

BLACKFEET NATION

P.O. BOX 850

BROWNING, MONTANA 59417

(406) 338-7179

FAX 338-7530

EXECUTIVE COMMITTEE

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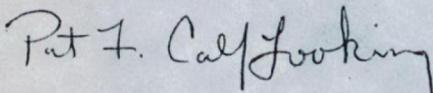
David Rathke, PhD:

Enclosed is a draft of the Final Report for the (314) Clean Lakes Program. A copy of this report has been sent to Lee Roberts for his review. Our office apologies for the extended delay of this document, but gathering of data, organizing it, and incorporating it into the final product took longer than we anticipated.

We hope this report will confer to your office the direction in which the Blackfeet Environmental Office is pursuing water Quality. We are working very hard to complete tasks and objectives which were already in place before we arrived at this job.

Our office would appreciate any suggestions or comments regarding this report.. If you have any questions, please contact our office at (406) 338-7421. Thank You.

Environmental Scientist,



Pat F. Calf Looking

cc: Crono file

Final Report

(314) CLEAN LAKES PROGRAM OF THE BLACKFEET INDIAN RESERVATION

Prepared for :
ENVIRONMENTAL PROTECTION AGENCY
REGION V111

Federal Building, rm. 285
301 South park, Drawer 10096
Helena, Mt. 59626-0096

ATTENTION:

Lee Roberts
David Rathke

SUBMITTED BY:

The Blackfeet Environmental
Department

PREPARED BY:

Wayne Smith, Administrative Director
Pat F. Calf Looking, Environmental Scientist
Gerald Wagner, Environmental Scientist
Henry Butterfly, Water Technician

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INTRODUCTION:

Characterization of lakes on the Blackfeet Reservation

The Blackfeet Reservation consists of a diversity of lakes. Enclosed in the 1.5 million acres of the Reservation boundaries are incredible mountainous lakes, magnificent foothill and grassland lakes, and numerous prairie pothole water bodies. Also, various reservoirs originate on the western side of the Blackfeet Reservation.

The multitude of lakes on the Reservation support a variety of uses of which include the following: sanctuary for waterfowl, bolster first-class fishing, and provide water for agricultural, animal, and human applications. Also, ecosystems depend heavily on the water quality of these Reservation lakes.

There are four major drainage basins residing on the Blackfeet Reservation. They are the Cut Bank, Milk River, St. Marys, and the Two Medicine drainage basins. The Milk River and St. Marys basins empty into southern Alberta in Canada. The Cut Bank and Two Medicine basins discharge into the Missouri River and eventually into the Mississippi River. The drainage basins begin at the Continental Divide.

The water quality of the lakes listed in this report will be determined and then an preliminary assessment will be completed. Chemical, biological, and physical characteristics will be the principal factors taken into account during this assessment process, but other contributing elements will also be considered. They include precipitation, run off, erosion, dust, atmospheric gases, underground water, etc.

This Clean Lakes Report is intended to inform the public and EPA about the lakes on the Blackfeet Reservation with a primary focus on the water quality of these lakes.

PAGE NOT

AVAILABLE

DIGITALLY

SIZE OF DRAINAGE BASINS

<u>Basin</u>	<u>Area Size</u>
1. St. Marys	214 Square Miles
2. Milk River	507 Square Miles
3. Two Medicine	670 Square Miles
4. Cut Bank	1,008 Square Miles

MEASURED ANNUAL RUNOFF IN DRAINAGE BASINS

<u>Basin</u>	<u>1991 (acres-ft.)</u>	<u>1992 (acres-ft.)</u>
1. St. Marys	592,700 measured	279,000 measured
2. Milk River	23,331 measured	no data available
3. Two Medicine	679,100 measured	250,770 estimated
4. Cut Bank	179,000 measured	66,930 measured

St. Marys
Drainage Basin

Duck Lake

Duck Lake is located in the St. Marys drainage basin, and is the second largest lake on the Blackfeet Reservation. It is situated a mile east of Babb, Montana and forty miles north of Browning, Montana on BIA Highway 464. Also, Canada is perched ten miles to the north of it. Duck Lake runs in an east-westerly direction, and is solidified in the foothills of the Rocky Mountain range.

There are two types of lands encompassing the shoreline of Duck Lake. Fee land embraces all of the northern, eastern, and western shores. Fee also can be found on three quarters of the southern shore. This is where most of the colonizing has taken place in the form of cabins, trailer homes, and other dwellings. Tribal land is focused on the remainder of the lake where a store, boat dock, and campsite are used as revenue for the tribal budget.

Duck Lake supports a healthy fishery with seven species currently abiding in its waters. Canadians and Tribal members take full advantage of the opportunities which Duck Lake has to offer them. Fishing, boating, swimming, water skiing, camping, and picnicking are enjoyed by all.

Duck lake acts as a landlord to many water fowl species in the summer months and a rest stop for migrating birds in the spring and autumn months.

Drainage Basin Characteristics

Duck Lake has no defined tributaries flowing into it. It is charged by ground water and run off. Duck Lake comprises part of the St. Marys watershed, and is located in the eastern part of it. Any excess water in Duck leaves via a culvert on the west end of the lake and drains into the St. Marys River.

Duck Lake coincides in two distinct ecoregions one being the Northern Rockies and the other being the Montana Valley and Foothill Prairies. The riparian soils which surround this lake include cobbly, gravelly, stony, and light clay loams. The dominant vegetation which exist in these soils are the bearded wheatgrass, rough fescue, and the blue bunch wheatgrass.

Duck Lake is used primarily for recreational purposes, but stock also utilized Duck for watering on the east end. This practice may be closed off in the near future. To the west, the Rocky Mountains protrude into the sky. To the north, ranching is the main industry in this basin.

Lake Basin Characteristics

Duck Lake has considerable magnitude with a surface area of 1,449.40 acres and shoreline length of 52,662 feet. We measured the middle of the lake twice in 1993 and found the deepest point to be sixty-eight feet. This point is located directly north of the tribal store and boat dock in the middle of the lake. The timber stands, which were once abundant on the south west shores, are now replaced with residential structures. The rest of the Duck Lake shore line is covered with grassy type vegetation.

Duck Lake has an elevation of 5,021 feet with water levels varying from year to year due to ground water and run off contributions. There has been a serious lowering of the water level over the past decade by several feet.

Water Quality

Duck Lake was monitored in 1974-75 and was entered into the Blackfeet Tribal Water Quality Management Plan of 1981. Also, the Blackfeet Environmental Office monitored this lake in 1993 under sec. 314 of the Clean Water Act.

Because of the relatively high calcium and magnesium levels (Table 3), Duck Lake's water is considered to be hard. Alkalinity is also elevated indicating the lakes ability to neutralize strong acids.

At this time, Duck Lake would be classified as a mesotrophic water body because of the results obtained in the last two years. Our data shows a moderate amount of nutrients in the fall months with **chlorophyll a** shifting when changes in total phosphorus and nitrogen levels occur. The results in October of 1993 show an intermediate quantity of Phosphates and Nitrates indicating an algae growth in the lake.

Biological Characteristics

Fish:

Duck Lake currently houses seven species of fish. The fish fauna are comprised of the following: rainbow trout, brown trout, brook trout, lake chub, fathead minnow, white sucker, and Bonneville cutthroat trout.

Table 1. Characteristics of Duck Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, Stony, and Light Clay Loams. (Loam).
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies, Montana Valley and Foothill Prairies
dominant vegetation	Aspen: Bearded Wheatgrass, Rough Fescue, Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Duck Lake.

elevation (ft.)	5,021.00
surface area (acres)	1,449.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	68.0
mean depth (ft.)	Unknown
shoreline length (ft.)	52,662.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-24"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Duck Lake. Average concentrations in mg/L; pH in pH units. Samples were collected from euphotic zone on 28 October 1992, and twice in 1993 on 4 August & 20 October. There were four grab samples obtained at each visit.

	1992	1993
	Mean	Mean
pH (range)	9.00	8.89
alkalinity (mg/L CaCo ₃)	----	434.50
conductivity (umhos/cm)	443	685.00
turbidity (NTU)	3.20	1.26
dissolved oxygen	----	7.40
total suspended solids	3.44	1.77
Ca	25.82	24.39
Mg	73.97	76.06
K	8.75	8.83
Na	27.13	28.09
Cl	3.39	3.31
SO ₄	3.39	4.34

Table 4. Nutrient, chlorophyll a and Secchi depth data for Duck Lake. Average concentrations in ug/L. Samples were collected from the euphotic zone once on 28 Oct. 1992, and twice in 1993 on 4 August & 20 October. There were four grab samples obtained at each visit.

	1992	1993
	Mean	Mean
total phosphorus	20.04	18.48
NH3-N	<1.80	13.88
NO2/3	<2.80	5.09
chlorophyll a	6.34	1.61
secchi depth (ft)	8'	11'6"

Flat Top Lake

Flat Top Lake is very hard to find and access. A four by four vehicle would be needed to get to this lake. It is located east of Flat Top Mountain, or a half mile west of St. Marys lake. Babb lies in a round about way four miles to the north on US Highway 89, and St. Marys community is three miles to the south on the same highway.

This lake received its name from Flat Top Mountain. It is not open to the public. The land encircling Flat Top Lake is in trust status. There are no activities linked to Flat Top Lake although it is regularly planted with trout by the Blackfeet Fish and Game Department. Wildlife and forest abound in this area.

Drainage Basin Characteristics

Flat Top Lake sits close to the south west boundary of the St. Marys drainage basin. It is the smallest lake in this basin. Flat Top is charged by run off and ground water. There is no visible outlet.

The Northern Rockies Ecoregion is the home to this lake. Aspen, Lodgepole pine, and Douglas fir make up the vegetation around the lake with loam type soils supporting them.

Most of the drainage basin is located north of Flat Top Lake with mountains occupying the northwest side and prairies the northeast portion.

Lake Basin Characteristics

The depth of this lake could not be measured because of access problems with boat. Flat top is a small lake with a surface area of 21.70 acres and a shoreline length of 4,459 feet. Timber stands surround the lake with one road leading into it on the west side.

Flat Top has an elevation of 5,658. This is one of the higher lakes on the Blackfeet Reservation. Run off is the biggest contributor to the volume of water.

Water Quality

In 1965, some monitoring of Flat Top Lake did occur with the data being entered into the Blackfeet Tribes Water Quality Management Plan. The testing of its waters was resumed by the Blackfeet Environmental Program in 1993 under Sec. 314 of the Clean Water Act.

Flat Top Lake is a well buffered, freshwater lake. All physical and chemical parameters look excellent (Table 3). The water has a low hardness as predicted by calcium and magnesium levels.

The total phosphorus content is extremely low with the nitrogen levels even smaller. Also, the **chlorophyll a** concentrations are almost non-existent. Put all three factors above together, and this would add up to a oligotrophic lake.

Biological Characteristics

Fish:

Flat Top Lake contains Yellowstone Cutthroat Trout.

Table 1. Characteristics of Flat Top Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Gravelly, Stony, and Cobbly Clay Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Douglas Fir, Englemann Spruce, Lodgepole Pine.
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Flat Top Lake.

elevation (ft.)	5,658.00
surface area (acres)	21.70
volume (acre-ft.)	Unknown
maximum depth (ft.)	Unknown
mean depth (ft.)	Unknown
shoreline length (ft.)	4,459.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Flat Top Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 31 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.40
alkalinity (mg/L CaCo3)	-----	147.40
conductivity (umhos/cm)	-----	220.00
turbidity (NTU)	-----	0.62
dissolved oxygen	-----	6.60
total suspended solids	-----	0.78
Ca	-----	28.95
Mg	-----	21.14
K	-----	0.59
Na	-----	31.98
Cl	-----	0.38
SO4	-----	2.33

Table 4. Nutrient, chlorophyll a and Secchi depth data for Flat Top Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 31 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	14.56
NH3-N	----	< 5
NO2/3	----	< 2
chlorophyll a	----	0.79
secchi depth (ft)	----	----

Pike Lake

Pike Lake sits on the northern most reaches of the Blackfeet Reservation. To reach Pike Lake, a traveler would have to take US Highway 89 north of Babb for six miles, and then turn west on a dirt road for four miles. Pike lies on the Blackfeet Reservation boundary and the Canada line. Pike is set just below the Rocky Mountains on its front range.

Pike Lake is surrounded by tribal land. There are a couple of picnic sites on the east side of this lake. A loan residential structure sits on a hill about a half of mile to the south of the lake.

The name Pike Lake comes from the Pike fish that were introduced there many years ago. Canadians as well as Americans take advantage of the pike in this lake.

Wildlife and domestic animals utilize Pike Lake as a water source. Waterfowl also can be seen resting on this cool pristine mountain lake.

Drainage Basin Characteristics

Pike Lake rests on the northern most region of the St. Marys drainage basin. Run off and ground water contribute to the volume of water in this lake. A tributary outlet leaves Pike Lake on the western side with the water flowing into Otatso Creek. The water eventually ends up in the St. Marys River.

The Northern Rockies Ecoregion is where Pike Lake is located at. The most persistent vegetation in this area is the bearded wheatgrass, rough fescue, and the bluebunch wheatgrass. The larger vegetation consist of the Aspen. The soils are cobbly, gravelly, stony, sandy, and light clay loams.

The drainage basin has mountains to the west, prairies to the east, and agricultural practices intensifying to the north. Babb and St. Marys are the two towns located in this drainage basin.

Lake Basin Characteristics

This is a fairly deep mountainous lake with 25 feet being the deep point measured in 1993. Pike has a shoreline measurement of 12,435 feet and a surface area of 102.40 acres. It is nestled in a symmetrical valley of Aspens, willows, and pines.

The USGS surveyed Pike Lake at 4,519 feet. Precipitation is the biggest donator to Pikes volume of water.

Water Quality

The Water Quality Management Plan of the Blackfeet Tribe has documentation that Pike was monitored in 1966. The water quality of Pike was monitored more indepth by the Blackfeet Environmental Office in 1993.

Pike Lake has excellent water quality. Pike is a well buffered, fresh water lake. The water is moderately hard. The main ions are calcium and magnesium (Table 3).

Total phosphorus and ammonia concentrations are reasonably low, and this coupled with the almost non-existent **chlorophyll a** levels would place Pike Lake under the oligotrophic bracket. Other evidence supporting this assessment would be the clear water and high secchi dish reading.

Biological Characteristics

Fish:

Pike Lake contains the Northern Pike species. There is no other data available.

Table 1. Characteristics of Pike Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, Stony, Sandy, and Light Clay Loams
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Aspen, Bearded Wheatgrass, Rough Fescue, Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Pike Lake.

elevation (ft.)	4,519.00
surface area (acres)	102.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	25.0
mean depth (ft.)	Unknown
shoreline length (ft.)	12,435.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-24"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Pike Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 26 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.38
alkalinity (mg/L CaCo3)	-----	211.20
conductivity (umhos/cm)	-----	417.00
turbidity (NTU)	-----	0.79
dissolved oxygen	-----	7.00
total suspended solids	-----	0.78
Ca	-----	42.18
Mg	-----	26.59
K	-----	1.18
Na	-----	13.39
Cl	-----	1.27
SO4	-----	3.25

Table 4. Nutrient, chlorophyll a and Secchi depth data for Pike Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 26 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	24.12
NH3-N	-----	24.24
NO2/3	-----	2.90
chlorophyll a	-----	0.79
secchi depth (ft)	-----	16'7"

Sherburne Reservoir

Sherburne Reservoir is located four miles west of Babb, Montana on a paved road. The border of Canada lies fourteen miles to the north east on US Highway 89. This magnificent lake is etched into the Rocky Mountains in an east-westerly orientation.

Most of Sherburne Reservoir resides in Glacier National Park. Only the eastern tip of this lake is on tribal land which also includes the control structure (dam). At the east end of the reservoir, the famous Many Glacier Chalet can be found.

Sherburne Reservoir is used primarily by tourists in the summer months. A boat dock is established at Many Glaciers which accommodates rental of boats.

Drainage Basin Characteristics

Sherburne Reservoir is situated in the St. Marys drainage basin on the extreme west side. Sherburne is charged by several intermitted streams, run off, springs, and two tributaries. Appekunny and Windy creeks enter Sherburne from the west side. Water is released on the east side of the lake through Sherburne Dam.

The Northern Rockies Ecoregion is the site of Sherburne Reservoir. The timber stands surrounding this reservoir include the Lodgepole pine, Englemann spruce, Douglas fir, Alpine fir, and the Aspen. The soil makeup includes the cobbly, gravelly, stony, and cobbly clay loams.

The drainage basin is made up of mountains to the west and foothill and prairies to the east.

Lake Basin Characteristics

Sherburne is a man made Reservoir which was once the Swiftcurrent Creek basin. This reservoir is a semi-deep lake with 44 feet being the inmost point. The surface area is 1,392.41 acres of which only 50.6 acres are located in the Blackfeet Reservation boundaries. Sherburne has a perimeter of 6,954 feet with forest and a paved road paralleling the north side and forest & mountain covering the south side.

The elevation, of is Sherburne Reservoir, is listed at 4,788 feet. The latest data has Sherburne storing 42,733 acre feet of water in 1990 with 64,793 being the storage capacity of this reservoir. The Specifications on this reservoir are noted on (Table 2.).

Water volume and levels are determined mostly by the amount of water released by Bureau of Reclamation. This agency is also responsible for up keep of dam. Sherburne's water is used for irrigational purposes with the Fort Belnap Indian Reservation getting the majority of water via the Milk River.

Water Quality

Water quality was monitored in 1980 for a couple of constituents. The ensuing results were placed in the Water Quality Management Plan of the Blackfeet Nation. Water quality was monitored more intensely in 1993 by the Blackfeet Environmental Office.

Sherburne Reservoir is a freshwater lake because of low concentrations of total suspended solids and salts. The amount of calcium and magnesium tends to reveal the lakes relatively low hardness.

The low concentrations of total phosphorus, nitrogen compounds, and **chlorophyll a** definitely labels Sherburne as an oligotrophic lake, but additional testing is needed to prove analysis.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Sherburne Reservoir drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, Stony, and Cobbly Clay Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Alpine Fir, Aspen, Douglas Fir, Englemann Spruce, Lodgepole Pine.
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Sherburne Reservoir.

elevation (ft.)	Unknown
surface area (acres)	1,392.41 of which 50.6 acres are on the Reservation.
storage capacity (acre-ft.)	64,793.00
storage in 1990 (acre-ft.)	42,733.00
maximum depth (ft.)	44.0
mean depth (ft.)	Unknown
shoreline length (ft.)	6,954.00
control structures	compacted earthfill with concrete base slab
dam height (ft.)	108.5
dam crest length (ft.)	1,200.00
overflow spillway crest elevation (ft.)	4,788.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available

Table 3. Major ions and related water quality variables for Sherburne Reservoir. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 30 September 1993.

	1992	1993
	Mean	Mean
pH (range)	----	8.33
alkalinity (mg/L CaCo3)	----	61.60
conductivity (umhos/cm)	----	115.00
turbidity (NTU)	----	1.55
dissolved oxygen	----	8.40
total suspended solids	----	1.0
Ca	----	16.54
Mg	----	6.02
K	----	0.26
Na	----	0.80
Cl	----	0.25
SO4	----	3.49

Table 4. Nutrient, chlorophyll a and Secchi depth data for Sherburne Reservoir. Average concentrations in ug/L. A sample was collected from the euphotic zone on 30 September 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	8.68
NH3-N	----	13.71
NO2/3	----	4.41
chlorophyll a	----	1.74
secchi depth (ft)	----	11'10"

St. Marys Lake

Lower St. Marys Lake is the largest and most utilized water body on the Reservation. It lies on the northwestern fringe of the Blackfeet Nation. St. Marys Lake is located a mile north of the town of St. Marys and two miles south of Babb, Montana. The lake is in a beautiful setting with the spectacular Rocky Mountains west of it and rolling plains to the east.

The lakeshore is subdivided into lots which the Blackfeet Tribal Council leases out. There are numerous dwellings which surround this lake with the populace being represented on the western shores. There is also a K.O.A. camp ground nestled on the south west end of the lake which provides the following services: fishing permits, camp sites and showers, store, etc.

St. Marys lake is most renowned for its fisheries. There are many species of fish residing in this particular lake. The most prominent being the lake and mountain whitefish. Also, contained in this lake are the bull trout and westslope cutthroat trout which are currently being considered for the endangered species list. St. Marys Lake also supports many recreational activities such as swimming, boating, water skiing, etc.

Another positive resource associated with St. Marys Lake are the multitude of wildlife inhabiting its surrounding. The grizzly bear, moose, and elk are a few of the big game which utilize this lake as part of their livelihood.

Drainage Basin Characteristics

The drainage basin, which St. Marys Lake is situated in, is the smallest basin on the Blackfeet Reservation, but has the second highest acre-ft of water leaving the reservation. The natural drainage has been altered by construction of a canal diverting water out of St. Mary River about a mile below the lake. The diverted water flows into the Milk River and eventually Canada. St. Marys Lake is charged by run off, ground water, and intermittent streams which are spring fed. The major inflow into the lake comes from five major tributaries. St. Marys River, Divide Creek, and Wild Creek enter the Lake from the south. Swiftcurrent and Boulder Creeks charge St. Marys Lake from the north end.

St. Marys Lake lies within the Northern Rockies Ecoregion. The watershed consists of the Rockies to the west and is characterized by mountainous valleys throughout. The soils are comprised of cobbly, gravelly, and stony loams. The dominant vegetation on these soils include Lodgepole pine, Douglas fir, Englemann Spruce, and Aspen.

The drainage basin is covered by forest to the west and rolling hills to the north with St. Marys Lake located in the southwestern portion. There are a couple of towns concentrated in this drainage basin of which was mentioned earlier.

Lake Basin Characteristics

St. Marys Lake is a large, deep, mountainous lake with a surface area of 2,187.40 acres. The deepest point was 64 feet, which we measured in 1993, and is located across from an island at midpoint of the lake. The shoreline is very long with dense timber on the western side, a sandy delta on the north side, and grassy/timber type vegetation on the eastern side. The length of the shoreline was measured at 86,478 feet with it being owned by the Blackfeet Tribe.

The elevation of St. Marys Lake was measured at 4,471 feet according to the topographical map put out by the USGS department. The water levels fluctuate from year to year. There are multiple factors involved in the varying levels of water during the year, but the dewatering of Sherburne Lake to the west causes the most immediate change.

Water Quality

The water quality of St. Marys Lake was monitored in 1975 and entered into the 1981 Water Quality Management Plan (208). Also, the Blackfeet Environmental Office in 1993 monitored this lake under the Clean Lakes Program.

St. Marys is a freshwater lake with concentrations of total suspended solids and alkalinity lower than most lakes on the reservation.

Because the levels of **chlorophyll a** and total phosphorus are very low, the water transparency is quite clear. The low concentrations of **chlorophyll a** is a good indicator that algal biomass is low. Thus St. Marys Lake is more than likely to be oligotrophic, but further monitoring is needed to confirm this assessment.

Biological Characteristics

Fish:

Seventeen species of fish have been identified in the waters of St. Marys Lake. They include the bull trout, westslope cutthroat trout, lake trout, brook trout, rainbow trout, lake whitefish, mountain whitefish, northern pike, longnose dace, lake chub, pearl dace, longnose sucker, white sucker, trout perch, burbot, spoonhead sculpin, and the shorthead sculpin. The rainbow trout and a few other species of fish are stocked annually. Commercial fishing is a big enterprise on this lake.

Table 1. Characteristics of St. Marys Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, Stony, and Light Clay Loams. (Loam).
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Aspen, Englemann Spruce, Douglas Fir, Lodgepole Pine
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of St. Marys Lake.

elevation (ft.)	4,471.00
surface area (acres)	2,187.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	64.0
mean depth (ft.)	Unknown
shoreline length (ft.)	86,478.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-24"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for St. Marys Lake. Average concentrations in mg/L; pH in pH units. Samples were collected from euphotic zone on 16 October 1992, and twice in 1993 on 5 August & 21 October. There were four grab samples taken at each visit.

	1992	1993
	Mean	Mean
pH (range)	8.04	7.92
alkalinity (mg/L CaCO ₃)	----	72.60
conductivity (umhos/cm)	----	125.50
turbidity (NTU)	1.33	0.67
dissolved oxygen	6.70	8.58
total suspended solids	2.16	0.5
Ca	24.89	23.11
Mg	6.34	6.09
K	0.30	0.25
Na	0.66	0.77
Cl	0.19	5.67
SO ₄	0.19	4.03

Table 4. Nutrient, chlorophyll a and Secchi depth data for St. Marys Lake. Average concentrations in ug/L. Samples were collected from the euphotic zone once on 16 Oct. 1992, and twice in 1993 on 5 August & 21 October. There were four grab samples taken at each visit.

	1992	1993
	Mean	Mean
total phosphorus	7.49	6.01
NH3-N	7.91	5.56
NO2/3	37.81	43.98
chlorophyll a	E0.00	.159
secchi depth (ft)	none	26'6"

Mill River
Drainage Basin

Goose Lake

Goose is a medium sized lake which is situated a mile north of Duck Lake and seven miles south of the Canadian border. A four wheel vehicle is needed to get to this lake. The terrain is very rough and hard to access. A trail north of Duck Lake will get a visitor to Goose Lake. The shoreline is in fee status with the lake owned and maintained by the Blackfeet Tribe.

Goose Lake is mainly utilized as a place for fishing. This lake is one of a few which have brook trout residing in them. The Blackfeet Fish and Game actively stock this lake.

Drainage Basin Characteristics

Goose Lake sits on the northwest fringes of the Milk River drainage basin. It is only one of two lakes in this basin. There are no inlets or outlets to this lake. Water volume is depends on run off and ground water.

Goose Lake is situated in two ecoregions. They are the Northern Rockies Ecoregion and the Montana Valley and Foothill Prairies Ecoregion. Under normal conditions, bearded wheatgrass, rough fescue, and bluebunch wheatgrass are the types of vegetation which would thrive in area. These grasses are supported by cobbly, gravelly, stony, and light clay loams.

The entirety of this basin is used for agricultural practices with a small portion to the west covered with mountains and forest.

Lake Basin Characteristics

Goose is a medium sized lake with a surface area of 245.20 acres. The perimeter was figured at 17,792 by the GIS system. The deepest point was measured at 11 feet. The lake is surrounded by Aspen.

The elevation is 5,172 feet. The water level is dependent on the amount of precipitation in the preceding year.

Water Quality

The water quality of Goose Lake was monitored sparingly through the years of 1966-77 with the results placed in the Water Quality Management Plan of the Blackfeet Tribe. The Blackfeet Environmental Office monitored Goose Lake again in 1993 and entered results in this report.

Goose Lake is well buffered, freshwater water body. The water hardness is relatively low. The main ions were the magnesium and calcium cations (Table 3).

Because of the moderate levels of nutrients and **chlorophyll a**, Goose lake would be classified as mesotrophic, but additional testing would be needed to prove it.

Biological Characteristics

Fish:

Goose lake is home to the brook trout.

Table 1. Characteristics of Goose Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, Stony, and Light Clay Loams. (Loam).
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies, Montana Valley and Foothill Prairies
dominant vegetation	Aspen: Bearded Wheatgrass, Rough Fescue, Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Goose Lake.

elevation (ft.)	5,172.00
surface area (acres)	245.20
volume (acre-ft.)	Unknown
maximum depth (ft.)	11.0
mean depth (ft.)	Unknown
shoreline length (ft.)	17,793.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-24"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Goose Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 19 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.34
alkalinity (mg/L CaCo3)	-----	123.20
conductivity (umhos/cm)	-----	210.00
turbidity (NTU)	-----	2.92
dissolved oxygen	-----	7.45
total suspended solids	-----	-----
Ca	-----	16.96
Mg	-----	22.92
K	-----	2.07
Na	-----	3.40
Cl	-----	-----
SO4	-----	-----

Table 4. Nutrient, chlorophyll a and Secchi depth data for Goose Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 19 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	45.52
NH3-N	----	5.92
NO2/3	----	< 2
chlorophyll a	----	11.19
secchi depth (ft)	----	3'9"

Horse Lake

Horse Lake is found by traveling thirteen miles north of Browning on the Duck Lake Road or as it is sometimes called BIA Highway 464, turn west on a gravel road beside the Milk River, go two miles up this road, and the lake is located between Toad Creek and the Milk River. Horse Lake sits in a pocket up near the continental divide with the west shore tribally owned and the rest of shoreline in fee hands.

This lake is not used as a recreational lake. It is very hard to access in dry or wet weather. Horse Lake is primarily utilized for stock watering. It is believed that Horse Lake was named for a horse that entered this lake years ago and did not return. The lake was dry at the time.

Drainage Basin Characteristics

Horse Lake is only one of two lakes which reside within the boundaries of the Milk River drainage basin. It is located in the south western half of this basin. Horse Lake is charged by run off, ground water, and one intermitted stream entering from the north end of the lake.

Horse Lake coincides in the Montana Valley and Foothill Prairies Ecoregion. The main vegetation around this lake is the western wheatgrass and blue bunch wheatgrass. The soils consist of light clay, clay, and silty clay loams. Also, shale can be found in the area.

The drainage basin has forest and mountains to the west with ranching and farming becoming more prevalent to the east. There are no communities in this basin.

Lake Basin Characteristics

Horse Lake is a shallow lake with the deepest point measured in 1993 at 7 feet. The measurement was taken at the middle of the lake. The surface area of Horse Lake is approximated at 238 acres. The shoreline is covered with prairie grass type vegetation with the north shore having a sandy beach.

The elevation of Horse Lake was measured at 4,841 feet by the USGS. The volume of water available for stock is controlled by the amount of precipitation in the preceding year.

Water Quality

Horse Lake was monitored in 1993 by the Blackfeet Environmental Office under Sec. 314 of the Clean Water Act.

Horse is a fresh water lake, that is well buffered. The conductivity is highly elevated indicating a separation of salts in this water body. Sodium (anion) concentrations are very high. The highest cation content in Horse is the sulphates.

The largest concentration of nutrients in Horse Lake is the phosphates. The nitrogen and **chlorophyll a** levels are quite low. Thus, Horse Lake would be classified as mesotrophic because of the **chlorophyll a** levels are lower in this lake than in lakes with similar total phosphorus concentrations, but again further testing is needed to prove assessment.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Horse Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Light Clay, Clay, and Silty Clay Loams. Also, Loam and Shale.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Western Wheatgrass, Blue Bunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Horse Lake.

elevation (ft.)	4,841.00
surface area (acres)	238.00
volume (acre-ft.)	Unknown
maximum depth (ft.)	7.0
mean depth (ft.)	unknown
shoreline length (ft.)	12,899.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Horse Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone 2 September 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	5.70
alkalinity (mg/L CaCo3)	-----	1,122.00
conductivity (umhos/cm)	-----	2,150.00
turbidity (NTU)	-----	5.70
dissolved oxygen	-----	8.25
total suspended solids	-----	2.45
Ca	-----	12.20
Mg	-----	52.91
K	-----	10.96
Na	-----	509.66
Cl	-----	16.65
SO4	-----	138.64

Table 4. Nutrient, chlorophyll a and Secchi depth data for Horse Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 2 September 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	60.97
NH3-N	-----	< 5
NO2/3	-----	2.39
chlorophyll a	-----	2.34
secchi depth (ft)	-----	4'9"

Cut Bank Drainage Basin

Guardipee Lake

Guardipee Lake is situated nineteen miles east of Browning on US Highway #2, turn south on dirt road for three miles to Mission Lake, and then head west for three more miles. A guide would be needed to access this lake since roads leading to it are not well defined. Guardipee is surrounded by rolling hills.

The land encircling Guardipee Lake is in trust. The Guardipee family owns land around this lake, and this is where the name came from. There is definitely no recreational activities or any other uses of its waters. Guardipee Lake was once a major stock watering hole for Reservation cattle, but careless farming practices turned this lake into a dead lake. The lake is fenced off as to keep everything out.

Drainage Basin Characteristics

Guardipee Lake is located in the south central portion of the Cut Bank drainage basin. It is charged by run off, ground water, and a small stream which is fed by Lamott springs on the west side of lake. There are no outlets.

Guardipee Lake sets in the Montana Valley and Foothill Prairies Ecoregion. Green needlegrass and needle & thread are the dominant vegetation in surrounding area with clay and cobbly loam soils supporting them.

The far western section of this drainage basin is covered with mountains and forest. The central area is more urbanized where the communities of Browning and Blackfoot can be found with ranching being the main land use. The eastern portion is dominated by farming applications.

Lake Basin Characteristics

Five feet was the deepest point measured on Guardipee Lake. Guardipee is a shallow lake with very poor water quality. It has a surface area of 81.60 acres with a shoreline length of 10,387 feet. Grasses, banks, and rocky beaches make up the shoreline around Guardipee Lake.

The elevation of Guardipee is 4,046 feet. The contributing factors to water levels would be runoff and small stream on west side.

Water Quality

Guardipee Lake was monitored in 1993 by the Blackfeet Environmental Office with ensuing data being placed in this Clean Lakes Report.

Guardipee has extremely poor water quality due to farming practices in the area. The conductivity is excessively high, and thus pointing to enormous separation of salts (ions) in the water of this lake. Because of salt content in lake, Guardipee is a saline lake. All of the cation and anion concentrations are way above normal and are most likely due to surface and ground water runoff into the lake. All of these values are of concern to our office. The sulphates, sodium, and magnesium levels are more prevalent or in excess than other ions (Table 3). The high value of Total Suspended Solids indicates that the water is very turbid. The source of contamination is probably linked to use of land in the area.

The Total Phosphorus (TP) content is very high and it is certain that TP is coming directly off the clay particles comprising the TSS. The **Chlorophyll a** concentration is also high with secchi reading very low. The combination of above contributors does help determine trophic status of lake, but again further analysis would be needed to assess Guardipee Lake. At this time, Guardipee would be a hyper-eutrophic lake.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Guardipee Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay or Cobbly Loam
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Green Needlegrass, Needle and Thread
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Guardipee Lake.

elevation (ft.)	4,046.00
surface area (acres)	81.60
volume (acre-ft.)	Unknown
maximum depth (ft.)	5.0
mean depth (ft.)	Unknown
shoreline length (ft.)	10,387.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Guardipee Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 2 September 1993.

	1992	1993
	Mean	Mean
pH (range)	----	9.26
alkalinity (mg/L CaCO ₃)	----	67.30
conductivity (umhos/cm)	----	15,000.00
turbidity (NTU)	----	16.0
dissolved oxygen	----	8.0
total suspended solids	----	46.0
Ca	----	107.52
Mg	----	1,324.74
K	----	213.18
Na	----	4,077.31
Cl	----	477.60
SO ₄	----	14,679.91

Table 4. Nutrient, chlorophyll a and Secchi depth data for Guardipee Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 2 September 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	306.88
NH3-N	----	12.63
NO2/3	----	< 2
chlorophyll a	----	30.53
secchi depth (ft)	----	< 1'

Hidden Lake

Hidden Lake is located north of the community of Starr School on what is referred to as Starr Flat. Hidden can be accessed by traveling two and a half miles up this flat. Hidden sits on the prairie grasslands.

Hidden Lake resides on private property. It is one of the easier lakes to access. Hidden is primarily a fishing lake with a few garbage cans on the south shore for sanitary purposes. There is one residence in the immediate area which is located a mile to the west of Hidden Lake.

Fishing and picnicking are the main activities associated with Hidden Lake.

Drainage Basin Characteristics

Hidden Lake is positioned in the west central region of the Cut Bank drainage basin. Hidden Lakes volume is dependent upon run off, ground water, and a small irrigation ditch on the south side. There is no outlet.

Montana Valley and Foothill Prairies Ecoregion is the environment in which Hidden Lake can be found. Under normal conditions, Rough fescue is the dominant vegetation with the soil type being clay, gravelly clay, and gravelly clay loams.

Mountains and forest project into the sky on the west side of drainage basin while ranching and farming intensify to the east.

Lake Basin Characteristics

Hidden Lake is a semi-deep water body with the deepest spot measured at 19 feet in 1993. The surface area, of Hidden Lake, is estimated at 49.20 acres with a parameter of 5,472 feet. Uncultivated shortgrass prairie is the type of land which surrounds Hidden Lake.

Hidden Lake has an elevation of 4,616 feet. The amount of water in lake is governed by precipitation and flow from irrigation ditch.

Water Quality

A few parameters were monitored in 1980 by US Fish and Wildlife Service and data was subsequently entered into Water Quality Management Plan of the Blackfeet Tribe. More intense monitoring of Hidden Lake was done in 1993 by the Blackfeet Environmental Office and results are entered into this report.

Hidden Lake is a well buffered, freshwater lake. It is reasonably alkaline due to pH of 9.82 (Table 3). The content of calcium and magnesium indicate a moderate hardness to the water. The dominant ions are the cations of magnesium and sodium.

The trophic status of Hidden Lake would fall under either mesotrophic or eutrophic category. Because of the somewhat high concentrations of nutrients and **chlorophyll a**, eutrophic status would fit the definition of Hidden Lake, but further monitoring should be done to prove this assessment.

Biological Characteristics

Fish:

Hidden Lake contains the rainbow trout, brook trout, and the white sucker. This lake is planted annually, but due to the owner not allowing right of way, this lake might not be stocked in the coming years.

Table 1. Characteristics of Hidden lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Gravelly Clay, and Gravelly Sandy Clay Loams
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Hidden Lake.

elevation (ft.)	4,616.00
surface area (acres)	49.20
volume (acre-ft.)	Unknown
maximum depth (ft.)	19.0
mean depth (ft.)	Unknown
shoreline length (ft.)	5,472.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Hidden Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.82
alkalinity (mg/L CaCo3)	-----	550.00
conductivity (umhos/cm)	-----	819.00
turbidity (NTU)	-----	2.40
dissolved oxygen	-----	10.25
total suspended solids	-----	3.38
Ca	-----	21.65
Mg	-----	60.08
K	-----	3.91
Na	-----	98.79
Cl	-----	5.07
SO4	-----	5.05

Table 4. Nutrient, chlorophyll a and Secchi depth data for Hidden Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	55.32
NH3-N	----	27.84
NO2/3	----	7.37
chlorophyll a	----	13.87
secchi depth (ft)	----	6'

Hope Lake

Hope is a small lake which is set on the eastern edge of the Blackfeet Reservation. It can be reached by taking US Highway #2 seven miles west of the town of Cut Bank, turn north on Henderson Road for two miles, and then turn east on dirt road for another mile. Hope sits in the middle of farm land.

There are a number of activities associated with this lake. Stock watering is the principal use of Hope Lake, but fishing and irrigation are also employed there.

The Blackfeet Fish and Game plant rainbow trout in Hope Lake on a regular basis.

Drainage Basin Characteristics

Hope is the easterly most lake on the reservation, and is set in the Cut Bank drainage basin. Hope is charged by ground water and an irrigation ditch. There is very little runoff. On the east end of lake, water is pumped out and used for irrigation.

The Montana Valley and Foothill Ecoregion is the area which Hope Lake is engraved in. Green needle grass and rough fescue are the vegetation normally seen in this area with clay, gravelly clay, and gravelly sandy clay loams soils supporting these flora.

The mountains can be seen in the west with agriculture becoming more prominent to the east.

Lake Basin Characteristics

The deepest point surveyed in 1993 was 12 feet at the middle of the lake. The surface area was measured at 68.80 acres with a perimeter of 6,969 feet. Hope Lake is surrounded by tilled land which is in fee status.

This is one of the lower lakes on the Blackfeet Reservation at 3,877 feet. The water volume is controlled by irrigation turn outs to and from the lake.

Water Quality

Monitoring of Hope Lake was done by the Blackfeet Environmental Office under Sec. 314 of the Clean Water Act with results documented in this report.

Hope is a well buffered, freshwater lake. The turbidity and total suspended solids were moderately elevated indicating lots of sedimentation in water. Hope has a mediocre content of calcium and magnesium which places the hardness of water in the relative low category. Sulphate and calcium are the dominant ions (Table 3).

Total phosphorus is very high. Also, the contents of nitrogen and **Chlorophyll a** levels are slightly raised. These heightened concentrations in junction with low secchi reading would signify that Hope is a eutrophic lake.

Biological Characteristics

Fish:

The fish fauna residing in Hope Lake are the rainbow trout, brook trout, and the white sucker.

Table 1. Characteristics of Hope Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Gravelly Clay, and Gravelly Sandy Clay Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Green Needlegrass, Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Hope Lake.

elevation (ft.)	3,877.00
surface area (acres)	68.80
volume (acre-ft.)	Unknown
maximum depth (ft.)	12.0
mean depth (ft.)	Unknown
shoreline length (ft.)	6,969.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Hope Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 27 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.75
alkalinity (mg/L CaCo3)	-----	154.00
conductivity (umhos/cm)	-----	416.00
turbidity (NTU)	-----	12.90
dissolved oxygen	-----	8.21
total suspended solids	-----	8.60
Ca	-----	34.02
Mg	-----	13.90
K	-----	2.01
Na	-----	25.73
Cl	-----	4.81
SO4	-----	55.49

Table 4. Nutrient, chlorophyll a and Secchi depth data for Hope Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 27 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	124.20
NH3-N	-----	36.98
NO2/3	-----	12.21
chlorophyll a	-----	23.16
secchi depth (ft)	-----	2'

Kipp Lake

Kipp lake can be reached by turning off at Blackfoot on US Highway #2, ten miles east of Browning and twenty five miles west of Cut Bank. Kipp is located in rolling hill type terrain with the Rocky Mountains visible twenty miles to the west.

The land surrounding Kipp Lake is currently being employed in the form of ranching and farming. Half of the north east shore is in fee status with the remainder of the lake shore in the possession of the Blackfeet Tribe. An outhouse and a hand water pump are the only luxuries available to you at this lake.

Kipp Lake got its name from a man who ran a trading post near the lake in the early 1900's. His name was Joe Kipp. He obtained the land around the lake when the 1924 Allotment Act was inacted.

Kipp Lake is used primarily as a fishing lake year around.

Drainage Basin Characteristics

Kipp Lake is located in the Cut Bank drainage basin, which is the largest basin on the reservation, but has the second lowest output of measured run off of the four basins. Kipp is charged by run off, ground water, and one intermitted stream on the west end. Also, a turn out from Willow Creek is used to charge Kipp Lake on the northwest side. A turn out on the north end is used to release water back into Willow Creek for stock watering purposes.

Kipp Lake is embedded in the Montana Valley and Foothill Prairies Ecoregion. The terrain immediately surrounding the lake is close to being level, but does have a slight rise (0-5% slope). The riparian soils around the lake consist of various loams and sands with the influential vegetation being green needlegrass and needle/thread.

The drainage basin is covered with grass-type vegetation extending out from Kipp Lake. Cattle use Kipp as a source of drinking water. Agriculture dominates this drainage basin.

Lake Basin Characteristics

Kipp Lake is very shallow with 15 feet being the deep point measured straight across from the dock. The surface area of Kipp is 311.60 acres with a perimeter of 18,480 feet. The entirety, of this lake, can be accessed for fishing and stock watering purposes. Swimming was once a big recreational activity on Kipp Lake, but excess weeds became to numerous.

Kipp Lake has an elevation of 4,106 feet. The level of water in Kipp Lake depends on run off and ground water, but can be raised or lowered when turn outs from Willow Creek are opened/closed.

Water Quality

Kipp Lake was monitored in 1967 for a few parameters and this data was entered in the 1981 Water Quality Management Plan of the Blackfeet Tribe. The Blackfeet Environmental Office measured twenty one parameters in this lake in 1992 and 1993 under Sec. 314 of the Clean Water Act.

The high sulphate values should be looked into with the source hopefully being found and then eliminated. The high sulphate concentrations are causing a bad smell to the lake. The higher magnesium levels are a good indicator that there is a relative hardness to the water. The elevated values of conductivity, turbidity, and total suspended solids points to alot of particles and ions in water sample (table 3).

As indicated by the enormously heightened nitrate, nitrite, and ammonia levels, algae growth is running rampant in this lake. Also, **chlorophyll a** is extremely high, and is important for new growth in algal cells. Examining the data available to us, Kipp Lake's trophic status would be called hyper-eutrophic.

Biological Characteristics

Fish:

Kipp lake contains three species of fish. They include the rainbow trout, white sucker, and longnose sucker. The rainbow trout is planted annually.

Table 1. Characteristics of Kipp Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Cobbly, Gravelly Clay, and Silty Clay Loams. (Loam). Cobbly and Gravelly Sand.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Green Needlegrass, Needle and Thread
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Kipp Lake.

elevation (ft.)	4,106.00
surface area (acres)	311.60
volume (acre-ft.)	Unknown
maximum depth (ft.)	15.0
mean depth (ft.)	unknown
shoreline length (ft.)	18,480.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Kipp Lake. Average concentrations in mg/L; pH in pH units. Samples were collected from euphotic zone once on 27 October 1992, and twice in 1993 on 2 August & 11 October. There were four grab samples obtained at each visit.

	1992	1993
	Mean	Mean
pH (range)	9.23	9.03
alkalinity (mg/L CaCo3)	----	240.90
conductivity (umhos/cm)	----	762.00
turbidity (NTU)	7.66	9.52
dissolved oxygen	8.80	8.70
total suspended solids	6.97	5.93
Ca	29.19	29.05
Mg	63.93	52.80
K	8.75	8.99
Na	99.27	64.30
Cl	14.48	11.58
SO4	14.48	169.60

Table 4. Nutrient, chlorophyll a and Secchi depth data for Kipp Lake. Average concentrations in ug/L. Samples were collected from the euphotic zone once on 27 Oct. 1992, and twice in 1993 on 2 August & 11 October. There were four grab samples obtained at each visit.

	1992	1993
	Mean	Mean
total phosphorus	87.49	45.19
NH3-N	41.87	119.44
NO2/3	65.55	185.50
chlorophyll a	1.04	57.79
secchi depth (ft)	3'2"	8'8"

Mission Lake

Mission Lake is the biggest lake in the Cut Bank drainage basin. The four mile dirt road leading to Mission Lake can be reached by driving seventeen miles east of Browning on US Highway 2. Also, the dirt road can be accessed by going eighteen miles west of Cut Bank on US Highway 2. Mission is located in a green valley in the south central part of the Reservation.

Mission lake has no structures about its shoreline, but it does have a hand pump for water on the north central side. Also, trash cans are strategically placed on the north side which are maintained by Blackfeet Fish & Game. The entirety of land surrounding Mission is in trust.

Mission lake is a haven for the big time fisherman. This lake draws anglers from Canada and throughout the United States. Mission was featured as one of the best lakes for fishing in the country on a National Televised Show. Recreational activities are limited to fishing on this lake because of the weed problem.

Mission Lake houses numerous waterfowl during their migrating rituals.

Drainage Basin Characteristics

Mission Lake is charged by run off and ground water with no tributaries contributing to its volume. Mission does have a turn out on the east end of the lake which allows for cleansing of this water body. Two Medicine irrigation canal runs parallel to the lake on the north side and can possible charge Mission.

Montana Valley and Foothill Prairies Ecoregion is the home of Mission Lake with the riparian soils consisting of clay and cobbly loams. Under normal conditions, green needlegrass and needle & thread vegetation are the dominant species.

The land basin extending out from Mission Lake is used for farming to the north and east, and ranching to the south and west. Although, some farming is occurring west of the lake.

Lake Basin Characteristics

Mission Lake has a measured surface area of 755 acres with the deepest point being 33 feet straight outward from the water pump on the west side. The shoreline is substantially long at 44,851 feet with range land dominating its surroundings. Cattle owners utilize Mission for stock watering throughout the summer while the fisherman uses it year around.

The USGS surveyed the elevation of Mission Lake at 3,954 feet. The water levels tend to variate with amount of precipitation that year.

Water Quality

Mission Lake was periodically monitored from 1955-80 and the resulting data entered in the 1981 Water Quality Management Plan of the Blackfeet Nation. Mission was monitored twice in 1993 under Sec. 314 of the Clean Water Act.

The water in Mission Lake is well buffered and very hard. The dominant ions being sodium and sulphate. The transparency is often poor because of the dense algal growth.

The nutrients increased from August to November in 1993 with Chlorophyll a decreasing at the same time. The high Total Phosphorus values are a good indicator that there is algal abundance in this lake. It is very difficult to place a trophic label on this lake without further testing, but there is definitely a substantial amount of nutrients in this lake.

Biological Characteristics

Fish:

Mission Lake houses the rainbow trout, burbot, walleye-sauger hybrid, and white sucker. Rainbow trout is the primary species and thus stocked annually.

Table 1. Characteristics of Mission Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay and Cobbly Loam.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Green Needlegrass, Needle and Thread
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Mission Lake.

elevation (ft.)	3,954.00
surface area (acres)	755.00
volume (acre-ft.)	Unknown
maximum depth (ft.)	33.0
mean depth (ft.)	unknown
shoreline length (ft.)	44,851.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Mission Lake. Average concentrations in mg/L; pH in pH units. Samples were collected from euphotic zone twice in 1993, once on 2 August and once on 11 October. Four grab samples were collected at each visit.

	1992	1993
	Mean	Mean
pH (range)	----	8.94
alkalinity (mg/L CaCO ₃)	----	169.40
conductivity (umhos/cm)	----	1,319.00
turbidity (NTU)	----	3.17
dissolved oxygen	----	8.08
total suspended solids	----	3.25
Ca	----	53.17
Mg	----	68.26
K	----	3.94
Na	----	151.69
Cl	----	10.89
SO ₄	----	518.29

Table 4. Nutrient, chlorophyll a and Secchi depth data for Mission Lake. Average concentrations in ug/L. Samples were collected from the euphotic zone twice in 1993, once on 2 August and once on 11 October. Four grab samples were collected at each visit.

	1992	1993
	Mean	Mean
total phosphorus	-----	58.81
NH3-N	-----	28.04
NO2/3	-----	14.54
chlorophyll a	-----	1.83
secchi depth (ft)	-----	4'3"

No Chief Lake

No Chief is a very small lake which is located four miles south west of Browning on BIA Highway #1. It is found in the rolling plains of the Blackfeet Reservation. The shoreline is covered with grasses and the east shore is the only access onto the water. The lake and surrounding area are owned by the Blackfeet Tribe.

There are no recreational activities associated with No Chief Lake. The lake is used mainly as a place to water livestock.

Drainage Basin Characteristics

No Chief rests on the southern boundary of the Cut Bank drainage basin. Run off and ground water are the main sources of charging for this lake. No Chief does not have an outlet for water flow.

No Chief Lake is situated in the Montana Valley and Foothill Prairies Ecoregion. Rough fescue is the dominant vegetation with clay and loam soils surrounding the lakes perimeter.

Forest and mountains dominant the far west edges of this drainage basin. Farming and ranching cover the rest of this basin. Also, Browning is located in this watershed.

Lake Basin Characteristics

No Chief is the most shallowest lake that was measured in 1993 by Blackfeet Environmental Office. The surface area covering No Chief is 72.60 acres with a shoreline of 7,315 feet. Four feet was the deepest point in the lake. No Chief sits in the high rolling hills of the Blackfeet Reservation.

The lake called No Chief abides at an elevation of 4,931 feet. The water level has dramatically been reduced over the years as evident of high cut banks.

Water Quality

The water quality of No Chief Lake was monitored once in 1973 and results were placed in Water Quality Management Plan of the Blackfeet Tribe. The Blackfeet Environmental Office continued monitoring in 1993 under Sec. 314 of the Clean Water Act.

No Chief is a well buffered lake. The dissolved oxygen is rather high indicating oxygenated groundwater. The dominant ions are sulphate and magnesium. There is some hardness to the water as evident by calcium and magnesium levels (Table 3).

The moderate concentrations of nutrients in No Chief Lake along with a low content of **chlorophyll a** is a beneficial aid in determining the status of this lake. At this time, No Chief would be considered a mesotrophic lake because of preceding values (Table 4).

Biological Characteristics

No data available at this time.

Table 1. Characteristics of No Chief lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Cobbly, and Stony Loams. Loam and Clay.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of No Chief Lake.

elevation (ft.)	4,931.00
surface area (acres)	72.60
volume (acre-ft.)	Unknown
maximum depth (ft.)	4.0
mean depth (ft.)	Unknown
shoreline length (ft.)	9,315.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for No Chief Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.58
alkalinity (mg/L CaCo3)	-----	244.20
conductivity (umhos/cm)	-----	854.00
turbidity (NTU)	-----	1.30
dissolved oxygen	-----	12.20
total suspended solids	-----	2.14
Ca	-----	46.78
Mg	-----	63.07
K	-----	17.17
Na	-----	58.57
Cl	-----	8.01
SO4	-----	228.78

Table 4. Nutrient, chlorophyll a and Secchi depth data for No Chief Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	45.22
NH3-N	-----	17.30
NO2/3	-----	< 2
chlorophyll a	-----	1.10
secchi depth (ft)	-----	3'3"

Railroad Lake

Railroad is a very small lake which is located a few miles south west of Browning on US Highway #2. When you reach this point turn to the south, the lake is now in view beside the train tracks. Railroad Lake sits in a coulee with prairie grasslands surrounding it.

A dirt road runs into Railroad Lake from the north side with railroad tracks passing by it on the east side. An old house sits a quarter of a mile to the north of Railroad Lake. The land surrounding this lake is in trust.

There are no recreational occurrences happening at Railroad Lake. Livestock watering is the only activity associated with this lake.

Drainage Basin Characteristics

Railroad Lake sits in the southern section of the Cut Bank drainage basin. There are no tributaries flowing into Railroad Lake. This lake is charged by run off and ground water with excess water exiting on the east end, and eventually depositing into Depot Coulee Creek.

Railroad Lake rests in the Montana Valley and Foothill Prairies Ecoregion with rough fescue vegetation surrounding its perimeter. The soils are comprised of loams and clay.

The western area of the drainage basin entails the mountains and forest. The central area consists of ranching and two towns (Browning and Blackfoot). The eastern area is predominantly used for farming.

Lake Basin Characteristics

The deepest point sampled in 1993 was 7 feet. Railroad Lake has an elevation of 4,500 feet. Precipitation controls the volume of water trickling into Railroad Lake. The shoreline is surrounded by grassland and trodden cattle paths.

Water Quality

Some vague monitoring of Railroad Lake was done in 1966 with results published in the Blackfeet Tribes 208 Water Quality Management Plan. More indepth monitoring was accomplished by the Blackfeet Environmental Office in 1993 and is documented in this report.

Railroad Lake is a moderately buffered lake with lots of particles in water (total suspended solids). Because of the elevated cations of magnesium and calcium (Table 3), the water is considered hard. The anion sulfate is the most abundant of the ions. This high concentration of sulfates is probably linked to surface runoff.

The values of total phosphorus and ammonia indicate this lake is somewhat rich in nutrients. The richness of nutrients coupled with the elevated **chlorophyll a** content points in the direction of an algae problem. It is very difficult to classify the trophic status of Railroad Lake without further testing.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Railroad Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Cobbly, and Stony Loams. Loam and Clay.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Railroad Lake

elevation (ft.)	4,500.00
surface area (acres)	Not available
volume (acre-ft.)	Unknown
maximum depth (ft.)	7.0
mean depth (ft.)	Unknown
shoreline length (ft.)	Unavailable
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Railroad Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.60
alkalinity (mg/L CaCo3)	-----	286.00
conductivity (umhos/cm)	-----	924.00
turbidity (NTU)	-----	7.50
dissolved oxygen	-----	9.40
total suspended solids	-----	15.33
Ca	-----	76.51
Mg	-----	51.83
K	-----	3.08
Na	-----	58.96
Cl	-----	3.53
SO4	-----	223.27

Table 4. Nutrient, chlorophyll a and Secchi depth data for Railroad Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	82.0
NH3-N	-----	25.40
NO2/3	-----	2.26
chlorophyll a	-----	9.54
secchi depth (ft)	-----	2'

Sharp Lake

The best way to access Sharp Lake is by taking Highway 464 north of Browning for two miles, turn east on BIA Highway 13 for six miles, next turn at the first gate past Cut Bank Creek bridge to the right, and finally follow road for one mile to this water body. Sharp Lake is set in the prairie grasslands of the Blackfeet Reservation.

Sharp is a medium sized lake which is surrounded by a barbwire fence. Thus, closing it off to the public. The lake and riparian lands are tribally owned. Sharp Lake has a high bank on the north and east sides with sandy shores on the remainder of the lake. There is also three storage grain bens situated on the north side of Sharp Lake.

There are no activities associated with Sharp Lake. The water quality is very poor at this lake. The ecosystems that once flourished around this lake are almost void.

Drainage Basin Characteristics

Sharp Lake rests in the central part of the Cut Bank Drainage basin. It is charged by runoff and ground water. Also, a small tributary flows into Sharp Lake from the west end charged by the Cut Bank Creek. There is no outlet or outflow on this lake.

Sharp Lake is nestled in the Montana Valley and Foothill Prairies Ecoregion. The dominant vegetation is the rough fescue with the soils being loams, silty clay, and soft shale.

The drainage basin involves mountains to the west with ranching and farming increasing the farther east you travel. The towns of Browning and Cut Bank are located in this basin along with small community of Blackfoot.

Lake Basin Characteristics

Our office could not measure the depth of Sharp Lake because we could not access the fence around it. The surface area, of Sharp Lake, is 264.30 acres with a parameter of 14,423 feet.

The elevation of Sharp Lake is 4,195 feet according to the topography map published by the Geological Survey in 1968. The water has declined several feet over the last decade. The biggest contributor to water volume would be runoff and ground water.

Water Quality

Sharp Lake was monitored by the Blackfeet Environmental Office in 1993 under Section 314 of the Clean Water Act.

Sharp Lake is well buffered. Because of the extremely high total suspended solids content, Sharp would be classified as a saline lake. The conductivity reading would indicate a heavy concentrations of salts. We did not get results back from contract lab on metals because their instruments would not read the murky water. We did get anion data which was abnormally high.

In saline lakes, total phosphorus is not related to algal growth because growth requirements are met by supply. So, the out greatly elevated values for total phosphorus in Sharp Lake does not mean algae growth is running rampant. It is very certain that the high total phosphorus concentrations are coming directly off the clay particles comprising the total suspended solids. There was no nitrogen values sent to us, but chlorophyll a results very high. Hyper-eutrophic would be the term used to define Sharp Lake due to the high nutrient and chlorophyll a levels.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Sharp Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay and Cobbly Clay Loams, Silty Clay, and soft Shale
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Sharp Lake.

elevation (ft.)	4,195.00
surface area (acres)	264.30
volume (acre-ft.)	Unknown
maximum depth (ft.)	Unknown
mean depth (ft.)	Unknown
shoreline length (ft.)	14,423.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Sharp Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 27 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.22
alkalinity (mg/L CaCo3)	-----	1,045.00
conductivity (umhos/cm)	-----	1,990.00
turbidity (NTU)	-----	-----
dissolved oxygen	-----	8.40
total suspended solids	-----	1,029.92
Ca	-----	-----
Mg	-----	-----
K	-----	-----
Na	-----	-----
Cl	-----	77.74
SO4	-----	338.84

Table 4. Nutrient, chlorophyll a and Secchi depth data for Sharp Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 27 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	6,420.92
NH3-N	-----	-----
NO2/3	-----	-----
chlorophyll a	-----	58.71
secchi depth (ft)	-----	-----

Whiskey John Lake

Whiskey John is located directly on the south side of US Highway #2 five miles west of Browning. It is set on the foot hills of the Rocky Mountains.

The land surrounding the shores of Whiskey John is in trust or Blackfeet owned. This lake is not used for any recreational purposes. Stock watering is its only application.

Drainage Basin Characteristics

Whiskey John rests on the south west boundary of the Cut Bank drainage basin. It is charged by run off and ground water. The east shore can be an outlet due to it being lower than the rest of the water body.

Whiskey John Lake is situated in the Montana Valley and Foothill Prairies Ecoregion. Rough Fescue is the main vegetation found in this area with loam and clay soils supporting it.

The drainage basin has mountains to the west, and prairie grasslands to the east with the communities of Browning and Blackfoot residing in it.

Lake Basin Characteristics

Six feet was the deepest area measured on Whiskey John Lake by the Blackfeet Environmental Office in 1993. The surface area of this lake is only 23.74 acres. Grasses encompass the shoreline with the east side open for stock watering.

The elevation of Whiskey John was surveyed at 4,957 feet. Precipitation is the main element in the volume of water at this lake.

Water Quality

Water quality was tested in 1980 with ensuing results placed in the Blackfeet Tribe's 208 Water Quality Management Plan. More extensive monitoring of Whiskey John Lake was done by the Blackfeet Environmental Office in 1993.

Whiskey John is a well buffered lake. The dissolved oxygen is sort of high due to the shallowness of lake with oxygenated groundwater more than likely to occur there. Sodium and magnesium are the most numerous ions (Table 3). The water has a low hardness to it based on content of cations.

The results (Table 4) obtained in 1993 are quite hard to decipher. At this point, Whiskey John would be considered an oligo-mesotrophic lake because of moderately high phosphate content and low **chlorophyll a** concentration.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Whiskey John Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Cobbly, and Stony Loams. Loam and Clay.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Whiskey John Lake.

elevation (ft.)	4,957.00
surface area (acres)	23.74
volume (acre-ft.)	Unknown
maximum depth (ft.)	6.0
mean depth (ft.)	Unknown
shoreline length (ft.)	Unavailable
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Whiskey John Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.54
alkalinity (mg/L CaCo3)	-----	352.00
conductivity (umhos/cm)	-----	576.00
turbidity (NTU)	-----	2.60
dissolved oxygen	-----	10.70
total suspended solids	-----	4.13
Ca	-----	14.48
Mg	-----	26.62
K	-----	7.11
Na	-----	89.94
Cl	-----	3.54
SO4	-----	0.02

Table 4. Nutrient, chlorophyll a and Secchi depth data for Whiskey John Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 25 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	40.47
NH3-N	----	7.75
NO2/3	----	< 2
chlorophyll a	----	1.69
secchi depth (ft)	----	5'

Two Medicine
Drainage Basin

South Alkali Lake

South Alkali Lake is very hard to access in dry or wet weather. Alkali can be reached by going 17 miles south of Cut Bank on Highway 358, and then turning west on a dirt road for four miles. This is one of the largest lakes on the reservation at a mile wide by a mile and a half long, but it is very shallow. South Alkali is situated in a grassy valley.

This lake is tribally owned with some stock watering occurring on its shores. South Alkali is known as a waterfowl sanctuary. South Alkali received its name because of the abundance of alkali in the soil about its shorelines.

Drainage Basin Characteristics

South Alkali Lake is situated at the foremost eastern section of the Two Medicine drainage basin. Birch Creek canal supplies South Alkali with a sufficient amount of water. The water enters South Alkali on the south side of the lake.

The Montana Valley and Foothill Prairies Ecoregion is where South Alkali Lake is located at. Under ordinary conditions, the Western wheatgrass and Green needlegrass are the governing vegetation. Clay and clay loams are the soils which can be found in this drainage basin.

Mountains and forest can be located to the far west with rangeland increasing in the middle of drainage basin. The area immediately surrounding lake is mostly farm land.

Lake Basin Characteristics

South Alkali Lake is the largest lake in the Two Medicine drainage basin. The surface area is measured at 1,014.50 acres and shoreline length at 34,742 feet. We were 150 yards from the south shore and measured the depth of South Alkali at 3 feet on the 1 of September 1993. The shore line consist of sandy beaches mixed with grassy type banks.

The elevation of South Alkali Lake is set at a relatively low 3,786 feet. The quantity of water, in this lake, is controlled by precipitation and amount of water released into it by Birch Creek canal.

Water Quality

South Alkali was monitored in 1979 by US Fish and Wildlife Service and again in 1993 by the Blackfeet Environmental office.

The extremely high conductivity reading in South Alkali signifies a large amount of charged ions (anions & cations) in the water. It is a highly buffered lake which has hard water. The total suspended solids points to a very turbid lake. The sulphate anion concentration, which is highly elevated, is possibly linked to sulphates enter lake through surface run off and ground water.

Because South Alkali has a high total phosphorus content, a low nitrogen and **chlorophyll a** content, and a low secchi reading, this indicates an algae abundance. At this time, South Alkali would be called a mesotrophic lake because of the reasons stated above, but there should be some extensive monitoring of this lake to prove this assessment. The water is very green and scummy. This could be from the wealth of algae or high particulate level in this lake.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of South Alkali Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay and Clay Loam
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Western Wheatgrass, Green Needlegrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of South Alkali Lake.

elevation (ft.)	3,786.00
surface area (acres)	1,014.50
volume (acre-ft.)	Unknown
maximum depth (ft.)	Not available
mean depth (ft.)	Unknown
shoreline length (ft.)	34,742.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for South Alkali Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 1 September 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.43
alkalinity (mg/L CaCo3)	-----	431.20
conductivity (umhos/cm)	-----	4,500.00
turbidity (NTU)	-----	73.0
dissolved oxygen	-----	8.80
total suspended solids	-----	37.50
Ca	-----	23.16
Mg	-----	74.32
K	-----	4.26
Na	-----	1,279.16
Cl	-----	76.21
SO4	-----	2,133.08

Table 4. Nutrient, chlorophyll a and Secchi depth data for South Alkali Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 1 September 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	109.43
NH3-N	----	< 5
N02/3	----	< 2
chlorophyll a	----	3.57
secchi depth (ft)	----	< 1'

Cooper Lake

Cooper is a tiny lake which rests in the high foothills of the Rocky Mountains. It is located a half mile east of Lewis and Clark National Park and almost on top of western boundary of the Blackfeet Reservation. Cooper can be accessed by taking BIA Highway #1 eight miles to the north of Heart Butte community, and then turn west for 2.5 miles. A four wheel vehicle is definitely needed to get to Cooper Lake.

Cooper is owned and stocked by the Blackfeet Tribe. The land to the west is owned by the federal government with remaining land in trust.

Cooper Lake received its name from the Cooper family who lived near the lake in the 1930's. It's original name was Many White Horses Lake.

This lake is known for its cutthroat trout which the Blackfeet Fish and Game plants there on a regular basis. Also, in the summer, cattle use Cooper Lake as a water source.

Drainage Basin Characteristics

Cooper Lake rests on the west central fringe of the Two Medicine drainage basin. It is charged by run off, ground water, and a tributary on the north western side. There is no outlet on this lake.

The Northern Rockies Ecoregion is where Cooper Lake is situated. Under normal conditions, rough fescue is the grass in this area. The soils consist of loams, silty clay, and rock outcrops.

Cooper sits in the far western section of this drainage basin with ranching progressing to farming the farther east you travel. Heart Butte is the only community in this basin, and is located in the southern half of basin.

Lake Basin Characteristics

Because we could not get boat up to lake, we did not measure depth of Cooper Lake. This lake is very small with a surface area of 31.40 acres and a shoreline length of 7,330 feet. Cooper Lake is surrounded by a combination of Aspen, willow, and various pines. Cooper rests at an elevation of 5,375 feet with its water level affected by precipitation.

Water Quality

Cooper Lake was monitored by the Blackfeet Environmental Office in 1993 with consequential results entered into this report (Tables 3-4).

Cooper is a semi-buffered, freshwater lake with excellent water quality. The hardness of the water is relatively low as magnesium and calcium concentrations would attest to. These two cations are also the main ions in Cooper (Table 3).

Because of the almost non-existent algae growth, low nutrient content, and very low **Chlorophyll a** levels (Table 4), Cooper Lake would be assessed as an oligotrophic lake.

Biological Characteristics

Fish:

Cooper lake contains Snake River cutthroat trout.

Table 1. Characteristics of Cooper Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Stony and Cobbly Clay Loams. Loam, Silty Clay, and Rock Outcrops.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Cooper Lake.

elevation (ft.)	5,375.00
surface area (acres)	31.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	Unknown
mean depth (ft.)	Unknown
shoreline length (ft.)	7,330.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Cooper Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 30 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.35
alkalinity (mg/L CaCo3)	-----	93.50
conductivity (umhos/cm)	-----	141.00
turbidity (NTU)	-----	0.77
dissolved oxygen	-----	8.60
total suspended solids	-----	0.56
Ca	-----	14.89
Mg	-----	18.78
K	-----	0.17
Na	-----	1.64
Cl	-----	0.36
SO4	-----	2.38

Table 4. Nutrient, chlorophyll a and Secchi depth data for Cooper Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 30 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	17.0
NH3-N	----	7.06
NO2/3	----	< 2
chlorophyll a	----	0.56
secchi depth (ft)	----	----

Dog Gun Lake

Dog Gun Lake is located about one and a half miles up the Hughes Trail. The Hughes Trail is situated four miles to the west of the Heart Butte Cut Across. The Heart Butte Cut Across is located thirteen miles south of Browning on BIA Highway #1. Dog Gun is set inside the splendor of the Rocky Mountains.

The land surrounding Dog Gun Lake is under two different ownerships. A portion of the southwest and northeast side is fee lands with the balance of shoreline owned by the Blackfeet Tribe. There are a couple of houses sitting a few hundred yards from shore on the south end.

Dog Gun is known for its fishing by local residents. Dog Gun is fished throughout the year.

Drainage Basin Characteristics

Dog Gun Lake lies on the far west fringes of the Two Medicine drainage basin. The lake is charged by ground water and alot of run off. Also, two perennial tributaries flow into Dog Gun Lake. One unnamed stream enters from the west end and Deep Creek emerges from the south. The outflow leaves Dog Gun on the east end.

Northern Rockies Ecoregion is where Dog Gun Lake resides. The most abundant vegetation around the lake is the rough fescue with the soils being loams, silty clay, and rock outcrops.

This drainage basin consists of mountains to the west with agriculture developing more in the easterly direction.

Lake Basin Characteristics

Dog Gun is a shallow lake which was measured at 9 feet by the Blackfeet Environmental Office in 1993. The shoreline, of Dog Gun Lake, was measured at 15,612 feet, and the surface area at 124.40 acres. Most of the lake shore is covered with grasses. The west and southwest shores do have some timber stands which are the of the Aspen species.

Dog Gun has an elevation of 5,183 feet as was surveyed by the USGS. The volume of water residing in this lake is regulated by precipitation.

Water Quality

The monitoring of Dog Gun Lake has occurred twice in the past twenty years. Once very moderately in 1974 by the US Fish and Wildlife Service with data entered into Water Quality Management Plan of Blackfeet Tribe, and once in 1993 by the Blackfeet Environmental Office with data present in this report.

Dog Gun is a well buffered, freshwater lake. The concentration of anions and cations are especially low. The small contents of calcium and magnesium in water sample does indicate that water is soft (Table 3).

There is elevated concentrations of phosphorus, ammonia, and **chlorophyll a**. By examining the these value (Table 4), we can determine that there is definitely algae growth in this lake. In leu of these results, eutrophic status would best fit this lake. There would have to be additional testing done to justify assessment.

Biological Characteristics

Fish:

Dog Gun Lake contains a variety of fish species. The fish fauna include the rainbow trout (which is planted annually), brook trout, Arctic grayling, white sucker, and the fathead minnow.

Table 1. Characteristics of Dog Gun Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Stony and Cobbly Clay Loams. Loam, Silty Clay, and Rock Outcrops.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Dog Gun Lake.

elevation (ft.)	5,183.00
surface area (acres)	124.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	9.0
mean depth (ft.)	Unknown
shoreline length (ft.)	15,612.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Dog Gun Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.20
alkalinity (mg/L CaCo3)	-----	81.40
conductivity (umhos/cm)	-----	105.00
turbidity (NTU)	-----	8.92
dissolved oxygen	-----	6.90
total suspended solids	-----	5.46
Ca	-----	13.14
Mg	-----	5.35
K	-----	0.27
Na	-----	3.61
Cl	-----	0.22
SO4	-----	1.50

Table 4. Nutrient, chlorophyll a and Secchi depth data for Dog Gun Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	119.90
NH3-N	-----	39.26
NO2/3	-----	< 2
chlorophyll a	-----	23.99
secchi depth (ft)	-----	2'8"

Four Horns Lake

Four Horns Lake is accessed by driving fifteen miles to the south of Browning on US Highway 89 turning west on BIA Highway 4 for three miles, and then turn south on dirt road for three more miles. Four Horns is the second biggest lake in the Two Medicine drainage basin and is set in the prairies of the Blackfeet Reservation.

Four Horns Lake was created in the 1920's to store water for irrigation on the Badger-Fisher Flats. Tribal land circumscribes the entirety of Four Horns Lake. A few trash cans, a pit toilet, and a handpump are the only luxuries surrounding this lake. This lake obtained its name from the family called Four Horns who were allotted land around it.

Four Horns is known for its fishery. Stock watering, fishing, and irrigation are the principle uses of Four Horn Lake. Also, many species of water fowl utilize this lake as a resting place during their seasonal migration.

Drainage Basin Characteristics

Four Horn Lake is positioned in the lower south eastern half of the Two Medicine drainage basin. Two Medicine drainage basin had the highest measured runoff in 1991 at an estimated 679,100 acre feet. Four Horn is charged by runoff, a small intermittent stream out of Jackson coulee to the south, and by a canal carrying water from Big Badger creek on the west side. On the east side of the lake, a turnout can be found which yields water for irrigation purposes.

Four Horn Lake is located in the Montana Valley and Foothill Prairies Ecoregion. The most prominent vegetation around this lake is needle & thread and green needlegrass. Clay and cobbly loams are the dominant riparian soils around this lake.

The land base surrounding Four Horn Lake has mountains and range land to the west with agriculture dominating in the east.

Lake Basin Characteristics

The surface area, of Four Horn Lake, is 718.60 acres. There was a bottom profile done by the US Fish and Wildlife Service in 1981 with the deepest point measured at 33 feet. The length of the shoreline is 34,584 feet.

Four Horn has an elevation of 4,111 feet. The amount of water available for irrigation practices is depended upon several factors with the influx of water from Big Badger being the most important one. Also, the volume of water in Four Horns is controlled by the turnout on east side.

Water Quality

The monitoring of Four Horn Lake was done in 1980 under the Water Quality Management Plan of the Blackfeet Nation. Also, a more intense measuring of parameters was completed in 1993 by the Blackfeet Environmental Office under the Clean Water Act.

Four Horns is a well buffered, freshwater lake with the dominant ions being sulphate, calcium, and magnesium. The water is hard because of the elevated content of calcium and magnesium.

The extremely low nutrient and Chlorophyll a readings (Table 4) are good evidence that Four Horn Lake would be grouped in the oligotrophic category, but subsequent testing would be necessary to substantiate it.

Biological Characteristics

Fish:

Four Horn has a great fishery with the walleye being unique to it. The lake also contains other species including the rainbow trout, brown trout, mountain whitefish, and the white suckers.

Table 1. Characteristics of Four Horns Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay and Cobbly Loam.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Green Needlegrass, Needle and Thread
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Four Horns Lake.

elevation (ft.)	4,111.00
surface area (acres)	718.60
volume (acre-ft.)	Unknown
maximum depth (ft.)	23.0
mean depth (ft.)	Unknown
shoreline length (ft.)	34,584.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	10-14"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Four Horns Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 12 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.47
alkalinity (mg/L CaCO ₃)	-----	123.20
conductivity (umhos/cm)	-----	400.00
turbidity (NTU)	-----	1.81
dissolved oxygen	-----	7.20
total suspended solids	-----	2.02
Ca	-----	46.39
Mg	-----	27.59
K	-----	0.81
Na	-----	4.91
Cl	-----	0.40
SO ₄	-----	108.54

Table 4. Nutrient, chlorophyll a and Secchi depth data for Four Horns Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 12 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	7.10
NH3-N	-----	6.34
NO2/3	-----	< 2
chlorophyll a	-----	0.32
secchi depth (ft)	-----	12' 6"

Magee Lake

Magee lake is situated six miles south of Browning on BIA Highway #1. Travel down a dirt road east of this highway for one mile, and this will take you directly to Magee lake. This lake sits inside of rolling hills.

The only activity associated with Magee Lake is watering of stock. It was stocked with rainbow in 1993, but is not heavily fished. Magee Lake acquired its name from the Magee family who own land around this small water body. There is a small area on the south west shore that is fee land.

Drainage Basin Characteristics

Magee Lake is located in the north central portion of the Two Medicine drainage basin. Magee is charged by run off, ground water, and a small intermitted tributary on the west end. There are no outlets on this lake.

Magee Lake is localized in the Montana Valley and Foothill Prairies with rough fescue vegetation being dominant. The riparian soils include clay, cobbly, and stony loams plus clay.

Magee is set in prairie grassland portion of the Blackfeet Reservation.

Lake Basin Characteristics

Magee is a very small shallow lake with a surface area of 49.30 acres, and a shoreline length of 5,969 feet. The deepest point found in 1993 was 8 feet by the Blackfeet Environmental Office. Magee Lake is a major waterhole for livestock. The affects of these animals on this lake are seen on trodden shoreline and the water quality.

Magee Lake has an elevation of 4,676 feet. The main contributor, to volume of water in Magee, would be the precipitation factor for that year.

Water Quality

Magee was monitored in 1973 and data was entered into the Water Quality Management Plan of the Blackfeet Tribe, and has been measured only once since then by the Blackfeet Environmental Office in 1993.

Magee has a water quality problem. The lake water is well buffered with an enormous suspended particle problem determined by extremely high conductivity readings, and heightened content of cation values (Table 3). Sodium and Magnesium are the dominant ions in Magee Lake.

The elevated concentrations of total phosphorus and ammonia does represent an algal problem. Also, **chlorophyll a** is moderately high thus indicating a wealth of algae. The high content of nutrients in Magee Lake might come from runoff or livestock wastes. Because this is a well nourished lake, Magee would be considered an eutrophic water body although further analysis would be needed to confirm it.

Biological Characteristics

Fish:

Magee Lake was stocked in 1993 with the rainbow trout species. No other fish fauna is known to live there.

Table 1. Characteristics of Magee Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Clay, Cobbly, and Stony Loams. Loam and Clay.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Magee Lake.

elevation (ft.)	4,676.00
surface area (acres)	49.30
volume (acre-ft.)	Unknown
maximum depth (ft.)	8.0
mean depth (ft.)	Unknown
shoreline length (ft.)	5,969.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Magee Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 18 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.93
alkalinity (mg/L CaCo3)	-----	481.80
conductivity (umhos/cm)	-----	2,250.00
turbidity (NTU)	-----	5.46
dissolved oxygen	-----	6.20
total suspended solids	-----	-----
Ca	-----	55.83
Mg	-----	273.30
K	-----	37.90
Na	-----	269.82
Cl	-----	-----
SO4	-----	-----

Table 4. Nutrient, chlorophyll a and Secchi depth data for Magee Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 18 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	111.54
NH3-N	----	170.12
NO2/3	----	6.33
chlorophyll a	----	10.26
secchi depth (ft)	----	5'10"

Water Quality

There was very limited monitoring of Mittens Lake in 1977 with the few of results put in the Water Quality Management Plan of the Blackfeet Tribe. Horse was monitored more extensively in 1993 by the Blackfeet Environmental Office.

Mittens Lake is well buffered, freshwater lake. The water is moderately hard as values of calcium and magnesium can attest to (Table 3). The main ions in this lake are magnesium and the sulphates.

The concentrations of phosphorus, nitrogen, and **chlorophyll a** are extremely low. These values along with the high secchi reading would point in the direction of an oligotrophic lake, but there are lots of weeds in this lake which might place Mittens in another trophic status. More extensive monitoring would be needed to classify this lake.

Biological Characteristics

Fish:

Mittens is known for its trophy trout. Rainbow trout is stocked annually in this lake.

Table 1. Characteristics of Mitten Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, and Stony Clay Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Mitten Lake.

elevation (ft.)	4,743.00
surface area (acres)	186.40
volume (acre-ft.)	Unknown
maximum depth (ft.)	11.0
mean depth (ft.)	Unknown
shoreline length (ft.)	15,450.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for Mittens Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 9 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	9.18
alkalinity (mg/L CaCo3)	-----	176.00
conductivity (umhos/cm)	-----	433.00
turbidity (NTU)	-----	0.80
dissolved oxygen	-----	8.00
total suspended solids	-----	0.82
Ca	-----	18.94
Mg	-----	33.89
K	-----	2.13
Na	-----	23.96
Cl	-----	0.46
SO4	-----	70.07

Table 4. Nutrient, chlorophyll a and Secchi depth data for Mittens Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 9 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	16.0
NH3-N	----	9.97
NO2/3	----	< 2
chlorophyll a	----	0.40
secchi depth (ft)	----	10'3"

Swift Reservoir

Swift Reservoir can be reached by taking US Highway 89 south east out of Browning for approximately forty miles, and then turn west on gravel road for another seventeen miles. This gravel road is located a few miles north of Dupuyer, MT. Swift is a medium sized lake which sits on the far southwest boundary of the Blackfeet Reservation.

Most of Swift Reservoir lies within the Lewis and Clark National Forest with the northern tip on Reservation lands. Swift is used mainly for irrigation storage and flood control. There is also some secondary benefits that include fishing, boating, and waterfowl habitat.

Swift Reservoir is also known as Birch Creek Reservoir (Dam) and was once an earth filled dam, but it was washed out in the 1964 flood. A new concrete dam was built in 1966.

Drainage Basin Characteristics

Swift Reservoir rests on the most southern part of the Two Medicine drainage basin. It is charged by the North Fork and South Fork of Birch Creek. The discharge of water exists out of Swift Dam on the eastern side of reservoir.

Swift Reservoir is nestled in the Northern Rockies Ecoregion with rough fescue vegetation being most prominent. Loams, silty clay, and Rock Outcrops are the soils to be found in the immediate area.

This drainage basin consists of the community of Heart Butte in the southern portion, the Rocky Mountains protruding in the west, and agriculture magnifying towards the east.

Lake Basin Characteristics

The reservoir is very deep at 90 feet. The surface area was measured at 443.57 acres and shoreline length at 51,984 feet. Mountain terrain surrounds most of this reservoir with the concrete structure (dam) on the east side facing the prairies.

The elevation of Swift Reservoir is 4,884 feet. The volume of water is controlled by Swift Dam. Water is regulated for irrigation applications.

Water Quality

Monitoring of water quality was initiated by the Blackfeet Environmental Office in 1993 under Sec. 314 of the Clean Water Act.

Swift Reservoir is a well buffered, freshwater water body. The water is relatively hard due to the calcium and magnesium content (Table 3). The water quality is excellent.

Nitrate and nitrite are the dominant nutrients in Swift Reservoir, but their concentrations are moderately low. This inorganic form of nitrogen can influence the composition of the algal community. The low content of nutrients along with small **Chlorophyll a** levels and high secchi depth reading corresponds to an oligotrophic lake.

Biological Characteristics

No data available at this time.

Table 1. Characteristics of Swift Reservoir drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Stony and Cobbly Clay Loams. Loam, Silty Clay, and Rock Outcrops.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Rough Fescue
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Swift Reservoir.

elevation (ft.)	4,884.00
surface area (acres)	443.57
storage capacity (acre-ft.)	35,570.00
storage in 1992 (acre-ft.)	187,565
maximum depth (ft.)	90.0
mean depth (ft.)	Unknown
shoreline length (ft.)	51,984.00
control structure	concrete dam
dam height (ft.)	205.00
dam crest length (ft.)	560.00
dam crest elevation (ft.)	4,883.50
overflow spillway crest elevation (ft.)	4,886.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available

Table 3. Major ions and related water quality variables for Swift Reservoir. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 10 August 1993.

	1992	1993
	Mean	Mean
pH (range)	----	8.18
alkalinity (mg/L CaCO ₃)	----	143.00
conductivity (umhos/cm)	----	300.00
turbidity (NTU)	----	0.78
dissolved oxygen	----	8.40
total suspended solids	----	< 0.5
Ca	----	40.98
Mg	----	12.92
K	----	0.46
Na	----	0.81
Cl	----	0.26
SO ₄	----	16.08

Table 4. Nutrient, chlorophyll a and Secchi depth data for Swift Reservoir. Average concentrations in ug/L. Samples were collected from the euphotic zone from 10 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	2.80
NH3-N	----	8.10
NO2/3	----	23.50
chlorophyll a	----	0.24
secchi depth (ft)	----	25'2"

North Twins Lake

North Twins Lake is located twenty miles south of Browning on BIA Highway 1. Also, it can be reached by going five miles north west of Heart Butte on the same highway. North Twins sets in the foothills just below the magnificent Rockies.

North Twins Lake has a few wooden tables, cooking areas, and trash cans to accommodate the recreationalist. The Blackfeet Fish & Game monitors and cleans around the lake daily. The land surrounding the lake is Tribally owned.

Many recreational activities are associated with North Twins Lake. Fishing, swimming, picnicking, non-motorized boating, and camping are some of activities which this lake has to offer.

Drainage Basin Characteristics

North Twins Lake sits in the south central portion of the Two Medicine drainage basin. This lake is charged by ground water and run off. Also, water is yielded to this lake through a culvert connecting it to South Twins Lake. An outlet can be found on the west shore. The water which leaves this turnout ends up in Badger Creek and consequently into the Two Medicine River.

North Twins Lake is situated in the Montana Valley and Foothill Prairies Ecoregion. The bluebunch wheatgrass is the dominant species of vegetation found around this lake. The riparian soils are comprised of cobbly, gravelly, and stony loams.

The drainage basin consists of mountains and forest to the south and west with range converting to farm land the further east you travel into the basin.

Lake Basin Characteristics

This is a very shallow lake with the deepest point being measured at 8 feet. Twins North Lake has a relatively small surface area of 14.27 acres. The shoreline length was measured at 4,217 feet. There are a few willows scattered on the south west shore with the entirety of the lake encompassed with grasses.

North Twins Lake has an elevation of 5,171 feet. The amount of water entering from South Twins is a big factor in the volume of water stored in this lake. Also, water exiting lake through turnout on west side affects volume.

Water Quality

North Twins Lake was initially monitored in 1966 and 1967 with the results being published in the 208 Water Quality Management Plan of the Blackfeet Tribe. Monitoring was reestablished in 1993 by the Blackfeet Environmental Office through the Clean Lakes Program.

The moderately low concentrations of calcium and magnesium signify that the water is slightly hard. The alkalinity value indicates the lake is well buffered.

Analyzing the limited data, North Twins Lake would fall under the classification of oligotrophic because of low concentrations of nutrients, low **chlorophyll a** value, high secchi reading, lack of algae, and the clearness of the water.

Biological Characteristics

Fish:

North Twins Lake is known for its rainbow trout which is stocked twice a year.

Table 1. Characteristics of North Twins Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, and Stony Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of North Twins Lake.

elevation (ft.)	5,171.00
surface area (acres)	14.27
volume (acre-ft.)	Unknown
maximum depth (ft.)	8.0
mean depth (ft.)	unknown
shoreline length (ft.)	4,217.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for North Twins Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
pH (range)	----	8.87
alkalinity (mg/L CaCo3)	----	257.40
conductivity (umhos/cm)	----	459.00
turbidity (NTU)	----	1.80
dissolved oxygen	----	8.10
total suspended solids	----	1.01
Ca	----	18.94
Mg	----	51.06
K	----	2.25
Na	----	17.75
Cl	----	2.32
SO4	----	12.67

Table 4. Nutrient, chlorophyll a and Secchi depth data for North Twins Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	----	12.7
NH3-N	----	5.30
NO2/3	----	< 2
chlorophyll a	----	1.59
secchi depth (ft)	----	8'3"

South Twins Lake

South Twins Lake is positioned twenty miles south of Browning on BIA Highway 1 and five miles north west of Heart Butte on the same highway. South Twins is set immediately below the Rocky Mountains on its foothills.

This lake has a limited number of tables and fireplaces about its shoreline which the Blackfeet Fish & Game monitors quite actively. Tribal land surrounds this lake. There are several residents which occupy a radius of 3-5 miles around the lake.

South Twins is a very popular fishing lake year around. This lake is one of the smallest sports fishing lakes which hosts numerous derbies. Also, recreational functions are popular during the summer months. They include picnicking, camping, swimming, etc.

Drainage Basin Characteristics

South Twins Lake sits in the south central portion of the Two Medicine drainage basin. This lake is charged by ground water and run off. There is one tributary which flows into South Twins Lake from the south side. This water comes from Evans Creek. There is a culvert on the north side of lake which releases excess water out of South Twins.

South Twins Lake is situated in the Montana Valley and Foothill Prairies Ecoregion. The bluebunch wheatgrass is the main vegetational species under normal conditions. The riparian soils are comprised of cobbly, gravelly, and stony loams.

The drainage basin consists of mountains and forest to the south and west, and range changing to farm land the further east you venture.

Lake Basin Characteristics

The deepest point measured was fifteen feet near the center of the lake. South Twins Lake has a comparative small surface area of 22.17 acres. The shoreline length was measured at 3,792 feet. Willows dominant the south shore while grassy type vegetation covers the remainder of the lake.

South Twins Lake has an elevation of 5,171 feet. The volume of water is controlled by turnout on north side of lake.

Water Quality

The earlier monitoring, of South Twins Lake, occurred in 1966 and 1967 and this data was placed in the 208 Water Quality Management Plan of the Blackfeet Tribe. Monitoring was revitalized in 1993 by the Blackfeet Environmental Office through the Clean Lakes Program.

The moderately low concentrations of calcium and magnesium signify that the water is slightly hard. The lake is well buffered by looking at the value of alkalinity.

Analyzing limited data, South Twins Lake would fall under the classification of oligotrophic because of low concentrations of nutrients, low **chlorophyll a** value, high secchi reading, lack of algae, and the clearness of the water.

Biological Characteristics

Fish:

Because South Twins Lake is heavily fished, it is stocked biannually with rainbow trout.

Table 1. Characteristics of South Twins Lake drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Cobbly, Gravelly, and Stony Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Montana Valley and Foothill Prairies
dominant vegetation	Bluebunch Wheatgrass
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of South Twins Lake.

elevation (ft.)	5,171.00
surface area (acres)	22.17
volume (acre-ft.)	Unknown
maximum depth (ft.)	15.0
mean depth (ft.)	unknown
shoreline length (ft.)	3,792.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	15-19"
mean residence time (yr.)	Not available
control structure	None

Table 3. Major ions and related water quality variables for South Twins Lake. Average concentrations in mg/L; pH in pH units. A sample was collected from euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
pH (range)	-----	8.33
alkalinity (mg/L CaCo3)	-----	224.40
conductivity (umhos/cm)	-----	410.00
turbidity (NTU)	-----	1.48
dissolved oxygen	-----	7.20
total suspended solids	-----	1.90
Ca	-----	33.25
Mg	-----	33.09
K	-----	1.66
Na	-----	11.24
Cl	-----	2.51
SO4	-----	11.19

Table 4. Nutrient, chlorophyll a and Secchi depth data for South Twins Lake. Average concentrations in ug/L. A sample was collected from the euphotic zone on 11 August 1993.

	1992	1993
	Mean	Mean
total phosphorus	-----	14.5
NH3-N	-----	7.48
NO2/3	-----	< 2
chlorophyll a	-----	2.14
secchi depth (ft)	-----	10'5"

Lower Two Medicine

Lower Two Medicine Lake is a man made water resource. The current dam was built in 1966 after the flood destroyed the former dam in 1964. Lower Two Medicine is engraved into the picturesque view of the Rocky Mountains. The lake lies four miles to north of the community of East Glacier on Highway 49.

The shoreline encompassing the lake is tribally owned, and is partially accessible from the east and west sides. There are no dwellings around the lake, but there is a convenience store located a quarter of a mile below the dam. A campground is situated around the store and part way up the western end of the lake.

In the summer months, Lower Two Medicine is used by recreational seekers in the form of swimming, boating, water skiing, picnicking, fishing, etc. The lake provides fishing year around.

Drainage Basin Characteristics

Lower Two Medicine Lake is found in the north western section of the Two Medicine drainage basin. The western end of Two Medicine Lake lies within Glacier National Park. This drainage basin had the most acre-feet of water leaving the reservation in 1991 than the other three basins. The natural drainage has been altered by Two Medicine Dam. Lower Two Medicine is charged by run off, ground water, and one major tributary. Two Medicine river enters the lake from the west end and is responsible for the largest contribution of water to this lake. On the southeast end of lake, water leaves Two Medicine Lake via a dam. The water exiting Two Medicine Lake eventually is deposited into the Marias River to the east.

Lower Two Medicine lake exists in the Northern Rockies Ecoregion. The riparian soils embedded along this lake are composed of various types of loams. In these soils, Lodgepole pine, Englemann spruce, Douglas fir , Alpine fir, and Aspen are the dominant vegetation.

The drainage basin is overlaid with forest and mountains to the west, and valley/prairies to the east. Ranching tends to be conjugated more in the western half of the basin with farming becoming more prominent towards the eastern side.

Lake Basin Characteristics

Lower Two Medicine Lake is a fairly deep mountainous lake with 49 feet being the deepest point measured in 1993. This lake has a surface area of 716.70 acres with a shoreline length of 38,2545 feet. This shoreline is very long with thick timber stands encircling the lake.

Lower Two Medicine has an elevation of 4,882 feet. The water level, of this lake, is manipulated by a dam on southeast end. The purpose of this dam is for flood control and to release water for irrigational uses.

Livestock use Lower Two Medicine as a drinking source and graze on land near it.

Water Quality

Lower Two Medicine was partially monitored in 1963-64 with the results placed in the 1981 Water Quality Management Plan of the Blackfeet Tribe. This lake was more intensely monitored by the Blackfeet Environmental Office in 1993.

Lower Two Medicine is a freshwater lake with total suspended solids and alkalinity concentrations being the one of the lowest on the reservation. The water is considered soft because the calcium and magnesium levels are quit low.

At this time, Lower Two Medicine Lake would be classified as an oligotrophic lake because the nutrient values are very low, Chlorophyll a values are < 1, and secchi readings are moderately high (Table 3). Further testing would have to be done to verify the trophic status of this lake.

Biological Characteristics

Fish:

Lower Two Medicine Lake contains the rainbow trout, brook trout, and the white suckers in its pristine waters.

Table 1. Characteristics of Lower Two Medicine drainage basin.

area(excluding lake) (miles sq.)	Unavailable
soil	Stony, Gravelly, Cobbly, Cobbly Clay, and Gravelly Clay Loams.
berock geology	Unavailable
terrain	Unavailable
ecoregion	Northern Rockies
dominant vegetation	Alpine Fir, Aspen, Douglas Fir, Englemann Spruce, Lodgepole Pine.
mean annual inflow (acres-ft)	Unknown
mean annual sunshine	Unknown

Table 2. Characteristics of Lower Two Medicine Lake.

elevation (ft.)	4,882.00
surface area (acres)	716.70
maximum storage (acre-ft.)	25,100.00
normal storage (acre-ft.)	11,850.00
maximum depth (ft.)	49.0
mean depth (ft.)	unknown
shoreline length (ft.)	38,254.00
control structures	earth dam with concrete overflow structure
dam height (ft.)	65.0
dam crest length (ft.)	1100.00
dam crest elevation (ft.)	4,883.00
overflow spillway crest elevation (ft.)	4,883.00
mean annual lake evaporation (in.)	Unknown
mean annual precipitation (in.)	20"+
mean residence time (yr.)	Not available

Table 3. Major ions and related water quality variables for Lower Two Medicine Lake. Average concentrations in mg/L; pH in pH units. Samples were collected from euphotic zone once on 3 August 1993. There were four grab samples collected at this visit.

	1992	1993
	Mean	Mean
pH (range)	----	7.18
alkalinity (mg/L CaCo3)	----	24.20
conductivity (umhos/cm)	----	103.00
turbidity (NTU)	----	1.35
dissolved oxygen	----	6.25
total suspended solids	----	< 0.5
Ca	----	8.51
Mg	----	4.29
K	----	0.24
Na	----	0.51
Cl	----	0.15
SO4	----	2.73

Table 4. Nutrient, chlorophyll a and Secchi depth data for Lower Two Medicine Lake. Average concentrations in ug/L. Samples were collected from the euphotic zone once on 3 August 1993. There were four grab samples collected at this visit.

	1992	1993
	Mean	Mean
total phosphorus	----	6.80
NH3-N	----	9.66
NO2/3	----	<2
chlorophyll a	----	0.476
secchi depth (ft)	----	7'8"