WATER QUALITY MONITORING RECOMMENDATIONS FOR GLACIER NATIONAL PARK

WATER
RESOURCES
FIELD
SUPPORT
LABORATORY

WRFSL PROJECT REPORT NO. 85-GLAC-01

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This report presents the results of a study conducted by the National Park Service Water Resources Field Support Laboratory. It is intended primarily for use by the particular Park Service area or areas that are addressed in the report but may be of interest to other persons working in water resources management. Requests for copies of this report or other WRFSL documents should be addressed to:

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Water Quality Monitoring Recommendations

for Glacier National Park

WRFSL Report 85-GLAC-01

Submitted to:

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PREFACE

These "Water Quality Monitoring Recommendations for Glacier National Park" are subdivided into a main report and Appendices A and B. The report contains the complete set of recommendations for monitoring in Glacier National Park and some background as to why each monitoring location is considered important. Therefore, the report is the working document. Appendix A contains over 220 citations to surface water quantity and quality records in and near Glacier National Park. These records are subdivided into three major drainage basins (i.e., Missouri River, Hudson Bay, and Flathead River) and serves as a complete guide to where, what, and when water resources data were collected. Appendix B is a bibliography of water resources publications relative to Glacier National Park. These two appendices provide an enormous quantity of background information for applications which require more in-depth investigation.

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Water Quality Monitoring Recommendations for Glacier National Park

INTRODUCTION

The waters of Glacier National Park are experiencing increasing threats, both internal and external to park boundaries. Several public documents focused attention on these problems and most noteworthy was a report (U.S. National Park Service, 1980) entitled "State of the Parks - 1980, A Report to the Congress" which identified at least ten specific water related threats. Since, historically, little effort has been placed in the area of hydrologic research by the Park Service at Glacier, less is presently known about the local hydrology than is needed to adequately address future problems.

The objective of this WRFSL project report is to recommend a water quality monitoring program for Glacier National Park which will provide information useful for management decisions over the next several decades. It is intended to address water quality problems which arise due to visitation and land use activities in and immediately surrounding the Park. Because little hydrologic data have been previously collected, current management actions may lack adequate information. Many threats to the water resources of Glacier National Park are already apparent, and therefore, a prompt and decisive commitment to studying these important resources is needed. Recently the Park commenced an excellent study of several lakes in an effort to quantify baseline conditions and to assess impacts to some of the more popular large valley lakes. In addition, the Park is sampling four tributaries to the North Fork of the Flathead River which drain an area of timber

harvesting in Canada. The work described herein is intended to provide additional information by expanding the current study.

Only surface water quality is considered in this work. Ground water samples are collected periodically in the proximity of sewage treatment facilities in the Park and this activity should continue. Noticeable differences will occur in ground water near these facilities as compared to other areas but this does not necessarily present a problem to the Park unless these aquifers are used as potable water sources; at present they are not. The important factor is the potential impact to nearby surface waters. If the waste disposal sites do not function according to design, degradation could harm fisheries and aesthetic qualities. This monitoring plan, therefore, concentrates on the surveillance of surface water quality to enable management to quickly react to future problems as they arise.

MONITORING DESIGN APPROACH

The monitoring plan proposed here was designed by first identifying existing or anticipated future water quality problems. Questions which will need to be addressed in the future regarding these problems are formulated and a data collection program is developed to provide information to answer these specific questions. It is necessary to anticipate future informational needs to ensure that an effective monitoring program is developed. Too often, unclear goals in the monitoring design stage result in programs which contribute little useful information. While it is difficult, if not impossible to anticipate all future concerns, many are already quite apparent and must be studied now to provide the information needed for appropriate management actions in the future. Also, many of the specific objectives presently considered will

be general enough to provide future information which will be of value for unanticipated needs.

After water quality concerns are identified and management questions formulated, monitoring program specifics including location and site(s), parameters to measure, and sampling frequencies are determined. The location of the recommended sampling sites presented in this report were selected by considering several factors. First, local watersheds are identified which are associated with existing water quality concerns. Second, existing records are reviewed to determine whether or not an ongoing study by the park or another agency is presently addressing the local problem conditions. In the case where an adequate study is in progress, no additional sampling is recommended, although the monitoring location and existing data are identified as an integral part of the monitoring program. Where no monitoring is being conducted, a specific sampling location is identified considering accessibility and previously collected information. (A summary of all known existing water quality and quantity records can be found in Appendix A of this report.)

The selection of water quality/quantity parameters (i.e., variables) to measure was made based on the specific concerns identified at each location. For reasons of economy, only those variables most important for a given location are recommended for study. The frequency of sampling suggested at each location was likewise kept to a minimum acceptable number to hold costs down. The sampling frequencies recommended here should allow meaningful evaluation after a period of three to five years. If, due to insufficient manpower or funds, these recommended measurements or frequencies are not feasible, some reductions in

the program may be possible. The Park staff should consult with the Water Resources Division in this case.

WATER QUALITY CONCERNS

To help in identifying water quality concerns, the Park is divided into three major watersheds: 1) Missouri River Basin, 2) Hudson Bay Basin, and 3) Flathead River Basin (Figure 1). These basins were further divided into smaller watersheds and evaluated for possible impacts resulting from local land usage. The text which follows identifies specific sampling locations identified in this review, but is purposely kept brief; more specific details for each sampling location are given in Tables 1 and 2. However, every location listed in Table 1 is an integral part of the recommended monitoring plan, although many of these are existing locations regularly sampled by either NPS or USGS. Sampling locations described in the text are referenced to Figure 1 and the tables by an associated number. This number is meaningful only for the purpose of cross referencing the text to the figure and tables.

Missouri River Basin

Located in the southeast quadrant of the Park, this basin is the smallest of the three major drainage basins within Glacier National Park. This area is largely undeveloped with only two areas accessible by road, Cut Bank Creek and Two Medicine Creek. The area is entirely a headwater region so there are no direct external land use impacts which affect the waters of this basin. Two camping areas, one each located on Cut Bank Creek and Two Medicine Lake, dispose of sewage via a pumped vault toilet system and a septic tank drain field, respectively.

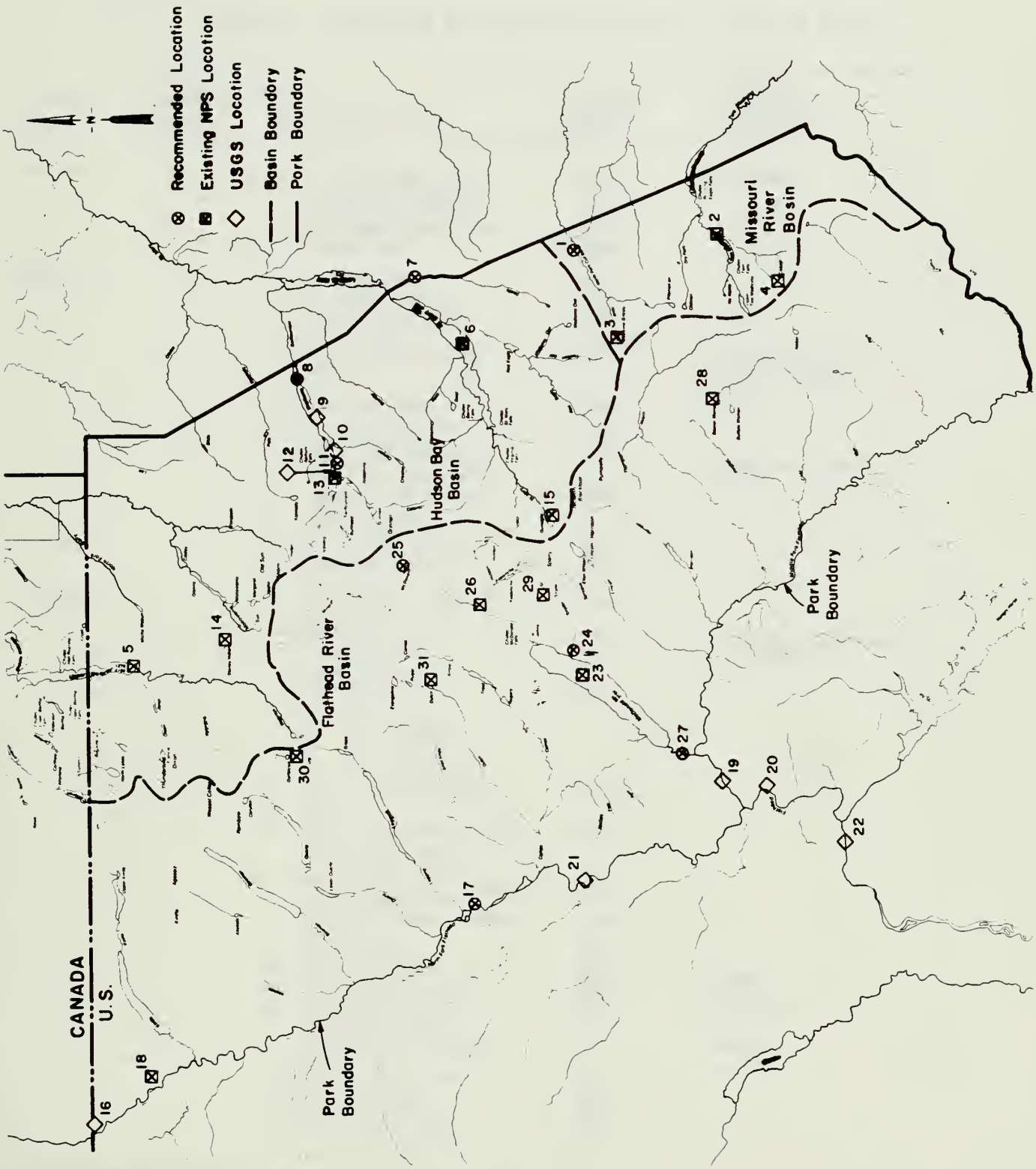

Figure 1. Glacier National Park

Table 1. Summary of Sampling Locations for Glacier National Park

Drainage Basin	Newly Recommended Location	Monitoring Location	Responsible Agency	Principal Concerns for New Locations
Missouri	√	1 - Cut Bank Creek above and below campground	NPS	Campground
		2 - Two Medicine Lake	NPS	
		3 - Medicine Grizzly Lake	NPS	
		4 - Cobalt Lake	NPS	
Hudson Bay		5 - Waterton Lake	NPS	
		6 - St. Mary Lake	NPS	
	√	7 - Divide Creek above and below STP*	NPS	Sewage
	√	8 - Lake Sherburne near dam	NPS	Natural gas and general reservoir quality
		9 - Lake Sherburne	USGS	
		10 - Swiftcurrent Creek at Lake Sherburne	USGS	
	√	11 - Swiftcurrent Creek above and below STP*	NPS	Sewage and diesel fuel
		12 - Swiftcurrent Creek at Many Glacier	USGS	
		13 - Swiftcurrent Lake	NPS	
		14 - Stoney Indian Lake	NPS	
		15 - Gunsight Lake	NPS	
Flathead		16 - North Fork at the U.S./ Canada border	USGS	
	√	17 - North Fork below confluence of Logging Creek	NPS	Timbering, coal mining, campgrounds
		18 - North Fork above Kintla Creek a. Sage Creek b. Spruce Creek c. Kishendin Creek d. Starvation Creek	NPS	
		19 - Middle Fork near West Glacier	USGS	
		20 - Below confluence of North and Middle Forks at Blankenship Bridge	USGS	
		21 - North Fork below confluence with Canyon Creek	USGS	
		22 - North Fork near Columbia Falls	USGS	
		23 - Lake McDonald	NPS	
	√	24 - Sprague Creek	NPS	Sewage
	√	25 - Granite Park Creek	NPS	Sewage
	√	26 - McDonald Creek near Avalanche Creek	NPS	Campground
	√	27 - McDonald Creek below Apgar	NPS	Sewage
		28 - Beaver Woman Lake	NPS	
		29 - Snyder Lake	NPS	
		30 - Gyrfalcon Lake	NPS	
		31 - Upper Dutch Lake	NPS	

*STP = Sewage Treatment Plant

At present, no continuing monitoring of Cut Bank Creek is being conducted. For this reason, a monitoring location (Location 1) consisting of two sampling sites, one above and one below the campground on Cut Bank Creek, is recommended to evaluate possible impacts to stream quality. Two Medicine Lake is presently being sampled as a part of the existing NPS water quality study (Location 2) and this area therefore is not recommended for additional study. Monitoring locations 3 and 4, Medicine Grizzly Lake and Cobalt Lake, respectively, are also part of the existing NPS study. A small amount of data exists at the Park boundary on Cut Bank Creek and may be of some use in future analyses (see Appendix A, Missouri River Basin sites 6 and 7).

Hudson Bay Basin

The Hudson Bay drainage lies in the northeast quadrant of the Park. Similar to the Missouri drainage, this basin is a headwater area which has no surrounding land use related impacts affecting its waters. There are three principal areas of use in this region: the Goat Haunt area on Waterton Lake, Many Glacier Hotel and complex, and St. Mary Lake development. Of prime importance to the water quality of Glacier National Park are the sewage disposal facilities located in the St. Mary and Many Glacier areas. Also, a suspected diesel fuel leak (recently corrected) at the Many Glacier Hotel and the possible leakage of several submerged natural gas wells into Lake Sherburne (a reservoir finished in 1919) are important considerations for this region of the Park. The proposed sampling program specifically addresses these known concerns.

The Goat Haunt region is only slightly developed and no real problems are thought to currently exist there. For this reason and

since Waterton Lake is a part of the existing park monitoring commitment (Location 5), no additional sampling in this region is recommended.

St. Mary Lake (Location 6) is also a part of the current monitoring program and any future impacts to the lake should be observed by the present study. It is recommended, however, that stream water quality be measured in Divide Creek (Location 7), both upgradient and downgradient from the sand filters at the St. Mary sewage treatment plant, to assess the effectiveness of this facility.

Sherburne Lake (Location 8) presently is not being sampled. It is recommended that this reservoir be included in the lake water quality study conducted by the NPS. If this is not a feasible option, the reservoir should be studied through periodic intensive surveys. These intensive surveys could be contracted through a local university or other such group. The studies should include evaluation of the trophic status of the lake and should check for indicators of hydrocarbon pollution from the diesel fuel leak and submerged natural gas wells. Discharge and lake elevation information are available and a few chemical measurements have been made in the past at this location (Locations 9 and 10). It should be noted that this site is not a high priority sampling location. If resources are limited, the Park may choose not to include this site in the program.

Swiftcurrent Creek downstream of Swiftcurrent Lake and above Lake Sherburne is the location of seep ponds where treated sewage from the Many Glacier Hotel and a campground complex is discharged. Samples should be collected both immediately upstream and downstream of this facility (Location 11). Also, samples should be analyzed periodically from this location to determine if there is an impact associated with

the diesel fuel leak at the Many Glacier Hotel. Discharge data for Location 11 may be obtained from the USGS gaging station located just below Swiftcurrent Lake (Location 12).

Monitoring locations 13, 14, and 15 (Swiftcurrent Lake, Stoney Indian Lake, and Gunsight Lake) are included in the existing NPS study.

Flathead River Basin

The Flathead River Basin occupies the entire western half of Glacier National Park. This watershed is primarily a headwater area like the east slope basins, but it does have some stream input from areas west of the Park that are out of the direct jurisdiction of the Park Service. Most of this part of the basin is administered by the USDA-National Forest Service and is managed as a multiple use area. Areas north of the Park which drain into the North Fork of the Flathead River are located in Canada and those lands also have a variety of land use activities. Of principal concern in Canada are timber harvesting and the Cabin Creek coal mining region. Timber harvesting also occurs to a lesser extent in the adjacent U.S. National Forest lands. Besides these external threats to the North Fork, the Middle Fork of the Flathead River and a principal tributary, McDonald Creek, face potential impacts from visitation similar to the east slope basins.

As previously mentioned, the North Fork of the Flathead River faces potential degradation from sources outside of the Park boundaries. In addition, there are numerous public campgrounds located within the Park which could also adversely affect water quality. For these reasons it is important to establish a sampling program on the North Fork for surveillance purposes. It should be noted that, at present, impacts to

this river do not appear to be extensive but a real potential for future degradation does exist over the next several years. It is important to establish current baseline conditions that presently prevail and therefore be in a position to quantify future changes as they occur. In a monitoring plan presented to the Flathead Basin Commission, Stanford (1984) recommended monitoring several tributaries to the North Fork that drain affected watersheds.

Accessibility is a real practical problem to overcome in this basin. Fortunately for the Park Service, the U.S. Geological Survey maintains an elaborate sampling program at the U.S.-Canadian border (Location 16) and the Park can use this as a source of data to track the effect of Canadian activities on North Fork water quality. The Park should, however, as a minimum establish at least one sampling site downstream of the border to assess the impacts of campgrounds in the area and timber harvesting west of the Park. A sampling site located immediately downstream of the confluence of Logging Creek (Location 17) is recommended since it is reasonably accessible from Park headquarters.

Analyses of water quality near Logging Creek will allow the assessment of changes in quality with respect to conditions at the border. Such changes could be attributed to the cumulative impacts of all activities between the border and Logging Creek. If a problem does occur, additional investigation upstream could isolate the source or sources of the problem and assist in mitigation.

The effects of timber harvesting in Canada on the water quality of the North Fork drainage are currently being monitored in the existing NPS study. Four tributaries, which flow into the North Fork between the U.S.-Canada border and the confluence of Kintla Creek, constitute this

monitoring. These tributaries are Sage, Spruce, Kishenehn, and Starvation Creeks. Unfortunately, these creeks do not appear on the map included in this report; however, the sampling locations are noted in aggregate as Monitoring Location 18 on the map in the general area of their locale.

The USGS measures some water quality variables at several locations along the Middle and North Forks (Locations 19, 20, 21, 22). These records can provide additional information to the Park staff.

The McDonald Creek Basin includes Lake McDonald and is the most developed and heavily used region in the Park. Lake McDonald itself has considerable development around its shores including the Apgar complex, campgrounds, inholdings with separate sewage tanks, and stables. The quality of the lake is presently monitored by the on-going Park Service study (Location 23) and no additional monitoring in the lake is recommended at this time.

Located near the top of the McDonald Creek watershed are two backcountry chalets which are popular visitor attractions, Sperry Chalet and Granite Park Chalet. These facilities generate sewage which is disposed of via surface application. Sampling for the effects of sewage needs to begin on the two local watersheds affected. This sampling can be done considerably downstream of the effluent source in more accessible areas. Sprague Creek near the inlet to Lake McDonald (Location 24) is an easily accessible location for sampling the effects of Sperry Chalet. Granite Park Chalet effluent can be monitored in the creek that drains Granite Park where it is nearest to the Logan Pass road, before its confluence with McDonald Creek (Location 25).

A campground/picnic site is located near the confluence of Avalanche Creek and McDonald Creek. Sewage is disposed of at these

facilities by a septic tank soil absorption system located on the flood plain of McDonald Creek. Water quality and discharge information should be collected in this area to assess possible leaching of waste water into the surface water system. Sampling should take place in McDonald Creek above and below the facility (Location 26). Additionally, water discharge should be measured at one of these sites.

The Apgar development complex is located on the south shore of Lake McDonald. A spray field is located below Apgar on McDonald Creek where treated sewage is applied to a meadow area adjacent to the creek. The effectiveness of this spray field should be evaluated through a monitoring program. Sampling sites (Location 27) should be established above and far enough below the spray field to allow complete mixing of constituents entering the creek from the facility. In addition to sampling at this reach for indicators of sewage, the lower site is an ideal location for evaluation of the cumulative impacts from all upstream activities.

Monitoring locations 28-31 are high country lakes presently being sampled in the ongoing NPS study.

STATISTICAL ANALYSIS

An important consideration in the establishment of any water quality monitoring program is initially identifying the methods by which the monitoring information will be analyzed. This step is important to ensure that the data collected will be useful in answering the questions initially raised. In this plan, two basic types of statistical analyses are recommended. Where baseline conditions are needed, computation of statistical and probabilistic characteristics are suggested. Where quantitative changes in water quality from an upstream to a downstream

station is of interest, the paired basin approach developed by the U.S. Forest Service is suggested. These data analysis methods are listed for each recommended monitoring location in Table 2.

The computation of basic statistical characteristics includes determination of the mean, variance, and coefficient of skew of each water quality variable sampled at a monitoring location. In addition, interrelationships between variables can be studied through regression analysis. The complete behavior of a water quality parameter can be modeled by fitting an appropriate probability distribution to the data. More complete descriptions of these basic methods may be found in any good probability and statistical reference (e.g., Haan, 1977; Benjamin and Cornell, 1970; Draper and Smith, 1966).

A description of the paired basin approach may be found in a Forest Service report (Ponce et al., 1982), and a brief description is given in Flug (1982, pp. 15-31). This method employs regression equations obtained from a control area and from an impacted area and compares the difference between the two. In this report, most of the monitoring locations in which the paired basin approach is recommended for statistical evaluation have two suggested sampling sites. One site is located above and the other below an area of possible impact. For these locations the control area is represented by the above site and the impacted area by the below site. A few other sites use a completely separate upstream monitoring location for the control area; these are specified in Table 2.

The use of statistical analyses in evaluating water quality data is often a difficult task. Common statistical methods can easily be misapplied resulting in incorrect evaluation of water quality conditions.

Table 2. Summary of management questions, recommended water quality parameters[1], sampling frequencies, and statistical analysis for each suggested monitoring location.

Cutbank Creek (Monitoring Location 1)	
Management Question:	What is the impact of the campground on water quality of Cutbank Creek?
Water Quality Parameters:	TN, TP, BOD, Q, SS, SC, FC, TC
Sampling Frequency:	Twice monthly during June, July, August, and September.
Statistical Analysis:	Paired basin analysis.
Divide Creek (Monitoring Location 7)	
Management Question:	Is treated sewage effluent disposed of in sand filters near Divide Creek adversely affecting water quality of the creek?
Water Quality Parameters:	TN, TP, BOD, Q, SC, FC, TC
Sampling Frequency:	Twice monthly during May, June, July, August, September, and October.
Statistical Analysis:	Paired basin analysis.
Lake Sherburne (Monitoring Location 8)	
Management Question:	Is hydrocarbon pollution present in Lake Sherburne and is the lake undergoing eutrophication?
Water Quality Parameters:	Intensive survey.
Sampling Frequency:	Not applicable.
Statistical Analysis:	Not applicable.
Swiftcurrent Creek (Monitoring Location 11)	
Management Question:	What is the impact of the nearby sewage disposal operation on Swiftcurrent Creek?
Water Quality Parameters:	TN, TP, BOD, Q, SC, FC, TC
Sampling Frequency:	Twice monthly during May, June, July, August, September, and October.
Statistical Analysis:	Paired basin analysis.

Table 2 (Continued).

North Fork Flathead below Logging Creek (Monitoring Location 17)	
Management Question:	What are the effects of surrounding land use activities and campgrounds on the quality of the North Fork?
Water Quality Parameters:	TN, TP, BOD, Q, SC, FC, TC, metals suite
Sampling Frequency:	Twice monthly during May, June, July, August, September, and October. Metals: once annually.
Statistical Analysis:	Paired basin analysis with USGS data collected at border. Characterization of baseline conditions by estimating statistical parameters and probability distributions of water quality variables.
Sprague Creek (Monitoring Location 24)	
Management Question:	What is the effect on the creek of sewage disposal from Sperry Chalet?
Water Quality Parameters:	TN, TP, BOD, Q, SC, FC, TC
Sampling Frequency:	Twice monthly during June, July, August, and September.
Statistical Analysis:	Characterization of statistical parameters and probability distribution, determination of compliance/noncompliance of stream standards.
Granite Park Creek (Monitoring Location 25)	
Management Question:	What is the effect on the creek of sewage disposal from Granite Park Chalet?
Water Quality Parameters:	TN, TP, BOD, Q, SC, FC, TC
Sampling Frequency:	Twice monthly during June, July, August, and September.
Statistical Analysis:	Characterization of statistical parameters and probability distribution, determination of compliance/noncompliance of stream standards.

Table 2 (Continued).

McDonald Creek near Avalanche Creek (Monitoring Location 26)	
Management Question:	What is the impact of Avalanche Creek Campground on the water quality of McDonald Creek?
Water Quality Parameters:	TN, TP, BOD, Q, SS, SC, FC, TC
Sampling Frequency:	Twice monthly during June, July, August and September.
Statistical Analysis:	Paired basin analysis.
McDonald Creek below Apgar (Monitoring Location 27)	
Management Questions:	1) What is the effect of the sewage sprayfield on McDonald Creek water quality? 2) What are the cumulative effects of upstream conditions on the quality of McDonald Creek?
Water Quality Parameters:	TN, TP, BOD, Q, SS, SC, FC, TC
Sampling Frequency:	Twice monthly during May, June, July, August, September, and October.
Statistical Analyses:	1) Paired basin analysis 2) Determination of stream standard compliance/noncompliance and statistical characterization of data.

[1] TN = Total nitrogen (persulfate digestion method)
TP = Total phosphorus (persulfate digestion method)
BOD = Biochemical oxygen demand
Q = Stream discharge
SS = Suspended sediment
SC = Specific conductance
FC = Fecal coliform
TC = Total coliform
SD = Secchi disk depth

For these reasons, it is advised that the Glacier National Park staff seek the assistance of the Water Resources Division in Fort Collins in the future when enough data is available to yield meaningful information regarding water quality conditions in the Park.

SAMPLING AND LABORATORY METHODS

The sampling methods and laboratory procedures used in the acquisition of water quality information are of utmost importance. Sampling at each site must be conducted in an acceptable and consistent manner. Methodology for sample collection and preservation can be found in Standard Methods for the Examination of Water and Waste Water, 15th ed. (APHA, 1980) or other recognized references. Acceptable laboratory methods can be obtained by contracting sample analysis work through an EPA-certified laboratory. Once sampling and laboratory methods have been selected and implemented, every effort should be made to continue their use in a consistent manner to ensure a statistically uniform data base for future analysis.

DATA STORAGE AND RETRIEVAL

It is recommended that data collected by the Park be entered into a data base system maintained on the park's microcomputer system. The Water Resources Division has developed such a system and can provide the necessary software and support for this effort. The use of this data base system will allow the Park to efficiently and quickly communicate data to the Water Resources Division at a future time when data analysis is desired. Also, the Park could group information into subfiles which contain only that data required for a specific application. This can be accomplished without the need for time-consuming keypunching and sorting each time a need arises.

SUMMARY

The waters of Glacier National Park represent a precious natural resource which need adequate scientific study to manage properly. In recognition of this statement, the Park has established a monitoring program to observe potential changes in the baseline conditions of relatively pristine high alpine lakes and to observe the more heavily used large valley lakes of the Park. The Water Resources Division of the National Park Service recommends extending this study to include observation of additional waters which may be affected by land use activities in the local watersheds.

The monitoring design approach used in this work involves the initial specification of known or suspected problem conditions in the various watersheds in and around the Park. From these problems, specific management questions are raised and a sampling program including where, what, and how often to sample is recommended. In addition, statistical methods are presented which will allow the evaluation of the management questions from the data acquired by the program. Recognizing the need for statistical evaluation up front ensures that the monitoring program will, in fact, produce data that will be useful to management in the future. Problems which may arise in the future which are not specifically addressed here may require additional sampling. However, due to prohibitive costs associated with an all-encompassing monitoring program, the present study, expanded according to this plan, represents a reasonable alternative which should allow the Park staff to track the water quality of Glacier National Park at moderate cost.

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APPENDIX A

Historic Water Resources Data for Glacier National Park

KEY

LOC : Location
S : Dates samples were taken
P : Parameters sampled
R : Bibliographic Reference*

*Bibliographic references are given in detail in Appendix B.

MISSOURI RIVER BASIN

1. Lake Creek
   LOC: R13W,T32N,S07; at the Glacier National Park border
   S: 5/11/82, 8/31/82
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, SO_4, cond., D.O., CO_2, temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1982

2. Midvale Creek
   LOC: R13W,T31N,S14; 400 ft. upstream from Glacier National Park border
   S: 5/7/82, 8/25/82
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, SO_4, cond., D.O., CO_2, temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1982

3. North Fork Cut Bank Creek
   LOC: R13W,T33N,S19; at the Glacier National Park border
   a. S: 6/75-9/75, 9/14/77
   P: Temp., alk., pH, D.O.; TDS, turb., hardness, TP (1975 only)
   R: Jennings, 1981
   b. S: 5/11/82, 8/31/82
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, SO_4, cond., D.O., CO_2, temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1982

4. Railroad Creek
   LOC: R13W,T31N,S35; ¼ mi. upstream from Glacier National Park border
   S: 5/12/82, 8/26/82
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, SO_4, cond., D.O., CO_2, temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1982

5. Summit Creek
   LOC: At drainage mile 2.5 and elevation 5100
   S: 5/29/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

6. Two Medicine River
   LOC: R13W,T32N,S31; 1/8 mi. below Trick Falls
   S: 5/11/82, 8/26/82
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, SO_4, cond., D.O., temp., CO_2
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1982

7. Two Medicine River
   LOC: R13W,T32N,S35; just below Two Medicine Dam at Lower Two Medicine Lake
   S: 4/80-5/80 (weekly), 7/28/80
   P: Temp., cond.
   R: Jennings, 1981

HUDSON BAY BASIN

1. Appekunney Creek
   LOC: Not specified
   S: 7/16/67, 7/22/67
   P: H_2CO_3, D.O., pH, temp.
   R: Robson, 1968

2. Baring Creek
   LOC: At drainage mile 2.8 and elevation 4600
   S: 6/26/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

3. Belly River
   LOC: At drainage mile 11.2 and elevation 4590
   S: 5/15/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

4. Cameron Lake
   LOC: At drainage mile 2.2 and elevation 5445
   S: 6/12/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

5. Cataract Creek
   LOC: At crossing of the Lake Grinnell Trail
   S: 7/14/66, 8/14/66, 6/24/67, 8/16/67
   P: H_2CO_3, D.O., temp.; pH (6/67 only); Ca, Mg, CO_2, HCO_3 (8/67 only)
   R: Robson, 1968

6. Creek above Lake Josephine
   LOC: On the Cataract Creek Trail
   S: 8/4/66
   P: H_2CO_3, D.O., pH, temp.
   R: Robson, 1968

7. Creek running through Grinnell Glacier Campground
   LOC: At the campground
   S: 7/15/67, 7/22/67, 8/16/67
   P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (once only)
   R: Robson, 1968

8. Divide Creek
   LOC: R14W,T34N,S03
   S: 6/15/78, 6/27/78, 7/6/78
   P: Temp., CO_2, D.O.
   R: Jennings, 1981

9. Divide Creek
   LOC: R14W,T35N,S33; near mouth
   S: 5/78-7/78 (4 dates)
   P: Temp., CO_2, D.O.
   R: Jennings, 1981

10. Divide Creek
    LOC: At drainage mile 8.5 and elevation 4550
    S: 6/26/68
    P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
    R: Wasem, 1968

11. Glacier flowing into Grinnell Creek
    LOC: Snowpatch near the glacier
    S: 8/3/66
    P: H_2CO_3, D.O., temp.
    R: Robson, 1968

12. Grinnell Creek
    LOC: 200 ft. below Grinnell Glacier
    S: 8/4/66
    P: H_2CO_3, D.O., temp.
    R: Robson, 1968

13. Grinnell Lake
    LOC: East shore, 200 ft. south of USGS water gauge
    a. S: 6/66-9/66 (4 dates), 6/67-8/67 (3 dates)
    P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2 HCO_3 (8/67 only)
    R: Robson, 1968
    b. S: 7/64-8/64 (semimonthly), 8/7/65
    P: H_2CO_3, CO_2, HCO_3, O_2, pH (7/12/64 only); Ca, Mg (8/65 only)
    R: Lehmkuhl, 1966

14. Grinnell Lake
    LOC: Below Grinnell Lake
    S: 6/66-9/66 (4 dates), 6/67-8/67 (4 dates)
    P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (8/67 only)
    R: Robson, 1968

15. Lake Josephine
    LOC: Outlet
    S: 7/2/66-8/14/66 (weekly), 9/6/66, 6/24/67-8/16/67 (weekly)
    P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (8/67 only)
    R: Robson, 1968

16. Lake Josephine
    LOC: Middle of lake, 5 meters deep
    S: 7/7/66, 7/14/66, 7/21/66
    P: H_2CO_3, D.O., pH, temp.
    R: Robson, 1968

17. Lake Josephine
    LOC: Middle of lake, 10 meters deep
    S: 7/7/66, 7/14/66, 7/21/66
    P: H_2CO_3, D.O., pH, temp.
    R: Robson, 1968

18. Lake Josephine
    LOC: At lower dock
    S: 7/7/66, 7/21/66, 7/28/66, 7/22/67
    P: H_2CO_3, D.O., pH, temp.
    R: Robson, 1968

19. Lake Josephine
LOC: Swampy area near outlet
S: 8/14/66, 8/29/66, 7/14/67, 7/22/67
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

20. Lake Josephine
LOC: Seeps entering on the south shore
S: 8/3/66, 8/14/66
P: H_2CO_3, D.O., temp.
R: Robson, 1968

21. Lake Josephine
LOC: South shore near a large flat rock
S: 7/66-8/66 (twice monthly)
P: H_2CO_3, D.O., temp.
R: Robson, 1968

22. Lake Josephine
LOC: Middle of lake surface
S: 7/66 (3 dates)
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

23. Lake Josephine
LOC: At the head under a wooden walkway
S: 8/3/66, 8/14/66, 7/8/67
P: H_2CO_3, D.O., temp.; pH (7/8/67 only)
R: Robson, 1968

24. Lake Josephine
LOC: At the upper dock
a. S: 7/66-8/66 (weekly); 6/67-8/67 (weekly)
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968
b. S: 7/64-8/64 (twice monthly), 8/7/65
P: H_2CO_3, CO_2, HCO_3, O_2; Ca, Mg (8/7/65 only); pH (7/12/64 only)
R: Lehmkuhl, 1966

25. Lake Josephine
LOC: Inlet
S: 6/66-8/66 (6 dates), 6/67-8/67 (3 dates)
P: H_2CO_3, D.O., temp.; pH (7/7/66, 7/2/67 only); Ca, Mg, CO_2, HCO_3 (8/67 only)
R: Robson, 1968

26. Lake Sherburne
LOC: Near filter beds
S: 7/3/67
P: H_2CO_3, D.O.
R: Robson, 1968

27. Lake Sherburne
LOC: Several hundred feet from filter beds
S: 7/3/67
P: H_2CO_3, D.O., temp.
R: Robson, 1968

28. Lee Creek
LOC: At drainage mile 5.0 and elevation 5200
S: 6/13/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

29. Loring Creek
LOC: R14W,T36N,S27; at the upper end of Lower St. Mary Lake at U.S. Hwy 89
S: 7/7/77
P: Temp.
R: Jennings, 1981

30. Lost Lake
LOC: East shore of lake
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

31. Lost Lake
LOC: Middle of lake
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

32. Lost Lake
LOC: West shore of lake
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

33. Lost Lake
LOC: At drainage mile 0.8 and elevation 4650
S: 6/26/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

34. Lower St. Mary Lake
LOC: Middle, south end of lake
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

35. Mokowanis River
LOC: At drainage mile 8.0 and elevation 4690
S: 5/14/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

36. Piegan Creek
LOC: At drainage mile 1.0 and elevation 6450
S: 6/26/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

37. Pine Coulee Creek
LOC: R14W,T36N,S27; just above confluence with St. Mary River
S: 7/7/77
P: Temp.
R: Jennings, 1981

38. Rose Creek
LOC: At drainage mile 4.8 and elevation 4500
S: 5/23/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

39. St. Mary River
LOC: R14W,T35N,S33; just below confluence with Divide Creek at Blackfeet Hwy 130
S: 5/78-7/78 (4 dates)
P: Temp., TS, TDS, TSS, turb., pH, alk., hardness, TP, Cl, NO_3, cond., fecal coliform, CO_2; D.O. (6/27/78 only)
R: Jennings, 1981

40. St. Mary River
LOC: Near Glacier National Park border
S: 5/78-7/78 (4 dates)
P: CO_2, temp.; TS, TDS, turb., pH, alk., Cl, hardness, TP, NO_3, cond., fecal coliform, D.O. (twice only); TSS (once only)
R: Jennings, 1981

41. Siyeh Creek
LOC: At drainage mile 2.5 and elevation 5850
S: 6/26/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

42. Stream (not named)
LOC: Originating from saddle between Grinnell Pt. and Grinnell Mtn.
S: 6/28/66, 8/14/66, 6/24/67
P: H_2CO_3, D.O., temp.; pH (6/24/67 only)
R: Robson, 1968

43. Swiftcurrent Creek
LOC: At drainage mile 14.5 and elevation 4750
a. S: 6/13/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: 8/67
P: Ca, Mg, CO_2, HCO_3
R: Robson, 1968

44. Swiftcurrent Creek
LOC: At confluence with Wilbur Creek
S: 7/14/66, 7/14/67, 7/22/67, 8/16/67
P: H_2CO_3, D.O., temp., pH
R: Robson, 1968

45. Swiftcurrent Creek
LOC: Behind campsite
S: 7/66-8/66 (3 dates), 6/67-8/67 (approx. weekly)
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

46. Swiftcurrent Creek
LOC: R15W,T36N,S36; between Sherburne Dam and USGS gauge house
S: 6/75-9/75 (monthly), 5/31/78, 4/80-9/80 (ten dates)
P: TS, TSS, SO_4 (once only); cond., D.O., temp., TDS, turb., pH, alk., hardness
R: Jennings, 1981

47. Swiftcurrent Lake
LOC: Public boat launching area
S: 7/66-8/66 (4 dates), 6/67-8/67 (4 dates)
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

48. Swiftcurrent Lake
LOC: Lower dock
S: 7/14/66, 7/28/66
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

49. Swiftcurrent Lake
LOC: Beach
S: 7/66-8/66 (3 dates), 6/67-8/67 (4 dates)
P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (8/67 only)
R: Robson, 1968

50. Swiftcurrent Lake
LOC: Launch bay
S: 7/66-8/66 (3 dates), 6/67-7/67 (4 dates)
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

51. Swiftcurrent Lake
LOC: Center surface
S: 7/21/66
P: H_2CO_3, D.O., temp.
R: Robson, 1968

52. Swiftcurrent Lake
LOC: Center, 5 meters deep
S: 7/14/66, 7/21/66
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

53. Swiftcurrent Lake
LOC: Center, 10 meters deep
S: 7/14/66, 7/21/66
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

54. Swiftcurrent Lake
LOC: At upper boat dock
S: 7/14/66, 7/21/66, 7/28/66
P: H_2CO_3, D.O., pH, temp.
R: Robson, 1968

55. Swiftcurrent Lake
LOC: Outlet
a. S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964
b. S: 7/64-8/64 (twice monthly), 10/7/65
P: H_2CO_3, CO_2, HCO_3, pH, O_2; Ca, Mg (10/65 only)
R: Lehmkuhl, 1966
c. S: 7/14/66, 7/21/66, 7/2/67, 7/14/67, 8/67
P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (8/67 only)
R: Robson, 1968

56. Swiftcurrent Lake
LOC: Middle of lake
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

57. Swiftcurrent Lake
LOC: Inlet
S: 7/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

58. Upper Grinnell Lake
LOC: Not specified
S: 8/4/66
P: H_2CO_3, D.O., temp.
R: Robson, 1968

59. Upper Waterton Lake
LOC: South end, middle of lake
S: 6/51-10/51 (4 dates)
P: Temp., D.O., pH
R: Cuerrier and Schultz, 1957

60. Upper Waterton Lake
LOC: Middle of lake at the U.S./Canada border
a. S: 6/15/51, 7/30/51, 10/6/51
P: Temp., D.O., pH
R: Cuerrier and Schultz, 1957
b. S: 1973
P: Cond., alk., HCO_3, hardness, Ca, Si, SO_4, N, TP, C
R: Anderson and Green, 1975

61. Waterton River
LOC: At drainage mile 25.6 and elevation 4150
S: 6/13/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

62. Wilbur Creek
LOC: At mouth
S: 7/16/67, 7/22/67, 8/16/67
P: H_2CO_3, D.O., pH, temp.; Ca, Mg, CO_2, HCO_3 (8/67 only)
R: Robson, 1968

63. Wilbur Creek
LOC: 30 meters below outlet from Iceberg Lake
S: 7/72-9/72 (4 dates)
P: Temp.
R: Howe, 1974

64. Wilbur Creek
LOC: 900 meters above Many Glacier Campground
S: 7/72-10/72 (4 dates), 4/29/73
P: D.O., CO_2, alk.; pH (8/72-9/72 only); Temp. (4/73 only)
R: Howe, 1974

65. Wilbur Creek
LOC: Upstream from Many Glacier Campground
S: 7/72-10/72 (5 dates); 4/29/73
P: D.O., CO_2, alk.; pH (8/72-9/72 only); temp. (4/73 only)
R: Howe, 1974

66. Wilbur Creek
LOC: Eastern tip of Many Glacier Campground
S: 7/72-10/72 (6 dates)
P: D.O., CO_2, temp., alk.; pH (8/72-10/72 only)
R: Howe, 1974

67. Wilbur Creek
LOC: At drainage mile 4.3 and elevation 4950; 4.19 km below outlet from Iceberg Lake
a. S: 5/24/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: 8/2/72, 9/2/72, 10/2/72
P: D.O., CO_2, temp., alk.; pH (8/2/72 only)
R: Howe, 1974

68. Wild Creek
LOC: At drainage mile 4.5 and elevation 4520
S: 6/26/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

69. Windy Creek
LOC: Not specified
S: 7/16/67, 7/22/67
P: H_2CO_3, temp., D.O.; pH (7/16/67 only)
R: Robson, 1968

FLATHEAD RIVER BASIN

1. Akokala Creek
   LOC: R21W,T35N,S15; 30 ft. upstream from bridge on Glacier Route 7
a. S: 4/20/77, 10/5/77
   P: TS, TDS, TSS, turb., pH, alk., hardness, P, chlorophyll, D.O., CO_2, cond., temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977
b. S: 10/80
   P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
   R: Fraley et al., 1981

2. Akokala Creek
   LOC: At drainage mile 11.5 and elevation 3550
   S: 6/10/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

3. Anaconda Creek
   LOC: At confluence with N.F. Flathead River
   S: 10/80
   P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
   R: Fraley et al., 1981

4. Anaconda Creek
   LOC: R20W,T34N,S36; 100 yds. above bridge on Glacier Route 7
   S: 4/7/77, 9/27/77
   P: TS, TDS, TSS, turb., pH, alk., hardness, P, chlorophyll, D.O., CO_2, cond., temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

5. Anaconda Creek
   LOC: Upper creek area
   S: 4/5/77
   P: TS, TDS, TSS, turb., pH, alk., hardness, P, chlorophyll, D.O., CO_2, cond., temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

6. Avalanche Creek
   LOC: At drainage mile 4.7 and elevation 3390
   S: 6/21/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

7. Bear Creek
   LOC: At drainage mile 11.5 and elevation 4100
   S: 5/22/68
   P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
   R: Wasem, 1968

8. Big Creek
   LOC: Midsection
   S: 7/15/69-9/10/69 (continuous)
   P: Temp.
   R: Nunnallee et al., 1976

9. Big Creek
   LOC: Upper creek area
   S: 7/15/69-9/10/69 (continuous)
   P: Temp.
   R: Nunnallee et al., 1976

10. Big Creek
    LOC: R20W,T33N,S22; just above confluence with N.F. Flathead River
a. S: 8/19/77
   P: Cond.
   R: Knapton, 1978
b. S: 7/15/69-9/10/69 (continuous), 10/75-10/76 (monthly)
   P: Temp. (1969 only); nutrients, metals, and physical parameters (10/75-10/76 only)
   R: Nunnallee et al., 1976

11. Bowman Creek
    LOC: R21W,T35N,S22
   S: 10/75-10/76 (monthly)
   P: Nutrients, metals, benthos, and physical parameters
   R: Nunnallee et al., 1976

12. Bowman Creek
    LOC: R21W,T35N,S23; 150 yds. upstream from bridge on Glacier Route 7
   S: 4/7/77, 10/5/77
   P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
   R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

13. Bowman Creek
    LOC: Just above confluence with N.F. Flathead River
a. S: 8/19/77
   P: Cond.
   R: Knapton, 1978
b. S: 10/80
   P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
   R: Fraley et al., 1981

14. Bowman Lake
    LOC: North shore of west end of lake
   S: 6/62-9/62 (5 dates)
   P: Temp., many biological parameters
   R: Kidd, 1964

15. Bowman Lake
    LOC: Middle of lake at west end
   S: 6/62-9/62 (5 dates)
   P: Temp., many biological parameters
   R: Kidd, 1964

16. Bowman Lake
    LOC: South shore of west end of lake
   S: 6/62-9/62 (5 dates)
   P: Temp., many biological parameters
   R: Kidd, 1964

17. Bowman Lake
LOC: Outlet; at drainage mile 10.5 and elevation 4020
a. S: 5/16/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: 8/7/77
P: Temp., pH, cond., alk., Ca, Mg
R: Appert, 1977

18. Camas Creek
LOC: R19W,T33N,S15; 50 ft. upstream from the bridge at Glacier Route 7
S: 4/5/77, 9/27/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

19. Camas Creek
LOC: R20W,T33N,S12; 1½ mi. upstream from N.F. Flathead River
S: 9/27/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

20. Camas Creek
LOC: R20W,T33N,S14; at confluence with N.F. Flathead River
a. S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981
b. S: 10/72-10/73 (monthly)
P: Alk., hardness, pH, Cl, NO_3, NH_3, PO_4, TP, turb., Ca, Mg
R: Stanford, 1975

21. Camas Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

22. Canyon Creek
LOC: At mouth, N.F. Flathead River
S: 7/15/69-9/10/69 (continuous)
P: Temp.
R: Nunnallee et al., 1976

23. Canyon Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

24. Canyon Creek
LOC: R20W, T32N, S29
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos and physical parameters
R: Nunnallee et al., 1976

25. Coal Creek

LOC: R17W,T31N,S26; 283 ft. upstream from mouth
S: 6/2/78, 8/27/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

26. Coal Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

27. Coal Creek
LOC: R20W,T34N,S20
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

28. Colts Creek
LOC: R22W,T37N,S08
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

29. Cyclone Creek
LOC: R21W,T34N,S35
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

30. Dutch Creek
LOC: Not specified
S: Not specified
P: Cond., diss. org. mat., TP, nitrate, sulfate
R: U.S. Environmental Protection Agency, 1983

31. Elelehum Creek
LOC: R21W,T33N,S22
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

32. Fish Creek
LOC: At drainage mile 5.5 and elevation 3580
S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

33. Fish Creek
LOC: R19W, T32N, S11
S: 10/74-10/75 (monthly)
P: NO_3, PO_4
R: Nunnallee et al., 1976

34. Fish Creek
LOC: R19W,T32N,S11; 75 yds. from Lake McDonald
S: 5/31/78, 6/30/78
P: TS, TDS, TSS, turb., pH, alk., hardness, chlorophyll, TP, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

35. Ford Creek
LOC: At drainage mile 7.0 and elevation 3770
a. S: 6/4/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

36. Ford Creek
LOC: R21W,T36N,S19; 25 ft. upstream from bridge on Glacier Route 7
S: 4/8/77, 10/5/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

37. Flathead River

LOC: R19W,T31N,S07; at Blankship Bridge
S: 1964-1976 (in progress as of 1976, monthly)
P: Alk., pH, turb., cond.
R: Nunnallee et al., 1976

38. Flathead River
LOC: 0.5 mi. below confluence of the north and middle forks
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

39. Harrison Creek
LOC: R18W,T32N,S36; ½ mi. upstream from mouth
S: 6/2/78, 8/27/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

40. Hawk Creek
LOC: R21W,T35N,S06
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

41. Hay Creek
LOC: R21W,T35N,S34
a. S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

b. S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

42. Hay Creek
LOC: R22W,T35N,S04
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

43. Hay Creek
LOC: R22W,T35N,S28; midsection
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

44. Hay Creek
LOC: R22W,T35N,S26
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

45. Hay Creek
LOC: R22W,T35N,S01
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

46. Hay Creek
LOC: R22W,T35N,S23
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

47. Hidden Lake
LOC: West shore
S: 8/1/62
P: Temp., many biological parameters
R: Kidd, 1964

48. Hidden Lake
LOC: Northeast shore
S: 8/1/62
P: Temp., many biological parameters
R: Kidd, 1964

49. Hidden Lake
LOC: North shore
S: 8/1/62
P: Temp., many biological parameters
R: Kidd, 1964

50. Hollowat Creek
LOC: R21W,T33N,S33
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

51. Jackson Creek
LOC: At the bridge on Administrative Road
S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals, and physical parameters
R: Sinning, 1976

52. Jackson Creek
LOC: R18W,T33N,S14
S: 10/74-10/75 (monthly)
P: NO_3, PO_4
R: Nunnallee et al., 1976

53. Jackson Creek
LOC: At drainage mile 1.8 and elevation 3150
S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

54. Johns Lake
LOC: Southwest end
S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

55. Johns Lake
LOC: Northeast end
S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

56. Johns Lake
LOC: Middle
S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

57. Kimmerly Creek
LOC: R20W,T32N,S29
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

58. Kintla Creek
LOC: At drainage mile 8.0 and elevation 4010
S: 5/28/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

59. Kintla Creek
LOC: R21W,T36N,S06; 400 ft. upstream from bridge crossing Kintla Creek on Glacier Route 7
S: 4/8/77, 10/5/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

60. Kintla Creek
LOC: At drainage mile 14.0 and elevation 3810
a. S: 6/10/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: Not specified
P: Cond., diss. org. mat., TP, NO_3, SO_4
R: U.S. Environmental Protection Agency, 1983

61. Kintla Lake
LOC: Outlet
S: 8/7/77
P: Temp., pH, cond., alk., Ca, Mg
R: Appert, 1977

62. Kintla Lake
LOC: At drainage mile 12.8 and elevation 4010
S: 6/3/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

63. Kishenehn Creek
LOC: At confluence with N.F. Flathead River
S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

64. Kishenehn Creek
LOC: R22W,T37N,S23; ¼ mi. upstream from mouth
S: 6/78-9/78 (monthly), 4/81-11/81 (6 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980, 1981

65. Kletomus Creek
LOC: R21W,T33N,S19
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

66. Lake Five
LOC: R19W,T31N,S10; middle of north end
S: 7/1/73-6/30/74 (4 samples)
P: Temp., pH, cond., light penetration, D.O., CO_2, HCO_3, CO_3, NO_3, PO_4, phytoplankton
R: Sonstelie, 1975

67. Lake Five
LOC: R19W,T31N,S10; middle of south end
S: 7/1/73-6/30/74 (4 samples)
P: Temp., pH, cond., light penetration, D.O., CO_2, HCO_3, CO_3, NO_3, PO_4, phytoplankton
R: Sonstelie, 1975

68. Lake McDonald
LOC: South end
a. S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964
b. S: 1974 (2 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Environmental Protection Agency, 1977

69. Lake McDonald
LOC: Middle, near Snyder Creek
S: 1974 (2 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Environmental Protection Agency, 1977

70. Lake McDonald
LOC: 30-60 m. south of inflow of Snyder Creek, 60-100 m. offshore
S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals, and physical parameters
R: Sinning, 1976

71. Lake McDonald
LOC: Southeast shore
S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

72. Lake McDonald
LOC: Northeastern shore
S: 6/62-9/62 (5 dates)
P: Temp., many biological parameters
R: Kidd, 1964

73. Lake McDonald
LOC: Middle, below Sprague Creek
S: 1974 (2 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Environmental Protection Agency, 1977

74. Lake McDonald
LOC: At drainage mile 25.8 and elevation 3144
S: 6/19/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

75. Lincoln Creek
LOC: R18W,T32N,S27; 165 ft. upstream from confluence with M.F. Flathead River
S: 6/2/78, 8/27/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

76. Logan Creek
LOC: At drainage mile 3.5 and elevation 3550
S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

77. Logan Creek
LOC: At confluence with McDonald Creek
S: 8/6/68, 8/7/68
P: Temp., alk., pH, D.O., diss. solids
R: Wasem, 1968

78. Logging Creek
LOC: At confluence with N.F. Flathead River
S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

79. Logging Creek
LOC: R20W,T34N,S21; ¼ mi. upstream from bridge on Glacier Route 7
S: 4/7/77, 9/27/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

80. Logging Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

81. McDonald Creek
LOC: At drainage mile 18.7 and elevation 3150
S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

82. McDonald Creek
LOC: 0.1 mi. from confluence with M.F. Flathead River
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

83. McDonald Creek
LOC: R19W,T32N,S23; ¼ mi. below outlet of Lake McDonald at the bridge
a. S: 5/78-7/78 (two dates)
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980
b. S: 7/82-8/82 (approx. weekly)
P: Nutrients, metals and physical parameters
R: Sinning, 1976
c. S: 10/79-9/81 (50 dates)
P: Temp., TSS, cond., pH, alk., major cations and anions, NH_4, NO_3, ortho-PO_4, fecal coliform
R: Foggin and McClelland, 1980

84. McDonald Creek
LOC: Just above outfall from the Lake McDonald Lodge treatment facility
S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals, and physical parameters
R: Sinning, 1976

85. McDonald Creek
LOC: Just below outfall from the Lake McDonald Lodge treatment facility
a. S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals, and physical parameters
R: Sinning, 1976
b. S: 10/79-9/81 (50 dates)
P: Temp., TSS, cond., pH, alk., major cations and anions, NH_4, NO_3, ortho-PO_4, fecal coliform
R: Foggin and McClelland, 1980

86. McDonald Creek
LOC: R18W,T33N,S11; 475 yds. below McDonald Falls at the head of the lake by the bridge
a. S: 5/78-7/78 (two dates)
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980
b. S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals and physical parameters
R: Sinning, 1976
c. S: 10/74-10/75 (monthly)
P: NO_3, PO_4
R: Nunnallee et al., 1976
d. S: 10/79-9/81 (50 dates)
P: Temp., TSS, cond., pH, alk., major cations and anions, NH_4, NO_3, ortho-PO_4, fecal coliform
R: Foggin and McClelland, 1980

87. McDonald Creek
LOC: Not specified
S: 9/27/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

88. McDonald Creek
LOC: R19W,T32N,S23; at outlet from Lake McDonald
a. S: 10/74-10/75 (monthly)
P: NO_3, PO_4
R: Nunnallee et al., 1976
b. S: 10/79-9/81 (50 dates)
P: Temp., TSS, cond., pH, alk., major cations and anions, NH_4, NO_3, ortho-PO_4, fecal coliform
R: Foggin and McClelland, 1980

89. McDonald Creek
LOC: 0.5 mi. below Logan Creek
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

90. McDonald Creek
LOC: 2.3 mi. below Avalanche Creek
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

91. McDonald Creek
LOC: 0.2 mi. above inlet to Lake McDonald
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

92. McDonald Creek
LOC: Below the major salmon spawning area
S: 10/79-9/81 (50 dates)
P: Temp., TSS, cond., pH, alk., major cations and anions, NH_4, NO_3, ortho-PO_4, fecal coliform
R: Foggin and McClelland, 1980

93. McGinnis Creek
LOC: R20W,T32N,S27
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

94. Middle Fork Flathead River
LOC: R19W,T32N,S34; near West Glacier
a. S: 10/72-11/73 (monthly)
P: Nutrients, metals, and physical parameters
R: Nunnallee et al., 1976
b. S: 10/75-10/76 (monthly)
P: Nutrients, metals, physical and biological parameters
R: Nunnallee et al., 1976
c. S: 1978 (3 dates)
P: Nutrients, metals, physical and biological parameters
R: Bahls et al., 1979
d. S: 10/72-11/72 (3 dates)
P: Alk., hardness, pH, Cl, NO_3, NH_3, PO_4, TP, turb., Ca, Mg
R: Stanford et al., 1975

e. S: Not specified
P: Cond., diss. org. mat., TP, NO_3, SO_4, TOC, C:N
R: U.S. Environmental Protection Agency, 1983
f. S: 12/67-7/68 (weekly)
P: Temp., alk., pH, D.O., TDS
R: Wasem, 1968
g. S: 7/13/70-7/16/70
P: Nutrients, metals, physical and biological parameters
R: U.S. Dept. of Agriculture, Flathead National Forest, 1973

95. Middle Fork Flathead River
LOC: R15W,T29N,S31; at confluence with Bear Creek
S: 5/70-4/73 (10 random dates)
P: Nutrients, metals, and physical parameters
R: Nunnallee et al., 1976

96. Middle Fork Flathead River
LOC: At drainage mile 65.0 and elevation 3150
S: 5/22/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

97. Middle Fork Flathead River
LOC: At drainage mile 43.0 and elevation 3750
S: 6/27/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

98. Middle Fork Flathead River
LOC: Just above confluence with N.F. Flathead River
S: 8/6/68, 8/7/68
P: Temp., pH, alk., D.O., diss. solids
R: Wasem, 1968

99. Moose Creek
LOC: R21W,T36N,S31
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

100. Moran Creek
LOC: R21W,T35N,S32
S: 7/69-9/69 (continuous), 7/70-9/70 (continuous)
P: Temp.
R: Nunnallee et al., 1976

101. Moran Creek
LOC: R21W,T34N,S02
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

102. Mt. Oberlin Cirque, snowfield
LOC: Near Logan Pass, Continental Divide
S: 8/6/68, 8/7/68
P: Temp., D.O., pH, alk., diss. solids
R: Wasem, 1968

103. Muir Creek
LOC: R16W,T30N,S16; 230 ft. upstream from mouth
S: 6/2/78, 8/27/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

104. North Fork Flathead River
LOC: At confluence with Camas Creek
S: Not specified
P: Cond., diss. org. mat., TP, NO_3, SO_4, TOC, C:N
R: U.S. Environmental Protection Agency, 1983

105. North Fork Flathead River
LOC: R20W,T32N,S35; just below confluence with Canyon Creek
a. S: 10/70-9/71, 10/75-present (ongoing, inconsistent)
P: Nutrients, metals, and physical parameters
R: U.S. Geological Survey, Water Resources Data for Montana, Parts 1 and 2
b. S: 1978 (3 dates)
P: Nutrients, metals, physical and biological parameters
R: Bahls et al., 1979
c. S: 5/70-1/73 (bimonthly)
P: Nutrients, metals, and physical parameters
R: Nunnallee et al., 1976

106. North Fork Flathead River
LOC: R21W,T35N,S22; at Polebridge
S: 10/75-10/76 (monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

107. North Fork Flathead River
LOC: At the U.S./Canada border
a. S: 10/70-9/71, 10/75-present (ongoing, monthly)
P: Nutrients, metals, physical and biological parameters
R: U.S. Geological Survey, Water Resources Data for Montana, Parts 1 and 2
b. S: 7/13/70-7/16/70
P: Nutrients, metals, physical parameters, herbicides, and insecticides
R: U.S. Dept. of Agriculture, 1973
c. S: Not specified
P: TOC, C:N
R: U.S. Environmental Protection Agency, 1983

108. North Fork Flathead River
LOC: At drainage mile 64.0 and elevation 3550
S: 6/4/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

109. Nyack Creek
LOC: R17W,T31N,S08; 1150 ft. above confluence with M.F. Flathead River
S: 6/2/78, 8/27/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

110. Ole Creek
LOC: R16W,T29N,S14; 1020 ft. upstream from mouth
a. S: 6/2/78, 8/26/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980
b. S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

111. Ole Creek
LOC: At drainage mile 14.8 and elevation 3780
S: 6/27/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

112. Park Creek
LOC: R16W,T29N,S03; 68 ft. upstream from mouth
S: 6/2/78, 8/26/78
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

113. Park Creek
LOC: At drainage mile 12.3 and elevation 3650
S: 6/27/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

114. Quartz Creek
LOC: R20W,T34N,S07; 100 yds above bridge on Glacier Route 7
S: 4/7/77, 9/27/77
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, D.O., CO_2, cond., temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977

115. Quartz Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

116. Red Meadow Creek
LOC: Midsection
S: 7/15/69-9/10/69 (continuous)
P: Temp.
R: Nunnallee et al., 1976

117. Red Meadow Creek
LOC: Upper creek area
S: 7/15/69-9/10/69 (continuous)
P: Temp.
R: Nunnallee et al., 1976

118. Red Meadow Creek
LOC: R21W,T35N,S07
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

119. Red Meadow Creek
LOC: Lower creek area; just above confluence with N.F. Flathead River
a. S: 8/19/77
P: Cond.
R: Knapton, 1978
b. S: 7/15/69-9/10/69 (continuous)
P: Temp.
R: Nunnallee et al., 1976

120. Sage Creek
LOC: At confluence with N.F. Flathead River
S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

121. Sage Creek
LOC: R22W,T37N,S09; 3/4 mi. upstream from N.F. Flathead River
S: 4/77, 10/77, 6/78-9/78 (monthly)
P: Nutrients, metals, and physical parameters
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1977, 1980

122. Sage Creek
LOC: R22W,T37N,S04; at U.S./Canada border
S: 3/81-11/81 (6 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1981

123. Snyder Creek
LOC: At drainage mile 4.8 and elevation 3170
S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968

124. South Fork Coal Creek
LOC: R22W,T34N,S26
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

125. South Fork Red Meadow Creek
LOC: R21W,T35N,S07
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

126. Sprague Creek
LOC: R18W,T33N,S23; at drainage mile 6.0 and elevation 3150
a. S: 6/21/68
P: Turb., temp., Fe, alk., diss. solids, pH, D.O.
R: Wasem, 1968
b. S: 7/72-8/72 (approx. weekly)
P: Nutrients, metals, and physical parameters
R: Sinning, 1976
c. S: 10/74-10/75 (monthly)
P: NO_3, PO_4
R: Nunnallee et al., 1976

127. Spruce Creek
LOC: R22W,T37N,S23; ¼ mi. upstream from N.F. Flathead River
S: 6/78-9/78 (monthly)
P: TS, TDS, TSS, turb., pH, alk., hardness, TP, chlorophyll, cond., D.O., CO_2, temp.
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980

128. Spruce Creek
LOC: R22W,T37N,S14; 1 3/4 mi. upstream from mouth
S: 7/30/80, 11/5/80, 3/81-11/81 (6 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980, 1981

129. Stanton Creek
LOC: At confluence with N.F. Flathead River
S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

130. Starvation Creek
LOC: Not specified
S: 8/19/77
P: Cond.
R: Knapton, 1978

131. Starvation Creek
LOC: R22W,T37N,S25; 50 yds from N.F. Flathead River
a. S: 6/78-9/78 (monthly), 4/81-11/81 (6 dates)
P: Nutrients, metals, and physical parameters
R: U.S. Dept. of the Interior, Fish and Wildlife Service, 1980, 1981
b. S: 10/80
P: TP, TOC, SO_4, NO_3, Mg, Ca, K, Na, alk., cond.
R: Fraley et al., 1981

132. Teepee Creek
LOC: R22W,T36N,S11
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

133. Trail Creek
LOC: R22W,T37N,S35
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

134. Trail Creek
LOC: Just above confluence with N.F. Flathead River
a. S: 8/19/77
P: Cond.
R: Knapton, 1978
b. S: Not specified
P: Cond., diss. org. mat., TP, NO_3, SO_4, TOC, C:N
R: U.S. Environmental Protection Agency, 1983

135. Upper Big Creek
LOC: R21W,T32N,S05
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

136. Upper Canyon Creek
LOC: R21W,T32N,S25
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

137. Upper Coal Creek
LOC: R22W,T34N,S24
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

138. Upper Moose Creek
LOC: R22W,T35N,S05
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

139. Upper Hay Creek
LOC: R22W,T35N,S32
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

140. Upper Teepee Creek
LOC: R22W,T36N,S09
S: 10/75-10/76 (in progress as of 10/76, quarterly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

141. Whale Creek
LOC: Just above confluence with N.F. Flathead River
S: 8/19/77
P: Cond.
R: Knapton, 1978

142. Whale Creek
LOC: R21W,T36N,S30
S: 10/75-10/76 (in progress as of 10/76, monthly)
P: Nutrients, metals, benthos, and physical parameters
R: Nunnallee et al., 1976

143. Whale Creek
LOC: Midsection
S: 7/15/69-9/10/69 (continuous)
P: Temp.
R: Nunnallee et al., 1976

APPENDIX B

Water Resources Bibliography for Glacier National Park

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