2]	TDS[3]	Alk[4]	Hardness	Ca	Mg	Fe	Mn	Na	Cl	SO_4	NO_3	PO_4	F	NH_3
2	9-11-69	--	7.5	--	160	132	32	72	11	11	0.19	0.01	1	19	3	0.9	0.01	0.01	0.42
	8-21-70	20.0	7.5	8.7	80	64	32	48	5	9	0.04	0.01	1	3	3	1.0	0.04	0.01	0.30
	12-15-70	--	6.8	--	87	59	32	40	10	4	0.14	0.07	2	3	6	0.3	0.03	0.01	0.06
	7-14-71	18.5	7.5	10.2	104	96	32	80	5	16	0.02	0.03	1	8	2	0.1	0.07	*	0.10
5	8-21-70	--	7.5	--	84	71	32	56	5	11	0.03	0.01	1	7	3	1.0	0.14	0.01	0.30
	12-15-70	--	6.9	--	80	58	28	40	10	4	0.01	0.04	2	2	5	0.4	0.01	0.01	0.10
	7-14-71	19.0	7.5	10.2	76	68	28	56	5	11	0.06	0.02	1	8	2	0.1	0.08	*	0.10
8	9-11-69	--	7.5	--	164	140	24	84	18	10	0.24	0.02	2	29	4	0.9	0.01	0.01	0.42
	8-21-70	20.2	7.6	9.3	96	82	24	56	5	11	0.09	0.01	1	13	4	1.0	0.09	0.01	0.30
	12-15-70	--	6.9	--	76	59	32	40	10	4	0.03	0.05	2	2	6	0.8	0.01	0.01	0.10
	7-14-71	19.5	7.3	10.0	84	76	32	60	8	10	0.03	0.02	1	8	2	0.1	0.07	*	0.10
11	9-11-69	--	7.6	--	160	128	32	80	14	11	0.03	0.06	1	25	5	0.5	0.01	0.01	0.56
	8-21-70	--	7.5	--	88	78	28	60	8	10	0.08	0.05	1	7	3	0.9	0.09	0.01	0.30
	12-15-70	--	7.0	--	76	61	28	28	8	2	0.13	0.14	2	2	6	0.6	0.06	0.06	0.10
	7-14-71	17.0	7.3	9.8	84	74	32	56	5	11	0.07	0.02	1	8	2	0.1	0.08	*	0.10
14	8-21-70	19.8	7.3	8.4	84	71	28	56	6	10	0.08	0.03	1	7	3	1.1	0.04	0.01	0.30
	12-15-70	--	6.9	--	80	61	28	32	8	3	0.07	0.11	2	2	5	0.7	0.04	0.01	0.04
	7-14-71	19.0	7.3	9.5	76	66	32	52	6	9	0.04	0.01	1	8	2	0.1	0.07	*	0.10

[1] - All results are reported in parts per million
[2] - Total solids
[3] - Total dissolved solids
[4] - Alkalinity
* - Indicates element was less than 0.01 ppm

TABLE IV
HEAVY METALS CONCENTRATIONS
Coeur d'Alene Lake

Station	Date	Zn	Cu	Pb	Cd
		ppm			
1	5-29-70	0.230	*	*	*
	8-21-70	0.181	0.007	*	0.016
	12-15-70	0.412	**	*	**
2	5-29-70	0.230	*	*	*
	8-21-70	0.164	**	*	*
	12-15-70	0.387	**	*	**
	7-13-71	0.153	**	*	**
2A	5-29-70	0.250	0.020	0.07	*
	8-21-70	0.169	**	*	0.002
2B	12-15-70	0.387	**	*	**
2C	7-13-71	0.300	**	*	**
3	5-29-70	0.190	*	0.03	*
	8-21-70	0.114	**	*	**
	12-15-70	0.522	**	*	**
4	5-29-70	0.260	*	*	*
	8-21-70	0.120	**	*	**
	12-15-70	0.512	**	*	**
5	5-29-70	0.190	*	*	*
	8-21-70	0.159	**	*	**
	12-15-70	0.525	**	*	**
	7-13-71	0.187	**	*	**
5A	5-29-70	0.190	0.020	*	*
	8-21-70	0.190	**	*	**
5B	7-13-71	0.237	**	*	**
5C	12-15-70	0.583	**	*	**
	7-13-71	0.281	**	*	**
6	5-29-70	0.180	0.020	*	*
	8-21-70	0.179	**	*	**
	12-15-70	0.512	**	*	**
7	5-29-70	0.270	*	*	*
	8-21-70	0.271	**	*	**
	12-15-70	0.566	**	*	**

TABLE IV cont'd.
HEAVY METALS CONCENTRATIONS
Coeur d'Alene Lake

Station	Date	Zn	Cu	Pb	Cd
		ppm			
8	5-29-70	0.180	*	*	*
	8-21-70	0.252	**	*	0.007
	12-15-70	0.616	**	*	**
	7-13-71	0.221	**	*	**
8A	5-29-70	0.190	*	*	*
	8-21-70	0.243	**	*	**
8B	8-21-70	0.475	*	*	**
	7-13-71	0.248	**	*	**
8C	12-15-70	0.556	**	*	**
	7-13-71	0.380	**	*	**
9	5-29-70	0.170	*	*	*
	8-21-70	0.213	**	*	**
	12-15-70	0.560	**	0.04	**
10	5-29-70	0.090	*	*	*
	8-21-70	0.548	**	*	**
	12-15-70	0.739	**	*	**
11	5-29-70	0.070	0.030	*	*
	8-21-70	0.687	**	*	0.007
	12-15-70	0.733	**	*	0.004
	7-13-71	0.306	**	*	**
11A	5-29-70	0.220	*	*	*
	8-21-70	0.492	**	*	**
	7-13-71	0.287	**	*	**
11B	12-15-70	0.872	**	*	0.002
	7-13-71	0.213	**	*	**
12	5-29-70	0.170	*	*	*
	8-21-70	0.809	**	*	0.017
	12-15-70	0.316	**	*	0.005
13	5-29-70	*	*	*	*
	8-21-70	0.330	0.006	*	**
	12-15-70	0.741	**	*	**
14	5-29-70	*	*	*	*
	8-21-70	0.237	**	*	0.005
	12-15-70	0.670	**	*	**
	7-13-71	0.129	**	*	**

TABLE IV cont'd.
HEAVY METALS CONCENTRATIONS
Coeur d'Alene Lake

Station	Date	Zn	Cu	Pb	Cd
		ppm			
14B	12-15-70	0.916	**	*	**
	7-13-71	0.192	**	*	**
14C	7-13-71	0.296	**	*	**
15	5-29-70	*	*	0.02	*
	8-21-70	0.262	**	*	**
	12-15-70	0.383	**	*	**

A. Sample from 20 feet
B. Sample from 50 feet
C. Sample from 100 feet

* Less than 0.01
** Less than 0.001

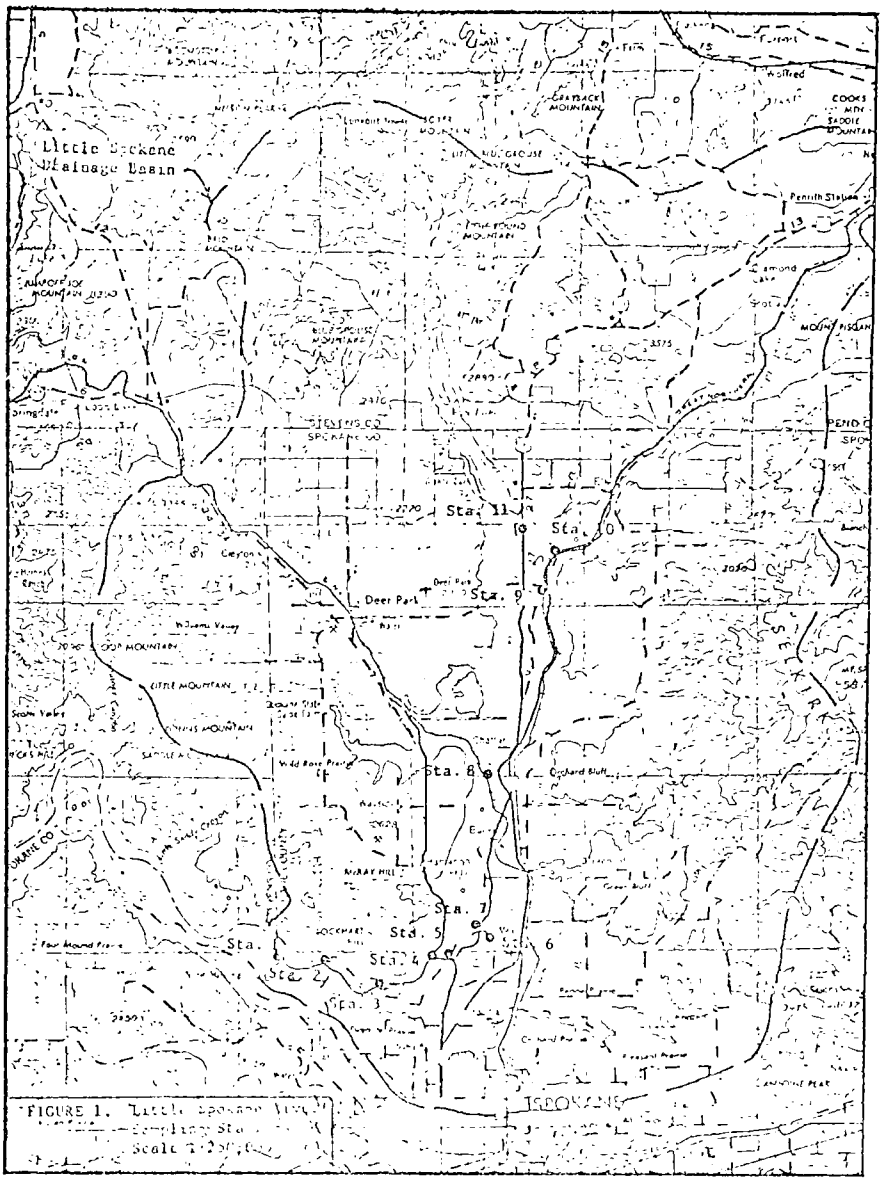


FIGURE 1. Little Spokane River
Compilation Sta
Scale 1:

Table III. Laboratory and field results for Little Spokane River Study - February through September, 1968

Constituent	Date (1968)	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11
Biochemical	2/13	1.5	1.8	1.3	1.9	1.6	1.7	1.5	2.8	2.2	1.8	2.5
Oxygen	3/5	0.7	0.8	0.8	1.1	0.9	0.7	1.2	1.2	1.3	1.0	1.1
Demand	5/14	0.8	0.9	0.2	1.3	0.9	1.2	1.0	2.6	1.2	1.0	1.7
(mg/l)	8/20	0.4	0.7	0.6	0.6	0.6	0.5	0.9	0.7	0.7	0.6	0.8
Chemical	2/13	6.4	3.2	4.8	7.2	7.2	1.0	8.0	22.4	1.5	4.0	7.2
Oxygen	5/14	10.2	6.4	9.0	11.5	14.1	9.0	12.8	21.1	9.0	10.2	11.5
Demand	6/4	5.6	5.6	5.6	6.4	11.2	11.2	8.0	16.0	9.6	5.6	14.4
(mg/l)	8/20	4.6	5.6	1.9	4.9	8.0	0.5	7.8	11.0	6.1	5.6	16.6
Dissolved	2/13	10.5	10.4	10.3	12.2	12.1	9.8	12.5	12.4	12.8	12.2	11.7
Oxygen	3/5	10.5	9.4	9.6	10.7	10.4	10.0	10.6	10.6	10.8	10.8	10.8
(mg/l)	5/14	8.1	8.3	8.4	9.9	9.9	9.8	9.4	10.8	10.1	9.8	9.7
	6/4	8.1	8.3	8.4	9.6	9.6	9.9	9.0	8.8	9.1	9.1	8.8
	8/20	9.8	8.7	8.6	9.9	9.4	9.7	9.9	9.7	10.4	9.7	9.3
	9/10	8.6	8.6	8.2	9.8	9.6	9.5	9.4	9.8	10.6	9.8	9.7
% Saturation	2/13	91	91	90	101	100	100	101	97	103	98	97
of Dissolved	3/5	96	85	86	94	91	93	93	93	93	95	93
Oxygen	5/14	83	85	86	104	104	107	99	113	105	100	104
	6/4	83	85	87	105	106	109	106	102	105	102	106
	8/20	99	89	84	105	101	111	106	104	114	105	106
	9/10	87	87	83	105	103	110	100	104	117	106	117
Temperature	2/13	5.5	6.0	6.0	4.0	4.0	12.6	3.0	2.0	3.0	3.0	4.0
(°C)	3/5	7.4	7.4	7.2	6.2	6.2	8.6	6.0	6.0	5.4	6.0	5.0
	5/14	12.5	12.5	12.9	14.0	14.0	16.0	14.0	14.0	12.9	12.5	15.0
	6/4	12.4	12.2	13.7	16.2	16.6	16.7	20.0	18.4	18.4	17.2	21.1
	8/20	12.3	12.5	12.9	15.0	14.9	18.0	14.9	15.1	16.0	15.2	18.0
	9/10	12.0	12.0	12.2	15.0	15.0	19.0	14.5	14.5	16.5	15.5	21.2
Flow	2/13					264						
(cfs)	3/5					473						
	5/14	445	442	422		203	34	161	32	124	61	55
	6/4					183						
	8/20					130						
	9/10	369	376	304		124	13	98	14	49	36	13

Table III. Laboratory and field results for Little Spokane River Study - (continued)

Constituent	Date (1968)	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11
Alkalinity $CaCO_3$ (mg/l)	2/13	90	87	87	64	64	89	58	69	36	64	23
	3/5	100	100	94	78	80	72	74	94	64	94	44
	5/14	114	107	106	96	98	86	101	144	75	100	44
	6/4	109	107	108	99	100	96	97	138	72	88	41
	8/20	114	116	115	116	117	120	115	144	87	94	44
	9/10	116	114	113	112	112	127	117	143	81	92	42
Hardness $CaCO_3$ (mg/l)	2/13	114	114	114	98	98	138	90	106	64	88	42
	3/5	120	104	100	77	82	74	75	87	58	82	52
	5/14	82	110	90	78	74	60	88	110	36	56	34
	6/4	108	104	104	90	92	98	86	124	58	84	24
	8/20	130	120	130	120	120	130	110	140	86	88	32
	9/10	126	128	124	120	118	150	108	144	80	88	40
pH	2/13	8.1	8.2	8.0	8.2	8.1	8.3	8.2	8.1	7.7	8.0	7.4
	3/5	7.8	7.8	7.9	7.8	7.8	7.8	7.7	7.7	7.7	7.8	7.4
	5/14	7.7	8.1	8.2	8.3	8.0	8.6	8.1	8.8	8.0	8.1	8.5
	6/4	8.0	8.2	8.3	8.4	8.4	8.8	8.4	8.8	8.3	8.2	8.9
	8/20	8.0	8.2	8.2	8.3	8.1	8.5	8.2	8.4	8.3	8.0	8.1
Conductivity (micromhos at 25°C)	2/13	225	220	223	200	205	290	187	230	138	188	100
	3/5	190	190	180	150	150	150	145	180	120	175	88
	5/14	240	240	230	200	210	200	193	260	145	188	89
	6/4	230	230	219	210	222	200	200	270	150	180	90
	8/20	260	250	255	245	260	285	230	270	175	190	86
	9/10	250	245	248	240	230	308	219	264	160	174	90
Total Coliform (sheen colonies/100 ml)	2/13	7,500	5,200	7,900	12,000	8,600	1,100	14,700	23,400	1,200	400	410
	3/5	1,220	1,100	1,200	1,000	1,000	1,000	1,400	1,100	3,500	580	580
	5/14	2,700	2,100	390	1,300		2,000	630	320	210	190	170
	6/4	1,000	840	500	1,300	730	2,100	490	670	750	540	620
	8/20	6,200	3,600	2,200	5,300	5,400	12,000	2,700	24,000	11,000	13,000	5,200
	9/10	2,100	1,300	5,000	5,400	7,000	16,000	3,100	11,000	630	450	700

Table III. Laboratory and field results for Little Spokane River Study - (continued)

Constituent	Date (1968)	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11
Total Phosphate PO_4-P (mg/l)	2/13	0.03	0.02	0.01	0.02	0.03	0.02	0.02	0.05	nil	0.01	0.003
	3/5	0.05	0.05	0.04	0.06	0.04	0.07	0.03	0.13	0.02	0.02	0.01
	5/14	0.03	0.03	0.04	0.04	0.04	0.03	0.04	1.20	0.03	0.02	0.03
	6/4	0.10	0.08	0.24	0.10	0.10	0.12	0.12	0.09	0.09	0.10	0.10
	8/20	0.20	0.20	0.22	0.22	0.22	0.23	0.22	0.31	0.21	0.21	0.20
	9/10	0.04	0.04	0.04	0.06	0.05	0.05	0.03	0.11	0.04	0.06	0.03
Ortho Phosphate PO_4-P (mg/l)	2/13	0.003	0.003	0.003	nil	0.003	0.003	0.01	0.003	0.003	0.003	0.003
	3/5	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.07	nil	nil	nil
	5/14	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.01	0.01	0.01
	6/4	0.05	0.04	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.02
	8/20	0.02	0.01	0.003	0.07	0.01	0.02	0.01	0.07	0.01	0.01	0.003
	9/10	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.06	0.01	0.01	0.01
Nitrate Nitrogen NO_3-N (mg/l)	2/13	0.54	1.06	0.54	0.52	0.50	0.59	0.32	0.50	0.20	0.32	0.32
	3/5	0.61	0.59	0.41	0.34	0.38	0.47	0.25	0.61	0.16	0.16	0.23
	5/14	0.70	0.47	0.34	0.20	0.29	0.34	0.14	0.47	0.20	0.23	0.36
	6/4	0.63	0.66	0.32	0.29	0.36	0.72	0.81	0.77	0.36	0.32	0.38
	8/20	nil	1.20	1.40	0.66	1.06	nil	0.70	0.15	0.52	nil	nil
	9/10	0.05	0.23	0.11	0.20	1.11	0.95	nil	1.24	0.18	nil	0.81
Kjeldahl Nitrogen N (mg/l)	3/5	0.5	0.3	0.3	0.4	0.4	0.2	0.5	0.6	0.7	0.3	0.6
	5/14	0.4	0.2	0.4	0.4	0.4	0.3	0.4	0.5	0.5	0.2	0.4
	6/4	0.2	0.3	0.2	0.3	0.3	0.2	0.3	0.5	0.3	0.2	0.3
	8/20	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.3	0.2	0.3	0.4
	9/10	0.34	0.25	0.25	0.45	0.50	0.31	0.36	0.45	0.31	0.28	0.81
Ammonia Nitrogen NH_3 (mg/l)	Values were nil for all dates and all stations during the survey.											

Table III. Laboratory and field results for Little Spokane River Study - (continued)

Constituent	Date (1968)	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11
Chloride	2/13	4.0	4.0	3.0	5.0	5.0	13.0	4.0	5.0	3.0	3.0	4.0
Cl	3/5	2.2	2.4	2.7	1.7	2.7	nil	0.2	nil	nil	nil	1.5
(mg/l)	5/14	2.7	2.7	2.7	2.7	3.5	5.7	2.0	2.7	1.7	1.7	1.5
	6/4	3.0	3.0	3.0	2.8	3.5	7.0	3.0	2.5	1.5	1.3	1.5
	8/20	2.5	2.8	2.5	3.0	3.5	7.5	1.2	2.0	1.2	1.2	1.2
	9/10	1.5	1.0	1.0	1.5	1.0	13.5	0.5	1.0	0.5	2.0	0.5
Turbidity	5/14	5.6	5.4	4.4	5.2	5.2	9.0	5.0	6.6	3.9	3.4	4.2
(JTU)	6/4	4.2	4.0	3.0	4.5	3.8	3.1	4.0	5.7	3.6	3.2	3.2
	8/20	1.8	1.5	1.5	1.5	1.1	1.4	1.0	1.2	0.5	0.5	0.5
	9/10	6.0	4.0	3.0	5.0	5.0	5.0	4.0	3.0	3.0	5.0	4.0

Water Year 1971 (Page 2 of 3)

Test TEMPERATURE

Units °C

	Collection Point	~~November~~		~~February~~		May		August	
		4/7	5/3	5/4	5/11	5/13	7/13	7/14	7/19
1	River at Chatcolet R.R. Bridge		8				15		18
2	River at Mission Point								
3	Benewah Cr. at Highway 5		7						
4	Hells Gulch at 95A Bridge		7						
5	River at Bud Fountains Landing		8				14		17
6	Cherry Cr. at Highway 5		6						
7	River at Outflow (St. Maries Lagoon)						14		16
8	River at St. Maries Bridge	5	8				14		16
9	St. Maries River at Sportsman Park	5							
10	River at St. Joe City Bridge	4					11		16
11	River at Falls Cr. Bridge			6					
12	River at Calder Bridge			6			11		16
13	Big Cr. at Road Bridge			6					
14	River at Marble Cr. Bridge			6				11	16
15	Marble Cr. at Road Bridge			6					
16	River at Hoyt Flat Bridge			6				10	14
17	Fishhook Cr. at Road Bridge			6					
18	River at P.F.I. Bridge below Avery			6				10	14
19	N. Fk. St. Joe at Road Bridge				6				
20	River at Prospector Cr. Bridge					5		10	12
21	Eagle Cr. at Road Bridge					6			
22	Quartz Cr. at Road Bridge					4			
23	River at Bluff Cr. Bridge					6			
24	Gold Cr. at Road Bridge					5			
25	Simmons Cr. at Road Bridge					4			
26	River at Beaver Cr. Bridge					1			
27	River at Red Ives Bridge					5		9	11
28	Red Ives Cr. at Road Bridge					5			
29	River at California Cr.								
30	Sherlock Cr.								

Water Year 1971 (Pg. 3 of 3)

Test TEMPERATURE - WATER

Units ~~°F~~ °C

	Collection Point	~~November~~		~~February~~		~~May~~		August
		7/26	8/3	8/9	8/17	8/20	8/20	8/26
1	River at Chatcolet R.R. Bridge	24	26	23	20	21	22.6	
2	River at Mission Point							
3	Benewah Cr. at Highway 5					21		
4	Hells Gulch at 95A Bridge					23		
5	River at Bud Fountains Landing	24	26	23	19	22	22.5	
6	Cherry Cr. at Highway 5					21		
7	River at Outflow (St. Maries Lagoon)	22	23	23	19	20		
8	River at St. Maries Bridge	22	22	23	19	20	22	
9	St. Maries River at Sportsman Park					20	22.5	
10	River at St. Joe City Bridge	18	20	22	20	19	18.5	
11	River at Falls Cr. Bridge					18		
12	River at Calder Bridge	18	19	19	17	17	17.5	
13	Big Cr. at Road Bridge							15
14	River at Marble Cr. Bridge	15	17	18	15			13
15	Marble Cr. at Road Bridge							11
16	River at Hoyt Flat Bridge	15	16	17	13			12
17	Fishhook Cr. at Road Bridge							10
18	River at P.F.I. Bridge below Avery	16	16	17	12			12
19	N. Fk. St. Joe at Road Bridge							13
20	River at Prospector Cr. Bridge	16	16	16	10			11
21	Eagle Cr. at Road Bridge							11
22	Quartz Cr. at Road Bridge							10
23	River at Bluff Cr. Bridge							11
24	Gold Cr. at Road Bridge							10
25	Simmons Cr. at Road Bridge							11
26	River at Beaver Cr. Bridge							10
27	River at Red Ives Bridge	15	16	14	16			9
28	Red Ives Cr. at Road Bridge			14	16			9
29	River at California Cr.							
30	Sherlock Cr.							

Water Year 1971 Test DISSOLVED OXYGEN

Units ppm

1970 1971

	Collection Point	November	February	May	August
			11	3 4 13	20 26
1	River at Chatcolet R.R. Bridge		13	10.8	9.8 9
2	River at Mission Point				
3	Benewah Cr. at Highway 5			10.2	10.9
4	Hells Gulch at 95A Bridge			9.4	9.7
5	River at Bud Fountains Landing		12.8	10.5	9.8 9
6	Cherry Cr. at Highway 5			11.2	11.2
7	River at Outflow (St. Maries Lagoon)		12.9		9.6
8	River at St. Maries Bridge		12.7	10.9	9.8 9
9	St. Maries River at Sportsman Park		12.1		10.1 9.5
10	River at St. Joe City Bridge		12.7		9.5 9
11	River at Falls Cr. Bridge		12.7	11.4	9.2
12	River at Calder Bridge		12.9	11.2	10.6 9.5
13	Big Cr. at Road Bridge			10.9	10.4
14	River at Marble Cr. Bridge		12.8	11.2	9.4
15	Marble Cr. at Road Bridge			11.2	10.6
16	River at Hoyt Flat Bridge		13.2	11.4	11.7
17	Fishhook Cr. at Road Bridge			11.2	12.3
18	River at P.F.I. Bridge below Avery		13.1	11.1	12.2
19	N. Fk. St. Joe at Road Bridge		12.4	5 in 2 10.8	12.7
20	River at Prospector Cr. Bridge			11.8	12.1
21	Eagle Cr. at Road Bridge			11.4	12.3
22	Quartz Cr. at Road Bridge			11.5	12.6
23	River at Bluff Cr. Bridge			11.7	12.2
24	Gold Cr. at Road Bridge			11.2	12.5
25	Simmons Cr. at Road Bridge			11.2	12.9
26	River at Beaver Cr. Bridge			11.2	12.5
27	River at Red Ives Bridge			11.1	12.4
28	Red Ives Cr. at Road Bridge			10.9	12.2
29	River at California Cr.				
30	Sherlock Cr.				

Water Year 1971 Test NITRATE

Units ppm

	Collection Point	1970 November	1971 February	May	August
		9	11	3 4 18	20/26
1	River at Chatcolet R.R. Bridge	0	.08	.06	.02 B
2	River at Mission Point	—			
3	Benewah Cr. at Highway 5	—		.06	.02
4	Hells Gulch at 95A Bridge	—		.05	.04
5	River at Bud Fountains Landing	0	.06	.05	.05 Z
6	Cherry Cr. at Highway 5	—		.04	.22
7	River at Outflow (St. Maries Lagoon)	0	.05		.06
8	River at St. Maries Bridge	0	.05	.04	.02 Z
9	St. Maries River at Sportsman Park	0	.06	M	.02 Z
10	River at St. Joe City Bridge	0	.06	M	.04 Z
11	River at Falls Cr. Bridge	0	.04	.06	.04
12	River at Calder Bridge	0	.04	.03	.04 Z
13	Big Cr. at Road Bridge	—		.08	.06
14	River at Marble Cr. Bridge	0	.03	.05	.06
15	Marble Cr. at Road Bridge	—		.06	.02
16	River at Hoyt Flat Bridge	0	.06	.04	.04
17	Fishhook Cr. at Road Bridge	—		.05	.02
18	River at P.F.I. Bridge below Avery	0	.05	.04	.03
19	N. Fk. St. Joe at Road Bridge	0	.05	.03-.04	.05
20	River at Prospector Cr. Bridge	0		.12	.02
21	Eagle Cr. at Road Bridge	—		.05	.02
22	Quartz Cr. at Road Bridge	—		.11	.04
23	River at Bluff Cr. Bridge	0		.03	.04
24	Gold Cr. at Road Bridge	—		.14	.04
25	Simmons Cr. at Road Bridge	—		.07	.04
26	River at Beaver Cr. Bridge	0		.04	.03
27	River at Red Ives Bridge	0		.01	.03
28	Red Ives Cr. at Road Bridge	—		.01	.03
29	River at California Cr.				

Water Year 1971 Test CHLORIDE

Units ppm

	Collection Point	November 1970	February 1971	May	August
		9	11	3 4 13	20 26
1	River at Chatcolet R.R. Bridge	2.5	2.5	3.5	10
2	River at Mission Point				
3	Benewah Cr. at Highway 5			3.5	7.5
4	Hells Gulch at 95A Bridge			3.5	7.5
5	River at Bud Fountains Landing	2.5	2.5	3.5	5
6	Cherry Cr. at Highway 5			3.5	10
7	River at Outflow (St. Maries Lagoon)	3.5	4		7.5
8	River at St. Maries Bridge	2.5	3	3.5	7.5
9	St. Maries River at Sportsman Park	2.5	2		7.5
10	River at St. Joe City Bridge	2.5	2		5
11	River at Falls Cr. Bridge	2.5	2	3.5	5
12	River at Calder Bridge	2.5	2		5
13	Big Cr. at Road Bridge			3.5	5
14	River at Marble Cr. Bridge	3.5	2.5	3.5	5
15	Marble Cr. at Road Bridge			3.5	7.5
16	River at Hoyt Flat Bridge	3.5	3.5	3.5	7.5
17	Fishhook Cr. at Road Bridge			3.5	7.5
18	River at P.F.I. Bridge below Avery	3.5	3.5	3.5	5
19	N. Fk. St. Joe at Road Bridge	2.5	2.5	2.5	5
20	River at Prospector Cr. Bridge	2.5	2.5	2.5	5
21	Eagle Cr. at Road Bridge			2.5	5
22	Quartz Cr. at Road Bridge			2.5	5
23	River at Bluff Cr. Bridge	2.5		2.5	2.5
24	Gold Cr. at Road Bridge			2.5	5
25	Simmons Cr. at Road Bridge			2.5	5
26	River at Beaver Cr. Bridge	2		2.5	5
27	River at Red Ives Bridge	2		2.5	5
28	Red Ives Cr. at Road Bridge				5
29	River at California Cr.				

Water Year 1971 Test COLIFORM - TOTAL

Units COLIFORM/100 ml

Collection Point	1970 NOV	1971 FEB	MAY	JULY			AUGUST		
	19	18	18	13	19	26-27	3-4	17	20
1 River @ Chatcolet R.R. Bridge	52	72	52	50	38	44	52	60	36
4 Hells Gulch @ 95A Bridge	---	180							
5 River @ Bud Fountain's Landing	---	120	44	36	20	20	28	24/64	20
6 Cherry Creek @ Highway 5	---	---	---	---	---	---	---	---	
7 River @ Outflow (St. Maries Lagoon)	300	240		340	190	264	200	300/120	
8 River @ St. Maries Bridge	32	40	72	38	36	136	100	76/48	200
9 St. Maries River @ Sportsman Park	---	---		---	---	---	---	---	36
10 River @ St. Joe City Bridge	6	32		24	20	16	48	36/64	52
12 River @ Calder Bridge	12	20	20	20	36	12	20	48	144
12S St. Joe River Below Calder	---	---	---	20	26	16	24	62	
14 River @ Marble Creek Bridge	16	52	32	16	20	16	56	20	
14S St. Joe River Below Ragan's	---	---	---	---	---	---	---	---	
16 River @ Hoyt Flat Bridge	52	96	24	16	---	56	76	164	
16A River Below Hoyt Flat Ranger Station	---	---	---	6	32	30	40	64/28	
18 River @ P.F.I. Bridge Below Avery	24	160	40	148	128	164	142	148/112	
20 River @ Prospector Creek Bridge	---	---	---	---	4	1	5	1	
27 River @ Red Ives Bridge	---	---	8	4	0	2	2	3	
27A River Below Red Ives Lagoon	---	---	---	4	0	1	4	2	
28 Red Ives Creek at Road Bridge	---	---	---	---	0	1	4	2	
29 River @ California Creek Bridge	---	---	---	---	---	---	---	---	

Custer National Forest
P. O. Box 407
St. Maries, Idaho 83861

Idaho Department of Health
Laboratories and Engineering & Sanitation Divisions

WATER QUALITY REPORT

Station 1

Location: County Kootenai (Name) Code (2-3) Municipality (Name) Code (4-6)

Name of Owner: Water Source Name & Number: St Joe River (7-8) (9-10)

Sample taken from: (11) (Check one) 1 River 2 Deep Well 3 Shallow Well 4 Infiltration Collector 5 Lake 6 Springs 7 Reservoir 8 Creek 9 Distribution System

Sampling point location: RR Bridge Clarkia Idaho Sample submitted by: MC Martin

Date of Collection: Month 5 Day 30 Year 71 (12-17) Date received:

Card 3 (1) Field Testing

Physical:

Temp. °F C	22	(18-19)
Odor (s.u.) MF 36		(20)
Field pH 7.4	7.8	(21-23)

Laboratory

(Check analysis desired)

☐ Color (s.u.)		(24-25)
☐ Turbidity (s.u.)	3	(26-27)

Chemical: (Results expressed in ppm) (mg/L)

☐ For routine analysis check here (Minimum sample one liter)

☐ Total solids	76	(28-31)
☐ ~~Hydrogen Sulfide (S)~~ TCS	68	(32-34)
☐ Alkalinity (as $CaCO_3$)	32	(35-37)
☐ Hardness (as $CaCO_3$)	48	(38-40)
☐ Calcium (Ca)	6	(41-43)
☐ Magnesium (Mg)	8	(44-46)
☒ Iron* (Fe)	0 / 01	(47-50)
☐ Manganese (Mn)	0 / 01	(51-53)
☐ Sodium (Na)	2	(54-56)
☑ Chloride (Cl)	4	(57-59)
☐ Sulphate (SO_4)	1	(60-62)
☒ Nitrate (NO_3)	0.3	(63-65)
☒ Phosphate (PO_4)	0 / 02	(66-68)
☐ Silica (SiO_2)	6.0	(69-70)
☐ Fluoride (F)	0 / 01	(71-74)
☒ Ammonia* (N)	0 / 1	(75-77)

*Special sampling procedure

Card 4 (1) Special Laboratory

Chemical (Part 2): (mg/L) (Minimum sample one liter)

☐ Aluminum (Al)		(18-19)
☐ Zinc (Zn)		(20-21)
☐ Phenols		(22-24)
☐ Cyanide (CN)		(25-26)
☐ CCE		(27-29)
☐ Copper (Cu)		(30-31)
☐ Arsenic (As)		(32-34)
☐ Barium (Ba)		(35-36)
☐ Cadmium (Cd)		(37-39)
☐ Chromium (Cr)		(40-42)
☐ Lead (Pb)		(43-45)
☐ Silver (Ag)		(46-48)
☐ Selenium (Se) B	< 0.1	(49-51)
☐ ~~A.B.S.~~ K	0.9	(52-53)

Radiological activity: (pCi/liter) (Minimum sample one gallon)

☐ Gross alpha		(55-57)
☐ Gross beta		(58-60)
☐ Radium 226		(62-64)
☐ Strontium 90		(66-68)
☐ Strontium 89		(70-72)
☐ Iodine 131		(74-76)

Copies of report to:

Date reported: 5-2-71

Chemist

Routine Bacteriological

Idaho Department of Health
Laboratories and Engineering & Sanitation Divisions
WATER QUALITY REPORT

Station 5

Location: County Bonneville (Name) Code (2-3) Municipality — (Name) Code (4-

Name of Owner: State (7-8) Source Name & Number: Mt. Ore Rim (9-

Sample taken from: (11) (Check one) [1] River [2] Deep Well [3] Shallow Well [4] Infiltration Collector [5] Lake [6] Springs [7] Reservoir [8] Creek [9] Distribution Syste

Sampling point location: Fountain West Sample submitted by: Dave Bingham

Date of Collection: Month 8 Day 26 Year 71 (12-17) Date received:

Card 3 (1) Field Testing

Physical: D.C. 9.0

Temp. °C 23.5 (18-19)

Odor (s.u.) NF 201 (20)

Field pH 7.2 7.5 (21-23)

Laboratory

(Check analysis desired):

- [ ] Color (s.u.) (24-25)
- [ ] Turbidity (s.u.) 4 (26-27)

Chemical: (Results expressed in ppm) (mg/L)

- [ ] For routine analysis check here (Minimum sample one liter)
- [ ] Total solids 92 (28-31)
- [ ] ~~Hydrogen Sulfide (S)~~ TDS 76 (32-34)
- [ ] Alkalinity (as $CaCO_3$) 44 (35-37)
- [ ] Hardness (as $CaCO_3$) 64 (38-40)
- [ ] Calcium (Ca) 8 . (41-43)
- [ ] Magnesium (Mg) 11 . (44-46)
- [ ] Iron* (Fe) < 0.01 (47-50)
- [ ] Manganese (Mn) < 0.01 (51-53)
- [ ] Sodium (Na) 2 . (54-56)
- [ ] Chloride (Cl) 4 . (57-59)
- [ ] Sulphate (SO_4) 2 . (60-62)
- [ ] Nitrate (NO_3) 0.3 (63-65)
- [ ] Phosphate (PO_4) 0.03 (66-68)
- [ ] Silica (SiO_2) 9.4 (69-70)
- [ ] Fluoride (F) < 0.1 (71-74)
- [ ] Ammonia* (N) < 0.1 (75-77)

*Special sampling procedure

Card 4 (1) Special Laboratory

Chemical (Part 2): (mg/L) (Minimum sample one liter)

- [ ] Aluminum (Al) (18-
- [ ] Zinc (Zn) (20-
- [ ] Phenols (22-
- [ ] Cyanide (CN) (25-
- [ ] CCE (27-
- [ ] Copper (Cu) (30-
- [ ] Arsenic (As) (32-
- [ ] Barium (Ba) (35-
- [ ] Cadmium (Cd) (37-
- [ ] Chromium (Cr) (40-
- [ ] Lead (Pb) (43-
- [ ] Silver (Ag) (46-
- [ ] ~~Selenium~~ (Se) 0.01 (49-
- [ ] ~~A.B.S.~~ 0.09 (52-

Radiological activity: (pCi/liter) (Minimum sample one gallon)

- [ ] Gross alpha (55-
- [ ] Gross beta (58-
- [ ] Radium 226 (62-
- [ ] Strontium 90 (66-
- [ ] Strontium 89 (70-
- [ ] Iodine 131 (74-

Copies of report to:

Date reported: 9-2-71

Chemist:

Pauline Dittmark

Idaho Department of Health
Laboratories and Engineering & Sanitation Divisions

Station 10

WATER QUALITY REPORT

Location: County Shoshone (Name) Code (2-3) Municipality Ft Lau City (Name) 10 Code (4

Name of Owner: State (7-8) Source Name & Number: Ft Lau River (9-

Sample taken from: (11) (Check one) [1] River [2] Deep Well [3] Shallow Well [4] Infiltration Collector [5] Lake [6] Springs [7] Reservoir [8] Creek [9] Distribution Syst

Sampling point location: Ft Lau City Garden Sample submitted by: Dr Dittmark

Date of Collection: Month 8 / Day 05 / Year 71 (12-17) Date received:

Card 3 (1) Field Testing

Physical:

Temp. °C	18.5	(18-19)
Odor (s.u.) NF 52		(20)
Field pH 7.4	8.1	(21-23)

Laboratory

(Check analysis desired):

☐ Color (s.u.)		(24-25)
☐ Turbidity (s.u.)	4.	(26-27)

Chemical: (Results expressed in ppm) (mg/L)

☐ For routine analysis check here (Minimum sample one liter)

☐ Total solids	72.	(28-31)
☐ ~~Hydrogen Sulfide (S)~~ TDS	56.	(32-34)
☐ Alkalinity (as $CaCO_3$)	36	(35-37)
☐ Hardness (as $CaCO_3$)	44.	(38-40)
☐ Calcium (Ca)	8	(41-43)
☐ Magnesium (Mg)	6	(44-46)
☐ Iron* (Fe)	< 0.01	(47-50)
☐ Manganese (Mn)	0.01	(51-53)
☐ Sodium (Na)	2.	(54-56)
☐ Chloride (Cl)	6.	(57-59)
☐ Sulphate (SO_4)	< 1	(60-62)
☐ Nitrate (NO_3)	0.2	(63-65)
☐ Phosphate (PO_4)	0.01	(66-68)
☐ Silica (SiO_2)	4.8	(69-70)
☐ Fluoride (F)	< 0.01	(71-74)
☐ Ammonia* (N)	< 1	(75-77)

*Special sampling procedure

Card 4 (1) Special Laboratory

Chemical (Part 2): (mg/L) (Minimum sample one liter)

☐ Aluminum (Al)		(18
☐ Zinc (Zn)		(20
☐ Phenols		(22
☐ Cyanide (CN)		(25
☐ CCE		(27
☐ Copper (Cu)		(30
☐ Arsenic (As)		(32
☐ Barium (Ba)		(35
☐ Cadmium (Cd)		(37
☐ Chromium (Cr)		(40
☐ Lead (Pb)		(43
☐ Silver (Ag)		(46
☐ ~~Selenium (Se)~~ B	< 0.1	(49
☐ ~~A.B.S.~~ K	0.8	(52

Radiological activity: (pCi/liter) (Minimum sample one gallon)

☐ Gross alpha		(55
☐ Gross beta		(58
☐ Radium 226		(61
☐ Strontium 90		(64
☐ Strontium 89		(67
☐ Iodine 131		(7-

Copies of report to:

Date reported: 9-2-71

Chemist:

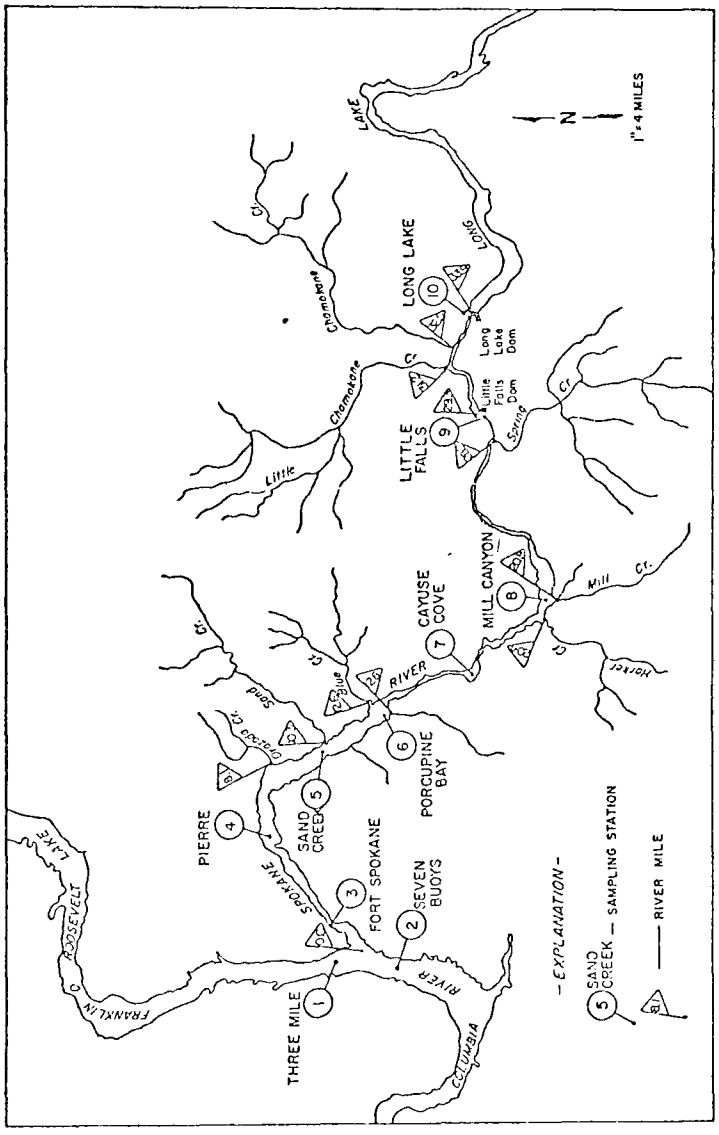


Figure 2. ILLUSTRATION OF THE LOWER SPOKANE RIVER WATER SAMPLING STATIONS AND RELATED LANDMARKS, WDE, 1970 AND 1971

Table 5. Total and fecal coliform bacteria counts per 100 ml, stations 1 - 10, at one-foot depth, WDE, 1970 and 1971.

1970 Total coliform counts.

Station	6/23	6/29	7/7	7/15	7/21	7/28	8/4	8/18	9/1	9/15	9/22	9/29	10/6	10/13	10/27	11/24
1	0	80	12	23	6	17	140	88	24	34	180	100	80	52	72	4
2	0	10	12	10	6	5	28	10	7	40	140	140	160	104	32	2
3	0	72	14	81	7	9	4	22	4	72	420	560	600	18	36	8
4	0	50	30	2	3	10	22	50	12	14	740	360	1000	200	260	4
5	4	4	14	0	2	12	2	12	2	26	1020	420	1200	100	60	4
6	6	4	20	2	3	22	24	16	4	20	980	760	1000	240	100	4
7	104	64	48	12	6	70	4	45	4	TNTC	500	TNTC	1600	200	160	62
8	166	34	600	0	8	50	140	0	0	86	540	2000	8000	4200	30	80
9	320	2500	210	TNTC	46	TNTC	TNTC	50	55	180	200	1800	2200	600	50	160
10	188	3070	144	TNTC	35	TNTC	TNTC	80	0	420	1000	2000	3400	1200	220	0

TNTC: Too numerous to count - plate overgrown with non-specific organism.

1971 Total coliform counts.

Station	4/13	5/18	6/15	7/20	8/17	8/31	9/14	9/17	12/8
1	2	4	10	0	46	-	0		
2	2	4	0	0	24	-	42		
3	14	44	0	0	108	490	14		
4	2	18	0	0	8	<200	12		
5	30	24	20	0	0	200	12		
6	20	36	0	0	4	<200	100		
7	-	-	190	0	14	<200	750		
8	-	-	310	10	TNTC	460	460		
9	230	380	360	14	-	370	-	500	9
10	126	680	64	2	-	2900	-	2300	10

1971 Fecal coliform counts.

Date	Stations 1	2	3	4	5	6	7	8	9	10
8/31	-	-	<20	<20	<20	<20	<20	<20	<20	<20

Table 8. Dissolved oxygen concentrations in mg/l at Stations 1 - 10, at one-foot depth, WDE, 1970 and 1971.

1970

Station	6/23	6/29	7/7	7/15	7/21	7/28	8/4	8/18	9/1	9/15	9/22	9/29	10/6	10/13	10/27	11/24
1	11.5	11.0	9.8	9.7	9.6	9.8	10.1	8.9	9.1	8.6	8.4	7.7	8.1	9.2	9.5	9.8
2	11.7	11.0	9.6	9.8	10.5	9.4	9.3	9.0	9.6	7.6	8.5	8.5	9.0	8.9	9.6	10.2
3	10.5	10.7	8.9	8.9	9.5	9.2	9.1	8.8	9.4	7.0	7.0	6.9	8.7	7.7	8.2	9.4
4	12.2	10.4	9.1	8.8	9.4	9.2	9.2	9.0	8.9	5.0	5.7	6.7	7.3	6.8	7.5	8.4
5	10.6	10.8	9.1	9.6	10.5	9.8	9.6	9.5	8.5	5.7	5.6	6.5	7.2	7.2	7.8	8.8
6	11.5	11.0	9.2	9.8	11.2	9.7	9.6	9.4	8.6	5.4	6.0	6.5	7.0	7.2	8.1	9.2
7	11.1	10.6	10.0	10.0	12.2	9.3	10.5	9.9	9.8	7.0	6.2	7.0	7.2	7.5	8.4	9.1
8	10.0	10.2	10.0	11.0	11.4	9.6	12.3	11.0	8.9	6.5	8.4	9.1	9.2	9.3	9.0	9.1
9	10.0	9.2	8.6	8.6	8.3	7.3	8.3	5.3	5.4	5.2	3.4	5.8	5.5	5.8	7.2	8.7
10	10.7	9.2	8.5	7.4	7.2	6.2	5.5	4.8	4.5	5.2	2.9	5.4	6.3	5.7	7.3	8.7

1971

Station	4/13	5/18	6/15*	7/20*	8/17	8/31	9/14	9/22	12/8
1	12.0	12.2	12.9	11.7	10.2	-	9.2		
2	12.4	12.3	12.2	11.3	10.1	-	8.6		
3	12.2	12.2	11.9	9.5	9.8	8.0	8.7		
4	12.6	12.5	12.1	9.9	9.5	8.1	8.5		
5	12.6	12.5	11.8	10.4	9.5	8.0	8.7		
6	12.4	12.4	11.9	9.9	9.5	7.7	8.1		
7	-	-	11.8	11.3	9.4	12.6	7.6		
8	-	-	11.8	11.8	9.6	11.0	8.2		
9	12.2	14.0	11.7	8.0	3.1	7.0	3.5		9.0
10	12.8	14.2	11.6	8.0	2.8	5.5	3.9	3.5	9.3

* Stations 1 - 8 sampled at 3 feet.

Table 10. Temperature in °C, stations 1 - 10, at one-foot depth, WDE, 1970 and 1971.

1970

Station	6/23	6/29	7/7	7/15	7/21	7/28	8/4	8/18	9/1	9/15	9/22	9/29	10/6	10/13	10/27	11/24
1	19.0	15.5	24.4	23.3	22.2	19.5	22.8	21.1	20.0	18.3	17.4	16.9	16.3	15.5	13.0	9.5
2	21.0	15.5	24.6	19.4	20.6	20.0	22.2	21.1	21.1	19.5	18.4	17.2	16.4	15.1	13.0	9.6
3	21.5	19.4	26.1	26.6	25.6	21.1	24.4	22.2	21.8	18.3	17.6	17.1	16.0	15.2	13.0	9.0
4	23.0	20.0	27.8	26.6	23.8	22.2	23.8	21.1	21.8	18.3	17.6	17.1	16.4	15.0	12.8	8.5
5	24.5	20.0	26.6	26.6	23.8	21.8	23.8	21.1	21.8	18.3	17.7	17.1	16.3	15.8	12.9	9.0
6	24.4	19.4	26.6	25.6	23.3	21.8	23.8	21.1	21.1	20.0	17.6	17.2	16.2	15.6	13.0	9.0
7	-	19.4	24.4	25.6	22.8	20.0	23.8	21.8	21.1	18.9	17.4	17.4	15.9	15.4	12.2	7.0
8	-	19.4	23.8	23.3	21.8	20.0	23.8	21.1	20.0	17.8	15.9	17.0	14.5	12.9	10.4	6.5
9	16.7	16.7	19.4	-	21.1	18.3	21.1	19.4	19.4	17.2	16.1	14.6	13.4	12.9	10.4	6.8
10	16.7	17.2	19.4	18.9	21.1	18.3	19.4	19.5	19.4	17.8	15.5	14.9	13.7	13.0	10.4	6.9

1971

Station	4/13	5/18	6/15*	7/20*	8/17	8/31	9/14	12/8
1	7.1	9.8	10.9	18.4	22.0	-	19.0	
2	7.7	10.8	12.0	19.4	22.0	-	18.5	
3	7.6	11.9	15.0	21.9	22.5	22.0	18.5	
4	9.1	12.7	15.6	23.0	23.5	22.0	19.0	
5	8.9	12.2	14.9	25.0	22.5	21.5	19.0	
6	9.0	12.4	15.0	25.6	22.5	20.5	19.0	
7	-	-	15.0	24.8	22.0	21.0	19.5	
8	-	-	14.4	22.7	21.5	20.5	18.5	
9	7.0	10.6	15.0	23.0	20.5	20.3	-	4.3
10	7.3	10.6	15.0	22.9	20.0	20.0	-	5.3

* Measured at 3 feet.

Table 17. Nitrate concentration as mg/l nitrogen, stations 1 - 10, WDE, 1970 and 1971.

1970, at one-foot depth	NO_3-N										
Station	6/22	7/21	8/4	8/18	9/1	9/15	9/29	10/8	10/13	10/27	11/24
1	0.02	0.04	0.04	0.07	0.00	0.00	0.09	0.06	0.07	0.17	0.15
2	0.04	0.01	0.03	0.09	0.02	0.00	0.05	0.06	0.11	0.09	0.03
3	0.03	0.03	0.03	0.04	-	0.00	0.29	0.13	0.22	0.33	0.13
4	0.02	0.02	0.04	0.04	-	0.33	0.46	0.41	0.51	0.56	0.48
5	0.04	0.02	0.05	0.03	0.01	0.33	0.31	0.42	0.41	0.68	0.34
6	0.06	0.01	0.03	0.03	0.13	0.31	0.32	0.44	0.75	0.36	0.38
7	0.08	0.02	0.03	0.06	-	0.33	0.30	0.61	0.77	0.46	0.42
8	0.09	0.04	0.06	0.04	0.16	-	0.20	0.46	0.62	0.54	0.25
9	0.09	0.22	0.34	0.99	0.34	0.63	0.52	0.58	0.80	0.69	0.43
10	0.07	0.20	0.40	0.77	0.41	0.75	0.36	0.75	0.87	0.44	0.30

1971, at one-foot depth	NO_3-N							
Station	4/13	5/18	6/15	7/20	8/17	8/31	9/14	12/8
1	0.63	0.12	0.19	0.07	0.08	-	0.05	
2	0.51	0.12	0.19	0.01	0.02	-	0.06	
3	0.58	0.06	0.06	0.00	0.02	0.21	0.04	
4	0.60	0.05	0.03	0.01	0.03	0.11	0.09	
5	0.59	0.04	0.09	0.01	0.03	0.13	0.07	
6	0.71	0.09	0.11	0.03	0.05	0.19	0.14	
7	-	-	0.13	0.01	0.10	0.04	0.11	
8	-	-	0.09	0.10	0.15	0.06	0.53	
9	0.66	0.13	0.11	0.11	0.63	0.35	0.33	0.63
10	0.72	0.05	0.12	0.23	0.74	0.36	0.45	0.58

1971		Depth	NO_3-N	
	Station	in ft.	8/31	9/14
	1	90		0.07
	2	90		0.06
	3	60	0.15	0.08
	4	60	0.08	0.06
	5	80	0.14	0.29
	6	80	0.21	0.26
	7	70	0.02	0.26
	8	40	0.35	0.36

Table 18. Dissolved orthophosphate concentration as mg/l phosphorus, stations 1 - 10, WDE, 1970 and 1971.

1970 at one-foot depth.

	P-D, ortho*										
Stations	6/22	7/21	8/4	8/18	9/1	9/15	9/29	10/8	10/13	10/27	11/24
1	<0.01	0.04	0.14	0.02	<0.01	0.01	0.01	0.01	0.00	0.00	0.01
2	0.01	0.01	0.03	0.01	<0.01	<0.01	<0.01	0.01	0.00	<0.01	0.00
3	0.01	0.01	0.03	0.01	-	0.01	0.01	0.01	0.00	<0.01	0.03
4	<0.01	0.01	0.03	0.01		0.01	0.01	0.01	0.01	0.01	0.01
5	<0.01	0.03	0.01	0.00	0.05	0.00	0.02	0.01	0.01	<0.01	0.00
6	0.01	0.01	0.01	0.00	<0.01	0.00	0.01	0.01	0.01	0.02	0.01
7	0.01	0.01	<0.01	<0.01		0.00	0.01	0.01	0.01	0.01	0.02
8	0.01	0.01	0.01	0.01	0.00	0.02	<0.01	0.01	0.00	<0.01	0.00
9	0.03	<0.01	0.04	0.02	0.03	0.01	0.01	0.01	0.01	0.02	0.02
10	<0.01	<0.01	0.01	0.07	0.02	0.01	0.02	0.01	0.01	0.02	0.02

*Inorganic phosphorus in the sample filtrate after filtration through 0.45 micron pore size, phosphorus free filters.

1971 at one-foot depth.

	P-D, ortho							
Stations	4/13	5/18	6/15	7/20	8/17	8/31	9/14	12/8
1	0.05	0.00	0.03	<0.01	0.00	-	0.01	
2	0.04	0.00	0.01	<0.01	0.00	-	0.01	
3	0.03	0.00	0.01	<0.01	0.00		0.01	
4	0.04	0.00	0.01	0.00	0.00	0.00	0.02	
5	0.03	0.00	0.01	0.00	0.00	<0.01	0.02	
6	0.03	0.00	0.01	0.00	0.00	0.02	0.02	
7	-	0.00	0.01	0.01	<0.01	<0.01	0.03	
8		0.00	0.01	0.01	<0.01	0.01	0.04	
9	0.04	0.00	0.01	0.00	0.05	0.01	0.08	0.04
10	0.04	0.00	0.01	0.01	0.05	0.04	0.06	0.05

	P-D, ortho		
Station	Depth in ft.	8/31	9/14
1	90		0.01
2	90		0.01
3	60	<0.01	0.01
4	60	<0.01	0.02
5	80	0.01	
6	80	0.01	0.05
7	70	0.04	0.05
8	40	0.04	

Table 19. Phosphorus concentration in mg/l, stations 1 10, WDE, 1970 and 1971.

1970 at one-foot depth.

Stations	6/22	7/21	8/4	8/18	9/1	(P)* 9/15	9/29	10/8	10/13	10/27	11/24
1	0.02	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.02	0.01	0.02
2	0.02	0.04	0.02	0.01	0.04	0.02	0.01	0.01	0.01	<0.01	<0.01
3	0.02	0.03	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.03
4	0.02	0.04	0.02	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.02
5	0.03	0.04	0.04	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01
6	0.04	0.03	0.02	0.03	0.01	0.02	0.02	0.01	0.02	0.02	0.01
7	0.04	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.02
8	0.01	0.05	0.02	0.01	0.02	0.04	0.01	0.01	0.01	<0.01	0.01
9	0.04	0.09	0.03	0.03	0.04	0.04	0.02	0.02	0.03	0.03	0.04
10	0.03	0.12	0.04	0.07	0.05	0.02	0.02	0.01	0.03	0.02	0.03

*All of the phosphorus present in the sample, regardless of form.

1971 at one-foot.

Stations	4/13	5/18	6/15	7/20	8/17	(P) 8/31	9/14	12/8
1	0.08	0.06	0.04	0.03	0.10		0.05	
2	0.09	0.06	0.04	0.04	0.05		0.02	
3	0.15	0.06	0.06	0.02	0.08	-	0.01	
4	0.10	0.05	0.02	0.01	0.07	<0.01	0.02	
5	0.10	0.04	0.04	0.02	0.07	0.01	0.02	
6	0.13	0.05	0.03	0.02	0.07	0.03	0.02	
7	-	-	0.07	0.02	0.08	0.01	0.03	
8	-	-	0.05	0.03	0.10	0.04	0.05	
9	0.10	0.05	0.10	0.04	0.17	0.05	0.09	0.07
10	0.08	0.07	0.05	0.04	0.10	0.36	0.08	0.05

Stations	Depth in ft.	(P) 8/31	9/14
1	90		0.02
2	90		0.02
3	60	0.01	0.02
4	60	0.01	0.04
5	80	0.01	
6	80	0.02	0.06
7	70	0.05	0.06
8	40	0.07	0.05

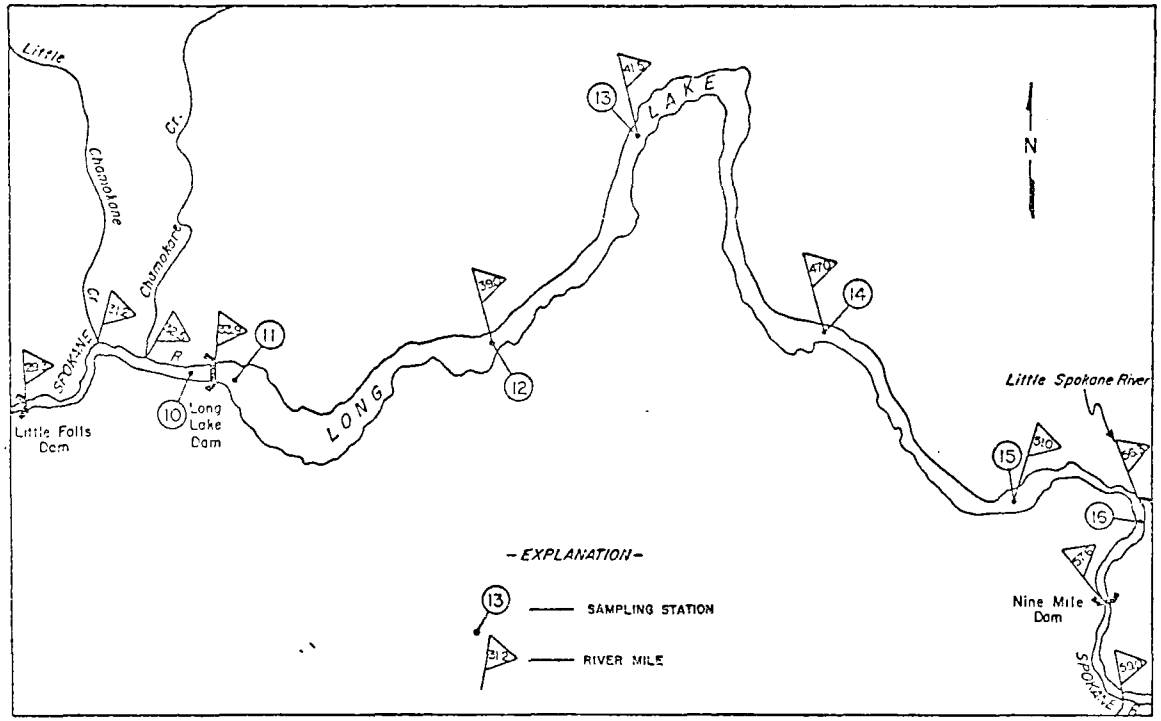


Figure 3. ILLUSTRATION OF THE LONG LAKE WATER SAMPLING STATIONS AND RELATED LANDMARKS, WDE, 1971

Table 12. Dissolved oxygen concentration and temperature, Long Lake, station 11, WDE, 1971.

Date	Depth in ft.	DO mg/l	Temp. °C
7/27	3	10.5	25.6
	40	7.5	18.0
	75	5.4	16.0
	140	(bottom depth)	
8/10	3	10.3	26.0
	20	4.8	20.8
	40	4.4	19.5
	80	1.8	16.0
8/18	3	9.4	23.0
	40	0.3	20.0
	80	1.7	16.0
8/23	3	9.6	21.0
	20	4.5	19.5
	40	1.6	19.0
	70	3.6	15.5
9/1	3	10.2	20.5
	20	0.1	19.5
	40	0.1	18.5
	70	0.0	17.0
	100	0.0	16.5
9/15	3	5.6	18.0
	20	5.2	17.5
	40	3.8	17.5
	70	0.0	16.5
	100	0.0	16.0
9/21	3	9.8	18.0
	45	6.0	17.0
	75	0.5	16.0

Table 13. Dissolved oxygen concentration and temperature, Long Lake, station 12, WDE, 1971.

Date	Depth in ft.	DO mg/l	Temp. °C
7/27	3	11.9	24.0
	50	5.5	16.7
	60	(bottom depth)	
8/10	3	11.2	27.0
	20	4.1	22.0
	45	2.0	19.0
8/23	3	9.0	21.8
	20	7.8	21.3
	45	3.0	18.5
9/1	3	5.7	19.5
	20	5.6	19.5
	40	3.8	19.5
	50	2.8	19.5
9/15	3	7.9	18.5
	20	7.7	18.0
	40	5.4	17.5
	50	5.5	16.5
9/21	3	7.2	17.9
	25	8.1	16.2
	50	6.8	15.8

Table 14. Dissolved oxygen concentration and temperature, Long Lake, station 13, WDE, 1971.

Date	Depth in ft.	DO mg/l	Temp. °C
7/27	3	11.2	24.0
	30	4.6	19.0
	70	2.6	15.5
	75	(bottom depth)	
8/10	3	10.8	26.0
	30	4.8	20.0
	50	2.2	18.7
8/18	3	10.4	24.0
	20	4.5	22.0
	42	3.7	20.0
9/1	3	6.8	19.5
	20	6.3	19.5
	40	4.5	20.0
	70	4.0	17.5
9/15	3	8.1	18.0
	20	8.1	18.0
	48	6.2	17.5
9/21	3	9.1	17.9
	25	7.4	16.8
	50	6.8	15.0

Table 15. Dissolved oxygen concentration and temperature, Long Lake, station 14, WDE, 1971.

Date	Depth in ft.	DO mg/l	Temp. °C
7/26	3	11.2	23.8
	20	6.4	20.0
	40	1.8	16.0
	50	(bottom depth)	
8/9	3	12.2	26.0
	25	7.3	-
	40	5.2	20.0
8/19	3	9.8	24.2
	20	6.6	22.6
	40	6.1	18.6
9/1	3	7.0	19.0
	18	5.8	19.0
	45	5.6	18.0
9/15	3	10.0	18.0
	20	9.6	18.0
	40	7.5	15.5
9/22	3	10.8	16.5
	20	8.0	15.5
	40	8.0	13.5

Table 16. Dissolved oxygen concentration and temperature, Long Lake, stations 15 and 16, WDE, 1971.

Station 15			
Date	Depth in ft.	DO mg/l	Temp. °C
7/26	3	6.9	20.8
	25	(bottom depth)	
8/9	3	14.6	24.0
	10	6.8	20.0
	20	6.3	20.0
8/18	3	11.8	22.5
	10	7.4	20.0
	20	6.9	18.5
9/1	3	7.0	16.0
	10	6.2	16.5
	20	6.2	16.5
9/15	3	7.8	15.5
	10	7.5	15.0
	20	7.8	15.0
9/22	3	8.0	13.5
	20	7.8	13.5

Station 16			
Date	Depth in ft.	DO mg/l	Temp. °C
7/26	5	7.8	18.7
	15	(bottom depth)	
8/9	5	7.6	21.5
8/24	10	8.0	16.8
9/8	5	8.8	16.0
9/22	5	9.0	13.5

TABLE 20. Nitrate concentration as mg/l nitrogen, Long Lake, stations 11 - 16, WDE, 1971.

Station	Depth in ft.	NO_3-N			
		7/21	8/23	9/1	9/15
11	3	0.00	0.02	0.12	0.46
	80	0.28	0.02		
	90				0.11
	100			0.06	
12	3	0.00	-	0.32	0.25
	50	0.25	0.44	0.48	0.47
13	3	0.00	0.05	0.19	0.19
	42	0.19			0.55
	60			0.46	
14	3	0.00	0.07	0.12	0.13
	40	0.29	0.56	0.48	0.49
15	3	0.45	0.39	0.50	0.65
	20	0.47	0.60	0.72	0.44
16	3		0.51		0.33

TABLE 21. Dissolved orthophosphate concentration as mg/l phosphorus, Long Lake, stations 11 - 16, WDE, 1971.

Station	Depth in ft.	P-D, ortho Date 7/21	8/23	9/1	9/15
11	3	<0.01	0.01	0.01	0.03
	80	0.04	0.00		
	90				0.08
	100			0.10	
12	3	<0.01	-	0.02	0.01
	50	0.03	0.04	0.06	0.05
13	3	<0.01	0.00	0.01	0.01
	42	0.04			0.06
	60			0.07	
14	3	0.01	0.00	0.01	0.01
	40	0.04	0.04	0.07	0.05
15	3	0.04	0.02	0.10	0.06
	20	0.04	0.02	0.10	0.07
16	3				0.08

TABLE 22. Phosphorus concentration in mg/l, Long Lake, stations 11 - 16, WDE, 1971.

Station	Depth in ft.	(P) 7/21	8/23	9/1	9/15
11	3	0.01	0.02	0.02	0.08
	80	0.06	0.02		
	90				0.12
	100			0.12	
12	3	0.03	0.08	0.04	0.03
	50	0.08	0.17	0.09	0.09
13	3	0.03	0.03	0.05	0.02
	42				0.08
	60	0.04	0.15	0.11	
14	3	0.04	0.04	0.05	0.02
	40	0.12	0.13	0.10	0.07
15	3	0.04	0.06	0.13	0.09
	20	0.04	0.09	0.12	0.10
16	3		0.11		0.10

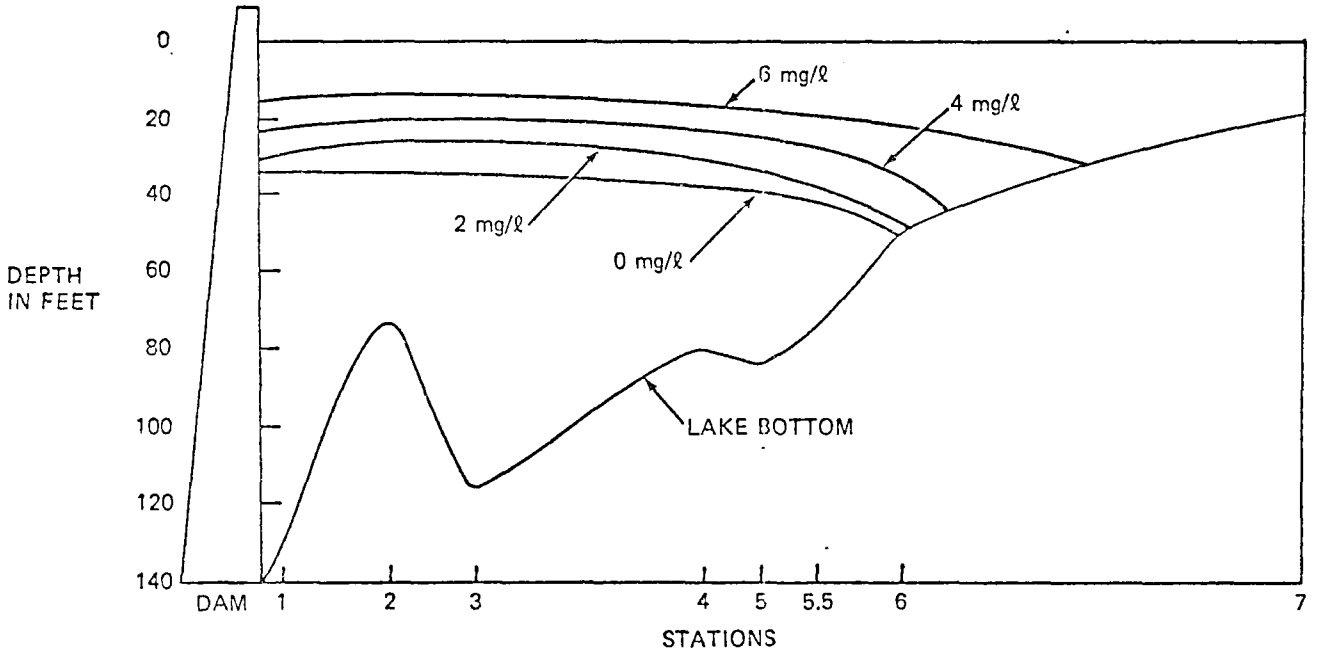


Figure 4. Dissolved oxygen profile estimations in Long Lake based on average concentrations measured at the 10' and 35' depths. Lake bottom profile based on average depth at each station.

APPENDIX III

LOCATIONS OF LAKE SAMPLING STATIONS

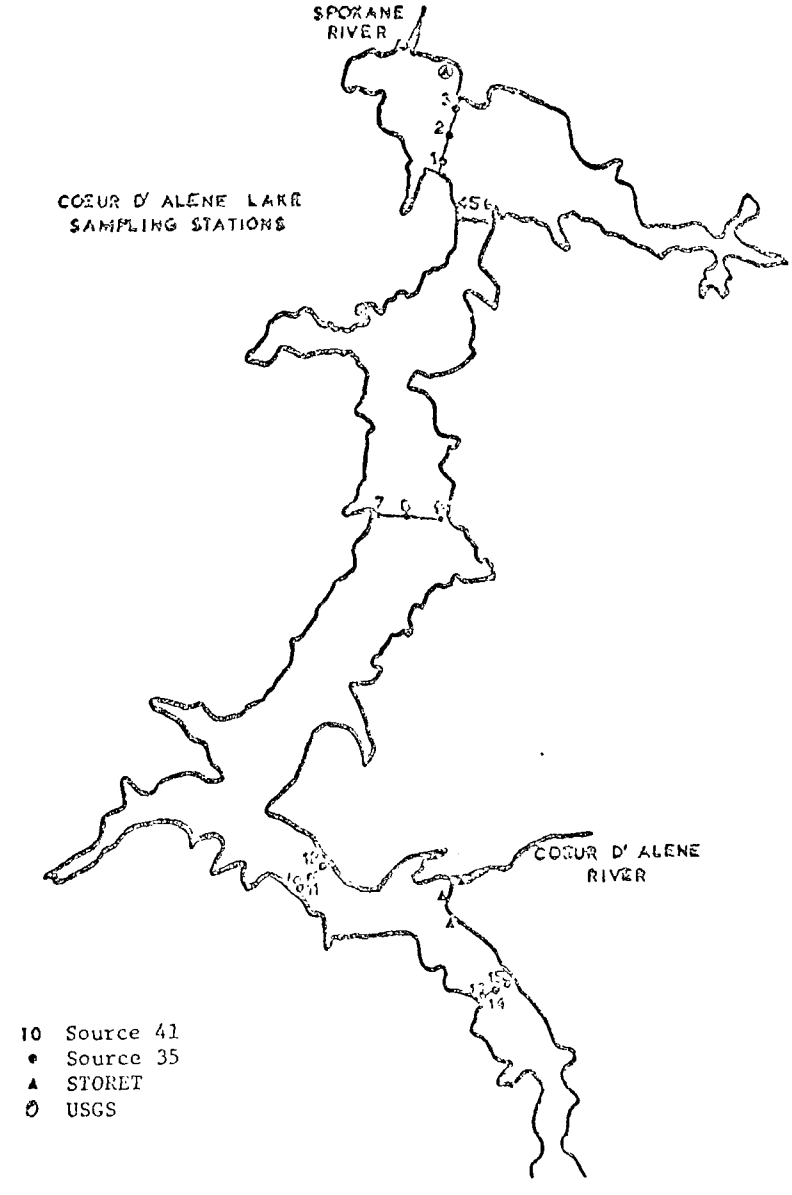
ATTACHMENT 1: SAMPLING STATIONS ON COEUR D'ALENE LAKE

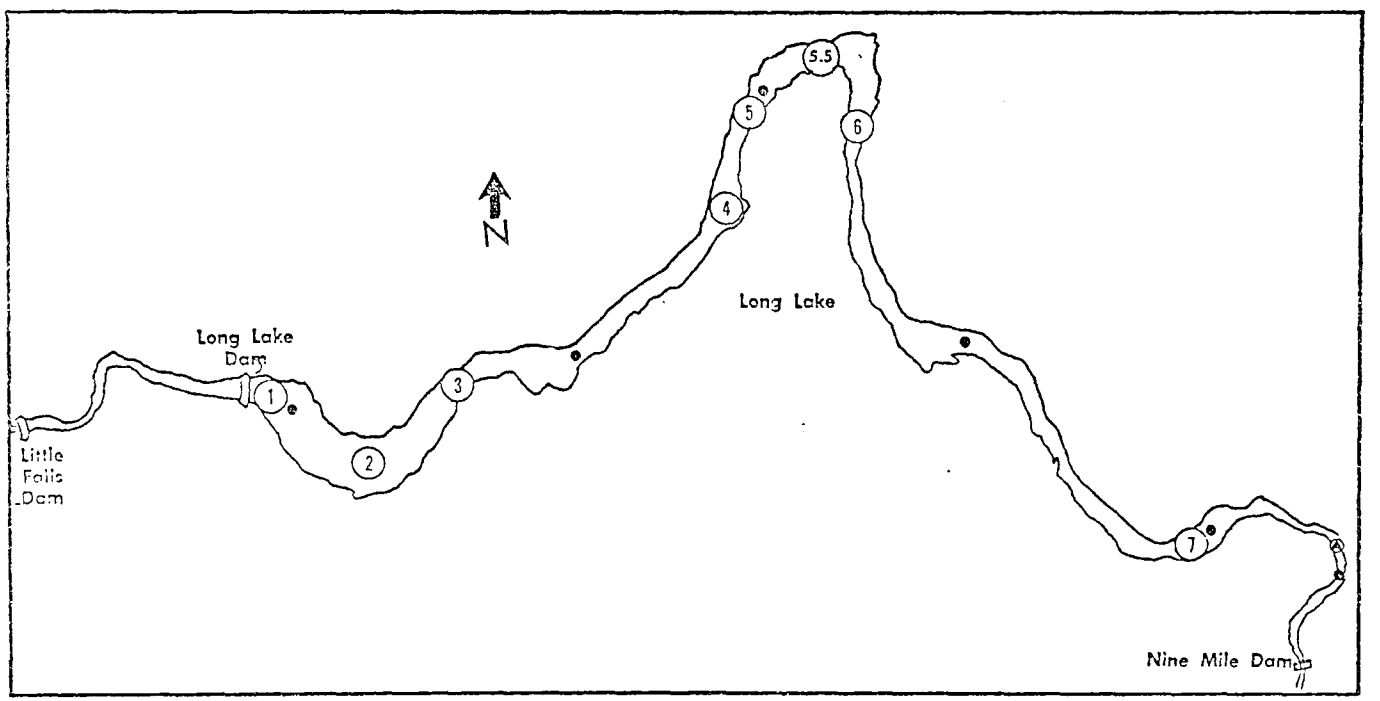
ATTACHMENT 2: SAMPLING STATIONS ON LONG LAKE

ATTACHMENT 3: SAMPLING STATIONS ON F.D. ROOSEVELT LAKE

ATTACHMENT 1

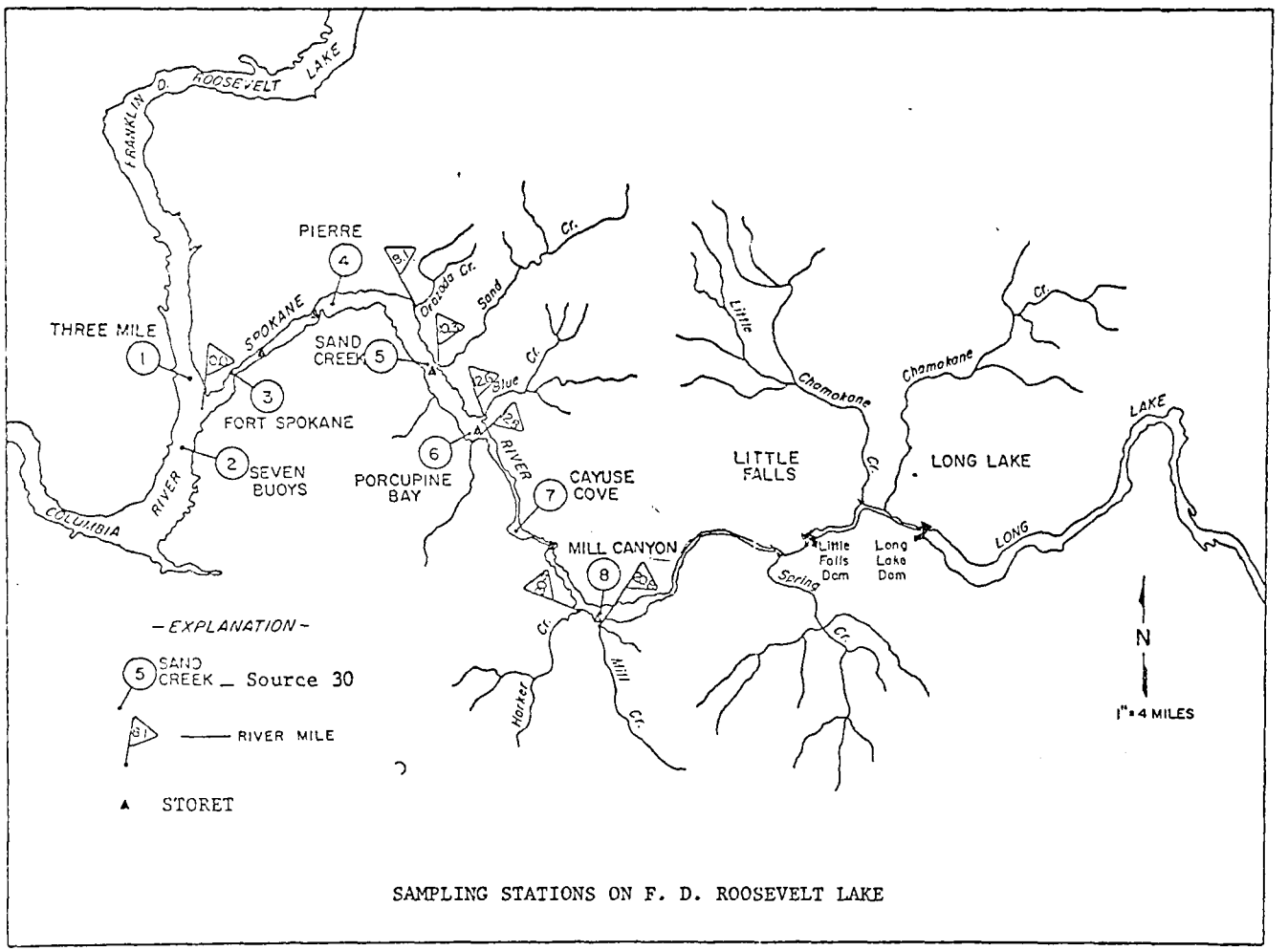
SAMPLING STATIONS ON COEUR D'ALENE LAKE





o Source 29
(2) Source 30
▲ STORET
○ USGS

SAMPLING STATIONS ON LONG LAKE



SAMPLING STATIONS ON F. D. ROOSEVELT LAKE

APPENDIX IV

RELATED PLANNED AND CURRENT STUDIES

RELATED PLANNED AND CURRENT STUDIES

Several studies related to the water resources of the Spokane River Basin are either presently underway or anticipated to begin in the near future. Completion of these studies will hopefully add to the available information necessary for more accurate verification of the several models and for their use in planning. The studies underway and anticipated include Level A type framework studies, Basin studies, project studies, and scientific investigations.

Broad Framework Studies

Western U.S. Water Plan, coordinated by the U.S. Bureau of Reclamation, Department of Interior

Columbia-North Pacific Comprehensive Framework Study of Water and Related Lands, conducted under the auspices of the Pacific Northwest River Basins Commission

Washington State Water Plan, being prepared by the Washington Department of Ecology

Wild and Scenic Rivers Study, by the Pacific Northwest River Basins Commission.

Basin Studies

Columbia River and Tributaries, Review Study by the North Pacific Division, U.S. Army Corps of Engineers

Regional Wastewater Management and Urban Drainage Study, Spokane River Basin, by the Seattle District, U.S. Army Corps of Engineers.

Local Studies

Water Resources of the Spokane Indian Reservation, a study sponsored by the Spokane Indian Tribe and conducted by Mr. Walter L. Woodward

A Study of the Underground Flows Between the Pend Oreille and Spokane River Systems, by the Water Resources Division, U.S. Geological Survey (Tacoma, Washington).

Scientific Investigations

An Integrated Study on the Impact of Metallic Trace Element Pollution in Coeur d'Alene, Spokane River-Lake Drainage System, sponsored by the Office of Water Resources Research through Washington State University, Pullman, Washington

The Biological Impact of Combined Metallic and Organic Pollution in the Coeur d'Alene and Spokane River-Lake Drainage System, sponsored by the Office of Water Resources Research and conducted by William Funk, Fred Rabe, and B. Filby.

Scheduling, coordination, and funding of water resources planning studies is complex and subject to frequent change. The list presented is based on information presently available and the user is advised to investigate the current status of study completion in updating data contained in this report. The Pacific-Northwest River Basins Commission has major responsibilities for coordination among federal, state, and local agencies and private groups or individuals undertaking water resources planning, and should be an initial point of contact.

APPENDIX V - BIBLIOGRAPHY

consisting of

ATTACHMENT 1: PUBLICATIONS OF VALUE FOR PHYSICAL DATA

ATTACHMENT 2: PUBLICATIONS OF VALUE FOR WATER QUALITY DATA

ATTACHMENT 3: PUBLICATIONS OF VALUE FOR WATER QUANTITY DATA

ATTACHMENT 4: PUBLICATIONS OF VALUE FOR METEOROLOGICAL DATA

ATTACHMENT 5: PUBLICATIONS OF GENERAL INTEREST

BIBLIOGRAPHY

Included within the bibliography are references to the large number of items reviewed during the course of the study. For ease of reference, the listing has been categorized. Within each category (Physical, Quality, Quantity, and Meteorological) there are publications or materials which provide other types of information as well. Their inclusion in a particular category reflects the predominate type of information contained or the principal use of the material for this study.

Similarly, of the numerous materials acquired during the course of the study, only a portion were of immediate value to the study. However, in view of the fact that future users of this report and the other study results may well be engaged in more comprehensive studies, all materials of a substantial nature which were received are listed. Those which were of principal value to the study are indicated by an asterisk.

ATTACHMENT 1

PUBLICATIONS OF VALUE FOR PHYSICAL DATA

PUBLICATIONS OF VALUE PRIMARILY FOR PHYSICAL DATA

* 1. Hydrology Subcommittee, Columbia Basin Inter-Agency Committee. River Mile Index, Spokane River and Tributaries, April 1964.

* 2. Soil Survey, Spokane County, Washington. USDA, Soil Conservation Service and Washington Agricultural Experiment Station, March 1968.

3. Woodward, Walter L., Water Resources and Utilities, Spokane Tribe of Indians, Spokane Reservation. Consulting Engineering Report, Spokane, Washington, 1971.

* 4. Coeur d'Alene & Long Lake Storage Tables, Washington Water Power Company.

* 5. Coeur d'Alene & Long Lake Rule Curves, Washington Water Power Company.

* 6. Washington Water Power Plant Data Sheet from Northwest Power Pool Operations Review, July 1972.

7. Little Falls Spillway Plan View, Washington Water Power Company.

* 8. Spokane River Profile, Washington Water Power Company, May 1954.

* 9. Meteorological Data for Calder, 1962 - 1971, St. Joe National Forest.

10. Meteorological Data for Red Ives. 1963-1971, St. Joe National Forest.

*11. Map of St. Joe National Forest, Idaho, 1972.

12. Army Corps of Engineers, High Velocity Channel, S. F. Coeur d'Alene River at Wallace, Idaho, November 1969.

*13. Profile Points, Reports of Water Surface Observations for Spokane River, Coeur d'Alene River, Wolf Lodge Creek, St. Joe River, and St. Maries River, U.S. Army Corps of Engineers, 1948, 1960.

*14. Barnes, Harry H. Jr., Roughness Characteristics of Natural Channels, Geological Survey Water Supply Paper 1849, U.S. Government Printing Office, Washington, 1967.

*15. "Gaging Station Records in Spokane River Basin, Washington, for Post Falls, Idaho to Long Lake, Washington, Including Little Spokane River", U.S.G.S.

*16. Layouts of County Road Bridges and Cross-sections at Flora Road, Sullivan Road and Argonne Road, Spokane , 1972.

*17. Discharge Measurement Notes for U.S.G.S Gaging Stations in Idaho.

*18. Spokane River and Tributaries, Washington and Idaho, Topography, Coeur d'Alene to Post Falls, U.S. Army Corps of Engineers, 1944.

*19 Spokane River and Tributaries, Washington and Idaho, Critical Sections of Spokane River; Profile of Spokane River in Spokane, U.S. Army Corps of Engineers, 1944.

*20. Hangman Creek, Washington RM 12.5 to RM 15.0 Water Surface Profiles, U.S. Army Crops of Engineers, May 1972.

*21. St. Joe River, Idaho, Water Surface Profiles, U. S. Army Corps of Engineers.

*22. St. Maries River, Idaho, Water Surface Profiles, U.S. Army Corps of Engineers.

*23. St. Joe and St. Maries, F.P.I.S - Expo '74, Cross Sections, U.S. Army Corps of Engineers, June 1972.

*24. Hangman Creek, Cross Sections, RM 12 to RM 14, U.S. Army Corps of Engineers, August 1972.

*25. Spokane River, Cross Sections, U.S. Army Corps of Engineers, August 1972.

26. Helca Mining Company, Proposed Relocation of Portion of the S.F. Coeur d'Alene River.

ATTACHMENT 2

PUBLICATIONS OF VALUE FOR WATER QUALITY DATA

PUBLICATIONS OF VALUE PRIMARILY FOR WATER QUALITY DATA

27. Cunningham, Dick and Gary Rothwell. Water Quality Report: Spokane and Little Spokane Rivers, December 1970 - March 1971. Office of Technical Services, Environmental Monitoring Division, Water Monitoring Section, Department of Ecology, State of Washington, December 1971.

28. Haggarty, Thomas G., Status Report: Water Pollution in the Spokane River. Technical Report 69-1, Washington State Water Pollution Control Commission, March 1970.

*29. Bishop, Robert A., and Ronald A. Lee. Spokane River Cooperative Water Quality Study. Report No. 72-001, State of Washington Department of Ecology, 1972.

*30. Cunningham, Richard K., and Roland E. Pine. Preliminary Investigation of Low Dissolved Oxygen Concentrations that Exist in Long Lake Located near Spokane, Washington. Technical Report No. 69-1, Washington State Water Pollution Control Commission, 1969.

*31. Burkhalter, R. A., R. K. Cunningham and H. B. Tracy, A Report on the Water Quality of the Little Spokane River. Technical Report No. 70-1, Washington State Water Pollution Control Commission, 1970.

32. Condit, Richard J., Phosphorus and Algal Growth in the Spokane River. Northwest Science, Vol. 46, No. 3, 1972.

*33. Gebhards, S., Frank Shields and Susan O'Neal. Mercury Levels in Idaho Fishes and Aquatic Environments, 1970-71. State of Idaho Fish and Game Department and Department of Health, November 1971.

34. Todhunter, Dick and Dick Cunningham. Water Quality Report: Spokane and Little Spokane Rivers, July 1971 - September 1971. Environmental Monitoring Division, Water Monitoring Section, State of Washington, Department of Ecology, August 1972.

*35. Gary O'Neal. Report on Coeur d'Alene River Survey, May 12-17, 1970, EPA, January 1972.

37. Richard K. Cunningham. Inland Empire Paper Company Effluent Study. State of Washington Water Pollution Control Commission, September 23-26, 1968.

*38. Leland L. Mink, Roy E. Williams, and Alfred T. Wallace. Effect of Industrial and Domestic Effluent on the Water Quality of the Coeur d'Alene River Basin. Idaho Bureau of Mines and Geology, March 1971.

*39. Handwritten copy of waste discharge data obtained from RAPP application form of Inland Empire Paper Company.

40. Van Denburgh, A. S. and J. F. Santos, Ground Water in Washington Its Chemical and Physical Quality. Water Supply Bulletin No. 24, Division of Water Resources, Department of Conservation, State of Washington, Olympia, Washington 98502, 1965.

*41. Stokes, Lee W. & Gene L. Ralston, Water Quality Survey, Coeur d'Alene River - Coeur d'Alene Lake, March 1972, Environmental Improvement Division, Idaho Department of Health, Boise, Idaho.

*42. Wissmar, Robert Charles, Some Effects of Mine Drainage on Primary Production in Coeur d'Alene River and Lake, Idaho, July 1972.

43. Parker, Jon Irving, Algae Production & Nutrient Enrichment in Lake Coeur d'Alene, Idaho, May, 1972.

44. Mine, Industrial & Domestic Waste Disposal Study for the South Fork Coeur d'Alene River, Cornell, Howland, Hayes & Merryfield, Engineers and Planners, October 1964.

45. Dissolved Oxygen Measurements for Long Lake, Washington in 1972, Washington Water Power Company.

*46. Long Lake Water Discharge Temperatures for 1970, 1971 and 1972, Washington Water Power Company.

*47. Water Quality Data for St. Joe River, St. Joe National Forest, 1970-1972.

48. USGS Ground Water Analysis, 7 wells in Spokane Area, October & November 1970.

49. Mink, Leland Leroy, Evaluation of Settling Ponds as a Mining Wastewater Treatment Facility, August 1972.

50. Water Facilities Inventory and Annual Report Sheets, State of Washington, Department of Social and Health Services, Health Services Division, Water Supply and Waste Section, 1972.

51. Report of Water Analyses, Regional Laboratory, Bureau of Reclamation, Boise, Idaho, 1959.

52. Cunningham, Dick and Todhunter, Dick. Water Quality Report: Spokane and Little Spokane Rivers, April 1971 - June 1971, Environmental Monitoring Division, Water Monitoring Section, State of Washington, Department of Ecology, November 1972.

*53. Crosby, James W., Investigation of Techniques to Provide Advance Warning of Ground-Water Pollution Hazards with Special Reference to Aquifers in Glacial Outwash, Office of Water Resources Research Project No. B-055-WASH, USDI, August 1971.

*54. Schneider, Robert F., The Impact of Various Heavy Metals on the Aquatic Environmental, EPA, Water Quality Office, TR No. 2, February 1971.

ATTACHMENT 3

PUBLICATIONS OF VALUE FOR WATER QUANTITY DATA

PUBLICATIONS OF VALUE PRIMARILY FOR WATER QUANTITY DATA

55. Woolridge, David D., Study D: Forests & Water Resources of Washington State. Report #3A. State of Washington Water Research Center, Washington State University and University of Washington, Pullman, Washington, March 1972.

56. Piper, Arthur M. & George A. LaRocque. Water Table Fluctuations in the Spokane Valley and Contiguous Area, Washington-Idaho. USDI, USGS Report, October 1939.

57. Unknown. Analysis of Increments of Discharge in Spokane River, Post Falls, Idaho to Long Lake, Washington. Apparently by USDI, USGS Water Resources Division. Undated (about 1951).

58. Unknown. Public Health Relationship of the Minnehaha Sewer District to the Greater Spokane Community. Esvelt & Saxton, Consulting Engineers for the City of Spokane, December 1964.

*59. Cline, Denzel R., Ground-Water Resources and Related Geology, North Central Spokane and Southeastern Stevens Counties of Washington. Water Supply Bulletin No. 27. State of Washington Department of Water Resources, Olympia, Washington, 1969.

60. Brown, H. C., Gaging Station Records in Spokane River Basin, Washington from Post Falls, Idaho to Long Lake, Washington including Little Spokane River, Water Years 1948 to 1950. USDI, USGS, Surface Water Branch, Tacoma, Washington, August 1951.

61. Coeur d'Alene Free Discharge Curve, Washington Water Power Co., June 1966.

62. Coeur d'Alene-Post Falls Profile Curves, Washington Water Power Co., Dec. 1954.

63. Nine Mile Spillway Capacity Curve, Washington Water Power Co., March 1958.

*64. Long Lake Spill Gate Curves, Washington Water Power Company, Nov. 1949.

*65. Little Falls Spill Curves (one gate), Washington Water Power Co., May 1945.

66. Daily CFS's for Main Simmon's River (St. Joe River), St. Joe National Forest, October 1966 - September 1971.

67. Daily CFS's for NF Simmon's River (St. Joe River), St. Joe National Forest, October 1966 - September 1971.

*68. Spokane Ground Water by Walter E. Johnson.

69. Two stream flow charts of Little Chamokane Creek into Spokane River, 1971 1972, Spokane Tribe of Indians.

70. Two stream flow charts of Chamokane Creek into Spokane River, 1971 - 1972, Spokane Tribe of Indians.

*71. Woodward, Walter L., Annual flow contributions of several creeks to Spokane River between Mile 0 and Long Lake Dam.

ATTACHMENT 4

PUBLICATIONS OF VALUE FOR METEOROLOGICAL DATA

PUBLICATIONS OF VALUE PRIMARILY FOR METEOROLOGICAL DATA

72. Phillips, Earl L., Washington Climate for these Counties: Adams, Lincoln, Spokane, Whitman., Ag. Ext. Service, Washington State University, Pullman, May 1965.

73. Liu, Kannson T. H. and Howard D. Coop., Study C: Warming of Small Impoundments through Natural Heat Exchange. Report #3A. State of Washington Water Research Center, Washington State University and University of Washington, Pullman, Washington, March 1971.

74. Meteorology Committee, Pacific Northwest River Basins Commission, Climatological Handbook, Columbia Basin States, Vol. 1, Parts A & B (Temperature); Vol. 2 (Precipitation); Vol. 3, Parts A & B (Hourly Data); June 68 September 1969.

*75. Hygrothermograph Charts for Lookout Point, 10 miles NNW of Spokane at 3120', 1966-1972.

76. Meteorological Data for Crystal Peak, Dunn Peak, Simmons and Bold Mountain, Calder and Red Ives, St. Joe National Forest, 1966 - 1971.

*77. Climatological Data, USDS, Environmental Science Services Administration, Environmental Data Service, Idaho and Washington, issues between 1968 and 1972.

ATTACHMENT 5

PUBLICATIONS OF GENERAL INTEREST

PUBLICATIONS OF GENERAL INTEREST

78. Woehlke, Louis Carl., Study E: Ultra-Long-Range Projections in Water Resources Planning. Report 3A, State of Washington Water Research Center, Washington State University and University of Washington, Pullman, Washington, December 1971.

79. Bell, Milo C., Study B: Water Demands for Enhancement of Fisheries (Food and Growth). Report #3A, State of Washington Water Research Center, Washington State University and University of Washington, Pullman, Wash., December 1971.

80. Unknown, Spokane Metropolitan Area Study, Spokane City Planning Commission, December 1959.

81. Weigle, J. M., and M. J. Mendorff., Records of Wells, Water Levels, and Quality of Ground Water in the Spokane Valley, Spokane County, Washington; State of Washington Ground-Water Report No. 2. USDI, USGS, Water Resources Division, Ground Water Branch, Tacoma, Washington, September 1952.

82. Stokes, Lee W., Biological Survey of the Coeur d'Alene River, September 10-11, 1969.

*83. A History of the Pollution of the South Fork of the Coeur d'Alene River Valley, Shoshone County, Idaho.

SELECTED WATER RESOURCES ABSTRACTS
INPUT TRANSACTION FORM

W

Spokane River Basin Model Project

October, 1974

Finnemore, E. John; and Shepherd, John L.

Systems Control, Inc.
Palo Alto, California

68-01-0756

12. Sponsoring Organization Environmental Protection Agency

Set of six volumes: Volume I - Final Report, Volume II - Data Report, Volume III - Verification Report, Volume IV - User's Manual for Steady-state Stream Model, Volume V - User's Manual for Dynamic Stream Model, Volume VI - User's Manual for Stratified Reservoir Model.

Three existing mathematical models, capable of representing water quality in rivers and lakes, have been modified and adapted to the Spokane River Basin in Washington and Idaho. The resulting models were named the Steady-state Stream Model, the Dynamic Stream Model, and the Stratified Reservoir Model. They are capable of predicting water quality levels resulting from alternative basinwide wastewater management schemes, and are designed to assist EPA, State, and local planning organizations to evaluate water quality management strategies and to establish priorities and schedules for investments in abatement facilities in the basin. Physical data and historical hydrologic, water quality and meteorologic data were collected, assessed and used for the model calibrations and verifications. The modified models are all capable of simulating the behavior of various subsets of up to sixteen different water quality constituents. Sensitivity analyses were conducted with all three models to determine the relative importance of a number of individual model parameters. The models were provided to the EPA as computer source card decks in FORTRAN IV language, with accompanying data decks. All development work on, and applications made with, these models were fully documented so as to permit their easy utilization and duplication of historical simulations by other potential users. A user's manual with a complete program listing was prepared for each model.

17a. Descriptors

17b. Identifiers

19. Security Class (Report)	21. No. of Pages
20. Security Class (Page)	22. Price

Send To:

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
U.S. DEPARTMENT OF THE INTERIOR
WASHINGTON D.C. 20240

E. John Finnemore | Systems Control, Inc.