Pierre Creek/Lake Hanson Water Quality
Study Area Report

Prepared by
South Dakota Department of Water and Natural Resources
Water Quality Management Section

June 1985

Pierre Creek/Lake Hanson Water Quality Study Area Report

Prepared by
South Dakota Department of Water and Natural Resources
Water Quality Management Section

June 1985

Pierre Creek/Lake Hanson Water Quality

Study Area Report

Prepared by

South Dakota Department of Water and Natural Resources

208 Water Quality Management Section

June 1985

The preparation of this report was financed through a Section 208 Water Quality Management Planning Grant from the U.S. Environmental Protection Agency

CONTENTS

Pierre Creek/Lake Hanson Water Quality Study Area Summary.....1

I. Pierre Creek/Lake Hanson Watershed Description.....6

A. General Description.....6

1. Pierre Creek.....6

2. Lake Hanson.....7

B. Beneficial Uses and Impairments.....9

C. Land Use.....11

D. Climate, Geology, and Major Soils.....12

II. Pierre Creek/Lake Hanson Water Quality Study Area Selection.....17

III. Soil Erosion and Sediment Yield Summary.....18

IV. Water Quality Status Report for Pierre Creek/Lake Hanson.....19

A. In-Lake Water Quality.....21

B. The Watershed and Water Quality.....33

V. Pierre Creek/Lake Hanson Watershed Problems and Recommendations.....41

A. Cropland/Grassland Runoff.....41

VI. In-Lake Problems and Recommendations.....44

A. Eutrophication.....44

B. Sedimentation.....45

VII. Implementation Activities.....46

VIII. References Cited.....49

IX. Appendices.....50

Appendix A. Statewide Fisheries Surveys, 1977-78

Appendix B. Third Planning and Development District Report

Appendix C. SCS Soil Erosion and Sediment Yield Study

Appendix D. Water Quality Summary Tables and Figures

Appendix E. Hanson County Conservation District Final Report

CONTENTS

Pierre Creek/Lake Hanson Water Quality Study Area Summary.....1

I. Pierre Creek/Lake Hanson Watershed Description.....6

A. General Description.....6

1. Pierre Creek.....6

2. Lake Hanson.....7

B. Beneficial Uses and Impairments.....9

C. Land Use.....11

D. Climate, Geology, and Major Soils.....12

II. Pierre Creek/Lake Hanson Water Quality Study Area Selection.....17

III. Soil Erosion and Sediment Yield Summary.....18

IV. Water Quality Status Report for Pierre Creek/Lake Hanson.....19

A. In-Lake Water Quality.....21

B. The Watershed and Water Quality.....33

V. Pierre Creek/Lake Hanson Watershed Problems and Recommendations.....41

A. Cropland/Grassland Runoff.....41

VI. In-Lake Problems and Recommendations.....44

A. Eutrophication.....44

B. Sedimentation.....45

VII. Implementation Activities.....46

VIII. References Cited.....49

IX. Appendices.....50

Appendix A. Statewide Fisheries Surveys, 1977-78

Appendix B. Third Planning and Development District Report

Appendix C. SCS Soil Erosion and Sediment Yield Study

Appendix D. Water Quality Summary Tables and Figures

Appendix E. Hanson County Conservation District Final Report

Pierre Creek/Lake Hanson Water Quality Study Area Summary

The Pierre Creek/Lake Hanson Water Quality Study Area (WQSA) lies in the central and northeast portions of Hanson County, South Dakota. The watershed is about 16 miles long and averages about 4 miles wide, encompassing some 40,000 acres of primarily level or gently sloping farmland. The headwaters of Pierre Creek begin in an area of potholes and sloughs in northeast Hanson County and flow south and southwest through a large wetland area (meandered Long Lake). After emerging from the wetland, Pierre Creek continues to flow south-southwest into Hanson Lake, a small reservoir located about 10 miles south of Long Lake and 2 miles south of the Town of Alexandria. From the reservoir outlet, the creek flows west and southwest into the James River.

Upper Pierre Creek from Section 11 to its headwaters is classified as intermittent. Flow in the lower creek is maintained during the entire year by a number of springs and water outflow from a nearby abandoned stone quarry about 2 miles above Hanson Lake.

Pierre Creek from the James River to S11, T102N, R58W is classified under the South Dakota State Water Quality Standards for the beneficial uses of warmwater semipermanent fish life propagation, limited contact recreation, wildlife propagation and stock watering, and irrigation. From S11, T102N, R58W to its headwaters the creek is classified for irrigation and as wildlife propagation and stockwatering water.

Hanson Lake is a 55-acre manmade impoundment on lower Pierre Creek constructed by the Lake Hanson Association in the mid-1930's. The reservoir is classified as having the beneficial use designations of: warmwater semipermanent fish life propagation, immersion recreation, limited contact recreation and wildlife propagation, and stock watering. The reservoir has a maximum depth of 18 feet

and an average depth of 7.6 feet. Symptoms of eutrophication such as dense blue-green algal blooms and extensive aquatic weed growth are present annually. Primary fish species managed for are largemouth bass and bluegill. There are no documented winter fish kills.

Approximately 71% of the Pierre Creek/Lake Hanson watershed is cropland, 25% is grassland and pasture, and about 4% is in roads, town sites, and farmsteads. The U.S. Soil Conservation Service (SCS) estimated that approximately 58% of the watershed was adequately treated in 1980.

Lakeside development on the north shore consists of 30 cabins (including 28 summer homes and 2 permanent residences) a small campground, boat ramp, toilets, swimming area, change houses, and a well and concession stand. Most of the land adjacent to the south side of Hanson Lake is grassland and pasture. There is considerable local interest in the reservoir as evidenced by the existence of Lake Hanson Association and local support of the Pierre Creek/Lake Hanson Water Quality Project.

To determine water quality characteristics and identify water quality problems within the Pierre Creek/Lake Hanson watershed, samples were taken at 11 sites: 7 sampling sites were located on Pierre Creek, including 6 placed at intervals upstream of Lake Hanson and one site about 1 mile downstream. Two (2) sites were within the body of the reservoir and the remaining two were located at the reservoir spillway and at a point where Pierre Creek enters Lake Hanson. Samples were collected after rainfall events and during snowmelt runoff.

In-lake sampling indicated Lake Hanson to be highly eutrophic as evidenced by high levels of phosphates and organic nitrogen. The main problem at Lake Hanson is dangerously high nutrient loading from the Pierre Creek watershed. Annual

phosphorus loads were .34 g/m^2/year in 1979, 1.67 g/m^2/year in 1982 and 1.23 g/m^2/yr in 1983. The corresponding nitrogen loads were 2.70, 7.16, and 7.01 g/m^2/year, respectively. In all cases, the nutrient loads greatly exceeded the permissible loading levels designated by Vollenweider (1968).

Shoreline erosion contributed 574 tons and watershed erosion, primarily from cropland, provided 890 tons of sediment to Lake Hanson. Incoming concentrations of dissolved and suspended solids from Pierre Creek were often found to be above acceptable levels.

Excessive fecal coliform levels (>2,000/100 ml) were observed 13 times at the reservoir inlet site and half of all samples at this site exceeded 200/100 ml. High coliform levels in excess of 200/100 ml were present 7 times at in-lake sites.

Non-point sources of pollution to Lake Hanson from the watershed as indicated by high nutrient and sediment loading as well as the presence of excessive fecal coliform levels are: inadequate crop residue on agricultural land, feedlots without pollution controls, lack of fertilizer management, overuse of pastures and grassland, stream bank erosion, failing individual septic tank systems, and seepage from the Alexandria sewage lagoon.

Recommendations

Nutrient and sediment loading to the reservoir from the watershed may be reduced by utilizing Best Management Practices (BMPs) on the land including implementation of fertilizer management practices, minimum tillage, and leaving crop residue to reduce erosion. Proper grazing use of rangeland and feedlot control systems will help in the reduction of nutrients and bacterial contamination to the lake. A detailed septic tank survey should be conducted

around the lake to identify any problem areas and technical assistance should be provided to control existing problems. The above is also applicable in regard to the Alexandria sewage lagoon system in reducing or eliminating its possible impact on Pierre Creek. Lakeshore and stream bank stabilization is recommended in areas that are rapidly eroding. After the above measures are implemented, a selective dredging program is recommended to improve the overall recreational potential of the reservoir and phosphorus precipitation should be investigated to reduce nutrients.

Implementation

About 2% of the watershed had BMPs applied during the Pierre Creek/Lake Hanson Water Quality Project which brings the total percentage of land adequately treated in the watershed to an estimated 60%.

Permanent grass cover was established on 729 acres and windbreak restoration was completed on 23 acres. In addition, 120 acres were placed under reduced tillage and about 25 acres of trees were planted within the watershed area. Three (3) wells and 7 dugouts were excavated to provide alternative livestock water supplies and to protect streamside land and the lake shoreline from excessive grazing pressure. Total treated acreage during the WQSA project amounted to about 897 acres.

Seepage from the Alexandria wastewater treatment lagoon was eliminated in July, 1984. However, the City must still riprap the east and north berms of the old lagoon (first cell) to provide for dike protection. Leaks in the pipeline leading into the first cell should also be repaired.

Other problem areas which still exist in the watershed and lake shoreline include overgrazing and lack of adequate vegetative cover on streamside and lakeshore land, faulty septic tanks for individual cabins, overflow from the Alexandria sewage lagoon (second cell), undetermined nutrient and fecal coliform input from an estimated 40 livestock operations within the watershed, soil erosion from inadequately managed croplands, and stream bank erosion.

The Hanson County Conservation District believes that the depressed farm economy in the Pierre Creek watershed for the past several years has hampered participation in various projects of the Pierre Creek/Lake Hanson Water Quality Program and that better economic conditions in the area would have resulted in a greater number of planned conservation practices or projects being carried out to completion.

I. Pierre Creek/Lake Hanson Watershed Description

A. General Description

1. Pierre Creek

The Pierre Creek/Lake Hanson Water Quality Study Area lies in the central and northeast portions of Hanson County, South Dakota. The watershed is about 16 miles long and averages about 4 miles wide encompassing approximately 38,361 acres of primarily level or gently sloping farmland (Figure 1).

The headwaters of Pierre Creek begin in an area of potholes and sloughs in northeast Hanson County and flow south and southwest through a large wetland area (meandered Long Lake). In the early 1950's a diversion was built across Pierre Creek near its southern entrance to Long Lake to divert runoff flow southward and away from the wetland area. In late March 1981, this dam was bypassed by a flat-bottomed waterway excavated by the National Guard to correct dam-related stream bank erosion in the vicinity and to use Long Lake as a settling basin for runoff sediment carried by Pierre Creek. At the present time, landowners around the lake have requested that the County replace the diversion. A 404 permit has been requested from the U. S. Army Corps of Engineers. No objection to the construction is anticipated and the diversion is scheduled to be completed in 1985.

After emerging from Long Lake the creek continues to flow in a south-southwesterly direction for about 11 miles. Approximately one mile southeast of the city of Alexandria (pop. 598), Pierre

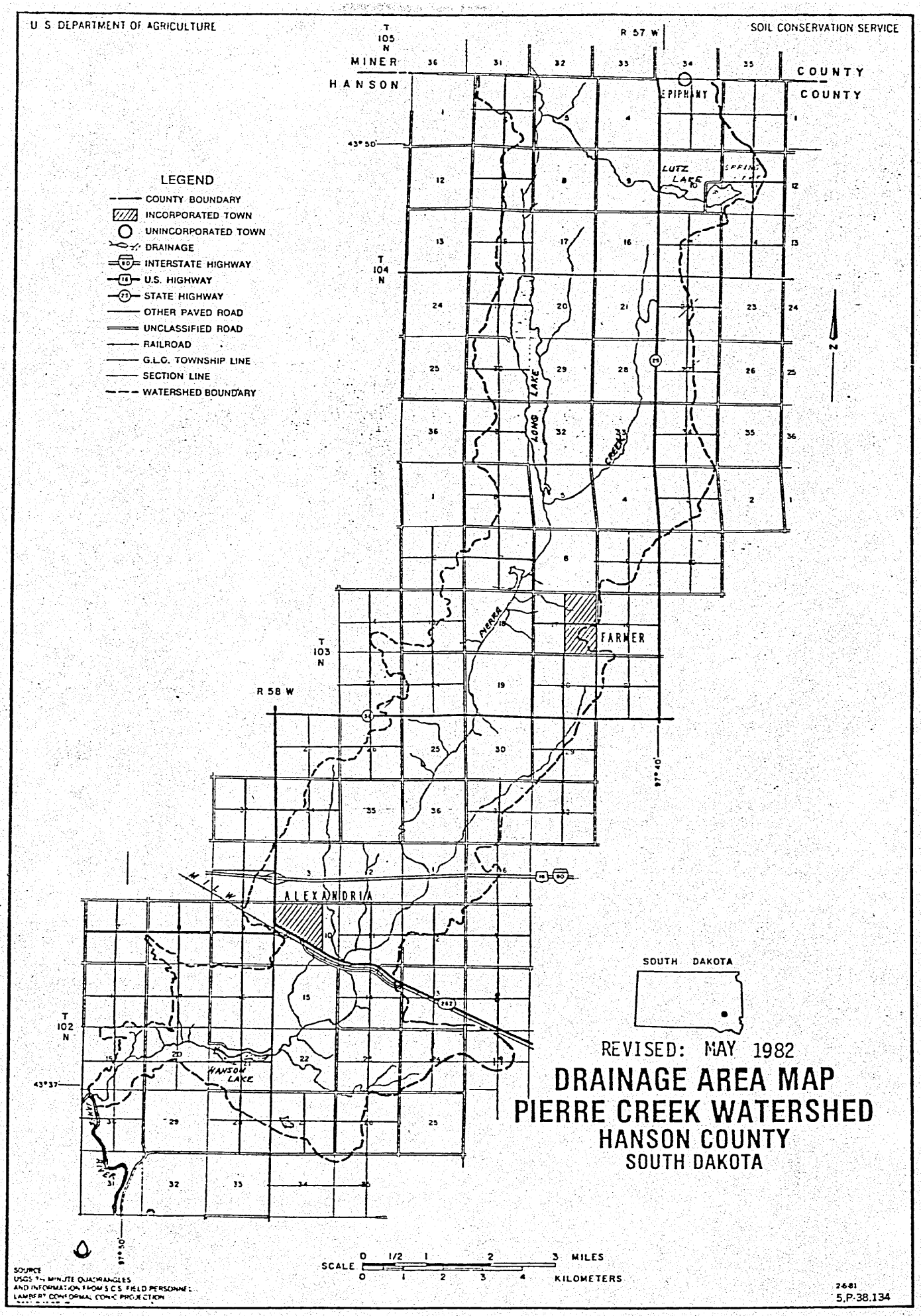

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
R 57 W
T 105 N
T 104 N
T 103 N
T 102 N
R 58 W
MINER COUNTY
HANSON COUNTY
EPIPHANY
FARMER
ALEXANDRIA
LUTZ LAKE
LONG LAKE
PIERRE CREEK
HANSON LAKE
LEGEND
COUNTY BOUNDARY
INCORPORATED TOWN
UNINCORPORATED TOWN
DRAINAGE
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
OTHER PAVED ROAD
UNCLASSIFIED ROAD
RAILROAD
G.L.O. TOWNSHIP LINE
SECTION LINE
WATERSHED BOUNDARY
SOUTH DAKOTA
REVISED: MAY 1982
DRAINAGE AREA MAP
PIERRE CREEK WATERSHED
HANSON COUNTY
SOUTH DAKOTA
SCALE 0 1/2 1 2 3 MILES
0 1 2 3 4 KILOMETERS
SOURCE
USGS 7½ MINUTE QUADRANGLES
AND INFORMATION FROM S.C.S. FIELD PERSONNEL
LAMBERT CONFORMAL CONIC PROJECTION
2-81
5,P-38,134

Figure 1.

Creek turns westward to flow into Lake Hanson, a 55 acre impoundment two miles southwest of the city. From the lake outlet it continues to flow west and then southwest into the James River.

In addition to runoff from its watershed, lower Pierre Creek receives water flow from a number of springs and a nearby abandoned stone quarry southeast of Alexandria. These sources normally maintain flow in this portion of the creek over the entire year and provide an input of one million gallons of water per day into Lake Hanson (C. McDonald, 1976, GF&P report). From Section 11 to its headwaters, Pierre Creek is classified as intermittent. After spring runoff abates in June, this portion of the creek is often reduced to a series of temporary pools. Except for brief periods of storm runoff during summer and fall, flows do not usually occur in the upper Pierre Creek.

2. Lake Hanson

Lake Hanson is a manmade impoundment on lower Pierre Creek constructed by the Lake Hanson Association in the mid 1930's. Construction of the dam was financed through the Works Progress Administration (WPA), but acquisition of the land necessary for the project was obtained by funds through local subscription. The lake association remains in existence today and administers management of the area and leasing of lakeshore lots.
In 1942, heavy runoff caused the dam to rupture. Repair of the dam was made by the South Dakota Department of Game, Fish and

Parks (GF&P). Long-term erosion of the reservoir stilling basin below the spillway apron was corrected in 1982 by the National Guard. These repairs, which involved the placement of rock riprap at the bottom of the spillway, were considered a temporary measure and are presently being monitored.

Runoff, natural springs, and discharge from the abandoned Alexandria quarry provide Lake Hanson with an ample supply of water. Overflow from the reservoir is continuous and averages about one million gallons per day.

Lake Hanson has a surface area of 54.9 acres and a shoreline of 2.2 miles. The maximum depth is 18 feet with an average depth of 7.6 feet. The bottom varies from muck in the deeper areas and upstream portion of the lake to sand and sandy clay in the shoal areas. Heavy growth of submergent vegetation occurs in the shallows and in the entire upper third of the lake, and dense bluegreen algal blooms occur during summer in open waters. These are visual indications of the reservoir's present advanced eutrophic condition.

Lake Hanson is managed by GF&P as a warmwater fishery for largemouth bass and bluegills. However, the present fish population consists of stunted bluegills, crappie, and a large number of carp. Dissolved oxygen levels have always been sufficient to support fish life during both summer and winter and there has been no known winterkill problems (Statewide Fisheries Surveys 1977-78, Report No. 78-7, Appendix A).

B. Beneficial Uses and Impairments

Lake Hanson provides recreational uses of limited boating, moderate weekend waterskiing, light snowmobiling, moderate swimming at the beach area, and sporadic fishing. The South Dakota GF&P (1970) estimated fishing opportunity provided by the Lake as 2,153 man-days per year. However, the estimated demand for fishing from Sioux Falls, Mitchell, and the surrounding area is 411,575 man-days per year. The fishery consists of bluegill, crappie, carp, perch, northern pike, sunfish, and largemouth bass. GF&P presently manages the Lake for largemouth bass and bluegills (Appendix A).

South Dakota Board of Water and Natural Resources Regulation, Chapter 74:03:02, "Surface Water Quality Standards" classifies Lake Hanson as having the beneficial use designations of: warmwater semipermanent fish life propagation, immersion recreation, limited contact recreation, and wildlife propagation and stockwatering (Table 1).

Heavy growth of submergent vegetation in nearshore areas and bluegreen algal blooms in open water impair immersion recreation and fishing in Lake Hanson. The present fish population is dominated by stunted bluegill and small crappie. The quality of angling has declined and the lake is used only sporadically by a few local fishermen. In former years when bass fishing was better the lake attracted a large number of anglers from Sioux Falls, Mitchell, and surrounding communities.

A recent visual survey by Department of Water and Natural Resources (DWNR) personnel indicated that large areas of land bordering the south side of the reservoir lack adequate vegetative cover and are subject to wind and water erosion. Wave erosion of lakeshore lots has been reported by several cabin owners on the north side of Lake Hanson. A farm south of the lake may be contributing barnyard drainage into the reservoir. These are some of the sources of sediment, nutrients, and bacteria that may be adding to the degredation of water quality in Lake Hanson.

The "Surface Water Quality Standards" divide Pierre Creek into two segments with each segment classified separately. Pierre Creek from the James River to S11, T102N, R58W is a permanent stream receiving continuous flow from the reservoir spillway, a number of springs, and Alexandria quarry about 2 miles above Lake Hanson. This segment of Pierre Creek has the same beneficial uses as Lake Hanson except that immersion recreation is replaced by irrigation use (Table 1). Impairments to the spring-fed section of the creek include inadequate vegetative cover on land bordering the banks, overgrazing, gully erosion from an old city landfill, wind erosion of surrounding land and other natural nonpoint sources, seepage from the Alexandria sewage lagoon and releases from the lagoon during periods of high flow in Pierre Creek.

Pierre Creek from S11, T102N, R58W to its headwaters is intermittent and is classified for irrigation, wildlife propagation and stockwatering. Although this creek segment has less stringent water quality criteria, it must not cause the more stringent criteria of

downstream waters to be exceeded. Impairments to water quality include sediment from stream bank erosion, sediment and nutrients from agriculture and natural nonpoint sources, sediment from gravel pits, and nutrient input from feedlots on the upper Pierre Creek watershed.

According to the "Surface Water Quality Standards" the Alexandria Quarry is considered a separate impoundment and is classified as having beneficial uses of: coldwater permanent fish life propagation, immersion recreation, limited contact recreation, wildlife propagation and stock watering.

Although Alexandria Quarry is privately owned, the quarry pond is stocked with fish by GF&P. Under the terms of the stocking agreement the pond is open to public fishing. To date, no impairments to water quality have been observed for this body of water.

Tables 1 and 2 list the water quality criteria for each beneficial use classification.

C. Land Use

Landsat Remote Sensing (Figure 2) estimates the total watershed drainage to be 43,844 acres. On-site land surveys by SCS give total watershed area as only 38,361 acres due to exclusion of non-contributing portions of the watershed. The on-site estimate is generally considered to be more reliable. Landsat Remote Sensing figures indicate that 75% of the watershed is cropland, 19% pasture, and about 3% farmstead and urban development. SCS estimates that 79% of the watershed is utilized as cropland, 12% as grassland and

Table 1. SURFACE WATER QUALITY STANDARDS FOR LAKE HANSON AND PIERRE CREEK

PARAMETER:	Lake Hanson				Pierre Creek from James River to S11,T102N,R58W				Pierre Creek from S11,T102N,R58W to Headwaters	
	Warm water semi-permanent fish life propagation	Immersion recreation	Limited contact recreation	Wildlife propagation and stock watering	Warm water semi-permanent fish life propagation	Irrigation water (May 15 - Sept. 30)	Limited contact recreation	Wildlife propagation and stock watering	Wildlife propagation and stock watering	Irrigation water (May 15 - Sept. 30)
Beneficial Use Rating Number	5	7	8	9	5	10	8	9	9	10
Alkalinity, Total/$CaCO_3$ - mg/l				750				750	750	
Chlorine, Total Residual - mg/l	<0.02				<0.02					
Coliform Fecal - organisms/100 ml		200	1000				1000			
Conductivity - micromhos/cm at 25° C.				4000		2500		4000	4000	2500
Cyanide, Free - mg/l	0.005				0.005					
Cyanide, Total - mg/l	0.02				0.02					
Hydrogen Sulfide, Undisassociated - mg/l	0.002				0.002					
Nitrogen, Ammonia Unionized (as N) - mg/l	0.04				0.04					
Nitrogen, Nitrates (as N) - mg/l				50				50	50	
Oxygen, Dissolved - mg/l	>5.0	>5.0	>5.0		>5.0		>5.0			
pH - Units	6.3<pH<9.0	6.5<pH<8.3	6.0<pH<9.0	6.0<pH<9.5	6.3<pH<9.0		6.0<pH<9.0	6.0<pH<9.5	6.0<pH<9.5	
Polychlorinated Biphenyls - mg/l	.000001				.000001					
Sodium Absorption Ratio (SAR)						10				10
Solids, Suspended - mg/l	90				90					
Solids, Total Dissolved - mg/l				2500				2500	2500	
Temperature - °F	90				90					

Table 2. SURFACE WATER QUALITY STANDARDS FOR THE ALEXANDRIA QUARRY IN THE PIERRE CREEK/LAKE HANSON WATERSHED

PARAMETER:	Alexandria Quarry			
	Cold water permanent fish life propagation	Immersion recreation	Limited contact recreation	Wildlife propagation [illegible] wat[illegible]g
Beneficial Use Rating Number	2	7	8	9
Alkalinity, Total/$CaCO_3$ - mg/l				750
Chlorides - mg/l	100			
Chlorine, Total Residual - mg/l	<0.02			
Coliform, Fecal - organisms/100 ml		200	1000	
Conductivity - micromhos/cm at 25° C.				4000
Cyanide, Free - mg/l	0.005			
Cyanide, Total - mg/l	0.02			
Hydrogen Sulfide, Undisassociated - mg/l	0.002			
Nitrogen, Ammonia Unionized (as N) - mg/l	0.02			
Nitrogen, Nitrates (as N) - mg/l				50
Oxygen, Dissolved - mg/l	>6.0	>5.0	>5.0	
Oxygen, Diss. in Spawning Areas - mg/l	>7.0			
pH - Units	6.6<pH<8.6	6.5<pH<8.3	6.0<pH<9.0	6.0<pH<9.
Polychlorinated Biphenyls - mg/l	0.000001			
Solids, Suspended - mg/l	<30			
Solids, Total Dissolved - mg/l				2500
Temperature - °F.	<65			

Pierre Creek Water Quality Study Area

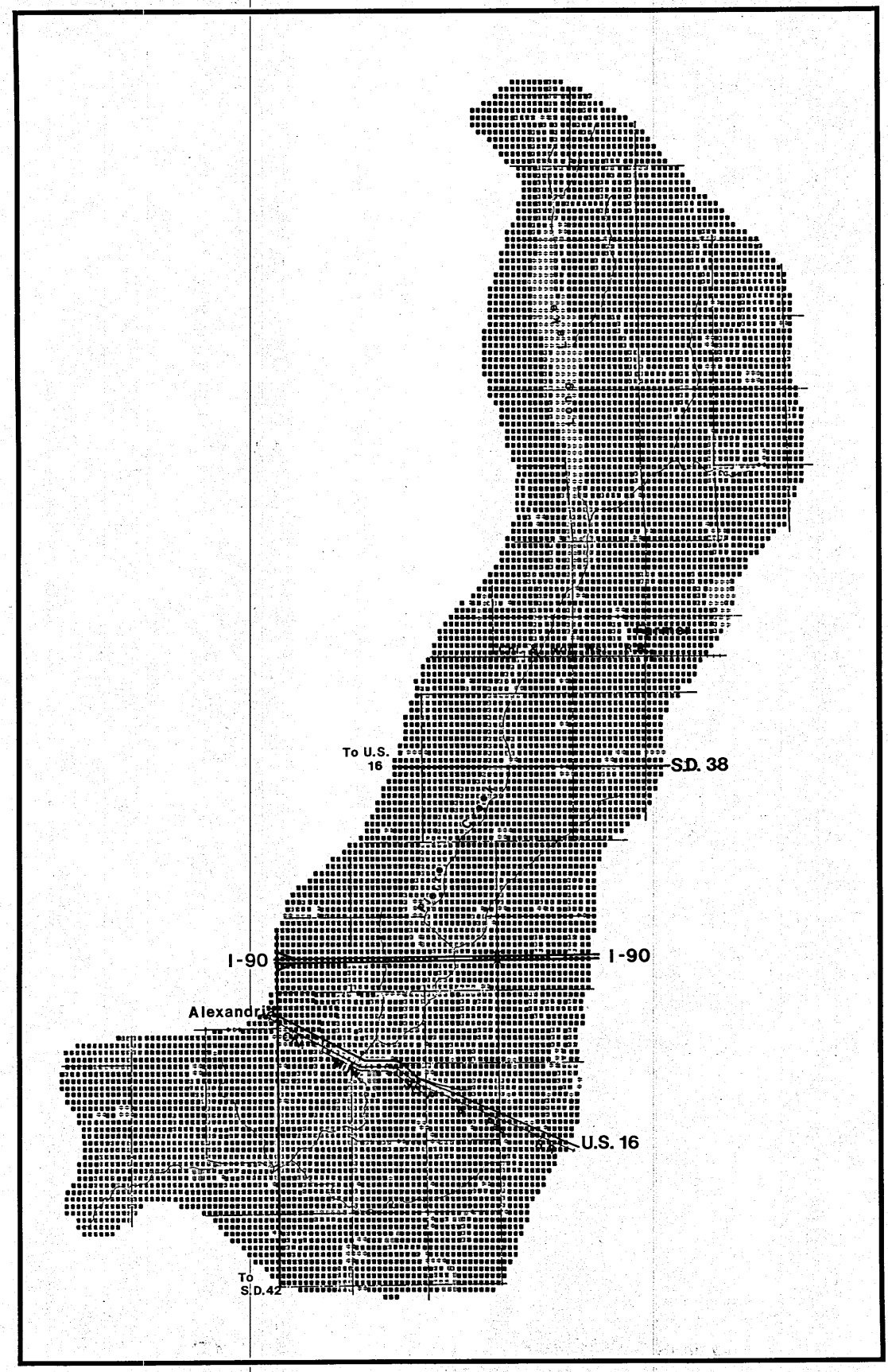


Figure 2.

Land Cover - July 1979

CATEGORY	ACRES	HECTARES	PERCENT	ACCURACY
URBAN + BUILT-UP	382	155	.9%	N O.*
CROPLAND	32,184	13,023	75.2%	99%
PASTURE	8240	3335	19.2%	78%
FARMSTEAD	861	349	2.0%	100%
WATER	162	66	.4%	N.O.*
WETLANDS	921	373	2.1%	87%
BARREN LANDS	94	38	.2%	100%
TOTALS	42,844	17,339	100.0%	94%

*No Observations

****

PIERRE CREEK WATER QUALITY STUDY AREA

PRODUCED BY
SOUTH DAKOTA STATE PLANNING BUREAU

IN 1975, THE SOUTH DAKOTA STATE PLANNING BUREAU INITIATED A COMPREHENSIVE REMOTE SENSING MAPPING PROGRAM THOUGHOUT THE STATE. THIS PIERRE CREEK WATER QUALITY STUDY AREA MAP WAS PART OF THAT PROGRAM, AND WAS PRODUCED THROUGH THE INTERPRETATION OF MEDIUM ALTITUDE BLACK AND WHITE PHOTOGRAPHY OF THE STUDY AREA. THE MAP HAS UNDERGONE A VERIFICATION PROCESS USING A 5% RANDOM SAMPLE, IN ORDER TO ASSESS THE ACCURACY OF THE REPRESENTED LAND COVER CATEGORIES.

SOIL EROSION CAN BE A MAJOR PROBLEM ON CULTIVATED LANDS, PARTICULARLY ON STEEP SLOPES AND DRAINAGE NETWORKS. CROP ROTATION, TILLAGE SYSTEMS, MANAGEMENT OF RESIDUES, AND OTHER CONSERVATION PRACTICES HAVE A SIGNIFICANT EFFECT IN REDUCING THE AMOUNT OF EROSION IN AREAS USED AS CROPLAND.

THE PREPARATION OF THIS MAP WAS FINANCED THROUGH A SECTION 208 WASTE TREATMENT MANAGEMENT GRANT FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY. FOR MORE INFORMATION CONTACT:

PLANNING INFORMATION SECTION
SOUTH DAKOTA STATE PLANNING BUREAU
CAPITOL BUILDING
PIERRE, SD 57501
605-773-3661

N

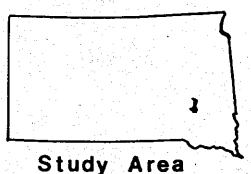
E

S

SCALE

4 3 2 1 0 1 2 3 4 Miles

4 3 2 1 0 1 2 3 4 Kilometers



Study Area Location

Figure 2. (continued)

pasture, and about 6% as farmstead and urban development. Much of the grassland in the watershed borders Pierre Creek and Lake Hanson.

Corn, oats, sorghum, soybeans, and alfalfa are the principal crops grown in the watershed. The cropland management presently in use consists of about 50% plow culture and 50% chisel or disc culture. The average rotation is 50% small grain, 20 percent row crop for grain, 20% row crop for silage, and 10 percent alfalfa. Beef cattle and hogs are the main livestock enterprise in the area.

The water quality study area has a population of 1,218, approximately half of which is concentrated in two towns within the watershed boundaries. Alexandria, the larger town and county seat, has a population of 598 (ca. 1970) and Farmer located 9 miles to the northeast has a population of 58.

Access to Lake Hanson is by a county asphalt road. Another asphalt road runs along the north side of the lake. Lakeside development on the north shore includes 30 cabins (28 summer homes and 2 permanent residences), a small campground, boat ramp, toilets, swimming area, change houses, and a well and concession stand. Most of the land adjacent to the south side of the lake is grassland and pasture.

D. Climate, Geology, and Major Soils

The climate of southeast South Dakota is continental with cold, dry winters and springs marked by appreciable rainfall and rapid weather changes. About 70% of the recorded yearly precipitation falls during the growing season (April-August). Highest precipitation normally occurs in June, averaging 3.67 inches over one ten-year period in the

Alexandria vicinity. Average minimum and maximum temperatures in the Alexandria vicinity are 62° and 91°F in July; 6° and 28°F in January. Mean annual temperature is 47°F. Average annual precipitation and lake evaporation amount to 22 inches and 37 inches, respectively.

The Pierre Creek/Lake Hanson watershed lies within the James Physiographic Province. This glacial plain is mostly nearly level to undulating and has many small potholes and sloughs (upper Pierre Creek watershed). The topography of southern Hanson County, which includes the lower Pierre Creek/Lake Hanson area, is undulating to rolling. The U.S. Soil Conservation Service (SCS) has assigned the following general soils classification for the watershed (Hanson County Soil Survey 1965).

1. Clarno-Ethan-Tetonka Association

   This association comprises a level to rolling glacial plain whose constituent loamy and silty soils were formed in glacial till and aluvium on the uplands. The soils are mostly nearly level to undulating, but steeper soils are on the sides of drainageways, around closed depressions and on the sides of some ridges and knolls. The drainage pattern is moderately well defined in some locations but is poorly defined in others. Most of upper Pierre Creek courses through a narrow strip of this soil association (Figure 1).

   About 35% of the area is comprised of Clarno soils, 15% of Ethan soils, and 15% of Tetonka soils. The rest are minor soils

including Betts, Crossplains, Harps, Hand, Prosper, Whitewood, Davison, Henkin, and Worthing.

Clarno soils are well drained and nearly level to gently rolling. They are on slight rises and were formed in glacial till. Ethan soils were also formed in glacial till, are well drained and mostly undulating to rolling. They generally occur in the higher parts of the landscape on ridges and knolls. Tetonka soils are poorly drained and level to nearly level. They formed in local alluvium and are in closed depressions in the low parts of some drainage ways.

Most areas of this association are cultivated. Corn, oats, sorghum, soybeans, and alfalfa are the main crops. Livestock is the main enterprise. Most crops in the area are grown for use by beef cattle and hogs. Control of erosion on Clarno and Ethan soils is the main concern of conservation management.

2. Clarno-Tetonka-Prosper Association

This association consists of a glacial plain with very gentle swells and swales. The low undulations are interspaced with poorly defined drainage ways and many closed depressions. The soils are nearly level to gently undulating.

Clarno soils comprise about 50% of this association, Tetonka soils 20% and Prosper soils 10%. Minor soils including Crossplain, Whitewood, Davison, Hand, Dudley, and Stickney together make up 20% of the area soils.

Prosper soils are moderately well drained and nearly level. They occur in shallow swales or concave low areas on flats. General characteristics of Clarno and Tetonka soils have been discussed in the previous association. Farming practices and management concerns are also similar to those in the previous discussion.

3. Ethan-Betts-Chaska Association

This association includes stream breaks and bottom land along the James River and its tributaries, including lower Pierre Creek (Figure 1). Slopes on the breaks are mostly hilly to steep and are dissected by many drainage ways that terminate in fans at the edge of the stream valley. The bottom land is nearly level.

Approximately 25% of this association is made up of Ethan soils, 20% Betts soils, and 20% Chaska soils. Minor soils make up the remaining 35% and include Bon, Clamo, James Lamo, Salmo, Wann, Clarno, Davis, Delmont, and Talmo.

Ethan soils are well drained and mostly rolling to steep in the middle part of the breaks. Betts soils are well drained to excessively drained. They are rolling to steep and are mostly in the higher part of the breaks. They are similar to Ethan soils but have a thinner surface layer. Chaska soils are nearly level, poorly drained soils found on bottom lands. They are subject to flooding and have a seasonal high water table.

The hazard of erosion is very severe on Ethan and Betts soils if plant cover is removed, due to rapid water runoff. Most areas of these soils remain in native grass or are used for pasture.

Chaska soils are cultivated mainly for corn, alfalfa, and sorghum. Livestock production is the main enterprise.

4. Hand-Clarno-Davison Association

This association consists of a glacial plain that is partly covered by glacial melt-water deposits. The short slopes are nearly level to gently rolling and are interspersed with swales, drainage ways, and closed depressions.

The association is made up of 45% Hand soils, 25% Clarno soils, 15% Davison soils, and 15% minor soils.

Hand and Davison soils are well drained to moderately well drained, nearly level to gently rolling, and formed in glacial melt-water deposits. Clarno soils formed in glacial till.

Runoff is slow to medium depending on the degree of slope. High lime content of Davison soils makes them susceptible to soil blowing. Other management concerns are controlling water erosion on gently rolling soils.

Most areas are cultivated. Crops and livestock practices are similar to those discussed for the Clarno-Ethan-Tetonka Association.

5. Prosper-Clarno-Stickney Association

This association consists of broad flats that are broken by swales, drainage ways, slight rises, and some depressions. The

soils are mostly level. The drainage pattern is poorly defined in some locations.

About 30% of soils in this association are Prosper; Clarno soils comprise 30%, and 10% are Stickney. Minor soils make up the remaining 30%. These include Crossplain, Whitewood, Davison, Hand, Dudley, and Tetonka.

Prosper and Clarno soils are moderately drained and well drained, respectively, and nearly level to undulating. Prosper soils occur in shallow swales and concave parts of broad flats. Clarno soils are on slight rises. Stickney soils are moderately well drained, nearly level, and occur on very slight rises.

Runoff is slow in much of this association. Farming in the lower parts is delayed in some years because of wetness in spring but in most years discharge is adequate. Improving the water intake of Stickney soils and controlling erosion on the steeper rises of Clarno soils are major management concerns. Farm crops and practices are identical to those discussed under the Clarno-Ethan-Tetonka Association.

II. Pierre Creek/Lake Hanson Water Quality Study Area Selection

Nominations for designation as a Water Quality Study Area (WQSA) within the Third Planning and Development District were solicited from the Third Planning and Development District Commission. During January and February 1979, the staff of the Third District and the Local RC&D areas selected several potential water quality study areas. After review by the Third District Planning and Development Commission, two study areas were given

final consideration: Corsica Lake (Douglas County) and Pierre Creek/Lake Hanson (Hanson County).

The criteria established for ranking purposes were the State Lakes Preservation Committee criteria, the South Dakota Lake Significance Ranking criteria, the availability of soils data and baseline information for the watershed. After reviewing each nominated watershed, the Pierre Creek/Lake Hanson watershed, according to the criteria ranking, received designation as the WQSA. Public interest, as well as implementation potential gave strong support to Pierre Creek/Lake Hanson's designation. Appendix B contains the Third Planning and Development District's report on the Pierre Creek/Lake Hanson WQSA.

III. Soil Erosion and Sediment Yield Summary

The U.S. Soil Conservation Service (SCS) conducted a soil erosion and sediment yield study of the Pierre Creek/Lake Hanson watershed. The study detailed the type, extent, and location of erosion and sedimentation problems, including the significance of the contribution from cropland, grassland, stream banks, gullies, and other sources. Detailed results of this study are presented in Appendix C.

SCS estimated total watershed soil erosion to be 88,719 tons per year with total sediment deposited in Lake Hanson at 1,464 tons or 1.12 acre-feet per year. Cropland and grassland erosion is 88,145 tons per year of which 890 tons per year is deposited as sediment in Lake Hanson. All of the lake shore erosion ends up as sediment in Lake Hanson and is estimated to be 574 tons per year (Table 3).

Table 3.

SOIL EROSION AND SEDIMENT YIELD
PIERRE CREEK - LAKE HANSON WATERSHED AREA

WQSA or Subwatershed		Cropland	Grassland	Sub Total	Channels	Lake shore	Construction 1/	Sub Total	Total	Acre Feet Per Yr. 2/	Percent 3/
Subwatershed "A"	Erosion Tons/Yr.	14,825	145	14,970					14,970		
	Sed. Yield 4/ Tons/Yr.										
Subwatershed "B"	Erosion Tons/Yr.	25,866	955	26,821					26,821		
	Sed. Yield 4/ Tons/Yr.										
Subwatershed "C"	Erosion Tons/Yr.	37,220	2,760	39,980					39,980		
	Sed. Yield 4/ Tons/Yr.	829	61	890					890	.68	0.16
Subwatershed "D"	Erosion Tons/Yr.	5,660	714	6,374		574		574	7,523		
	Sed. Yield 4/ Tons/Yr.					574		574	574	.44	0.11
Total	Erosion Tons/Yr.	83,571	4,574	88,145		574		574	88,720		
	Sed. Yield 4/ Tons/Yr.					574		574	1,464	1.12	0.27

1/ Not estimated, but has high potential. Planned developments should include a sediment control plan for before, during, and after construction.

2/ Tons converted to acre feet. Sediment in lake volume computed at 60 pounds per cubic foot due to submerged sediment.

3/ Annual sediment yield expressed as a percent of total lake volume. Lake volume of Lake Hanson is 417 acre feet.

4/ Sediment deposited in Lake Hanson.

SCS selected Best Management Practices (BMP's) to reduce sediment yield and estimated required coverage and probable costs to adequately treat the Pierre Creek/Lake Hanson watershed. Total cost for application of BMP's was at $363,909.00 or $9.49 per acre. Examples of needed conservation practices are conservation tillage and cropping systems, grassed waterways, proper grazing use of pasture, waste management systems, sediment control structures, etc. A detailed breakdown of conservation practices and costs is presented in Table 4.

IV. Water Quality Status Report for Pierre Creek/Lake Hanson

Lake Hanson is located in Hanson County, South Dakota, at a latitude of 43 Deg. 37 Min. 24 Sec. N. and a longitude of 97 Deg. 47 Min. 54 Sec. W. In Township 102N, Range 58W, Section 21. The morphometry of the lake is characterized below:

Area	54.9 A (22.2 ha)
Shoreline length	11,616 ft. (3,540 m)
Maximum depth	16.5 ft. (5.0 m)
Mean depth	7.6 ft. (2.3 m)
Volume	418.5 acre-feet ($5.163 \times 10^5 m^3$)
Watershed/lake surface area ratio	728
Origin of lake basin	Impoundment
Thermal stratification	Yes

Table 4.

BEST MANAGEMENT PRACTICES (Conservation Practices and Measures) 1/ 2/ 3/
PIERRE CREEK - LAKE HANSON WATERSHED AREA

Conservation Practices	Unit	Unit Cost 4/	Subwatershed "A"		Subwatershed "B"		Subwatershed "C"		Subwatershed "D"		Total Watershed	
			Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost
		(Dollars)		(Dollars)		(Dollars)		(Dollars)		(Dollars)		(Dollars)
Cropland-30,420 Acres												
Conservation Cropping System	acre	-	8,702	-	10,896	-	9,676	-	1,146	-	30,420	-
Conservation Tillage System	acre	5	6,962	34,810	8,717	43,585	7,741	38,705	917	4,585	24,337	121,685
Grass & Legumes in Rotation	acre	18	1,430	25,740	1,792	32,256	1,590	28,620	188	3,384	5,000	90,000
Grass Waterways	acre	500	-	-	2	1,000	11	5,500	2	1,000	15	7,500
Waste Utilization	acre	3	100	300	200	600	200	600	-	-	500	1,500
Minimize Fall Tillage	acre	-	2,611	-	4,358	-	4,838	-	688	-	12,495	-
Pasture & Hayland Planting	acre	20	10	200	40	800	300	6,000	50	1,000	400	8,000
Minimize Pesticide Use	acre	-	286	-	358	-	318	-	38	-	1,000	-
Windstrip Cropping	acre	6	209	1,254	349	2,094	387	2,322	55	330	1,000	6,000
Terraces	mile	2,112	-	-	-	-	1.5	3,168	.5	1,056	2	4,224
Grassland -4,592 Acres												
Proper Grazing Use	acre	-	1,063	-	1,401	-	995	-	214	-	3,673	-
Pasture and Hayland Planting	acre	20	290	5,800	381	7,620	271	5,420	58	1,160	1,000	20,000
Deferred Grazing	acre	-	347	-	458	-	325	-	70	-	1,200	-
Planned Grazing Systems	acre	-	868	-	1,144	-	813	-	175	-	3,000	-
Livestock Water Stations	acre	1,000	3	3,000	5	5,000	3	3,000	1	1,000	12	12,000
Critical Area Planting	acre	1,000	2	2,000	-	-	6	6,000	2	2,000	10	10,000
Pasture & Hayland Management	acre	-	290	-	381	-	271	-	58	-	1,000	-
Waste Management Systems	acre	20,000	-	-	1	20,000	2	40,000	-	-	3	60,000
Wildlife Upland Habitat Mgmt.	acre	5	12	60	14	70	12	60	2	10	40	200
Wildlife Wetland Habitat Mtnce.	acre	4	300	1,200	300	1,200	100	400	-	-	700	2,800
Farmsteads, Urban & Other, 3,349 acres												
Sediment Control Measures 5/	acre	2,000	-	-	-	-	8	16,000	2	4,000	10	20,000
TOTALS -- Total acres - 38,361 acres			-	-	74,364	-	114,225	-	155,795	-	19,525	-	363,909 or 9.49 per acre

1/ Needed to get (Land Adequately Treated).
2/ Refer to Soil Conservation Service Technical Guide for South Dakota 1981.
3/ On site investigation and planning are necessary to determine kinds, locations, sizes, extent & costs of practices (BMP's).
4/ Refer to Soil Conservation Service Cost-Return Handbook for South Dakota 1981.
5/ Examples of measures are: cover and green manure crop, filter strips, lined and grassed waterways, diversions, mulching, sediment basins, streambank protection, and critical area planting.

Pierre Creek is the major inflow into the lake and is also the outflow. The State of South Dakota has assigned the following beneficial uses to Lake Hanson:

- Warmwater semipermanent fish life propagation;
- Immersion recreation;
- Limited contact recreation; and
- Wildlife propagation and stock watering.

Figures 3 and 4 and Appendix Table IV-1 describe the location of the sampling sites. Site HA-5 was selected because it was located in the upper reach of the Pierre Creek watershed. Sampling Sites HA-6 and HA-10 were selected because they were above the City of Alexandria's Wastewater Treatment Plant (WWTP). The sites above the WWTP will be compared to Sites HA-1 and HA-1A, which are below the WWTP, in order to determine if the plant affects the waters downstream. Site HA-2 was located below a "slough" in order to determine if potential impacts from the WWTP were mitigated. Sampling Sites HA-3 and HA-4 were located on Lake Hanson's inlet and outlet, respectively. Although sampling Site HA-3 was selected as an inlet site, apparently the lake covers this site at times of high surface water levels so that it is essentially an in-lake site. However, the concentrations of various water quality parameters observed at this site will be considered to reflect input conditions. Sites selected to represent in-lake sites were HA-7 and HA-8. Site HA-9 was selected because it was below areas of severe soil erosion. This site will be compared to outlet Site HA-4 in order to determine if the area of severe erosion is impacting Pierre Creek.

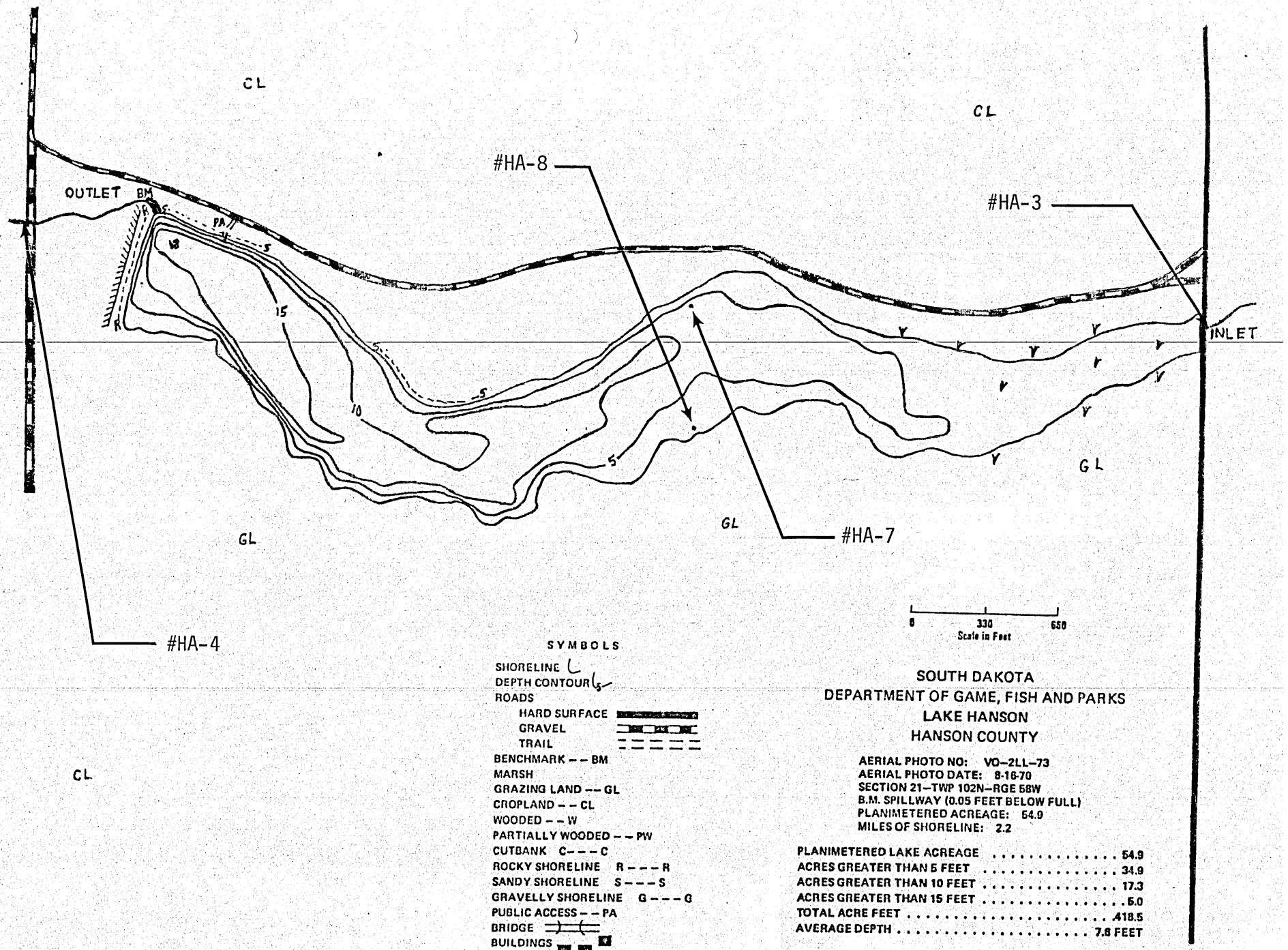


Figure 3. Lake Hanson sample sites

SYMBOLS

SHORELINE
DEPTH CONTOUR
ROADS
HARD SURFACE
GRAVEL
TRAIL
BENCHMARK – – BM
MARSH
GRAZING LAND – – GL
CROPLAND – – CL
WOODED – – W
PARTIALLY WOODED – – PW
CUTBANK C– – – C
ROCKY SHORELINE R– – – R
SANDY SHORELINE S– – – S
GRAVELLY SHORELINE G– – – G
PUBLIC ACCESS – – PA
BRIDGE
BUILDINGS

SOUTH DAKOTA
DEPARTMENT OF GAME, FISH AND PARKS
LAKE HANSON
HANSON COUNTY

AERIAL PHOTO NO: VO–2LL–73
AERIAL PHOTO DATE: 8-16-70
SECTION 21–TWP 102N–RGE 58W
B.M. SPILLWAY (0.05 FEET BELOW FULL)
PLANIMETERED ACREAGE: 54.9
MILES OF SHORELINE: 2.2

PLANIMETERED LAKE ACREAGE	54.9
ACRES GREATER THAN 5 FEET	34.9
ACRES GREATER THAN 10 FEET	17.3
ACRES GREATER THAN 15 FEET	6.0
TOTAL ACRE FEET	418.5
AVERAGE DEPTH	7.6 FEET

Site 46HA03 (HA-3)

Latitude 43 Deg., 37 Min., 27 Sec., Longitude 97 Deg., 47 Min., 12 Sec., Township 102N, Range 58W, Section 22, NW1/4, SW1/4, SW1/4, NW1/4. This site is the Pierre Creek inlet to Lake Hanson east of bridge and was sampled from 3/31/79 through 9/3/79. On 4/27/81, this site was relabeled HA-7 but as of 1/1/83, the State's designation was return to its original number.

Site 46HA04 (HA-4)

Latitude 43 Deg., 37 Min., 33 Sec., Longitude 97 Deg., 48 Min., 24 Sec., Township 102N, Range 58W, Section 20, NE1/4, NE1/4, SE1/4, NE1/4. This is the outlet site on Pierre Creek from Lake Hanson west of road. The site was sampled from 3/31/79 through 10/28/79. On 4/27/81 the site was relabeled as HA-9 and sampled from that date through the projects completion. As of 1/1/83, Site HA-9 was changed back to its original station number of HA-4.

Site 46HA07 (HA-07)

Latitude 43 Deg., 37 Min., 30 Sec., Longitude 97 Deg., 47 Min., 41 Sec., Township 102N, Range 58W, Section 21, SE1/4, NW1/4, SW1/4, NE1/4. This site was in-lake at the north shore and was sampled as Site HA-7 from 6/12/79 through 10/28/79. On 4/27/81, the site was renamed HA-8. As of 1/1/83, Site HA-8 was changed back to its original designation of HA-7.

Site 46HA08 (HA-08)

Latitude 43 Deg., 37 Min., 25 Sec., Longitude 97 Deg., 47 Min., 41 Sec., Township 102N, Range 58W, Section 21, SE1/4, SW1/4, SW1/4, NE1/4. This is an in-lake site at the south shore and was sampled from 6/12/79 through 10/28/79 when the site was inactivated.

Figure 3 (cont.). Lake Hanson sample sites.

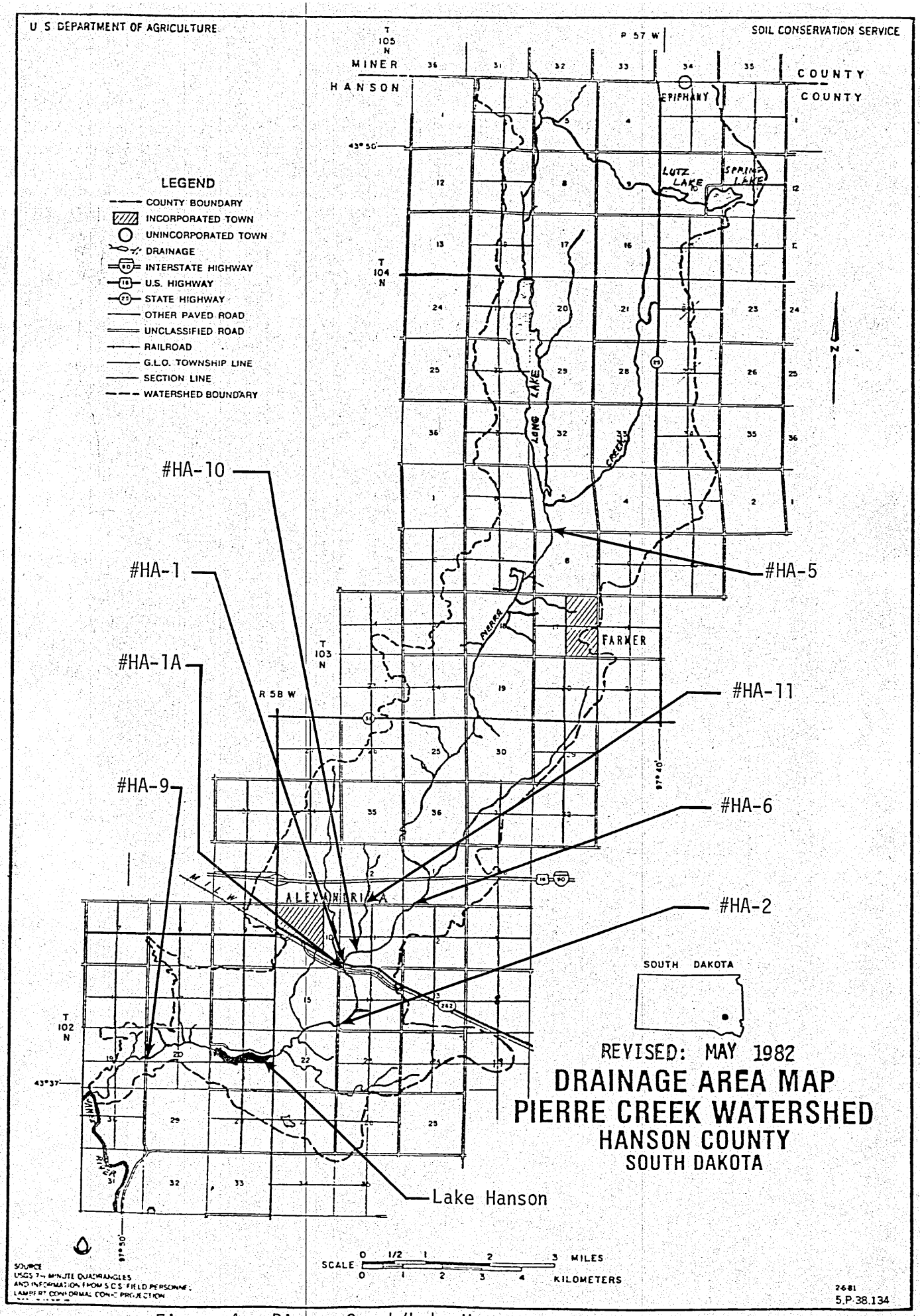


Figure 4. Pierre Creek/Lake Hanson watershed sample sites

Site 46HA01 (HA-1)	Latitude 43 Deg., 38 Min., 45 Sec., Longitude 97 Deg., 45 Min., 53 Sec., Township 102, Range 58, Section 11, NE1/4, SW1/4, SW1/4, SW1/4. This site is on Pierre Creek north of Highway 252 (old Highway 16) below the WWTP and was sampled from 3/20/79 through 10/3/79. The site was relabeled as Site HA-6A and was sampled from 2/19/82 to the end of the project. As of 1/1/83, Site HA-6A was changed back to its original station number of HA-1.
Site 46HA1A (HA-1A)	Latitude 43 Deg., 38 Min., 42 Sec., Longitude 97 Deg., 45 Min., 54 Sec., Township 102N, Range 58W, Section 11, SE1/4, SW1/4, SW1/4, SW1/4. This site was on Pierre Creek south of railroad tracks below the WWTP. Originally, this site was labeled as HA-6 and sampled from 11/30/81 through 5/20/82. As of 5/20/82, Site HA-6 was labeled as Site HA-1A and inactivated.
Site 46HA02 (HA-2)	Latitude 43 Deg., 35 Min., 53 Sec., Longitude 97 Deg., 45 Min., 59 Sec., Township 102N, Range 58W, Section 14, NW1/4, SW1/4, SW1/4, SW1/4. This site was sampled from 3/20/79 through 10/3/79 when it was inactivated. The general site description is Pierre Creek one mile south of WWTP east of bridge.
Site 46HA05 (HA-5)	Latitude 43 Deg., 44 Min., 45 Sec., Longitude 97 Deg., 42 Min., 03 Sec., Township 103N, Range 57W, Section 5, SW1/4, SW1/4, SE1/4, SW1/4. This site was on Pierre Creek below Long Lake north of the road and was sampled from 3/30/79 through 5/3/79 when the site was inactivated.
Site 46HA06 (HA-6)	Latitude 43 Deg., 39 Min., 33 Sec., Longitude 97 Deg., 44 Min., 37 Sec., Township 102N, Range 58W, Section 1, SW1/4, SE1/4, SW1/4, SW1/4. Located on Pierre Creek the site was 1.4 miles east of Alexandria above WWTP north of road. The site was sampled from 3/31/79 through 10/3/79 as Site HA-6. On 2/19/82, it was relabeled as Site HA-4 and was sampled until the projects completion. As of 1/1/83, Site HA-4 was changed backed to its original designation of HA-6.
Site 46HA09 (HA-9)	Latitude 43 Deg., 37 Min., 23 Sec., Longitude 97 Deg., 49 Min., 36 Sec., Township 102N, Range 58W, Section 20, NW1/4, NW1/4, NW1/4, SW1/4. This site was located on Pierre Creek above the confluence with the James River east of road and was sampled from 7/23/79 through 10/28/79 when it was inactivated.

Figure 4 (cont.). Pierre Creek watershed sample sites.

Site 46HA10 (HA-10)	Latitude 43 Deg., 38 Min., 56 Sec., Longitude 97 Deg., 45 Min., 39 Sec., Township 102N, Range 58W, Section 11, SW1/4, SW1/4, NE1/4, SW1/4. The location of this site was on Pierre Creek above WWTP at the confluence with a tributary. Originally, this site was labeled HA-5 and was sampled from 4/27/81 to the end of the project. As of 1/1/83, Site HA-5 was relabeled HA-10.
Site 46HA11 (HA-11)	Latitude 43 Deg., 39 Min., 33 Sec., Longitude 97 Deg., 45 Sec., 31.5 Sec., Township 102N, Range 58W, Section 2, SW1/4, SE1/4, SE1/4, SW1/4. Although this site was established on a Pierre Creek tributary 1/3 mile south of I-90 above a county road, it has not been sampled since created.

Figure 4 (cont). Pierre Creek watershed sample sites

In-Lake Water Quality

In this section, the water quality of Sites HA-3, HA-4, HA-7, and HA-8 (Figure 3) will be discussed. Appendix Tables IV-2 through IV-5 are annual summaries of the water quality data and Appendix Figures IV-1 through IV-61 illustrate the data for selected water quality parameters. Appendix tables and figures referred to in this chapter are contained in Appendix D.

Dissolved Oxygen (DO)

Hanson Lake has been classified by the State of South Dakota as a warmwater semipermanent fishery. Therefore, DO concentrations shall not decrease below 5.0 mg/l.

The mean DO concentration in 1979 at Site HA-3 was 9.28 mg/l and at the outlet site (HA-4) it was 10.10 mg/l. No values less than 5.0 mg/l were observed at these two sites. DO samples were not collected at HA-3 and HA-4 in 1981, 1982, or 1983. The mean DO concentrations observed at in-lake Site HA-7 were 9.67 mg/l in 1979, 8.47 mg/l in 1981, 10.14 mg/l in 1982, and 9.99 mg/l in 1983. At in-lake Site HA-8, which was only collected in 1979, the mean DO concentration was 8.82 mg/l. Again, DO concentrations less than 5.0 mg/l were not observed. Therefore, DO in Lake Hanson is adequate to support its assigned beneficial uses.

Figures IV-1 through IV-4 demonstrate the DO concentrations observed at the sampling sites. Only Figure IV-3 (Site 46HA07) had enough data points to observe over a long term period. In general, DO concentrations decrease during the summer and increased in late fall and winter.

Biochemical Oxygen Demand (BOD)

The mean BOD concentrations at Site HA-3 in 1979 was 5.51 mg/l and the range of concentrations was 1.89 mg/l to 7.83 mg/l. In 1982, only one sample was collected at Site HA-3 and its concentration was 23.0 mg/l. The reason for this high BOD is not known.

The mean BOD concentration at the outlet (HA-4) was 6.56 mg/l in 1979 and the values ranged from 1.89 to 9.3 mg/l. In-lake mean BOD concentrations were 5.27 mg/l in 1979 at Site HA-7 and 5.25 mg/l (1 sample) at Site HA-8. With the exception of the single sample at Site HA-3, BOD levels were relatively low during the period they were sampled.

pH

The water quality standard for pH, assigned to Lake Hanson, is "pH shall be greater than 6.3 units and less than 9.0 units." Over the sampling period, pH values ranged from 5.6 to 8.3 at Site HA-3. Therefore, unacceptable pH values occurred at this site on 11 November 1981 and on 19 February 1982. At Site HA-4, pH values ranged from 5.2 to 8.4 units over the study period. Unacceptable levels were observed on 29 August 1981, 28 October 1981, 20 January 1982, and 18 February 1982. Only two unacceptable levels were observed in-lake. One of these values was 2.5, recorded at Site HA-7. This value is extremely low and is assumed to be the result of sampler/instrumentation error. Overall, the majority of the pH values were within the limits of the water quality standards.

Figures IV-5 through IV-8 illustrate the pH data. In general, pH values were lower in the winter and increased in the spring to relatively stable values in the summer.

Alkalinity (Total)

Alkalinity can be defined as the sum total of components in the water that tend to elevate the pH of the water above a value of about 4.5 (EPA, 1976). In other words, it is a measure of the buffering capacity of the water. The total alkalinity values at the sampling sites ranged from 184 to 379 mg $CaCO_3$/l and the mean values per year were well over 200 mg/l. These concentrations indicate that Lake Hanson is a well buffered lake.

Solids (Total, Dissolved, and Suspended)

The water quality standard for suspended solids is "suspended solids shall not exceed 90 mg/l" in a water assigned the beneficial use of a warmwater semipermanent fishery and the standard for dissolved solids is "dissolved solids shall not exceed 2,500 mg/l" in a water assigned the beneficial use of wildlife propagation and stock watering. There is not a water quality standard for total solids.

Dissolved solids (residue, dissolved) is a term associated with freshwater systems and consists of inorganic salts, small amounts of organic matter and dissolved materials (EPA, 1976). The principal anions dissolved in water include the carbonates, chlorides, sulfates and nitrates and the principal cations are sodium, potassium, calcium, and magnesium. The suspended solids are those particles suspended in the water column which will not pass through a glass fiber filter (EPA, 1979). Suspended solids can have a detrimental effect on a lake's fishery. In 1965, the European Inland Fisheries Advisory Committee identified four means by which suspended solids can adversely affect fish and fish food populations (EPA, 1976). Fish swimming in waters with high suspended solids can be killed

directly, their growth rate reduced, or their resistance to disease reduced. In addition, suspended solids can prevent the successful development of fish eggs and larvae, modify natural movements and migrations of fish, and reduce the abundance of food available to fish.

Total solids at the four sites ranged from 429 mg/l to 4,317 mg/l and total dissolved solids ranged from 428 mg/l to 4,309 mg/l. There were three violations of total dissolved solids over the period of study at Site HA-3 and no violations at Sites HA-4, HA-7 and HA-8. Although only three excessive levels of total dissolved solids were observed, the source(s) should be identified for mitigation purposes. The mean concentrations at the four sites ranged from 1,784.34 to 2,198.73 mg/l indicating concentrations are approaching the 2,500 mg/l limit for total dissolved solids further supporting the need to identify the source(s).

Total suspended solids ranged from 1 mg/l to 415 mg/l. Fifteen samples were observed to have excessive levels at Site HA-3 and one sample was observed to be excessive at Site HA-7. Figures IV-9 through IV-11 illustrate the suspended solids data. At Site HA-3, the suspended solids concentrations were high in May of 1981, and in March, April, May and December in 1982. It is assumed that the high concentrations observed in March through May reflected runoff conditions. No obvious trends were at the other sites. In 1981 and 1982, the mean concentrations for suspended solids at Site HA-3 were 72.8 mg/l and 67.8 mg/l. These mean values are relatively high and indicate a potential problem to the lake. Sources resulting in these high levels need to be identified and corrected.

Phosphorus

Over the course of the study, four fractions of phosphorus were measured: total phosphorus, total orthophosphate, dissolved orthophosphate and dissolved organic phosphorus. Total phosphorus was determined by digesting the sample and then analyzing it colorimetrically. In the tables, total phosphorus is called total phosphate. Total orthophosphate was determined by direct colorimetry. This parameter measures dissolved orthophosphate, colloidal phosphate and organic phosphate. Up to 1983, total orthophosphate also consisted of some hydrolyzable phosphate because the water to be analyzed was taken from a sample preserved with 2 ml of sulfuric acid. Dissolved orthophosphate was determined by filtering a sample through a .45 micron filter and determining the phosphate concentration by direct colorimetry. Dissolved orthophosphate is that fraction assumed to be readily available for algal uptake. Because dissolved orthophosphate samples were taken from preserved samples, part of the concentration is probably hydrolyzable phosphorus. The last fraction measured was dissolved organic phosphorus. This fraction was determined by filtering through a .45 micron filter, digesting the sample, and then analyzing colorimetrically. Again, because the samples were taken from a preserved bottle, the hydrolyzable phosphorus fraction was also measured. The majority of the data consists of total phosphorus and total orthophosphate and therefore the discussion will concern only these two parameters.

In-lake mean concentrations at Site HA-7 for total phosphate were .085 mg/l in 1979, .046 mg/l in 1981, .068 mg/l in 1982, and .126 mg/l in 1983. At in-lake Site HA-8, the mean concentration of total phosphate was .101 mg/l

in 1979. These mean in-lake concentrations indicate that Lake Hanson is a hypereutrophic lake except in 1981 at Site HA-7 when it would have been classified as eutrophic. Figures IV-13 through IV-16 show the data graphically. The mean total phosphate concentration at Site HA-3 was .122 mg/l in 1979, .119 mg/l in 1981, .208 mg/l in 1982, and .167 mg/l in 1983. There is a trend at this site for total phosphorus concentrations to be highest in the spring and summer and to decrease in the winter. The increase in total phosphorus concentrations in 1983 is probably due to the high runoff that occurred that year resulting in flooding in southeastern South Dakota. The outlet (HA-4) samples had mean total phosphate concentrations of .100 mg/l in 1979, .058 mg/l in 1981, .069 mg/l in 1982, and .116 mg/l in 1983.

A lake with a phosphorus concentration exceeding .05 mg/l is characterized as hypereutrophic (Reckhow, et.al., 1980). Such a lake is characterized as a typical "old aged" lake in advanced succession, with some fisheries, high levels of sedimentation, and algae or macrophytes diminishing the open water surface area. Based on past analyses of eastern South Dakota lakes, Lake Hanson, although hypereutrophic, does not have concentrations of total phosphate as high as those observed in other lakes. Therefore, this lake should be considered as a potential candidate for restoration work since it does not display the degree of eutrophy observed elsewhere and would possibly respond to restoration work.

The "normal" range of dissolved orthophosphate, that fraction of phosphorus considered to be biologically available, is between .005 mg/l and .020 mg/l and a level of 0.1 mg/l is seldom exceeded even in a highly eutrophic lake (Boyd, 1969). Based on two data points observed at Site HA-7 in 1981, the

dissolved orthophosphate concentrations were at the .01 mg/l level indicating a highly eutrophic system.

Total orthophosphate mean concentrations ranged from .018 mg/l at Site HA-7 in 1981 to .059 mg/l in 1984. This fraction consists of dissolved orthophosphate in addition to colloidal phosphate and organic phosphate. Therefore, there is a potential for dissolved orthophosphate concentrations to exceed the .01 mg/l level.

Fecal Coliforms

Hanson Lake has been assigned the beneficial uses of immersion recreation. Therefore, fecal coliform levels are limited to 200 per 100 ml as a geometric mean based on a minimum of not less than five samples obtained during separate 24-hour periods for any 30-day period, nor shall they exceed this value in more than 20 percent of the samples examined in the above described 30-day period, nor shall they exceed 400 per 100 ml in any one sample from May 1 to September 30. At in-lake Site HA-7, two violations of the 400 per 100 ml level were observed (Table IV-8). One in August, 1979 (530 per 100 ml) and one in June, 1983 (1,200 per 100 ml). Excessive levels (greater than 200 per 100 ml) were observed seven times over the study period. In-lake Site HA-8 was observed to have five samples greater than 200 per 100 ml and four of the five samples violated the 400 per 100 ml limit in 1979 (Table IV-9). Therefore, there are periods when fecal coliform levels in-lake are high enough to cause concern about potential public health problems. Over the period of study, fecal coliform counts ranged from 3 per 100 ml to 20,000 per 100 ml. Figures IV-17 and IV-20 illustrate the in-lake data.

At Site HA-3, fecal coliforms ranged from 3 to 120,000 per 100 ml and the outlet (Site HA-4) ranged from 3 to 160,000 per 100 ml. If Site HA-3 is considered to reflect input conditions, then the same water quality standard for fecal coliforms that is applicable to the outlet site is applicable to Site HA-3. The water quality standard that affects that site is based on the assigned beneficial use of limited contact recreation. The standard is "Fecal coliforms shall not exceed a concentration of 1,000 per 100 ml as a geometric mean based on a minimum of not less than five samples during separate 24-hour periods for any 30-day period, nor shall they exceed this value in more than 20 percent of the samples examined in the above described 30-day period, nor shall they exceed 2,000 per 100 ml in any one sample from May 1 to September 30. At Site HA-3, the 2,000 per 100 ml limitation was violated three times in 1979, twice in 1981, six times in 1983, and twice in 1982. Levels of fecal coliform were greater than 200 per 100 ml in 51% of the samples over the study period. (NOTE: The violations reported in Tables IV-6 and IV-7 are based on 200 fecal coliforms/100 ml). The high levels of fecal coliforms need to be identified as to the source, whether due to runoff from pasture land, the City of Alexandria's wastewater treatment plant, or feedlots and mitigation actions taken.

Nitrogen

Analyses were conducted for four fractions of nitrogen; total Kjeldahl nitrogen, ammonia, nitrite, and nitrate. In addition, inorganic and organic nitrogen determinations were made by either summing ammonia, nitrate, and nitrite values (inorganic nitrogen) or by subtracting ammonia concentrations from total Kjeldahl nitrogen (organic nitrogen).

Total Kjeldahl nitrogen data is illustrated for Sites HA-3, HA-4, HA-7, and HA-8 in Figures IV-21 through IV-24. At Site HA-3, mean total Kjeldahl concentrations ranged from .540 mg/l in 1983 to .876 mg/l in 1979. Mean concentrations at Site HA-4, the outlet, ranged from .774 mg/l in 1983 to 1.252 mg/l in 1982. In-lake mean concentrations (Sites HA-7 and HA-8) ranged from .631 mg/l in 1982 to 1.350 mg/l in 1979.

Mean concentrations for ammonia as nitrogen ranged from .103 mg/l in 1979 to .205 mg/l in 1982 at Site HA-3, from .101 mg/l in 1983 to .333 mg/l in 1982 at Site HA-4, and from .052 mg/l in 1979 at Site HA-8 to .177 mg/l in 1982 at Site HA-7. Figures IV-25 through IV-28 illustrate the data. It appears in Figure IV-25 that the Site HA-3 had higher concentrations during late winter and early fall than later in the year. The same pattern appears to occur at the outlet Site HA-4. At the in-lake site (HA-7), there appears to be a peak of ammonia in late winter and early fall as was noted at Sites HA-3 and HA-4. However, there also appears to be a secondary peak which occurs during the summer as in 1982 and 1983 or in the late fall as in 1979 and 1981 (Figure IV-27).

The State of South Dakota has not established a standard for total ammonia but has a limit of 0.04 mg/l for the un-ionized fraction of ammonia. This limit was not exceeded during the period of study (Tables IV-6 through IV-9).

Nitrate as nitrogen concentrations range from 0 to 10 mg/l in unpolluted freshwater (Wetzel, 1975) and it is a nutrient source readily assimilated by the phytoplankton. Mean nitrate concentrations ranged from .100 to .300 mg/l at the in-lake sites, from .200 mg/l to .313 mg/l at Site HA-3, and from .300 mg/l to .900 mg/l at Site HA-4. All values were at the lower

end of the range expected in unpolluted natural waters. In Figures IV-29 through IV-32, it appears that, in general, the nitrate concentrations increased in late winter and early spring and then decreased over the summer. Also, sometimes in the late fall they appeared to increase again.

Nitrite concentrations are generally low in natural waters (0 to .01 mg/l; Wetzel, 1975). In general, nitrite values were less than .01 mg/l at all sites (Tables IV-2 through IV-5; Figures IV-33 through IV-36) indicating that nitrites were comparable to those found in natural unpolluted waters.

The mean concentrations of inorganic nitrogen are presented in Tables IV-10 through IV-14 and the data is illustrated in Figures IV-37 through IV-48. Based on Table 11-4 in Wetzel (1975), the trophic state of Lake Hanson ranged from ultra-oligotrophic to oligo-mesotrophic. This means that the inorganic nitrogen concentrations were relatively low in-lake and would indicate that the lake has low productivity within the biota. However, the trophic state based on total phosphorus concentrations indicates that Lake Hanson would have high productivity. This situation will be discussed later in this section.

Based on Figures IV-37 through IV-48, it appears that the general trend is for inorganic nitrogen concentrations to increase in late fall or winter and decrease over spring runoff to a summer low.

Figure IV-49 through IV-61 illustrate the organic nitrogen data and Tables IV-10 through IV-14 present the mean concentrations per year observed during the study. Based on Table 11-4 (Wetzel, 1975), Lake Hanson would be classified as a eutrophic lake (i.e., a lake reflecting high productivity). Therefore, the organic nitrogen fraction dominates the

nitrogen cycle within the lake. However, the availability of the organic nitrogen for assimulation by the phytoplankton and aquatic macrophytes is not known. Based on the figures, there are indications that organic nitrogen may follow a similar trend as inorganic nitrogen but it is not as distinct.

Limiting Nutrient

A methodology used by the Environmental Protection Agency (EPA) (1980) to determine whether phosphorus or nitrogen will tend to be limiting in a lake system is to calculate the ratio between total nitrogen and total phosphorus. If this ratio is about 15:1, then these two nutrients are considered to be optimum for maintenance of a diverse population of algae. If the ratio is greater than 15:1, the system is considered to be phosphorus limited and if it is less than 15:1, the system is considered to be nitrogen limited. The further the ratio is from 15:1, the more comfortable the analyst is with his conclusion.

Sites HA-3, HA-7, and HA-8 all had ratios indicating that Lake Hanson tended toward nitrogen limitation. The annual mean ratio for Site HA-8 in 1979 was 1.52 (standard deviation=2.50). For Site HA-7, the annual mean ratios were .980 (one data point in 1979), 5.88 (standard deviation=2.77) in 1982, and 1.38 (standard deviation=1) in 1983. At Site HA-3, which can act as either an in-lake or an input site, the annual mean ratios were 2.0263 (standard deviation=2.0263) in 1979, 2.15 (standard deviation=1.49), 2.0487 (standard deviation=2.0279), and 1.936 (standard deviation=1.3084).

Trophic State Index

Carlson (1977) developed a methodology to calculate trophic state indices based on total phosphorus, Secchi disc, and chlorophyll *a*. For every 10 unit increase (e.g., 0 to 10), the biomass of the algae doubles. At Site HA-7, the trophic state index for total phosphorus was 67.91 (standard deviation=3.38) in 1979, 55.90 (standard deviation=6.91) in 1981, 60.59 (standard deviation=6.21) in 1982, and 71.49 (standard deviation=7.52) in 1983. The range over the four year period was 37.37 in 1981 to 89.85 in 1983. The values calculated in 1981 have to be viewed with prejudice since it is reputed that the total phosphorus samples were filtered before digestion. At Site HA-8, the mean total phosphorus index was 69.53 (standard deviation=6.47). In general, the trophic state index indicates that the phytoplankton populations probably had a very high biomass over the period of study.

Nutrient Loads

When the original sampling stations were established, Site HA-3 was selected to represent the input site to the lake. However, it was later discovered that this site can be inundated by the lake and then it is essentially an in-lake site. For the purpose of this analysis, it was assumed that the concentrations of nutrients observed at this site were representative of the concentrations entering the lake. In addition, it was assumed that the amount of water entering the lake is equivalent to the amount of water leaving the lake. Therefore, the discharge waters from the lake were used in conjunction with the nutrient concentrations observed at

Site HA-3 to determine nutrient loads. The estimated nutrient loads were as follows:

	Total Phosphorus (g/yr)	Total Nitrogen (g/yr)
1979	76,556	598,319
1982	370,647	1,584,725
1983	272,051	1,556,043

Lake Hanson has a mean depth of 2.3 m and a surface area of 22.2 hectares. Using Table 12-10 in Wetzel (1975), which is based on Vollenweider's (1968) investigation, the loads to a lake with a mean depth of five meters that would be considered dangerous are 0.13 g $P/m^2/yr$ and 2.0 g $N/m^2/yr$. In Lake Hanson, the total phosphorus loads were .34 $g/m^2/yr$ in 1979, 1.67 $g/m^2/yr$ in 1982, and 1.23 $g/m^2/yr$ in 1983. The total nitrogen loads were 2.70 $g/m^2/yr$ in 1979, 7.16 $g/m^2/yr$ in 1982, and 7.01 $g/m^2/yr$ in 1983. Therefore, both nutrients were above the levels that would be considered dangerous for a lake with a mean depth of 5 meters and Lake Hanson has a mean depth of only 2.3 meters. Efforts need to be made to reduce both nitrogen and phosphorus loads to Lake Hanson.

The Watershed and Water Quality

One potential problem source in the watershed was the wastewater treatment facilities for the City of Alexandria. The sewage lagoons were apparently losing water through seepage and muskrats had dug holes into the sewage lagoon dikes through which water was leaking.

Water quality monitoring Sites HA-1 and HA-1A were established below the plant and Sites HA-5, HA-6, and HA-10 were established above the plant (Figure 4). Site HA-5 was as far upstream in the watershed as feasible and was assumed to reflect the best water quality to be found in the watershed. Site HA-6 was 1.4 miles east of Alexandria above the WWTP and Site HA-10 was just below this site on the confluence with a tributary that could be introducing additional nutrient sources into the stream. For purposes here, Sites HA-1 and HA-1A are the same site except for the fact that the water was sampled on one side of a road crossing the creek, or the other. Site HA-2 was located below a slough. This site was selected because it was thought that it might reflect nutrient uptake and suspended solids reduction as the water flow was reduced by the macrophytes. Tables IV-15 through IV-20 summarize the data collected at these sites. Because the purpose of these sites was to determine if water quality changed as Pierre Creek approached the lake and in particular to determine if the wastewater treatment facilities were impacting the lake, a Tukey-Kramer test for multiple comparisons among pairs of means based on unequal sample sizes was used to determine significant differences (Sokal and Rohlf, 1981).

In 1979, Sites HA-5 and HA-6 had significantly greater ($P<.05$) concentrations of total phosphorus than Site HA-2. Site HA-6 had a significantly greater ($P<.05$) concentration of phosphorus than Site HA-1. In addition, the concentrations of total dissolved solids was significantly greater ($P<.05$) at Sites HA-2, HA-1 and HA-6 than at Site HA-5. The general conclusions are that in 1979 total phosphorus concentrations were greater upstream than downstream and total dissolved solids were greater downstream and immediately above the plant than further upstream at Site HA-5. It cannot be concluded from these results that the wastewater

treatment plant was increasing the nutrient and solid concentrations downstream. All other tests between ammonia, nitrates, suspended solids and BOD (Biochemical Oxygen Demand) were non-significant.

In 1981, the total phosphorus concentrations were significantly higher ($P<.05$) at Site HA-1A than at Site HA-10 above the WWTP. It is possible that the wastewater treatment plant was impacting the creek in 1981.

In 1982, data was available only for Sites HA-1A, HA-1, HA-10, and HA-6. Site HA-6 had greater phosphorus concentrations than Sites HA-1A, HA-1 and HA-10 and it had greater total dissolved solids than Site HA-10 ($P<.05$). The reason for the higher concentrations of phosphorus and total dissolved solids at Site HA-6 is not known, but it does imply that there is a non-point source of pollution.

The only significant difference observed in 1983 was between Sites HA-10 and HA-6. Site HA-10 had greater concentrations of suspended solids than Site HA-6. If the wastewater treatment plant's lagoons are impacting Pierre Creek, this point source should be eliminated. However, there are problems with certain parameters indicating further investigation into identifying non-point sources of pollution.

Sampling Site HA-9 was established downstream from Site HA-4, the outlet below areas of severe erosion. The data collected from the two sites was compared statistically using a t-test analyses. The mean concentrations of total dissolved solids, suspended solids, ammonia, total Kjeldahl nitrogen, fecal coliforms, and total phosphorus were compared between Sites HA-9 and HA-4. Suspended solids, fecal coliforms and total phosphorus concentrations were significantly higher ($P<.05$) downstream at Site HA-9

than upstream at Site HA-4. The increase in suspended solids probably is the result of erosion. However, the phosphorus and fecal coliform results imply other problems such as cattle near or in the creek. Table IV-21 presents the summarized data at Site HA-9.

Summary

Lake Hanson is a shallow warm water lake located in Hanson County, South Dakota. The lake has the following assigned beneficial uses:

- Warmwater semipermanent fish life propagation;
- Immersion recreation;
- Limited contact recreation; and
- Wildlife propagation and stock watering.

Pierre Creek is the major input source to the lake and the major outflow.

The following observations reflect the water quality in this study area:

1. Dissolved oxygen concentrations in the lake are adequate to support its assigned beneficial uses.
2. Biochemical oxygen demand levels were relatively low during the study except for one sample from Site HA-3 which was 23.0 mg/l. The reason for this high BOD is unknown.
3. Low pH values (<6.3) were observed at the input site, the outflow site and in the lake. However, the majority of the pH values were within the limits for the State of South Dakota Water Quality Standards.
4. Mean values of alkalinity were over 200 mg $CaCO_3$/year indicating a well buffered lake.
5. Total solids ranged from 429 mg/l to 4,317 mg/l.

6. Total dissolved solids at Sites HA-3, HA-4, HA-7, and HA-9 range from 428 mg/l to 4,309 mg/l and three violations of the State's Water Quality Standards for total dissolved solids were observed at Site HA-3. The mean concentrations of total dissolved solids at the four sites ranged from 1,784.34 to 2,198.73 mg/l. These mean values are high and are approaching the limit of 2,500 mg/l. The source(s) of total dissolved solids need to be identified and mitigation actions taken.

7. Fifteen samples at Site HA-3 were observed to have excessive levels of suspended solids (greater than 90 mg/l) and one in-lake sample at Site HA-7 was observed to have excessive levels. The number of excessive concentrations represent a potential problem for the lake.

8. Mean in-lake concentrations of total phosphate indicate that Lake Hanson is a hypereutrophic system.

9. Excessive fecal coliform levels (greater than 200 per 100 ml) were observed seven times in-lake over the study period. These values are high enough to cause concern about potential health problems.

10. If Site HA-3 is considered to be an input site, then excessive levels of fecal coliforms (greater than 2,000 per 100 ml) were observed 13 times over the study period and if it is considered to be an in-lake site, then 51% of the samples had fecal coliform levels greater than 200 per 100 ml.

11. The State's standard for un-ionized ammonia was not observed to be violated during the study period.

12. All nitrate values were at the lower end of the range of expected nitrate concentrations in unpolluted natural waters.

13. Mean concentrations of inorganic nitrogen indicate a lake with a trophic status of ultra-oligotrophic to oligo-mesotrophic and mean concentrations of organic nitrogen reflect a eutrophic lake. Organic nitrogen is the dominant nitrogen source in Lake Hanson.

14. Based on a total nitrogen to total phosphorus ratio of 15:1 as optimum, Lake Hanson would be considered to tend toward nitrogen limitation.

15. Based on Carlson's trophic state index for total phosphorus, Lake Hanson is probably a highly productive lake. (Range of mean concentrations 55.90 to 71.49.)

16. Both nitrogen and phosphorus loads should be considered as dangerous to the health of the lake.

17. The wastewater treatment plant facilities were not shown to be impacting the water quality of Pierre Creek.

18. Suspended solids, fecal coliform and total phosphorus concentrations were significantly greater downstream from Lake Hanson than at its outlet, supporting the contention that areas of severe erosion are impacting Pierre Creek. In addition, there maybe other non-point sources of pollutants causing the increases in phosphorus and fecal coliforms.

Recommendations

Based on the water quality data, the following recommendations are made:

1. Lake Hanson should be considered for further data collection efforts and restoration activities.

2. Sampling efforts should be designed to locate nonpoint and point sources of total dissolved solids, suspended solids, total phosphorus, organic nitrogen, and fecal coliforms.

3. Restoration activities should include activities designed to mitigate the sources identified through sampling in (2). Best Management Practices (BMPs) designed to reduce soil erosion should be considered, and enforcement actions or BMPs to reduce the proximity of cattle to the lake and the creek.

4. The input of nutrients and fecal coliforms from septic tanks should be investigated to determine the degree of inputs.

5. Seepage from the Alexandria wastewater treatment plant lagoons was eliminated in July 1984. However, the City must still riprap the east and north berms to provide for dike protection.

6. Loading of the nutrients phosphorus and nitrogen should be reduced below dangerous levels.

V. Pierre Creek/Lake Hanson Watershed Problems and Recommendations

Problems adversely affecting water quality in Lake Hanson are identified in the following discussion along with recommendations for corrective action. Although in-lake wateshed problems are discussed separately, in-lake problems are symptoms of problems occurring in the watershed. Therefore, water quality in Lake Hanson cannot be significantly improved without concurrent and coordinated work on watershed problems.

A. Cropland/Grassland Runoff

Problem:

Nutrient loading from the Pierre Creek watershed has created highly eutrophic conditions in Lake Hanson. Data gathered from tributary Site HA-03 indicate that Lake Hanson is receiving dangerous loads of total phosphorus and total nitrogen. Total phosphorus loads were .34 $g/m^2/yr$ in 1979, 1.67 $g/m^2/yr$ in 1982, and 1.23 $g/m^2/yr$ in 1983. The corresponding nitrogen loads were 2.70, 7.16, and 7.01 $g/m^2/yr$, respectively (Chapter IV). These nutrients have originated in runoff mainly from feedlots, livestock feeding stations, cropland, and releases and seepage from Alexandria's sewage lagoon and conduits. Failure to reduce these nutrient loads will result in further deterioration of Lake Hanson water quality. Symptomatic of worsening water conditions may be reduced water clarity, increases in aquatic macrophytes, increased algal blooms, occurrence of fish kills, and water odor problems.

High fecal coliform levels were reported in water entering the lake (Site HA-03) on a number of occasions throughout the study period (see Water Quality Chapter IV). Excessive fecal coliform levels were also present at in-lake sites and the outlet Site HA-04 on several sampling dates. The precise origin of these contaminants is unknown at the present time, although livestock operations scattered throughout the watershed and the Alexandria sewage lagoon are probable major sources.

Sediment loading into Lake Hanson from cropland/grassland sources amounts to 890 tons per year. This quantity of sediment poses no immediate threat to reservoir water storage capacity although, given the small volume of the impoundment, it should be considered a longterm problem. Sediments deposited at the upstream portion of the reservoir have created a large shallow area with dense growth of submergent vegetation. Such areas have limited value for fishing and other recreation. Major sources of sediments are streambank erosion, runoff from crop and grasslands, and gully erosion from the old Alexandria Landfill located about 150 feet from the creek and approximately 2 miles upstream of Lake Hanson.

Recommendations:

Critical erosion areas in the watershed should be updated with appropriate maps and prioritized. The Best Management Practices (BMP's) outlined in Table 4 should be implemented as needed in the watershed. Current fertilizer application rates and timing should be determined. An evaluation of this data should be assessed to determine whether fertilizer management practices need to be implemented. Five thousand (5,000) feet of eroding streambanks on

Pierre Creek should be stabilized and rock riprap placed in critical erosion areas. If feasible, a 30 foot wide grassed buffer zone should be established on sides of the creek (particularly in the area between Alexandria Quarry and Lake Hanson) where overgrazing has severely reduced streamside vegetative cover. Watershed managers should investigate the possibility of constructing sediment control dams at appropriate locations along the course of tributaries to retain runoff material and further reduce sedimentation into Lake Hanson.

It was estimated that 21 hog and 20 cattle operations are located in the Pierre Creek drainage area (Hanson County Conservation District Final Report, 1984, Appendix E). Drainage patterns and nutrient contributions of local feedlots should be established and monitored to determine their impact on Lake Hanson water quality. Appropriate waste treatment systems and control structures can then be put in place, to reduce nutrient and fecal coliform levels entering Pierre Creek and Lake Hanson.

A comprehensive septic tank survey is needed that would establish the location of the systems, their age, construction, maintenance practices, and identify potential problem areas. A preliminary on-site survey did not indicate any problems with existing residential waste disposal systems; but in June 1982, infrared photo imagery by EPA identified two homes on the northern shore of Lake Hanson with surface-failing on-site waste disposal systems.

Seepage from the Alexandria wastewater treatment lagoon was eliminated in July 1984. However, the City must still riprap the east and north berms of the old lagoon (first cell) to provide for dike protection.

Leaks in the pipeline leading into the first cell should also be repaired.

Releases (overflows) from the second cell into Pierre Creek were observed in the spring of 1983 (T. Keller, personal communication). It is recommended that the lagoon be constructed in such a manner (according to the Municipal Compliance Plan) as to minimize or eliminate nutrient and fecal coliform contamination to Pierre Creek. The present Alexandria National Pollutant Discharge Elimination System (NPDES) Permit specifies no discharge into Pierre Creek from the Alexandria lagoon system.

Effluent and sediment runoff from the old landfill needs to be eliminated. An RC&D Critical Area Project - CA-272-HA, Alexandria's Old City Landfill was surveyed and blueprint plans and cost estimates were completed. However, the landfill site was subsequently purchased by the owners of the Alexandria Quarry and there were difficulties in raising local matching funds for the stabilization project. As a result, the project still remains uncompleted.

VI. In-Lake Problems and Recommendations

A. Eutrophication

Problem:

The major problem with Lake Hanson is eutrophication as evidenced by high concentrations of phosphates and organic nitrogen and increased nuisance growths of rooted aquatic vegetation and blue-green algae.

Recommendations:

Comprehensive watershed treatment will greatly alleviate the in-lake problems. Due to the small size of the reservoir, results may be apparent in only a few years. Because of the great influence of the Pierre Creek watershed on Lake Hanson water quality, in-lake treatment should be secondary to watershed stabilization.

A method for reducing nutrient concentrations in the reservoir is chemical phosphorus precipitation. This method involves the application of a chemical such as aluminum sulfate (alum) to the lake surface to tie up the soluble phosphorus which forms a precipitate, settles out, and creates a partial bottom seal. This treatment may have to be repeated every 1 to 3 years, depending on conditions.

B. Sedimentation

Problem:

Sediments deposited in Lake Hanson from the Pierre Creek watershed have created extensive areas of shallow water in the upper third (east end) of the reservoir which provides favorable habitats for dense, nuisance growths of aquatic weeds. Additional sediment is provided to the reservoir from shoreline erosion. Excessive sedimentation and subsequent proliferation of aquatic weeds result in the loss of usable open water areas and represent an impairment to boating, fishing, and immersion recreation.

Recommendations:

1. A feasibility study should be conducted to determine if selective dredging should be undertaken in the east end of the reservoir. If dredging is identified as a cost-effective alternative, efforts should be made to secure funding.

2. A feasibility study should be made to determine the cost-effectiveness of harvest and removal of rooted aquatic vegetation.

3. Eroding shoreline areas should be stabilized by rock riprap.

VII. Implementation Activities

Upon selection of the Pierre Creek/Lake Hanson watershed as a WQSA, DWNR contracted with the Hanson County Conservation District to retain a Project Coordinator. The Project Coordinator collected study area data and worked toward establishing restoration plans for Lake Hanson and the Pierre Creek drainage area. In doing this, the Project Coordinator worked with DWNR, the Hanson County Conservation District, the Alexandria City Council, and other political entities as well as soliciting public involvement in the study.

About 2% of the land in the Pierre Creek/Lake Hanson watershed was treated during this project period, which brings the total percentage of treated land in the watershed to an estimated 60 percent. Total treated acreage during the WQSA project amounted to about 897 acres. The amount of Agricultural Conservation Program (ACP) funds used for BMP's each crop year, with cost share at 75%, was as follows: 1981-$5,618.00,

1982-$11,266.00, 1983-$6,263.00, for a total of $23,120.00 (Hanson County Conservation District Final Report, 1984, Appendix E).

Establishment of permanent cover by grass seeding was completed on 729 to 732 acres and windbreak restoration was completed on 23 acres. In addition, 120 acres were placed under conservation tillage and about 25 acres of shelterbelts (trees) were established in the watershed. Three new wells and seven dugouts were excavated to provide alternative livestock water supplies and protect streamside and lakeshore land from excessive grazing pressure.

The obvious leaks in the old Alexandria sewage lagoon were repaired in the spring of 1984 (Robert Wagner, Project Coordinator, personal communication) and the project was completed in July 1984.

Estimated watershed acreage that remains to be treated with cost of treatment includes:

1. 2,000 acres - grass seeding - $12,500

2. 8,000 acres - strip cropping - cost N.A. (not available)

3. 30 miles - field windbreaks - $5,175

4. 5 miles - grassed waterways - $5,280

5. 2,500 acres - contour farming - cost N.A.

6. 3,000 acres - grass management - cost N.A.

7. 19 agricultural waste systems - $66,500

Through the efforts of the Project Coordinator, the Pierre Creek/Lake Hanson WQSA program has increased public awareness of local water quality and pollution problems. Farmers and home owners have been informed of the water quality problems facing the Pierre Creek watershed through lake association and city meetings, displays, and distribution of literature. Information on progress of the water quality project was disseminated through articles in county newspapers and a quarterly newsletter published by the Hanson County Conservation District.

Area landowners and landusers have been exposed to conservation work through the promotion of soil conservation measures. The Annual Tillage Conferences held at the Mitchell Corn Palace in December of 1982 and 1983 provided local farmers with information on no-till and minimum tillage and their preventive effects on soil and water erosion. Valuable tillage information was also provided by the Bainbridge Tillage Demonstration test plot. This 40 acre field was divided into a series of evaluation plots planted with corn and oats to compare three tillage systems: conventional, chisel, disk plant, and no-till. The project will be continued for two more crop years.

The Hanson County Conservation District believes that the depressed farm economy in the Pierre Creek watershed for the past several years has hampered participation in various projects of the program and that better economic conditions in the area would have resulted in a greater number of planned conservation practices or projects being carried out to completion (Robert Wagner, Appendix E).

VIII. References Cited

Carlson, R.E. 1977. A Trophic State Index for Lakes Limnology and Oceanography. 22:361-369.

Reckhow, K.H., M.N. Beaulac, and J.T. Simpson. 1980. Modeling Phosphorus Loading and Lake Response Under Uncertainty: A Manual and Compilation of Export Coefficients. United States Environmental Portection Agency. EPA 440/5-8-011.

Sohal, R.R. and F.J. Rohlf. 1981. Biometry. W.H. Freeman and Company, San Francisco.

Soil Survey of Hanson and Hutchinson Counties, South Dakota. 1978. Soil Conservation Service, U.S. Department of Agriculture and South Dakota Agricultural Experiment Station. 127 pp.

U.S. Environmental Protection Agency. 1976. Quality Criteria for Water. U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency. 1979. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency. EPA 600/4-79-020.

Vollenweider, R.A. 1968. Scientific fundamentals of the eutrophication of lakes and flowing waters, with particular reference to nitrogen and phosphorus as factors in eutrophication. O.E.C.D. Council Reports. 159 pp.

Wetzel, R.G. 1975. Limnology. W.B. Saunders and Company, Philadelphia.

IX. Appendices

Appendix A. Statewide Fisheries Surveys, 1977-78

FILE COPY

78-7

SOUTH DAKOTA

FISHERIES

STATEWIDE FISHERIES SURVEYS, 1977 - 78

Survey of Public Waters

SOUTH DAKOTA DEPARTMENT OF
WILDLIFE, PARKS, & FORESTRY

WILDLIFE DIVISION

Anderson Building
Pierre, SD 57501

REPORT NO. 78-7

F-21-R Statewide Fisheries Survey
SUMMARY

Name	County(ies)	No.	Watershed	Ident.No.
Lake Hanson	Hanson	34	James	34-2
At or Near Alexandria				

Township(s)	Range(s)	Section(s)
102	58	21

Population: 20 miles 29,300 40 miles 63,350 100 miles 375,250

Mgt.Classification	Ecological Classification	Fishing Water:	20 miles	40 miles	100 miles
Warmwater	Rough fish-Game fish	Perm.,Semi-perm.	No ac	No ac	No ac
Semi-Permanent		Marginal	ac	ac	ac

SOURCE OF INFORMATION: 1. Fish Lake Survey Report(s) 1977 2. Game Lake Surveys
3. Lake File x 4. Gazetteer 5. D-J Report 1971, 1972 6. 1975 7.
Maps: 8. Department map 9. List of Meandered Lakes 10. Field investigation

Item	Data	Source
Area-Acres	55	8
Meander Ar-Ac	None	9
Max. Depth- Ft.	18	8
Median Depth- Ft.	8	8
Littoral Area - %	96	8
Shore Length - Mi.	2.9	8
Greatest Length - Mi.	1.12	8
Meandered - Yes or No	No	9
Annual Fluctuation - Ft.	+ .5 , -.5	3
Long-term Fluctuation - Ft.	+ .5 , -.5	3
No. Islands	None	8,10
No. Dwellings	25	3
No. Resorts, Units at Resorts	None	3
No. Boats - Resort, Private	None	3
No. Boat Liveries	None	3

Dams Artificial
Constructed in 1936 by Lake Hanson Ass'n.

Major Drainage Basin: Missouri River

Sequence of Waterways to Major Drainage Basin

Pierre Cr., James River, Missouri River

Inlets-Trib.No.	Name	Source of info
Location	Flow-C.F.S.	
22-102-58	N.D.	3,8

Outlet	Trib.No.	
Pierre Cr.		3,8

Watershed Description
The watershed occurs throughout gently rolling hills mainly covered by grasses with some farm land. Soil type: Barnes silt loam underlain with gravel and granite. 80% pasture, 20% cropland

Watershed Ownership
100% Private

Benchmark: Water level 0.4 feet above ~~below~~
Benchmark is spillway level
Additional comments:

Shoal Water	Ledge-rock	Boulder	Rubble	Gravel	Sand	Silt	Clay	Muck			Source
Soil - %		5	20		5			70			10
Lake Bottom -%								100			10

Shore Cover: 5% cottages, 2% woodland, 1% marsh, 92% pasture and grasses
Accessibility: Public access NW corner of lake, owned by Lake Hanson Association.
Erosion & Pollution: Very little erosion, used to be severe pollution from City waste water. new waste sewage lagoon corrected this.
% Emergent Cover 2, Dist. Cattail growth in upper end of lake in inlet
% Occur.Submerged Veg. 33 Dist. Throughout upper one half of lake

Water Plants	Species	Abund.	Water Plants	Species	Abund.	Water Plants	Species	Abund.
Cattail	Typha sp.	Common						
Coontail	Ceratophyllum sp.	Abundant						
Redhead grass	Potamogeton sp.	Common						
Duck weed	Lemna sp.	Common						

Algae No data
Plants grow to depth of 10 ft.

Fish Species	ABUND. No.	ABUND. Wt.	Sex	Growth Rate	Spawning Facilities	S.
Bluegill	164	1[illegible].7	T	*	Excellent	1,10
Crappie	55	7.7	T	*	Fair	1,10
Carp	1	1.2	T	N.D.	Good	1,10
Y.Perch	1	0.08	T	*	Good	1,10
N. Pike	1	1.7	T	*	Fair	1,10
G. Sunfish	1	0.005	T	N.D.	Fair	1,10
Winterkill Dates	None				G. r.8	

Item	Surface	S.	Below Therm.	S.
Temp. - °F.	76	3	N.D	
D.O. - p.p.m.	10+	3		
T.Alk. - p.p.m.	N.D.			
SO_4 - p.p.m.	N.D.			
Cl. - p.p.m.	N.D.			
T.P. - p.p.m.	N.D.			
T.N. - p.p.m.	N.D.			
Color				
Secchi Disc Reading 2 Ft.4"				10
Cause of Turbidity N.D. 7/14/77				
Loc.of Therm. N.D. Ft.from surf.				
Winter D.O. See lake file				

Special Problems: Heavy growth of submergent vegetation throughout summer. — 3

ABBREVIATIONS: A - abundant, C - common, O - occasional, R - rare, P - present, S - source of data, G - 250' gillnet set for 24 hours, T - trapnet set for 24 hours, E - Electrofishing

WATERFOWL HABITAT		S.
Nesting Cover	Limited	10
Brood Cover	Limited to cattails in upper end	10
Loafing Areas	None	10

Utilization - Species	No.Adults	No.Broods	Species	No.Adults	No.Broods
Various species during migration, little other use.					

Aquatic Furbearer Habitat: Limited mink and muskrat in upper end of lake. — 10

Other Wildlife

Recreational Use		Amount and/or Success	S.
Summer Angling	X	moderate in spring-good success-small bluegills	10
Winter Angling	X	Very light - poor success	10
Spearing			
Hunting			
Trapping			
Snowmobiling	X	Light	10
Boating	X	Limited	10
Canoeing			
Waterskiing	X	Moderate on weekends	10
Picnicking			
Camping			
Swimming	X	Moderate at beach area	10

* Scales on file
** Gill netting data on enclosed sheet

Additional information: (Netting tables, shoreline seining, other surveys, rough removal, stocking records, etc.)

See attached sheets

Management Recommendations:

Lake Hanson should be managed as a largemouth bass and bluegill fishery. Presently a large population of stunted bluegills exists in the lake. Carp are also present. Angling for bass is diminished from past levels. Chemical renovation should be considered. At present, somewhat of a conflict exists between area fishermen, who would like to see eradication and restocking, and waterskiers, who would just as soon see carp in the lake to control vegetation. Public support is needed before renovation could be undertaken.

By Ronald L. Brandt

Date August 23, 1978

(CF-Form 71-1)
Page 3

3. Fish Abundance

NETTING SUMMARY SHEET

Observer Bradwisch, Rokusek

LAKE Hanson COUNTY Hanson Date July 13-15, 1977

Total Gillnet Sets 1 250 ft. Experiment nylon nets.

SPECIES	TOTAL CATCH No.(%)	TOTAL CATCH Wt.(%)	Ave. Size Ins.	Ave. Size Lbs.	Average Catch/Net No.	Average Catch/Net Wt.	Statewide Median/net No.	Statewide Median/net Wt.
Crappie	41 (77.4)	2.77 (24.4)	5.4	.07	41	2.77		
Carp	4 (7.5)	5.15 (45.3)	14.1	1.3	4	5.15		
Y. Perch	6 (11.3)	.42 (3.7)	5.8	.07	6	.42		
Pike	1 (1.9)	3.0 (26.4)	23.5	3.0	1	3.0		
Bluegill	1 (1.9)	.03 (0.3)	3.8	.03	1	.03		

Total Trapnet sets 8, mesh size 3/4". Total Pocketnet sets 0, mesh size

SPECIES	TOTAL CATCH No.(%)	TOTAL CATCH Wt.(%)	Ave. Size Ins.	Ave. Size Lbs.	Average Catch/Net No.	Average Catch/Net Wt.	Statewide Median/net No.	Statewide Median/net Wt.
Bluegill	1314(74.2)	117.5 (58.9)	5.3	0.09	164	14.7	23.8	5.1
Crappie	438(24.7)	58.2 (29.1)	6.7	0.13	55	7.7	27.6	10.1
Carp	7 (0.4)	9.71 (4.9)	14.4	1.4	1	1.2	21.1	17.1
Y. Perch	9 (0.5)	.63 (0.3)	5.7	0.07	1	0.08	13.0	1.6
Pike	1 (0.06)	13.55(6.8)	37.3	13.55	1	1.7	2.8	6.5
G. Sunfish	1 (0.06)	.04(0.02)	4.2	0.04	1	.005	15.4	2 0

(GF-Form 71-6)
Page 8

37. Fish Sizes

Lake Hanson

LENGTH - FREQUENCY DISTRIBUTIONS
SPECIES AND NUMBERS OF FISH IN LENGTH GROUPS

Total length in inches	Crappie	Bluegill	Carp	Y. Perch	N.Pike	G. Sunfish				
3.0 - 3.4										
3.5 - 3.9		1								
4.0 - 4.4	1					1				
4.5 - 4.9	12	5								
5.0 - 5.4	24	30		2						
5.5 - 5.9	15	15		11						
6.0 - 6.4	8			2						
6.5 - 6.9	6									
7.0 - 7.4	9									
7.5 - 7.9	6									
8.0 - 8.4	5									
8.5 - 8.9	3									
9.0 - 9.4	2									
9.5 - 9.9										
10.0 - 10.4										
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9			1							
13.0 - 13.9			6							
14.0 - 14.9			2							
15.0 - 15.9			1							
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9			1							
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9					1					
24.0 - 24.9										
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
37.0 - 37.9					1					
TOTALS	91	51	11	15	2	1				

(CF-Form 71-6)
Page 9

[redacted] Natural Reproduction of Fish - Shoal Water Seini[redacted] [redacted]oun[redacted]es) [redacted]nsc[redacted]

Seine Measurements: Length 40 feet, Depth 6 feet,
Mesh size 1/4 inch square.

Date July 13-15, 1977
Collectors Bradwisch, Rokusek

	Station Number		Show number of seine hauls made at each station in ( )				Totals
	1 ( )	2 ( )	3 ( )	4 ( )	5 ( )	6 ( )	
Total linear distance covered-feet	100	50	150				300 Linear Feet
Greatest water depth - feet							
Bottom Soil Type Amount of Vegetation ++							Acre(s)
Water Temperature-°F.							
Wind Intensity & Direction +							
Time of Day & Date							
Location on Lake	SW Corner	S Side by Bridge	N Side by Bridge				

SIZE AND NUMBER

Species ***	Station #1		Station #2		Station #3		Station #4		Station #5		Station #6		TOTALS		
	YY**	O*	YY	O	YY	O	YY	O	YY	O	YY	O	YY	O	All
Bluegill		22		15		27								64	64
LM Bass	2		1		2								5		5
Crappie	3		2										5		5
G. Sunfish -				1										1	5

++ Heavy, Moderate, Light, None, etc. + Strong, Moderate, Light, Calm.
*** Group separately minnows and darters without identifying them, unless readily identifiable in field. Preserve sample for later identification in laboratory.
** YY - Young-of-year or fingerlings.
* Others, includes yearlings and adults, minnows and darters. Take scale samples from sizes of fish, especially game fish, not taken in test nets.

(GF-Form 71-6)

Appendix B. Third Planning and Development District Report

GENERAL CRITERIA FOR SELECTION OF A WATER QUALITY STUDY AREA

	WQSA NOMINEES		
	Pierre Creek/Lake Hanson	Corsica Lake	
1. A WQSA should generate public support and input.	3	1	
2. A WQSA should already have base line data information on it.	3	1	
3. A WQSA should have few drainage areas.	3	3	
4. WQSA's should have diverse public uses.	3	2	
5. The watershed area of each WQSA should be kept to as small an area as possible so management efforts can give the best quality control.	3	3	
6. Accessability to the WQSA should be good.	3	3	
7. The location and make-up of the WQSA should facilitate collection of necessary data.	3	2	
8. Ownership of land in and around a WQSA should facilitate designation of a management agency.	3	3	
9. Level of beneficial uses water area provides.	3	3	
10. Demonstration potential as a WQSA.	3	1	
11. Should be typical of many other areas in District.	3	2	
TOTAL.....	33	24	

SCORING USED

3 - Strongly satisfies criteria

2 - Moderately satisfies criteria

1 - Slightly satisfies criteria

0 - Does not satisfy criteria

Pierre Creek/Lake Hanson Water Quality Study Area

During 1979, Planning and Development District III in cooperation with the Hanson County Commission, Hanson County Conservation District, the Lower James RC&D and several other local interested groups worked to develop a water quality study area on the Pierre Creek/Lake Hanson watershed. This watershed is located within Hanson County and it drains into the James River. Because the James River or its tributaries flow through seven counties within Planning and Development District III, a study of this particular watershed would have substantial applicability throughout the Planning District. Although the Pierre Creek/Lake Hanson area is very similar to other areas, it also has its peculiarities which make it desireable as a water quality study area. These similarities and differences will be discussed at length in latter parts of this discussion and will demonstrate why the area was selected as a water quality study area.

Method of Selection

Planning and Development District III, under the conditions of its 208 water quality planning contract, was given the responsibility of selecting a water quality study area. Before an area was selected, staff of the Planning District attended meetings of the local Resource Conservation and Development Areas (RC&D) and discussed the program with those committees asking them to recommend suitable areas. There are two RC&D areas (Randall and Lower James) within this Planning District and, combined, they serve the same counties as those served by District III.

Because the RC&D councils are active in water development and conservation, and because the membership of the councils generally have extensive knowledge of the local water resources in the area, their expertise was requested when selecting a water quality study area. During January and February of 1979, staff of District III met with the RC&D's to discuss selecting a water quality study area. At each meeting, rather lengthy discussions developed and several different potential study areas were examined. Although several different areas were discussed, each RC&D council was capable of selecting one area to recommend as a water quality study area.

Once the RC&D's made their recommendations, the Committee of Planning and Development District III reviewed them. On March 14, 1979, they recommended to the Department of Water and Natural Resources that Pierre Creek/Lake Hanson and Corsica Lake be considered as possible water quality study areas for the upcoming year. After the District Committee made its recommendation, it was then the responsibility of the Department of Water and Natural Resources to make the final selection.

Criteria For Selection

During the discussion of water quality study area selection with the RC&D's, several criteria were mentioned including; local interest and support, available data, size of study area and the special features of the area. From this discussion, District staff compared the two proposed study areas and rated each against a rather lengthy list of criteria. The criteria sheet used is attached here as exhibit A. Once the in-staff rating was completed, it was obvious which study area was superior. However, the District III Committee did not prioritize the selections and left the final selection decision up to the Department of Water and Natural Resources.

Interest in Selection

During the literature search, District staff uncovered or was supplied substantial information concerning the Pierre Creek/Lake Hanson water quality study area. Both the Hanson County Commission and Conservation District sponsored a RC&D measure plan for the Pierre Creek/Lake Hanson area. In addition, the Soil Conservation Service has undertaken extensive research within the project area and have determined areas in need of soil conservation and critical erosion areas. Exhibit B contains each of these reports which demonstrate the strong local support this project has.

While District III was considering nominations for water quality study areas, the Hanson County Conservation District and Lower James RC&D were actively lobbying for the Pierre Creek/Lake Hanson project area. Numerous letters were sent and received by these two agencies during their effort to assure their project area was selected for study. These letters are attached as exhibit C and definitely demonstrates active local support for the Pierre Creek/Lake Hanson project. Local support, which eventually lead to the area being selected as a water quality study area, is evident in these letters.

In closing, it must be stressed that active local interest in the Pierre Creek/Lake Hanson watershed as a water quality study area eventually lead to its selection. It is this same local interest that will assure successful completion of the project and eventual implementation.

LETTERS OF SUPPORT

DEC - 1978
RECEIVED DEC 5 1978

November 30, 1978

Dr. Allyn O. Lockner
Department of Environmental Protection
Joe Foss Building
Pierre, So. Dak. 57501

Dear Dr. Lockner;

The Conservation District and County Commissioners of Hanson County are co-sponsors of a measure to designate the Pierre Creek Watershed as a non-point water quality study area.

We would like to have you give serious consideration to this measure. We feel there will be good general acceptance if water monitoring shows that land treatment is needed. Also, the Conservation District is ready to provide all the assistance we can.

We urge your attention to this request.

Sincerely,

Ralph Dennis

Ralph Dennis, Chairman

cc: Robert D. Richter, Area Conservationist
SCS, Sioux Falls, S. D.

Jim Hunt Project Coordinator
Lower James RC&D, Mitchell, S. D.

Herman Tushaus, Director
Third Planning & Development District
P.O. Box 687, Yankton Co. Courthouse
Yankton, So. Dak. 57078

RECEIVED DEC 15 1978

December 14, 1978

Ralph Dennis, Chairman
Hanson County Conservation District
Box 82
Alexandria, South Dakota 57311

Dear Ralph:

In reply to your letter of November 30, 1978, you may be assured that I will give serious consideration to the selection of the Pierre Creek Watershed as a potential Water Quality Study Area.

I was pleased to hear from personnel of the Department of Environmental Protection attending your meeting that this watershed offers a unique physiographic area for study, as well as the potential for enthusiastic public support and participation. As you know, the aspect of public support is essential, for without it, everyone's efforts are not likely to be successful.

I have also been informed that all the applicable subcontractors for "208" have been notified and have expressed interest and a willingness to cooperate.

If you have any questions or additional input please contact me or Dave Pfahler. You may be confident that we shall inform you as to the outcome as soon as the selection process is complete.

Sincerely,

Allyn O. Lockner, Secretary
Department of Environmental Protection

cc: Richard Howard, Administrator
Office of Water Quality
Robert D. Richter, Area Conservationist, SCS
Sioux Falls, South Dakota

LowerJames RC&D

996.1031

1315 NORTH MAIN • MITCHELL, SOUTH DAKOTA 57301 • P.O. BOX 956 • 605, [redacted]

January 12, 1979

RECEIVED JAN 22 1979

Mr. Herman Tushaus, Director
Planning & Develop. District III
P. O. Box 687
Yankton County Courthouse
Yankton, South Dakota 57078

Dear Herman:

The Lower James RC&D Council wishes to thank you and the District III Directors for your continued support of the proposed Pierre Creek Water Quality Study Area. Your vote of confidence by the District Directors Wednesday evening was appreciated.

We encourage you to assist us in seeking the appropriate funds to implement this study proposal from 208 Planning monies, Model Implementation Program (MIP) Funding, and/or 314 which is Clean Lakes monies.

As you recall we stressed the need to get this proposal underway as soon as possible so that the program would be in line for the Rural Clean Water Program that is proposed to be implemented in October of this year.

We would also appreciate if you could forward the appropriate response to the State Department of Environmental Protection and encourage them to start the project as soon as possible.

If we as the RC&D Council and the Sponsors can be of any additional assistance to you, please let us know.

Sincerely,

Harold Naser

Harold Naser, Chairman
Lower James RC&D Council

James C. Hunt

James C. Hunt
Coordinator, RC&D

Lower James RC&D

996.1031

1315 NORTH MAIN • MITCHELL, SOUTH DAKOTA 57301 • P.O. BOX 956 • 605, [redacted]

January 29, 1979

Mr. Wayne Testerman, State Executive Director
State Agricultural Stabilization and Conservation Committee
Agriculture Stabilization and Conservation Service
Federal Building
200 4th St. S.W.
Huron, South Dakota 57350

Dear Mr. Testerman:

The Lower James RC&D Council wishes to take this opportunity to inform you and the State Committee of the nomination of the Pierre Creek Drainage Area, as a Water Quality Study Area in Hanson County. This nomination has been submitted to the Planning and Development District III and to the State Department of Environmental Protection for Non-Point Water Quality Control Assistance. A tentative work outline has been developed in which inventory and monitoring of the study area will start this year and be completed by the fall of 1979.

We are taking this opportunity to at this time alert you to the fact that the Council and local sponsors from Hanson County will be requesting special project funds for special conservation practices (BMP's) in this water study area. We feel it is appropriate to let you know that the Sponsors will be making this request so that your office and committee can budget for assistance and seek Federal Funding.

Thank you for your consideration in assisting the Hanson County Sponsors.

Sincerely,

Harold Naser, Chairman
Lower James RC&D Council

HN:kac
cc: Jake Gross, Area Director, ASCS, Freeman, S.D.
Planning and Development District III, Yankton, S.D.
Hanson Co. Conservation District, Alexandria, S.D.
Hanson Co. ASCS Committee, Alexandria, S.D.

Lower James RC&D

1315 NORTH MAIN • MITCHELL, SOUTH DAKOTA 57301 • P.O. BOX 956 • 605, [redacted]

996.1031

January 29, 1979

Department of Environmental Protection
4th Floor - Joe Foss Building
Pierre, South Dakota 57501

Dear Secretary:

The Lower James RC&D Council wishes to request assistance of your department in regards to application of the Lake Restoration Program (Section 314 of the Federal Water Pollution Control Act and Ammendment PL92-500) for Lake Hanson, sponsored by the Hanson County Conservation District, Hanson County Commission and the Lake Hanson Association. This request will be in relationship to the proposed Pierre Creek Non-Point Water Quality Study Area previously recommended for study.

Lake Hanson and its drainage lies within this water quality study area.

An inventory of resources will be started this spring and be completed by the fall of 1979. A formal application will be made to your Department requesting Lake Restoration assistance and funding.

We felt it was important that we alert you and your Department at this time of this proposal being requested by the sponsors of the Lower James RC&D project from Hanson County.

Your acknowledgement and assistance in regards to this request will certainly be appreciated.

Sincerely,

Harold Naser, Chairman
Lower James RC&D Council

HN:kac
cc: Hanson County Conservation District
Lake Hanson Association
Planning and Development District III

Hanson County Conservation District

Box 82 - Alexandria, South Dakota 57311

RECEIVED FEB 5 1979

January 30, 1979

Mr. Wayne Testerman
State Executive Director
Agricultural Stabilization and Conservation Service
Federal Building
200 4th Street, S.W.
Huron, SD 57350

Dear Mr. Testerman:

The Hanson Co. Conservation District and County Commissioner of Hanson County are sponsoring a measure to designate the Pierre Creek Watershed as a Water Quality Study Area.

This is to alert you that in the future we will be requesting special project funds from your office for special conservation work in this watershed area.

Sincerely,

Ralph Dennis

Ralph Dennis, Chairman

pl

RECEIVED JUN 12 1979

Hanson County Conservation District
Box 82 - Alexandria, SD 57311 - Phone (605) 239-4635

June 8, 1979

Mr. Herman Tushaus, Director
Planning & Development District III
Yankton, SD 57078

Dear Mr. Tushaus:

The Hanson County Conservation District and the Hanson County Commission, sponsors of the Pierre Creek-Lake Hanson Non-Point Water Quality Study Area, held their first public information meeting with a number of agencies and local people participating. Local interest and support continue to be present. We as sponsors of the Pierre Creek-Lake Hanson Non-Point Water Quality Study Area wish to take this opportunity to apply for the Rural Clean Water Program, and upgrade water quality in the Study Area. It is believed that sufficient data and monitoring would be obtained by the Spring of 1980. Already some possible problem treatment areas have been listed:

approximately 60 acres of eroding drainage ways in cropland;
approximately 500 feet of eroding streambank;
approximately 10 small roadside and/or grassland gullies;
approximately 5 severe gullies on large draining ways in cropland;
1 poorly filled dumpground;
4 abandoned gravel pits;
2 small feedlots needing treatment.

We would appreciate your assitance and designation of the Pierre Creek-Lake Hanson Non-Point Water Quality Study Area for the Rural Clean Water Program.

If we can be of any additional assitance to you, please let us know.

Sincerely,

Ralph Dennis

Ralph Dennis, Chairman
Hanson County Conservation District

RD:pl

Appendix C. SCS Soil Erosion and Sediment Yield Study

SECTION 208 - WATER QUALITY STUDY AREAS

SOIL EROSION AND SEDIMENT YIELD STUDY

IN

PIERRE CREEK - LAKE HANSON WATERSHED

HANSON COUNTY, SOUTH DAKOTA

SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
HURON, SOUTH DAKOTA

ASSISTED BY
SOUTH DAKOTA DEPARTMENT OF WATER AND NATURAL RESOURCES
PIERRE, SOUTH DAKOTA

February 1981

SOIL EROSION AND SEDIMENT YIELD

IN

PIERRE CREEK - LAKE HANSON WATER QUALITY STUDY AREA

IN

HANSON COUNTY, SOUTH DAKOTA

Introduction

Intense use of our natural resources over the years has caused a general deterioration of our environment. Some of our air, soil, and water resources have become polluted. Increased public awareness of this situation helped to bring about the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). Section 208 of P.L. 92-500 addresses water pollution problems as it calls for management practices "...(to) be developed and implemented to assure adequate control of sources of pollutants in each state."

The South Dakota Department of water and Natural Resources has responsibility for formulating a section 208 water quality management plan for South Dakota. The watershed was one of six selected in 1980 for study to facilitate formulation of the plan. (See Figure 1.)

It is generally thought that sediment and nutrients are the principal pollutants in South Dakota lakes and streams. 1/, 2/, 3/

This report outlines more detailed information on soil erosion, sediment sources and quantities, management practices to control sediment, and costs for those practices. This information was developed by the Soil Conservation Service (SCS) for the South Dakota Department of Water and Natural Resources.

1/ Mathew, F.L., "Water Pollution in South Dakota, Part I: Natural Water Quality and Pollution Sources," 1970, South Dakota Water Resources Institute, South Dakota State University, Brookings, South Dakota, 34 pages.

2/ "Development Components of the South Dakota Water Plan, Volume II-B" 1977, Division of Resources Management, South Dakota Department of Water and Natural Resources, Pierre, South Dakota.

3/ "A plan for the Classification-Preservation-Restoration of Lakes in Northeastern South Dakota" 1977, State Lakes Preservation Committee, State of South Dakota and the Old West Regional Commission, Pierre, South Dakota.

Summary

This study has determined relative percentages of erosion and sediment yield from cropland, grassland, gullies, streambanks, and other sources. The Universal Soil Loss Equation and direct volume methods were used to estimate gross erosion which was multiplied by estimated sediment delivery ratios developed by watershed shape analysis 1/ to obtain estimated sediment yields.

Sediment was determined to be a pollutant in the Pierre Creek - Lake Hanson Water Quality Study Area (WQSA). Best management practices (BMP's) for this state section 208 water quality management plan thus became those management practices that reduced sediment yield.

A review of the Technical Guide for South Dakota (available at offices of the Soil Conservation Service) indicated soil and water conservation practices (management practices) that are potential BMP's. The relationships between runoff, sediment yield, and management practices, were outlined and, coupled with views of SCS district conservationists, a number of BMP's were selected for the WQSA. Costs for BMP's were generally abstracted from the SCS Cost-Return Handbook.

No quantification of reductions in sediment yield due to application of BMP's was attempted. The reasons for this are twofold:
1. The technical data base was inadequate.
2. The potential combinations of BMP's were too great.

Definition and Outline of Study Methods

Erosion

Sheet erosion occurs as water flows overland and moves layers of soil particles loosened by raindrop impact. Rill erosion is movement of soil particles as overland flow concentrates into small channels, or rills, 2 to 12 inches deep. Soil particles are loosened in rills by shear force exerted on the bottom and banks of the rill by the channelized water. Bank sloughing, or miniature landslides, occur as the bottom and lower banks are eroded.

The Universal Soil Loss Equation (USLE), 2/, 3/ was used to estimate sheet and rill erosion in the WQSA's. SCS personnel familiar with each WQSA derived the data needed for the USLE from their field experience, Section III of the South Dakota Technical Guide and detailed soils maps.

1/ "Sediment yield was Gross Erosion in Minnesota" by O.M. Finkelson, Geologist, SCS, St. Paul, Minnesota 1978.

2/ Wischmeir, W.H., and Smith, D.D., "Prediction Rainfall Erosion Looses, A Guide to Conservation Planning", Agricultural Handbook, No. 537, December 1978, Science & Education Administration.

3/ "Estimating Soil Loss Resulting from Water and Wind Erosion in South Dakota," June 1977, South Dakota Technical Guide III-1, USDA, SCS, Huron, South Dakota.

Sheet and rill erosion from construction sites, roads and roadbanks was estimated using a direct volume method (multiplying the area of erosion by an estimated rate of erosion and the volume weight of the eroding soil. 1/ Sample areas were observed in each WQSA and county highway maps were used to expand the sample data.

Gully and streambank erosion is soil moved by water flowing in channels that are greater than 12 inches deep. The mechanisms of loosening and moving soil particles are the same as in rill erosion except for the larger scale. Lake shore erosion occurs as wave action loosens and moves soil particles. The direct volume method was used to estimate gully, streambank, and lake shore erosion. The effects of ice were also considered in the erosion rate. Sample areas were observed in each WQSA and aerial photographs were used to expand the sample data.

Sediment Yield

Sediment yield is the amount of soil removed from a drainage basin. 2/, 3/ It is measured (or estimated) at a point or at a stream channel cross section and only represents a fraction of the total soil eroded in the basin above that point.

In this study, gross erosion was estimated and then multiplied by an estimated sediment delivery ratio to obtain sediment yield. This ratio is expressed as a percent and represents the amount of soil removed from a watershed (sediment) divided by the amount of soil moved in the watershed (erosion). It is thus inversely proportional to the amount of deposition occurring between points of erosion and the point where sediment yield is measured.

Many factors affect sediment yield - watershed size, shape, hydrology, channel density, land use, vegetative cover, geology and topography, soil structure, texture, and permeability. The interaction between all of these factors was subjectively analyzed after a delivery ratio was selected from a drainage area versus delivery ratio curve. This analysis resulted in raising or lowering the curve ratio and the adjusted ratio was used to estimate sediment yield from all sources of sheet and rill erosion. Much higher ratios were used to estimate sediment yield from gully, streambank, and lakeshore erosion.

1/ Method is outlined in the "Erosion and Sediment Inventory Handbook," USDA-SCS, Syracuse, New York (1972) and in "Guide to Sedimentation Investigations," Technical Guide 12, South Technical Service Center, USDA-SCS, Fort Worth, Texas (1976).

2/ "Sedimentation," 1975 National Engineering Handbook, Section 3, USDA, SCS, Washington, D.C.

3/ "Predicting Sediment Yields," in "Proceedings of the National Symposium on Soil Erosion and Sedimentation by Water," 1977, American Society of Agricultural Engineers, Publication 4-77, St. Joseph, Michigan.

Best Management Practices

The Environmental Protection Agency (EPA) has defined best management practices, as published in the Federal Register, as follows:

> "The term, best management practices (BMP), means a practice, or combination of practices, that is determined by a State (or designated areawide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (40 CFR Part 130)."

Thus best management practices in section 208 water quality management plans are primarily those management practices that are believed to have a beneficial impact on water quality. 1/ Since sediment yield affects water quality adversely in these study areas, management practices that reduce sediment yield will be BMP's. Best management practices were selected from Section III of the South Dakota Technical Guide and costs were taken from the SCS Cost-Return Handbook.

Narrative Comments

The Soil Conservation Service completed a study of the Pierre Creek - Lake Hanson Watershed. The purpose of this study was to identify the water erosion and sedimentation problems relative to Lake Hanson. The watershed was divided into four subwatersheds. (See Watershed Map)

This study brings out the kinds and amounts of erosion and sedimentation including the location, extent, and whether or not each tributary significantly contributes sediment into Lake Hanson.

Table 1 shows the present "Land Uses and Estimated Acres Needing Treatment" of the Pierre Creek - Lake Hanson Watershed Area. Figures are given for each tributary and a total for the watershed. Pierre Creek - Lake Hanson Watershed contains 38,361 acres. Figures are given for the following uses: cropland, grassland (both tame and native included), woodland, farmsteads, roads, and urban, and non-sediment contributing areas. Estimated acres are listed for acres adequately treated, and acres needing treatment with recommended Best Management Practices (conservation practices) which will contribute to water quality improvement as well as erosion control on the land in the watershed area.

1/ "Environmental Impact of Land Use on Water Quality, Final Report on the Black Creek Project (Summary," 1977, U.S. Environmental Protection Agency 905/9-77-007-A, Great Lakes National Program Office, Chicago, Illinois.

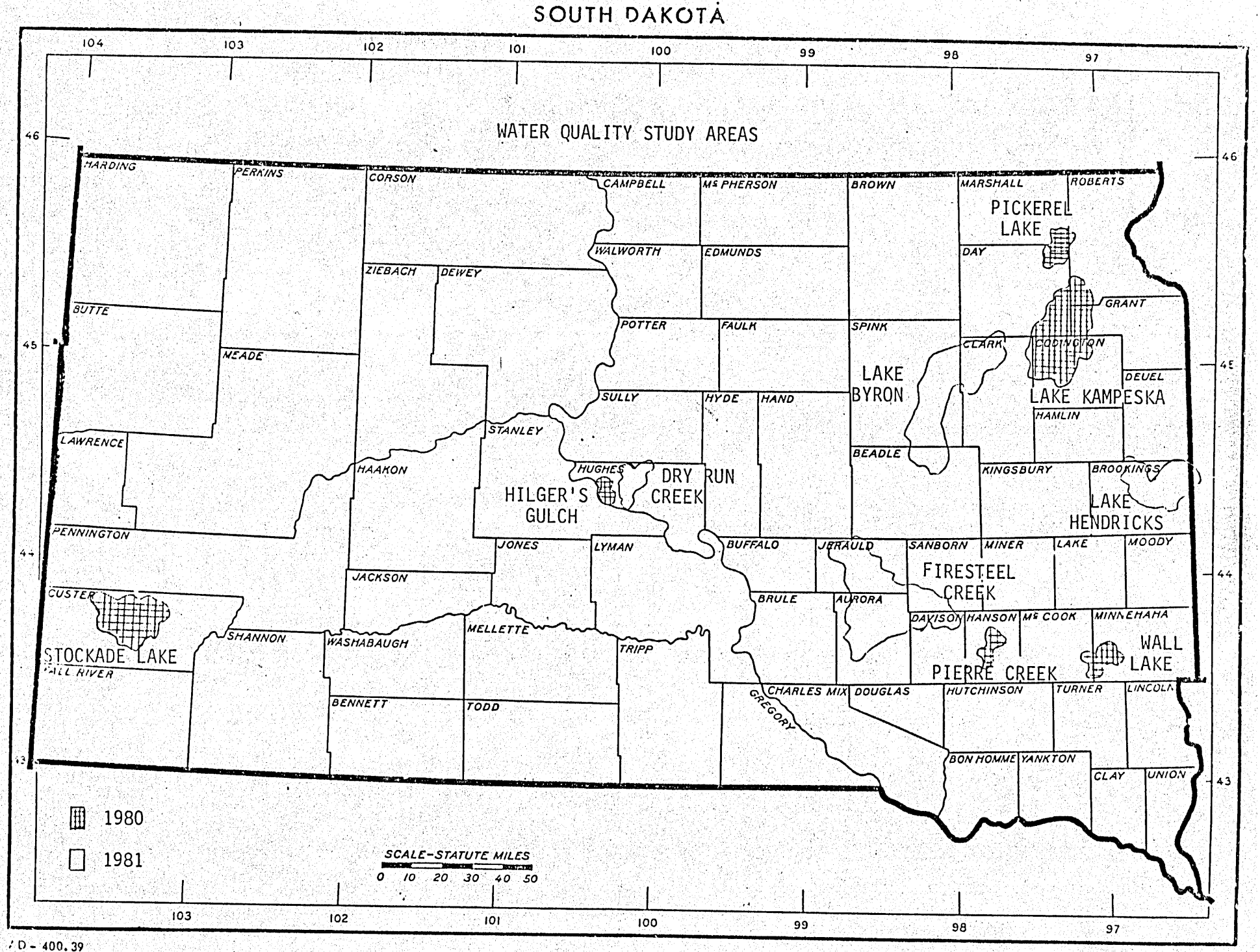
Narrative Comments (cont.)

Table 2 - "Soil Erosion and Sediment Yield Estimates" lists erosion and sediment yield information. The figures are given by tributaries. They are further broken down by land use, sheet and rill erosion, and other erosion and sediment yields. A final total column shows estimated total tons of sediment per year for the watershed.

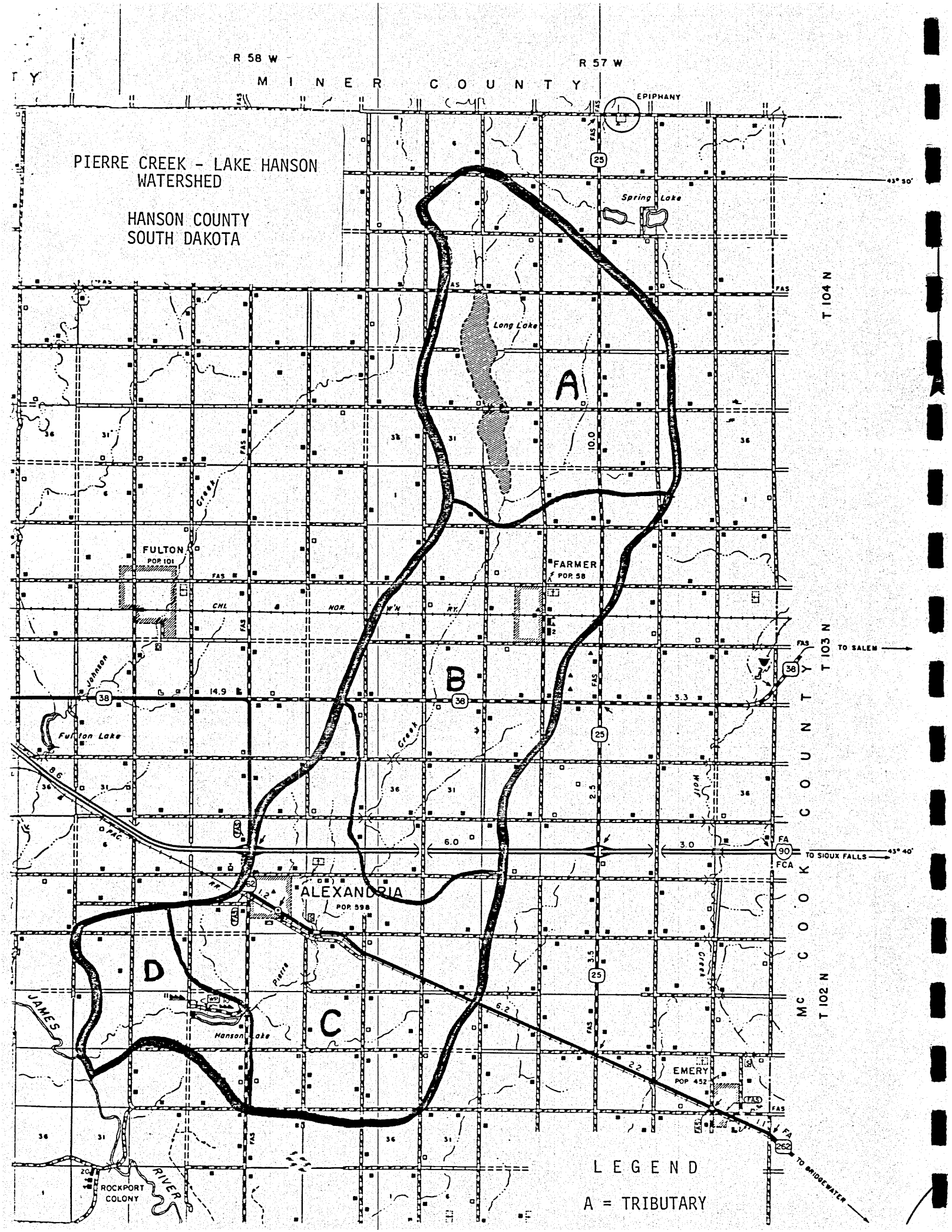
No figures were developed showing the extent of soil losses from erosion by wind. It was felt that an estimate of 1 to 1½ tons per acre per year could be used if this information is needed.

Table 3 - "Estimates of Best Management Practices (Conservation Practices and Measures) needed for Land Adequately Treated, Including Costs" shows the major land treatment needed in this watershed area. The table also shows estimated amounts and probable costs to get the land in this watershed "adequately treated". It must be kept in mind, that these are "Estimates" only, and that specific practices, and accurate amounts together with precise costs can only be obtained in a planning process with the owners and operators of each tract of land, based on their decisions on how each field is to be used and treated. This study does not show this sort of detailed information.

FIGURE 1



SD - 400.39
6-62


PIERRE CREEK - LAKE HANSON
WATERSHED
HANSON COUNTY
SOUTH DAKOTA
R 58 W
R 57 W
MINER COUNTY
EPIPHANY
Spring Lake
Long Lake
A
B
C
D
FULTON
POP. 101
FARMER
POP. 58
CHI. & NOR. W'N RY.
Johnson
Fulton Lake
Creek
ALEXANDRIA
POP. 598
Pierre
Hanson Lake
JAMES
RIVER
ROCKPORT
COLONY
EMERY
POP. 452
TO SALEM
TO SIOUX FALLS
TO BRIDGEWATER
T 104 N
T 103 N
T 102 N
McCOOK COUNTY
43° 50'
43° 40'
LEGEND
A = TRIBUTARY

PIERRE CREEK

HANSON COUNTY, SOUTH DAKOTA

WATER QUALITY STUDY AREA*

ESTIMATED SHEET AND RILL EROSION



WHERE CULTIVATED, SOIL LOSSES >5 TONS/AC/YR



SOIL LOSSES <5 TONS/AC/YR

*Detailed soil information can be obtained in the soil survey publication for Hanson-Hutchinson Counties.

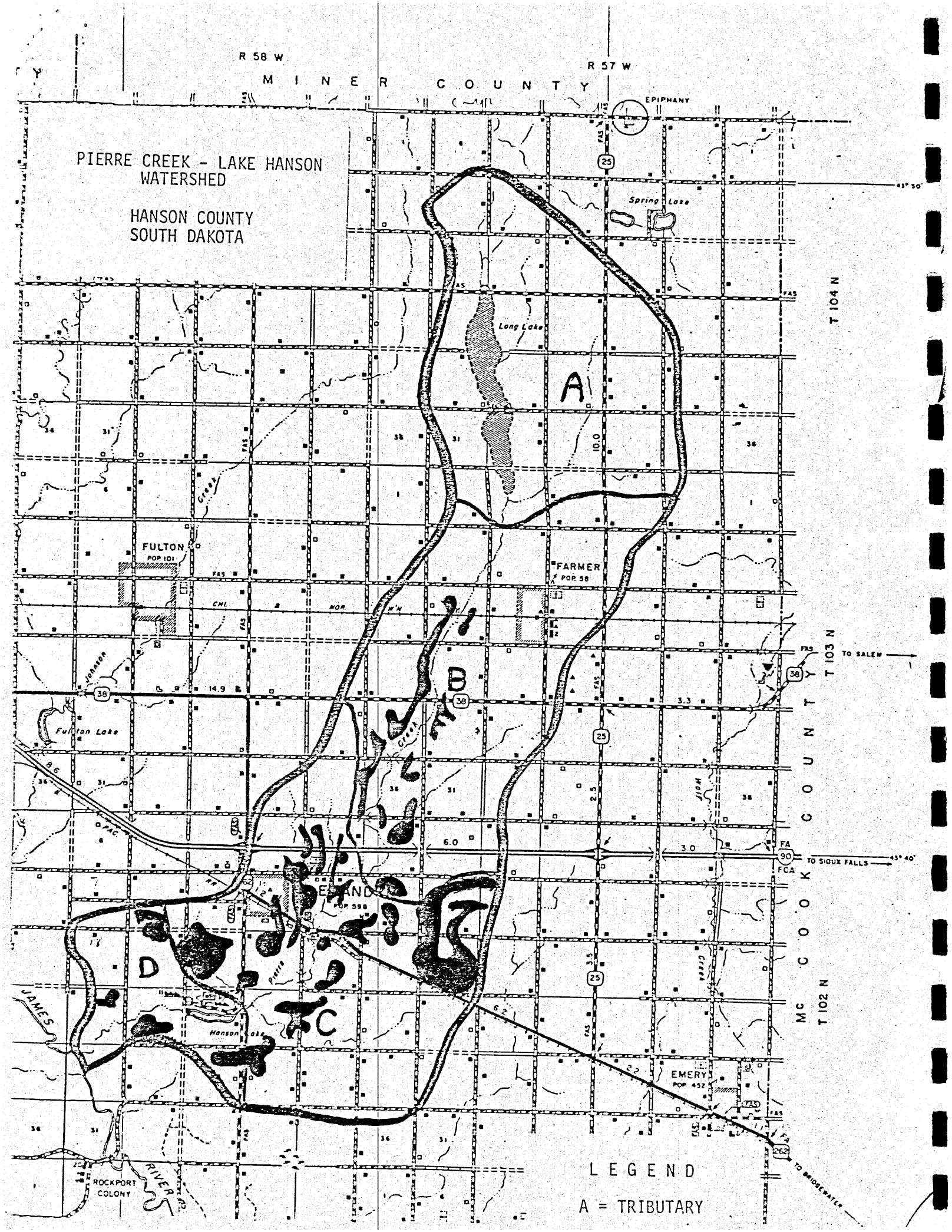

PIERRE CREEK - LAKE HANSON
WATERSHED
HANSON COUNTY
SOUTH DAKOTA
R 58 W
R 57 W
MINER COUNTY
EPIPHANY
Spring Lake
Long Lake
A
B
C
D
FULTON
POP 101
FARMER
POP 58
Fulton Lake
ELKANDER
POP 598
Hanson Lake
EMERY
POP 452
ROCKPORT
COLONY
JAMES
RIVER
TO SALEM
TO SIOUX FALLS
TO BRIDGEWATER
T 104 N
T 103 N
T 102 N
McCOOK COUNTY
43° 50'
43° 40'
LEGEND
A = TRIBUTARY

TABLE 1

LAND USE AND ESTIMATED ACRES NEEDING TREATMENT
PIERRE CREEK - LAKE HANSON WATERSHED

WQSA or SUBWATERSHEDS	LAND USE (Acres) and TREATMENT (Acres and Percent)											
	CROPLAND		GRASSLAND		WOODLAND		FARMSTEAD AND URBAN		NON SEDIMENT CONTRIBUTING[1]		TOTAL	
	AC	%	AC	%	AC	%	AC	%	AC	%	AC	%
Subwatershed "A" Adequately	8,702	100	1,329	100	-	-	534	100	735	100	11,300	100
Treated	6,091	70	399	30	-	-	427	80	656	89	7,573	67
Needs Treatment	2,611	30	930	70	-	-	107	20	79	11	3,727	33
Subwatershed "B" Adequately	10,896	100	1,751	100	-	-	866	100	60	100	13,573	100
Treated	6,538	60	525	30	-	-	693	80	54	90	7,810	58
Needs Treatment	4,358	40	1,226	70	-	-	173	20	6	10	5,763	42
Subwatershed "C" Adequately	9,676	100	1,244	100	-	-	867	100	40	100	11,827	100
Treated	4,838	50	373	30	-	-	694	80	36	90	5,941	50
Needs Treatment	4,838	50	871	70	-	-	173	20	4	10	5,886	50
Subwatershed "D" Adequately	1,146	100	268	100	-	-	187	100	60[2]	100	1,661	100
Treated	458	40	80	30	-	-	150	80	60	100	748	45
Needs Treatment	688	60	188	70	-	-	37	20	-	-	913	55
TOTAL FOR WATERSHED Adequately	30,420	100	4,592	100	-	-	2,454	100	895	100	38,361	100
Treated	17,925	59	1,377	30	-	-	1,964	80	806	90	22,072	58
Needs Treatment	12,495	31	3,215	70	-	-	490	20	89	10	16,289	42

1/ Generally, water, marsh and sloughs
2/ Lake Hanson surface area.

TABLE 2

SOIL EROSION AND SEDIMENT YIELD
PIERRE CREEK - LAKE HANSON WATERSHED AREA

WQSA or Subwatershed		Cropland	Grassland	Sub Total	Channels	Lake shore	Construction [1]	Sub Total	Total	Acre Feet Per Yr. [2]	Percent [3]
Subwatershed "A"	Erosion Tons/Yr.	14,825	145	14,970					14,970		
	Sed. Yield [4] Tons/Yr.										
Subwatershed "B"	Erosion Tons/Yr.	25,866	955	26,821					26,821		
	Sed. Yield [4] Tons/Yr.										
Subwatershed "C"	Erosion Tons/Yr.	37,220	2,760	39,980					39,980		
	Sed. Yield [4] Tons/Yr.	829	61	890					890	.68	0.16
Subwatershed "D"	Erosion Tons/Yr.	5,660	714	6,374		574		574	7,523		
	Sed. Yield [4] Tons/Yr.					574		574	574	.44	0.11
Total	Erosion Tons/Yr.	83,571	4,574	88,145		574		574	88,720		
	Sed. Yield [4] Tons/Yr.					574		574	1,464	1.12	0.27

1/ Not estimated, but has high potential. Planned developments should include a sediment control plan for before, during, and after construction.

2/ Tons converted to acre feet. Sediment in lake volume computed at 60 pounds per cubic foot due to submerged sediment.

3/ Annual sediment yield expressed as a percent of total lake volume. Lake volume of Lake Hanson is 417 acre feet.

4/ Sediment deposited in Lake Hanson.

TABLE 3

BEST MANAGEMENT PRACTICES (Conservation Practices and Measures) 1/ 2/ 3/
PIERRE CREEK - LAKE HANSON WATERSHED AREA

Conservation Practices	Unit	Unit Cost 4/	Subwatershed "A"		Subwatershed "B"		Subwatershed "C"		Subwatershed "D"		Total Watershed	
			Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost	Amount Needed	Cost
		(Dollars)		(Dollars)		(Dollars)		(Dollars)		(Dollars)		(Dollars)
Cropland-30,420 Acres												
Conservation Cropping System	acre	-	8,702	-	10,896	-	9,676	-	1,146	-	30,420	-
Conservation Tillage System	acre	5	6,962	34,810	8,717	43,585	7,741	38,705	917	4,585	24,337	121,685
Grass & Legumes in Rotation	acre	18	1,430	25,740	1,792	32,256	1,590	28,620	188	3,384	5,000	90,000
Grass Waterways	acre	500	-	-	2	1,000	11	5,500	2	1,000	15	7,500
Waste Utilization	acre	3	100	300	200	600	200	600	-	-	500	1,500
Minimize Fall Tillage	acre	-	2,611	-	4,358	-	4,838	-	688	-	12,495	-
Pasture & Hayland Planting	acre	20	10	200	40	800	300	6,000	50	1,000	400	8,000
Minimize Pesticide Use	acre	-	286	-	358	-	318	-	38	-	1,000	-
Windstrip Cropping	acre	6	209	1,254	349	2,094	387	2,322	55	330	1,000	6,000
Terraces	mile	2,112	-	-	-	-	1.5	3,168	.5	1,056	2	4,224
Grassland -4,592 Acres												
Proper Grazing Use	acre	-	1,063	-	1,401	-	995	-	214	-	3,673	-
Pasture and Hayland Planting	acre	20	290	5,800	381	7,620	271	5,420	58	1,160	1,000	20,000
Deferred Grazing	acre	-	347	-	458	-	325	-	70	-	1,200	-
Planned Grazing Systems	acre	-	868	-	1,144	-	813	-	175	-	3,000	-
Livestock Water Stations	acre	1,000	3	3,000	5	5,000	3	3,000	1	1,000	12	12,000
Critical Area Planting	acre	1,000	2	2,000	-	-	6	6,000	2	2,000	10	10,000
Pasture & Hayland Management	acre	-	290	-	381	-	271	-	58	-	1,000	-
Waste Management Systems	acre	20,000	-	-	1	20,000	2	40,000	-	-	3	60,000
Wildlife Upland Habitat Mgmt.	acre	5	12	60	14	70	12	60	2	10	40	200
Wildlife Wetland Habitat Mtnce.	acre	4	300	1,200	300	1,200	100	400	-	-	700	2,800
Farmsteads, Urban & Other, 3,349 acres												
Sediment Control Measures 5/	acre	2,000	-	-	-	-	8	16,000	2	4,000	10	20,000
TOTALS - Total acres - 38,361 acres		-	-	74,364	-	114,225	-	155,795	-	19,525	-	363,909 or 9.49 per acre

1/ Needed to get (Land Adequately Treated).
2/ Refer to Soil Conservation Service Technical Guide for South Dakota 1981.
3/ On site investigation and planning are necessary to determine kinds, locations, sizes, extent & costs of practices (BMP's).
4/ Refer to Soil Conservation Service Cost-Return Handbook for South Dakota 1981.
5/ Examples of measures are: cover and green manure crop, filter strips, lined and grassed waterways, diversions, mulching, sediment basins, streambank protection, and critical area planting.

Appendix D. Water Quality Summary Tables and Figures

Site 46HA01 (HA-1)	Latitude 43 Deg., 38 Min., 45 Sec., Longitude 97 Deg., 45 Min., 53 Sec., Township 102, Range 58, Section 11, NE1/4, SW1/4, SW1/4, SW1/4. This site is on Pierre Creek north of Highway 252 (old Highway 16) below the WWTP and was sampled from 3/20/79 through 10/3/79. The site was relabeled as Site HA-6A and was sampled from 2/19/82 to the end of the project. As of 1/1/83, Site HA-6A was changed back to its original station number of HA-1.
Site 46HA1A (HA-1A)	Latitude 43 Deg., 38 Min., 42 Sec., Longitude 97 Deg., 45 Min., 54 Sec., Township 102N, Range 58W, Section 11, SE1/4, SW1/4, SW1/4, SW1/4. This site was on Pierre Creek south of railroad tracks below the WWTP. Originally, this site was labeled as HA-6 and sampled from 11/30/81 through 5/20/82. As of 5/20/82, Site HA-6 was labeled as Site HA-1A and inactivated.
Site 46HA02 (HA-2)	Latitude 43 Deg., 35 Min., 53 Sec., Longitude 97 Deg., 45 Min., 59 Sec., Township 102N, Range 58W, Section 14, NW1/4, SW1/4, SW1/4, SW1/4. This site was sampled from 3/20/79 through 10/3/79 when it was inactivated. The general site description is Pierre Creek one mile south of WWTP east of bridge.
Site 46HA03 (HA-3)	Latitude 43 Deg., 37 Min., 27 Sec., Longitude 97 Deg., 47 Min., 12 Sec., Township 102N, Range 58W, Section 22, NW1/4, SW1/4, SW1/4, NW1/4. This site is the Pierre Creek inlet to Lake Hanson east of bridge and was sampled from 3/31/79 through 9/3/79. On 4/27/81, this site was relabeled HA-7 but as of 1/1/83, the State's designation was return to its original number.
Site 46HA04 (HA-4)	Latitude 43 Deg., 37 Min., 33 Sec., Longitude 97 Deg., 48 Min., 24 Sec., Township 102N, Range 58W, Section 20, NE1/4, NE1/4, SE1/4, NE1/4. This is the outlet site on Pierre Creek from Lake Hanson west of road. The site was sampled from 3/31/79 through 10/28/79. On 4/27/81 the site was relabeled as HA-9 and sampled from that date through the projects completion. As of 1/1/83, Site HA-9 was changed back to its original station number of HA-4.
Site 46HA05 (HA-5)	Latitude 43 Deg., 44 Min., 45 Sec., Longitude 97 Deg., 42 Min., 03 Sec., Township 103N, Range 57W, Section 5, SW1/4, SW1/4, SE1/4, SW1/4. This site was on Pierre Creek below Long Lake north of the road and was sampled from 3/30/79 through 5/3/79 when the site was inactivated.

Table IV-1. Sample site descriptions on Pierre Creek and Lake Hanson.

Site 46HA06 (HA-6)	Latitude 43 Deg., 39 Min., 33 Sec., Longitude 97 Deg., 44 Min., 37 Sec., Township 102N, Range 58W, Section 1, SW1/4, SE1/4, SW1/4, SW1/4. Located on Pierre Creek the site was 1.4 miles east of Alexandria above WWTP north of road. The site was sampled from 3/31/79 through 10/3/79 as Site HA-6. On 2/19/82, it was relabeled as Site HA-4 and was sampled until the projects completion. As of 1/1/83, Site HA-4 was changed backed to its original designation of HA-6.
Site 46HA07 (HA-7)	Latitude 43 Deg., 37 Min., 30 Sec., Longitude 97 Deg., 47 Min., 41 Sec., Township 102N, Range 58W, Section 21, SE1/4, NW1/4, SW1/4, NE1/4. This site was in-lake at the north shore and was sampled as Site HA-7 from 6/12/79 through 10/28/79. On 4/27/81, the site was renamed HA-8. As of 1/1/83, Site HA-8 was changed back to its original designation of HA-7.
Site 46HA08 (HA-8)	Latitude 43 Deg., 37 Min., 25 Sec., Longitude 97 Deg., 47 Min., 41 Sec., Township 102N, Range 58W, Section 21, SE1/4, SW1/4, SW1/4, NE1/4. This is an in-lake site at the south shore and was sampled from 6/12/79 through 10/28/79 when the site was inactivated.
Site 46HA09 (HA-9)	Latitude 43 Deg., 37 Min., 23 Sec., Longitude 97 Deg., 49 Min., 36 Sec., Township 102N, Range 58W, Section 20, NW1/4, NW1/4, NW1/4, SW1/4. This site was located on Pierre Creek above the confluence with the James River east of road and was sampled from 7/23/79 through 10/28/79 when it was inactivated.
Site 46HA10 (HA-10)	Latitude 43 Deg., 38 Min., 56 Sec., Longitude 97 Deg., 45 Min., 39 Sec., Township 102N, Range 58W, Section 11, SW1/4, SW1/4, NE1/4, SW1/4. The location of this site was on Pierre Creek above WWTP at the confluence with a tributary. Originally, this site was labeled HA-5 and was sampled from 4/27/81 to the end of the project. As of 1/1/83, Site HA-5 was relabeled HA-10.
Site 46HA11 (HA-11)	Latitude 43 Deg., 39 Min., 33 Sec., Longitude 97 Deg., 45 Sec., 31.5 Sec., Township 102N, Range 58W, Section 2, SW1/4, SE1/4, SE1/4, SW1/4. Although this site was established on a Pierre Creek tributary 1/3 mile south of I-90 above a county road, it has not been sampled since created.

Table IV-1. Sample site descriptions on Pierre Creek and Lake Hanson.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642852-0653609

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	14.0031	70.9751	8.42467	24.4000	1.11000	79/03/31	79/09/03
00011	WATER	TEMP	FAHN		13	57.2308	230.361	15.1776	76.0000	34.0000	79/03/31	79/09/03
00020	AIR	TEMP	CENT		12	16.3408	120.129	10.9604	30.0000	.000000	79/03/31	79/09/03
00021	AIR	TEMP	FAHN		12	61.4167	388.813	19.7183	86.0000	32.0000	79/03/31	79/09/03
00300	DO		MG/L		11	9.28181	4.71169	2.17064	13.7000	7.10000	79/04/10	79/09/03
00301	DO	SATUR	PERCENT		2	79.9500	280.844	16.7584	91.8000	68.1000	79/04/17	79/08/06
00310	BOD	5 DAY	MG/L		4	5.50500	6.57032	2.56326	7.83000	1.89000	79/04/17	79/07/05
00400	PH		SU		4	7.77500	.042536	.206244	8.00000	7.50000	79/07/05	79/09/03
00403	LAB	PH	SU		13	7.98230	.036397	.190781	8.30000	7.60000	79/03/31	79/09/03
00410	T ALK	CACO3	MG/L		10	310.800	2048.10	45.2559	379.000	251.000	79/03/31	79/09/03
00500	RESIDUE	TOTAL	MG/L		13	2039.54	121760	348.941	2545.00	1446.00	79/03/31	79/09/03
00515	RESIDUE	DISS-105	C MG/L		13	2013.00	120345	346.908	2502.00	1419.00	79/03/31	79/09/03
00530	RESIDUE	TOT NFLT	MG/L		13	26.5384	169.604	13.0232	56.0000	12.0000	79/03/31	79/09/03
00608	NH3+NH4-	N DISS	MG/L		1	.360000			.360000	.360000	79/03/31	79/03/31
00610	NH3+NH4-	N TOTAL	MG/L		12	.102500	.009166	.095739	.350000	.020000	79/04/06	79/09/03
00613	NO2-N	DISS	MG/L		1	.030000			.030000	.030000	79/03/31	79/03/31
				K	12	.010000	.634E-10	.000008	.010000	.010000	79/04/06	79/09/03
				TOT	13	.011538	.000031	.005547	.030000	.010000	79/03/31	79/09/03
00620	NO3-N	TOTAL	MG/L		8	.312500	.198392	.445412	1.40000	.100000	79/03/31	79/09/03
				K	5	.100000	-.279E-08	.000000	.100000	.100000	79/04/26	79/08/06
				TOT	13	.230769	.127307	.356801	1.40000	.100000	79/03/31	79/09/03
00625	TOT KJEL	N	MG/L		13	.876153	.087559	.295903	1.32000	.450000	79/03/31	79/09/03
00671	PHOS-DIS	ORTHO	MG/L P		1	.105000			.105000	.105000	79/03/31	79/03/31
31616	FEC COLI	MFM-FCBR	/100ML		10	2812.70	.153E+08	3917.73	10000.0	7.00000	79/04/17	79/09/03
70505	T PO4	P-COL	MG/L		13	.121923	.001420	.037687	.200000	.078000	79/03/31	79/09/03
70507	PHOS-T	ORTHO	MG/L P		12	.072167	.000970	.031141	.121000	.022000	79/04/06	79/09/03

Table IV-2.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000—CLASS-00-CSN-RSP-0642852-0653609

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	18.1100	22.5950	4.75342	23.9000	8.33000	81/04/27	81/10/27
00011	WATER	TEMP	FAHN		14	61.8571	174.134	13.1960	75.0000	26.0000	81/04/27	81/12/16
00020	AIR	TEMP	CENT		14	21.2871	151.269	12.2992	32.8000	-.143E+02	81/04/27	81/12/16
00021	AIR	TEMP	FAHN		14	70.2857	490.226	22.1410	91.0000	6.00000	81/04/27	81/12/16
00400	PH		SU		12	7.40833	.546298	.739120	8.10000	5.60000	81/04/27	81/12/16
00500	RESIDUE	TOTAL	MG/L		15	2253.47	10829.7	104.066	2450.00	2056.00	81/04/27	81/12/16
00515	RESIDUE	DISS-105	C MG/L		15	2180.67	12728.0	112.818	2444.00	1958.00	81/04/27	81/12/16
00530	RESIDUE	TOT NFLT	MG/L		15	72.7667	2081.25	45.6207	170.000	6.00000	81/04/27	81/12/16
00610	NH3+NH4-	N TOTAL	MG/L		15	.136000	.003911	.062542	.280000	.050000	81/04/27	81/12/16
00613	NO2-N	DISS	MG/L	K	15	.010000	.498E-10	.000007	.010000	.010000	81/04/27	81/12/16
00620	NO3-N	TOTAL	MG/L		4	.200000	-.198E-07	.000000	.200000	.200000	81/07/07	81/12/16
				K	11	.100000	.178E-07	.000134	.100000	.100000	81/04/27	81/10/27
				TOT	15	.126667	.002095	.045774	.200000	.100000	81/04/27	81/12/16
00625	TOT KJEL	N	MG/L		15	.728666	.285812	.534614	2.46000	.240000	81/04/27	81/12/16
00671	PHOS-DIS	ORTHO	MG/L P		3	.246333	.123972	.352097	.651000	.010000	81/05/11	81/11/30
31616	FEC COLI	MFM-FCBR	/100ML		14	2496.64	.180E+08	4249.43	14000.0	10.0000	81/04/27	81/12/16
70505	T PO4	P-COL	MG/L		3	.118667	.000569	.023861	.146000	.102000	81/04/27	81/06/23
70506	SOL PO4-.	T P-COL	MG/L		12	.133250	.004475	.066894	.264000	.051000	81/05/26	81/12/16
70507	PHOS-T	ORTHO	MG/L P		12	.116916	.004767	.069045	.252000	.037000	81/04/27	81/12/16

Table IV-2. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642852-0653609

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER			RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010 WATER	TEMP	CENT		38	8.39549	56.0235	7.48489	24.4000	-.610E+01	82/01/20	82/12/27
00011 WATER	TEMP	FAHN		41	48.3658	189.589	13.7691	76.0000	21.0000	82/01/20	82/12/27
00020 AIR	TEMP	CENT		41	12.8651	121.088	11.0040	30.0000	-.138E+02	82/01/20	82/12/27
00021 AIR	TEMP	FAHN		41	55.1707	392.597	19.8141	86.0000	7.00000	82/01/20	82/12/27
00310 BOD	5 DAY	MG/L		1	23.0000			23.0000	23.0000	82/05/20	82/05/20
00400 PH		SU		40	7.56498	.267121	.516838	8.20000	5.80000	82/01/20	82/12/27
00500 RESIDUE	TOTAL	MG/L		42	2166.67	104298	322.952	3070.00	1129.00	82/01/20	82/12/27
00530 RESIDUE	TOT NFLT	MG/L		41	67.8049	7793.56	88.2812	415.000	1.00000	82/02/18	82/12/27
			K	1	1.00000			1.00000	1.00000	82/01/20	82/01/20
			TOT	42	66.2143	7709.73	87.8051	415.000	1.00000	82/01/20	82/12/27
00610 NH3+NH4-	N TOTAL	MG/L		41	.204878	.017195	.131131	.590000	.020000	82/01/20	82/12/27
00613 NO2-N	DISS	MG/L	K	41	.010244	.000002	.001562	.020000	.010000	82/01/20	82/12/27
00619 UN-IONZD	NH3-NH3	MG/L		2	.001500	.000004	.002121	.003000	.000000	82/01/20	82/03/23
00620 NO3-N	TOTAL	MG/L		16	.256250	.035958	.189626	.700000	.100000	82/01/20	82/12/27
			K	25	.100000	.769E-07	.000277	.100000	.100000	82/03/22	82/10/27
			TOT	41	.160975	.019439	.139424	.700000	.100000	82/01/20	82/12/27
00625 TOT KJEL	N	MG/L		40	.820495	.151726	.389520	1.63000	.110000	82/01/20	82/12/27
00940 CHLORIDE	TOTAL	MG/L		1	10.0000			10.0000	10.0000	82/05/20	82/05/20
00945 SULFATE	SO4-TOT	MG/L		1	1230.00			1230.00	1230.00	82/05/20	82/05/20
31616 FEC COLI	MFM-FCBR	/100ML		33	39186.5	.436E+11	208812	1200000	3.00000	82/02/18	82/12/13
			K	5	7.20000	14.7001	3.83407	10.0000	3.00000	82/03/22	82/04/22
			TOT	38	34031.4	.378E+11	194655	1200000	3.00000	82/02/18	82/12/13
70300 RESIDUE	DISS-180 C	MG/L		42	2100.48	98639.1	314.069	3069.00	1093.00	82/01/20	82/12/27
70505 T PO4	P-COL	MG/L		10	.208800	.026371	.162392	.630000	.060000	82/01/20	82/07/28
70506 SOL PO4-	T P-COL	MG/L		30	.192566	.016474	.128352	.508000	.038000	82/02/18	82/12/27
70507 PHOS-T	ORTHO	MG/L P		40	.153474	.009188	.095852	.390000	.025000	82/01/20	82/12/27

Table IV-2. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642852-0653609

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		20	10.9755	75.9106	8.71267	25.0000	-.388E+01	83/01/18	83/12/14
00011	WATER	TEMP	FAHN		20	51.7500	245.776	15.6773	77.0000	25.0000	83/01/18	83/12/14
00020	AIR	TEMP	CENT		20	10.9495	151.922	12.3257	30.0000	-.127E+02	83/01/18	83/12/14
00021	AIR	TEMP	FAHN		20	51.7000	491.696	22.1742	86.0000	9.00000	83/01/18	83/12/14
00400	PH		SU		20	7.69999	.107370	.327674	8.10000	7.00000	83/01/18	83/12/14
00500	RESIDUE	TOTAL	MG/L		20	2213.70	453075	673.109	4317.00	822.000	83/01/18	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		20	15.0000	175.789	13.2586	51.0000	1.00000	83/01/18	83/12/14
00610	NH3+NH4-	N TOTAL	MG/L		20	.129500	.022079	.148589	.670000	.020000	83/01/18	83/12/14
00613	NO2-N	DISS	MG/L		2	.010000	-.145E-10	.000000	.010000	.010000	83/06/28	83/10/26
				K	18	.010000	.410E-10	.000006	.010000	.010000	83/01/18	83/12/14
00620	NO3-N	TOTAL	MG/L	TOT	20	.010000	.490E-10	.000007	.010000	.010000	83/01/18	83/12/14
					18	.216666	.006177	.078591	.400000	.100000	83/01/18	83/12/14
				K	2	.100000	-.372E-08	.000000	.100000	.100000	83/04/25	83/08/23
00625	TOT KJEL	N	MG/L	TOT	20	.205000	.006816	.082558	.400000	.100000	83/01/18	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		20	.540000	.117537	.342836	1.79000	.170000	83/01/18	83/12/14
					16	1382.50	7286579	2699.37	9100.00	20.0000	83/02/16	83/11/16
				K	2	6.50000	24.5000	4.94975	10.0000	3.00000	83/01/18	83/03/16
70300	RESIDUE	DISS-180	C MG/L	TOT	18	1229.61	6627335	2574.36	9100.00	3.00000	83/01/18	83/11/16
70505	T PO4	P-COL	MG/L		20	2198.70	456755	675.836	4309.00	798.000	83/01/18	83/12/14
70506	SOL PO4-	T P-COL	MG/L		19	.167157	.012867	.113433	.477000	.061000	83/02/16	83/12/14
70507	PHOS-T	ORTHO	MG/L P		1	.064000			.064000	.064000	83/01/18	83/01/18
					20	.110250	.007602	.087188	.366000	.036000	83/01/18	83/12/14

Table IV-2. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642853-0653610

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		31	16.5590	60.8255	7.79907	27.2000	.560000	79/03/31	79/10/28
00011	WATER	TEMP	FAHN		31	61.8064	196.965	14.0344	81.0000	33.0000	79/03/31	79/10/28
00020	AIR	TEMP	CENT		30	18.5433	80.5493	8.97492	30.0000	.000000	79/03/31	79/10/28
00021	AIR	TEMP	FAHN		30	65.4000	261.077	16.1579	86.0000	32.0000	79/03/31	79/10/28
00300	DO		MG/L		29	10.1031	5.87797	2.42445	18.0000	5.60000	79/04/10	79/10/28
00301	DO	SATUR	PERCENT		2	88.0000	72.0000	8.48528	94.0000	82.0000	79/04/17	79/06/05
00310	BOD	5 DAY	MG/L		6	6.56166	7.52100	2.74244	9.30000	1.89000	79/04/17	79/08/08
00400	PH		SU		6	7.19999	1.59609	1.26337	8.40000	5.20000	79/08/19	79/10/28
00403	LAB	PH	SU		27	8.07592	.017710	.133077	8.30000	7.71000	79/03/31	79/08/29
00410	T ALK	CACO3	MG/L		23	250.565	1350.41	36.7479	302.000	184.000	79/03/31	79/08/29
00500	RESIDUE	TOTAL	MG/L		31	1912.90	92377.5	303.937	2364.00	1012.00	79/03/31	79/10/28
00515	RESIDUE	DISS-105	C MG/L		31	1893.74	92391.4	303.960	2346.00	996.000	79/03/31	79/10/28
00530	RESIDUE	TOT NFLT	MG/L		31	19.1452	71.3202	8.44513	50.0000	3.50000	79/03/31	79/10/28
00608	NH3+NH4-	N DISS	MG/L		5	.232000	.032270	.179639	.520000	.090000	79/03/31	79/09/10
00610	NH3+NH4-	N TOTAL	MG/L		11	.110000	.016780	.129538	.360000	.020000	79/04/06	79/09/24
				K	15	.020000	.532E-09	.000023	.020000	.020000	79/04/23	79/10/28
				TOT	26	.058077	.008768	.093638	.360000	.020000	79/04/06	79/10/28
00613	NO2-N	DISS	MG/L		7	.015714	.000129	.011339	.040000	.010000	79/03/31	79/08/13
				K	24	.010000	.404E-10	.000006	.010000	.010000	79/04/26	79/10/28
				TOT	31	.011290	.000032	.005623	.040000	.010000	79/03/31	79/10/28
00620	NO3-N	TOTAL	MG/L		5	.900000	.350000	.591608	1.80000	.400000	79/03/31	79/04/17
				K	26	.100000	.762E-07	.000276	.100000	.100000	79/04/23	79/10/28
				TOT	31	.229032	.136129	.368957	1.80000	.100000	79/03/31	79/10/28
00625	TOT KJEL	N	MG/L		31	1.05225	.204857	.452611	2.32000	.250000	79/03/31	79/10/28
00671	PHOS-DIS	ORTHO	MG/L P		4	.053500	.007027	.083827	.179000	.008000	79/03/31	79/09/10
				K	1	.005000			.005000	.005000	79/07/01	79/07/01
				TOT	5	.043800	.005741	.075767	.179000	.005000	79/03/31	79/09/10
31616	FEC COLI	MFM-FCBR	/100ML		22	49.5000	6429.50	80.1842	370.000	3.00000	79/05/14	79/10/28
				K	4	3.00000	.000000	.000000	3.00000	3.00000	79/04/17	79/05/03
				TOT	26	42.3461	5693.51	75.4554	370.000	3.00000	79/04/17	79/10/28
70505	T PO4	P-COL	MG/L		31	.099871	.002882	.053688	.292000	.044000	79/03/31	79/10/28
70507	PHOS-T	ORTHO	MG/L P		21	.034143	.002159	.046465	.185000	.005000	79/04/06	79/10/03
				K	5	.008000	.000045	.006708	.020000	.005000	79/05/24	79/10/28
				TOT	26	.029115	.001845	.042951	.185000	.005000	79/04/06	79/10/28

Table IV-3.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642853-0653610

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		15	15.8973	71.0488	8.42905	25.6000	-.389E+01	81/04/27	81/12/17
00011	WATER	TEMP	FAHN		15	60.6000	229.830	15.1602	78.0000	25.0000	81/04/27	81/12/17
00020	AIR	TEMP	CENT		15	20.4573	165.867	12.8789	32.2000	-.143E+02	81/04/27	81/12/17
00021	AIR	TEMP	FAHN		15	68.8000	537.460	23.1832	90.0000	6.00000	81/04/27	81/12/17
00400	PH		SU		11	7.67272	.284228	.533131	8.20000	6.50000	81/04/27	81/12/17
00500	RESIDUE	TOTAL	MG/L		15	2025.53	57888.0	240.599	2272.00	1495.00	81/04/27	81/12/17
00515	RESIDUE	DISS-105 C	MG/L		15	2006.13	53060.6	230.349	2246.00	1491.00	81/04/27	81/12/17
00530	RESIDUE	TOT NFLT	MG/L		15	19.4000	361.401	19.0105	78.0000	3.00000	81/04/27	81/12/17
00610	NH3+NH4-	N TOTAL	MG/L		15	.110000	.002586	.050850	.200000	.040000	81/04/27	81/12/17
00613	NO2-N	DISS	MG/L	K	15	.010000	.498E-10	.000007	.010000	.010000	81/04/27	81/12/17
00619	UN-IONZD	NH3-NH3	MG/L		1	.000000			.000000	.000000	81/12/17	81/12/17
00620	NO3-N	TOTAL	MG/L		2	.350000	.045000	.212132	.500000	.200000	81/04/27	81/12/17
				K	13	.100000	.298E-07	.000173	.100000	.100000	81/05/11	81/11/30
				TOT	15	.133333	.010952	.104654	.500000	.100000	81/04/27	81/12/17
00625	TOT KJEL	N	MG/L		15	.839333	.247449	.497443	2.11000	.160000	81/04/27	81/12/17
00671	PHOS-DIS	ORTHO	MG/L P		2	.046500	.001741	.041719	.076000	.017000	81/05/26	81/07/21
31616	FEC COLI	MFM-FCBR	/100ML		14	221.571	62674.9	250.350	730.000	3.00000	81/04/27	81/12/17
70505	T PO4	P-COL	MG/L		4	.057500	.000150	.012234	.071000	.044000	81/04/27	81/07/07
70506	SOL PO4-	T P-COL	MG/L		11	.064909	.003612	.060097	.231000	.024000	81/05/26	81/12/17
70507	PHOS-T	ORTHO	MG/L P		12	.017667	.000145	.012040	.046000	.005000	81/05/11	81/12/17
				K	1	.005000			.005000	.005000	81/04/27	81/04/27
				TOT	13	.016692	.000145	.012051	.046000	.005000	81/04/27	81/12/17

Table IV-3. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642853-0653610

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		18	11.0428	103.280	10.1627	26.1000	-.500E+01	82/02/18	82/12/27
00011	WATER	TEMP	FAHN		21	52.3809	342.448	18.5054	79.0000	23.0000	82/01/20	82/12/27
00020	AIR	TEMP	CENT		21	15.1271	183.317	13.5394	32.2000	-.138E+02	82/01/20	82/12/27
00021	AIR	TEMP	FAHN		21	59.2381	593.894	24.3699	90.0000	7.00000	82/01/20	82/12/27
00300	DO		MG/L		1	7.20000			7.20000	7.20000	82/08/25	82/08/25
00400	PH		SU		21	7.47142	.382153	.618185	8.00000	5.90000	82/01/20	82/12/27
00500	RESIDUE	TOTAL	MG/L		20	1924.30	46718.3	216.144	2363.00	1581.00	82/01/20	82/12/27
00515	RESIDUE	DISS-105 C	MG/L		2	2154.50	61.0000	7.81025	2160.00	2149.00	82/07/07	82/07/21
00530	RESIDUE	TOT NFLT	MG/L		19	20.2631	436.094	20.8829	78.0000	2.00000	82/01/20	82/12/27
				K	1	1.00000			1.00000	1.00000	82/06/16	82/06/16
00610	NH3+NH4-	N TOTAL	MG/L	TOT	20	19.3000	431.695	20.7773	78.0000	1.00000	82/01/20	82/12/27
					19	.333157	1.15571	1.07504	4.76000	.020000	82/01/20	82/12/27
				K	1	.020000			.020000	.020000	82/11/09	82/11/09
00613	NO2-N	DISS	MG/L	TOT	20	.317499	1.09979	1.04871	4.76000	.020000	82/01/20	82/12/27
00620	NO3-N	TOTAL	MG/L	K	20	.010500	.000005	.002236	.020000	.010000	82/01/20	82/12/27
					2	.300000	.020000	.141421	.400000	.200000	82/02/18	82/03/23
				K	18	.105555	.000556	.023571	.200000	.100000	82/01/20	82/12/27
00625	TOT KJEL	N	MG/L	TOT	20	.125000	.005132	.071635	.400000	.100000	82/01/20	82/12/27
00671	PHOS-DIS	ORTHO	MG/L P		20	1.25249	4.11939	2.02963	9.60000	.170000	82/01/20	82/12/27
31616	FEC COLI	MFM-FCBR	/100ML		1	.076000			.076000	.076000	82/07/21	82/07/21
					17	10598.0	.149E+10	38673.0	160000	3.00000	82/01/20	82/12/13
				K	1	10.0000			10.0000	10.0000	82/03/23	82/03/23
70300	RESIDUE	DISS-180 C	MG/L	TOT	18	10009.8	.141E+10	37601.2	160000	3.00000	82/01/20	82/12/13
70505	T PO4	P-COL	MG/L		18	1877.00	42587.3	206.367	2359.00	1555.00	82/01/20	82/12/27
70506	SOL PO4-	T P-COL	MG/L		6	.068500	.000433	.020801	.088000	.031000	82/01/20	82/07/28
70507	PHOS-T	ORTHO	MG/L P		14	.061571	.001105	.033246	.146000	.027000	82/02/18	82/12/27
					19	.029737	.000464	.021533	.101000	.009000	82/01/20	82/12/27

Table IV-3. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642853-0653610

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		18	11.2722	86.4176	9.29611	26.7000	-.439E+01	83/01/18	83/12/14
00011	WATER	TEMP	FAHN		17	53.2941	277.847	16.6687	80.0000	24.0000	83/01/18	83/12/14
00020	AIR	TEMP	CENT		17	9.96705	167.564	12.9447	30.6000	-.127E+02	83/01/18	83/12/14
00021	AIR	TEMP	FAHN		17	49.9412	542.936	23.3010	87.0000	9.00000	83/01/18	83/12/14
00400	PH		SU		18	7.77777	.170065	.412390	8.20000	6.70000	83/01/18	83/12/14
00500	RESIDUE	TOTAL	MG/L		18	1881.44	258442	508.372	2401.00	429.000	83/01/18	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		18	16.5000	121.794	11.0360	33.0000	1.00000	83/01/18	83/12/14
00610	NH3+NH4-	N TOTAL	MG/L		15	.101333	.007312	.085512	.330000	.020000	83/01/18	83/12/14
				K	3	.020000	-.232E-09	.000000	.020000	.020000	83/03/16	83/10/26
				TOT	18	.087778	.006995	.083635	.330000	.020000	83/01/18	83/12/14
00613	NO2-N	DISS	MG/L	K	18	.010000	.410E-10	.000006	.010000	.010000	83/01/18	83/12/14
00620	NO3-N	TOTAL	MG/L		2	.350000	.005000	.070710	.400000	.300000	83/02/16	83/02/25
				K	16	.100000	.357E-07	.000189	.100000	.100000	83/01/18	83/12/14
				TOT	18	.127778	.006830	.082644	.400000	.100000	83/01/18	83/12/14
00625	TOT KJEL	N	MG/L		18	.774444	.283250	.532212	2.56000	.340000	83/01/18	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		14	309.071	580977	762.218	2900.00	7.00000	83/01/18	83/11/16
				K	2	10.0000	.000000	.000000	10.0000	10.0000	83/03/16	83/04/25
				TOT	16	271.687	513948	716.902	2900.00	7.00000	83/01/18	83/11/16
70300	RESIDUE	DISS-180	C MG/L		18	1864.94	257023	506.974	2396.00	428.000	83/01/18	83/12/14
70505	T PO4	P-COL	MG/L		17	.115882	.005244	.072417	.370000	.058000	83/02/16	83/12/14
70506	SOL PO4-	T P-COL	MG/L		1	.024000			.024000	.024000	83/01/18	83/01/18
70507	PHOS-T	ORTHO	MG/L P		13	.044846	.006029	.077649	.296000	.006000	83/01/18	83/12/14
				K	5	.005000	-.363E-11	.000000	.005000	.005000	83/04/25	83/11/16
				TOT	18	.033778	.004593	.067774	.296000	.005000	83/01/18	83/12/14

Table IV-3. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642854-0653611

/TYPA/AMBNT/LAKE

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		11	19.9627	27.6426	5.25762	25.6000	8.89000	79/06/12	79/10/28
00011	WATER	TEMP	FAHN		11	67.9091	89.4930	9.46007	78.0000	48.0000	79/06/12	79/10/28
00020	AIR	TEMP	CENT		11	22.8673	50.9523	7.13809	31.1000	9.44000	79/06/12	79/10/28
00021	AIR	TEMP	FAHN		11	73.1818	164.966	12.8439	88.0000	49.0000	79/06/12	79/10/28
00300	DO		MG/L		11	9.67272	1.19824	1.09464	11.2000	7.80000	79/06/12	79/10/28
00310	BOD	5 DAY	MG/L		2	5.27000	.009796	.098975	5.34000	5.20000	79/07/31	79/08/08
00400	PH		SU		3	7.80000	.120094	.346546	8.20000	7.60000	79/07/08	79/10/28
00403	LAB	PH	SU		9	8.08111	.004272	.065364	8.20000	8.01000	79/06/12	79/08/29
00410	T ALK	CACO3	MG/L		6	236.167	936.187	30.5972	289.000	206.000	79/06/12	79/08/29
00500	RESIDUE	TOTAL	MG/L		11	2132.55	25752.0	160.474	2374.00	1808.00	79/06/12	79/10/28
00515	RESIDUE	DISS-105	C MG/L		11	2106.91	26568.0	162.997	2364.00	1786.00	79/06/12	79/10/28
00530	RESIDUE	TOT NFLT	MG/L		11	25.6363	150.056	12.2497	49.0000	10.0000	79/06/12	79/10/28
00610	NH3+NH4-	N TOTAL	MG/L		6	.060000	.006960	.083427	.230000	.020000	79/06/12	79/10/28
				K	5	.020000	.407E-09	.000020	.020000	.020000	79/07/05	79/08/29
00613	NO2-N	DISS	MG/L	TOT	11	.041818	.003916	.062581	.230000	.020000	79/06/12	79/10/28
00620	NO3-N	TOTAL	MG/L	K	11	.010000	.465E-10	.000007	.010000	.010000	79/06/12	79/10/28
					1	.100000			.100000	.100000	79/07/31	79/07/31
				K	10	.100000	.000000	.000000	.100000	.100000	79/06/12	79/10/28
00625	TOT KJEL	N	MG/L	TOT	11	.100000	.178E-07	.000134	.100000	.100000	79/06/12	79/10/28
31616	FEC COLI	MFM-FCBR	/100ML		11	1.35000	.421217	.649013	3.08000	.700000	79/06/12	79/10/28
70505	T PO4	P-COL	MG/L		10	195.300	27964.9	167.227	530.000	6.00000	79/06/12	79/10/28
70507	PHOS-T	ORTHO	MG/L P		11	.085000	.000316	.017771	.102000	.050000	79/06/12	79/10/28
					10	.020700	.000063	.007945	.038000	.010000	79/06/12	79/10/28
				K	1	.005000			.005000	.005000	79/07/05	79/07/05
				TOT	11	.019273	.000079	.008900	.038000	.005000	79/06/12	79/10/28

Table IV-4.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642854-0653611

/TYPA/AMBNT/LAKE

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	17.0546	48.1935	6.94215	25.6000	2.22000	81/05/11	81/11/30
00011	WATER	TEMP	FAHN		13	62.6923	155.566	12.4726	78.0000	36.0000	81/05/11	81/11/30
00020	AIR	TEMP	CENT		14	19.6900	169.687	13.0264	32.2000	-.143E+02	81/05/11	81/12/16
00021	AIR	TEMP	FAHN		14	67.4286	550.112	23.4545	90.0000	6.00000	81/05/11	81/12/16
00300	DO		MG/L		15	8.47333	1.37495	1.17258	10.6000	7.20000	81/04/27	81/12/16
00400	PH		SU		12	7.35833	2.41173	1.55297	8.20000	2.50000	81/04/27	81/12/16
00500	RESIDUE	TOTAL	MG/L		15	2043.53	51164.6	226.196	2264.00	1509.00	81/04/27	81/12/16
00515	RESIDUE	DISS-105	C MG/L		15	2024.80	49557.7	222.616	2237.00	1497.00	81/04/27	81/12/16
00530	RESIDUE	TOT NFLT	MG/L		15	18.7333	78.6387	8.86784	36.0000	4.00000	81/04/27	81/12/16
00610	NH3+NH4-	N TOTAL	MG/L		9	.080000	.003650	.060415	.220000	.020000	81/04/27	81/11/30
				K	6	.020000	.512E-09	.000023	.020000	.020000	81/07/21	81/12/16
				TOT	15	.056000	.003011	.054876	.220000	.020000	81/04/27	81/12/16
00613	NO2-N	DISS	MG/L	K	15	.010000	.498E-10	.000007	.010000	.010000	81/04/27	81/12/16
00620	NO3-N	TOTAL	MG/L	K	15	.100000	.425E-07	.000206	.100000	.100000	81/04/27	81/12/16
00625	TOT KJEL	N	MG/L		14	.738571	.114383	.338205	1.46000	.210000	81/04/27	81/12/16
00671	PHOS-DIS	ORTHO	MG/L P	K	2	.010000	-.145E-10	.000000	.010000	.010000	81/05/26	81/07/21
31616	FEC COLI	MFM-FCBR	/100ML		11	23.4545	234.073	15.2995	53.0000	3.00000	81/05/26	81/10/27
				K	3	3.00000	.000000	.000000	3.00000	3.00000	81/04/27	81/12/16
				TOT	14	19.0714	255.918	15.9974	53.0000	3.00000	81/04/27	81/12/16
70505	T PO4	P-COL	MG/L		4	.045750	.000366	.019120	.074000	.034000	81/04/27	81/07/07
70506	SOL PO4-	T P-COL	MG/L		10	.037100	.000229	.015147	.061000	.010000	81/05/26	81/12/16
				K	1	.010000			.010000	.010000	81/09/01	81/09/01
				TOT	11	.034636	.000273	.016530	.061000	.010000	81/05/26	81/12/16
70507	PHOS-T	ORTHO	MG/L P		11	.018091	.000024	.004888	.024000	.007000	81/05/11	81/12/16
				K	2	.005000	.000000	.000000	.005000	.005000	81/04/27	81/09/01
				TOT	13	.016077	.000044	.006639	.024000	.005000	81/04/27	81/12/16

Table IV-4. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109 -
0000 CLASS 00 CSN-RSP 0642854-0653611

/TYPA/AMBNT/LAKE

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		16	9.48499	92.5579	9.62070	25.6000	-.388E+01	82/02/18	82/12/27
00011	WATER	TEMP	FAHN		19	49.7368	306.095	17.4956	78.0000	25.0000	82/01/20	82/12/27
00020	AIR	TEMP	CENT		19	13.3321	167.943	12.9593	30.0000	-.138E+02	82/01/20	82/12/27
00021	AIR	TEMP	FAHN		19	56.0000	543.889	23.3214	86.0000	7.00000	82/01/20	82/12/27
00300	DO		MG/L		18	10.1444	5.19912	2.28016	15.0000	7.00000	82/01/20	82/12/27
00400	PH		SU		19	7.58947	.218791	.467751	8.20000	6.80000	82/01/20	82/12/27
00500	RESIDUE	TOTAL	MG/L		18	1803.94	113972	337.597	2407.00	888.000	82/01/20	82/12/27
00530	RESIDUE	TOT NFLT	MG/L		18	19.5555	316.380	17.7871	77.0000	3.00000	82/01/20	82/12/27
00610	NH3+NH4-	N TOTAL	MG/L		7	.177143	.011791	.108584	.310000	.070000	82/01/20	82/12/27
				K	11	.020000	.745E-09	.000027	.020000	.020000	82/03/23	82/12/13
				TOT	18	.081111	.010375	.101859	.310000	.020000	82/01/20	82/12/27
00613	NO2-N	DISS	MG/L	K	18	.010556	.000006	.002357	.020000	.010000	82/01/20	82/12/27
00620	NO3-N	TOTAL	MG/L		2	.300000	.020000	.141421	.400000	.200000	82/02/18	82/03/23
				K	16	.106250	.000625	.025001	.200000	.100000	82/01/20	82/12/27
				TOT	18	.127778	.005654	.075191	.400000	.100000	82/01/20	82/12/27
00625	TOT KJEL	N	MG/L		18	.630555	.195123	.441728	1.65000	.050000	82/01/20	82/12/27
31616	FEC COLI	MFM-FCBR	/100ML		10	147.100	47304.8	217.497	700.000	7.00000	82/06/16	82/11/09
				K	6	5.33333	13.0667	3.61479	10.0000	3.00000	82/01/20	82/11/29
				TOT	16	93.9375	33411.7	182.789	700.000	3.00000	82/01/20	82/11/29
70300	RESIDUE	DISS-180	C MG/L		18	1784.39	112306	335.121	2400.00	878.000	82/01/20	82/12/27
70505	T PO4	P-COL	MG/L		6	.068167	.000369	.019198	.092000	.041000	82/01/20	82/07/28
70506	SOL PO4-	T P-COL	MG/L		12	.047333	.000414	.020335	.095000	.020000	82/02/18	82/12/27
70507	PHOS-T	ORTHO	MG/L P		18	.027444	.000255	.015979	.067000	.008000	82/01/20	82/12/27

Table IV-4. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642854-0653611

/TYPA/AMBNT/LAKE

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		20	12.9470	93.3776	9.66321	26.7000	-.388E+01	83/01/18	83/12/14
00011	WATER	TEMP	FAHN		20	55.3000	302.117	17.3815	80.0000	25.0000	83/01/18	83/12/14
00020	AIR	TEMP	CENT		20	11.7235	160.408	12.6652	30.6000	-.127E+02	83/01/18	83/12/14
00021	AIR	TEMP	FAHN		20	53.1000	518.938	22.7802	87.0000	9.00000	83/01/18	83/12/14
00300	DO		MG/L		19	9.99473	1.52279	1.23401	12.2000	7.30000	83/01/18	83/12/14
00400	PH		SU		20	7.88999	.144133	.379648	8.50000	7.10000	83/01/18	83/12/14
00500	RESIDUE	TOTAL	MG/L		20	1915.65	204959	452.724	2423.00	516.000	83/01/18	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		20	18.7500	474.513	21.7833	105.000	2.00000	83/01/18	83/12/14
00610	NH3+NH4-	N TOTAL	MG/L		14	.125000	.018027	.134265	.390000	.010000	83/01/18	83/12/14
				K	6	.020000	.512E-09	.000023	.020000	.020000	83/08/08	83/10/26
				TOT	20	.093500	.014771	.121537	.390000	.010000	83/01/18	83/12/14
00613	NO2-N	DISS	MG/L		2	.010000	-.145E-10	.000000	.010000	.010000	83/02/25	83/06/28
				K	18	.010000	.410E-10	.000006	.010000	.010000	83/01/18	83/12/14
				TOT	20	.010000	.490E-10	.000007	.010000	.010000	83/01/18	83/12/14
00620	NO3-N	TOTAL	MG/L		4	.175000	.009167	.095743	.300000	.100000	83/01/18	83/06/28
				K	16	.100000	.357E-07	.000189	.100000	.100000	83/03/16	83/12/14
				TOT	20	.115000	.002395	.048936	.300000	.100000	83/01/18	83/12/14
00625	TOT KJEL	N	MG/L		20	.721999	.067775	.260336	1.23000	.330000	83/01/18	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		11	166.364	121125	348.031	1200.00	10.0000	83/02/16	83/10/26
				K	7	9.00000	7.00000	2.64575	10.0000	3.00000	83/01/18	83/11/16
				TOT	18	105.167	77484.0	278.359	1200.00	3.00000	83/01/18	83/11/16
70300	RESIDUE	DISS-180	C MG/L		20	1896.90	206802	454.754	2401.00	510.000	83/01/18	83/12/14
70505	T PO4	P-COL	MG/L		19	.126368	.005354	.073168	.380000	.051000	83/02/16	83/12/14
70506	SOL PO4-	T P-COL	MG/L		1	.037000			.037000	.037000	83/01/18	83/01/18
70507	PHOS-T	ORTHO	MG/L P		18	.059278	.006073	.077927	.286000	.005000	83/01/18	83/12/14
				K	2	.005000	.000000	.000000	.005000	.005000	83/04/25	83/09/26
				TOT	20	.053850	.005712	.075581	.286000	.005000	83/01/18	83/12/14

Table IV-4. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642855-0653612

/TYPA/AMBNT/LAKE

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	20.9838	29.6846	5.44835	25.6000	8.89000	79/06/25	79/10/28
00011	WATER	TEMP	FAHN		13	69.7692	96.0277	9.79937	78.0000	48.0000	79/06/25	79/10/28
00020	AIR	TEMP	CENT		13	22.7800	48.7034	6.97879	31.1000	9.44000	79/06/25	79/10/28
00021	AIR	TEMP	FAHN		13	73.0000	157.667	12.5565	88.0000	49.0000	79/06/25	79/10/28
00300	DO		MG/L		14	8.82142	2.15877	1.46927	10.4000	5.70000	79/06/12	79/10/28
00310	BOD	5 DAY	MG/L		1	5.25000			5.25000	5.25000	79/08/08	79/08/08
00400	PH		SU		8	7.37499	.859305	.926987	7.90000	5.10000	79/07/16	79/10/28
00403	LAB	PH	SU		10	8.02799	.020047	.141586	8.18000	7.70000	79/06/12	79/09/03
00410	T ALK	CACO3	MG/L		7	270.428	1644.35	40.5506	329.000	212.000	79/06/12	79/09/03
00500	RESIDUE	TOTAL	MG/L		14	2099.07	59143.4	243.194	2377.00	1589.00	79/06/12	79/10/28
00515	RESIDUE	DISS-105	C MG/L		14	2079.07	56953.8	238.650	2331.00	1573.00	79/06/12	79/10/28
00530	RESIDUE	TOT NFLT	MG/L		14	27.1428	169.517	13.0199	54.0000	5.00000	79/06/12	79/10/28
00610	NH3+NH4-	N TOTAL	MG/L		13	.051538	.001764	.042001	.170000	.020000	79/06/12	79/10/28
				K	1	.020000			.020000	.020000	79/07/01	79/07/01
				TOT	14	.049286	.001699	.041224	.170000	.020000	79/06/12	79/10/28
00613	NO2-N	DISS	MG/L		2	.010000	-.145E-10	.000000	.010000	.010000	79/08/08	79/08/13
				K	12	.010000	.634E-10	.000008	.010000	.010000	79/06/12	79/10/28
				TOT	14	.010000	.716E-10	.000008	.010000	.010000	79/06/12	79/10/28
00618	NO3-N	DISS	MG/L	K	1	.100000			.100000	.100000	79/07/01	79/07/01
00620	NO3-N	TOTAL	MG/L		1	.300000			.300000	.300000	79/06/12	79/06/12
				K	12	.100000	.108E-07	.000104	.100000	.100000	79/06/25	79/10/28
				TOT	13	.115384	.003077	.055470	.300000	.100000	79/06/12	79/10/28
00625	TOT KJEL	N	MG/L		14	.861428	.319721	.565439	1.87000	.220000	79/06/12	79/10/28
31616	FEC COLI	MFM-FCBR	/100ML		13	2208.92	.318E+08	5645.07	20000.0	16.0000	79/06/12	79/10/28
70505	T PO4	P-COL	MG/L		14	.101714	.002179	.046677	.234000	.033000	79/06/12	79/10/28
70507	PHOS-T	ORTHO	MG/L P		13	.035077	.001594	.039920	.162000	.009000	79/06/12	79/10/28
				K	1	.005000			.005000	.005000	79/07/05	79/07/05
				TOT	14	.032929	.001536	.039187	.162000	.005000	79/06/12	79/10/28

Table IV-5.

PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA03

QUEJE
1 1150 2000 unn
PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609

/TYPA/AMONT/STREAM/RUNOFF

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 79/03/31 TO 84/01/26

	00400 PH SU	00011 WATER TEMP FAHN	31616 FEC COLI MFM-FCBR /100ML	00300 DO MG/L	00500 RESIDUE TOTAL MG/L	70300 RESIDUE DISS-180 C MG/L	00530 RESIDUE TOT NFLT MG/L	00608 NH3+NH4- N DISS MG/L	00619 UN-IONZD NH3-NH3 MG/L
NO OF VALUES	78	90	82	11	92	64	92	91	76
MEAN	7.606	52.26	16810.3	9.282	2174.	2134.	49.29	0.166	0.0025
MEDIAN	7.800	52.00	215.0	8.600	2227.	2176.	27.00	0.140	0.0022
NO OF VIOLS	3	0	42	0	5	2	15	0	0
PERCENT VIOL	4.	0.	51.	0.	5.	3.	16.	0.	0.
MINIMUM VIOL	5.600	0.0	210.0	0.0	2501.	3069.	97.50	0.0	0.0
MEAN VIOL	6.633	0.0	32778.6	0.0	2989.	3689.	172.10	0.0	0.0
MAXIMUM VIOL	8.500	0.0	1200000.0	0.0	4317.	4309.	415.00	0.0	0.0
MIN CRITERIA	6.500	*********	*********	5.000	*********	*********	*********	*********	*********
MAX CRITERIA	8.300	90.00	200.0	* *******	2500.	2500.	90.00	*********	0.0400

STORET RETRIEVAL DATE 84/06/18 - STAND - VERSION OF APR. 1983
VIOLATIONS ONLY STN 4 PAGE 1.1

Table IV-6.

PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA04

QUEUE
1 1212 2000 unn
PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58W NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
/TYPA/AMBNT/STREAM/RUNOFF 21SDLAKE B20109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 79/03/31 TO 84/01/26

	00400 PH SU	00011 WATER TEMP FAHN	31615 FEC COLI MFM FCBR /100ML	00300 DO MG/L	00500 RESIDUE TOTAL MG/L	70300 RESIDUE DISS-180 C MG/L	00530 RESIDUE TOT NFLT MG/L	00608 NH3+NH4- N DISS MG/L	00619 UN-IONZD NH3-NH3 MG/L
NO OF VALUES	57	85	75	39	85	37	85	85	55
MEAN	7.586	57.27	2516.6	10.006	1935.	1887.	18.49	0.151	0.0029
MEDIAN	7.800	60.00	33.0	9.800	1961.	1882.	17.00	0.060	0.0014
NO OF VIOLS	5	0	15	0	0	0	0	0	0
PERCENT VIOL	9.	0.	20.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	5.200	0.0	240.0	0.0	0.	0.	0.0	0.0	0.0
MEAN VIOL	6.380	0.0	12410.7	0.0	0.	0.	0.0	0.0	0.0
MAXIMUM VIOL	8.400	0.0	100000.0	0.0	0.	0.	0.0	0.0	0.0
MIN CRITERIA	6.500 *********	*********		5.000 *********	*********	*********	*********	*********	
MAX CRITERIA	8.300	90.00	200.0 *********		2500.	2500.	90.00 *********		0.0400

STORET RETRIEVAL DATE 84/06/18 - STAND - VERSION OF APR. 1983 STN 6 PAGE 1.1
VIOLATIONS ONLY

Table IV-7.

PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA007

QUEUE
1 1385 2000 unn
PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS 46HA007
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
/TYPA/AMONT/LAKE 21SDLAKE 020109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 79/06/12 TO 84/01/26

	00400 PH SU	00011 WATER TEMP FAHN	31616 FEC COLI MFM-FCBR /100ML	00300 DO MG/L	00500 RESIDUE TOTAL MG/L	70300 RESIDUE DISS-180 C MG/L	00530 RESIDUE TOT NFLT MG/L	00608 NH3+NH4- N DISS MG/L	00619 UN-IONZD NH3-NH3 MG/L
NO OF VALUES	55	64	59	64	65	39	65	65	52
MEAN	7.667	57.03	95.4	9.622	1960.	1860.	19.89	0.000	0.0015
MEDIAN	7.300	60.50	20.0	9.800	2001.	1872.	18.00	0.020	0.0007
NO OF VIOLS	2	0	7	0	0	0	1	0	0
PERCENT VIOL	4.	0.	12.	0.	0.	0.	2.	0.	0.
MINIMUM VIOL	2.500	0.0	210.0	0.0	0.	0.	105.00	0.0	0.0
MEAN VIOL	5.500	0.0	522.9	0.0	0.	0.	105.00	0.0	0.0
MAXIMUM VIOL	8.500	0.0	1200.0	0.0	0.	0.	105.00	0.0	0.0
MIN CRITERIA	6.500 *********	*********	5.000 *********	*********	*********	*********	*********	*********	
MAX CRITERIA	8.300	90.00	200.0 *********	2500.	2500.	90.00 *********	0.0400		

STORET RETRIEVAL DATE 84/06/18 - STAND - VERSION OF APR. 1983 STN 8 PAGE 1.1
VIOLATIONS ONLY

Table IV-8.

PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS

46HA08

QUEUE

t!

1 1433 2000 unn

PIERRE/CREEK LAKE HANSON CRITERIA VIOLATIONS

46HA08

43 37 23.0 097 47 41.0 2

LAKE HANSON AT THE SOUTH SHORE T102N R58W S21

46061 SOUTH DAKOTA HANSON

MISSOURI RIVER 090600

/TYPA/ANBNT/LAKE

JAMES RIVER

21SDLAKE 820109

0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612

SUMMARY OF VIOLATIONS ON SAMPLES COLLECTED FROM 79/06/12 TO 79/10/28

	00400 PH SU	00011 WATER TEMP FAHN	31616 FEC COLI MFM-FCBR /100ML	00300 DO MG/L	00500 RESIDUE TOTAL MG/L	70300 RESIDUE DISS-180 C MG/L	00530 RESIDUE TOT NFLT MG/L	00608 NH3+NH4- N DISS MG/L	00619 UN-IONZD NH3-NH3 MG/L
NO OF VALUES	8	13	13	14	14	0	14	14	8
MEAN	7.375	69.77	2208.9	8.821	2099.	0.	27.14	0.049	0.0010
MEDIAN	7.600	74.00	130.0	9.200	2160. *********		26.00	0.030	0.0009
NO OF VIOLS	1	0	5	0	0	0	0	0	0
PERCENT VIOL	13.	0.	38.	0.	0.	0.	0.	0.	0.
MINIMUM VIOL	5.100	0.0	210.0	0.0	0.	0.	0.0	0.0	0.0
MEAN VIOL	5.100	0.0	5636.0	0.0	0.	0.	0.0	0.0	0.0
MAXIMUM VIOL	5.100	0.0	29000.0	0.0	0.	0.	0.0	0.0	0.0
MIN CRITERIA	6.500 ********* *********			5.000 ********* *********		*********	*********	*********	
MAX CRITERIA	9.300	90.00	200.0 *********		2500.	2500.	90.00 *********		0.0400

STORET RETRIEVAL DATE 84/06/18 - STAND - VERSION OF APR. 1983

VIOLATIONS ONLY

STN 9 PAGE 1.1

Table IV-9.

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
STATION=21SDLAKE 46HA01					
ORGN	27	0.976	0.423	0.200	2.200
INORGN	26	0.337	0.371	0.170	2.100
STATION=21SDLAKE 46HA02					
ORGN	27	0.882	0.752	0.110	3.750
INORGN	26	0.400	0.646	0.130	3.000
STATION=21SDLAKE 46HA03					
ORGN	12	0.755	0.286	0.430	1.240
INORGN	12	0.246	0.157	0.130	0.660
STATION=21SDLAKE 46HA04					
ORGN	26	1.010	0.475	0.230	2.300
INORGN	26	0.257	0.335	0.130	1.560
STATION=21SDLAKE 46HA05					
ORGN	3	1.787	0.212	1.560	1.980
INORGN	3	0.150	0.000	0.150	0.150
STATION=21SDLAKE 46HA06					
ORGN	22	1.123	0.653	0.140	3.180
INORGN	21	0.171	0.047	0.130	0.310
STATION=21SDLAKE 46HA07					
ORGN	11	1.308	0.657	0.680	3.060
INORGN	11	0.152	0.063	0.130	0.340
STATION=21SDLAKE 46HA08					
ORGN	14	0.812	0.557	0.200	1.850
INORGN	13	0.177	0.064	0.130	0.340
STATION=21SDLAKE 46HA09					
ORGN	9	1.199	0.402	0.650	1.910
INORGN	7	0.259	0.091	0.120	0.410

Table IV-10. Mean concentrations, standard deviations, and maximum and minimum values of organic and inorganic nitrogen observed at the sampling sites on Pierre Creek/ Lake Hanson in 1979.

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
STATION=21SDLAKE 46HA03					
ORGN	15	0.593	0.554	0.040	2.400
INORGN	15	0.273	0.080	0.160	0.390
STATION=21SDLAKE 46HA04					
ORGN	15	0.729	0.529	0.030	2.050
INORGN	15	0.253	0.100	0.170	0.550
STATION=21SDLAKE 46HA07					
ORGN	14	0.684	0.357	0.120	1.430
INORGN	15	0.166	0.055	0.130	0.330
STATION=21SDLAKE 46HA1A					
ORGN	15	0.613	0.385	0.050	1.400
INORGN	15	0.196	0.058	0.130	0.320
STATION=21SDLAKE 46HA10					
ORGN	14	0.769	0.786	0.030	3.250
INORGN	14	0.161	0.041	0.130	0.240

Table IV-11. Mean concentrations, standard deviations, and maximum and minimum values of organic and inorganic nitrogen observed at the sampling sites on Pierre Creek/Lake Hanson in 1981.

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
STATION=21SDLAKE 46HA01					
ORGN	20	0.508	0.392	0.020	1.450
INORGN	21	0.275	0.181	0.130	0.970
STATION=21SDLAKE 46HA03					
ORGN	40	0.616	0.332	0.050	1.400
INORGN	41	0.376	0.242	0.130	1.300
STATION=21SDLAKE 46HA04					
ORGN	20	0.935	1.045	0.090	4.840
INORGN	20	0.453	1.113	0.130	5.170
STATION=21SDLAKE 46HA06					
ORGN	39	0.744	0.597	0.000	3.820
INORGN	39	0.253	0.442	0.090	2.670
STATION=21SDLAKE 46HA07					
ORGN	18	0.549	0.451	0.000	1.630
INORGN	18	0.219	0.151	0.130	0.720
STATION=21SDLAKE 46HA1A					
ORGN	27	0.836	0.746	0.230	3.960
INORGN	27	0.456	0.392	0.190	1.640
STATION=21SDLAKE 46HA10					
ORGN	46	0.605	0.538	-0.010	2.630
INORGN	46	0.318	0.269	0.140	1.650

Table IV-12. Mean concentrations, standard deviations, and maximum and minimum values of organic and inorganic nitrogen observed at the sampling sites on Pierre Creek/Lake Hanson in 1982.

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
STATION=21SDLAKE 46HA01					
ORGN	19	0.544	0.387	0.140	1.880
INORGN	19	0.311	0.237	0.150	1.210
STATION=21SDLAKE 46HA03					
ORGN	20	0.410	0.228	0.100	1.120
INORGN	20	0.344	0.210	0.150	1.080
STATION=21SDLAKE 46HA04					
ORGN	18	0.687	0.510	0.170	2.450
INORGN	18	0.226	0.157	0.130	0.740
STATION=21SDLAKE 46HA06					
ORGN	15	0.457	0.241	0.090	1.000
INORGN	15	0.147	0.028	0.130	0.240
STATION=21SDLAKE 46HA07					
ORGN	20	0.628	0.200	0.310	1.130
INORGN	20	0.218	0.161	0.120	0.700
STATION=21SDLAKE 46HA1A					
ORGN	1	0.460	.	0.460	0.460
INORGN	1	0.370	.	0.370	0.370
STATION=21SDLAKE 46HA10					
ORGN	20	0.485	0.327	0.120	1.550
INORGN	20	0.278	0.202	0.130	1.090

Table IV-13. Mean concentrations, standard deviations, and maximum and minimum values of organic and inorganic nitrogen observed at the sampling sites on Pierre Creek/Lake Hanson in 1983.

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
STATION=21SDLAKE 46HA01					
ORGN	2	0.285	0.007	0.280	0.290
INORGN	0	.	.	.	.
STATION=21SDLAKE 46HA03					
ORGN	2	0.375	0.106	0.300	0.450
INORGN	0	.	.	.	.
STATION=21SDLAKE 46HA04					
ORGN	1	0.430	.	0.430	0.430
INORGN	0	.	.	.	.
STATION=21SDLAKE 46HA06					
ORGN	1	0.550	.	0.550	0.550
INORGN	0	.	.	.	.
STATION=21SDLAKE 46HA07					
ORGN	1	0.340	.	0.340	0.340
INORGN	0	.	.	.	.
STATION=21SDLAKE 46HA10					
ORGN	1	0.300	.	0.300	0.300
INORGN	0	.	.	.	.

Table IV-14. Mean concentrations, standard deviations, and maximum and minimum values of organic and inorganic nitrogen observed at the sampling sites on Pierre Creek/Lake Hanson in 1984.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA01
43 38 45.0 097 45 53.0 2
PIERRE CK AT US HWY 16 T102N R58W SW4 S 11
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642850-0653607

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		27	13.0789	38.1027	6.17274	23.3000	.000000	79/03/20	79/10/03
00011	WATER	TEMP	FAHN		27	55.5555	123.567	11.1161	74.0000	32.0000	79/03/20	79/10/03
00020	AIR	TEMP	CENT		27	15.5670	67.1953	8.19727	28.9000	.000000	79/03/20	79/10/03
00021	AIR	TEMP	FAHN		27	60.0370	217.654	14.7531	84.0000	32.0000	79/03/20	79/10/03
00095	CNDUCTVY	AT 25C	MICROMHO		1	629.000			629.000	629.000	79/03/20	79/03/20
00300	DO		MG/L		25	6.19199	9.60744	3.09959	15.4000	1.70000	79/03/20	79/10/03
00301	DO	SATUR	PERCENT		2	76.2000	3427.93	58.5485	117.600	34.8000	79/04/12	79/07/01
00310	BOD	5 DAY	MG/L		8	5.08749	7.41016	2.72216	11.0000	1.92000	79/03/20	79/08/15
				K	2	1.00000	.000000	.000000	1.00000	1.00000	79/05/03	79/05/24
00335	COD	LOWLEVEL	MG/L	TOT	10	4.26999	8.73371	2.95528	11.0000	1.00000	79/03/20	79/08/15
00400	PH		SU		1	73.0000			73.0000	73.0000	79/03/20	79/03/20
00403	LAB	PH	SU		2	6.65000	.605011	.777824	7.20000	6.10000	79/09/24	79/10/03
00410	T ALK	CACO3	MG/L		25	7.51879	.016958	.130221	7.70000	7.22000	79/03/20	79/09/03
00500	RESIDUE	TOTAL	MG/L		23	344.261	6474.50	80.4643	425.000	85.0000	79/03/20	79/09/03
00515	RESIDUE	DISS-105	C MG/L		27	2134.22	264050	513.858	2710.00	519.000	79/03/20	79/10/03
00530	RESIDUE	TOT NFLT	MG/L		27	2117.89	265426	515.196	2700.00	486.000	79/03/20	79/10/03
					26	16.9423	74.4869	8.63058	38.0000	2.00000	79/03/20	79/10/03
				K	1	1.00000			1.00000	1.00000	79/07/31	79/07/31
00610	NH3+NH4-	N TOTAL	MG/L	TOT	27	16.3518	81.0356	9.00198	38.0000	1.00000	79/03/20	79/10/03
00613	NO2-N	DISS	MG/L		27	.175555	.028041	.167453	.940000	.060000	79/03/20	79/10/03
					5	.012000	.000020	.004472	.020000	.010000	79/03/20	79/05/30
				K	22	.010000	.332E-10	.000006	.010000	.010000	79/04/09	79/10/03
00618	NO3-N	DISS	MG/L	TOT	27	.010370	.000004	.001925	.020000	.010000	79/03/20	79/10/03
00620	NO3-N	TOTAL	MG/L		1	1.80000			1.80000	1.80000	79/03/20	79/03/20
					14	.249999	.182692	.427425	1.70000	.100000	79/03/31	79/09/03
				K	12	.100000	.108E-07	.000104	.100000	.100000	79/05/27	79/10/03
00625	TOT KJEL	N	MG/L	TOT	26	.180769	.100815	.317514	1.70000	.100000	79/03/31	79/10/03
31616	FEC COLI	MFM-FCBR	/100ML		27	1.15185	.286691	.535436	3.14000	.320000	79/03/20	79/10/03
70505	T PO4	P-COL	MG/L		22	4297.41	.386E+08	6217.43	21000.0	7.00000	79/03/20	79/10/03
70507	PHOS-T	ORTHO	MG/L P		27	.245296	.024677	.157088	.920000	.092000	79/03/20	79/10/03
					27	.187925	.014741	.121412	.666000	.074000	79/03/20	79/10/03

Table IV-15.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA01
43 38 45.0 097 45 53.0 2
PIERRE CK AT US HWY 16 T102N R58W SW4 S 11
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642850-0653607

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		16	9.09624	70.7046	8.40860	24.4000	-.443E+01	82/02/19	82/12/27
00011	WATER	TEMP	FAHN		20	49.9500	197.525	14.0543	76.0000	24.0000	82/02/19	82/12/27
00020	AIR	TEMP	CENT		19	15.9957	119.050	10.9110	29.4000	-.610E+01	82/02/19	82/12/27
00021	AIR	TEMP	FAHN		19	60.7895	385.958	19.6458	85.0000	21.0000	82/02/19	82/12/27
00310	BOD	5 DAY	MG/L		10	12.1000	54.5445	7.38542	24.0000	2.00000	82/05/20	82/12/13
00400	PH		SU		20	7.05500	.308889	.555778	7.60000	5.30000	82/02/19	82/12/27
00500	RESIDUE	TOTAL	MG/L		21	2180.43	122045	349.349	2435.00	1013.00	82/02/19	82/12/27
00530	RESIDUE	TOT NFLT	MG/L		21	20.5238	787.562	28.0635	120.000	1.00000	82/02/19	82/12/27
00610	NH3+NH4-	N TOTAL	MG/L		19	.143158	.008690	.093218	.360000	.020000	82/02/19	82/12/27
				K	2	.020000	-.232E-09	.000000	.020000	.020000	82/09/28	82/10/27
				TOT	21	.131428	.009193	.095880	.360000	.020000	82/02/19	82/12/27
00613	NO2-N	DISS	MG/L	K	21	.010476	.000005	.002182	.020000	.010000	82/02/19	82/12/27
00619	UN-IONZD	NH3-NH3	MG/L		2	.002000	.100E-10	.000003	.002000	.002000	82/05/27	82/06/30
00620	NO3-N	TOTAL	MG/L		4	.250000	.056667	.238048	.600000	.100000	82/02/19	82/12/27
				K	17	.105882	.000588	.024255	.200000	.100000	82/05/20	82/11/29
				TOT	21	.133333	.012333	.111056	.600000	.100000	82/02/19	82/12/27
00625	TOT KJEL	N	MG/L		20	.633000	.186906	.432326	1.58000	.060000	82/02/19	82/12/27
00940	CHLORIDE	TOTAL	MG/L		20	25.4999	77.0765	8.77932	36.7000	4.40000	82/05/20	82/12/27
00945	SULFATE	SO4-TOT	MG/L		20	1131.70	27537.7	165.945	1290.00	494.000	82/05/20	82/12/27
31616	FEC COLI	MFM-FCBR	/100ML		20	646.400	525635	725.007	2600.00	3.00000	82/02/19	82/12/13
70300	RESIDUE	DISS-180	C MG/L		21	2159.90	117454	342.715	2422.00	1006.00	82/02/19	82/12/27
70505	T PO4	P-COL	MG/L		10	.221900	.015954	.126310	.515000	.119000	82/05/20	82/07/28
70506	SOL PO4-	T P-COL	MG/L		11	.090000	.003818	.061793	.258000	.044000	82/02/19	82/12/27
70507	PHOS-T	ORTHO	MG/L P		21	.122095	.010087	.100432	.464000	.038000	82/02/19	82/12/27

Table IV-15. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA01
43 38 45.0 097 45 53.0 2
PIERRE CK AT US HWY 16 T102N R58W SW4 S 11
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642850-0653607

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		19	10.7342	67.3692	8.20787	22.2000	-.555E+01	83/01/18	83/12/14
00011	WATER	TEMP	FAHN		19	51.3158	218.007	14.7651	72.0000	22.0000	83/01/18	83/12/14
00020	AIR	TEMP	CENT		19	11.1147	147.536	12.1465	30.0000	-.127E+02	83/01/18	83/12/14
00021	AIR	TEMP	FAHN		19	52.0000	477.444	21.8505	86.0000	9.00000	83/01/18	83/12/14
00310	BOD	5 DAY	MG/L		18	7.83333	23.7941	4.87792	19.0000	1.00000	83/01/18	83/12/14
00400	PH		SU		19	7.47368	.129788	.360261	8.10000	6.50000	83/01/18	83/12/14
00500	RESIDUE	TOTAL	MG/L		19	2331.53	334680	578.515	2991.00	727.000	83/01/18	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		19	20.3684	230.580	15.1848	50.0000	3.00000	83/01/18	83/12/14
00610	NH3+NH4-	N TOTAL	MG/L		19	.162631	.026476	.162715	.800000	.040000	83/01/18	83/12/14
00613	NO2-N	DISS	MG/L		2	.020000	.000200	.014142	.030000	.010000	83/02/16	83/12/14
				K	17	.010000	.436E-10	.000007	.010000	.010000	83/01/18	83/11/16
00620	NO3-N	TOTAL	MG/L	TOT	19	.011053	.000021	.004588	.030000	.010000	83/01/18	83/12/14
					8	.187500	.012679	.112599	.400000	.100000	83/01/18	83/12/14
				K	11	.100000	.178E-07	.000134	.100000	.100000	83/04/25	83/11/16
00625	TOT KJEL	N	MG/L	TOT	19	.136842	.006901	.083070	.400000	.100000	83/01/18	83/12/14
00940	CHLORIDE	TOTAL	MG/L		19	.706315	.283002	.531980	2.68000	.210000	83/01/18	83/12/14
00945	SULFATE	SO4-TOT	MG/L		18	27.5499	33.9437	5.82612	38.9000	14.2000	83/01/18	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		18	1201.61	102191	319.673	1525.00	336.000	83/01/18	83/12/14
70300	RESIDUE	DISS-180	C MG/L		17	720.588	2395028	1547.59	6300.00	10.0000	83/01/18	83/11/16
70505	T PO4	P-COL	MG/L		19	2311.16	331087	575.402	2961.00	707.000	83/01/18	83/12/14
70506	SOL PO4-	T P-COL	MG/L		17	.237941	.020477	.143098	.573000	.074000	83/02/16	83/12/14
70507	PHOS-T	ORTHO	MG/L P		1	.064000			.064000	.064000	83/01/18	83/01/18
					18	.139889	.015327	.123804	.478000	.039000	83/01/18	83/12/14

Table IV-15. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA1A
43 38 42.0 097 45 54.0 2
PIERRE CR JUST BLW RR TR/HA01 102N-58W-S11 CCCD
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663799-0693817

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	16.1977	18.1382	4.25889	23.3000	8.33000	81/04/27	81/10/27
00011	WATER	TEMP	FAHN		14	58.7857	132.798	11.5238	74.0000	28.0000	81/04/27	81/12/16
00020	AIR	TEMP	CENT		14	21.1985	148.297	12.1777	32.2000	-.143E+02	81/04/27	81/12/16
00021	AIR	TEMP	FAHN		14	70.1428	481.058	21.9330	90.0000	6.00000	81/04/27	81/12/16
00400	PH		SU		11	6.96363	.988550	.994258	8.00000	5.00000	81/05/11	81/12/16
00500	RESIDUE	TOTAL	MG/L		15	2305.40	9102.85	95.4089	2529.00	2144.00	81/04/27	81/12/16
00515	RESIDUE	DISS-105	C MG/L		15	2288.40	8728.00	93.4238	2507.00	2135.00	81/04/27	81/12/16
00530	RESIDUE	TOT NFLT	MG/L		15	17.0000	135.429	11.6374	50.0000	5.00000	81/04/27	81/12/16
00610	NH3+NH4-	N TOTAL	MG/L		15	.086000	.003411	.058407	.210000	.020000	81/04/27	81/12/16
00613	NO2-N	DISS	MG/L	K	15	.010000	.498E-10	.000007	.010000	.010000	81/04/27	81/12/16
00620	NO3-N	TOTAL	MG/L		1	.100000			.100000	.100000	81/12/16	81/12/16
				K	14	.100000	.412E-07	.000203	.100000	.100000	81/04/27	81/11/30
				TOT	15	.100000	.425E-07	.000206	.100000	.100000	81/04/27	81/12/16
00625	TOT KJEL	N	MG/L		15	.699333	.140521	.374861	1.46000	.170000	81/04/27	81/12/16
00671	PHOS-DIS	ORTHO	MG/L P		1	.010000			.010000	.010000	81/11/30	81/11/30
				K	1	.010000			.010000	.010000	81/07/21	81/07/21
				TOT	2	.010000	-.145E-10	.000000	.010000	.010000	81/07/21	81/11/30
31616	FEC COLI	MFM-FCBR	/100ML		12	1660.25	5131691	2265.32	5800.00	7.00000	81/04/27	81/12/16
70505	T PO4	P-COL	MG/L		5	.141800	.003081	.055504	.203000	.092000	81/04/27	81/07/07
70506	SOL PO4-	T P-COL	MG/L		10	.118600	.004333	.065829	.254000	.010000	81/06/09	81/12/16
70507	PHOS-T	ORTHO	MG/L P		13	.112461	.003188	.056462	.226000	.026000	81/04/27	81/12/16

Table IV-16.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA1A
43 38 42.0 097 45 54.0 2
PIERRE CR JUST BLW RR TR/HA01 102N-58W-S11 CCCD
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663799-0693817

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		24	9.00750	35.2114	5.93392	25.0000	1.11000	82/02/18	82/05/20
00011	WATER	TEMP	FAHN		27	47.1481	120.516	10.9780	77.0000	28.0000	82/01/20	82/05/20
00020	AIR	TEMP	CENT		27	10.6941	87.7193	9.36586	28.3000	-.138E+02	82/01/20	82/05/20
00021	AIR	TEMP	FAHN		27	51.2592	284.356	16.8628	83.0000	7.00000	82/01/20	82/05/20
00400	PH		SU		23	7.30869	.181707	.426271	7.70000	6.20000	82/01/20	82/05/20
00500	RESIDUE	TOTAL	MG/L		26	2182.69	227119	476.570	2572.00	426.000	82/01/20	82/05/20
00530	RESIDUE	TOT NFLT	MG/L		23	21.9130	609.356	24.6851	99.0000	2.00000	82/01/20	82/05/20
				K	3	1.00000	.000000	.000000	1.00000	1.00000	82/04/07	82/04/21
				TOT	26	19.5000	582.660	24.1383	99.0000	1.00000	82/01/20	82/05/20
00610	NH3+NH4-	N TOTAL	MG/L		27	.235185	.062064	.249127	1.33000	.040000	82/01/20	82/05/20
00613	NO2-N	DISS	MG/L	K	27	.010000	.358E-10	.000006	.010000	.010000	82/01/20	82/05/20
00620	NO3-N	TOTAL	MG/L		9	.433333	.107500	.327872	1.00000	.100000	82/01/20	82/05/20
				K	18	.100000	.525E-07	.000229	.100000	.100000	82/03/22	82/05/19
				TOT	27	.211111	.058718	.242318	1.00000	.100000	82/01/20	82/05/20
00625	TOT KJEL	N	MG/L		27	1.07073	.655430	.809586	4.15000	.420000	82/01/20	82/05/20
00671	PHOS-DIS	ORTHO	MG/L P		1	.051000			.051000	.051000	82/04/19	82/04/19
00940	CHLORIDE	TOTAL	MG/L		2	39.1500	59.4050	7.70747	44.6000	33.7000	82/05/19	82/05/20
00945	SULFATE	SO4-TOT	MG/L		2	1215.00	1250.00	35.3553	1240.00	1190.00	82/05/19	82/05/20
31616	FEC COLI	MFM-FCBR	/100ML		18	4507.05	.269E+09	16402.0	70000.0	3.00000	82/01/20	82/05/20
				K	8	7.37500	13.1250	3.62284	10.0000	3.00000	82/03/31	82/04/20
				TOT	26	3122.54	.187E+09	13690.3	70000.0	3.00000	82/01/20	82/05/20
70300	RESIDUE	DISS-180	C MG/L		26	2163.31	222945	472.170	2570.00	426.000	82/01/20	82/05/20
70505	T PO4	P-COL	MG/L		4	.344750	.051067	.225980	.660000	.125000	82/01/20	82/05/20
70506	SOL PO4-	T P-COL	MG/L		23	.140260	.019503	.139652	.637000	.047000	82/02/18	82/05/13
70507	PHOS-T	ORTHO	MG/L P		26	.117730	.013717	.117119	.637000	.035000	82/01/20	82/05/20

Table IV-16. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA1A
43 38 42.0 097 45 54.0 2
PIERRE CR JUST BLW RR TR/HA01 102N-58W-S11 CCCD
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663799-0693817

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		1	3.89000			3.89000	3.89000	83/04/13	83/04/13
00011	WATER	TEMP	FAHN		1	39.0000			39.0000	39.0000	83/04/13	83/04/13
00020	AIR	TEMP	CENT		1	-.559E+00			-.559E+00	-.559E+00	83/04/13	83/04/13
00021	AIR	TEMP	FAHN		1	31.0000			31.0000	31.0000	83/04/13	83/04/13
00310	BOD	5 DAY	MG/L		1	59.0000			59.0000	59.0000	83/04/13	83/04/13
00400	PH		SU		1	7.80000			7.80000	7.80000	83/04/13	83/04/13
00500	RESIDUE	TOTAL	MG/L		1	1677.00			1677.00	1677.00	83/04/13	83/04/13
00530	RESIDUE	TOT NFLT	MG/L		1	18.0000			18.0000	18.0000	83/04/13	83/04/13
00610	NH3+NH4-	N TOTAL	MG/L		1	.060000			.060000	.060000	83/04/13	83/04/13
00613	NO2-N	DISS	MG/L	K	1	.010000			.010000	.010000	83/04/13	83/04/13
00620	NO3-N	TOTAL	MG/L		1	.300000			.300000	.300000	83/04/13	83/04/13
00625	TOT KJEL	N	MG/L		1	.520000			.520000	.520000	83/04/13	83/04/13
00940	CHLORIDE	TOTAL	MG/L		1	23.5000			23.5000	23.5000	83/04/13	83/04/13
00945	SULFATE	SO4-TOT	MG/L		1	895.000			895.000	895.000	83/04/13	83/04/13
31616	FEC COLI	MFM-FCBR	/100ML		1	1800.00			1800.00	1800.00	83/04/13	83/04/13
70300	RESIDUE	DISS-180	C MG/L		1	1659.00			1659.00	1659.00	83/04/13	83/04/13
70505	T PO4	P-COL	MG/L		1	.247000			.247000	.247000	83/04/13	83/04/13
70507	PHOS-T	ORTHO	MG/L P		1	.168000			.168000	.168000	83/04/13	83/04/13

Table IV-16. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA02
43 37 53.0 097 45 59.0 2
PIERRE CK BELOW WWTP T102N R58W SW4 S 14
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 CLASS 00 CSN-RSP 0642851-0653608

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		27	13.4526	43.1265	6.56708	23.3000	.000000	79/03/20	79/10/03
00011	WATER	TEMP	FAHN		27	56.2222	139.798	11.8236	74.0000	32.0000	79/03/20	79/10/03
00020	AIR	TEMP	CENT		27	15.6252	69.5641	8.34051	29.4000	.000000	79/03/20	79/10/03
00021	AIR	TEMP	FAHN		27	60.1481	225.824	15.0275	85.0000	32.0000	79/03/20	79/10/03
00095	CNDUCTVY	AT 25C	MICROMHO		1	686.000			686.000	686.000	79/03/20	79/03/20
00300	DO		MG/L		24	8.53749	5.46333	2.33738	14.7000	2.40000	79/03/20	79/10/03
00301	DO	SATUR	PERCENT		2	95.9500	.125000	.353553	96.2000	95.7000	79/06/05	79/08/29
00310	BOD	5 DAY	MG/L		9	4.39444	8.92041	2.98671	10.0000	.510000	79/03/20	79/07/31
00335	COD	LOWLEVEL	MG/L		1	76.0000			76.0000	76.0000	79/03/20	79/03/20
00400	PH		SU		8	7.12499	1.18502	1.08859	8.20000	4.60000	79/07/08	79/10/03
00403	LAB	PH	SU		25	7.77879	.024394	.156185	8.10000	7.35000	79/03/20	79/08/29
00410	T ALK	CACO3	MG/L		22	326.491	5589.23	74.7612	394.000	94.8000	79/03/20	79/08/29
00500	RESIDUE	TOTAL	MG/L		27	2036.63	215743	464.482	2512.00	568.000	79/03/20	79/10/03
00515	RESIDUE	DISS-105	C MG/L		27	2018.93	217387	466.248	2504.00	546.000	79/03/20	79/10/03
00530	RESIDUE	TOT NFLT	MG/L		27	102.889	195885	442.589	2317.00	2.00000	79/03/20	79/10/03
00610	NH3+NH4-	N TOTAL	MG/L		25	.163599	.042590	.206374	.990000	.020000	79/03/20	79/09/24
				K	2	.020000	-.232E-09	.000000	.020000	.020000	79/06/12	79/10/03
00613	NO2-N	DISS	MG/L	TOT	27	.152962	.040783	.201947	.990000	.020000	79/03/20	79/10/03
					6	.028333	.000897	.029944	.080000	.010000	79/03/20	79/05/21
				K	21	.010000	.349E-10	.000006	.010000	.010000	79/04/09	79/10/03
00618	NO3-N	DISS	MG/L	TOT	27	.014074	.000233	.015257	.080000	.010000	79/03/20	79/10/03
00620	NO3-N	TOTAL	MG/L		1	2.30000			2.30000	2.30000	79/03/20	79/03/20
					19	.326315	.372046	.609956	2.40000	.100000	79/03/28	79/08/19
				K	7	.100000	.000000	.000000	.100000	.100000	79/05/21	79/10/03
00625	TOT KJEL	N	MG/L	TOT	26	.265384	.278353	.527592	2.40000	.100000	79/03/28	79/10/03
00671	PHOS-DIS	ORTHO	MG/L P		27	1.03481	.810068	.900038	4.74000	.130000	79/03/20	79/10/03
31616	FEC COLI	MFM-FCBR	/100ML		1	.170000			.170000	.170000	79/07/31	79/07/31
70505	T PO4	P-COL	MG/L		22	1604.59	.324E+08	5694.73	27000.0	7.00000	79/03/20	79/10/03
70507	PHOS-T	ORTHO	MG/L P		27	.167222	.022585	.150281	.844000	.071000	79/03/20	79/10/03
					26	.116153	.011851	.108864	.577000	.029000	79/03/20	79/10/03

Table IV-17.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA05
43 42 45.0 097 42 03.0 2
PIERRE CK BLW LONG LAKE T103N R57W SW4 SEC5
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820116
0000 CLASS 00 CSN-RSP 0643056-0592834

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		7	5.79142	23.8734	4.88604	13.9000	1.11000	79/03/30	79/05/03
00011	WATER	TEMP	FAHN		7	42.4286	77.2884	8.79138	57.0000	34.0000	79/03/30	79/05/03
00020	AIR	TEMP	CENT		7	5.94000	53.5805	7.31987	13.3000	-.555E+01	79/03/30	79/05/03
00021	AIR	TEMP	FAHN		7	42.7143	174.240	13.2000	56.0000	22.0000	79/03/30	79/05/03
00300	DO		MG/L		5	9.55999	3.99310	1.99827	11.2000	7.10000	79/03/30	79/05/03
00301	DO	SATUR	PERCENT		1	69.4000			69.4000	69.4000	79/04/23	79/04/23
00403	LAB	PH	SU		7	7.88999	.042480	.206108	8.12000	7.51000	79/03/30	79/05/03
00410	T ALK	CACO3	MG/L		7	113.171	1442.24	37.9768	168.000	61.0000	79/03/30	79/05/03
00500	RESIDUE	TOTAL	MG/L		7	514.000	16868.7	129.879	757.000	380.000	79/03/30	79/05/03
00515	RESIDUE	DISS-105	C MG/L		7	491.714	20275.5	142.392	751.000	326.000	79/03/30	79/05/03
00530	RESIDUE	TOT NFLT	MG/L		7	22.2857	335.905	18.3277	54.0000	3.00000	79/03/30	79/05/03
00608	NH3+NH4-	N DISS	MG/L		4	.177500	.006092	.078049	.250000	.110000	79/03/30	79/04/23
00610	NH3+NH4-	N TOTAL	MG/L		3	.040000	.372E-08	.000061	.040000	.040000	79/04/09	79/05/03
00613	NO2-N	DISS	MG/L		4	.010000	-.776E-10	.000000	.010000	.010000	79/03/30	79/04/23
				K	3	.010000	.000000	.000000	.010000	.010000	79/04/17	79/05/03
				TOT	7	.010000	.116E-09	.000011	.010000	.010000	79/03/30	79/05/03
00618	NO3-N	DISS	MG/L		3	1.83333	2.17333	1.47422	3.50000	.700000	79/03/30	79/04/17
00620	NO3-N	TOTAL	MG/L		1	.100000			.100000	.100000	79/05/03	79/05/03
				K	3	.100000	-.186E-08	.000000	.100000	.100000	79/04/09	79/04/26
				TOT	4	.100000	-.248E-08	.000000	.100000	.100000	79/04/09	79/05/03
00625	TOT KJEL	N	MG/L		7	1.87714	.052823	.229833	2.10000	1.53000	79/03/30	79/05/03
00671	PHOS-DIS	ORTHO	MG/L P		4	.249750	.006286	.079286	.367000	.198000	79/03/30	79/04/23
31616	FEC COLI	MFM-FCBR	/100ML	K	4	3.00000	.000000	.000000	3.00000	3.00000	79/04/17	79/05/03
70505	T PO4	P-COL	MG/L		7	.394999	.009624	.098100	.515000	.244000	79/03/30	79/05/03
70507	PHOS-T	ORTHO	MG/L P		3	.327667	.020794	.144202	.425000	.162000	79/04/09	79/05/03

Table IV-18.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA06
43 39 33.0 097 44 37.0 2
PIERRE CK 1.4 MI E OF ALEX. T102N R58W SW4 S 1
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820116
0000 CLASS 00 CSN-RSP 0643057-0592835

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		23	12.4600	48.8981	6.99272	23.9000	.000000	79/03/31	79/10/03
00011	WATER	TEMP	FAHN		23	54.4348	158.443	12.5874	75.0000	32.0000	79/03/31	79/10/03
00020	AIR	TEMP	CENT		23	14.8395	69.3537	8.32789	29.4000	.000000	79/03/31	79/10/03
00021	AIR	TEMP	FAHN		23	58.7391	224.841	14.9947	85.0000	32.0000	79/03/31	79/10/03
00300	DO		MG/L		22	6.48181	7.89394	2.80961	11.2000	1.30000	79/04/09	79/10/03
00301	DO	SATUR	PERCENT		3	82.9333	322.445	17.9568	96.2000	62.5000	79/04/23	79/06/05
00310	BOD	5 DAY	MG/L		1	6.10000			6.10000	6.10000	79/06/05	79/06/05
00403	LAB	PH	SU		22	7.60499	.026739	.163521	7.97000	7.21000	79/03/31	79/09/03
00410	T ALK	CACO3	MG/L		20	334.250	5529.05	74.3576	436.000	201.000	79/03/31	79/09/03
00500	RESIDUE	TOTAL	MG/L		24	2349.29	407290	638.193	3066.00	1232.00	79/03/31	79/10/03
00515	RESIDUE	DISS-105	C MG/L		24	2334.67	406369	637.470	3058.00	1206.00	79/03/31	79/10/03
00530	RESIDUE	TOT NFLT	MG/L		22	15.9545	203.474	14.2644	55.0000	1.00000	79/03/31	79/10/03
				K	2	.500000	.500000	.707107	1.00000	.000000	79/04/23	79/07/30
				TOT	24	14.6667	204.841	14.3123	55.0000	.000000	79/03/31	79/10/03
00608	NH3+NH4-	N DISS	MG/L		2	.295000	.031250	.176777	.420000	.170000	79/03/31	79/04/09
00610	NH3+NH4-	N TOTAL	MG/L		21	.057619	.001229	.035058	.170000	.020000	79/04/06	79/10/03
				K	1	.020000			.020000	.020000	79/04/17	79/04/17
				TOT	22	.055909	.001235	.035140	.170000	.020000	79/04/06	79/10/03
00613	NO2-N	DISS	MG/L		5	.018000	.000320	.017889	.050000	.010000	79/03/31	79/04/23
				K	19	.010000	.388E-10	.000006	.010000	.010000	79/04/17	79/10/03
				TOT	24	.011667	.000067	.008165	.050000	.010000	79/03/31	79/10/03
00618	NO3-N	DISS	MG/L		1	.200000			.200000	.200000	79/04/12	79/04/12
00620	NO3-N	TOTAL	MG/L		5	.480000	.631999	.794984	1.90000	.100000	79/03/31	79/05/24
				K	18	.100000	.525E-07	.000229	.100000	.100000	79/04/09	79/10/03
				TOT	23	.182608	.140593	.374957	1.90000	.100000	79/03/31	79/10/03
00625	TOT KJEL	N	MG/L		23	1.22130	.371174	.609241	3.24000	.290000	79/03/31	79/10/03
				K	1	.200000			.200000	.200000	79/09/24	79/09/24
				TOT	24	1.17875	.398496	.631265	3.24000	.200000	79/03/31	79/10/03
00671	PHOS-DIS	ORTHO	MG/L P		2	.156500	.007081	.084146	.216000	.097000	79/03/31	79/04/09
31616	FEC COLI	MFM-FCBR	/100ML		19	54873.7	.523E+11	228909	1000000	3.00000	79/04/17	79/10/03
70505	T PO4	P-COL	MG/L		24	.487458	.040643	.201601	.855000	.200000	79/03/31	79/10/03
70507	PHOS-T	ORTHO	MG/L P		22	.455909	.035974	.189667	.822000	.198000	79/04/06	79/10/03

Table IV-19.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA06
43 39 33.0 097 44 37.0 2
PIERRE CK 1.4 MI E OF ALEX. T102N R58W SW4 S 1
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820116
0000 CLASS 00 CSN-RSP 0643057-0592835

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		33	7.28787	38.8952	6.23660	18.3000	-.666E+01	82/02/19	82/12/13
00011	WATER	TEMP	FAHN		39	48.2051	172.011	13.1153	79.0000	20.0000	82/02/19	82/12/13
00020	AIR	TEMP	CENT		39	13.6858	99.2465	9.96225	29.4000	-.610E+01	82/02/19	82/12/13
00021	AIR	TEMP	FAHN		39	56.6410	321.921	17.9421	85.0000	21.0000	82/02/19	82/12/13
00400	PH		SU		36	7.38332	.236405	.486215	7.80000	5.50000	82/02/19	82/12/13
00500	RESIDUE	TOTAL	MG/L		38	2534.18	596519	772.346	3219.00	447.000	82/02/19	82/12/13
00530	RESIDUE	TOT NFLT	MG/L		27	14.9630	673.883	25.9593	140.000	1.00000	82/02/19	82/12/13
				K	11	1.00000	.000000	.000000	1.00000	1.00000	82/04/01	82/08/11
				TOT	38	10.9211	514.723	22.6875	140.000	1.00000	82/02/19	82/12/13
00610	NH3+NH4-	N TOTAL	MG/L		21	.100000	.015380	.124016	.400000	.020000	82/02/19	82/12/13
				K	18	.020000	.438E-09	.000021	.020000	.020000	82/03/31	82/11/29
				TOT	39	.063077	.009727	.098626	.400000	.020000	82/02/19	82/12/13
00613	NO2-N	DISS	MG/L	K	39	.010256	.000003	.001601	.020000	.010000	82/02/19	82/12/13
00619	UN-IONZD	NH3-NH3	MG/L		3	.000333	.333E-06	.000577	.001000	.000000	82/03/31	82/08/25
00620	NO3-N	TOTAL	MG/L		4	.874999	.989167	.994569	2.30000	.100000	82/02/19	82/11/29
				K	35	.100285	.000532	.023073	.200000	.010000	82/03/11	82/12/13
				TOT	39	.179743	.135266	.367785	2.30000	.010000	82/02/19	82/12/13
00625	TOT KJEL	N	MG/L		39	.806662	.376636	.613707	3.85000	.050000	82/02/19	82/12/13
00671	PHOS-DIS	ORTHO	MG/L P		4	.575749	.033342	.182599	.708000	.312000	82/02/20	82/12/13
00940	CHLORIDE	TOTAL	MG/L		1	5.70000			5.70000	5.70000	82/06/16	82/06/16
00945	SULFATE	SO4-TOT	MG/L		1	1290.00			1290.00	1290.00	82/06/16	82/06/16
31616	FEC COLI	MFM-FCBR	/100ML		33	5721.57	.325E+09	18041.4	98000.0	3.00000	82/02/19	82/12/13
				K	4	10.0000	.000000	.000000	10.0000	10.0000	82/03/22	82/04/07
				TOT	37	5104.10	.292E+09	17104.4	98000.0	3.00000	82/02/19	82/12/13
70300	RESIDUE	DISS-180	C MG/L		38	2523.37	596604	772.401	3198.00	447.000	82/02/19	82/12/13
70505	T PO4	P-COL	MG/L		7	.782714	.211372	.459752	1.38000	.264000	82/03/22	82/07/14
70506	SOL PO4-	T P-COL	MG/L		32	.441937	.045655	.213670	.980000	.071000	82/02/19	82/12/13
70507	PHOS-T	ORTHO	MG/L P		35	.416942	.039238	.198086	.962000	.024000	82/02/19	82/11/29

Table IV-19. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA06
43 39 33.0 097 44 37.0 2
PIERRE CK 1.4 MI E OF ALEX. T102N R58W SW4 S 1
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820116
0000 CLASS 00 CSN-RSP 0643057-0592835

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		15	11.5993	66.8869	8.17844	22.8000	-.110E+01	83/02/25	83/12/14
00011	WATER	TEMP	FAHN		15	52.8666	216.126	14.7012	73.0000	30.0000	83/02/25	83/12/14
00020	AIR	TEMP	CENT		15	10.8613	144.460	12.0192	28.9000	-.127E+02	83/02/25	83/12/14
00021	AIR	TEMP	FAHN		15	51.5333	467.125	21.6131	84.0000	9.00000	83/02/25	83/12/14
00400	PH		SU		14	7.12857	.057617	.240036	7.90000	7.00000	83/02/25	83/12/14
00500	RESIDUE	TOTAL	MG/L		15	2580.73	448434	669.652	3185.00	1243.00	83/02/25	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		14	7.28571	61.7583	7.85864	27.0000	1.00000	83/02/25	83/12/14
				K	1	1.00000			1.00000	1.00000	83/05/16	83/05/16
00610	NH3+NH4-	N TOTAL	MG/L	TOT	15	6.86667	59.9810	7.74474	27.0000	1.00000	83/02/25	83/12/14
					11	.043636	.000945	.030748	.130000	.020000	83/02/25	83/12/14
				K	4	.020000	.000000	.000000	.020000	.020000	83/03/16	83/10/18
00613	NO2-N	DISS	MG/L	TOT	15	.037333	.000792	.028149	.130000	.020000	83/02/25	83/12/14
00620	NO3-N	TOTAL	MG/L	K	15	.010000	.498E-10	.000007	.010000	.010000	83/02/25	83/12/14
					1	.100000			.100000	.100000	83/12/14	83/12/14
				K	14	.100000	.412E-07	.000203	.100000	.100000	83/02/25	83/11/16
00625	TOT KJEL	N	MG/L	TOT	15	.100000	.425E-07	.000206	.100000	.100000	83/02/25	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		15	.494666	.055584	.235762	1.04000	.220000	83/02/25	83/12/14
					12	905.833	783281	885.032	2700.00	40.0000	83/04/13	83/11/16
				K	1	10.0000			10.0000	10.0000	83/03/16	83/03/16
70300	RESIDUE	DISS-180 C	MG/L	TOT	13	836.923	779740	883.029	2700.00	10.0000	83/03/16	83/11/16
70505	T PO4	P-COL	MG/L		15	2573.93	450662	671.313	3180.00	1223.00	83/02/25	83/12/14
70507	PHOS-T	ORTHO	MG/L P		15	.402400	.035654	.188822	.720000	.173000	83/02/25	83/12/14
					15	.377333	.035813	.189244	.695000	.153000	83/02/25	83/12/14

Table IV-19. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA10
43 38 56.0 097 45 39.0 2
PIERRE CR ABV ALEX STAB POND I02N-58W-S11 CACC
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663800-0693818

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		13	15.2054	14.5104	3.80925	21.1000	8.33000	81/04/27	81/10/27
00011	WATER	TEMP	FAHN		14	56.8571	132.749	11.5217	70.0000	24.0000	81/04/27	81/12/16
00020	AIR	TEMP	CENT		12	20.8816	181.056	13.4557	32.2000	-.155E+02	81/04/27	81/12/16
00021	AIR	TEMP	FAHN		12	69.5833	585.540	24.1979	90.0000	4.00000	81/04/27	81/12/16
00400	PH		SU		11	6.77272	1.33220	1.15421	7.80000	3.50000	81/04/27	81/12/16
00500	RESIDUE	TOTAL	MG/L		14	2320.50	5968.00	77.2528	2474.00	2199.00	81/04/27	81/12/16
00515	RESIDUE	DISS-105	C MG/L		14	2299.64	5635.69	75.0712	2437.00	2174.00	81/04/27	81/12/16
00530	RESIDUE	TOT NFLT	MG/L		11	26.5454	1122.67	33.5063	95.0000	1.00000	81/04/27	81/12/16
				K	3	1.00000	.000000	.000000	1.00000	1.00000	81/06/23	81/10/27
				TOT	14	21.0714	981.918	31.3356	95.0000	1.00000	81/04/27	81/12/16
00610	NH3+NH4-	N TOTAL	MG/L		9	.057778	.001369	.037006	.120000	.030000	81/04/27	81/12/16
				K	5	.020000	.407E-09	.000020	.020000	.020000	81/06/23	81/10/27
				TOT	14	.044286	.001196	.034577	.120000	.020000	81/04/27	81/12/16
00613	NO2-N	DISS	MG/L	K	14	.010000	.537E-10	.000007	.010000	.010000	81/04/27	81/12/16
00620	NO3-N	TOTAL	MG/L		1	.200000			.200000	.200000	81/12/16	81/12/16
				K	13	.100000	.298E-07	.000173	.100000	.100000	81/04/27	81/10/27
				TOT	14	.107143	.000714	.026727	.200000	.100000	81/04/27	81/12/16
00625	TOT KJEL	N	MG/L		14	.813571	.661178	.813128	3.37000	.050000	81/04/27	81/12/16
00671	PHOS-DIS	ORTHO	MG/L P		3	.146667	.010280	.101392	.237000	.037000	81/05/11	81/08/03
31616	FEC COLI	MFM-FCBR	/100ML		14	2015.21	.186E+08	4318.85	14000.0	7.00000	81/04/27	81/12/16
70505	T PO4	P-COL	MG/L		5	.066600	.001543	.039285	.136000	.041000	81/04/27	81/07/07
70506	SOL PO4-	T P-COL	MG/L		9	.120333	.005435	.073723	.247000	.037000	81/06/09	81/12/16
70507	PHOS-T	ORTHO	MG/L P		10	.078300	.002379	.048772	.160000	.027000	81/05/26	81/12/16
				K	1	.005000			.005000	.005000	81/04/27	81/04/27
				TOT	11	.071636	.002629	.051276	.160000	.005000	81/04/27	81/12/16

Table IV-20.

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA10
43 38 56.0 097 45 39.0 2
PIERRE CR ABV ALEX STAB POND I02N-58W-S11 CACC
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663800-0693818

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		35	7.54398	28.0305	5.29439	16.7000	-.332E+01	82/02/18	82/12/27
00011	WATER	TEMP	FAHN		46	48.0217	113.446	10.6511	69.0000	26.0000	82/01/20	82/12/27
00020	AIR	TEMP	CENT		46	12.9660	108.116	10.3979	29.4000	-.138E+02	82/01/20	82/12/27
00021	AIR	TEMP	FAHN		46	55.3261	349.826	18.7036	85.0000	7.00000	82/01/20	82/12/27
00310	BOD	5 DAY	MG/L		9	9.82222	49.2345	7.01673	22.0000	2.00000	82/08/11	82/12/13
00400	PH		SU		44	7.09770	.267964	.517653	7.60000	5.00000	82/01/20	82/12/27
00500	RESIDUE	TOTAL	MG/L		46	2186.65	208439	456.551	3280.00	470.000	82/01/20	82/12/27
00530	RESIDUE	TOT NFLT	MG/L		40	15.9825	240.853	15.5195	66.0000	1.00000	82/02/18	82/12/27
				K	6	1.00000	.000000	.000000	1.00000	1.00000	82/01/20	82/10/13
00610	NH3+NH4-	N TOTAL	MG/L	TOT	46	14.0283	234.766	15.3221	66.0000	1.00000	82/01/20	82/12/27
00613	NO2-N	DISS	MG/L		46	.158260	.016641	.129000	.740000	.030000	82/01/20	82/12/27
					2	.010000	-.145E-10	.000000	.010000	.010000	82/05/20	82/08/11
				K	44	.010227	.000002	.001508	.020000	.010000	82/01/20	82/12/27
00620	NO3-N	TOTAL	MG/L	TOT	46	.010217	.000002	.001474	.020000	.010000	82/01/20	82/12/27
					15	.246666	.062666	.250332	.900000	.100000	82/01/20	82/12/27
				K	31	.103225	.000323	.017963	.200000	.100000	82/03/22	82/11/09
				TOT	46	.150000	.024333	.155991	.900000	.100000	82/01/20	82/12/27
00625	TOT KJEL	N	MG/L		46	.763256	.355517	.596253	2.85000	.100000	82/01/20	82/12/27
00940	CHLORIDE	TOTAL	MG/L		20	22.9000	106.962	10.3422	57.6000	7.20000	82/05/20	82/12/27
00945	SULFATE	SO4-TOT	MG/L		20	1127.25	21544.4	146.780	1290.00	565.000	82/05/20	82/12/27
31616	FEC COLI	MFM-FCBR	/100ML		34	537.559	853864	924.047	4300.00	3.00000	82/02/18	82/12/13
				K	11	8.09091	10.6909	3.26970	10.0000	3.00000	82/01/20	82/04/14
				TOT	45	408.133	693352	832.678	4300.00	3.00000	82/01/20	82/12/13
70300	RESIDUE	DISS-180	C MG/L		46	2172.76	210103	458.370	3264.00	470.000	82/01/20	82/12/27
70505	T PO4	P-COL	MG/L		15	.247199	.038965	.197395	.790000	.058000	82/01/20	82/07/28
70506	SOL PO4-	T P-COL	MG/L		31	.112322	.003664	.060530	.312000	.034000	82/02/18	82/12/27
70507	PHOS-T	ORTHO	MG/L P		46	.112804	.015341	.123859	.782000	.012000	82/01/20	82/12/27

Table IV-20. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA10
43 38 56.0 097 45 39.0 2
PIERRE CR ABV ALEX STAB POND I02N-58W-S11 CACC
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER BASIN 090600
JAMES RIVER BASIN
21SDLAKE 820904
0000 CLASS 00 CSN-RSP 0663800-0693818

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		20	10.1950	67.9877	8.24547	23.3000	-.610E+01	83/01/18	83/12/14
00011	WATER	TEMP	FAHN		20	50.3500	220.346	14.8441	74.0000	21.0000	83/01/18	83/12/14
00020	AIR	TEMP	CENT		20	10.2535	144.603	12.0251	29.4000	-.127E+02	83/01/18	83/12/14
00021	AIR	TEMP	FAHN		20	50.4500	468.367	21.6418	85.0000	9.00000	83/01/18	83/12/14
00310	BOD	5 DAY	MG/L		15	11.2667	202.781	14.2401	61.0000	2.00000	83/01/18	83/11/16
00400	PH		SU		20	7.42499	.153564	.391873	7.90000	6.60000	83/01/18	83/12/14
00500	RESIDUE	TOTAL	MG/L		20	2340.65	322019	567.467	2943.00	711.000	83/01/18	83/12/14
00530	RESIDUE	TOT NFLT	MG/L		20	32.2500	1399.04	37.4037	124.000	1.00000	83/01/18	83/12/14
00610	NH3+NH4-	N TOTAL	MG/L		20	.143500	.018371	.135541	.680000	.020000	83/01/18	83/12/14
00613	NO2-N	DISS	MG/L	K	20	.010000	.367E-10	.000006	.010000	.010000	83/01/18	83/12/14
00620	NO3-N	TOTAL	MG/L		4	.225000	.022500	.150000	.400000	.100000	83/02/16	83/12/14
				K	16	.100000	.357E-07	.000189	.100000	.100000	83/01/18	83/10/26
				TOT	20	.125000	.006184	.078640	.400000	.100000	83/01/18	83/12/14
00625	TOT KJEL	N	MG/L		20	.628999	.184220	.429209	2.23000	.250000	83/01/18	83/12/14
00940	CHLORIDE	TOTAL	MG/L		17	22.8882	19.3242	4.39593	30.1000	10.1000	83/01/18	83/12/14
00945	SULFATE	SO4-TOT	MG/L		17	1130.76	172991	415.922	1590.00	150.000	83/01/18	83/12/14
31616	FEC COLI	MFM-FCBR	/100ML		15	921.333	2476211	1573.60	5600.00	10.0000	83/02/16	83/11/16
				K	3	16.6667	133.334	11.5470	30.0000	10.0000	83/01/18	83/04/25
				TOT	18	770.555	2159604	1469.56	5600.00	10.0000	83/01/18	83/11/16
70300	RESIDUE	DISS-180	C MG/L		20	2308.40	315862	562.016	2936.00	699.000	83/01/18	83/12/14
70505	T PO4	P-COL	MG/L		18	.253666	.017701	.133047	.495000	.074000	83/02/25	83/12/14
70506	SOL PO4-	T P-COL	MG/L		1	.037000			.037000	.037000	83/01/18	83/01/18
70507	PHOS-T	ORTHO	MG/L P		19	.133052	.006169	.078545	.354000	.036000	83/01/18	83/12/14

Table IV-20. (continued)

STORET RETRIEVAL DATE 84/05/14 - INVENT - VERSION OF SEP. 1981

46HA09
43 37 33.0 097 49 36.0 2
PIERRE CK ABV CNFL W JAMES T102N R58W NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820116
0000 CLASS 00 CSN-RSP 0643058-0592861

/TYPA/AMBNT/STREAM/RUNOFF

PARAMETER				RMK	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	BEG DATE	END DATE
00010	WATER	TEMP	CENT		9	21.2889	36.9758	6.08078	28.9000	7.20000	79/07/23	79/10/28
00011	WATER	TEMP	FAHN		9	70.3333	119.753	10.9432	84.0000	45.0000	79/07/23	79/10/28
00020	AIR	TEMP	CENT		9	23.8222	68.8843	8.29965	32.8000	6.70000	79/07/23	79/10/28
00021	AIR	TEMP	FAHN		9	74.8889	223.364	14.9454	91.0000	44.0000	79/07/23	79/10/28
00300	DO		MG/L		9	6.48888	2.93365	1.71279	10.3000	4.60000	79/07/23	79/10/28
00301	DO	SATUR	PERCENT		1	84.4000			84.4000	84.4000	79/10/28	79/10/28
00310	BOD	5 DAY	MG/L		1	6.54000			6.54000	6.54000	79/07/31	79/07/31
00400	PH		SU		1	7.50000			7.50000	7.50000	79/10/28	79/10/28
00403	LAB	PH	SU		6	7.80999	.002148	.046351	7.90000	7.78000	79/07/23	79/08/19
00410	T ALK	CACO3	MG/L		6	226.000	82.4000	9.07744	243.000	217.000	79/07/23	79/08/19
00500	RESIDUE	TOTAL	MG/L		9	2024.33	18454.0	135.845	2224.00	1841.00	79/07/23	79/10/28
00515	RESIDUE	DISS-105	C MG/L		9	1979.33	21960.0	148.189	2172.00	1763.00	79/07/23	79/10/28
00530	RESIDUE	TOT NFLT	MG/L		9	45.0000	427.750	20.6821	78.0000	19.0000	79/07/23	79/10/28
00610	NH3+NH4-	N TOTAL	MG/L		9	.138889	.006886	.082983	.300000	.010000	79/07/23	79/10/28
00613	NO2-N	DISS	MG/L		1	.010000			.010000	.010000	79/08/13	79/08/13
				K	8	.010000	.665E-10	.000008	.010000	.010000	79/07/23	79/10/28
				TOT	9	.010000	.582E-10	.000008	.010000	.010000	79/07/23	79/10/28
00618	NO3-N	DISS	MG/L		1	.100000			.100000	.100000	79/08/08	79/08/08
				K	1	.100000			.100000	.100000	79/08/07	79/08/07
				TOT	2	.100000	-.372E-08	.000000	.100000	.100000	79/08/07	79/08/08
00620	NO3-N	TOTAL	MG/L		2	.100000	-.372E-08	.000000	.100000	.100000	79/08/19	79/09/10
				K	5	.100000	-.279E-08	.000000	.100000	.100000	79/07/23	79/10/28
				TOT	7	.100000	.000000	.000000	.100000	.100000	79/07/23	79/10/28
00625	TOT KJEL	N	MG/L		9	1.33778	.199944	.447150	2.21000	.780000	79/07/23	79/10/28
31616	FEC COLI	MFM-FCBR	/100ML		9	5671.78	.905E+08	9515.11	30000.0	6.00000	79/07/23	79/10/28
70505	T PO4	P-COL	MG/L		9	.144444	.001373	.037058	.187000	.070000	79/07/23	79/10/28
70507	PHOS-T	ORTHO	MG/L P		9	.049778	.000412	.020296	.072000	.018000	79/07/23	79/10/28

Table IV-21.

Figure IV-2.

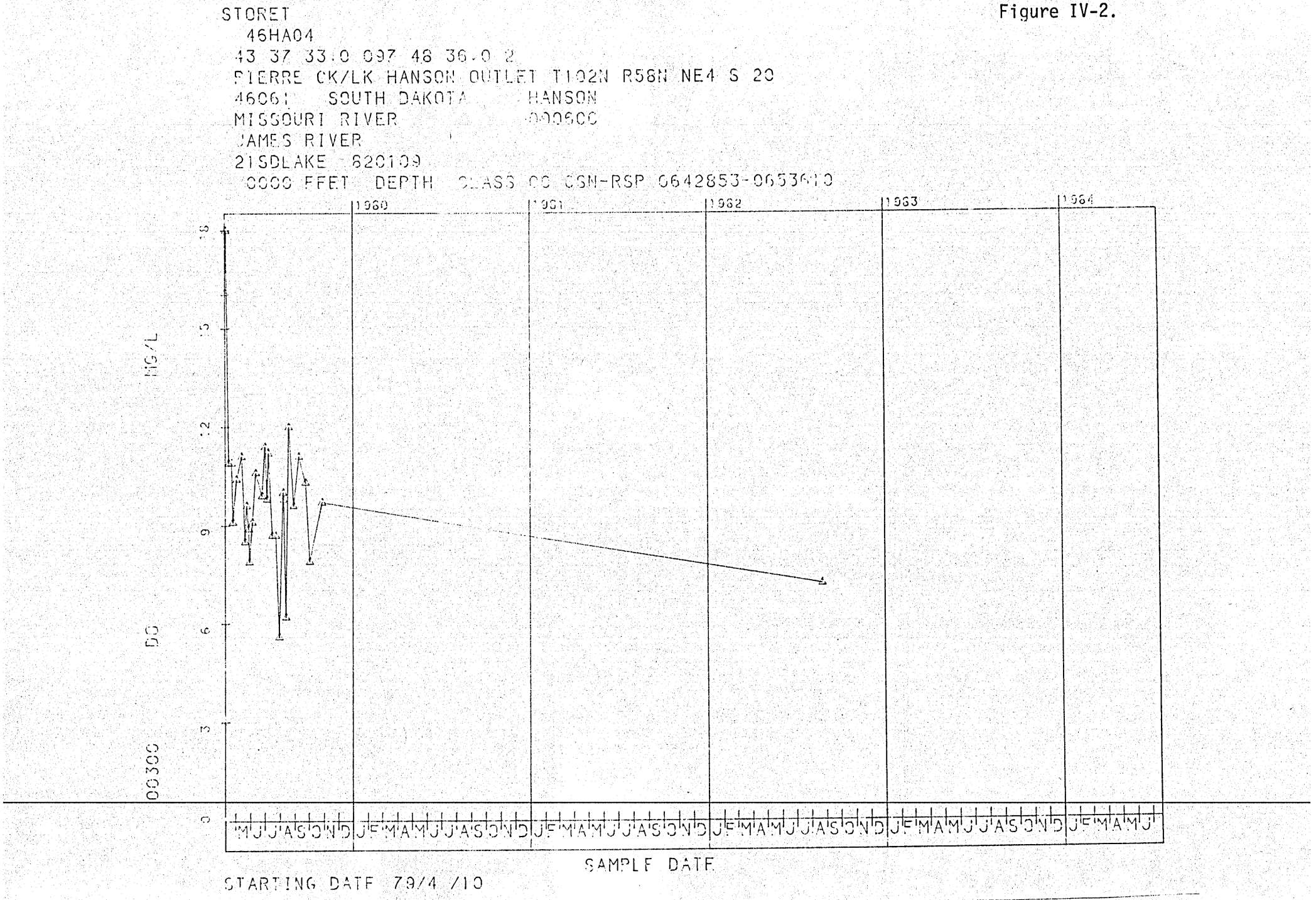
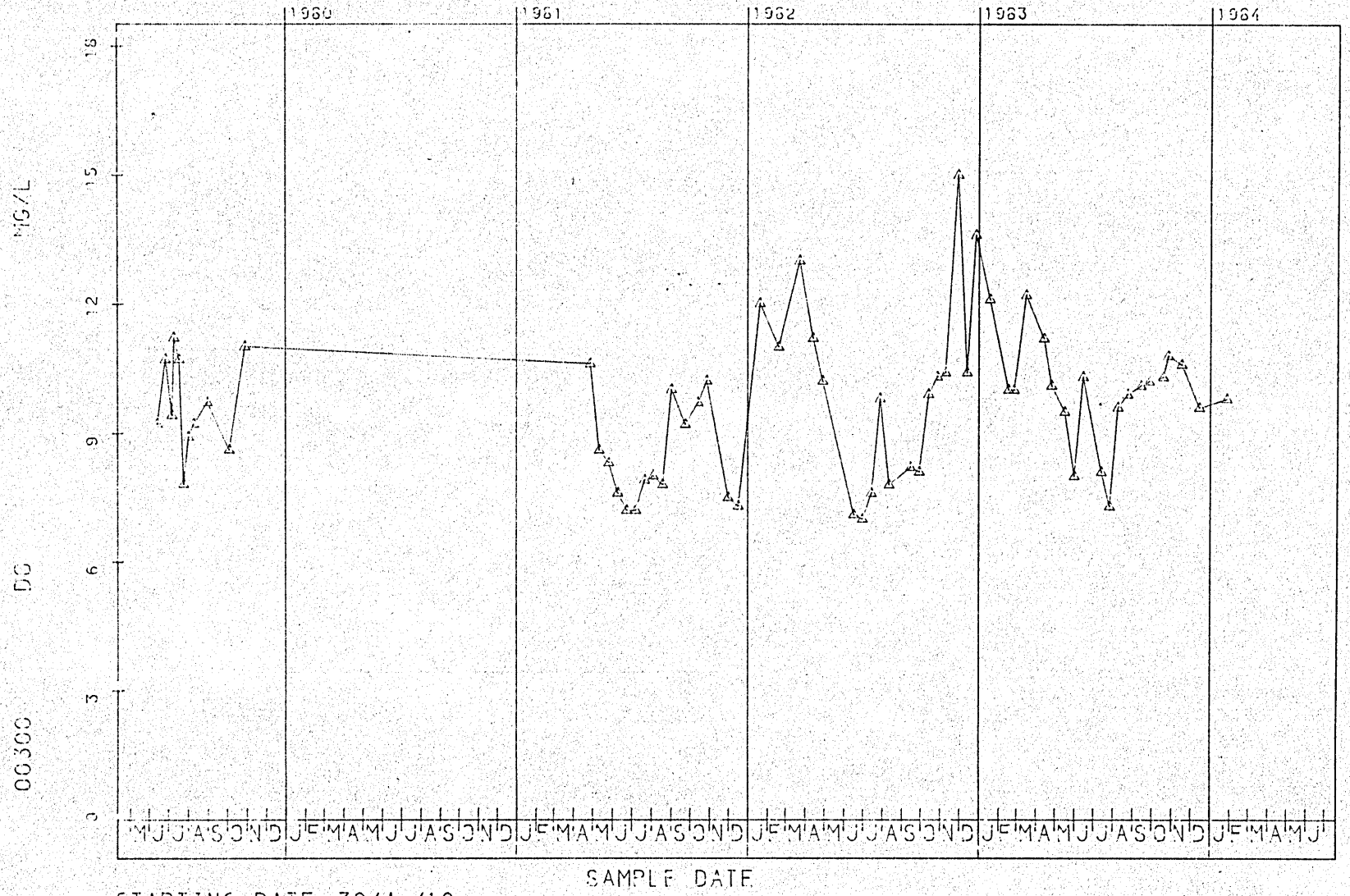

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 000900
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610
1960
1961
1962
1963
1964
MG/L
DO
00300
0
3
6
9
12
15
MJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJ
SAMPLE DATE
STARTING DATE 79/4 /10

Figure IV-3.

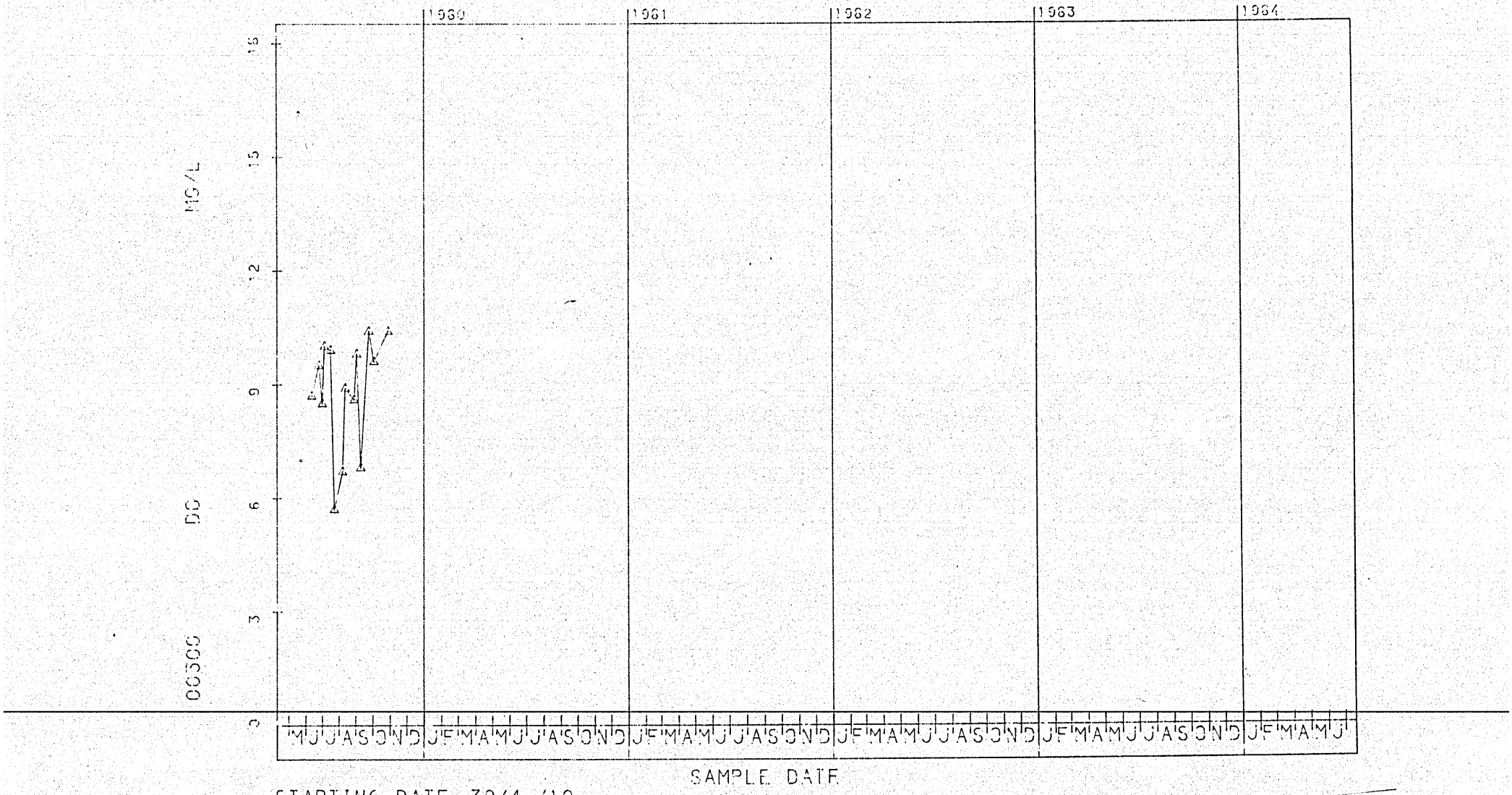
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642854-0653611



STARTING DATE 79/4 /10

Figure IV-4.

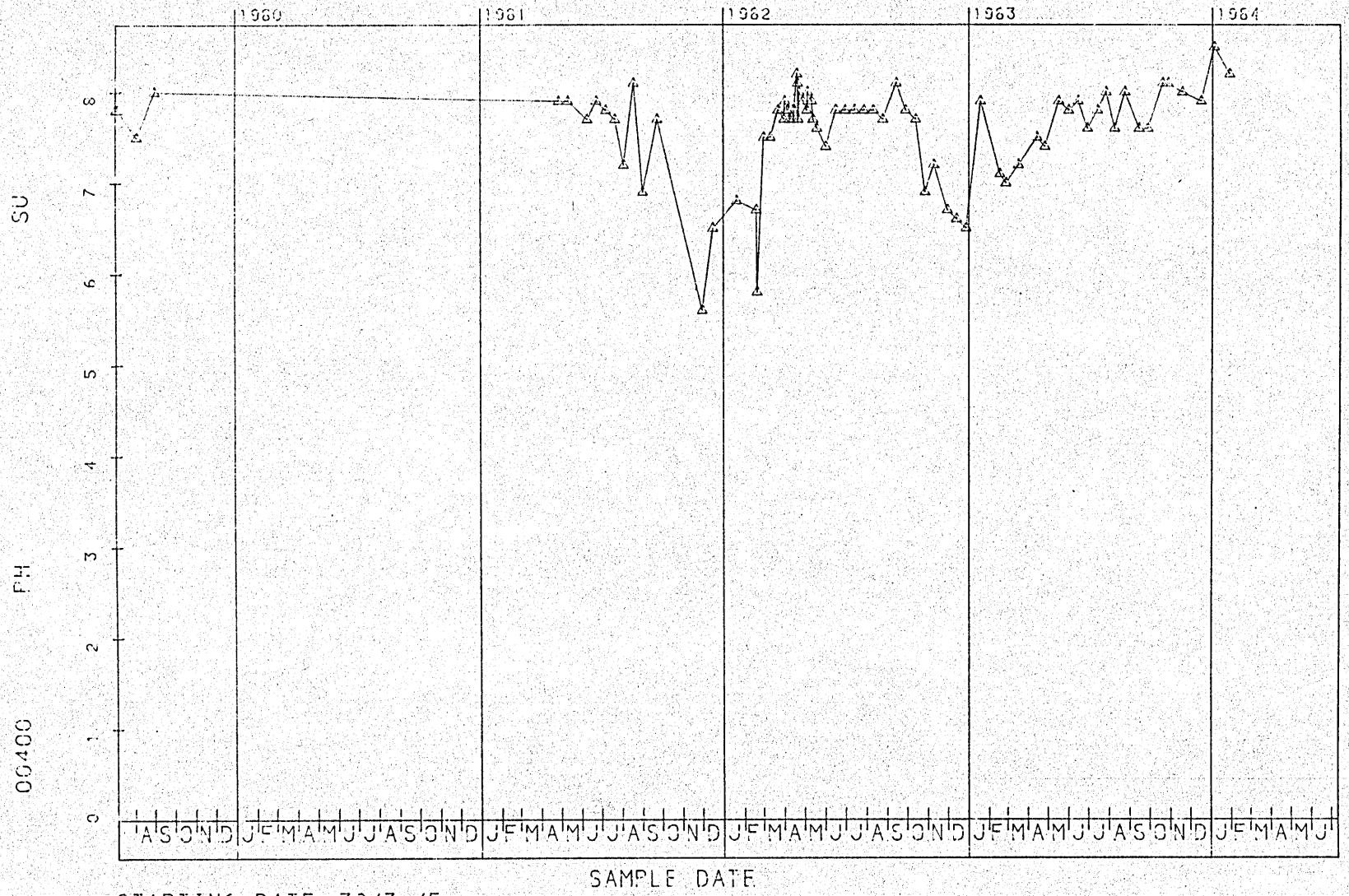
STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642855-0653612



STARTING DATE 7904 /10

Figure IV-5.

STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642852-0653609



STARTING DATE 79/7 /5

Figure IV-6.

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 000600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610

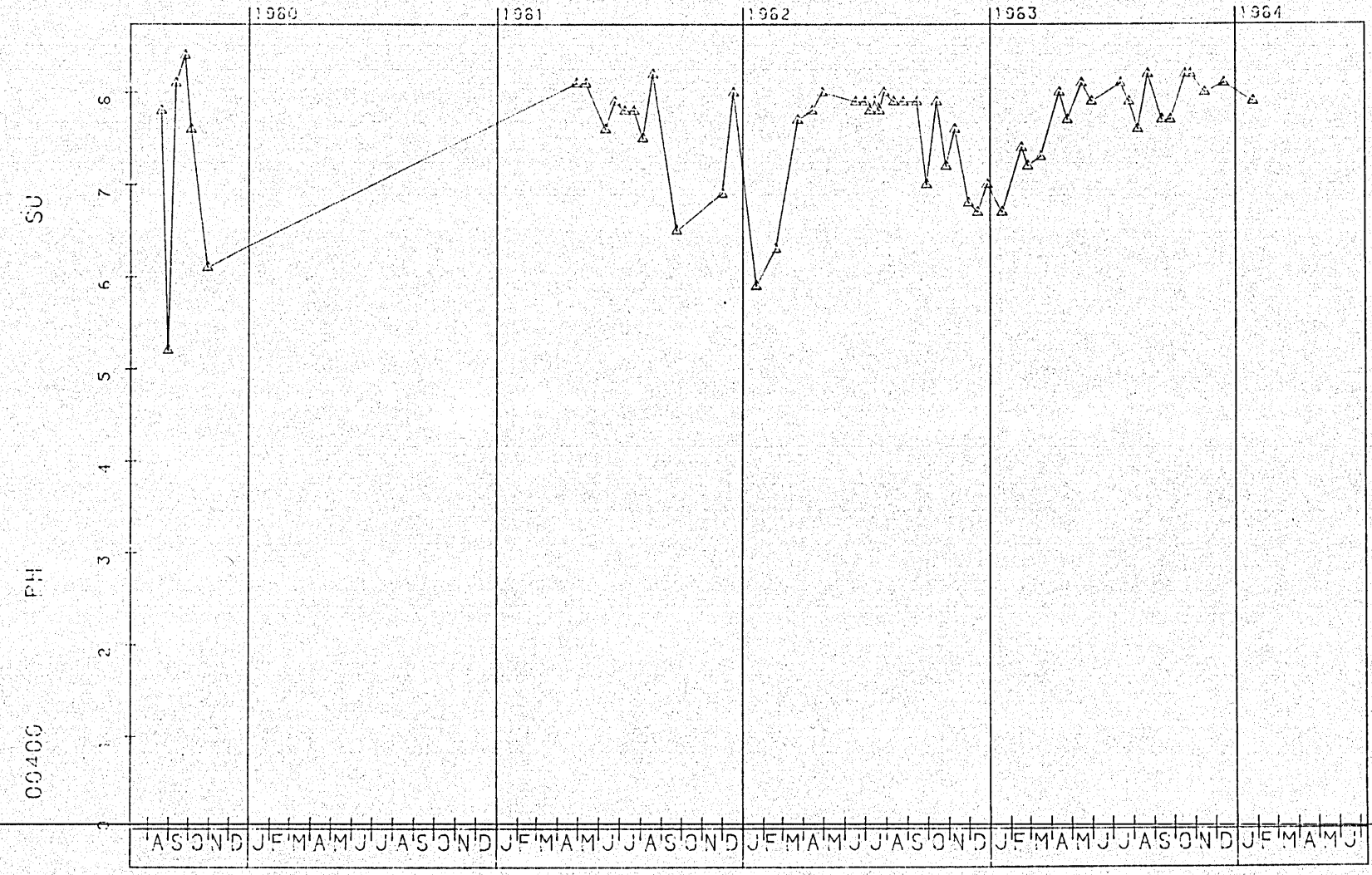
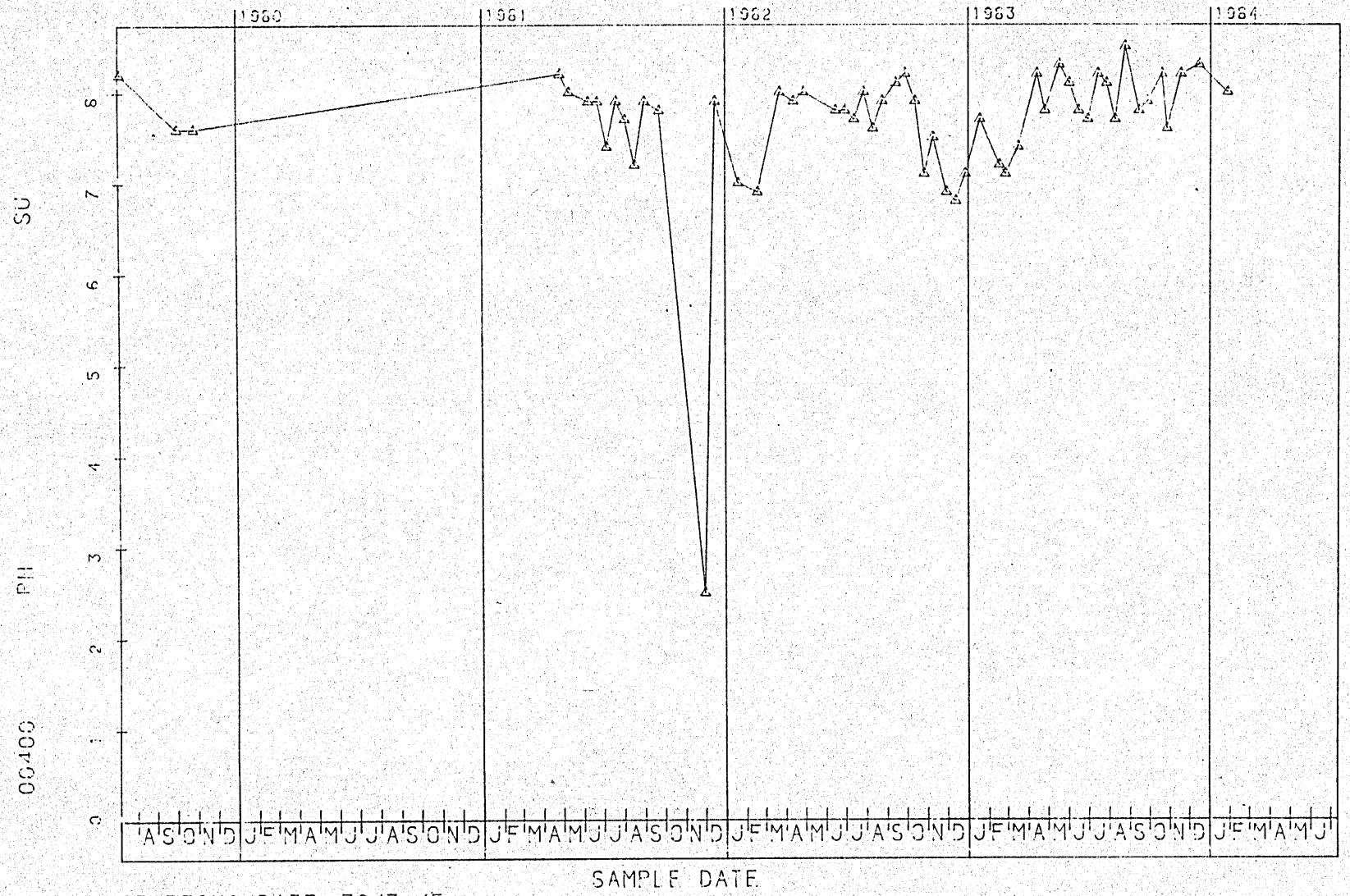


Figure IV-7.

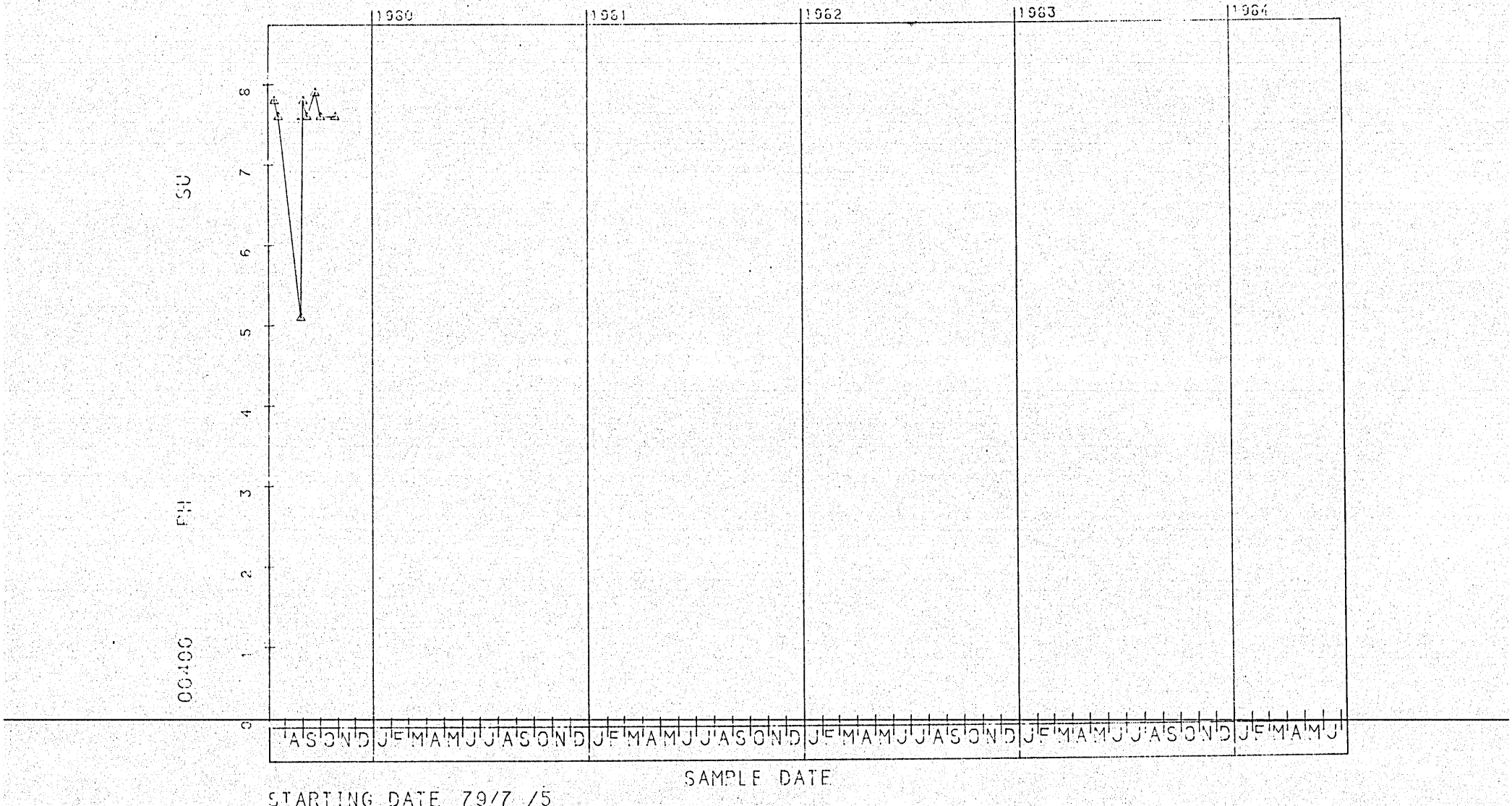
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611



STARTING DATE 79/7 /5

Figure IV-8.

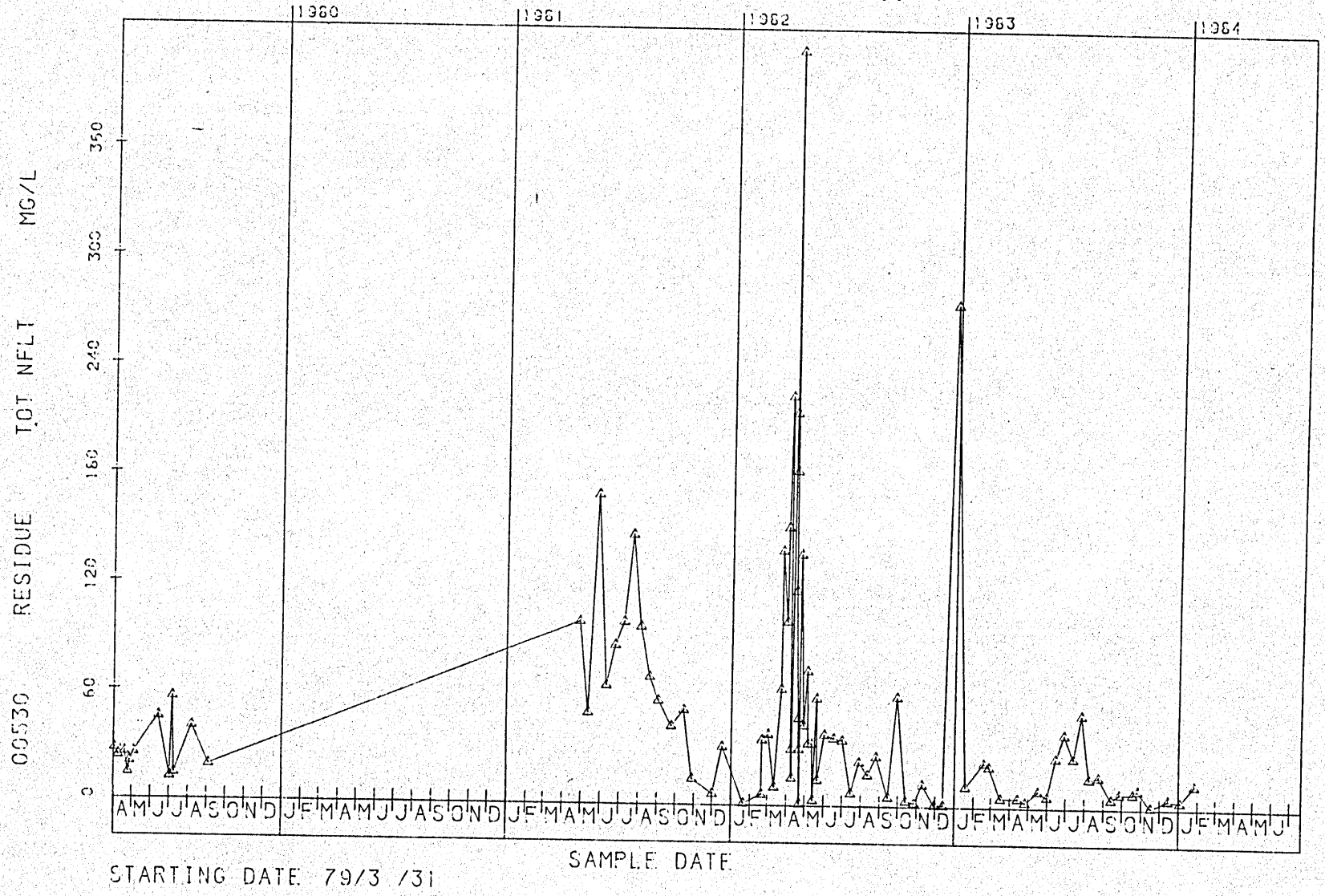
STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STARTING DATE 79/7 /5

Figure IV-9.

STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609



STARTING DATE 79/3 /31

Figure IV-10.

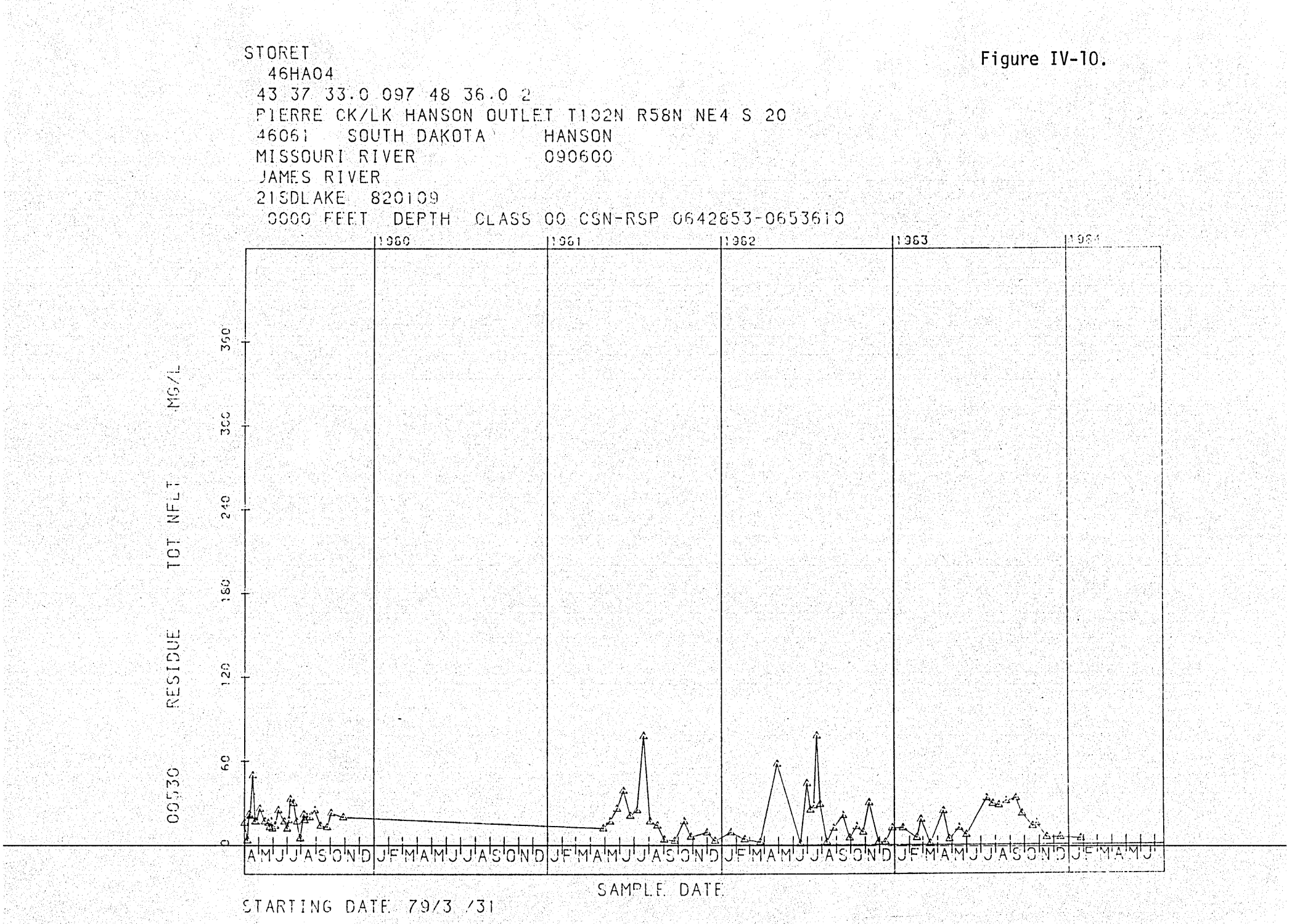
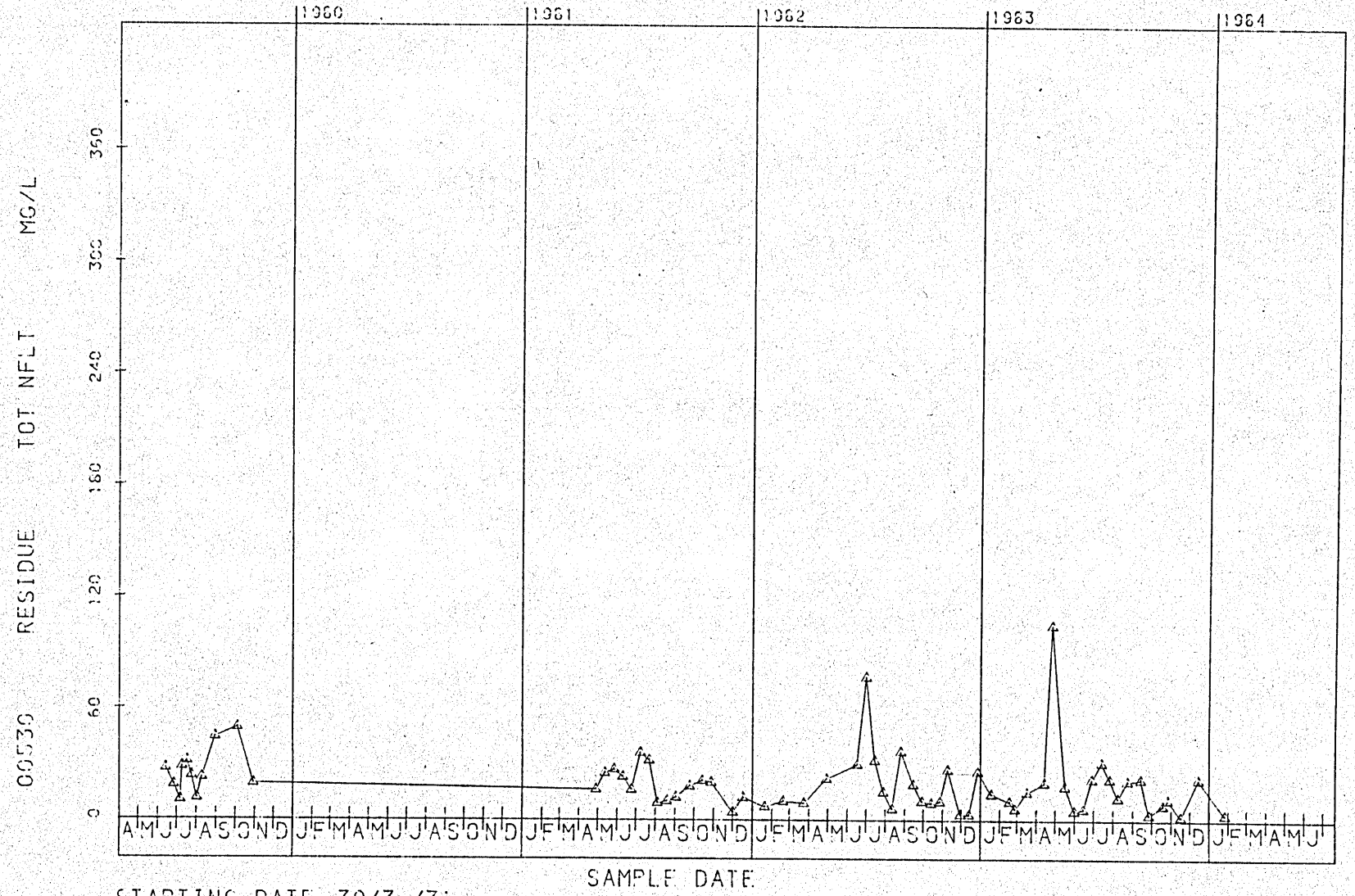

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610
1960
1961
1962
1963
1964
00530 RESIDUE TOT NFLT MG/L
0
60
120
180
240
300
360
AMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJ
SAMPLE DATE
STARTING DATE 79/3 /31

Figure IV-11.

STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611



STARTING DATE 79/3 /31

Figure IV-12.

STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612

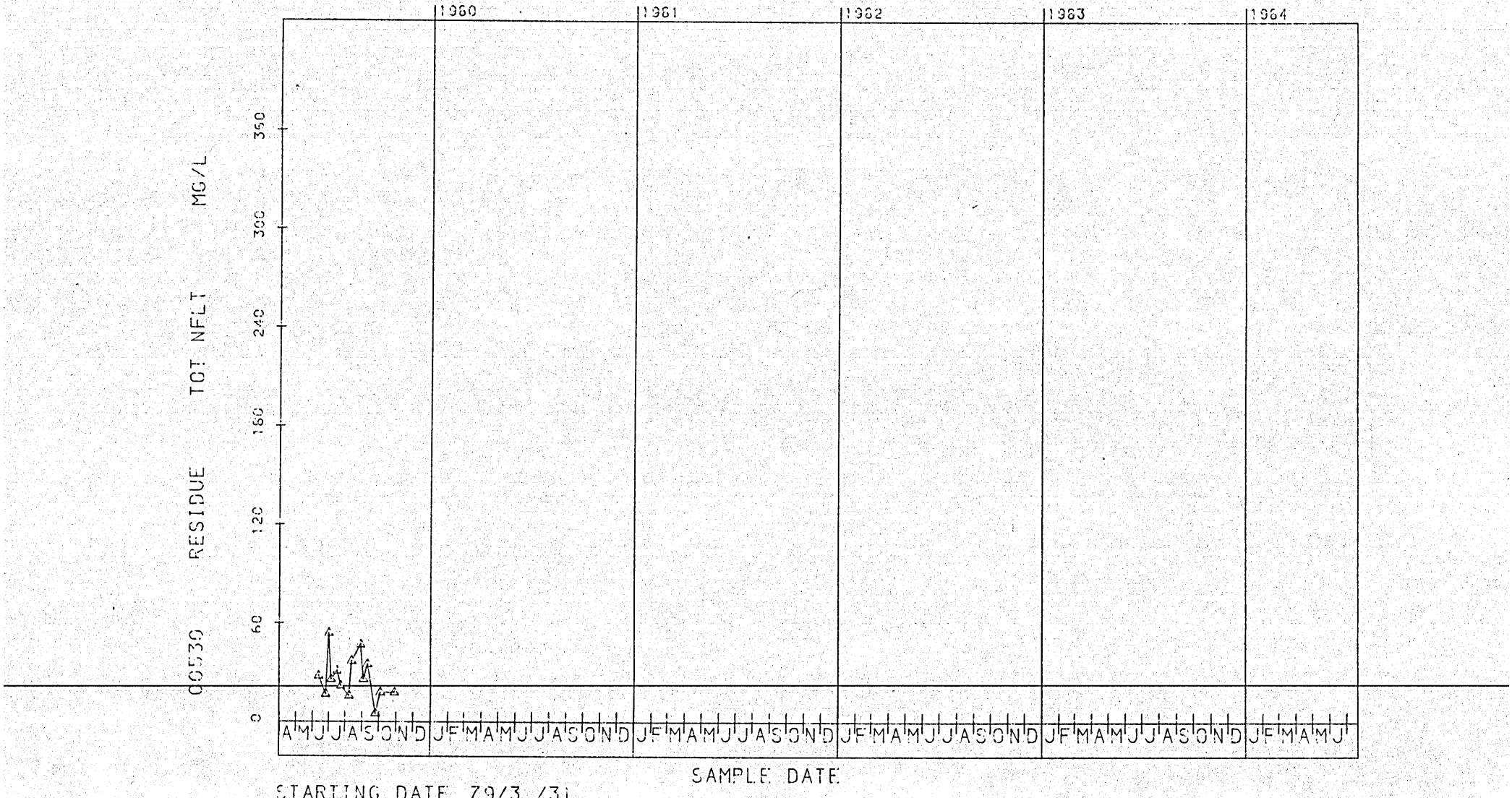
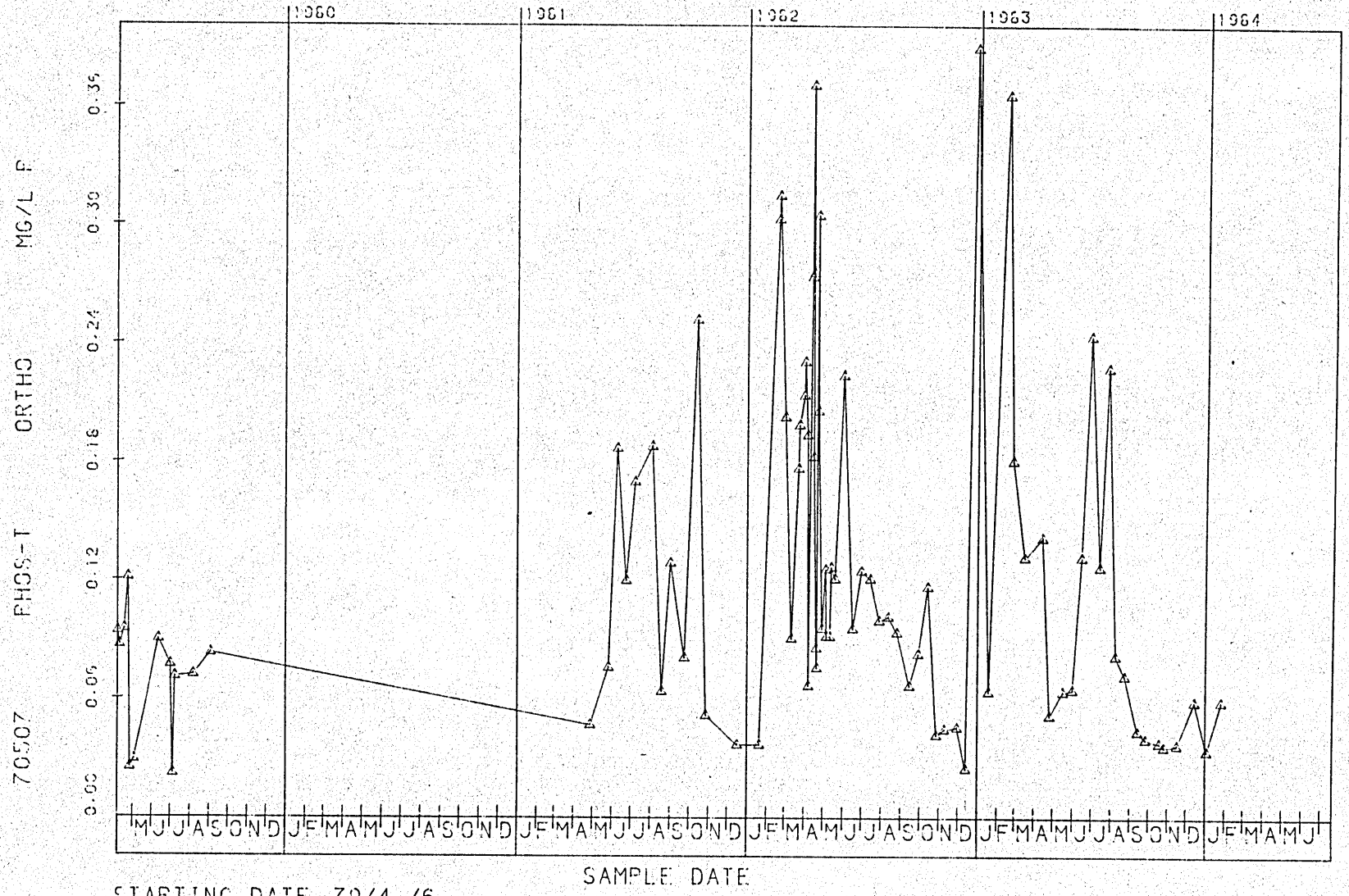


Figure IV-13.

STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609



STARTING DATE 79/4 /6

Figure IV-14.

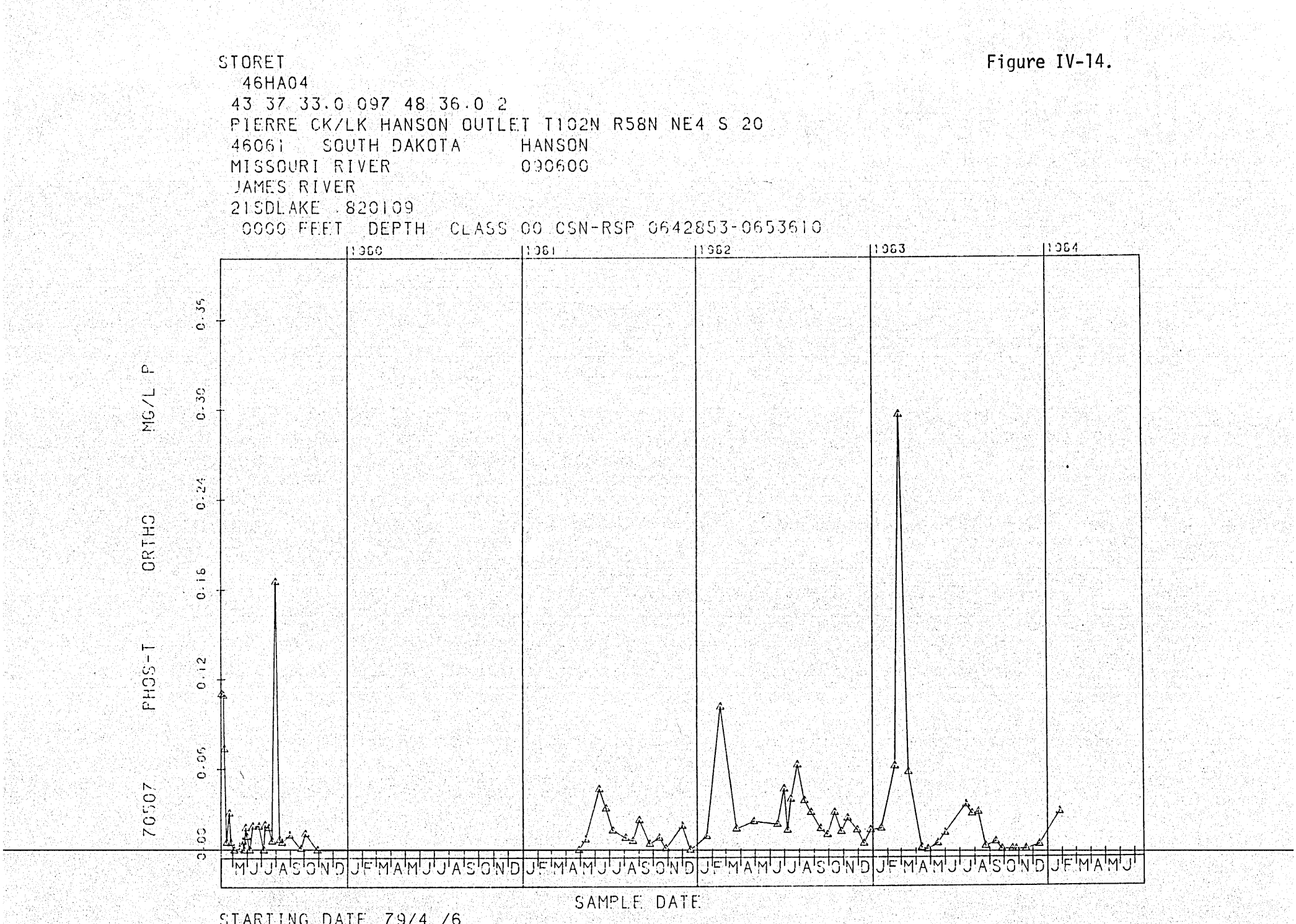

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 030600
JAMES RIVER
21SDLAKE .820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610
1960
1961
1962
1963
1964
70507 PHOS-T ORTHO MG/L P
0.35
0.30
0.24
0.18
0.12
0.06
0.00
M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
SAMPLE DATE
STARTING DATE 79/4 /6

Figure IV-15.

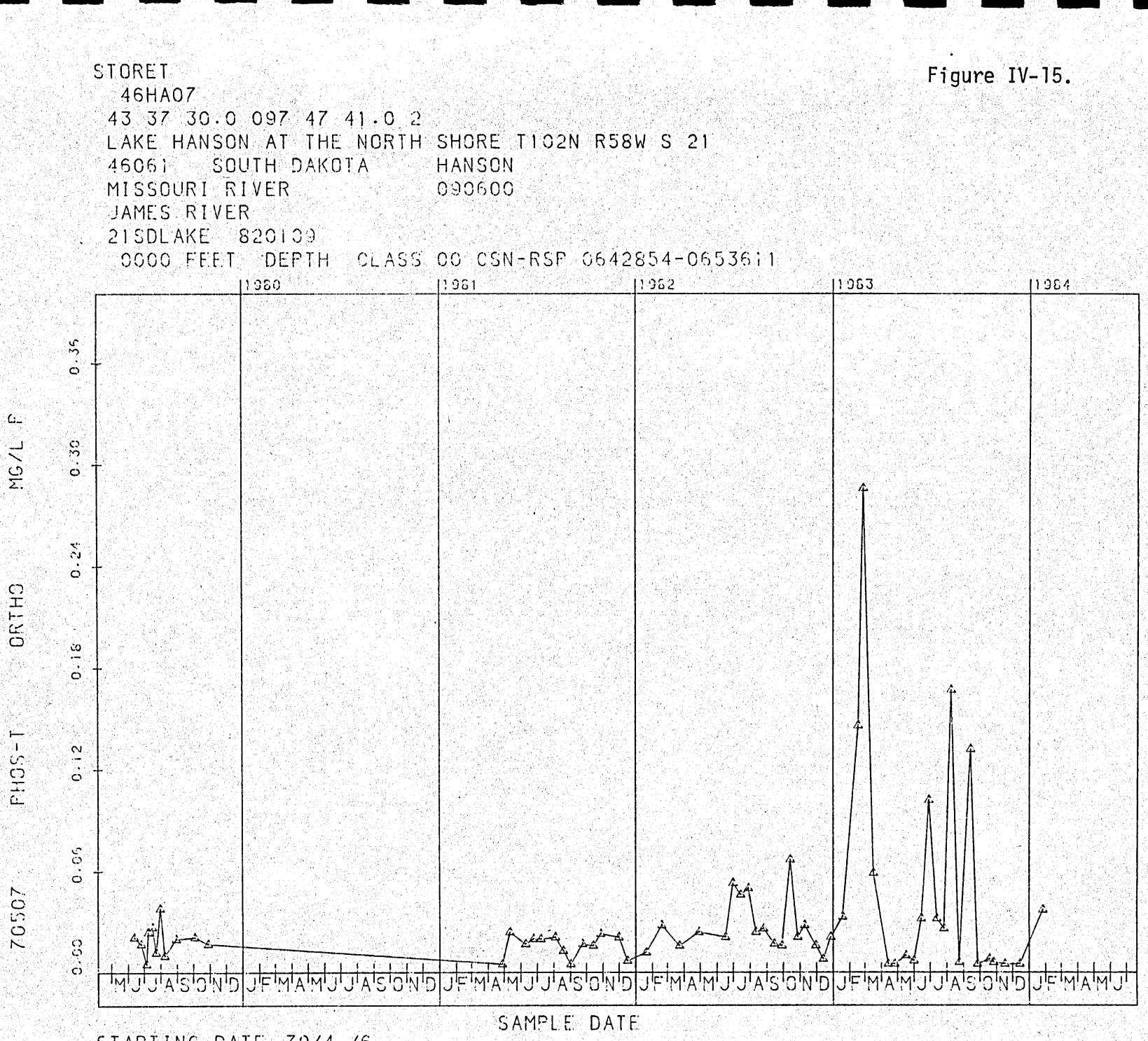
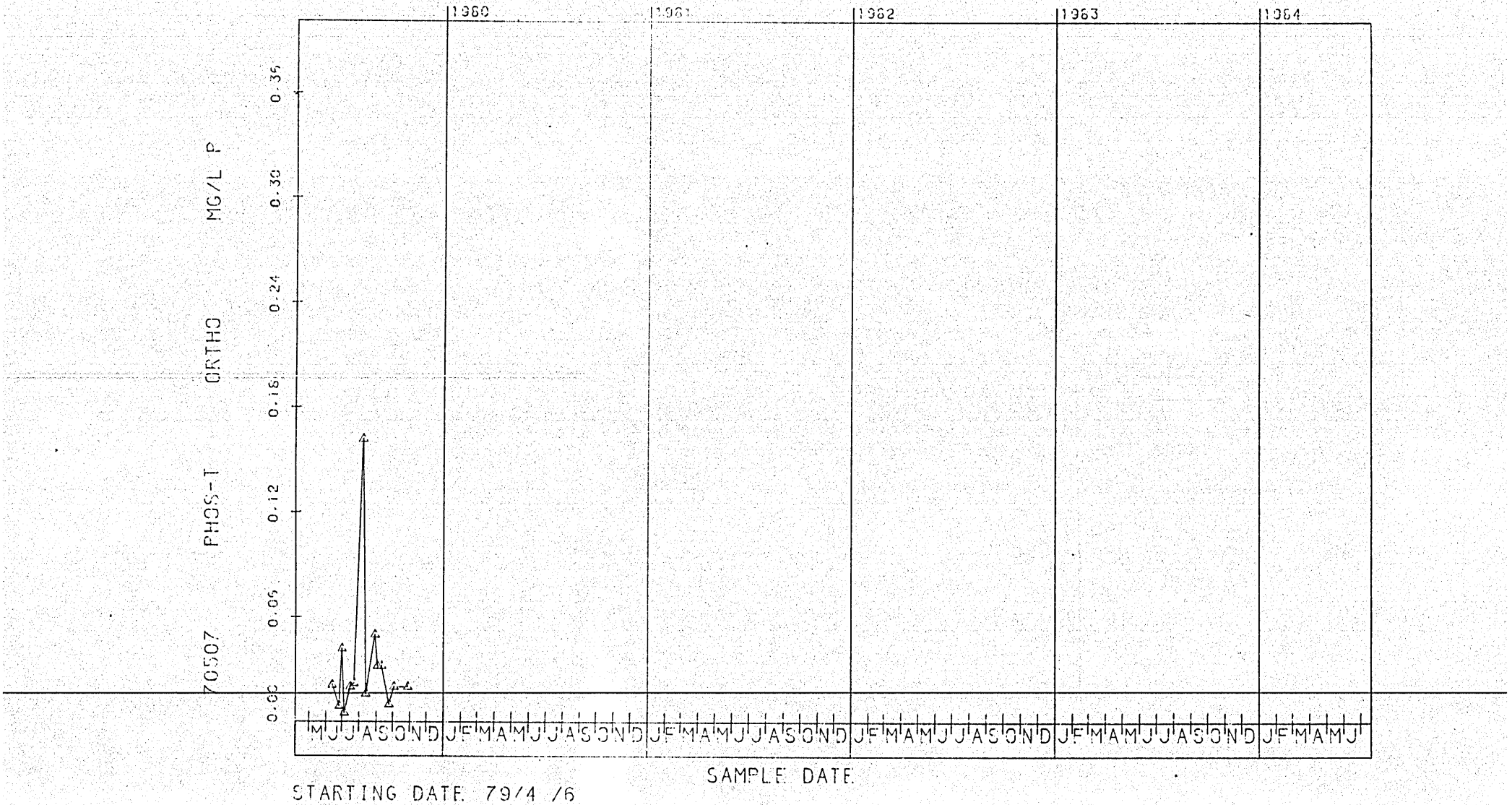

STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611
1960
1961
1962
1963
1964
0.36
0.30
0.24
0.18
0.12
0.06
0.00
70507 PHOS-T ORTHO MG/L P
M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
SAMPLE DATE
STARTING DATE 79/4 /6

Figure IV-16.

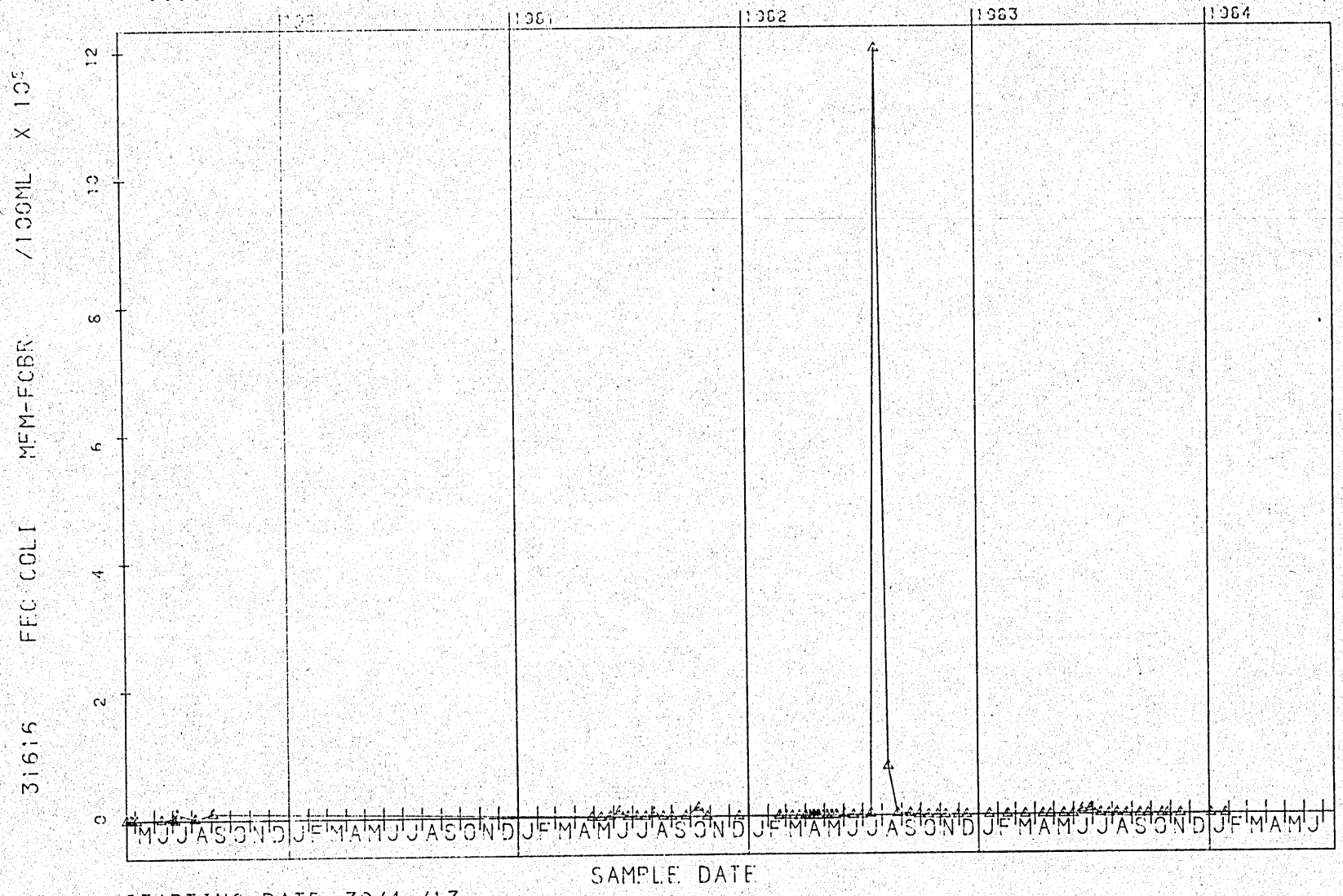
STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 000600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STARTING DATE 7974 /6

Figure IV-17.

STORET
46HA03
43 37 27.0 097 17 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE S[illegible]
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609



STARTING DATE 79/4 /17

Figure IV-18.

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610

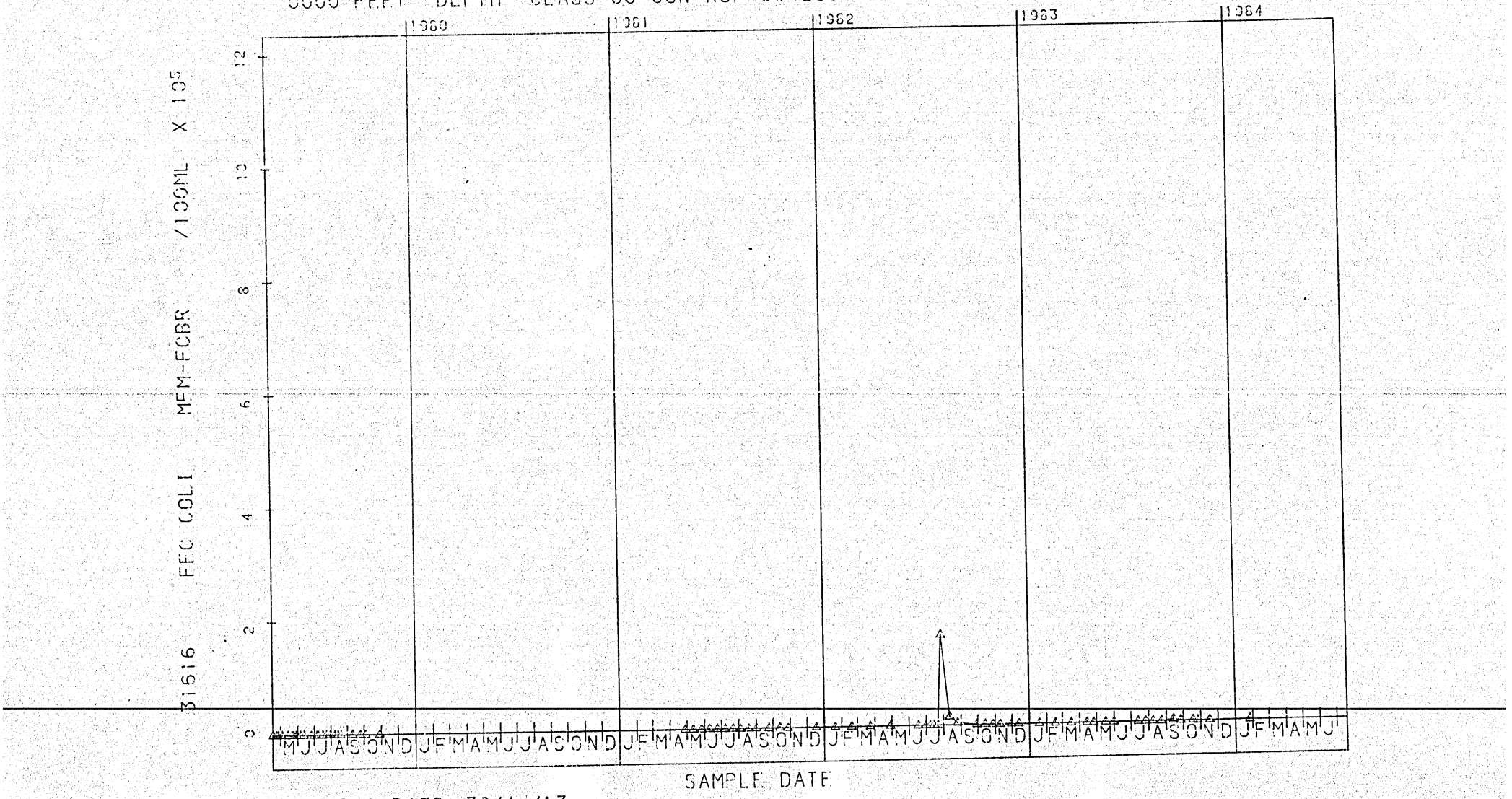
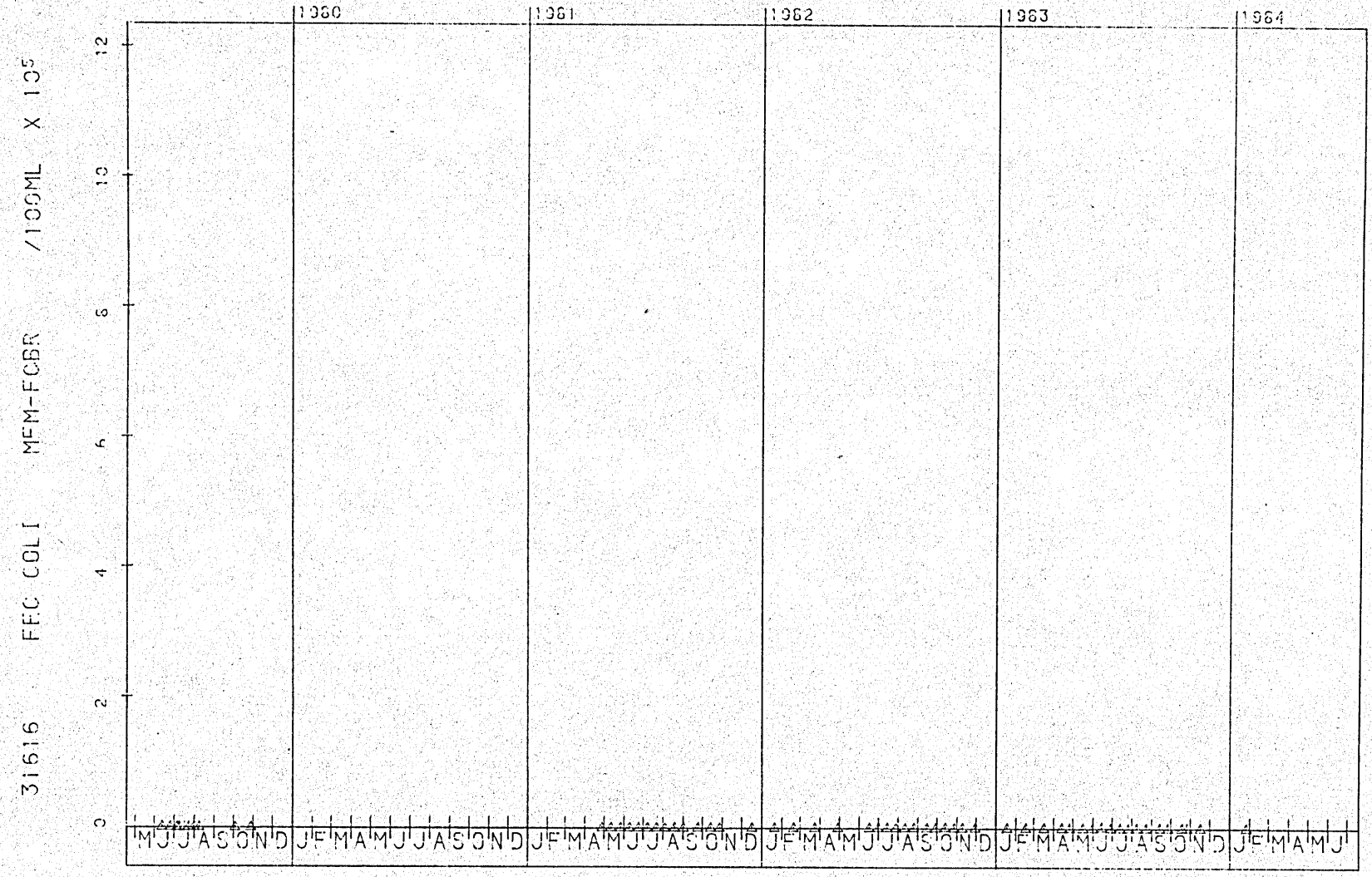


Figure IV-19.

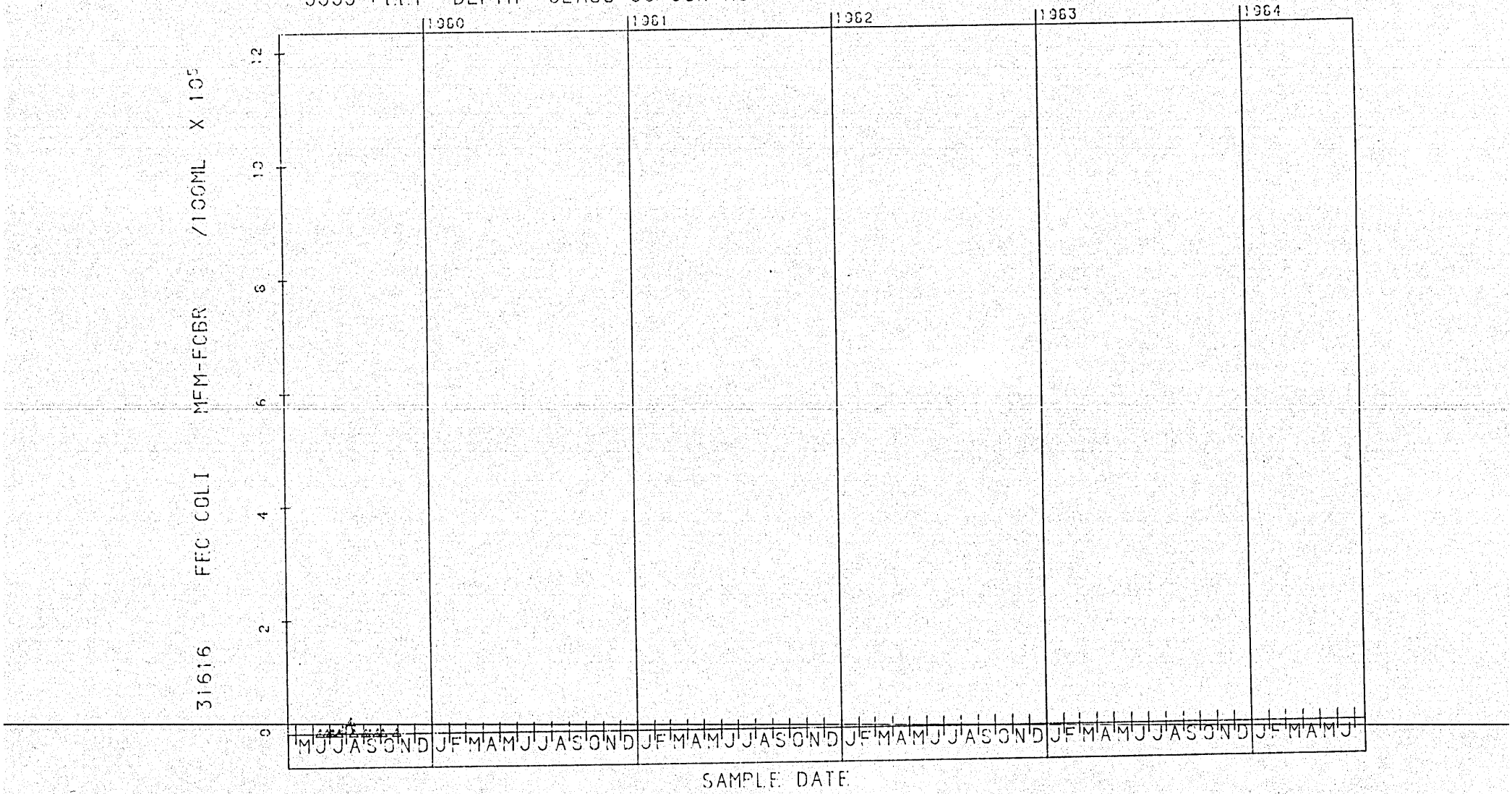
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642854-0653611



STARTING DATE 79/4 /17

Figure IV-20.

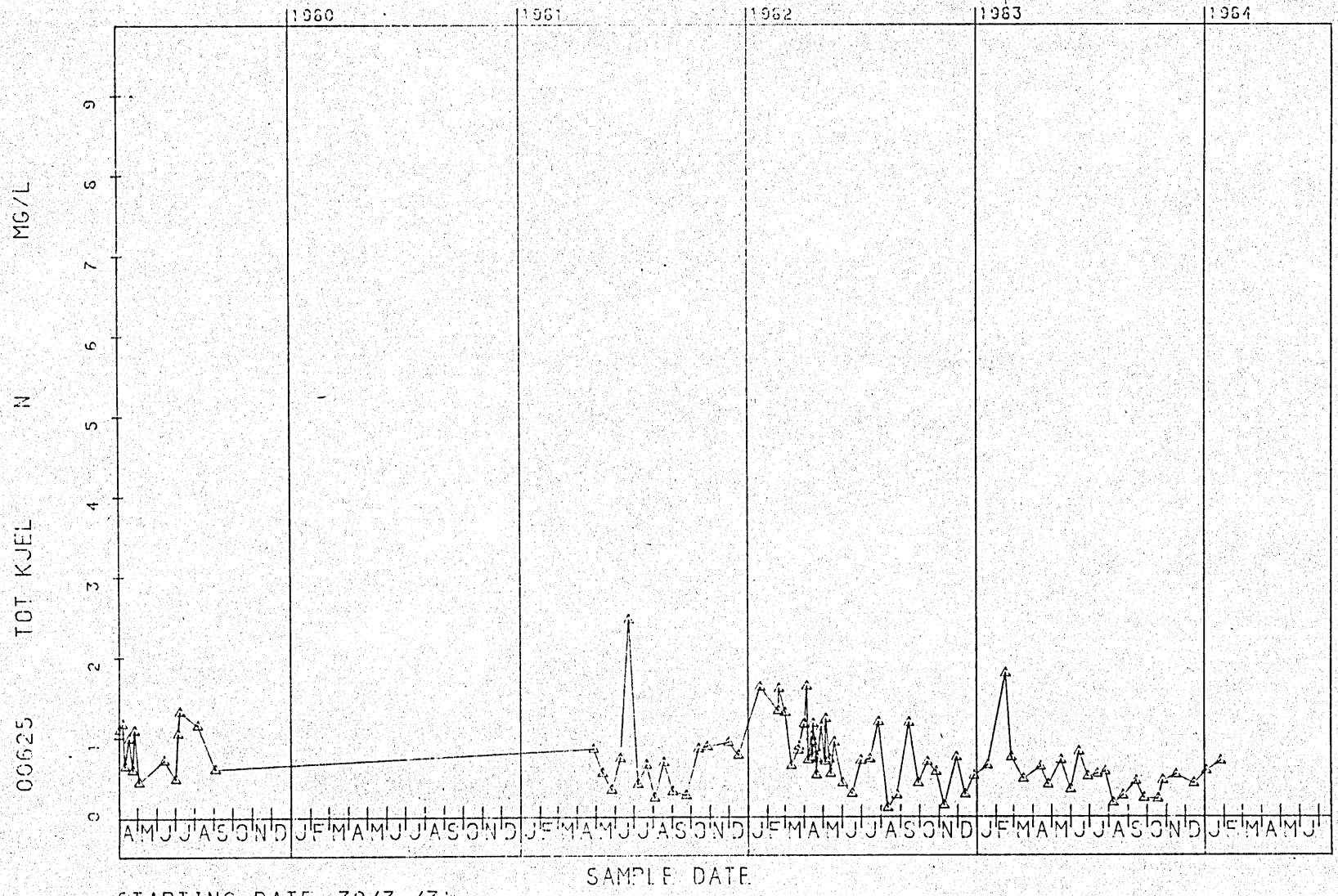
STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STARTING DATE 79/4 /17

Figure IV-21.

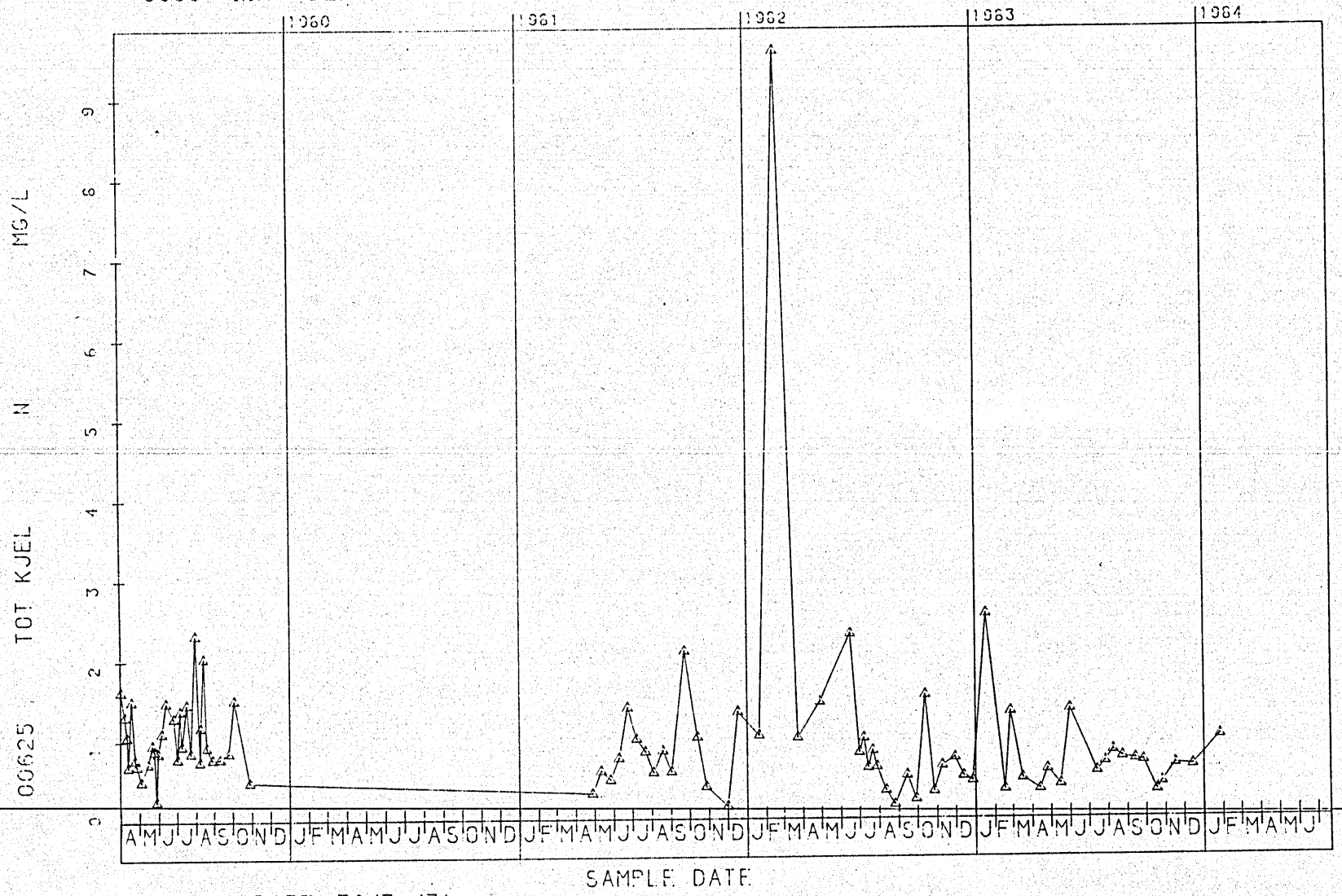
STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSM-RSP 0512852-0653609



STARTING DATE 79/3 /31

Figure IV-22.

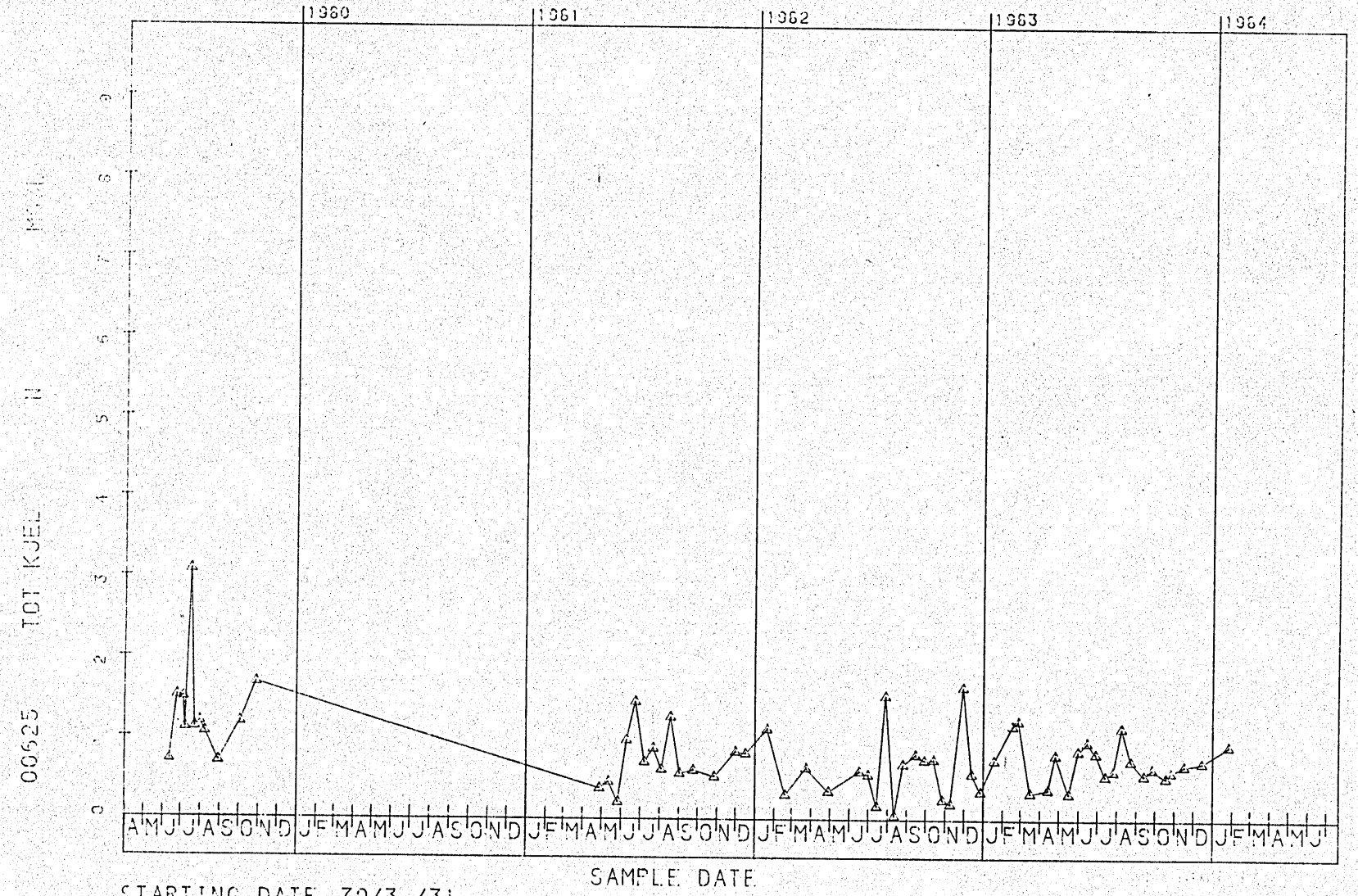
STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610



STARTING DATE 79/3 /31

Figure IV-23.

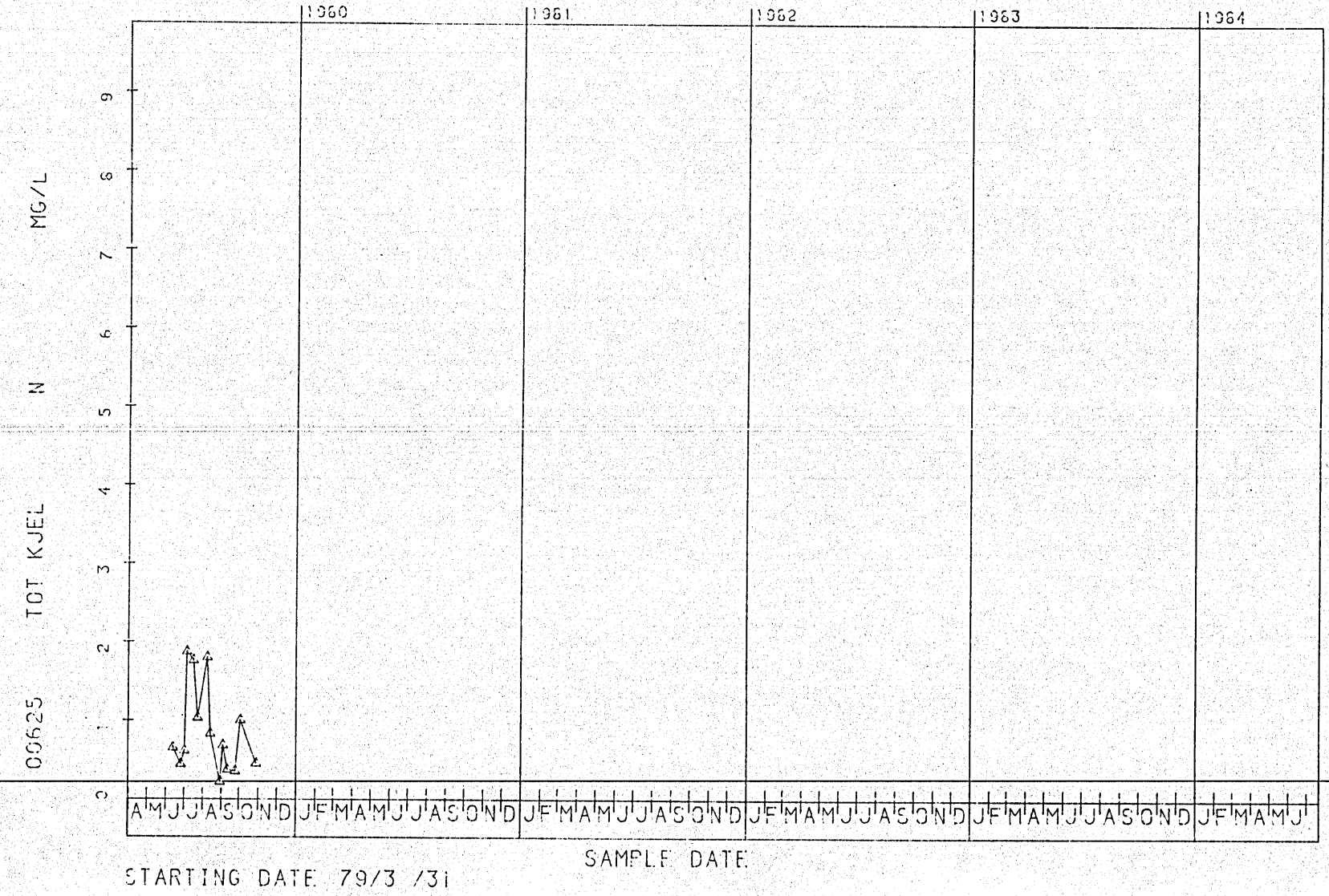
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611



STARTING DATE 79/3 /31

Figure IV-24.

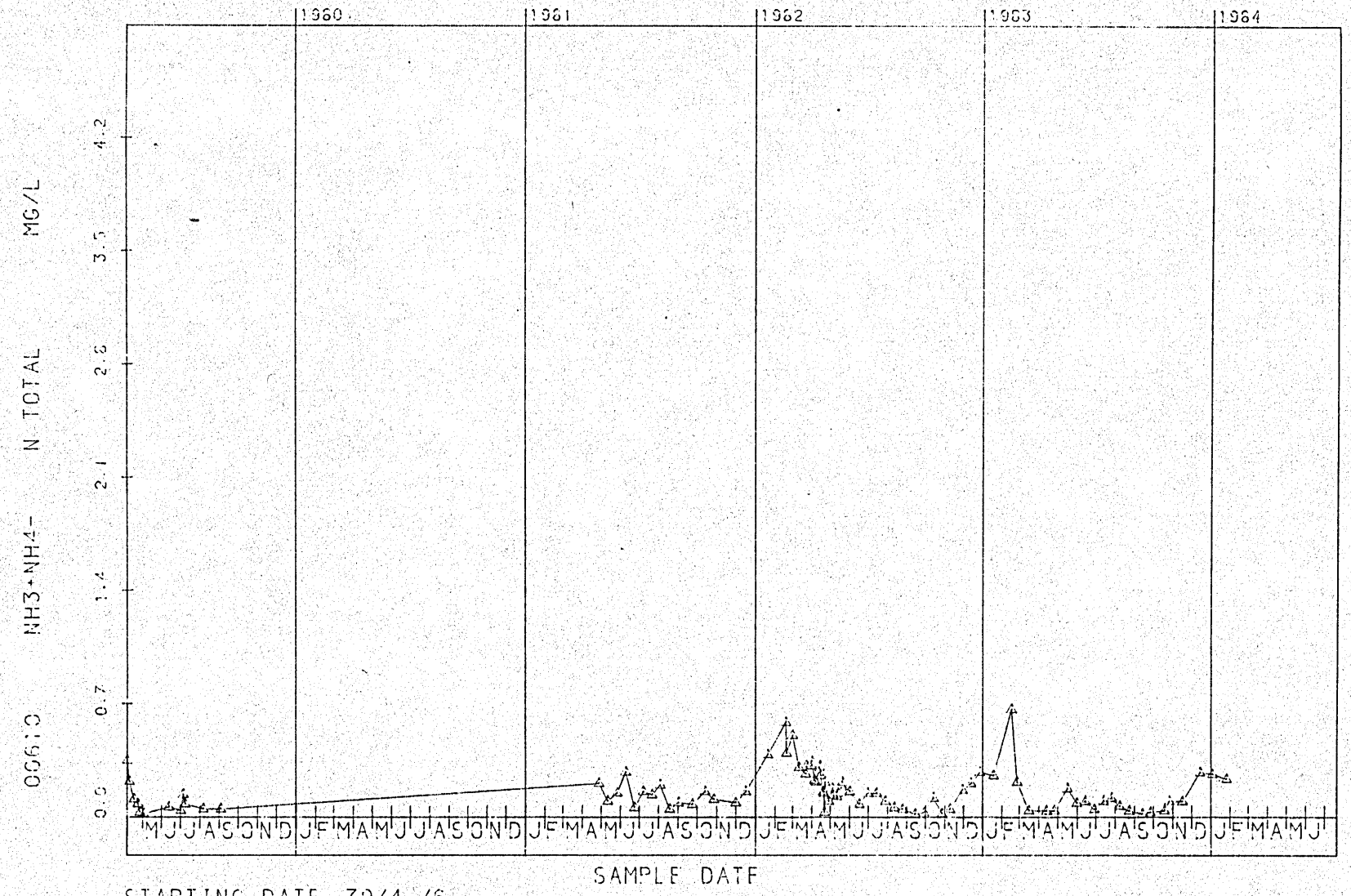
STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STARTING DATE 79/3 /31

STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642852-0653600

Figure IV-25.



STARTING DATE 79/4 /6

Figure IV-26.

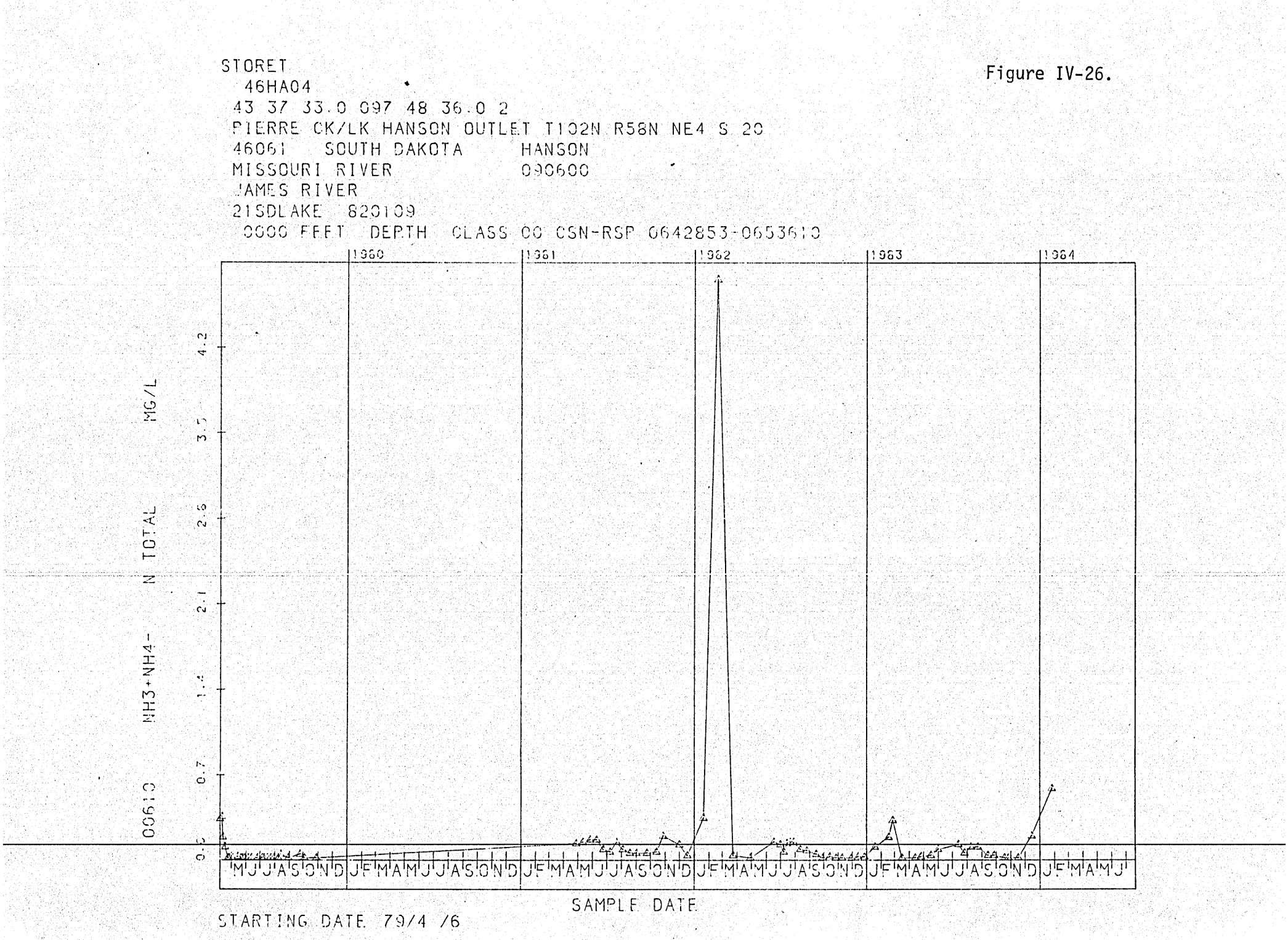
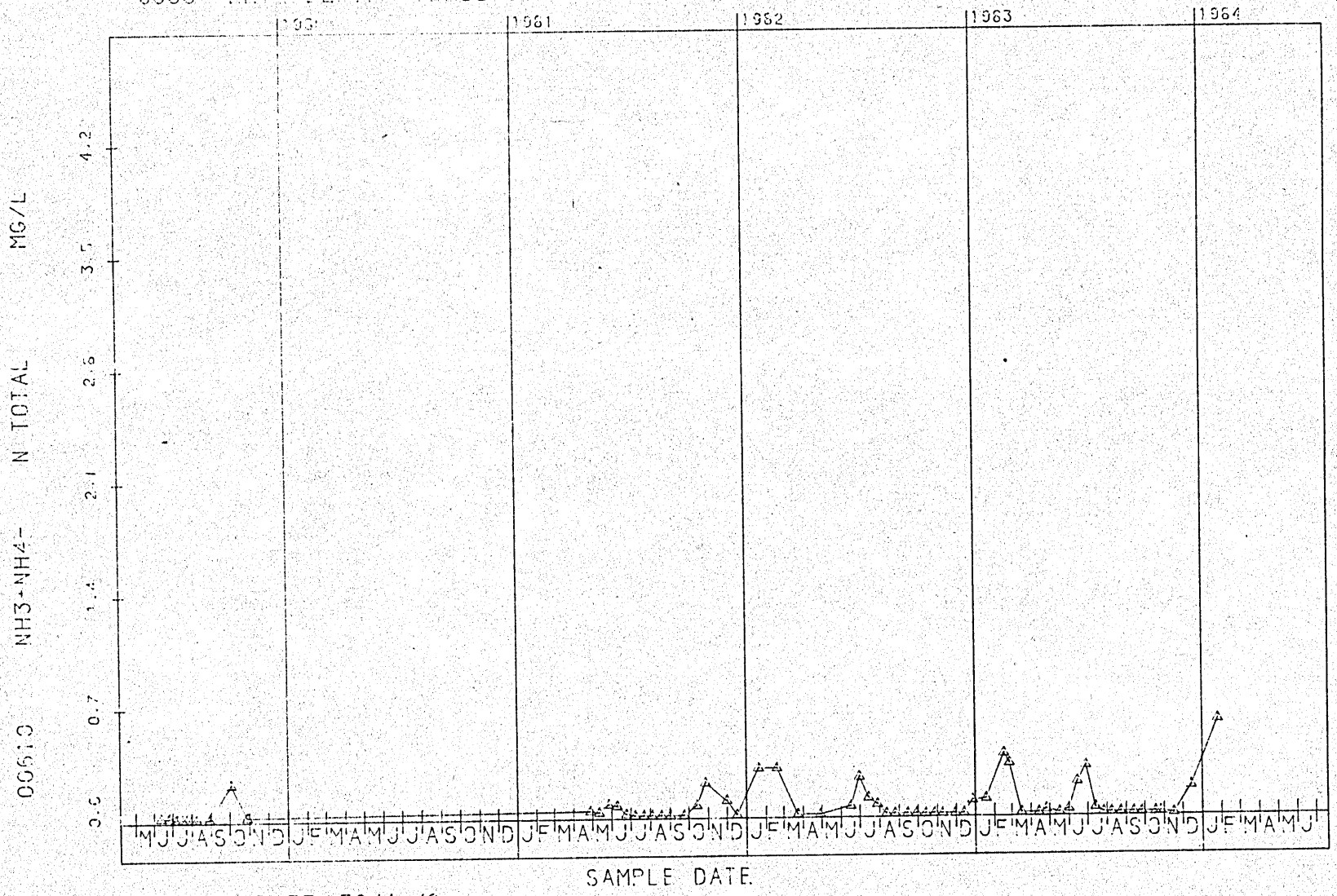

STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610
1960
1961
1962
1963
1964
00610 NH3+NH4- N TOTAL MG/L
4.2
3.5
2.8
2.1
1.4
0.7
0.0
M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
SAMPLE DATE
STARTING DATE 79/4 /6

Figure IV-27.

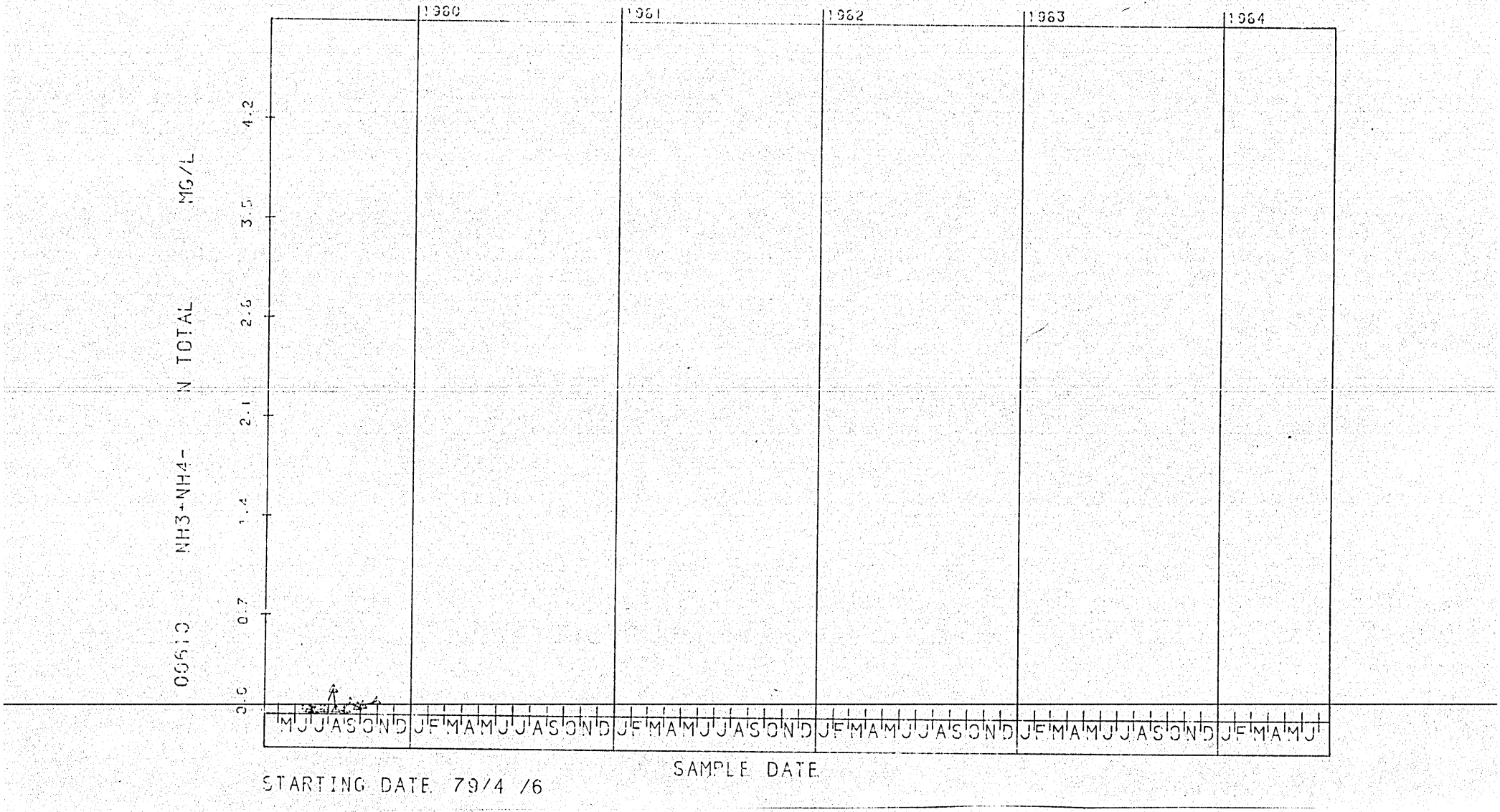
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 080600
JAMES RIVER
21SDLAKE S20 02
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611



STARTING DATE 79/4 /6

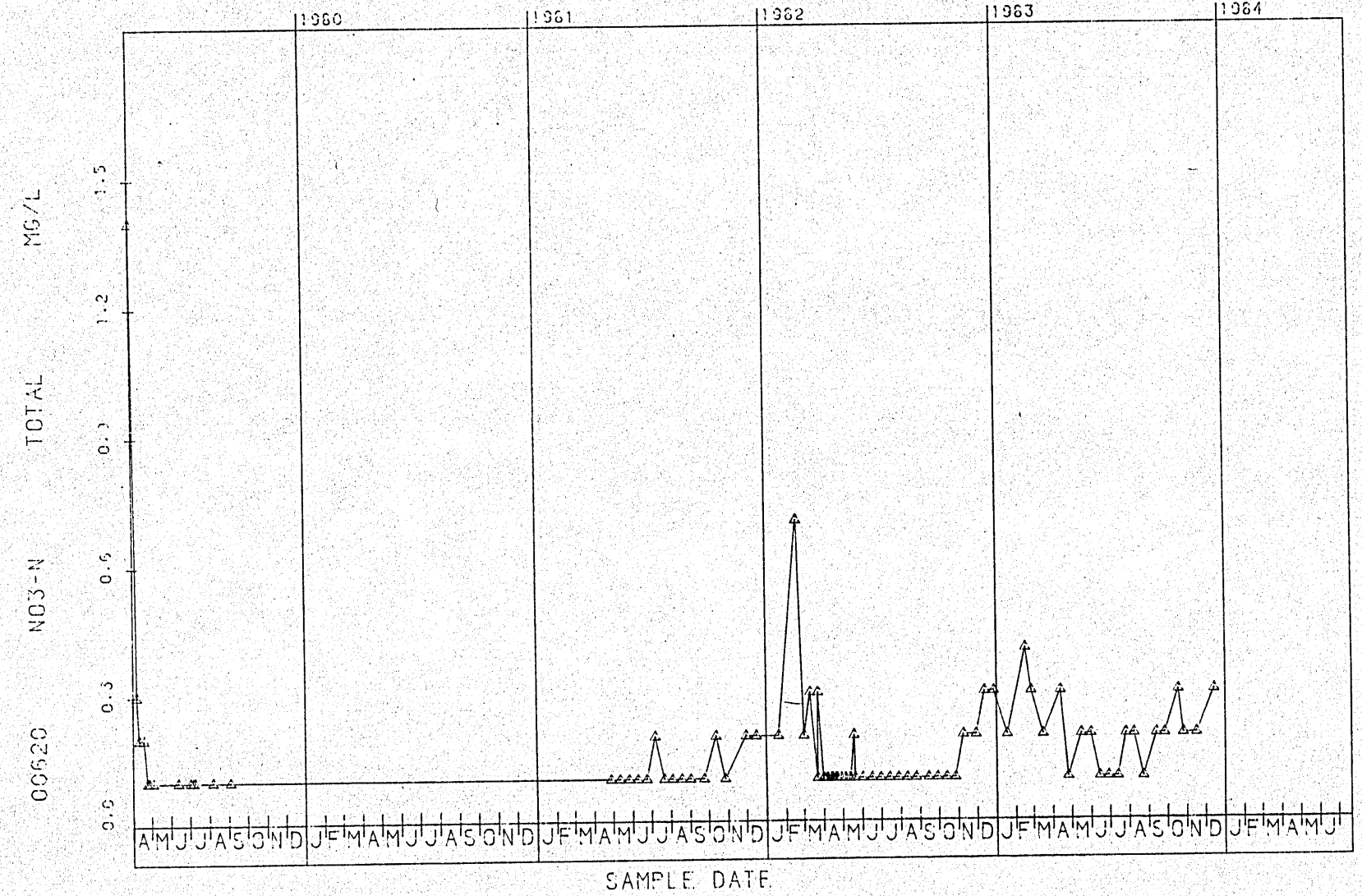
Figure IV-28.

STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609

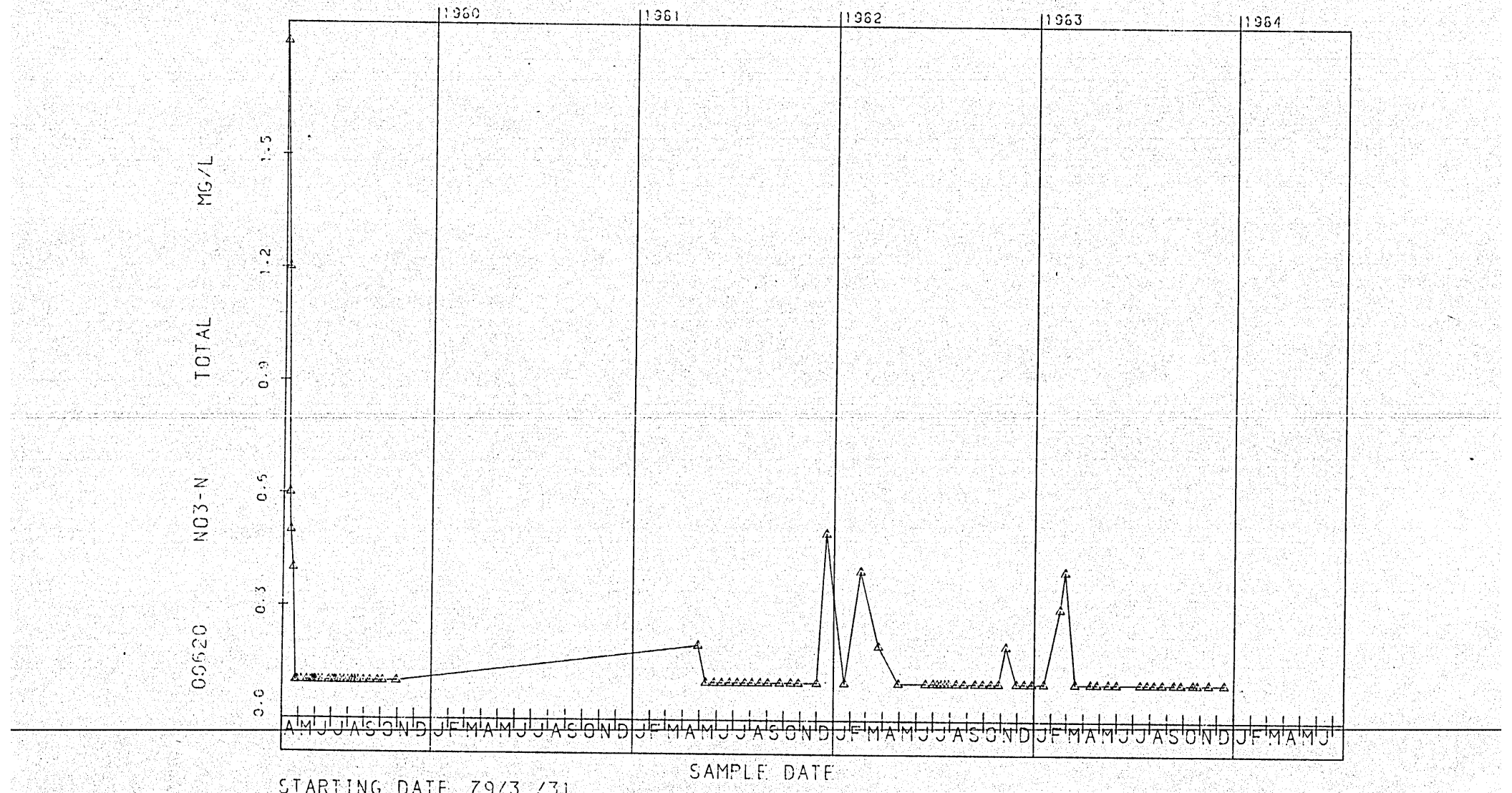
Figure IV-29.



STARTING DATE 79/3 /31

Figure IV-30.

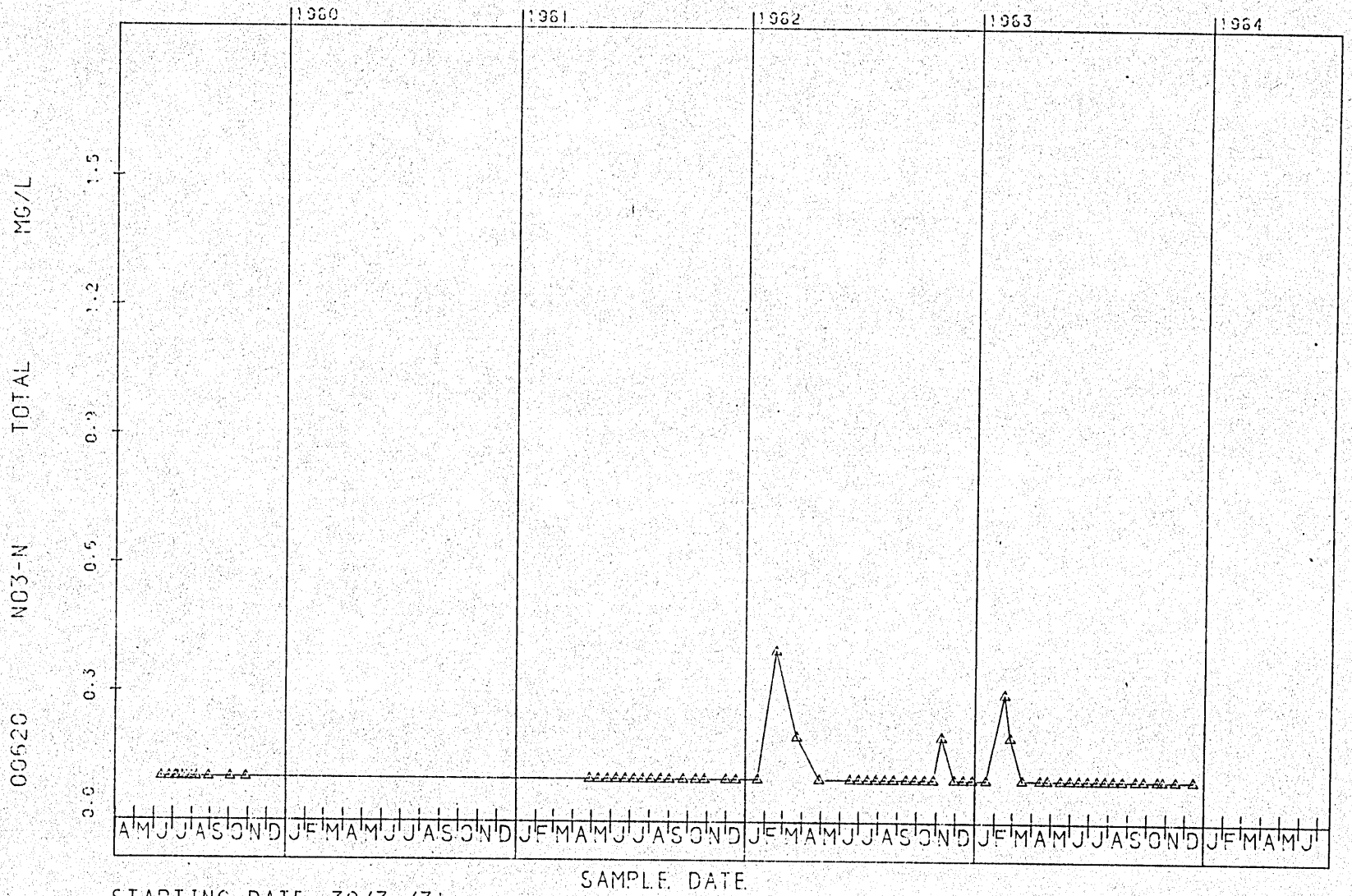
STORET
46HA04
43 37 33.0 097 48 36.0 2
PIERRE CK/LK HANSON OUTLET T102N R58N NE4 S 20
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610



STARTING DATE 79/3 /31

Figure IV-31.

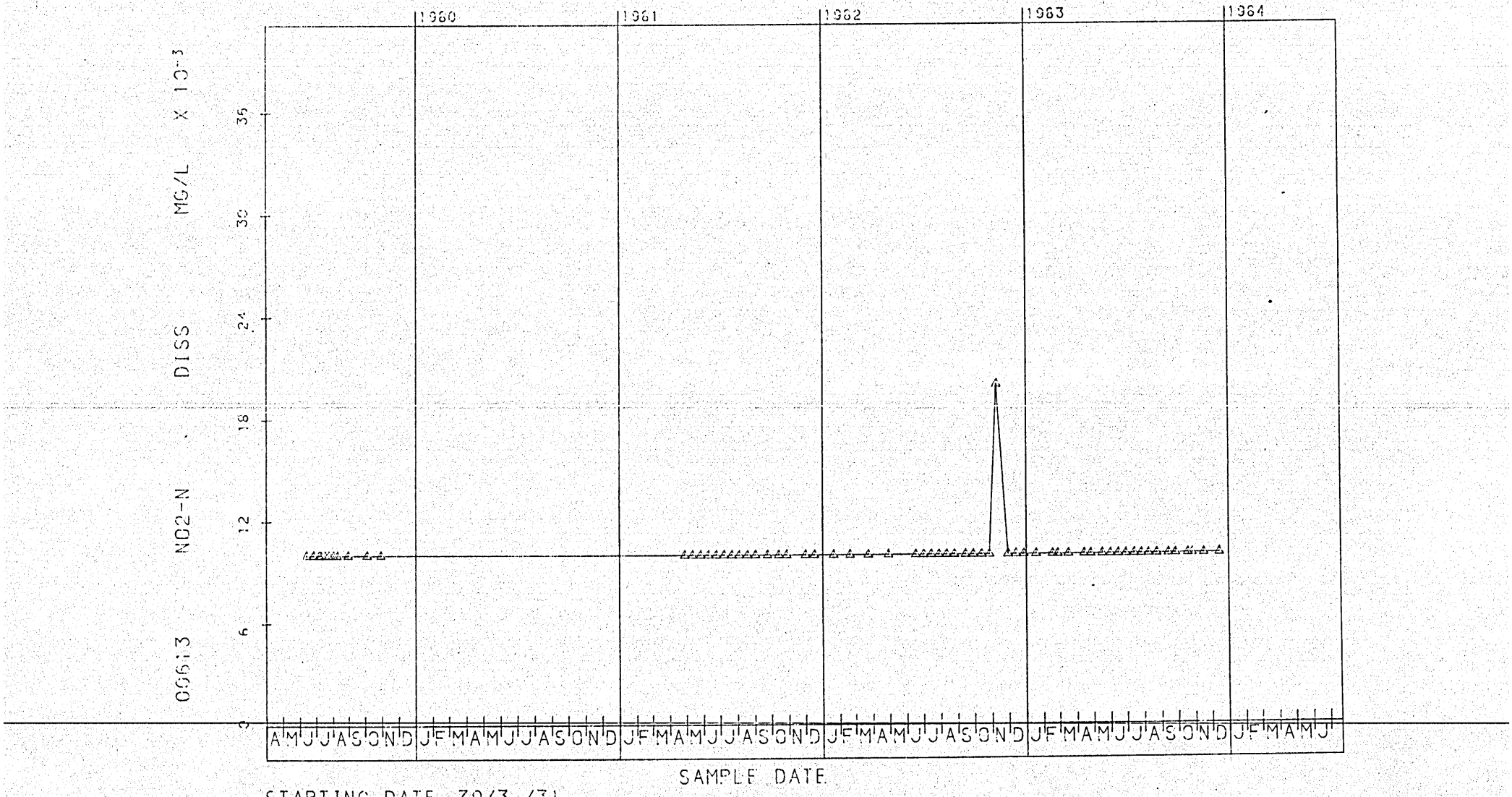
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642854-0653611



STARTING DATE 79/3 /31

Figure IV-32.

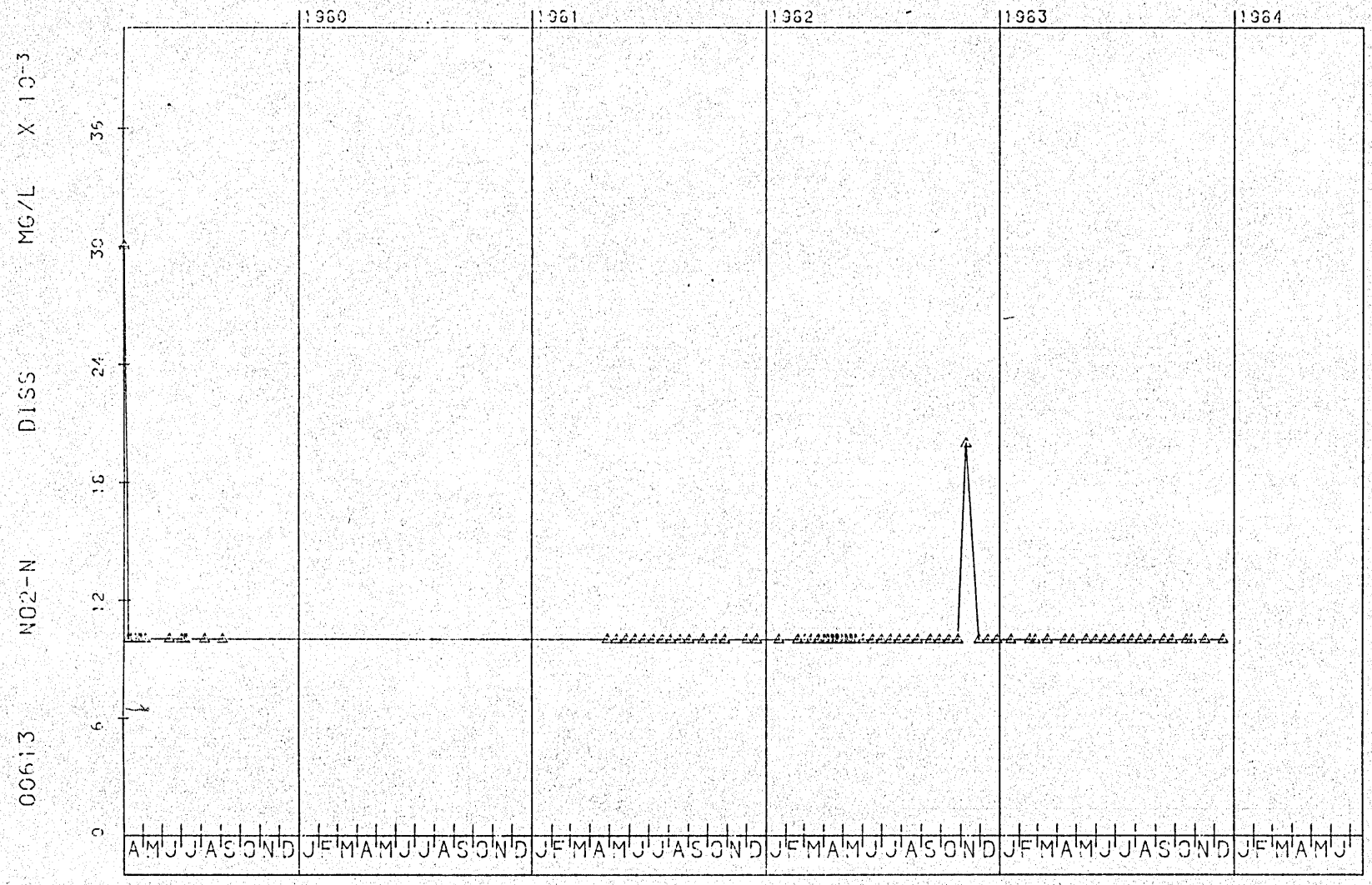
STORET
46HA07
43 37 30.0 097 47 41.0 2
LAKE HANSON AT THE NORTH SHORE T102N R58W S 21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 OSN-RSP 0642854-0653611



STARTING DATE 79/3 /31

Figure IV-33.

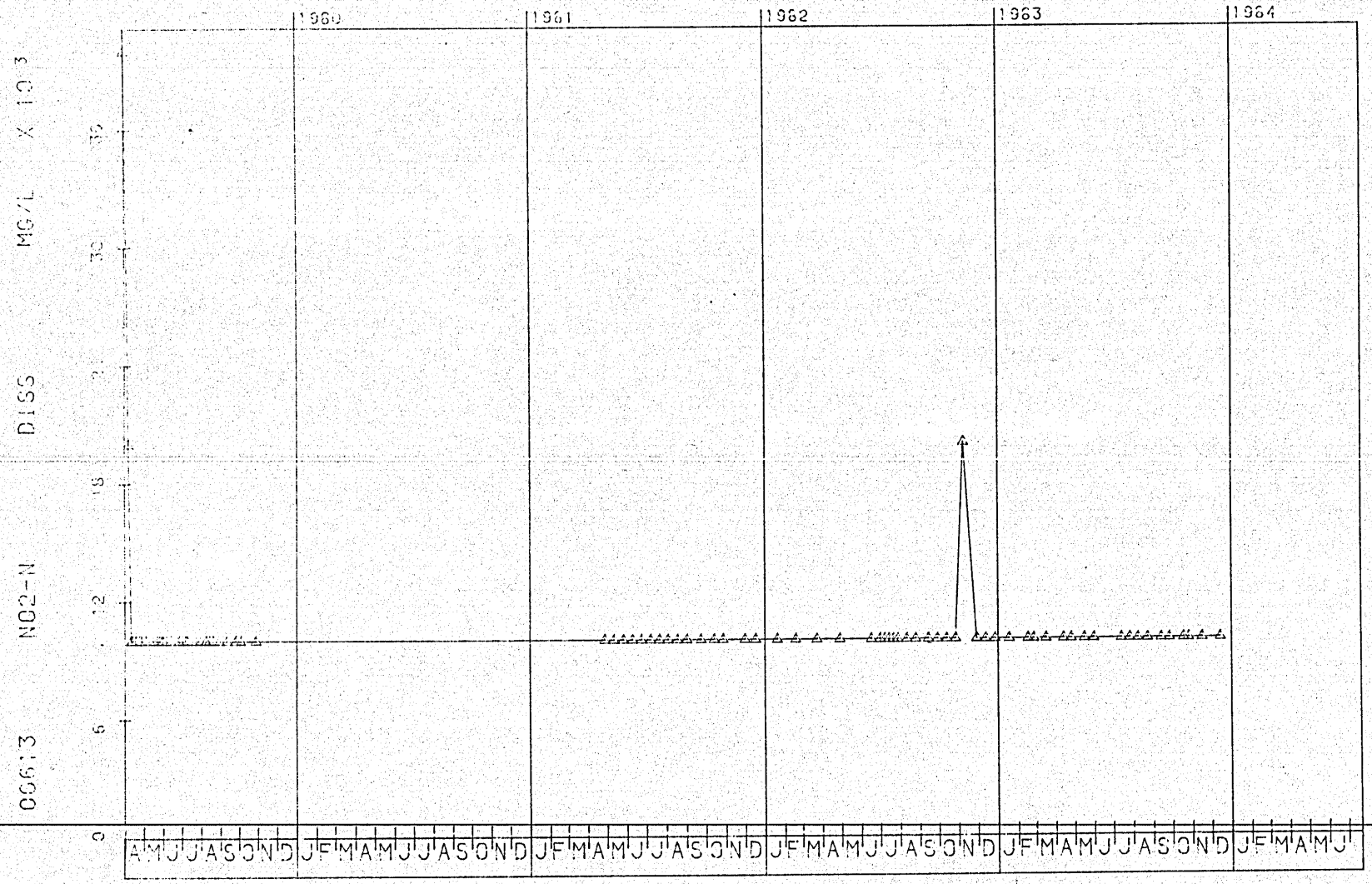
STORET
46HA03
43 37 27.0 097 47 14.0 2
PIERRE CK INLET/LK HANSON T102N R58W NW4 S 22
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642852-0653609



STARTING DATE 79/3 /31

Figure IV-34.

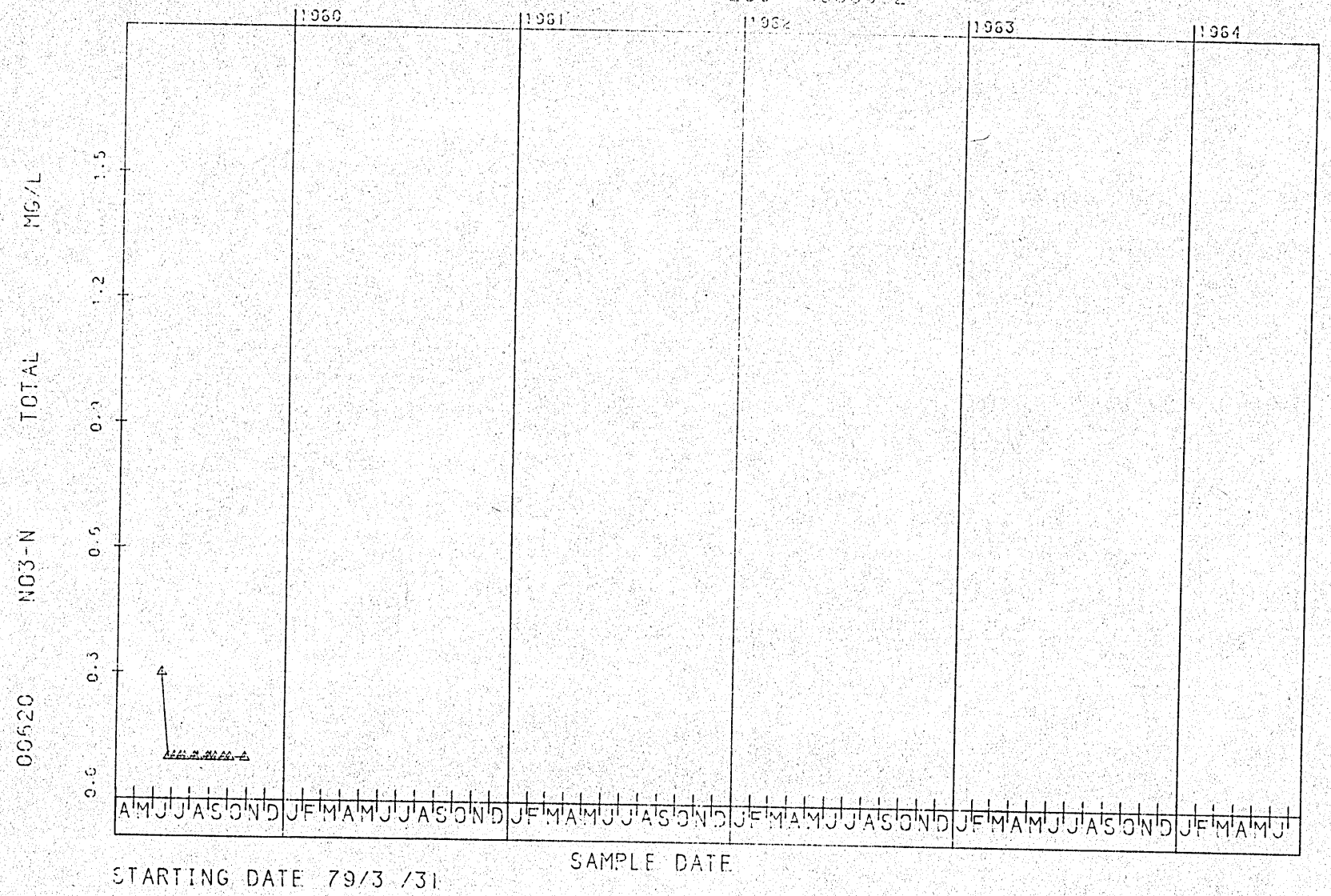
STORET
16HA04
43 37 35.0 097 48 36.0 2
[illegible] CRK/LK HANSON OUTLET T102N R58N NE4 S 20
[illegible] SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE S20109
[illegible] FEET DEPTH CLASS 00 CSN-RSP 0642853-0653610



STARTING DATE 79/3 /31

Figure IV-35.

STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R56W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
JAMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612



STARTING DATE 79/3 /31

Figure IV-36.

STORET
46HA08
43 37 23.0 097 47 41.0 2
LAKE HANSON AT THE SOUTH SHORE T102N R58W S21
46061 SOUTH DAKOTA HANSON
MISSOURI RIVER 090600
'AMES RIVER
21SDLAKE 820109
0000 FEET DEPTH CLASS 00 CSN-RSP 0642855-0653612

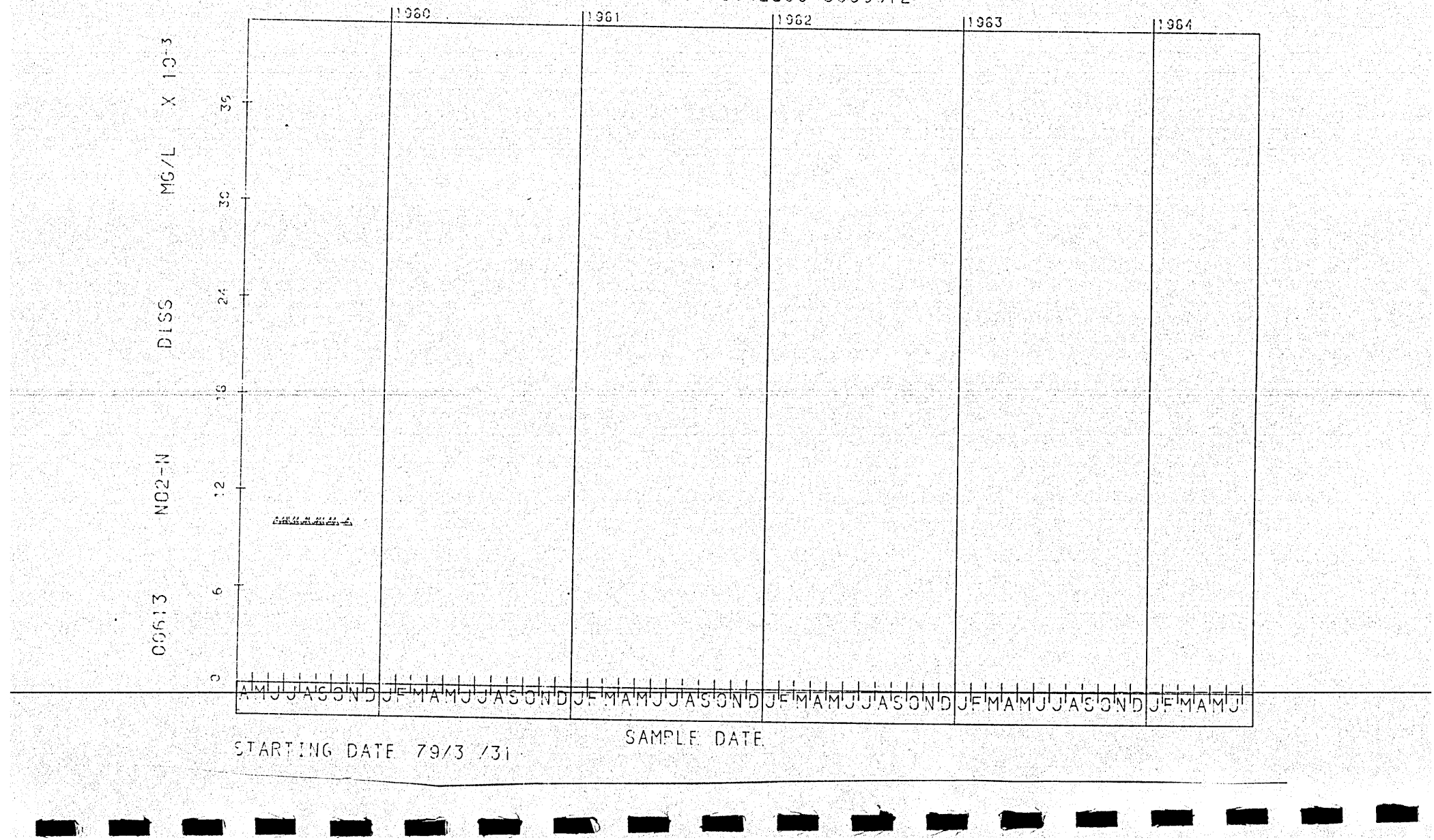


Figure IV-37.

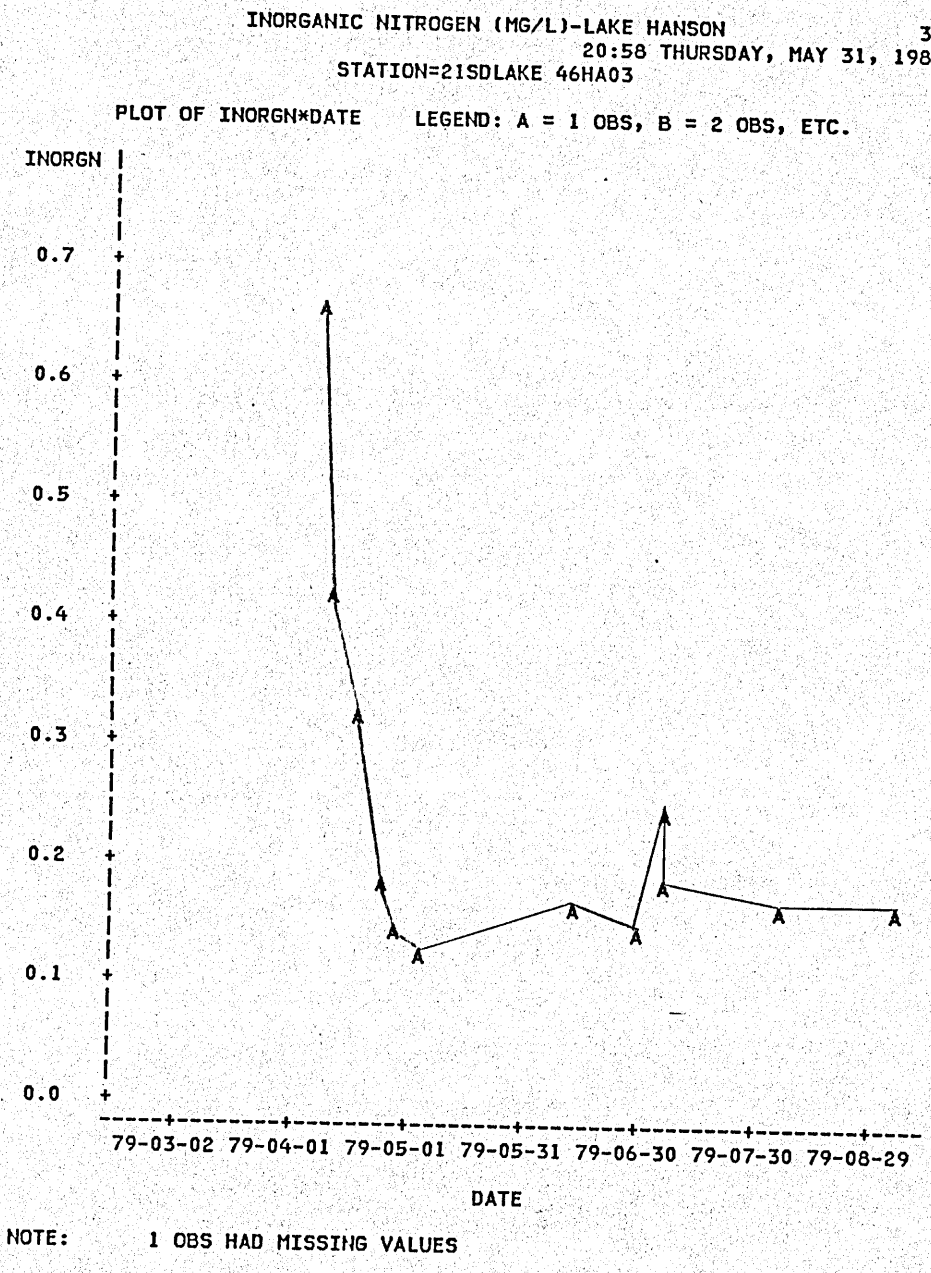

INORGANIC NITROGEN (MG/L)-LAKE HANSON 38
20:58 THURSDAY, MAY 31, 1984
STATION=21SDLAKE 46HA03
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
79-03-02 79-04-01 79-05-01 79-05-31 79-06-30 79-07-30 79-08-29
DATE
NOTE: 1 OBS HAD MISSING VALUES

Figure IV-38.

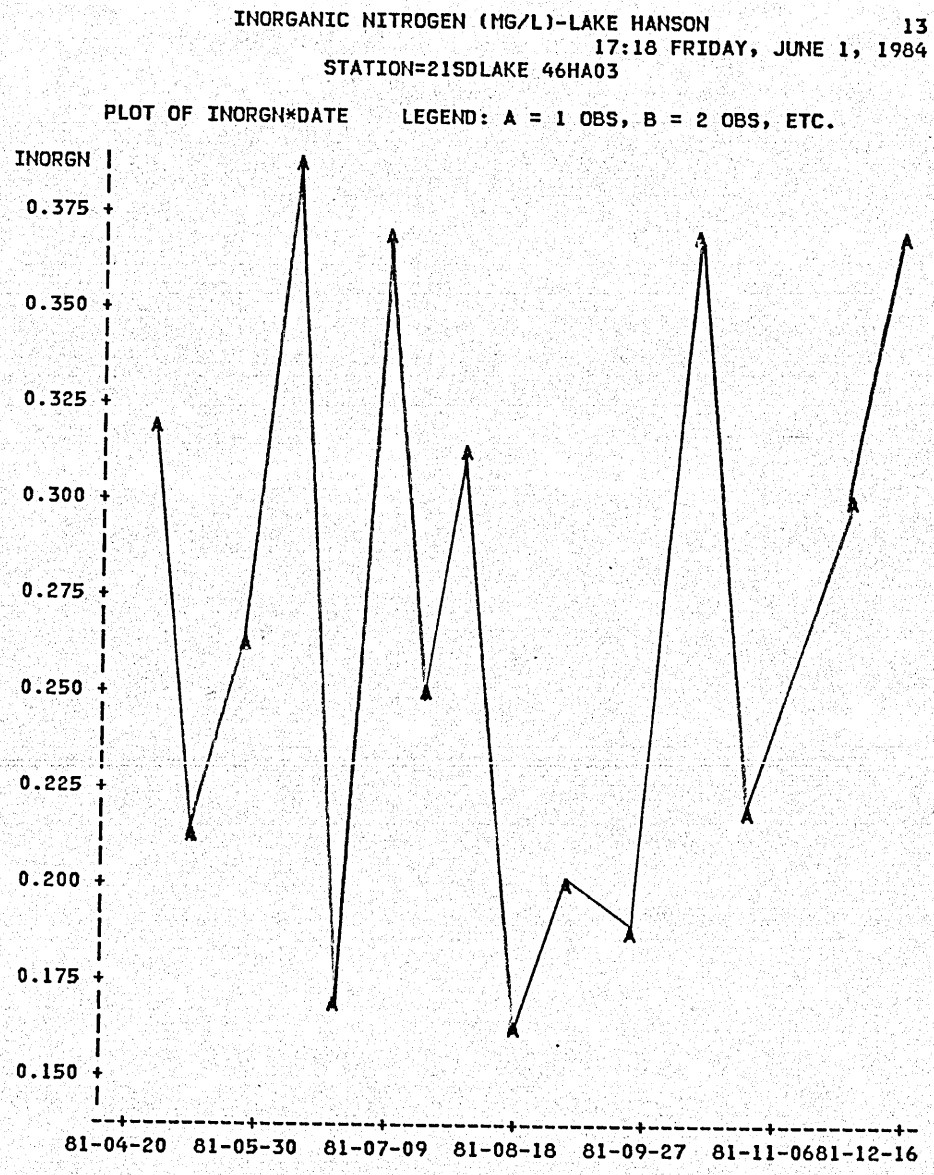

INORGANIC NITROGEN (MG/L)-LAKE HANSON 13
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA03
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
81-04-20
81-05-30
81-07-09
81-08-18
81-09-27
81-11-06
81-12-16
DATE

Figure IV-39.

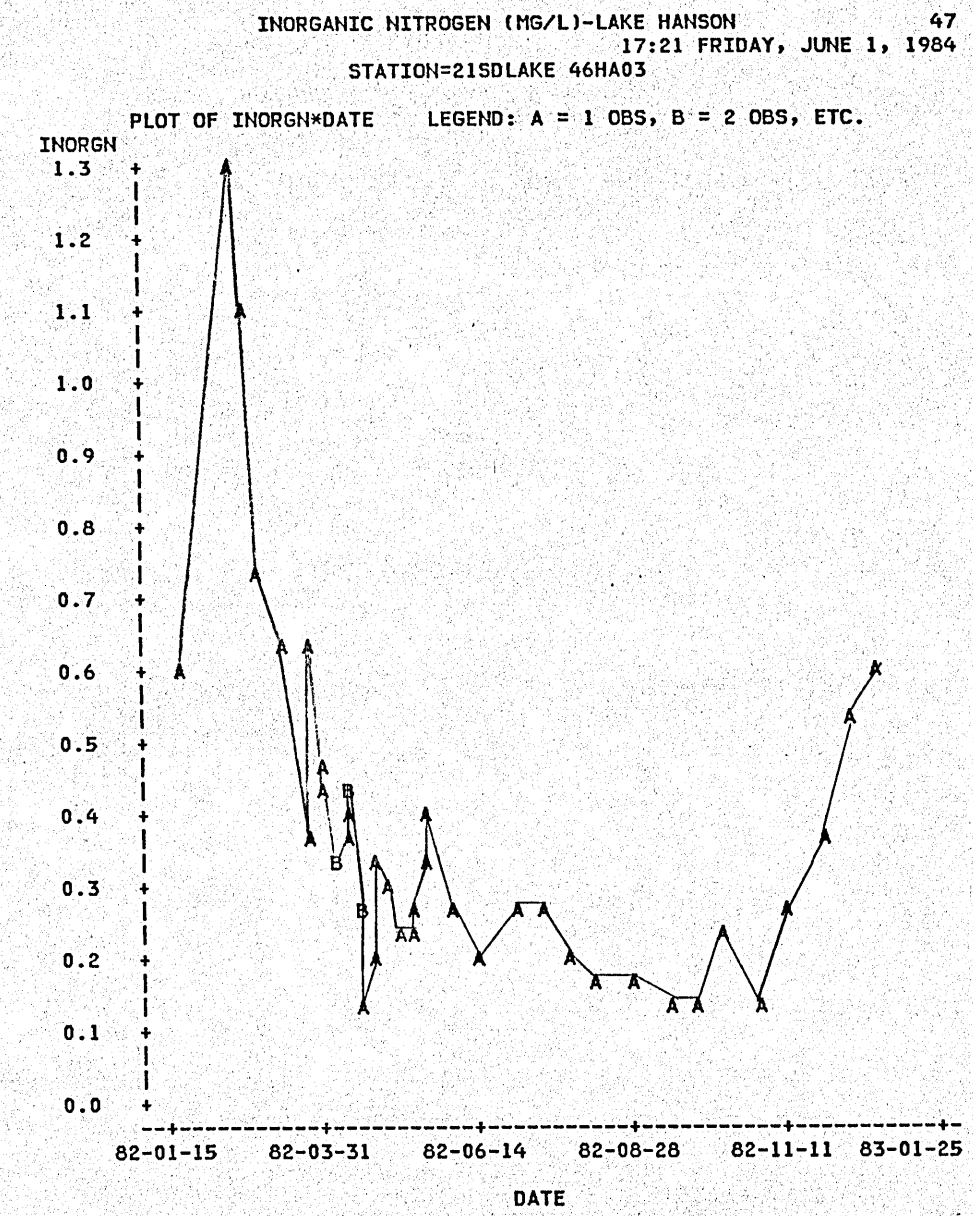

INORGANIC NITROGEN (MG/L)-LAKE HANSON 47
17:21 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA03
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
82-01-15
82-03-31
82-06-14
82-08-28
82-11-11
83-01-25
DATE

Figure IV-40.

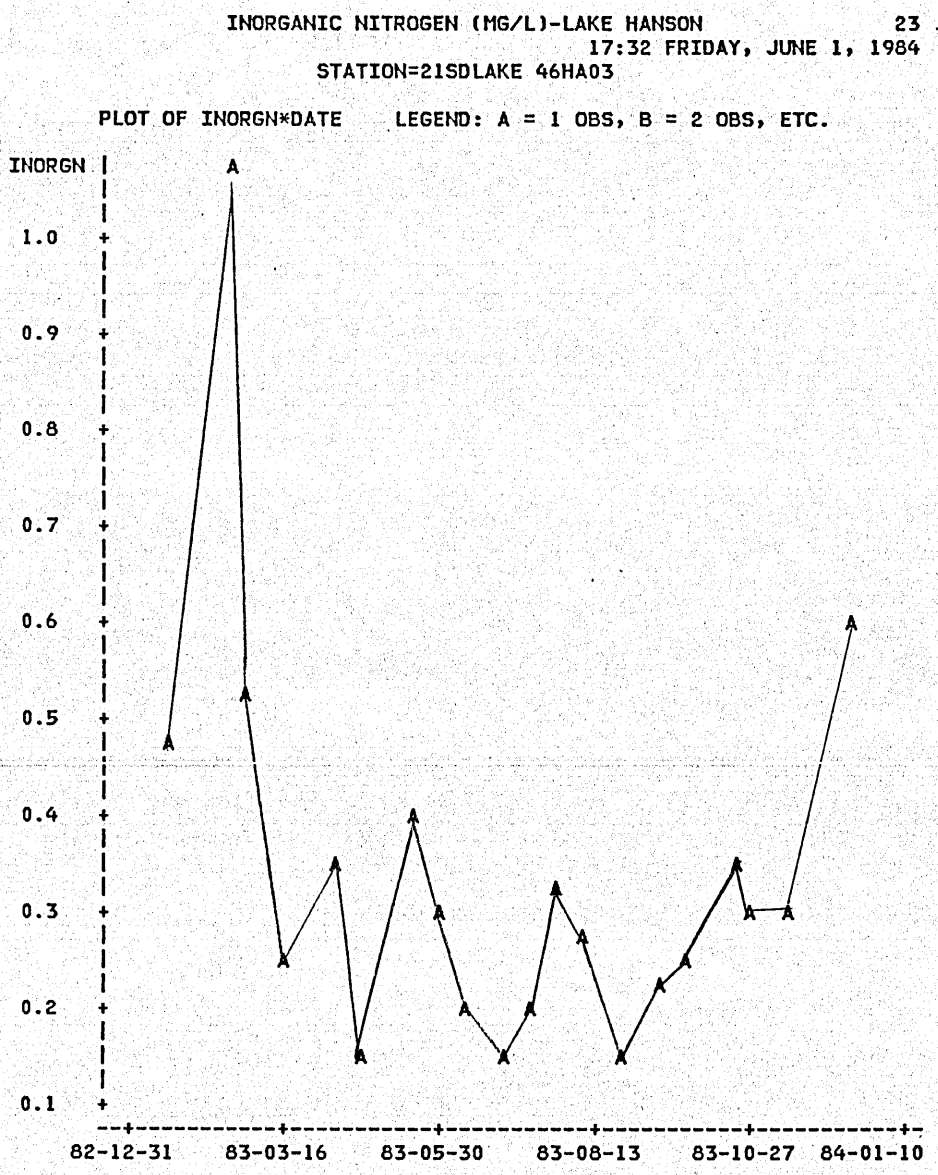

INORGANIC NITROGEN (MG/L)-LAKE HANSON 23
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA03
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-41.

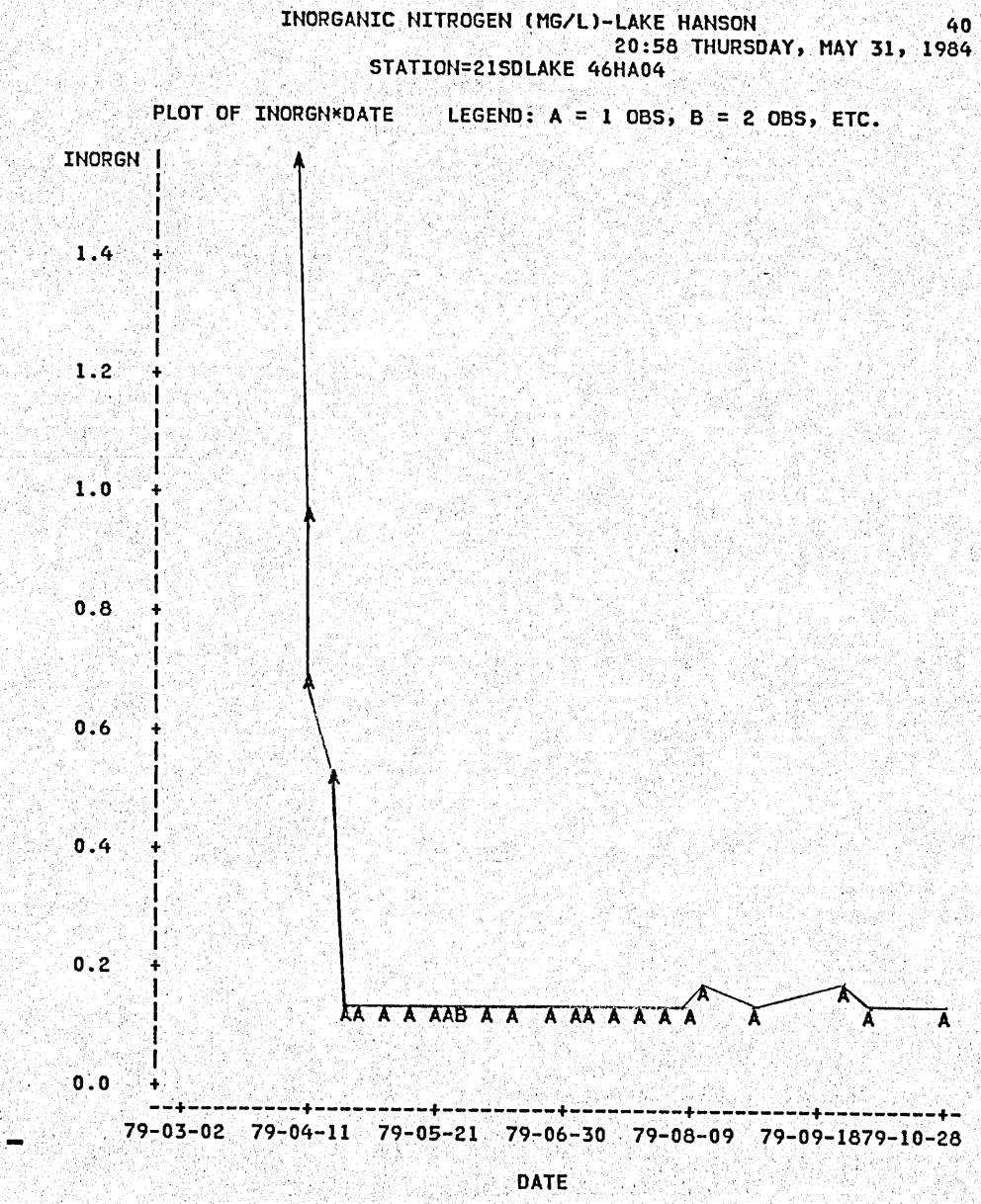

INORGANIC NITROGEN (MG/L)-LAKE HANSON 40
20:58 THURSDAY, MAY 31, 1984
STATION=21SDLAKE 46HA04
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
AA A A AAB A A A AA A A A A A A A A
79-03-02 79-04-11 79-05-21 79-06-30 79-08-09 79-09-18 79-10-28
DATE
NOTE: 5 OBS HAD MISSING VALUES

Figure IV-42.

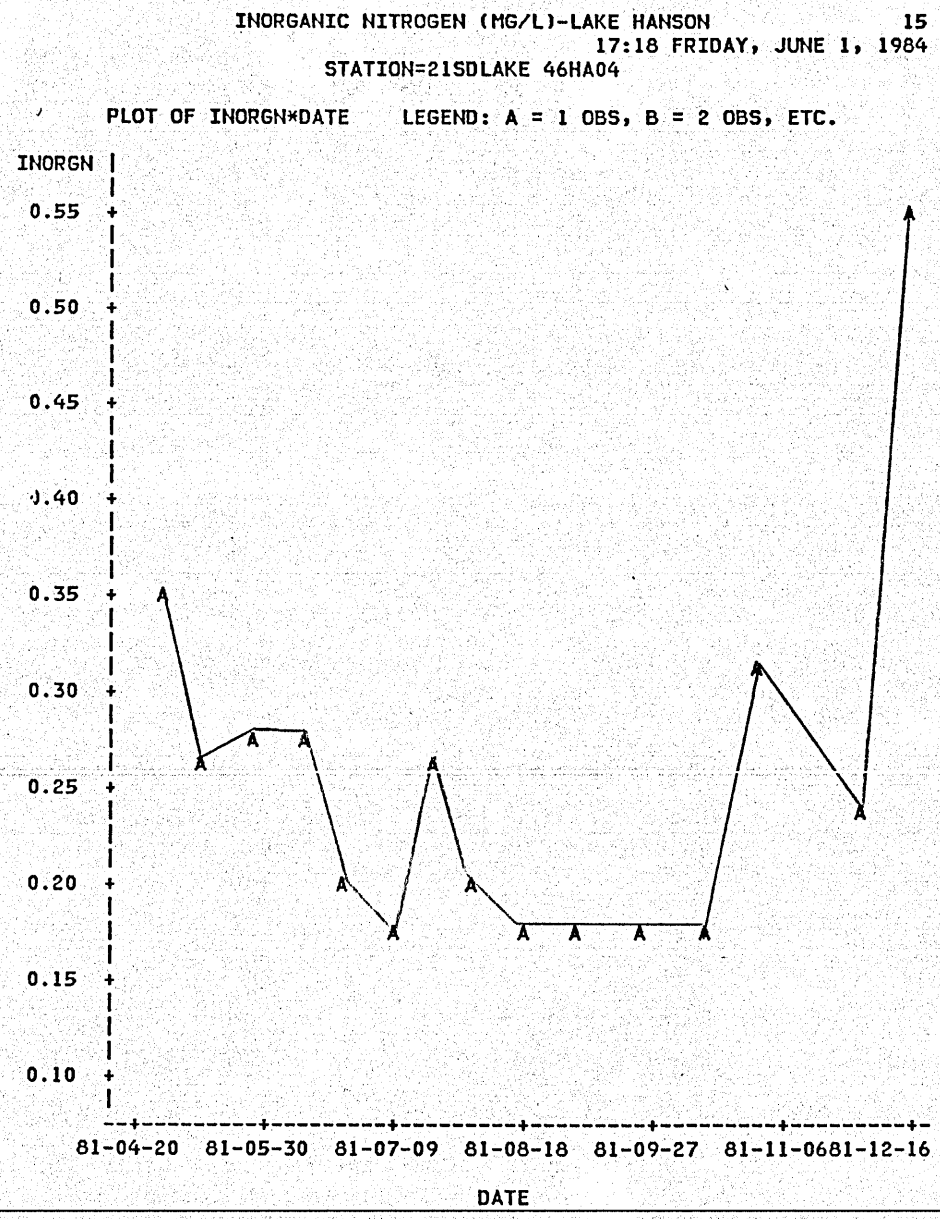

INORGANIC NITROGEN (MG/L)-LAKE HANSON 15
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
81-04-20 81-05-30 81-07-09 81-08-18 81-09-27 81-11-06 81-12-16
DATE

Figure IV-43.

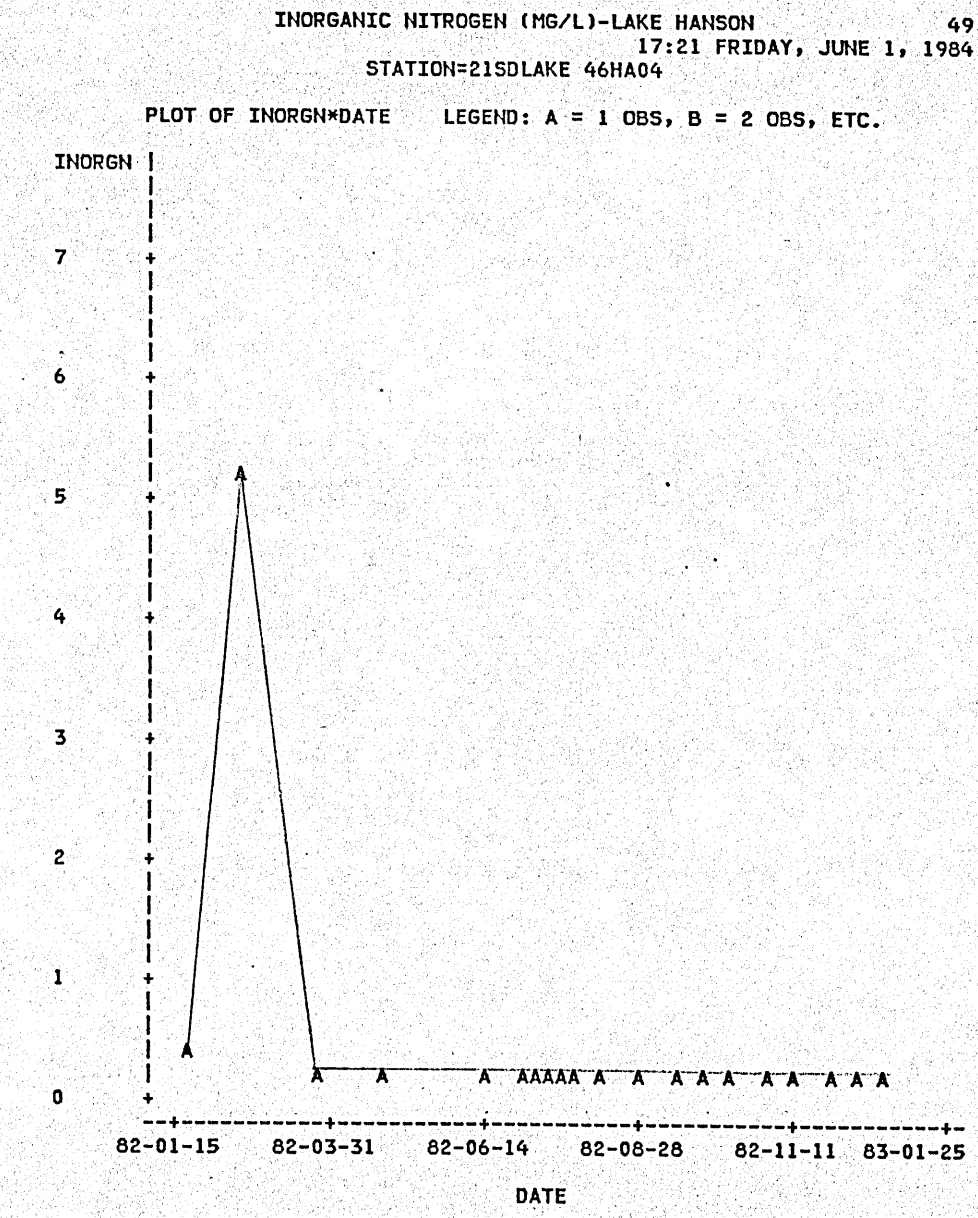

INORGANIC NITROGEN (MG/L)-LAKE HANSON 49
17:21 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
7
6
5
4
3
2
1
0
82-01-15
82-03-31
82-06-14
82-08-28
82-11-11
83-01-25
DATE

Figure IV-44.

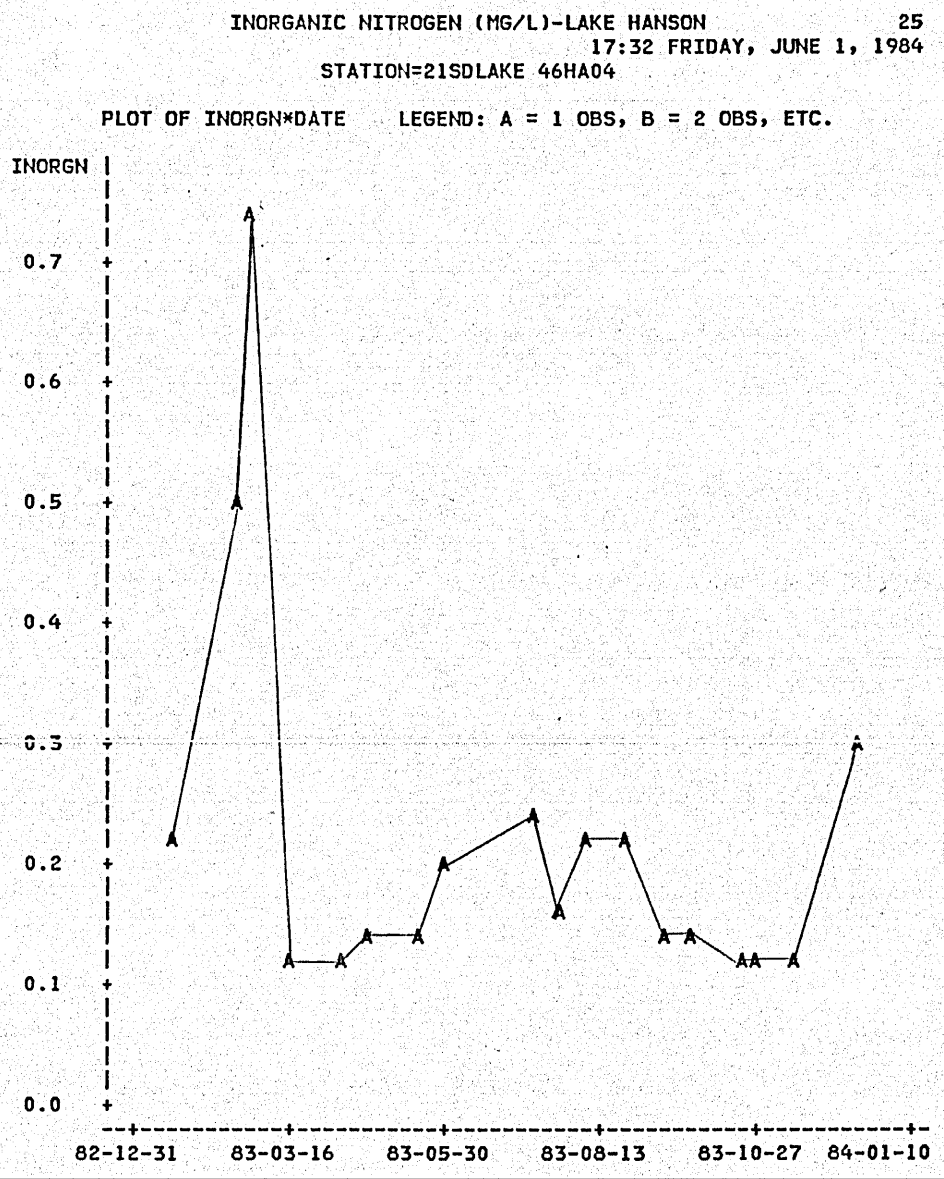

INORGANIC NITROGEN (MG/L)-LAKE HANSON 25
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-45.

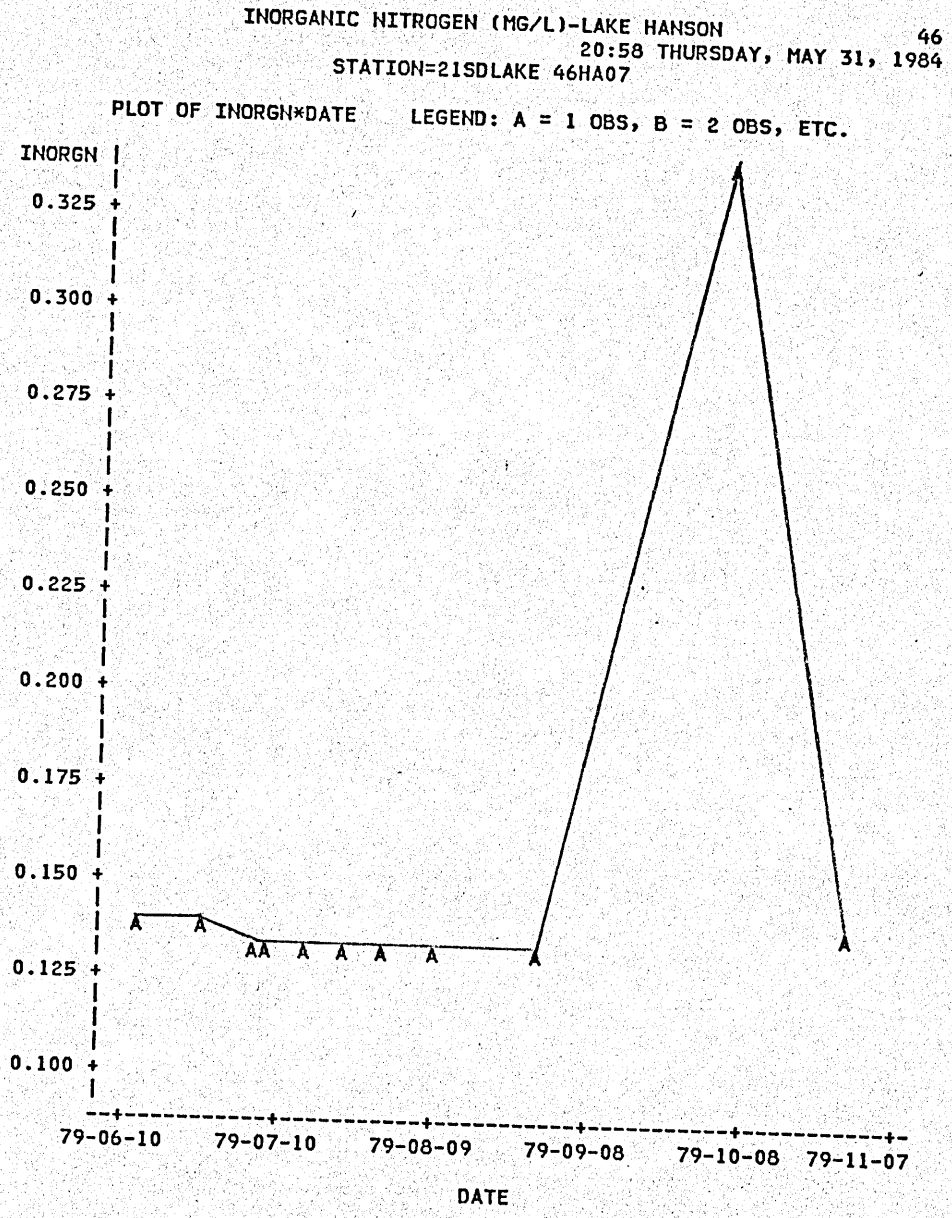

INORGANIC NITROGEN (MG/L)-LAKE HANSON
46
20:58 THURSDAY, MAY 31, 1984
STATION=21SDLAKE 46HA07
PLOT OF INORGN*DATE
LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
79-06-10
79-07-10
79-08-09
79-09-08
79-10-08
79-11-07
DATE

Figure IV-46.

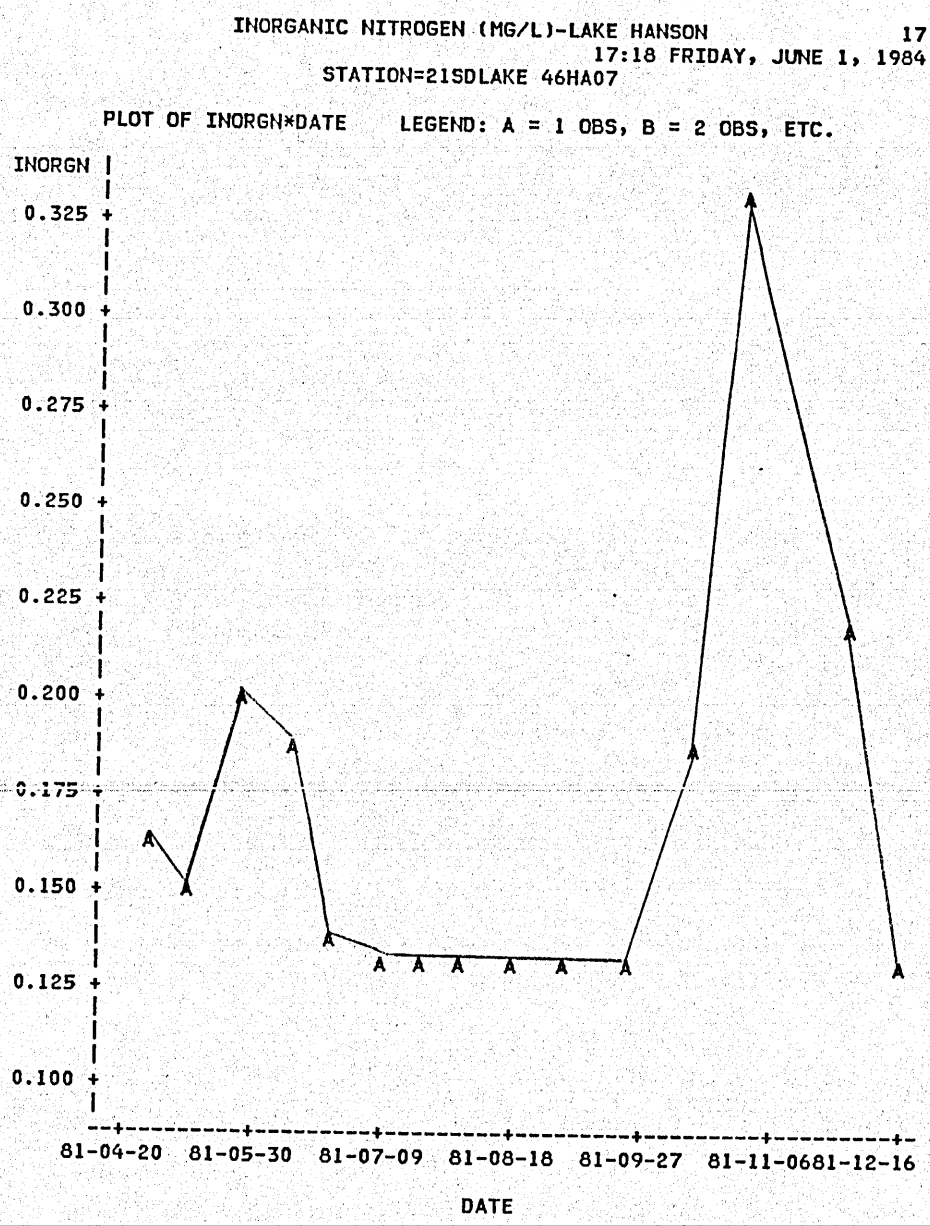

INORGANIC NITROGEN (MG/L)-LAKE HANSON 17
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
81-04-20
81-05-30
81-07-09
81-08-18
81-09-27
81-11-06
81-12-16
DATE

Figure IV-47.

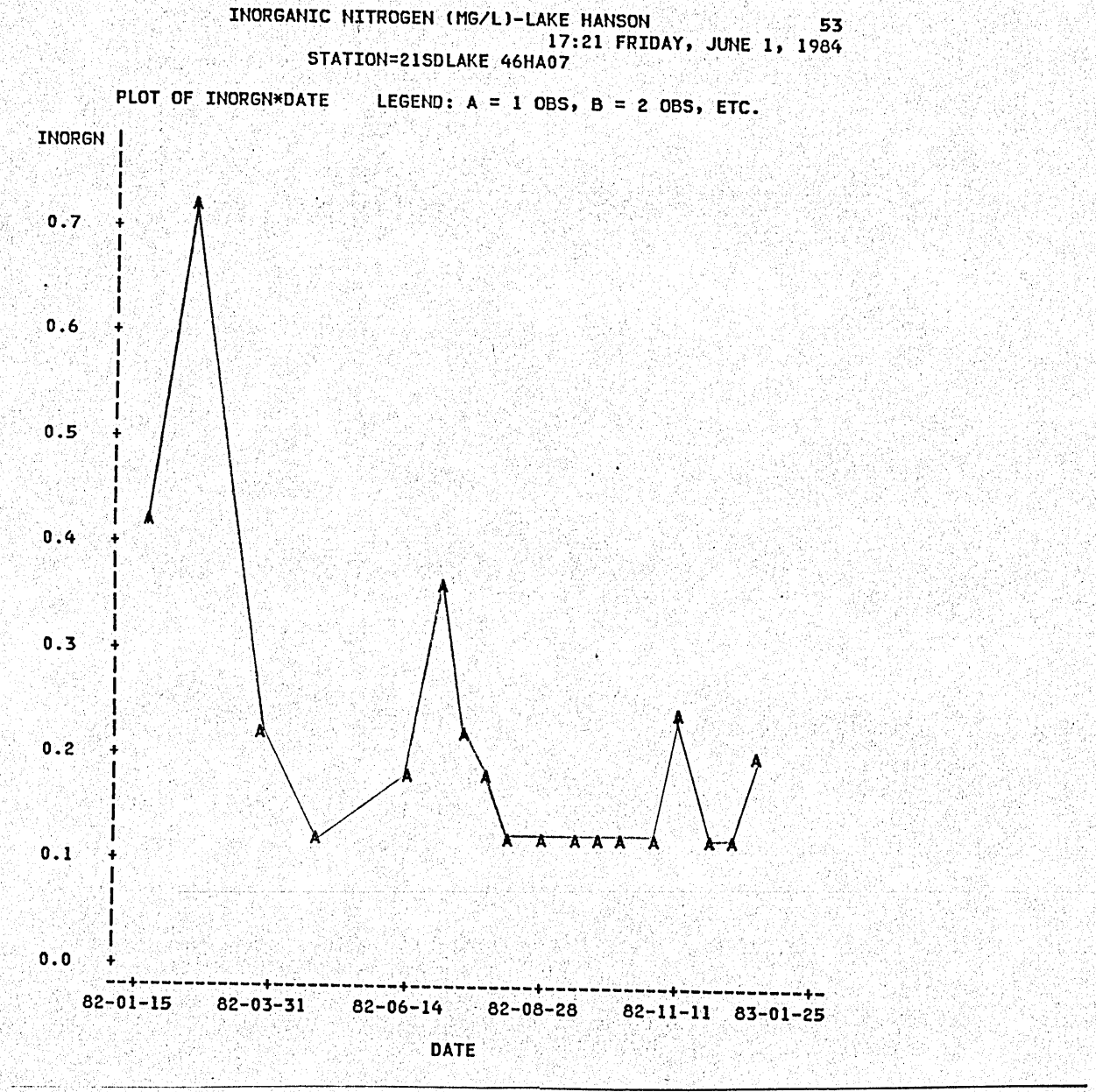

INORGANIC NITROGEN (MG/L)-LAKE HANSON 53
17:21 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
82-01-15
82-03-31
82-06-14
82-08-28
82-11-11
83-01-25
DATE

Figure IV-48.

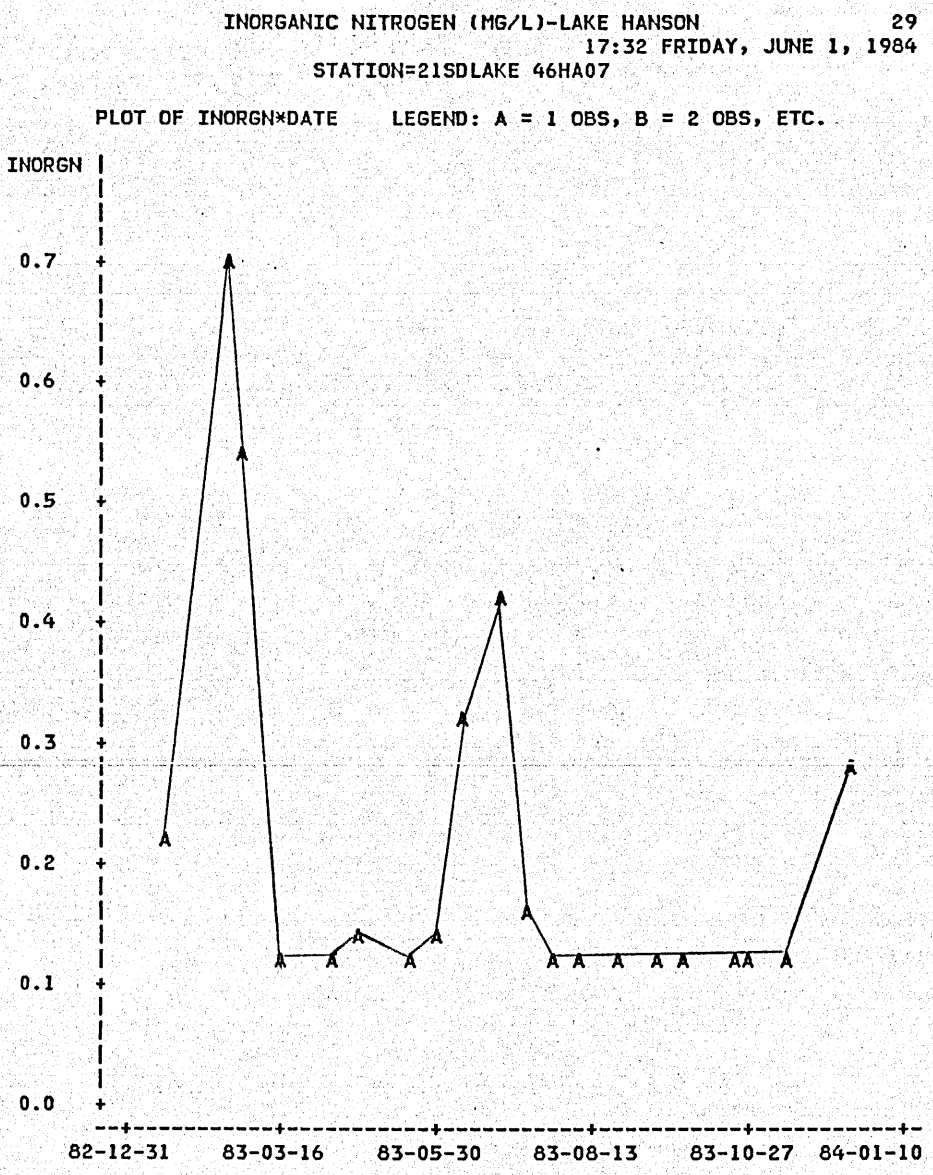

INORGANIC NITROGEN (MG/L)-LAKE HANSON 29
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF INORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
INORGN
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-49.

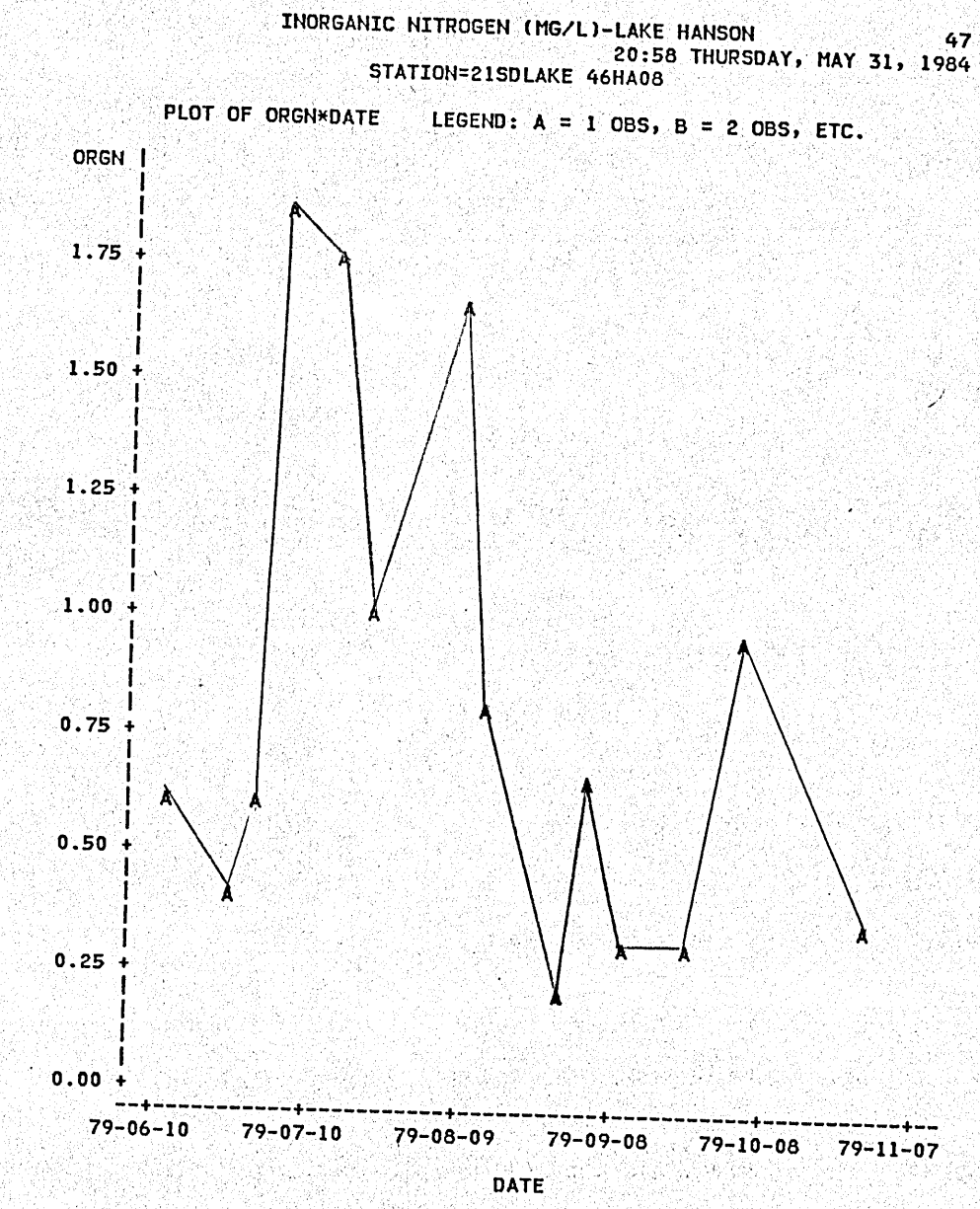
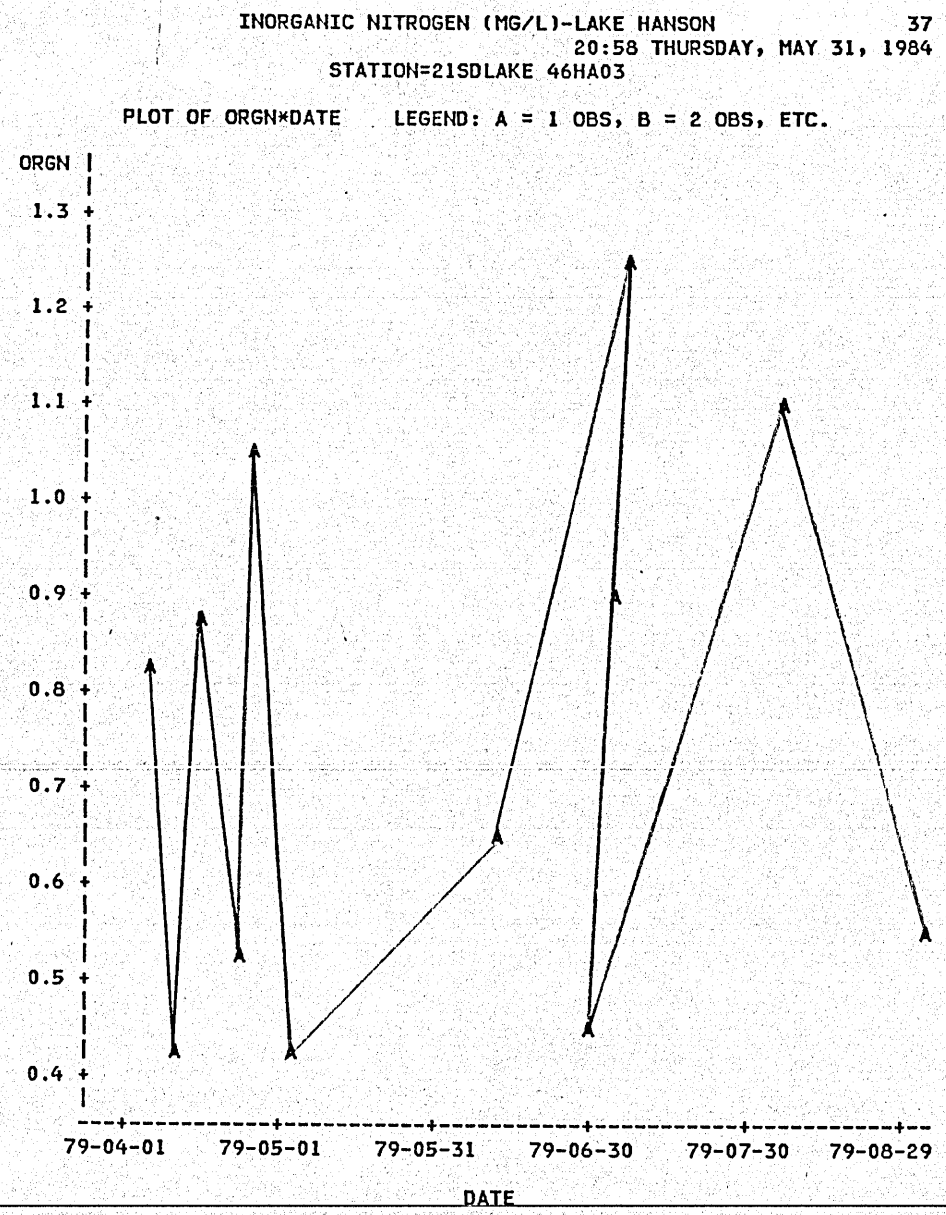

INORGANIC NITROGEN (MG/L)-LAKE HANSON
47
20:58 THURSDAY, MAY 31, 1984
STATION=21SDLAKE 46HA08
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
79-06-10
79-07-10
79-08-09
79-09-08
79-10-08
79-11-07
DATE

Figure IV-50



NOTE: 1 OBS HAD MISSING VALUES

Figure IV-51.

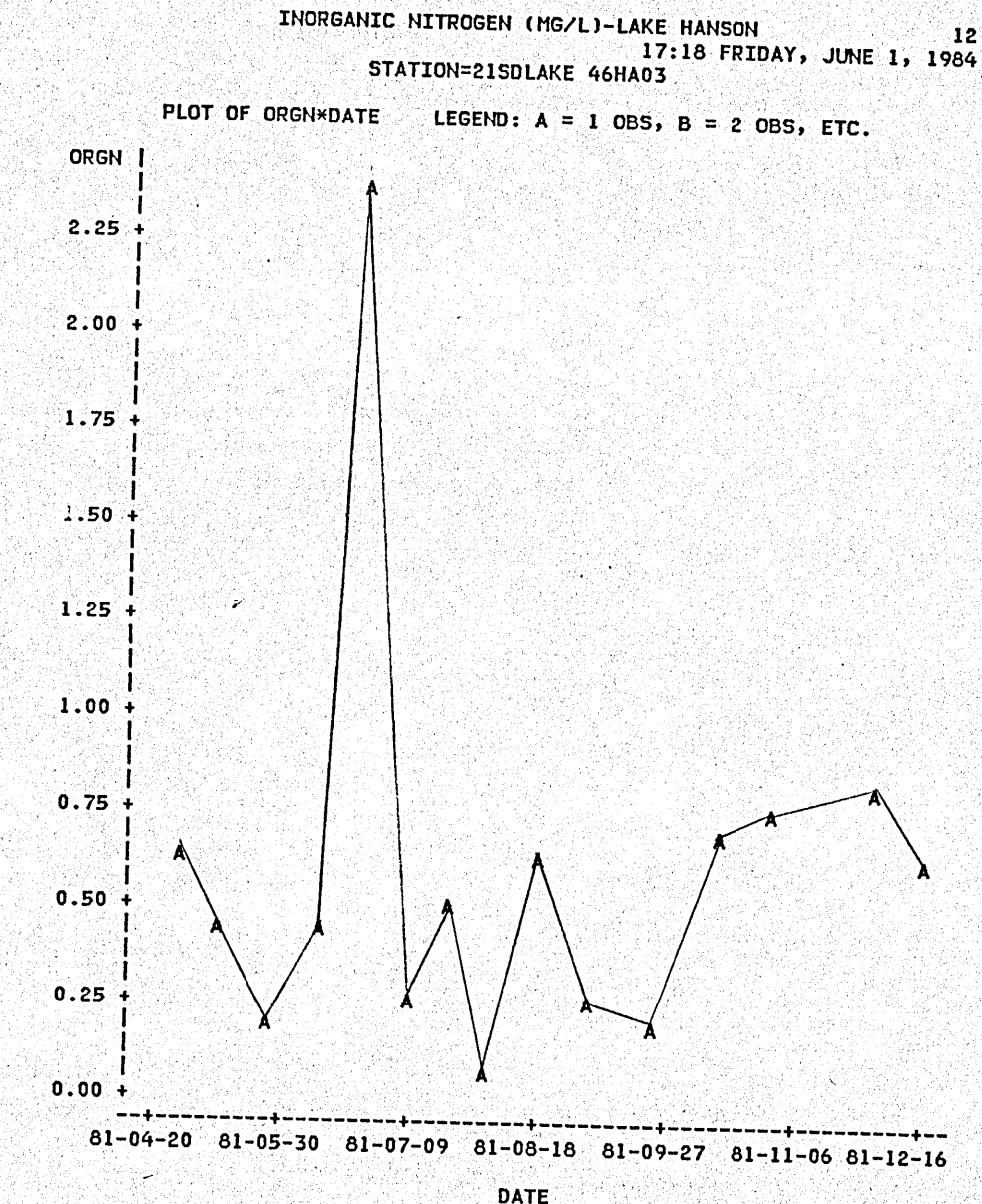
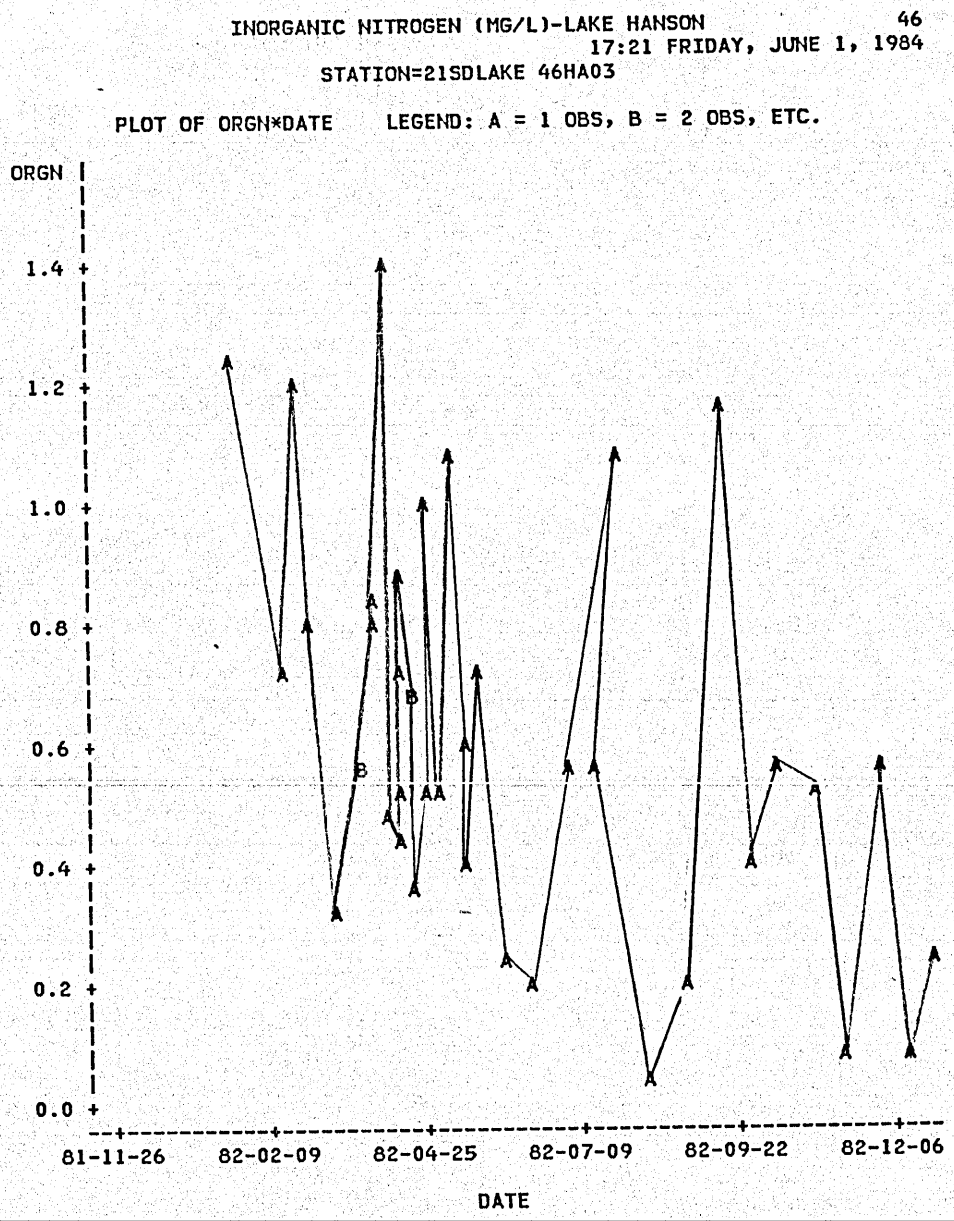

INORGANIC NITROGEN (MG/L)-LAKE HANSON
12
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA03
PLOT OF ORGN*DATE
LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
81-04-20
81-05-30
81-07-09
81-08-18
81-09-27
81-11-06
81-12-16
DATE

Figure IV-52.



NOTE: 1 OBS HAD MISSING VALUES

Figure IV-53.

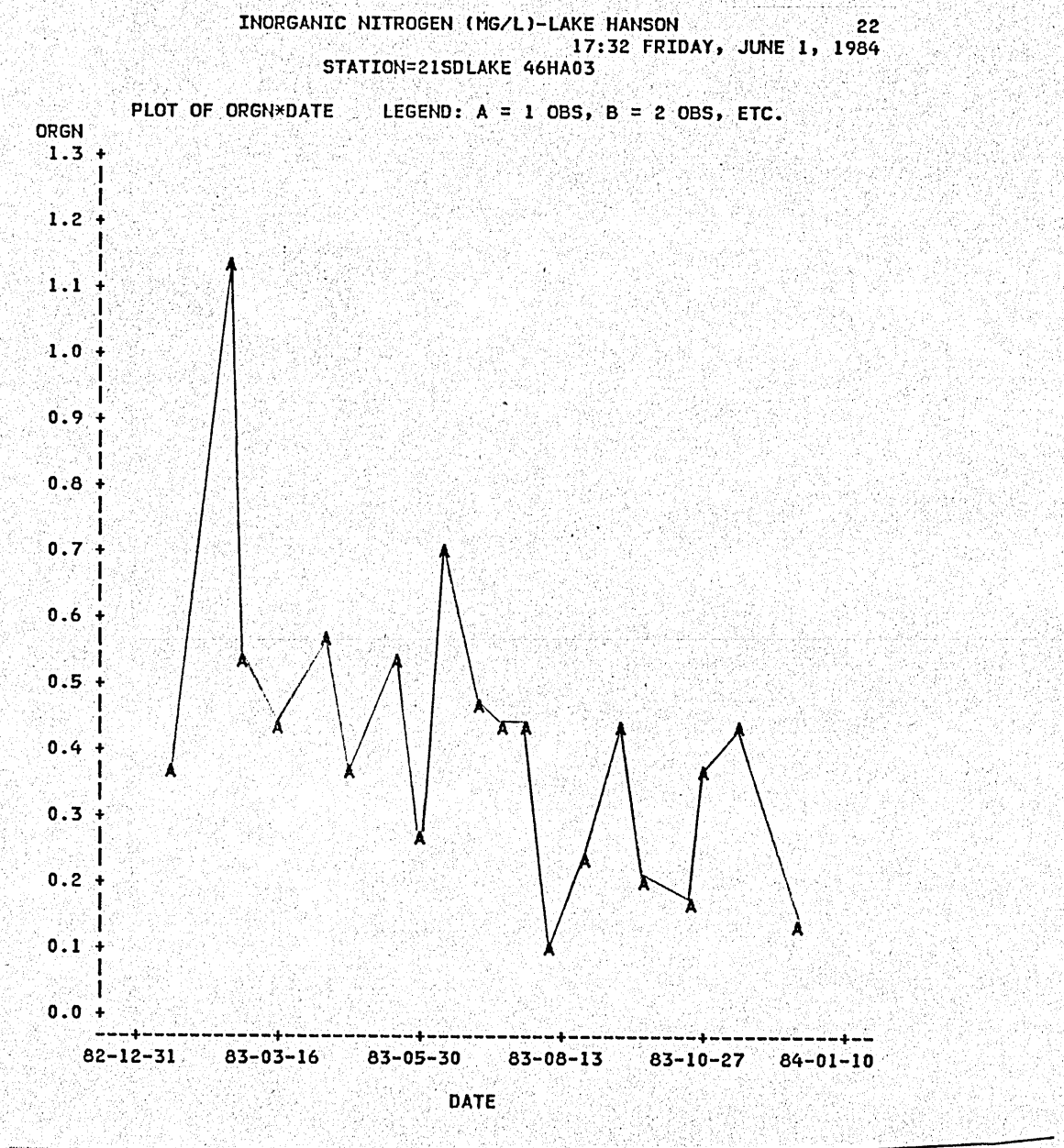
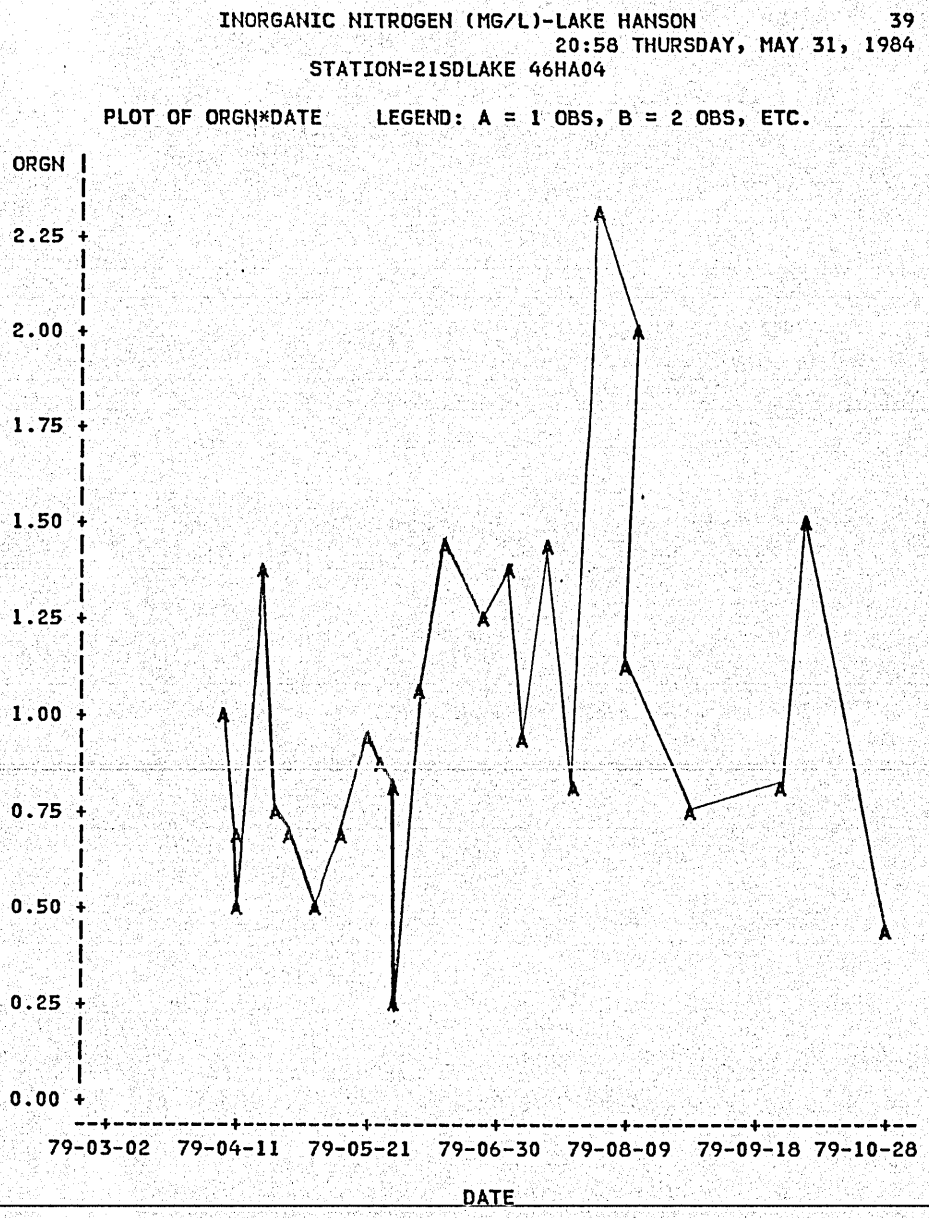

INORGANIC NITROGEN (MG/L)-LAKE HANSON 22
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA03
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-54.



NOTE: 5 OBS HAD MISSING VALUES

Figure IV-55.

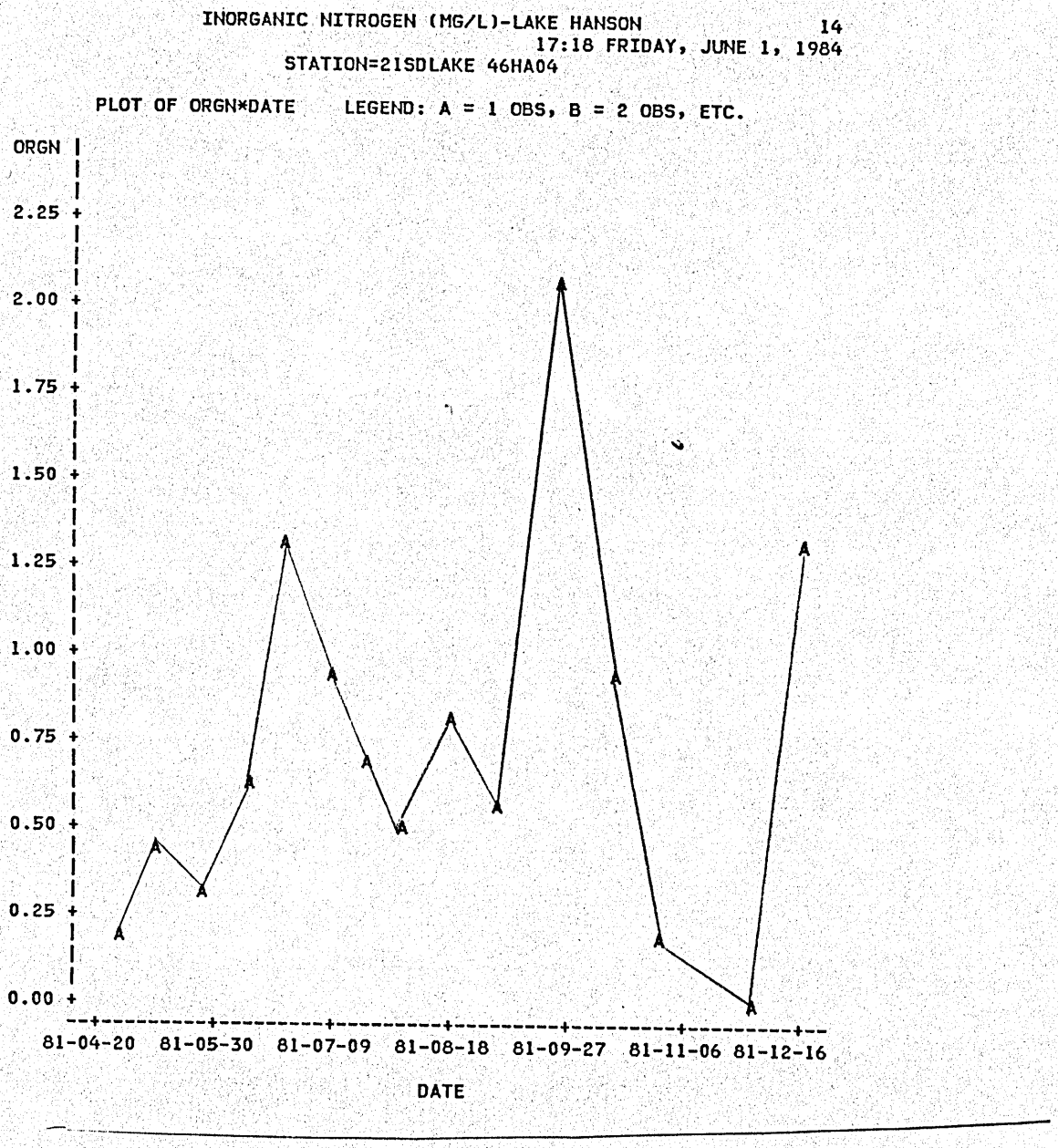

INORGANIC NITROGEN (MG/L)-LAKE HANSON 14
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
81-04-20
81-05-30
81-07-09
81-08-18
81-09-27
81-11-06
81-12-16
DATE

Figure IV-56.

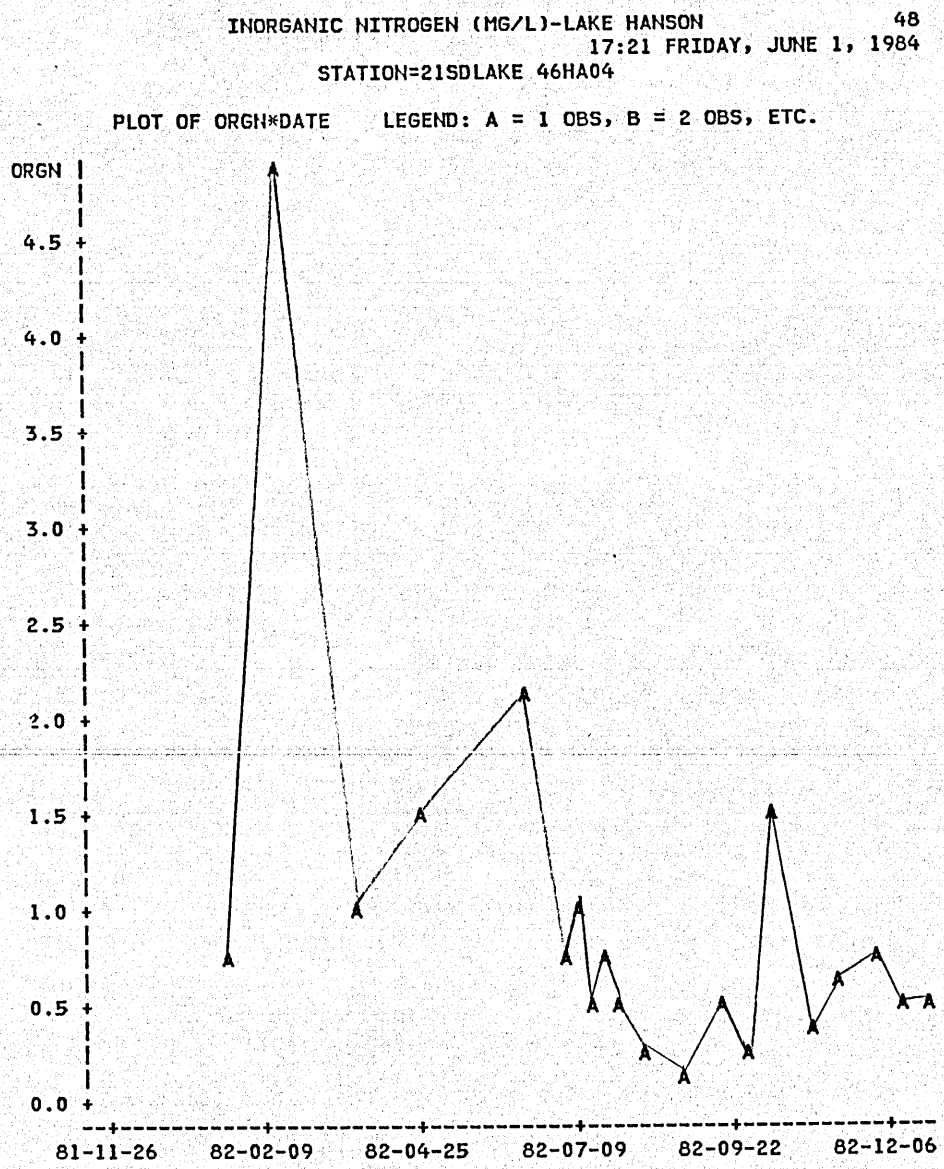

INORGANIC NITROGEN (MG/L)-LAKE HANSON 48
17:21 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
81-11-26
82-02-09
82-04-25
82-07-09
82-09-22
82-12-06
DATE

Figure IV-57.

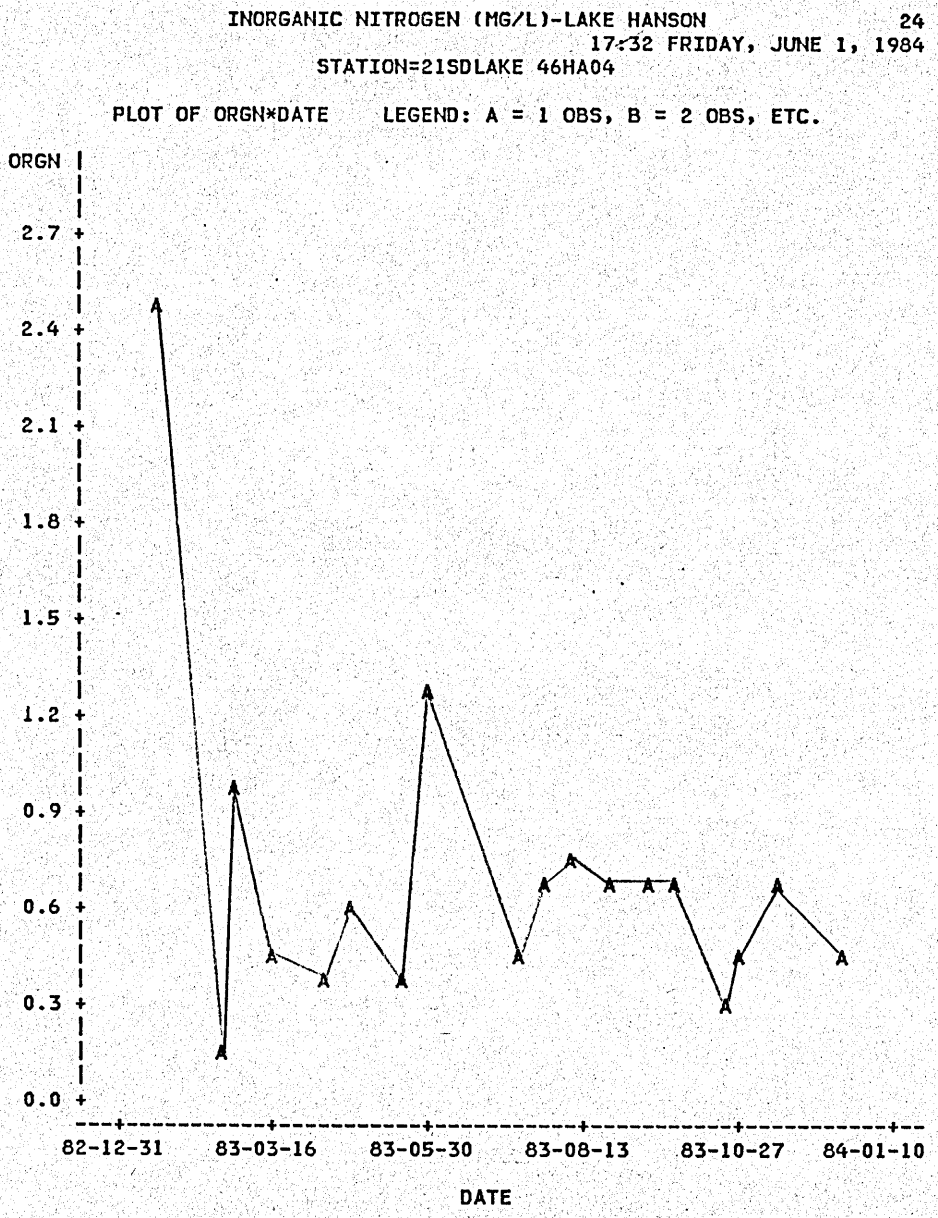

INORGANIC NITROGEN (MG/L)-LAKE HANSON 24
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA04
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-58.

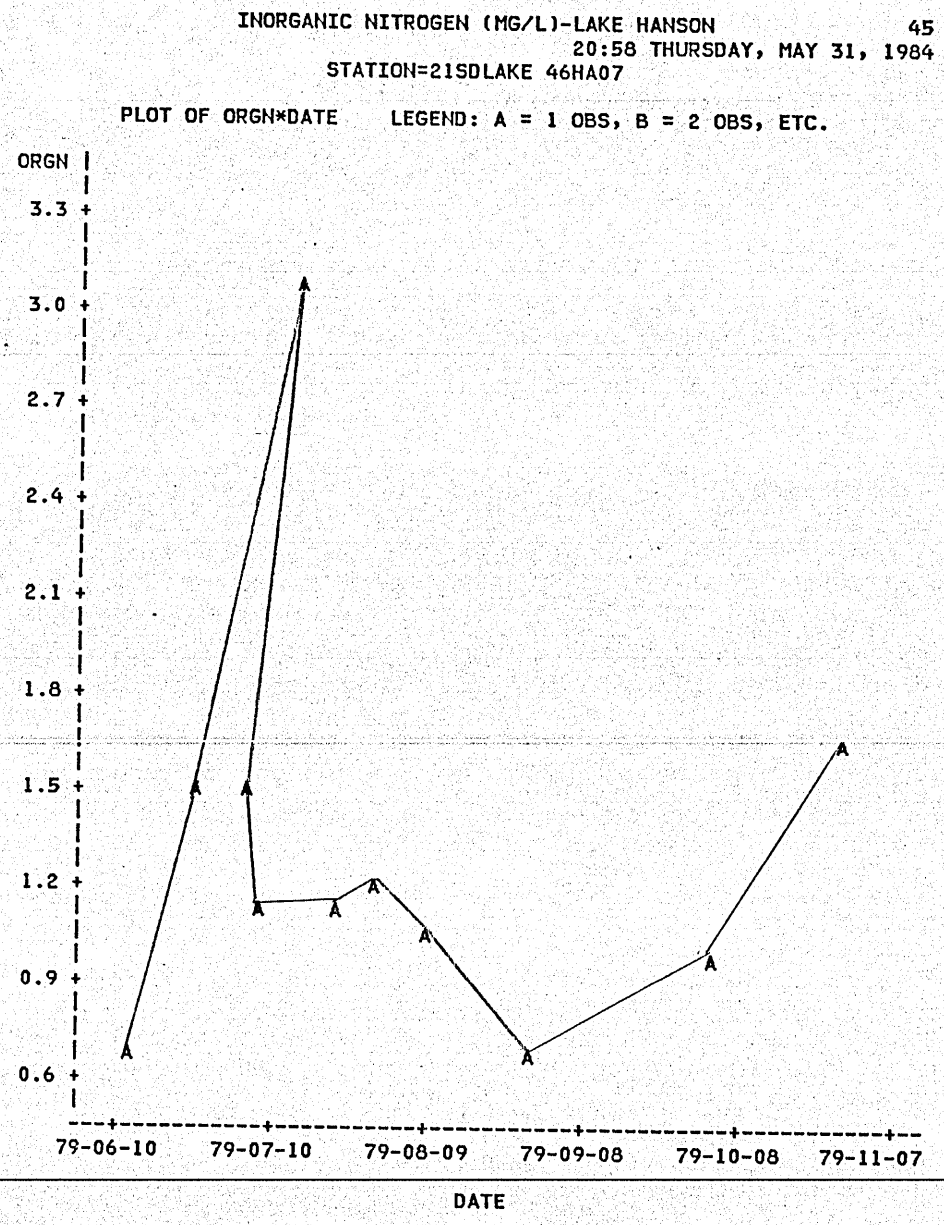

INORGANIC NITROGEN (MG/L)-LAKE HANSON 45
20:58 THURSDAY, MAY 31, 1984
STATION=21SDLAKE 46HA07
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
3.3
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
79-06-10
79-07-10
79-08-09
79-09-08
79-10-08
79-11-07
DATE

Figure IV-59.

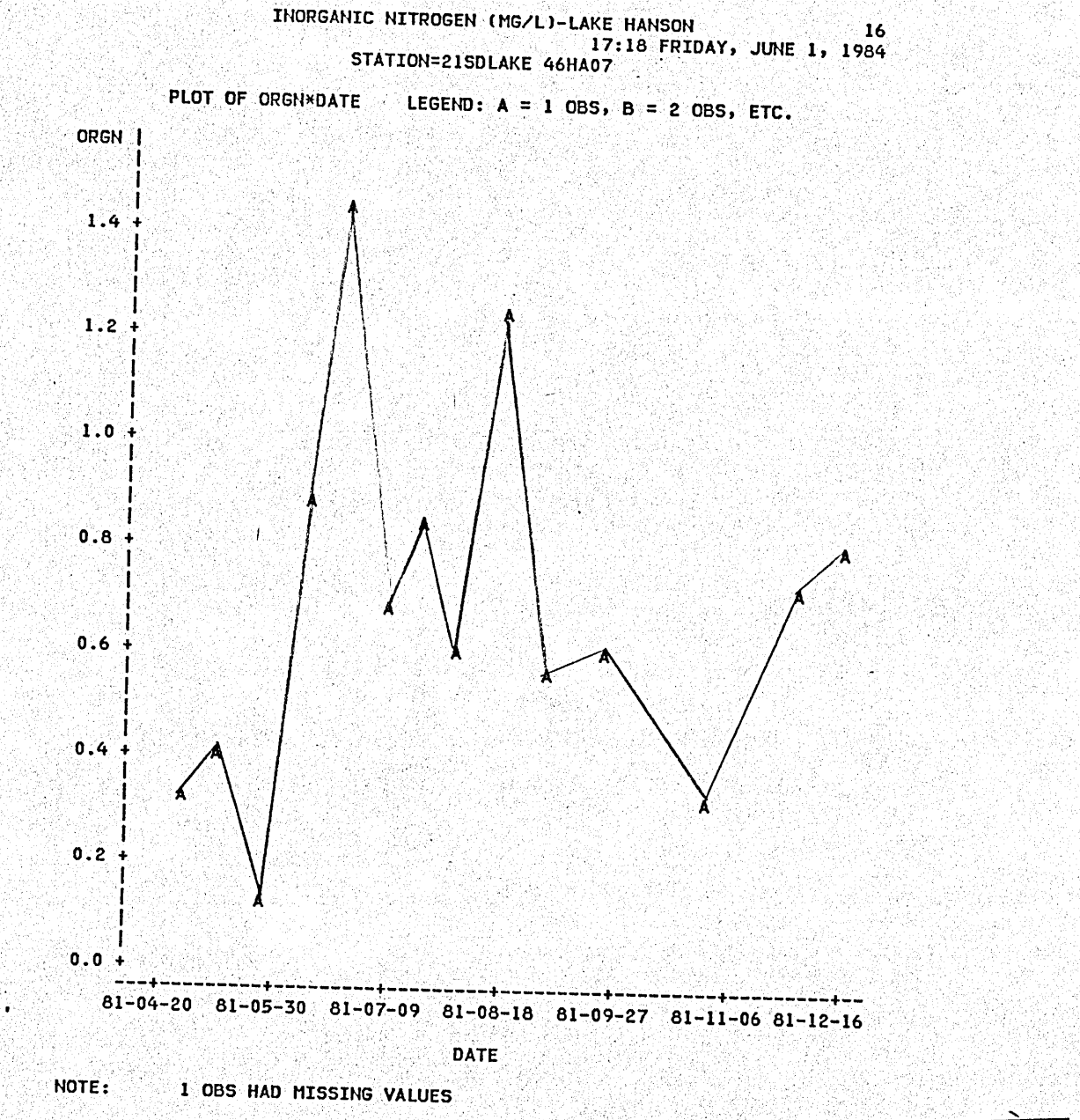

INORGANIC NITROGEN (MG/L)-LAKE HANSON
16
17:18 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
81-04-20
81-05-30
81-07-09
81-08-18
81-09-27
81-11-06
81-12-16
DATE
NOTE: 1 OBS HAD MISSING VALUES

Figure IV-60.

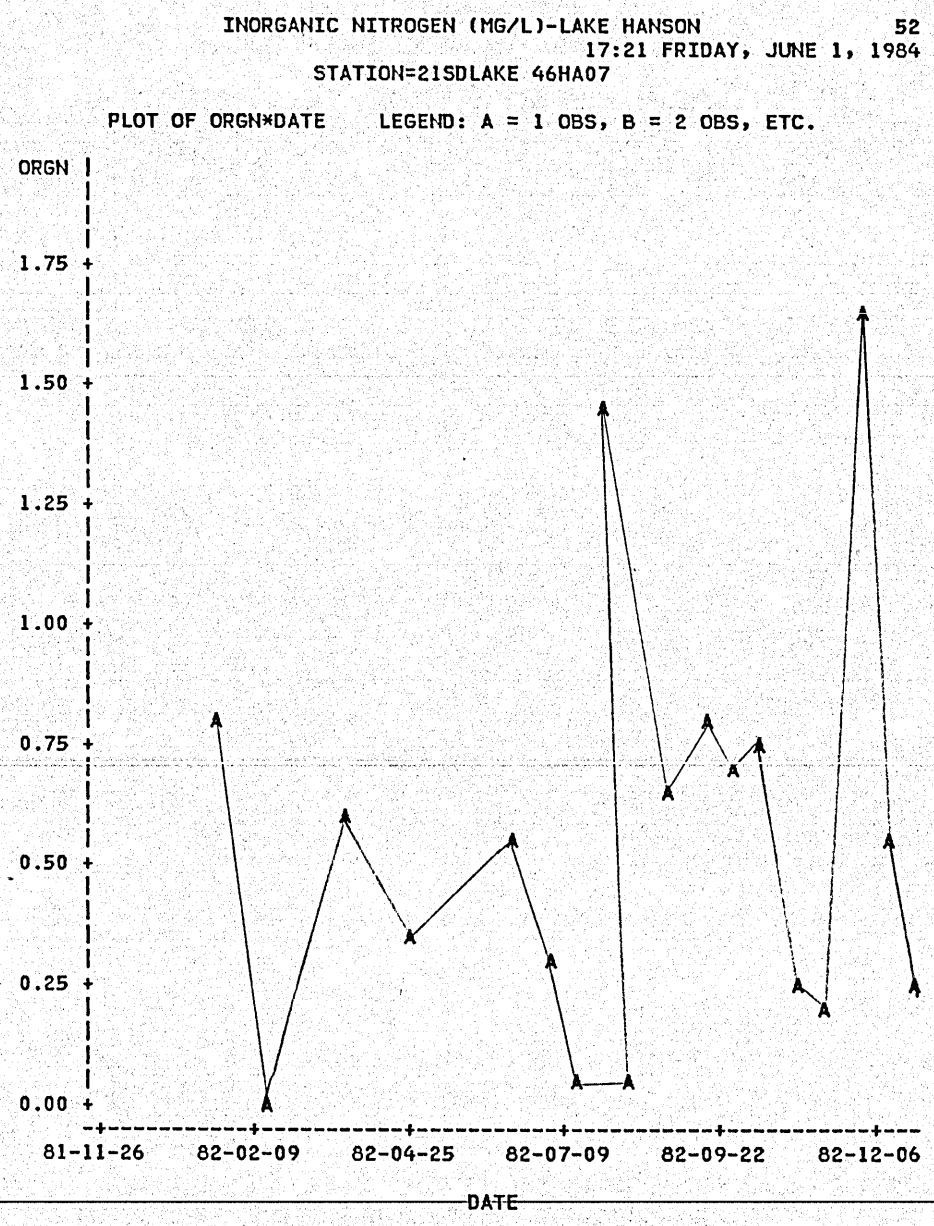

INORGANIC NITROGEN (MG/L)-LAKE HANSON 52
17:21 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
81-11-26
82-02-09
82-04-25
82-07-09
82-09-22
82-12-06
DATE

Figure IV-61.

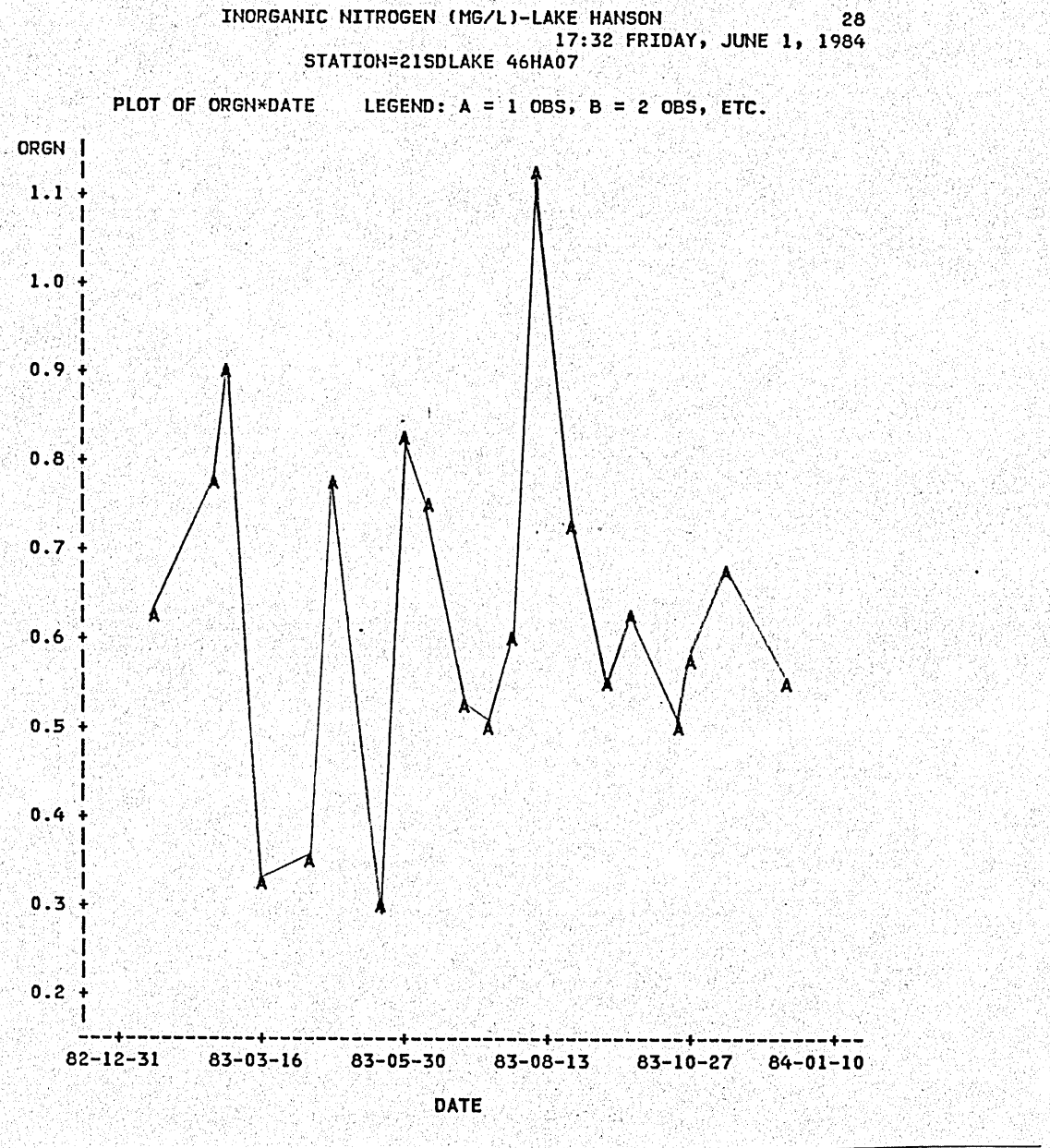
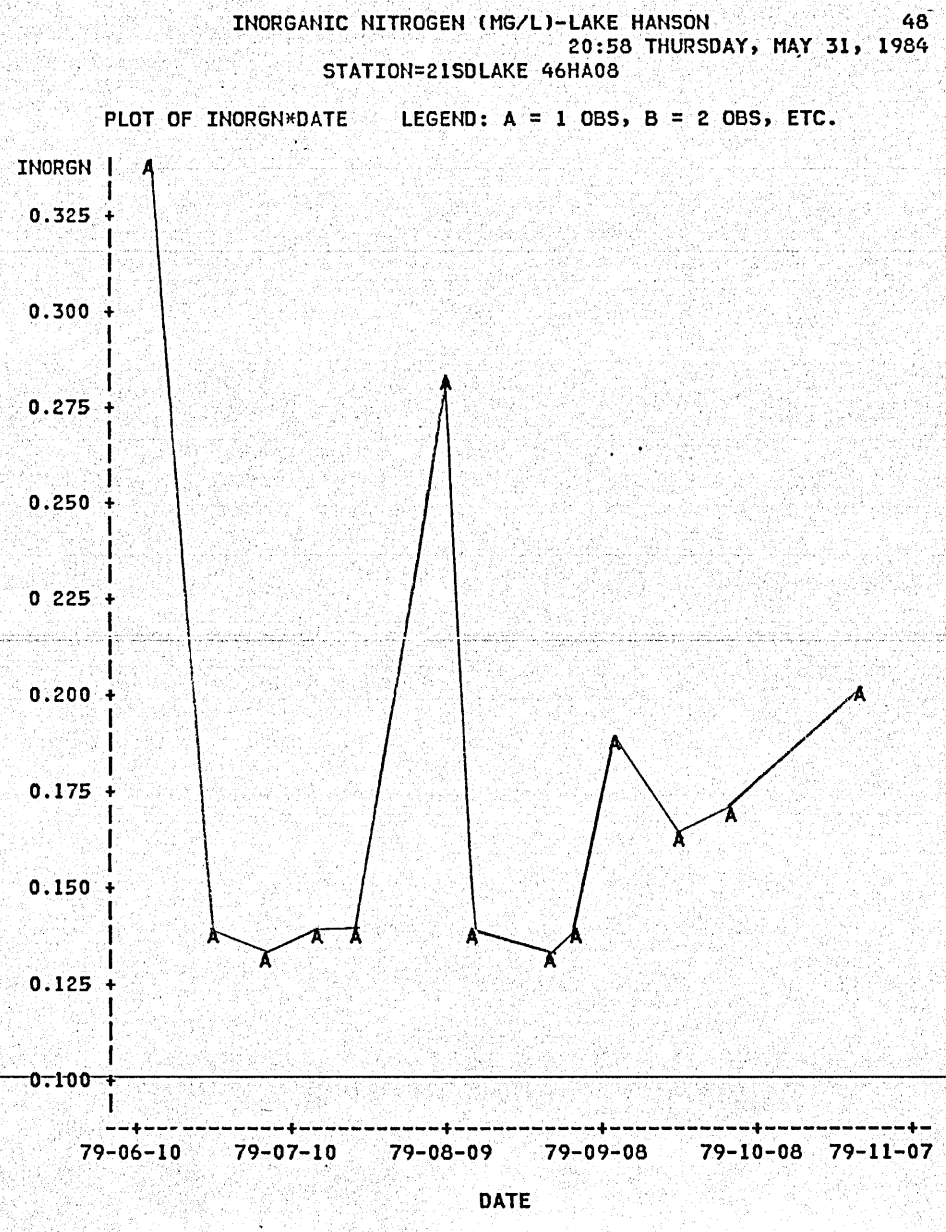

INORGANIC NITROGEN (MG/L)-LAKE HANSON 28
17:32 FRIDAY, JUNE 1, 1984
STATION=21SDLAKE 46HA07
PLOT OF ORGN*DATE LEGEND: A = 1 OBS, B = 2 OBS, ETC.
ORGN
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
82-12-31
83-03-16
83-05-30
83-08-13
83-10-27
84-01-10
DATE

Figure IV-62.



NOTE: 1 OBS HAD MISSING VALUES

Appendix E. Hanson County Conservation District Final Report

PIERRE CREEK - LAKE HANSON "208" WATER QUALITY STUDY

FINAL REPORT

By Project Coordinator- Robert Wagner

On May 27, 1980, the Hanson County Soil Conservation District and the South Dakota Department of Water and Natural Resources entered into an agreement to assist in producing an effective water quality management plan for the Pierre Creek-Lake Hanson Watershed, consisting of approximately 42,844 acres of land. This contract was funded by a grant from E.P.A. and financed through a section 208 Waste Treatment Management Planning Grant from the United States Environmental Protection Agency.

The reason for entering into this agreement was to get an evaluation of the water quality in the waterways of Pierre Creek, that are being polluted by Nitrates, Phosphates, sediment and bacteria. The sources of this pollution include- animal and human wastes, runoff from roads, highways and fields, and sediment from soil disturbing activities.

The results of this pollution have been the degradation of water quality, especially in Lake Hanson, the loss of prime soils from farms, loss of wildlife and habitat, and less desirable recreation areas.

Through the promotion of Conservation Measures with 130 landusers in the watershed area, and best management practices, (B.M.P.) applied in the years 1980 into 1984 we have attempted to correct some of the problems that existed. At the beginning of the project and throughout 1981 each of the 130 landusers were contacted and given the Pierre Creek-Lake Hanson "Special Project" handbook, which was prepared by the Soil Conservation District, Soil Conservation Service, and the A.S.C.S. This "Special Project" handbook contains the cost sharing A.C.P. practices available to each landuser in the Pierre Creek Watershed. These same people were again contacted during the years of 1982-1983 to find out if there were A.C.P. practices that could be of a benefit to the farmland in their operations.

The economic conditions of this particular area of South Dakota since the start of the Pierre Creek-Lake Hanson Water Quality Study have not been favorable. Some farm operators have been forced to turn to other occupations as a result of low grain and livestock prices, compared to what it cost to produce grain and livestock. I feel this has had a great impact on the participation in the Pierre Creek Watershed.

A great deal of technical assistance has been provided to different proposed projects and when the cooperators would see the cost estimates, they found it too expensive to complete this particular practice or project. This was evident in at least four different animal waste systems that were planned near the Pierre Creek Mainstream. However; some of these farmers went ahead and put in less expensive units fashioned after the original plans to try and correct the problems.

A work plan was put together at the beginning of the Pierre Creek-Lake Hanson Water Quality Study. The objective being to assist and encourage landusers in the watershed in the placement of Conservation practices to ensure the adequate treatment of the Watershed by Resource Management systems and thus improve water quality. Goals adopted were to identify land areas that need additional land treatment and provide planning and technical assistance in the use of practical resource management systems to the owners and users of that land.

An advisory board was established. Members consist of the Hanson County Commissioners, Wayne, Jasper, Edgerton, and Springlake Township board members, City Council members from Alexandria and Farmer, Intercounty Electric board member, and the President of the Lake Hanson Association. Advisory board meetings were held as the study continued to get input and views from these people.

I attended the Alexandria City Council Meetings on several occasions, working together with council members on management problems at the Alexandria City Lagoon, which has been leaking into Pierre Creek. Plans have been made to correct this problem in 1984.

A sediment survey was also completed in Lake Hanson in February 1981. This soil sediment accumulation was complied and these records will serve as a "yard stick" for measuring the success of the Pierre Creek-Lake Hanson Water Quality Study, by comparing this early survey and the success of conservation practices in the watershed.

A feedlot survey was completed in July 1982 which showed 21 hog and 20 cattle and dairy operations of significant size directly in the watershed area, as well as 3 slurry systems.

A drainage area map of the Pierre Creek Watershed was complied at the start of the study and used as the study continued. Also developed was a questionaire for a septic tank survey at Lake Hanson to assess problems that may exist, to provide a data base to justify future activities .

Aerial photos of the Pierre Creek-Lake Hanson Watershed have been used for information on land usage. Many pictures and slides were taken throughout the watershed and a slide presentation has been completed that demonstrates the effect that good conservation practices had on this project. Some of these photos were used on a photo display board, that was developed and displayed at local business places, Banks in the area, Hanson County Courthouse and the Hanson County A.S.C.S Office.

Water samples at six sampling sites have been taken and sent to the State Health Laboratory at Pierre, South Dakota. Twice monthly (as the general rule) except when runoff from heavy rains or fast snow melt occurred, (then taken daily,) from the start of the project through January of 1984.

Among the Best Management Practices completed in the project are: 729 acres of SL-1 (permanent Vegetative cover), 23 acres of SL-7 (windbreak restoration), 120 acres of SL-14 (reduced tillage) and 3 wells and 7 dugouts, which is the SL-6 practice (grazing land protection). Also, about 25 acres of trees have been planted in the watershed area.

The amount of A.C.P. funds used for these B.M.P. for each crop year is as follows, with cost share at 75%:
1981 - $5618.00, 1982 - $11266.00, 1983 - $6236.00, for a total of $23120.00.

A "Drive-it-yourself" conservation tour was established in the area partially in the watershed. The tour pointed out many of the different conservation practices used in the Pierre Creek Area.

In December of 1982 and also 1983, the Annual Tillage Conferences were held in the Corn Palace in Mitchell. This Conference provided farmers with information on the increasing interest in No-till and minimum tillage and how it relates to soil and water erosion. The project coordinator spent a good deal of time working with this annual event.

The Bainbridge Tillage Demonstration test plot has also taken a good deal of my time in the planting and harvesting seasons. This 40 acre field has been divided into a series of evaluation plots to compare three tillage systems: Conventional, Chisel, Disk plant and No-Till. With plantings of corn and oats this plot is producing valuable information. This will be continued for two more crop years.

An RC&D Critical Area Project - CA-272-HA, Alexandria Old City Landfill, was surveyed and blueprints plans and cost estimates were completed. However; this land changed ownership and the work has not been completed as of yet. There is renewed interest at this time and probably will still be completed in the summer of 1984. This project, if completed, would be a big benefit to clean water, as it is located a few hundred feet from the Pierre Creek Mainstream.

News articles were published in the county papers as the work continued in the watershed area. Also, the Hanson County Conservation District began publishing a quarterly newsletter in September 1981. Articles covering the water quality project were written and pictures taken for each Newsletter published through January 1984.

Different movie films of interest and educational value to children, were shown in classes in the Alexandria (Hanson) and Emery School systems, along with the Pierre Creek slide presentation.

Reports of progress were reported at the monthly R.C.& D. meetings by the project coordinator. Also meetings with the Hanson County Commissioners and Lake Hanson Association Board, pertaining to needed repairs on the Lake Hanson Spillway. These repairs were later completed by the National Guard of South Dakota.

A "Conservation Tillage Demonstration" was held in the fall of 1982 and also 1983 in the area. It was well attended by farm operators in the Pierre Creek Watershed Area, as well as surrounding counties. Machinery dealers using tillage implements as well as chemical products and their application, were successfully demonstrated. People from S.D.S.U. Extension, were on hand to give brief information to the crowd.

As we approached February 15, 1984, it was evident that the Pierre Creek-Lake Hanson Water Quality Study was coming to its conclusion. I believe much has been accomplished. However there are some area's where much more could be accomplished in this project area, in the placement of more conservation practices.

Attached are the drainage area map of the Pierre Creek Watershed, Hanson County. Alexandria, South Dakota.

Also, the final Financial Report of the "208" Water Quality Grant between the Hanson County Conservation District and the South Dakota Department of Water and Natural Resources.

A copy of the Pierre Creek-Lake Hanson Water Quality Study Work Plan is also attached.

Robert Wagner

Robert Wagner
Project Coordinator

LowerJames RC&D

996.1031

1315 NORTH MAIN • MITCHELL, SOUTH DAKOTA 57301 • P.O. BOX 956 • 605, [redacted]

January 29, 1979

RECEIVED JAN 30 1979

Mr. Herman Tushaus, Director
Planning & Development District III
P. O.#687
Yankton County Courthouse
Yankton, South Dakota 57078

Dear Herman:

We checked our files here Herman, and we noted that we did not send you a copy of the letter that was transmitted to Dave Pfahler, Water Quality Specialist, Department of Environmental Protection on December 19, 1978. In that letter we requested assistance in regards to the Pierre Creek Non-Point Water Quality Study Area and listed a work outline so that all parties could participate.

You may wish to review this letter Herman, and note the work outline as suggested.

Any comments that you wish to make will certainly be appreciated.

Sincerely,

James C. Hunt

James C. Hunt, Coordinator
Lower James RC&D Area

JCH:kac
Enc.

WD-22-HA

December 19, 1978

Dave Pfahler, Water Quality Specialist
Office of Water Quality
Dept. of Environmental Protection
Office Bldg. #2
Pierre, South Dakota 57501

Dear Mr. Pfahler:

The sponsors for the Pierre Creek Non-point Water Quality Study Area have contacted the Lower James RC&D Council to continue to assist them on further development of this project. They have asked what the next step is on development and what assistance was needed from them. Since your agency will be assisting with monitoring and funding, we hesitate recommending any additional developments at this time, especially when your department is reviewing programs and getting them ready for the 1979 South Dakota Legislative Session.

If we may, we would like to take this opportunity to suggest the attached tentative work outline for you and the sponsors. We believe the outline would be of great assistance to them, the sponsors.

Dave, we would appreciate your comments and would be happy to work with you towards the completion of a work outline and the Pierre Creek Non-point Water Quality Study Area Project.

Sincerely,

Harold Naser, Chairman
Lower James RC&D Council

HN:s

James C. Hunt
RC&D Coordinator

cc - Hanson County
Conserv. District

- Hanson County
Commissioners

PIERRE CREEK NON-POINT WATER QUALITY STUDY AREA
HANSON COUNTY, SOUTH DAKOTA
WORK OUTLINE

Progress Activity	Who	When
1. Develop Pierre Creek Non-Point Walter Quality Study Area RC&D Measure Plan	Lower James RC&D Area	September, 1978
2. Review Measure Plan with Sponsors (Hanson County Conservation District & Hanson County Commissioners)	Lower James RC&D Area	November, 1978
3. Request letters of support and endorsement of the Water Quality Study Area.	Sponsors	December, 1978
4. Request approval from the South Dakota Department of Environmental Protection.	Sponsors	December, 1978
5. Develop a public information and education program for the Pierre Creek Non-Point Study Area.	Sponsors, DEP, Cooperating organizations	January, 1979
6. Select potential monitoring location sites.	DEP	January, 1979
7 Review monitoring site locations with Sponsors and request assistance in requiring landowners' permission to monitor water quality.	Sponsors, DEP, Cooperating organizations	January, 1979
8. Organize monitoring personnel, inventory resources, and establish base line data (remote sensing).	Sponsors, DEP, Cooperating organizations	February, 1979
9. Install monitoring equipment and train personnel.	DEP, Cooperating organizations	February, 1979 March, 1979 April, 1979
10. Collect, record, and assemble water quality information and inventories.	DEP, Cooperating organizations	(Each Water Quality year) (Progress Report 6 months?)
11. Complete draft copies of water quality information and inventories, and review with local Sponsors.	DEP, Cooperating organizations	November, 1979
12. Hold a public information meeting in Pierre Creek Non-Point Water Quality Study Area.	Sponsors, DEP, Cooperating organizations	December, 1979

Progress Activity	Who	When
13 Begin implementation program meeting with these landowners where water quality problems exist.	Sponsors, Cooperating organizations	January, 1980 (or sooner)
14. Develop conservation and water quality resource plans with landowners. Assist them with the application of conservation and best management practices to improve water quality and protect the soil resource.	Sponsors, Cooperating organizations	February, 1980, March, 1980, April, 1980, and on
15. Continue to monitor and evaluate water quality. Publish annual progress report	DEP, Cooperating organizations	(Each Water Quality Year)

To: Board of Supervisors, Hanson County Conservation District

Subject: Submittal of recommended Special Projects Docket for evaluation and referral to ASCS County Committee.

From: Jin Bleeker, Project Coordinator Pierre Creek - Lake Hanson Water Quality Project

The Pierre Creek watershed is comprised of some 45,000 acres in Hanson County and extends from the North Central portion of the county through the South West portion of the county. Some of the estimated erosion problems within the watershed include:

1) About 60 acres of eroding drainage ways in cropland
2) Approximately 5000 feet of eroding streambank
3) Ten small roadside or grassland gullies
4) Five locations with severe gullies or draining large areas of cropland
5) One poorly filled dump ground
6) Four abandoned gravel pits
7) Two feedlots needing treatment

In developing a special projects docket for the Pierre Creek - Lake Hanson Water Quality Project we have received input from several agencies including ASCS, SCS, Lower James RC&D, and the Hanson County Conservation District. As a draft copy we would like to submit for your approval a docket including the following practices.

SL1 Permanent Vegetative Cover Establishment
SL2 Permanent Vegetative Cover Improvement
SL3 Stripcropping Systems
SL4 Terrace Systems
SL5 Diversions
SL6 Grazing Land Protection
SL7 Windbreak Restoration or Establishment
SL11 Permanent Vegetative Cover on Critical Areas
SL12 Vegetative Row Barrier
SL13 Contour Farming
WC1 Water Impoundment Reservoirs
WC2 Spreader Ditches or Dikes
WP1 Sediment Retention, Erosion, or Water Control Structures
WP2 Stream Protection
WP3 Sod Waterways
WP4 Animal Waste Control Facilities
WL1 Permanent Wildlife Habitat
WL2 Shallow Water Areas For Wildlife

These are practices that have been the regular practices used by the Hanson County ASCS. We have assigned priority to several practices because they are more directly related to water quality in that they can be used to reduce erosion and sediment control problems as well as reducing pollution in the watershed. In addition there are two special practices

that would have a direct impact on water quality and should be included in the docket for the project area. Those practices are:

1) Minimum Tillage
2) Deferred Grazing

Those practices that have been assigned high priority are:

SL1 Permanent Vegetative Cover Establishment
SL2 Permanent Vegetative Cover Improvement
SL3 Stripcropping Systems
SL4 Terrace Systems
SL5 Diversions
SL6 Grazing Land Protection
SL7 Windbreak Restoration or Establishment
SL11 Permanent Vegetative Cover on Critical Areas
SL13 Contour Farming
WC1 Water Impoundment Reservoirs
WP1 Sediment Retention, Erosion, or Water Control Structures
WP2 Stream Protection
WP3 Sod Waterways
WP4 Animal Waste Control Facilities
WL1 Permanent Wildlife Habitat
WL2 Shallow Water Areas For Wildlife
SP Minimum Tillage
SP Deferred Grazing

The Special Project Docket will coincide with the regular Hanson County ASCS Docket as it is developed for FY 1981 and will contain any changes made during the year by ASCS. The only departure from the regular docket would be in the area of special practices if those are not incorporated into the regular practices.

ASCS has a unique opportunity to foster the use of the Agricultural Conservation Program (ACP) on a county wide basis by using the Pierre Creek - Lake Hanson Water Quality Project as a public demonstration area for Best Management Practices in addition to the main goal of improving water quality in the project area. An 85% cost share ratio is recommended for all practices in the project area to properly implement the Best Management Practices. By offering a high level of funding it will be possible to secure the participation of key landowners in the initial stages of the project and thereby encourage the cooperation of other landowners thus accelerating the application of conservation practices and the treatment of high priority areas. Both long term contracts and annual agreements could be used to establish Best Management Practices on the land in the watershed and around the lake.

Anticipated requirement for ACP fund for the first year would : $30,000 out of the $81,000 approved for the project. It is probable that

first year practices cost will be the greatest of the three year program for several reasons:

1) The project will be ready for landowner contracts in the spring of 1981 (Coincides with ASCS programs)
2) The most serious problem areas will have highest priority for treatment.
3) The per centage of successful contacts will probably decrease as seriousness of problems decrease.