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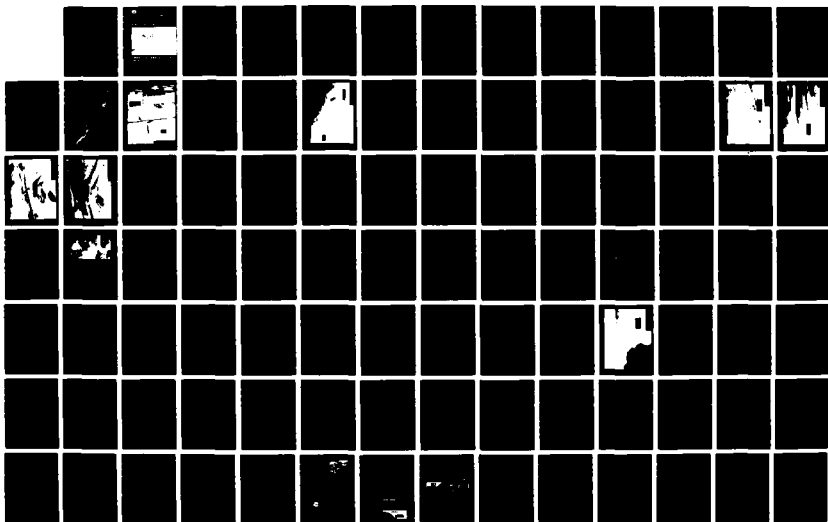
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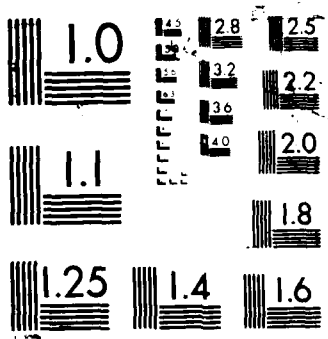
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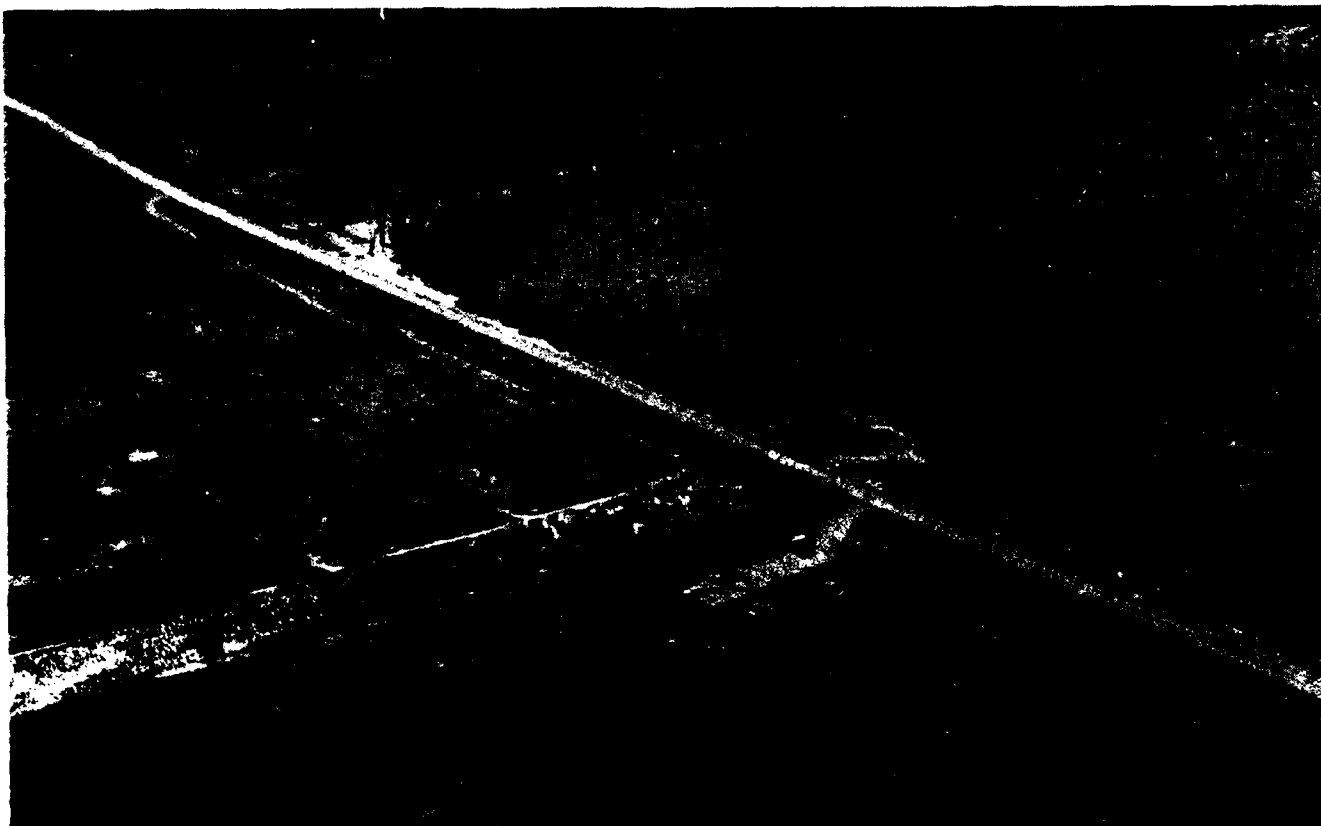


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St. Paul District

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## PROBLEM APPRAISAL REPORT

AD-A191 276



## OPERATION PLAN EVALUATION LAKE TRAVERSE

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**LAKE TRAVERSE ROPE**  
**(RESERVOIR OPERATION PLAN EVALUATION)**  
**PROBLEM APPRAISAL REPORT**



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January 1987

LAKE TRAVERSE ROPE  
(RESERVOIR OPERATION PLAN EVALUATION)  
PROBLEM APPRAISAL REPORT

EXECUTIVE SUMMARY

This problem appraisal report summarizes the problem identification information gathered during the initial stages of the St. Paul District, Corps of Engineers Lake Traverse Operation Plan Evaluation. Significant concerns were gathered through public involvement and in-house experiences with the project.

Concerns about flood control, summer low flows on the Bois de Sioux and Red River, water supply, water quality, sedimentation, fish and wildlife, recreation, shoreline erosion, and cultural resources will be addressed in the remaining activities.

This problem appraisal report recommends that the Lake Traverse ROPE be completed as described in this report. The draft ROPE report is scheduled to be completed in September 1987.

Lake Traverse and Orwell Reservoir (also a Corps of Engineers reservoir) both affect the Red River of the North downstream of Wahpeton, North Dakota, and Breckenridge, Minnesota. Thus, certain aspects of the recently modified water control plans for Orwell Reservoir are being reviewed to ensure consistency of mutual benefits with the Lake Traverse water control review.

LAKE TRAVERSE ROPE  
(RESERVOIR OPERATION PLAN EVALUATION)  
PROBLEM APPRAISAL REPORT

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**LAKE TRAVERSE ROPE  
(RESERVOIR OPERATION PLAN EVALUATION)  
PROBLEM APPRAISAL REPORT**

**PROJECT AUTHORIZATION AND PURPOSE**

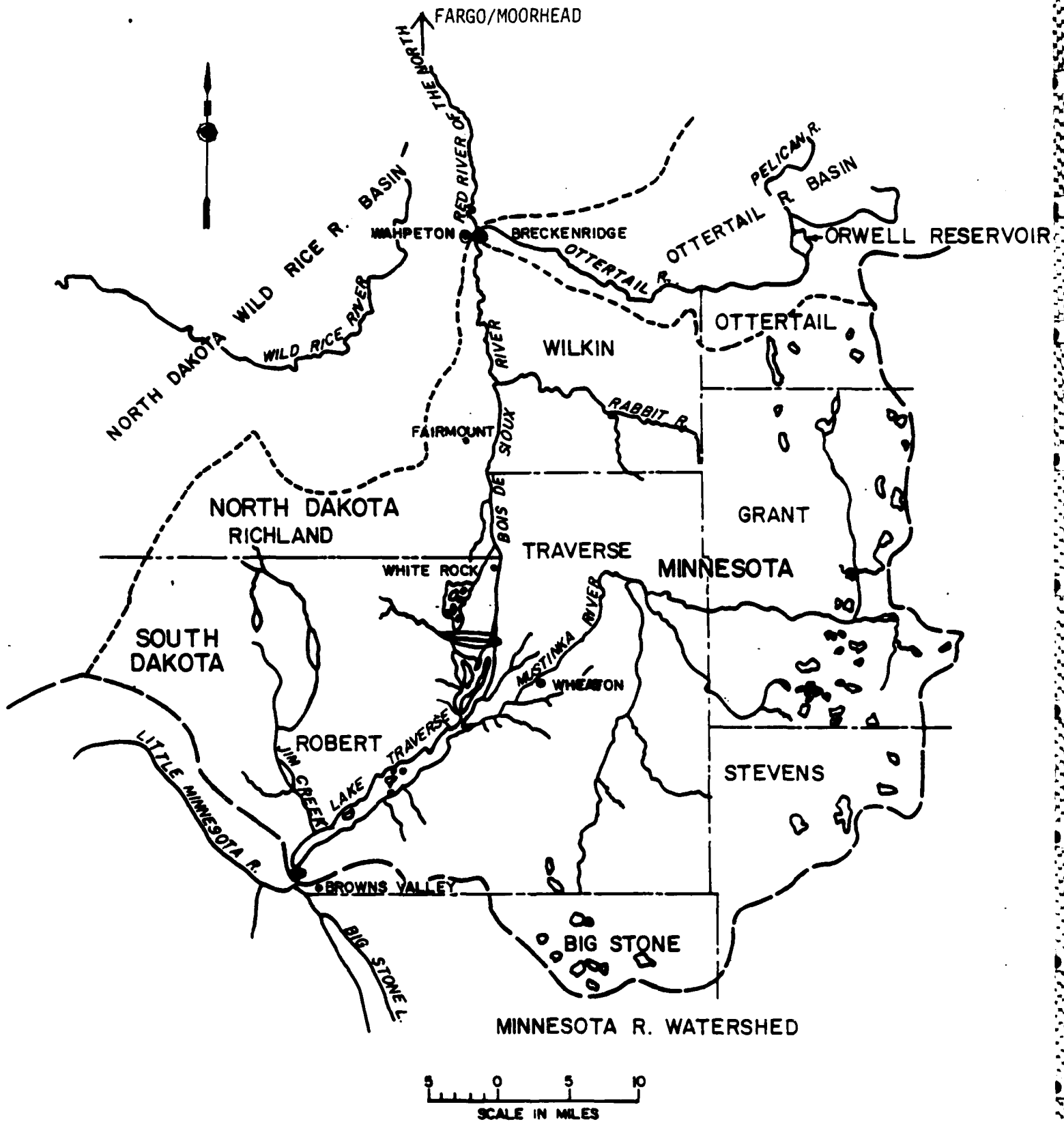
The Lake Traverse project was authorized by the Flood Control Act of 22 June 1936. The project was authorized primarily to provide flood control along the Bois de Sioux River and, to a lesser degree, the Red River Valley. The secondary authorized purpose of the reservoir is to store water for conservation and for preservation of fish and wildlife. The improvement of the Bois de Sioux River channel for about 24 miles downstream is to provide adequate channel capacity when the reservoir is lowered from maximum pool to project conservation levels.

The Flood Control Act approved June 28, 1938, relieved local interests of the responsibility for acquisition of lands and payment of damages in connection with the project and made its maintenance and operation responsibilities of the Federal Government.

The Federal Water Project Recreation Act of 1965 (Public Law 89-72) established the development of recreational potential at Federal water projects as a full project purpose.

**BOIS DE SIOUX-MUSTINKA RIVERS BASIN DESCRIPTION**

The Bois de Sioux-Mustinka Rivers basin is roughly circular and constitutes the southern limit of the Red River basin (see figure 1). The basin occupies portions of Minnesota, North Dakota, and South Dakota. The total land area is 2,340 square miles, which makes this one of the largest basins in the Red River system. Most of the basin is located in the Minnesota counties of Traverse, Big Stone, Stevens, Grant, Ottertail, and Wilkin. The North Dakota portion of the basin consists of the southeast corner of Richland County, and the South Dakota portion is the northeast corner of Roberts County. The basin



# **LEGEND:**

- BOUNDARY BETWEEN THE RED RIVER AND OTHER WATERSHEDS.
- - - - BOUNDARY BETWEEN BASINS COMPRISING THE RED RIVER WATERSHED.

**FIGURE 1**

RED RIVER OF THE NORTH  
DRAINAGE BASIN MAP



contains no watershed districts and has no legal status to complement its natural status as a hydrologic unit.

The Bois de Sioux-Mustinka Rivers basin is bordered on the northwest by the Wild Rice River subbasin in North Dakota and on the northeast by the Ottertail River subbasin in Minnesota. The southeast, southwest, and southern borders are the limit of the Red River basin study area. The northern point of the basin is the city limits of Wahpeton, North Dakota, and Breckenridge, Minnesota, which fall within the main stem basin.

The total basin drainage area is about 1,497,000 acres. However, on the northwest and northeast perimeters, it is difficult to distinguish between the drainage areas of the Bois de Sioux-Mustinka Rivers basin and the Wild Rice and Ottertail River basins. Generally, the topography of the basin is subdued. A near-level glacial lake plain covers most of the eastern portion, and gently rolling glaciated uplands characterize the western portion. Between the rolling hills and the flat plain is a transition zone composed of a series of ridges with moderate slopes that are former beach ridges of glacial Lake Agassiz. Most of the basin is sparse of vegetation with few trees, with the exception of the Lake Traverse and Cottonwood Slough areas. However, numerous small lakes, potholes, and swampy areas on the perimeters of the basin form an excellent habitat for wildlife.

The dominant water features of the basin are Lake Traverse, the Bois de Sioux River, the Mustinka River, and the Rabbit River. Lake Traverse and the associated smaller Mud Lake were constructed by the Corps of Engineers in 1941 for flood control and water conservation. Lake Traverse is an open-water lake surrounded for the most part by farm fields and pastures. The northern and southern ends are bordered by marsh vegetation and willow and cottonwood stands. The lake is elongated, with an average width of 1.5 miles and tending in a southwest-northeast direction for about 16 miles. The average depth is 13.2 feet. Mud Lake is about 7.5 miles long; the water is less than 2

feet deep and is interspersed with dense stands of cattails and bulrushes.

Lake Traverse and Mud Lake are the source of the Bois de Sioux River, which forms the boundary between the Dakotas and Minnesota. The Bois de Sioux River travels northward to the Wahpeton-Breckenridge area, where it meets the Ottertail River to form the Red River of the North. The river drops about 30 feet from Lake Traverse to Wahpeton, or about 0.3 foot per mile of river channel. Before channel improvements, which were completed by the Corps in connection with the Lake Traverse project, the river was shallow, with large areas of rushes and grasses. The channel received better definition through straightening and clearing, which were completed in 1941. The definition has apparently been lost in some reaches due to sedimentation and beaver dams.

The Mustinka River is the main tributary to the Bois de Sioux River. It begins in morainic hills in the northeast portion of the basin and flows southerly for about 28 miles, then generally westerly for 26 miles, and then southwesterly for 15 miles to Lake Traverse. The valley of the upstream portion of the river is well defined. However, at Norcross, Minnesota, the terrain becomes so level that drainage divides are not discernible, and the defined valley disappears for about 12 river miles, after which it becomes visible again. Important tributaries to the Mustinka River include Five Mile Creek, Twelve Mile Creek, and Eighteen Mile Creek. Five Mile Creek has been diverted into Twelve Mile Creek through County Ditch No. 42, so that it is actually a tributary to the Mustinka River only during periods of high flow.

The Rabbit River is another important tributary to the Bois de Sioux River. It has a drainage area of approximately 211,000 acres in Grant, Wilkin, Traverse, and Ottertail Counties. The Rabbit River flows westerly before joining the Bois de Sioux River about 12 miles south of Breckenridge.

## PROJECT DESCRIPTION

### LOCATION

Lake Traverse is in west central Minnesota, about 190 miles northwest of St. Paul and about 35 miles south of Breckenridge, Minnesota, and Wahpeton, North Dakota (see figure 2). The dam is on the Bois de Sioux River, 35 miles upstream of the point where the Otter Tail and Bois de Sioux Rivers combine to form the Red River of the North.

### PRINCIPAL PROJECT FEATURES

#### White Rock Dam

This dam is rolled-earthfill, 14,400 feet long from high ground on the Minnesota side to high ground on the South Dakota side. This total length includes the concrete control structure length of 47 feet. The upstream slope is 1V on 2-1/2H with a 6-inch gravel blanket topped with 12 inches of riprap. The downstream slope is 1V on 2H with 12-inch riprap near the base. Top width of the dam is 26 feet. The dam carries a roadway connecting U.S. Highway 81 in South Dakota with State Trunk Highway 236 in Minnesota. (See photograph 1 on page 7.)

Control Structure - The control structure is a reinforced concrete section topped with a bridge deck. There are three reversed tainter gates of welded construction 13 feet wide by 16 feet high with a stilling basin. Gate sills are at elevation 965.0. The distance between the abutments is 47 feet. The capacity of the structure is 4,000 second-feet at maximum pool of 981.0 and 5,600 second-feet if the pool reaches 982.0. It is estimated that the maximum possible flood can be passed without exceeding the latter pool elevation. Stoplogs are provided for emergencies and used during the winter so that the gates will not be frozen in during the periods of zero flow. Flood discharges are regulated by the three tainter gates supported on trunnions between two 4-foot-wide piers and the two abutments. When the gates are closed,

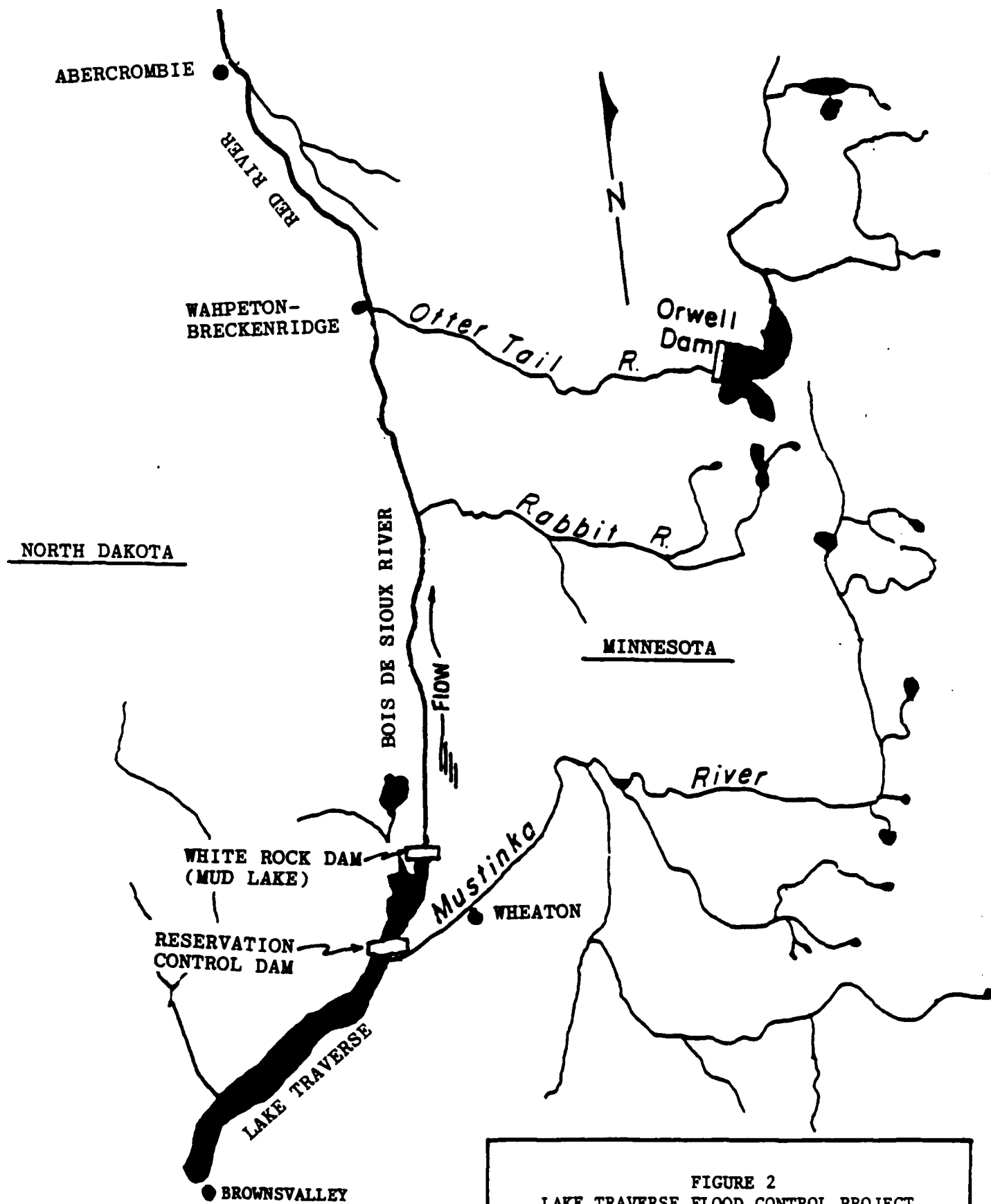
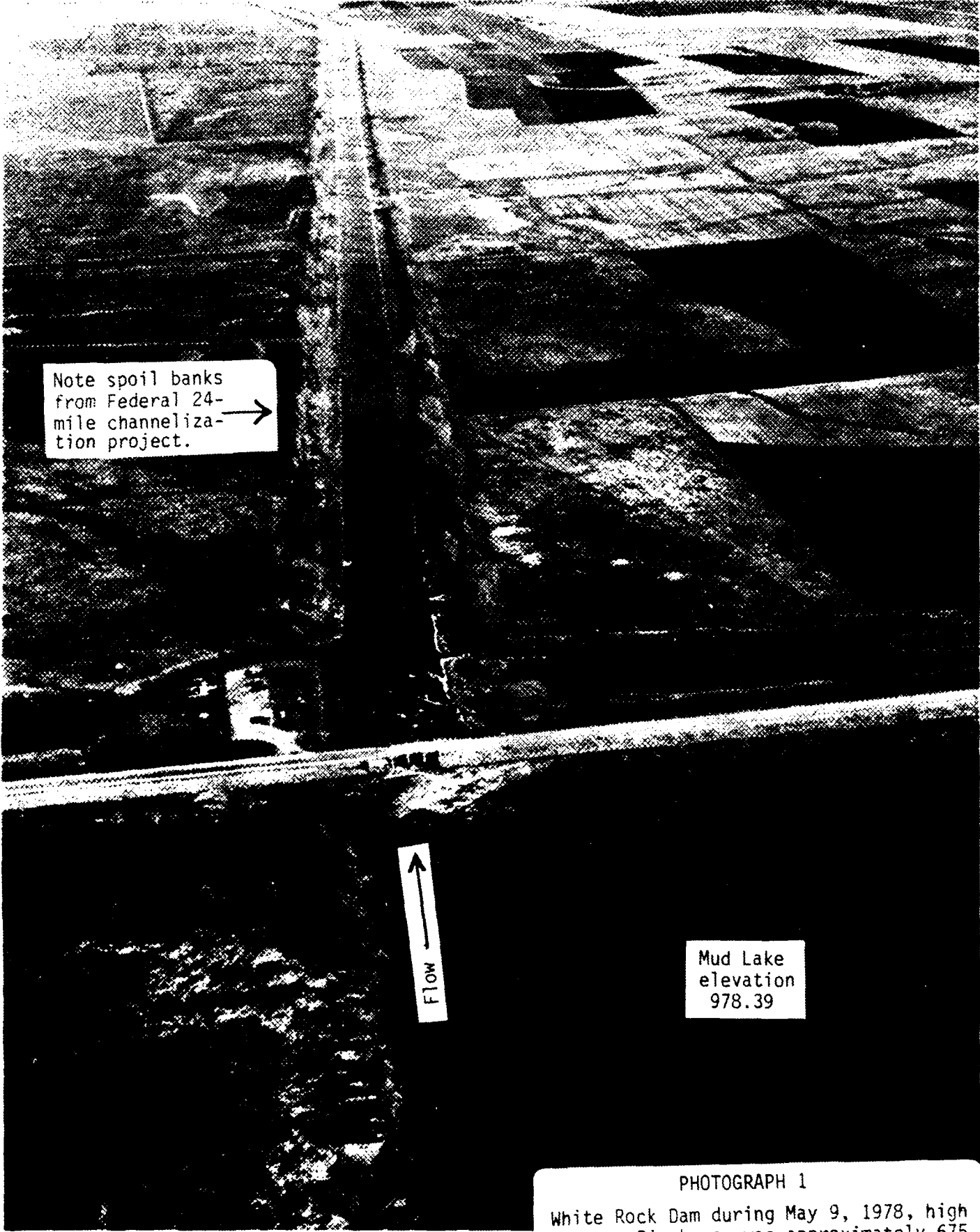


FIGURE 2  
LAKE TRAVERSE FLOOD CONTROL PROJECT  
AREA MAP



Note spoil banks  
from Federal 24-  
mile channeliza-  
tion project. →

↑  
FLOW

Mud Lake  
elevation  
978.39

PHOTOGRAPH 1

White Rock Dam during May 9, 1978, high  
water. Discharge was approximately 675  
cfs.

the top of the gates is at normal maximum pool elevation of 981.0, or 9.0 feet above normal conservation level of 972.0. The gate operating machinery is located on top of each pier. Hoists are operated manually. The approach channel to the control structure is approximately 2 miles long with a bottom elevation of 967.0. The channel was originally dredged to provide a free flow from Mud Lake proper to the dam. The channel has probably silted heavily since then. A recent survey is available from Construction Operations, Project Operations Branch, in the St. Paul District Office.

Pertinent Data - Pertinent design data for White Rock Dam are given in the following table.

White Rock Dam and Mud Lake  
Pertinent Design Data

---

Reservoir

Flowage rights to elevation	983.0 feet
Reservoir length at conservation pool	7.5 miles
Maximum reservoir width at conservation pool	2.5 miles

Dam

Crest elevation	986.0 feet
Maximum height	16 feet
Freeboard above spillway design flood height	4.0 feet

Spillway

Type	Gated concrete sill
Crest elevation	965.0 feet
Length of spillway crest	Three 13-foot bays
Elevation top of tainter gates (closed)	981.0 feet
Design discharge	5,600 second-feet

Stilling basin

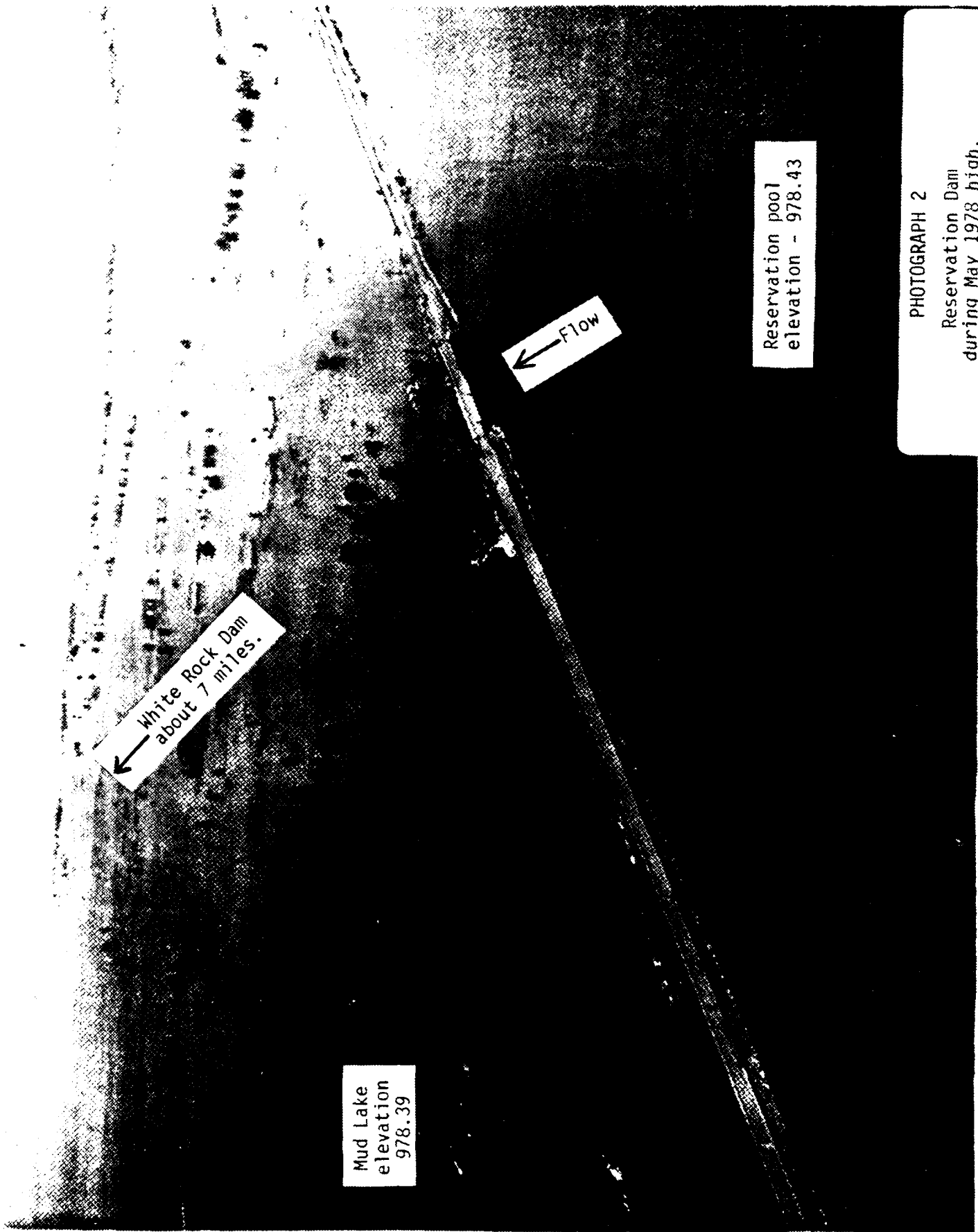
Type	Concrete apron with dentated sill
Length	34.07 feet
Maximum width at end sill	47 feet
Elevation of stilling basin floor	960.0 feet

---

### Reservation Control Dam

The dam is the highway that crosses the narrows between Lake Traverse proper and that portion of Lake Traverse known as Mud Lake. The original highway on the Minnesota side was built up to elevation 980.0 to provide additional spillway capacity during maximum floods. The built-up portion is about 9,100 feet long and is riprapped on the side slopes and blacktopped. The portion of the highway on the South Dakota side was raised to elevation 983.0, 1 foot above the maximum flood of record. The original bridge connecting these two highways was of timber construction but was replaced by a steel and concrete structure at the upstream side of the control structure. (See photograph 2 on page 10.)

Control Structure - The control structure is a grouted riprap weir to elevation 974.0 with steel sheet piling 15 feet long for the cutoff. The abutments are formed of 20-foot lengths of steel sheet piling. Across the top of the spillway are 17 stoplog sections, each separated by 8-inch H columns 20 feet long. The H columns form the support for a walkway over the spillway and provide the means of placing or removing the stoplogs. Two metal culverts 24 inches in diameter and 14 feet long with slide gates were placed under the spillway for low-water control; the inverts were set at elevation 970.0. These culverts are no longer operative. The slide gates have been removed and removable plugs inserted in the inlets. Riprap has been placed to prevent the plugs from coming out. In an emergency the riprap and plugs can be removed. Two feet of stoplogs maintain the lake at conservation elevation of 976.0. To prevent loss of water due to wind action, stoplogs are placed to elevation 977.0 during dry seasons. The spillway is made up of 18-inch derrick stone; the top 9 inches are filled with concrete, the bottom 9 inches are filled with gravel. The downstream face of the weir has a slope of 1V on 2-1/2H. The spillway length is 27 feet 6 inches and the maximum width is 150 feet.



White Rock Dam  
about 7 miles.

Mud Lake  
elevation  
978.39

Flow

Reservation pool  
elevation - 978.43

PHOTOGRAPH 2  
Reservation Dam  
during May 1978 high.



Reservoir - Lake Traverse pool is about 16.5 miles long from the reservation control structure to the dike at Browns Valley and it averages about 1-1/4 miles in width. At project conservation pool the capacity is 106,000 acre-feet and at full pool, elevation 981.0, the capacity is 164,500 acre-feet. White Rock pool is about 7-1/2 miles in length between White Rock Dam and Reservation Dam. At project conservation elevation 972.0 the capacity is 6,500 acre-feet and at full pool, elevation 981.0, the capacity is 85,500 acre-feet. The total flood storage capacity for both pools at elevation 981.0 is 137,000 acre-feet. For additional reservoir area-capacity data, see figures 3 and 4 on pages 13 and 14. The discharge-rating curve for White Rock Dam is found in figure 5 on page 15.

Reservoir Data - Pertinent design data for the Lake Traverse project are given in the table on the following page.

Reservation Dam and Reservation Pool  
Pertinent Design Data

---

Reservoir

Flowage rights to elevation	983.0 feet
Reservoir length at conservation pool	16.5 miles
Maximum reservoir width at conservation pool	1-3/4 miles

Dam

Type	Rolled-earth fill
Crest elevation	980.0 feet
Total length of earth embankment (spillway)	9,100 feet
Top width (roadway)	26 feet
Maximum height	14.5 feet

Spillway

Type	Grouted riprap weir
Crest elevation	974.0 feet
Net length of spillway crest	101.5 feet
Number of stoplog sections	17
Width of sections (clear opening)	Fifteen 6 feet by 2 feet Two 5.75 feet by 2 feet
Elevation top of stoplogs	976.0
Maximum discharge (design flood)	5,600 second-feet
Elevation of walkway over spillway	981.0

Outlet conduits

Size and length (plugged with removable plugs)	Two 24-inch by 14-foot C.M.P.
Invert elevation (intake and outfall)	970.0
Discharge capacity with pool at conservation level	80 second-feet total
Control (inoperative <sup>(1)</sup> )	Two Calco slide gates

Stilling basin

Type	Grouted derrick stone
Length	27.5 feet
Maximum width at end section	150 feet

---

(1) Damaged by ice. Gates removed when plugs were placed in culverts.

# LAKE TRAVERSE ELEVATION-CAPACITY CURVES

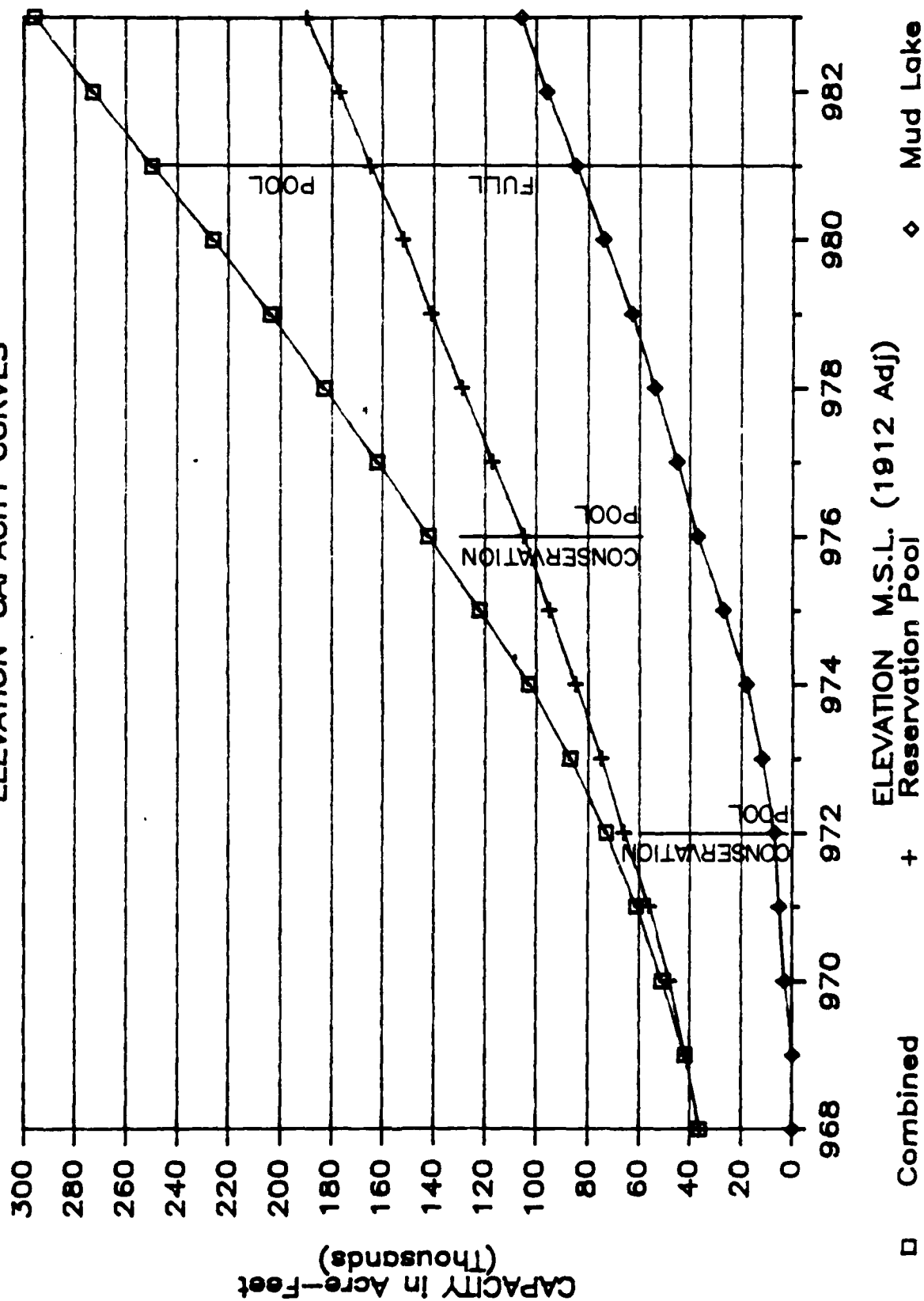
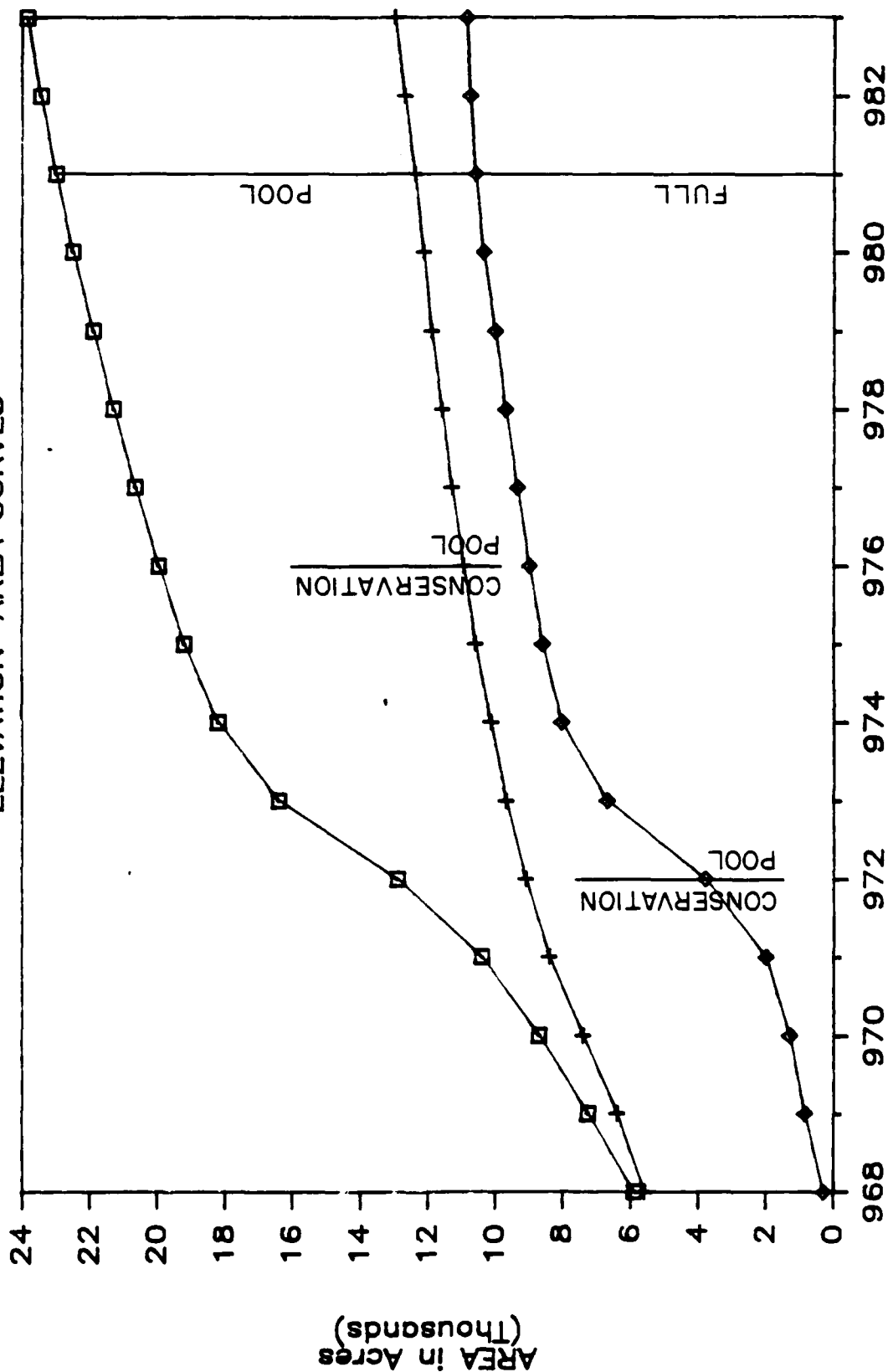


FIGURE 3

# LAKE TRAVERSE ELEVATION-AREA CURVES



ELEVATION M.S.L. (1912 Adj)

□ Combined

+

Reservation Pool

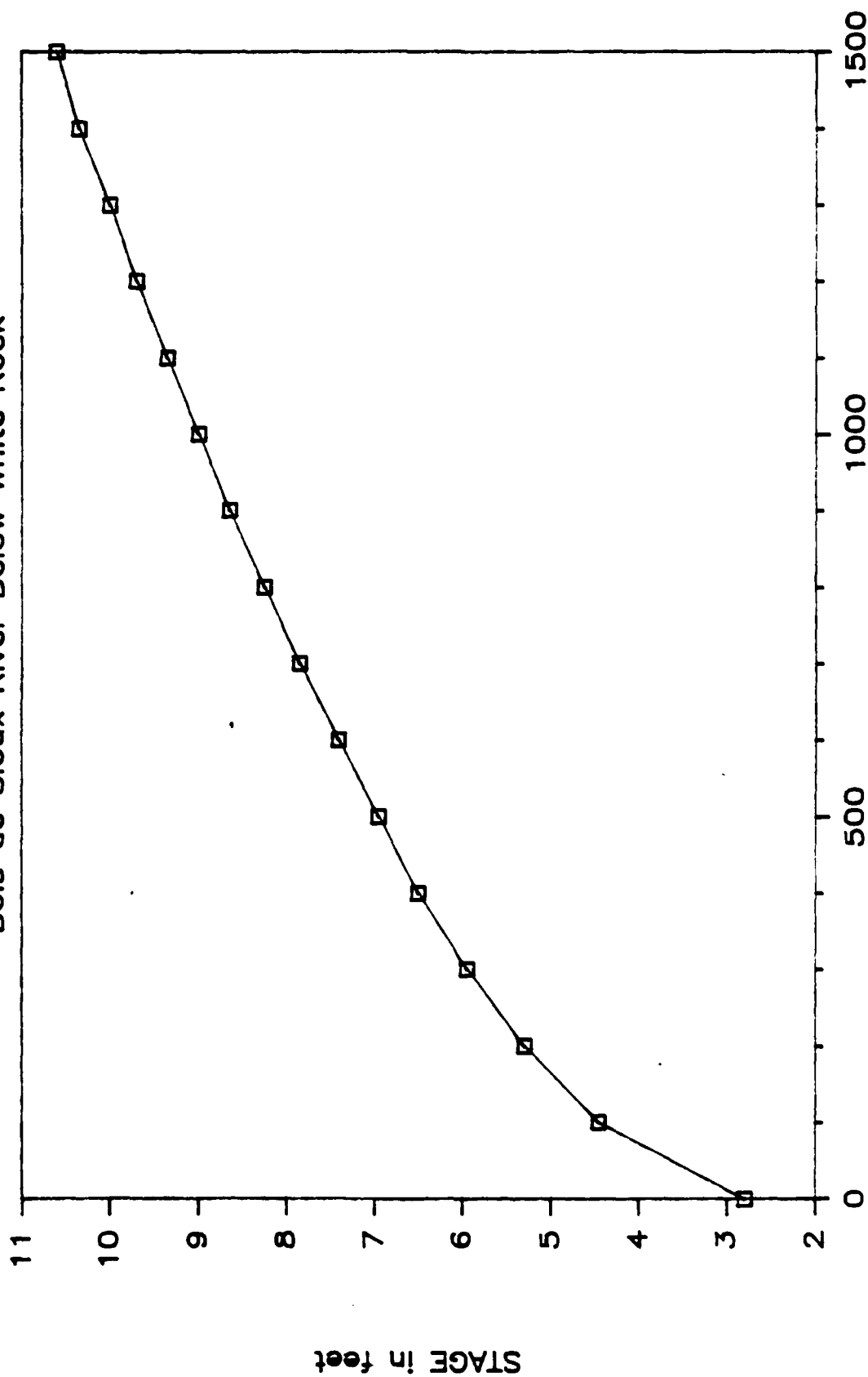
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Mud Lake

FIGURE 4

# DISCHARGE RATING CURVE

Bois de Sioux River Below White Rock



DISCHARGE in cfs

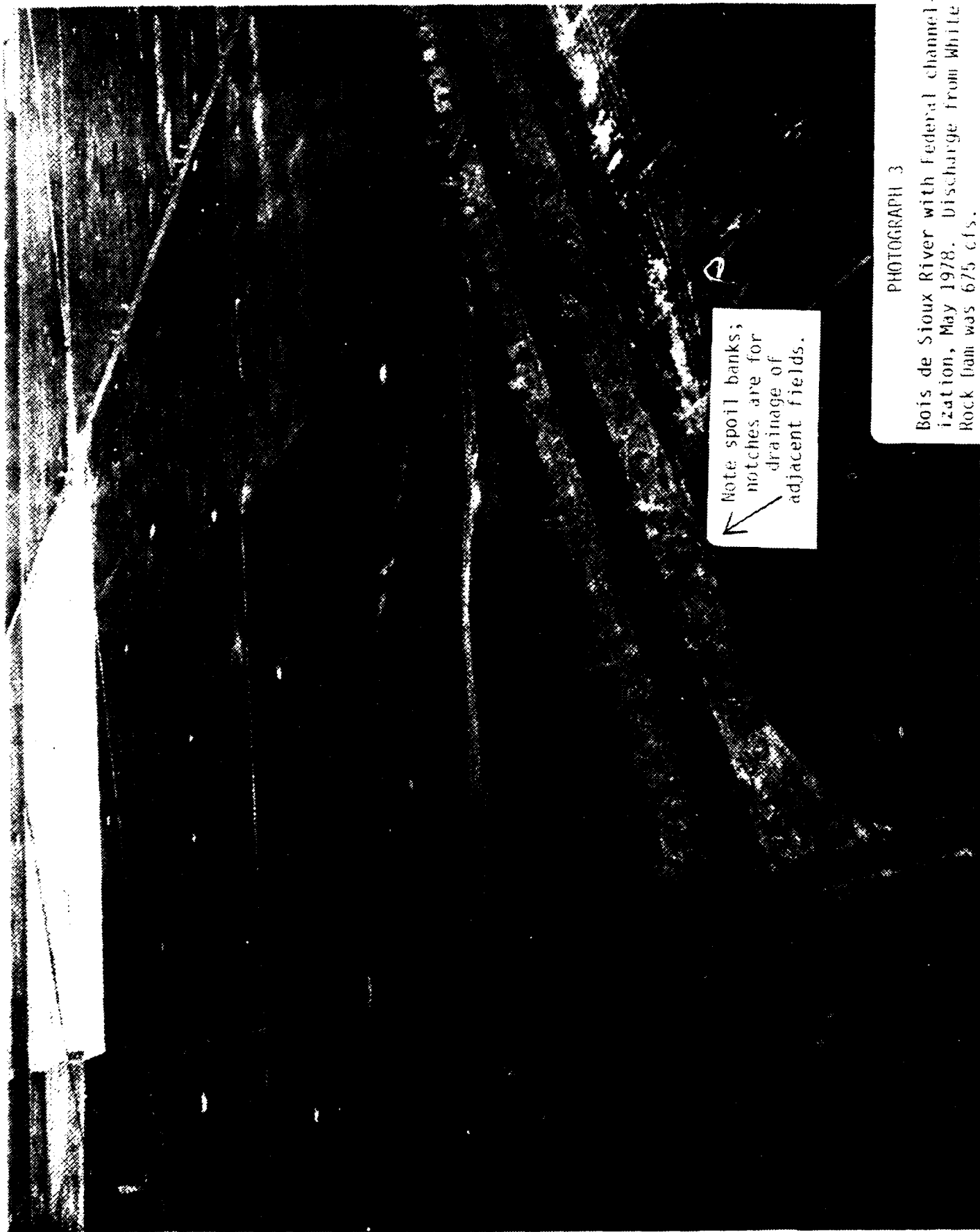
FIGURE 5

### Bois de Sioux River (Federal Channel Reach)

Channel Improvement - The Bois de Sioux River channel was improved by straightening and enlarging (see photographs 3 through 6). The work was accomplished by drag line. Total length of the improvement was approximately 24 miles from White Rock Dam to within 9 miles of Breckenridge, Minnesota, and Wahpeton, North Dakota. The improved channel bottom was 60 feet wide with side slopes of 1V on 3H. The longitudinal slope from White Rock Dam to the mouth of the Rabbit River is 1 in 10,000. This section is designed to carry 1,100 second-feet with a 1-foot freeboard. From the Rabbit River to the end of the project, the longitudinal slope is 14 in 100,000 with a capacity of 2,000 second-feet.

On the Mustinka River, 20.6 miles of channel straightening and deepening has been completed to increase the capacity from 830 second-feet to 2,140 second-feet. Similar improvements increased the discharge capacity of Twelve Mile Creek from 1,420 second-feet to 1,615 second-feet and County Ditch No. 42 from 385 second-feet to 400 second-feet. These channel improvements are expected to provide for floods of 10-year frequency with minimum freeboards of 1 foot.

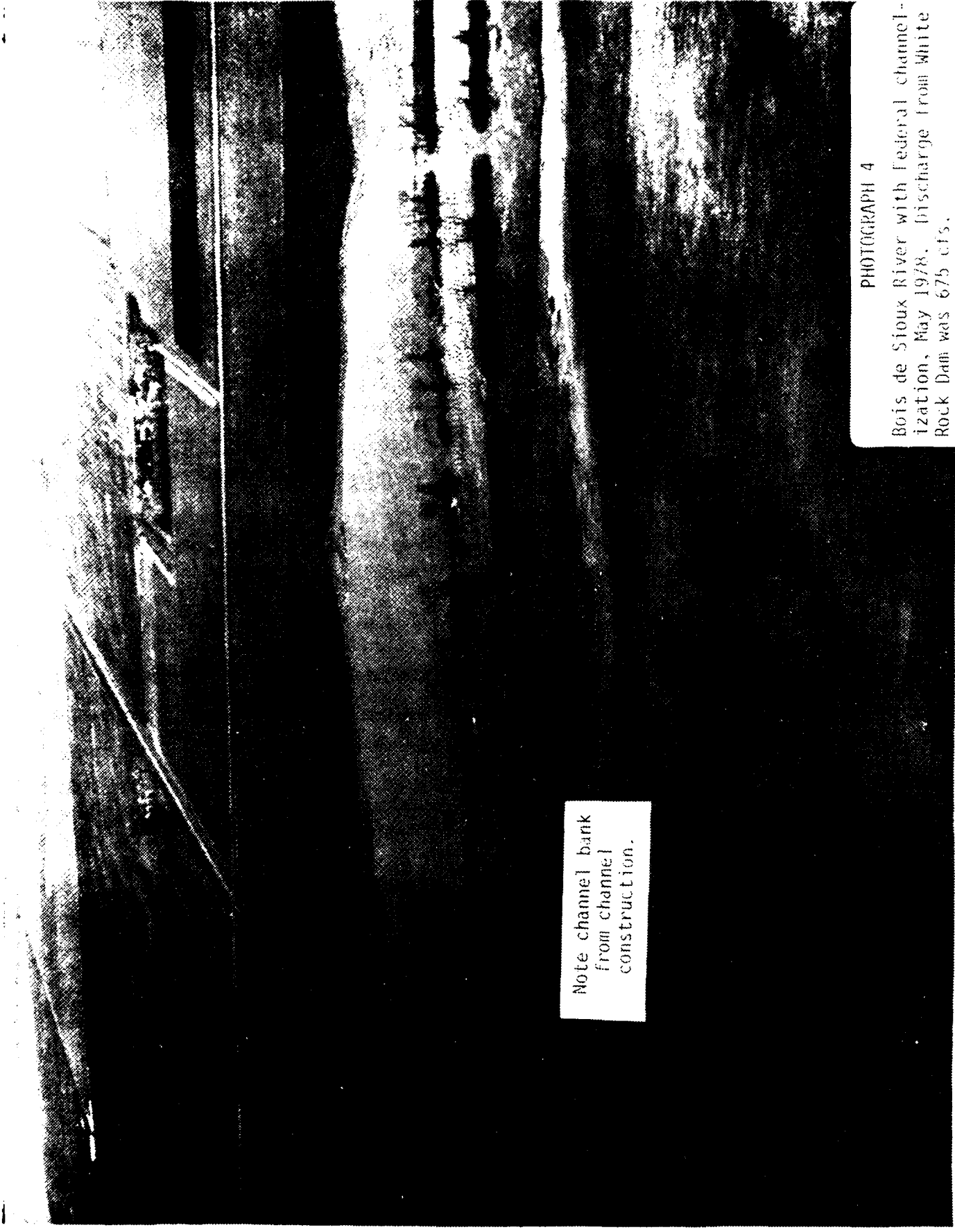
Browns Valley Dike - This dike was built to prevent pooled water in Lake Traverse from overflowing across the continental divide into the Little Minnesota River basin and causing flood damage in Browns Valley, Minnesota. The dike extends for 3,700 feet between the junction of South Dakota State Trunk Highway 10 and Minnesota State Trunk Highways 27 and 28. Top elevation of the dike is 987.0. The dike is constructed of rolled earth fill with a top width of 10 feet and slopes of 1V on 4H on both sides above elevation 981.0. On the lake side below elevation 981.0, the slope is 1V on 15H. A raised section of South Dakota State Trunk Highway 10 and Minnesota State Trunk Highway 28 along with a concrete box culvert funnels overbank flows from the Little Minnesota River into Lake Traverse in lieu of flooding into Browns Valley. The culvert is under South Dakota State Trunk Highway 10 and is divided in



Note spoil banks;  
notches are for  
drainage of  
adjacent fields.

PHOTOGRAPH 3

Bois de Sioux River with federal channel-  
ization, May 1978. Discharge from White  
Rock Dam was 675 cfs.



Note channel bank  
from channel  
construction.

PHOTOGRAPH 4

Bois de Sioux River with Federal channel-  
ization, May 1978. Discharge from White  
Rock Dam was 675 cfs.





Note lateral drainage  
ditch entering from both  
sides of the river channel.

PHOTOGRAPH 5

Bois de Sioux River with Federal channel-  
ization, May 1978. Discharge from White  
Rock Dam was 675 cfs.



PHOTOGRAPH 6

White Rock Dam and Lois de Stouy River  
Channel, May 1978

by 9-foot openings, 68 feet 9 inches long. The invert elevation on the lake or east side is at elevation 971.0 and on the west side at 974.0.

Pertinent design data on the Browns Valley dike and culvert are presented in the following table.

Browns Valley Dike and Culvert  
Pertinent Design Data

Dike

Type	Rolled-earth fill
Crest elevation (earth dike section)	987.0 feet
Crest elevation (culvert section)	986.5 <sup>±</sup> feet
Total length of earth embankment	3,700 feet
Top width	10 feet
Maximum height	16 feet
Freeboard above spillway design flood	5 feet
Total volume earth dike	93,000 <sup>±</sup> cubic yards

Culvert

Type	Concrete bay
Size	Three 6-foot by 9-foot openings
Length	68.75 feet
Invert elevation (east or reservoir side)	971.0
Invert elevation (west or Little Minnesota River side)	974.0

**PROJECT LANDS**

Lake Traverse

During the period 1940 to 1945, approximately 1,144 acres of fee title, 217 acres of additional lands formed by reliction, and 6,172 acres of flowage easement were acquired by the Federal Government for the Lake Traverse project by a series of condemnations. The fee title areas were obtained for construction of the two dams, maintenance areas, and public day-use facilities. The easement areas were needed for the flood control pool. Of the lands, 945 acres are leased to the Minnesota Department of Natural Resources for wildlife management, 456 acres are in a Corps managed wildlife area, and 10 acres are leased to Traverse

County for recreation. The land leased to the Minnesota Department of Natural Resources is adjacent to the Reservation Highway and consists of marsh and stands of willow and cottonwood. Approximately 5 acres are devoted to the three public use areas at Browns Valley Dike, Reservation Highway, and White Rock Dam.

Prior to construction of the project, the two pools of Lake Traverse tended to hold natural conservation levels at elevation 976.0 in the Reservation (south) pool and elevation 972.0 in the White Rock (north) pool. The pools were dry for several seasons during the 1930's "Dust Bowl" years, but normally averaged about the stated conservation elevations. The land below those conservation pool elevations was determined to be meandered lands and thus already in public ownership. The land between the conservation elevations and elevation 983.0 had to be acquired by the Federal Government for the flood control pool.

The Government essentially had two alternatives for acquiring the real estate rights needed to establish the flood control pool: (1) fee title or (2) flowage easement. The Government's fee title ownership of the flood control pool areas would result in a strip of Government-owned land along the entire lakeshore, barring legal access to the water by adjoining landowners. It was determined that fee title ownership would involve unacceptable amounts of administrative and coordination work with the adjacent landowners. Thus, flowage easements were used to establish the Lake Traverse flood control pool.

The following two paragraphs were taken from actual flowage easement documents for each affected property that were recorded in the appropriate county land offices.

SOUTH POOL (LAKE TRAVERSE) Conservation Pool Elevation 976.0  
(Situated between Reservation Highway and Browns Valley Dike)

The full, complete, and perpetual right, power, and privilege to overflow those lands lying below elevation 977.0 msl (1912 adj) and also the full, complete, and perpetual right, power, and privilege to overflow intermittently those lands lying between the taking line and elevation 977.0 msl (1912 adj), together with the right to go upon the lands, as occasion may require, to remove therefrom natural or artificial structures or obstructions which may be detrimental to the operation and maintenance of the dams and reservoirs.

NORTH POOL (MUD LAKE) Conservation Pool Elevation 972.0  
(Situated between Reservation Highway and White Rock Dam)

The full, complete, and perpetual right, power, and privilege to overflow intermittently each and all of the lands involved, together with the right to go upon the lands, as occasion may require, to remove therefrom natural or artificial structures or obstructions which may be detrimental to the operation and maintenance of the dams and reservoirs.

The taking line mentioned in the flowage easement wording was established using a metes and bounds description. The metes and bounds description of the flowage easement taking line was also recorded at the appropriate county land offices. Metes and bounds descriptions use wording involving a series of distances and angles from a known point that exactly and permanently describes the boundary line for the Federal flowage easement. The metes and bounds taking line was established by generally following the guide contour of elevation 983.0 where it was located at the time of being established. The contour of elevation 983.0 was not used as the taking line because erosion and other natural geophysical processes would tend to move the location of the contour out away from the reservoir over time. The use of any elevation contour for the taking line is generally accepted to provide a less precise location of the boundary over time than the use of metes and bounds descriptions. Metes and bounds descriptions can be reestablished on the ground by a qualified land surveyor at any time.

### Bois de Sioux River Channelization

The Congressional authorization for the Bois de Sioux River channelization portion of the project provided the Federal right and responsibility of construction and maintenance of the channel. The Corps of Engineers has rights within the project boundaries to excavate and remove land for the construction and maintenance of the project and to deposit the spoil.

The real estate interest for the construction and maintenance of the channel project is in the form of easements within specific project boundaries. The project boundaries are defined by metes and bounds descriptions. The easement strip established for the channel construction and maintenance averages approximately 500 to 600 feet in total width including both sides of the channel. Maps of the metes and bounds description are available in the St. Paul District map files.

The easement wording reserves the landowner's rights and privileges which may be enjoyed without interfering with the stated rights of the Federal Government. The spoil banks formed by project construction and maintenance are apparently being used as dikes by the landowners to protect their crops from summer flooding. As long as the use of spoil banks as dikes does not interfere with the Corps of Engineers maintenance of the channel, the landowner is conforming with the terms of the easement. Further, the Corps of Engineers does not have the right to interfere with such dikes by reason of the Federal real estate interest. This is true regardless of the dike's relationship to meander lines (Loukota/NCDRE-S, February 1981).

### **EXISTING PROJECT OPERATION AND RULE CURVE**

#### Purpose of Operation

As stated in the Congressional authorization, the primary objective in the operation of the Lake Traverse project is the reduction of

agricultural damages caused by flooding along the Bois de Sioux River and reduction of urban flood damages at Wahpeton, North Dakota, and Breckenridge, Minnesota. Also, at times of low flow conditions, the water in storage in this reservoir may be used for water supply and for fish and wildlife conservation. In 1965, Public Law 89-72 added recreation as a purpose to be considered at all Federal reservoir projects.

### Regulation Schedule

The following text and tables contain information about how the Lake Traverse project is operated during routine flood control and low-flow conditions. These paragraphs and tables have been taken from the reservoir regulation manual, with minor editing changes. The information is displayed graphically as a schematic on figure 6.

## ST. PAUL DISTRICT, CORPS OF ENGINEERS EXISTING WATER CONTROL PLAN FOR THE LAKE TRAVERSE-BOIS DE SIOUX RIVER PROJECT

### Section A - General Operation Directives

A-1. General - These instructions will be followed at all times except when the operation is based on special directive issued by the Water Control Center of the St. Paul District Office. Instructions contained in a special directive will be applicable for the period specified. The dam tender will maintain a log book of all such instructions received from the Water Control Center. The date and time of call, the information, and the name of the operator issuing the instructions will be recorded.

A-2. Gate Operation - At White Rock Dam, the discharge is regulated by three tainter gates. At the Reservation Control Dam, the discharge is regulated with 17 bays of stoplogs. There are also two 24-

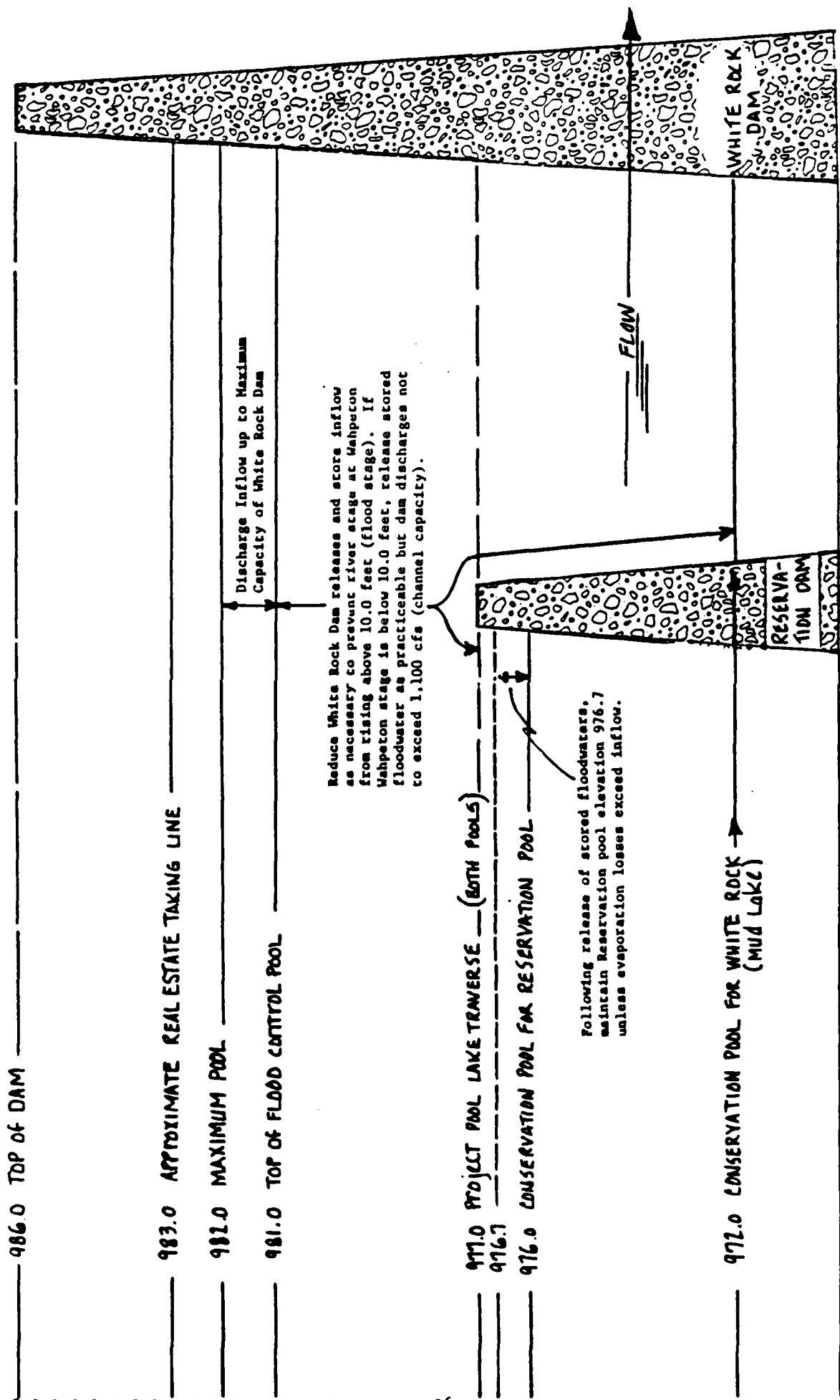


FIGURE 6

LAKE TRAVERSE FLOOD CONTROL PROJECT  
FLOOD CONTROL REGULATION SCHEMATIC



inch metal culverts originally intended for low water controls. These culverts are currently plugged but can be put into operation in an emergency.

A-3. Routine Operation - Following the spring breakup, any accumulation of storage above conservation levels in both pools will be held until about 1 May or, if possible, until danger of flooding at downstream points has passed. Should the accumulation of storage from the spring runoff cause the level in Reservation pool to rise above 976.5, the dam tender will start to remove the stoplogs in the control structure. If the rise continues, the removal of all stoplogs in the 17 bays should be accomplished by the time the pool rises to 977.0. The outflow from Reservation pool into the White Rock pool will then tend to equalize the level in both pools. Under this condition, the stoplogs will not be replaced until the level has dropped to 976.5. All stoplogs shall be in place by the time the level in Reservation pool is down to 976.0. After 1 May, or when downstream conditions permit, the Water Control Center will issue instructions for the release of the flood storage from White Rock Dam and set the rate of discharge required to draw the reservoir level down to conservation levels. Amounts to be released will not exceed channel capacity (1,100 square feet) or flood stage of 10 feet at the USGS gage at Wahpeton or Breckenridge.

A-4. Operation for Floods -

a. Spring floods. - Lake Traverse reservoir will store all flood runoff during and after the spring breakup which usually occurs during March and April. The operation will follow the procedure as noted in paragraph A-3, Routine Operation, with the following exceptions. Inflow will be stored and held up to reservoir elevation 981.0. If it should become evident that the current flood will exceed the capacity of the reservoir, the gates in White Rock Dam will be opened to pass the inflow into the reservoir and to maintain elevation 981.0. With the gates wide open and a pool elevation of 982.0, the discharge will be about 5,600 second-feet. It has been estimated,

however, that the maximum probable flood can be passed without exceeding elevation 982.0. When the inflow begins to decrease and the pool level drops to 981.0, the outflow will be reduced to the inflow to maintain the pool at 981.0 until the outflow has been reduced to the channel capacity or flow that will not exceed flood stage at Wahpeton-Breckenridge. Drawdown to conservation levels will continue at reduced rates so as not to interfere with downstream conditions.

b. Summer floods. - Should floods occur in the basin, because of excessive rainfall, the reservoir shall be operated to minimize damage in and below the area. Operation will be similar to that noted for spring floods except drawdown to conservation levels will be accomplished as rapidly as downstream conditions permit. The dam tender will maintain daily contact with the proper officials at downstream damage centers before and during release of storage from the reservoir. Warnings of impending releases shall also be given to interested parties located around Lake Traverse and along the Bois de Sioux channel between White Rock Dam and the cities of Wahpeton and Breckenridge.

A-5. Operation for Low-Water Control - There will be no operation for low-water control or release of storage water once conservation levels have been reached except for extreme emergency conditions. Conservation levels will be maintained in both pools as nearly as possible by keeping both control structures closed during periods of little or no inflow. Inflow into the reservoir is usually balanced by evaporation losses until the late summer and fall months when little or no inflow coupled with high evaporation losses causes a drop in the reservoir levels. This loss is usually much greater in White Rock pool which is shallower than the Reservation pool and has no apparent inflow source. Should extreme drought conditions occur, it is doubtful if the reservoir level would be high enough to release any storage, even for emergency purposes under present conditions.

A-6. Emergency Operation Procedure - In the event of failure of normal communication facilities, every effort will be made by the dam tender to maintain contact with the District office by any means available including radio, telegraph, or sending a messenger to the nearest point where communications are available. In such circumstances, the primary objective will be to insure the safety of the structure and to provide the most effective operation of the project by following the regulation schedule as shown in the table, (Reservoir Regulation Schedule) beginning on the following page. During such emergency operation, the schedule will be followed until contact with the District office is reestablished. It will also be necessary for the dam tender to keep informed concerning effects of any reservoir releases on downstream damage centers.

# Reservoir Regulation Schedule

Regulation Schedule	Reservoir Stage	Condition	Operation
<u>Routine Operation</u>			
Winter - Freeze-up to breakup	White Rock Pool 972.0±	Normal	Normally no discharge. Two gates closed and one gate wide open with stop logs in place to 972.0. Discharge permitted when stop logs are overtopped on rare occasions.
	Reservation Pool 976.0±		Normally no discharge. All stop logs in place to 977.0 and low water culverts plugged. Inflow insufficient to overtop stop logs. Discharge permitted if stop logs overtopped on rare occasions.
Spring - Breakup period Rising stage	Reservation Pool 976.0- 976.5		Prepare to remove stop logs.
	Reservation Pool 976.5- 977.0		Remove stop logs as necessary to maintain pool from 976.5 to 977.0. All stop logs to be removed when pool rises to 977.0. Allow both Reservation and White Rock pools to equalize. On falling stage, start replacing stop logs when pool drops to 976.5. All stop logs should be in place when pool drops to 976.0. Maintain pool 976.0.
	Reservation Pool 977.0 and higher.		Reservation pool is controlled by White Rock Dam.
	White Rock Pool 972.0- 977.0		All gates closed and stop logs removed. No discharge if potential flooding exists or flood stage of 10.0 feet is exceeded at Wahpeton. However, if no potential flooding or if flood stage will not be exceeded at Wahpeton, discharge up to maximum channel capacity of 1,100 cfs, and lower pool to and maintain 972.0 as quickly as possible.

# Reservoir Regulation Schedule (cont'd)

Regulation Schedule	Reservoir Stage	Condition	Operation
<u>Routine Operation</u>			
Spring - Breakup period Rising stage (cont'd)	White Rock & Reservation Pool 977.0- 981.0	Normal	Both pool levels rise or fall in unison, regulated by the outflow from White Rock Dam. Until pool reaches 981.0, dis- charge up to channel capacity, 1,100 cfs, but not to cause flood stage to be exceeded at Wahpeton.
Falling stage	Pool 981.0- 976.0		Lower Reservation pool to 977.0 as soon as possible. Start replacing stop logs in Reserva- tion Dam when pool drops to 976.5, and all stop logs shall be in place when pool drops to 976.0. Maintain Reservation pool 976.0. Lower White Rock pool to 972.0 as soon as pos- sible without exceeding channel capacity or causing flood stage to be exceeded at Wahpeton. Place stop logs to 972.0 in one gate bay and raise gate to wide open position. Maintain White Rock pool at 972.0.
Summer - Period following break- up to freeze-up	Reservation Pool 976.0 <sup>±</sup>		Maintain pool 976.0 if possible. Place stop logs at 977.0 to prevent loss of pool through wind action.
	White Rock Pool 972.0 <sup>±</sup>		Maintain pool 972.0 if possible. Place stop logs in one gate bay and raise gate to wide open position. Small increases in flow can be discharged over top of stop logs.
<u>Flood Control</u>			
Spring - Breakup period	Reservation Pool 976.0- 981.0 & White Rock Pool 972.0- 981.0	Above nor- mal inflow predicted.	Follow same procedure as under routine operation.

# Reservoir Regulation Schedule (cont'd)

Regulation Schedule	Reservoir Stage	Condition	Operation
<u>Flood Control</u>			
Spring - Breakup period (cont'd)	White Rock & Reservation Pool 981.0- 982.0	Above nor- mal inflow predicted.	On a rising stage, at 981.0 White Rock Dam is opened wide to preclude exceeding "Design Pool" of 982.0 in either pool. Discharge at 981.0 is 4,000 cfs and at 982.0 is 5,600 cfs. When pool again drops to 981.0, main- tain this stage by gradually reducing discharge at White Rock Dam to 1,100 cfs. After pool drops below 981.0, follow same procedure as under routine operation.
Summer - Period following break- up to freeze-up.	Reservation Pool 976.0- 981.0	Inflow in- creased by storm run- off.	Follow same procedure as under routine operation.
	White Rock Pool 972.0- 981.0		Immediately discharge up to channel capacity, 1,100 cfs, but do not cause flood stage to be exceeded at Wahpeton-Breck- enridge. Lower pool to and maintain 972.0 as soon as possible.
	White Rock & Reservation Pool 981.0- 982.0		Follow same procedure as under flood control, spring breakup period.
<u>Water Supply and Conservation</u>			
Summer	Reservation Pool 976.0- 970.0	Drought, little or no rain- fall.	No discharge except by special orders. Evaporation losses may lower pool below inverts of low water culverts.
	White Rock Pool 972.0- 967.0		No discharge except by special orders. One gate open with stop logs in place for minor fluctu- ations. If extreme drought con- ditions occur, evaporation losses may lower reservoir below bottom of approach chan- nel (967.0) to dam and prevent any release of storage if neces- sary in an emergency.

## **PUBLIC INVOLVEMENT**

The plan for public involvement for the Lake Traverse ROPE had as its goals: (1) informing affected agencies, units of government, representatives of affected citizens, and landowners surrounding the Lake Traverse-Bois de Sioux project of the ROPE study, and (2) hearing their definitions of related problems and opportunities and their ideas for better lake management.

Steps to date have included participation in Senator Charlie Berg's meeting to hear complaints about existing operations (July 1986); a mailing of questions and answers generated at that meeting to affected individuals (August 1986); a problem definition meeting in Wheaton with agencies, governments, representatives of known interest groups, and the general public (September 1986) (see photograph 7); and a newsletter summarizing the problem definition meeting (October 1986).

In January 1987, this Problem Appraisal Report will be sent to the involved agencies, governments, and interest groups, and a problem appraisal summary letter will be sent to interested individuals.

A coordination meeting may be held in February 1987 to discuss potential improvements with affected agencies, governments, and groups, to be followed in March 1987 by a progress report to those participants to describe the alternatives being evaluated.

After a recommended water control plan is developed by the Corps, using input from these meetings and other information, a public meeting will be held (probably in May or June 1987). The ROPE report will be sent to affected agencies, governments, and groups in September 1987, and a newsletter summarizing the recommendations will be sent to interested individuals. After comments are received, the ROPE report will be finalized in December 1987.



PHOTOGRAPH 7

Problem appraisal workshop at Wheaton, Minnesota, September 23, 1986. Participants review the lists of concerns that they prepared during the workshop. The lists of concerns are included in the Coordination Appendix to this report.

#### **INSTITUTIONAL ARRANGEMENTS**

Until specific improvements are proposed at Lake Traverse, there is no clear need for a local sponsor, nor any sure indication of what capabilities such a sponsor would require. There are, however, some requirements that water project sponsors in general must be able to meet: the authority to participate in such projects; the ability to acquire property, through purchase or condemnation; the ability to be sued (to hold and save the Federal Government free from suit); and the ability to generate revenue through levying taxes, issuing bonds, assessing properties, or charging fees. Many existing organizations or units of government in the Lake Traverse region possess all these capabilities.

Currently, there is some interest in the area in addressing water resource issues at a watershed or more unified level. A group that



could function across the political boundaries would be preferable, and yet hard to create, because of the multiplicity of organizations involved (three States, etc.). There are precedents for such cooperation in the area (see organizational list below), and water resource legislation in both North Dakota and Minnesota, in the last decade, has encouraged groups to be formed at hydrologically meaningful levels, such as a watershed. A petition for the completion of Bois de Sioux channel work was recently presented to the Corps, with joint encouragement from both Richland (ND) and Wilkin (MN) County commissioners. This type of joint action may be needed when recommended changes are eventually ready for implementation.

#### Existing Organizations/Governments in the Area:

##### MINNESOTA

Department of Natural Resources  
Water Resources Board (Comprehensive Local Water Management Act of 1985)  
Wilkin County  
Traverse County  
County Soil and Water Conservation Districts  
County Drain Conservation Districts

##### NORTH DAKOTA

State Water Commission  
State Conservationist  
Richland County  
Richland County Water Management District

##### SOUTH DAKOTA

Department of Water and Natural Resources  
Division of Water Quality  
Division of Project and Community Development  
Department of Game, Fish, and Parks  
Roberts County

##### INTERSTATE

Minnesota-South Dakota Boundary Waters Commission  
Tri-State Agreement (to manage waters of the Red River of the North)

##### NATIVE AMERICAN

Sisseton-Wahpeton Tribe

## PROBLEMS, NEEDS, AND OPPORTUNITIES

### INTRODUCTION

The following problem definition paragraphs contain preliminary information on the significant resources involved with Lake Traverse and its water control operation. The information was obtained from the Public Use Master Plan dated May 1979, various public agencies or groups, and in-house experts concerned with the particular resource. This information should become more refined as the study activities progress and as the public involvement program is accomplished. Accurate problem definition provides a necessary basis for formulation of alternative water control plans for Lake Traverse.

The primary water-related problems, needs, and desires in the Bois de Sioux River basin are flood control, fish and wildlife conservation and enhancement, recreation, water supply, water quality, erosion control, irrigation, and wastewater management. Previous reports have identified various water-related problems, needs, and desires in the Bois de Sioux-Mustinka Rivers basin from analysis of conditions and public and agency comments. More recent problem identification information has been obtained as a result of the public involvement program for this water control review for Lake Traverse. Each problem is discussed below, with an emphasis on flood problems.

### FLOOD PROBLEMS

#### Description

The topography of the Bois de Sioux River basin, subdued as it is, influences flood problems. A near level glacial lake plain covers most of the eastern part of the basin. The western part is characterized by gently rolling glaciated uplands. The flat topography, together with limited channel capacity, contributes to widespread flooding to shallow depths, especially in the central portion of the basin.

Flood conditions within the Bois de Sioux River basin are seldom made worse because of peak flows correlated with Red River main stem peak flows, since this area constitutes the headwaters of the Red River. Rather, the Bois de Sioux River basin contributes more to the floods on the Red River main stem, particularly because snowmelt from this basin often occurs when the lower (northern) reaches of the Red River are still jammed with ice. The Bois de Sioux and Otter Tail Rivers come together at Wahpeton and Breckenridge to form the Red River of the North. This junction causes flooding problems for Wahpeton and Breckenridge. The Bois de Sioux River contains about 6.0 percent of the total Red River basin drainage area, and runoff from the Bois de Sioux River basin contributes about 6.5 percent of the total Red River flow at the international boundary.

Floods occur nearly every year in the Bois de Sioux River basin as a result of snowmelt in March or April and sometimes in early May. Frequently aggravated by high intensity rains, these floods can cause delays in planting operations which are reflected in reduced crop yields. Given the short growing season, if the water stays on the land too long, it may be impossible to plant crops for the entire season, resulting in significant income losses for farmers.

In addition to spring snowmelt flooding, high-intensity summer rains cause a significant amount of flood damage. Although they may occur less often, the summer floods are characterized by high peak flows and, unlike spring floods, can cause extensive damage to maturing crops and can totally prevent crop harvest. This type of flooding is significantly influenced by the effects of localized runoff into the river channel. The Rabbit River and several smaller tributaries are believed to be the source of the majority of the high peak flows in the Bois de Sioux River that follow intense summer rainfall events.

Two separate types of flooding occur: (1) the most damaging type is associated with overbank flooding along the Bois de Sioux River and (2) runoff from snowmelt combined with rain can be impounded by culverts plugged with ice and by ditches within sections of land bounded by

roadway embankments (overland flooding). In overland flooding, the trapped water accumulates slowly until it overflows the roadways and inundates section after section of land as it moves overland in the general direction of the regional slope until it reaches a stream channel. The overland flooding is generally less damaging to agriculture because it quickly subsides before planting operations begin as the weather warms and melts the ice plugs.

#### Extent of the Floodplain

The Bois de Sioux-Mustinka Rivers floodplain has been estimated to be about 52,000 acres. Descriptive sources add another 75,000 acres, for a total of about 127,000 acres. The floodplain has the following major components: a 2,000-acre area associated with the Mustinka River, a 10,000-acre area corresponding to the Rabbit River drainage, and a 40,000-acre Bois de Sioux River floodplain. The Souris-Red-Rainy River Basins Comprehensive Study Report adds 30,000 acres to the Mustinka portion and 45,000 acres to the Bois de Sioux floodplain.

Each component area lies entirely within the Red River glacial lake plain. The Mustinka River floodplain area, delineated in flood insurance maps, depicts a narrow, well-defined band along the length of the principal channel. Descriptive sources depict a much larger area, having the same location and shape, of up to 3 miles in width. The Rabbit River floodplain area is depicted directly from floodplain maps and includes a dominant central segment approximately 2 miles wide and 6 miles long.

The Bois de Sioux River floodplain varies from about 1 mile wide at either end to more than 2 miles wide in the central segment. The additional area described places the width of the floodplain from 2 miles near the South Dakota border to more than 6 miles near the junction with the Otter Tail River. The extreme flatness of the area and corresponding lack of well defined channels leading to the main streams account for the large disparities between the delineated and descriptive identifications of the basin's floodplain.

### Trends

Participants at the September 1986 workshop, agency representatives, and in-house study team members have identified land use trends that are suspected to have occurred in the project area since the project was constructed. The trends are difficult to quantify and the information gap is of such a large magnitude that it is necessarily outside the scope of this water control study. Without exact and supportable information, it is impossible to evaluate the details of these problems in this water control review for Lake Traverse. However, the lack of exact quantification information does not prevent us from conceptualizing the likely effects of each trend. One caution is that past trends do not always accurately indicate future projections. Some government programs, agricultural technology, and purposeful planning by watershed districts can reduce undesirable land use practices and encourage desirable ones, thus affecting the historic trends.

One practice that has probably significantly increased the volume of water in the project system is ditching and installation of drainage tile in the wetter crop fields. This practice has probably reduced the overall volume of natural storage areas in the basin and placed more demand on the storage provided by the Lake Traverse project. This condition reduces the project's effectiveness and increases flood damage potential for downstream areas. Some area farmers have also expressed fear that the ditching practices may have even increased the size of the drainage basin by channeling runoff from (1) areas that used to contribute to adjacent watersheds and (2) formerly non-contributing areas.

Much of the agricultural flood damage reported by the farmers along the Bois de Sioux River probably occurs because high water levels in the river inhibit the success of ditching and drainage tile systems. Thus, much of the crop damage is occurring outside of the "direct" floodplain and is extremely difficult to identify without a detailed and expensive analysis. The indirect flood damage caused by backup of drainage systems is not being completely accounted for in our damage estimates because of the difficulty in obtaining that information.

Another land use trend has tended to increase the total number of acres of damageable row crops being planted in floodplain areas. The original cross section surveying information for the Bois de Sioux River and flowage mapping for areas around Mud Lake indicate that, before Lake Traverse was converted to a flood control project, much of the meandered and floodplain areas were being used for pasture and other agricultural practices that might be considered more practical and compatible uses of areas at risk to periodic inundation. Recent aerial photography and informal windshield inspections by study team members give the impression that significantly more acres in these floodplain and other marginal areas, such as drained wetlands, have been placed into row crop production. There has apparently been regional or even national pressure in the agriculture industry to place more acres into row crop production, including marginal and floodplain acreages, with associated greater risk of damage from high moisture levels and inundation.

#### Wahpeton-Breckenridge

Flood Damages. - The primary authorized purpose for the Lake Traverse project is flood damage reduction for the agricultural and urban damage centers along the Bois de Sioux River. The urban damage centers include the cities of Wahpeton and Breckenridge. Orwell Reservoir also provides flood damage reduction benefits for this urban area, but to a lesser extent than Lake Traverse because of Orwell's limited water storage capacity. Orwell Reservoir is located on the Otter Tail River, which joins the Bois de Sioux River at Breckenridge to form the Red River of the North. The Wilkin County Engineer and the Breckenridge City Engineer both requested that the water control operation of the two reservoirs be coordinated to provide the best available combined operation to reduce flood damages at Breckenridge. The other communities along the Bois de Sioux River are not located in its 100-year floodplain. Thus, the water control plans for Lake Traverse and Orwell Reservoir will be reviewed to consider the best available information and recent concerns.

The flood control operation plans for Lake Traverse and Orwell Reservoir and the flood emergency plans for Wahpeton and Breckenridge use the stage reading on the U.S. Geological Survey gage at Wahpeton as a decision criteria. The following table lists the critical gage readings.

<u>Gage Reading</u>	<u>Action Taken</u>
9.0	Wahpeton flood alert
9.5	Wahpeton - sewer pumping starts
10.0	Breckenridge flood alert - sewer lift stations begin to run longer to handle seepage into the sewer lines

The Wahpeton flood alert begins at about 9 feet (gage reading). At about 9.5 feet, sewers begin to flood and emergency pumping is necessary. At this elevation, basements would start to flood in Wahpeton if no sewer pumping were done. A city-owned levee protects a low part of town containing a park, golf course, and other day-use recreation facilities. Without the city-owned levee, these facilities would begin to flood at about 8.5 feet.

The peak gage reading during the spring flood in 1986 was 14.0 feet. Emergency pumping was required around the clock at Wahpeton. No structures were flooded directly in Wahpeton, but six businesses and six homes experienced basement flooding. Apparently, blockages formed in the sewer lines and resulted in water backing up in the sewer lines and into basements. Otherwise, the emergency sewer pumping by the city has been successful in the past. In 1986, the cost of emergency pumping was approximately \$12,000 in addition to the basement damage that was not estimated.

Damage at Breckenridge starts with sewer flooding damage at about 10 feet. As river stages increase, floodwaters can seep from storm sewers to nearby sanitary sewers. This places an additional burden on the sanitary lift stations and can lead to additional problems including releases of sewage directly to the river. During the spring flood in 1986, sewers were flooded and problems occurred with the lift stations

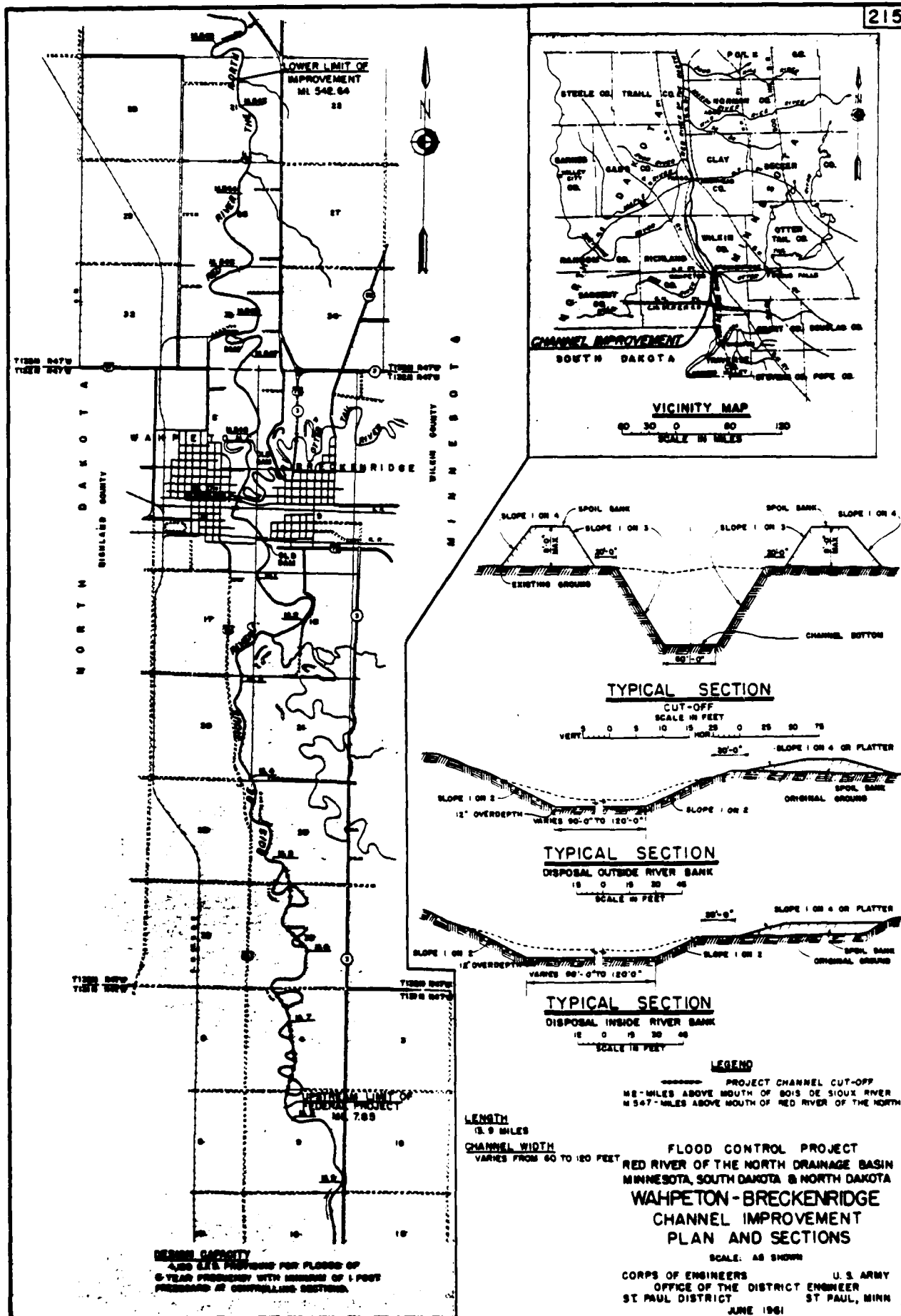
that required overtime labor and additional pumping. No structures were flooded at Breckenridge. Residential flooding has not been a significant problem since the city constructed the levees. The golf course in Breckenridge sustained losses estimated at \$13,000 from lost revenues, silt and debris removal, additional seeding, pumping, and overtime labor. Damages at the golf course begin at a stage of 10.5 feet.

Past Flood Control Studies. - The St. Paul District has been extensively involved in evaluating the flood problems at Wahpeton-Breckenridge. The information from these past studies will be used as best possible in the review of the water control plans for Lake Traverse and Orwell Reservoir. However, additional detailed study of structural flood control alternatives for Wahpeton-Breckenridge is outside the scope of this ROPE study.

The District helped prepare a Federal Flood Insurance Administration report, dated March 1978, for Wilkin County, Minnesota. The report includes flood profiles (500-, 100-, 50-, and 10-year) for the Otter Tail River from its mouth to river mile 25. The St. Paul District recently completed a draft Flood Insurance Study for the Federal Emergency Management Agency that includes the Bois de Sioux River and part of the Red River in the vicinity of Wahpeton and Breckenridge. The Flood Insurance Study report contains flood profiles for the Bois de Sioux River.

An authorized channel improvement project for flood control and major drainage would provide 13.9 miles of channel improvement of the Bois de Sioux River from the lower end of the Lake Traverse-Bois de Sioux River project to its confluence with the Red River of the North and on the Red River to a point 6 miles below the Bois de Sioux River. A map showing the location of this project is found on figure 7. The project is inactive because a review of the economics in 1956 and again in 1962 indicated that the project was not economically feasible.



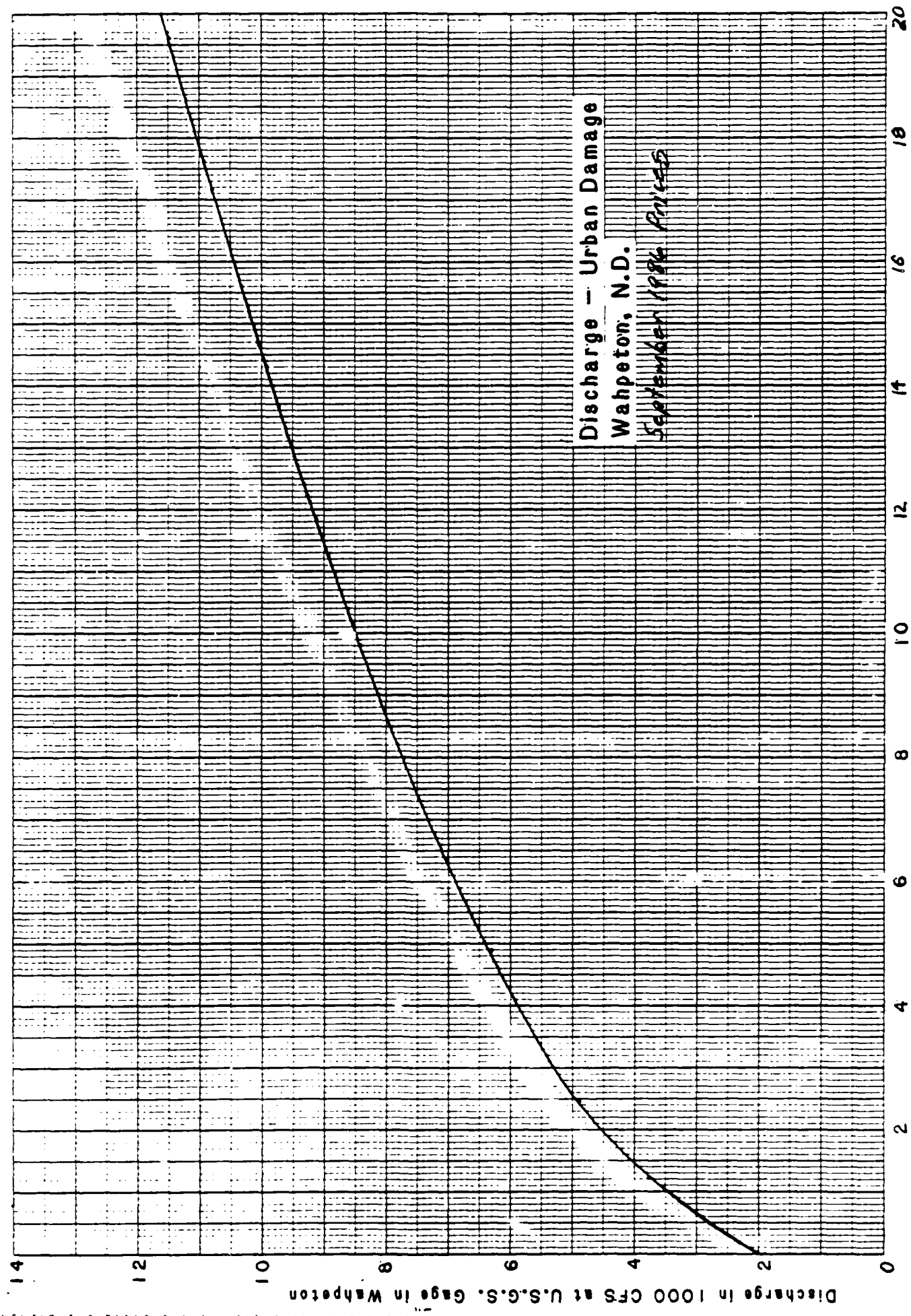


In 1965, the St. Paul District again reviewed the economic feasibility of the authorized channel project, recognizing benefits attributable to prevention of river scour problems at that time. The project was found to be infeasible. The St. Paul District Engineer received a petition in September 1986 from farmers located along the Bois de Sioux River upstream from Wahpeton-Breckenridge. The petition requests a current review of the economic feasibility of this authorized project. The authorized project economic evaluation will be updated again, in response to the petition, using available information from this ROPE study.

In 1969, the St. Paul District evaluated several levee plans, channelization alternatives, and a diversion of the Otter Tail River to the north of Breckenridge into the Red River of the North. None of these plans were found to be economically feasible. The discharge-damage curves for the 1969 study have been indexed up to 1986 price levels and are included as figures 8 and 9. Much of the damage reflected on the curves represents damages to basements from sewer backup. The discharge-rating curve is included as figure 10.

#### Bois de Sioux River

Agricultural Flooding. - Richland and Wilkin County officials and numerous farmers have indicated that flooding of agricultural lands along the Bois de Sioux River has been increasing over the past few years. Part of the problem has been the above average precipitation received in the basin. Landowners along the river have also reported numerous beaver dams, vegetation growth in the channel, and sedimentation in the channel. Summer releases from White Rock Dam at Lake Traverse may be contributing to the flooding, although typical summer releases from the dam are below 150 cfs.



Discharge - Urban Damage  
Wahpeton, N.D.  
September 1986 Prices

FIGURE 8

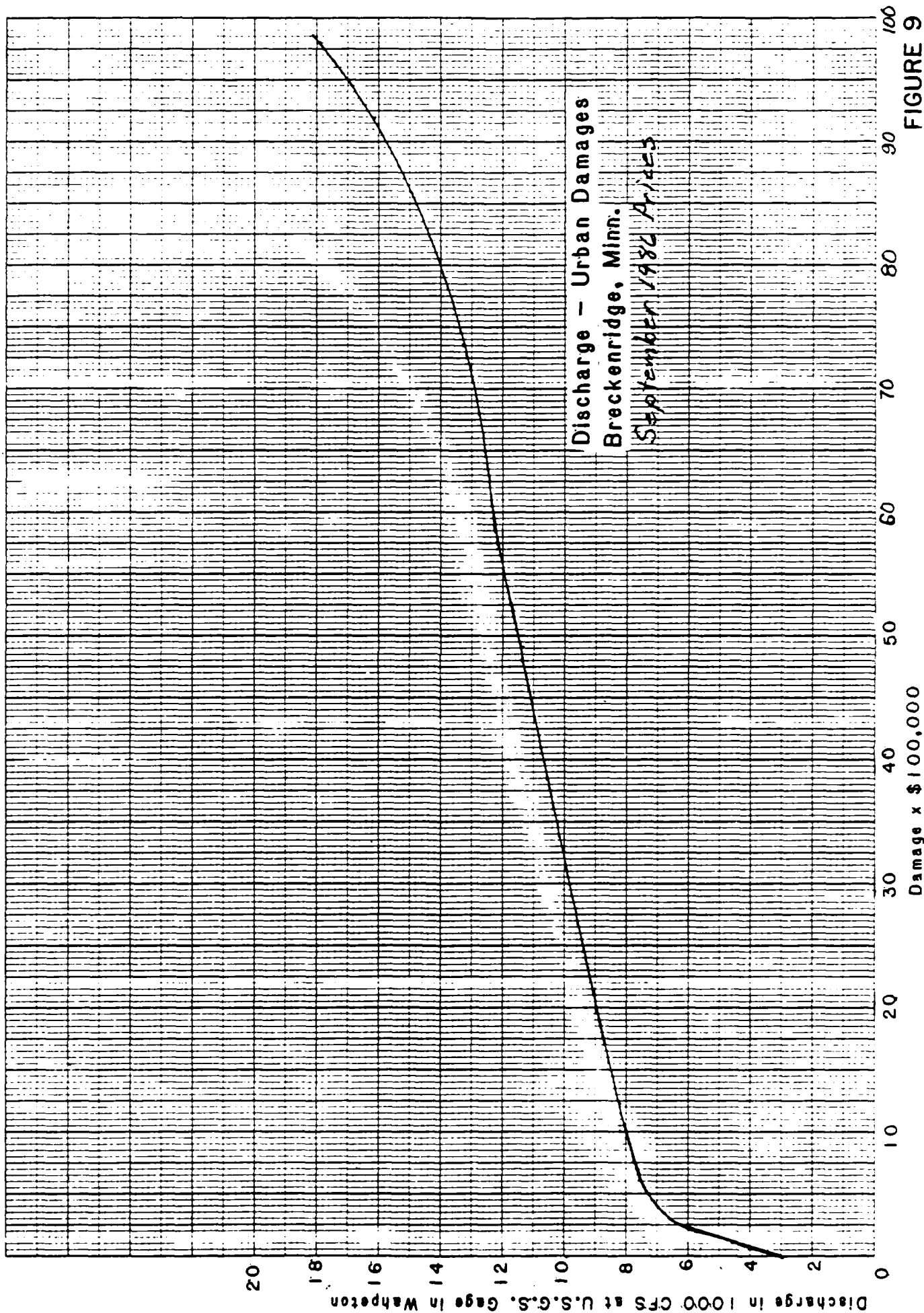


FIGURE 9

# DISCHARGE RATING CURVE

Red River At Wahpeton USGS Gage

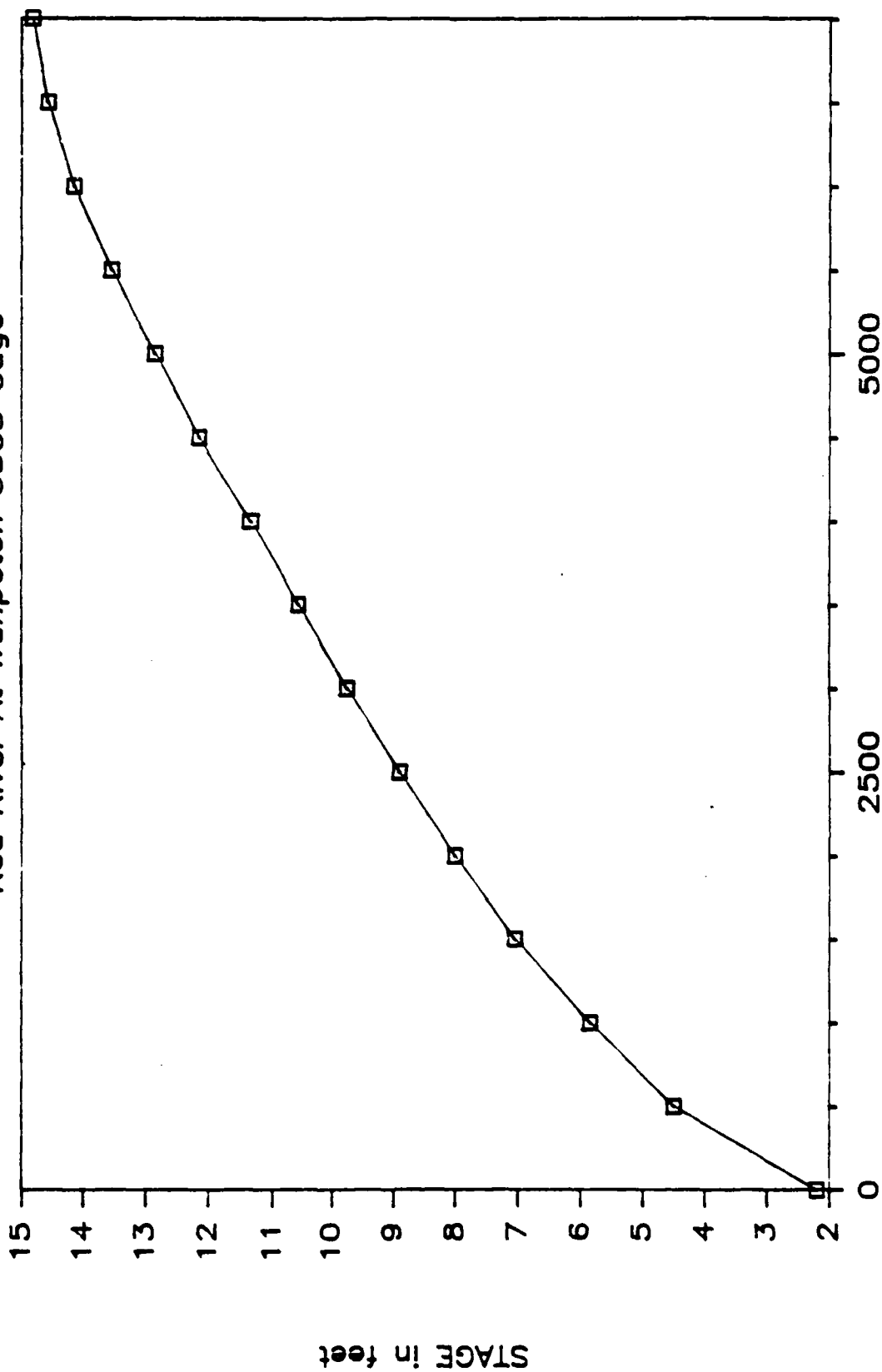


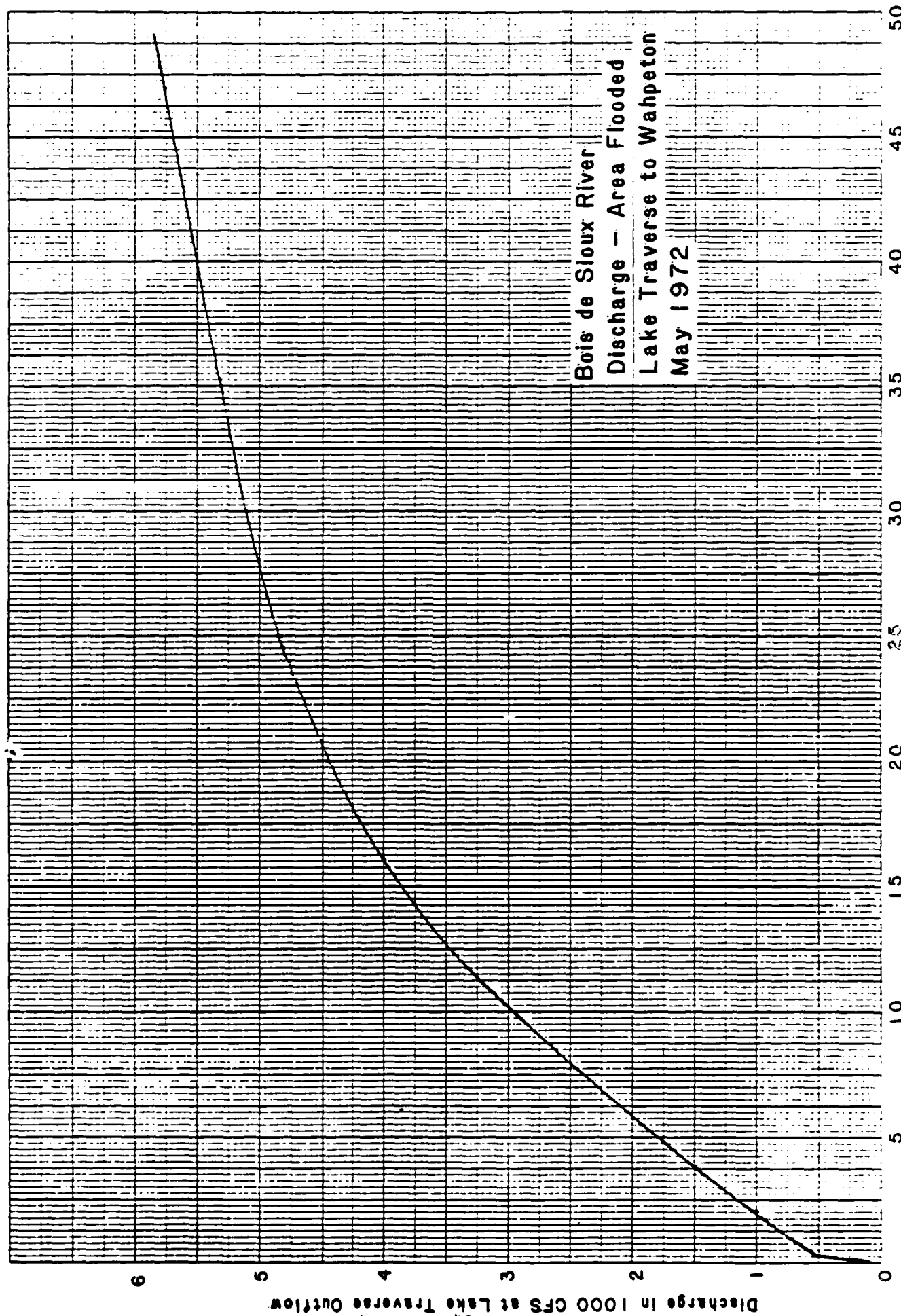
FIGURE 10

DISCHARGE in cfs

The problem is characterized by short duration flooding of farmlands at scattered locations along the Bois de Sioux River during the summer. See photographs 4 and 5 (pages 18 and 19). The flooding occurs after intense rainfalls because the existing channel does not have the capacity to carry the flows. Area farmers report that some of their land has been flooded several times over the summer and as late as mid-September. Complaints have been received by the county commissioners, mostly from the reach of the Corps channelization project completed in the 1940's (from White Rock Dam to 24 miles downstream).

The channelized portion of the river was designed to convey a flow of 1,100 cfs between White Rock Dam and the Rabbit River and 2,000 cfs from the Rabbit River to the downstream project limit. The channel was originally designed to provide for floods up to the 10-year frequency with 1 foot of freeboard. The land-use trends described in the previous section have probably increased the frequency of occurrence of the design discharges for the channel. The latest available discharge-area flooded curve, dated May 1972, is included as figure 11. The curve indicates that, at a 1,100 cfs flow, about 2,000 acres are being flooded. Aerial photos taken on May 20, 1986, when the discharge from White Rock Dam was 1,100 cfs, indicate that about 600 acres of agricultural production land was being flooded. About half of the 600 acres has been identified as meandered (State-owned) land being farmed by the adjacent landowners. The discharge-area flooded curve is valid only if the discharge on the river is in a steady state -- no unusually high local inflows below White Rock Dam. The aerial photos and a windshield survey by a St. Paul District economist indicated that many more acres were affected by poor field drainage than were probably being hampered by high river levels. Crop damage on this land can range from \$200 to \$300 per acre if a crop is planted and no yield is obtained.

Much of the flooding is apparently being caused by local runoff, particularly from the Rabbit River. The dates of some flooding complaints received from the public have been matched to the White Rock Dam discharge records. It has been found that the flow from White Rock



Area Flooded x 1000 acres

FIGURE 11

Dam has often been less than 100 cfs when flooding reports indicate that the river discharge is above 1,100 cfs. The only way to account for this is to assume that, between White Rock Dam and the point of flooding, over 1,000 cfs of flow has been contributed by local inflows to the river.

Channelization (Unconstructed Reach). - Channel improvement on the Bois de Sioux River and the Red River of the North in the vicinity of the Wahpeton-Breckenridge area is an uncompleted unit of a flood control project authorized for construction by the Flood Control Acts approved June 30, 1948, and May 17, 1950. This unit would have provided 13.9 miles of channel improvement on the Bois de Sioux and Red Rivers by cleaning, enlarging, and straightening the rivers from the lower end of the constructed project to just downstream of Wahpeton-Breckenridge. Figure 7 on page 49 shows the location of the project in relation to Wahpeton and Breckenridge. The figure also shows typical cross sections of the authorized channel design. The authorized channel project, if constructed, would also reduce flood damages at Wahpeton and Breckenridge.

Presently, this project is classified as "inactive" because previous studies showed that it lacked economic feasibility. To reclassify the project to "active" will require a letter from a non-Federal sponsor that indicates an official position in support of the project and its reactivation. The letter must also indicate the sponsor's willingness and legal ability to provide the items of local cooperation when required. However, initiation of detailed studies to adequately reevaluate the economic, technical, and environmental issues, based on current conditions, will depend not only on the receipt of a non-Federal sponsor letter, but also on the appropriation of study funds by Congress and the President. Inclusion in the budget, of course, depends on the budgetary objectives of Congress and the President and the needs of other worthy projects throughout the Nation.



In July 1985, the Richland County Water Management District and the Richland County Commissioners requested clarification as to what financial and other responsibilities would be expected of a local sponsor for this project. Clarification was provided to both groups, but neither has moved to sponsor the project, to date.

On September 19, 1986, the St. Paul District Engineer received a petition signed by 62 farmers who own or operate land in the affected drainage area located within Richland County, North Dakota, and Wilkin and Traverse Counties of Minnesota. The petition requests the District Engineer to reactivate and determine the economic feasibility of the authorized but unconstructed 13.9-mile reach of the channelization project. The petitioners indicate willingness to cooperate in the necessary studies to determine the feasibility of the authorized project, based on current conditions. However, the petitioners apparently have not yet attained the legal organization required of a Federal project sponsor.

#### Rabbit River Flooding

The Rabbit River is a tributary to the Bois de Sioux River at about 10 miles upstream from Wahpeton. Some areas along the downstream portion of the Rabbit River are subject to spring snowmelt flooding and flooding from summer rainstorms. The summer rainfall floods can damage crops. Both types of flooding can cause erosion damage to roadway crossings, and the larger events can cover roadways sufficiently to interrupt traffic. The damage caused by the Rabbit River is related to the water control of the Lake Traverse project only because, during certain conditions, releases from the White Rock Dam at Lake Traverse can aggravate somewhat the backwater effects of the Bois de Sioux River. This can increase flood stages slightly along the lower few miles of the Rabbit River. This effect will be considered in the evaluation of the Lake Traverse water control plan.

Another concern expressed by the Wilkin County Engineer is that the discharges from the Rabbit River can aggravate flooding along the Bois de Sioux River. The Bois de Sioux River agricultural flood problem is further aggravated by short duration (4 to 6 days) summer flood flows from the Rabbit River. The flood flows from the Rabbit River can cause flooding along the Bois de Sioux River for up to about 20 miles upstream from Wahpeton. This flooding includes induced flooding for 8 to 10 miles upstream of where the Rabbit River joins the Bois de Sioux River because of backwater effects. See the 1969 flood profile on figure 12. This effect will be considered in the evaluation of the Lake Traverse water control plan.

The other aspects of the Rabbit River flood problem are scheduled to be considered under the Corps of Engineers small projects authority for possible clearing and snagging or channel improvement. The St. Paul District contact for this study is Mr. Charles Crist at telephone (612) 725-7559.

In July 1986, the St. Paul District completed a low-detail review (initial review level) of the hydrology of the Rabbit River. The following paragraphs and discharge-frequency curve (figure 13) are from that hydrology effort.

A discharge-frequency curve has been developed for the mouth of the Rabbit River, Minnesota, using limited techniques. Although there is a U.S. Geological Survey gage on the Rabbit River near Nashua, Minnesota, the drainage area is only 56.1 square miles and reflects a small percentage of the total drainage basin. Basin parameters used in this analysis are shown at the top of page 54.

# BOIS DE SIOUX RIVER FLOOD PROFILES

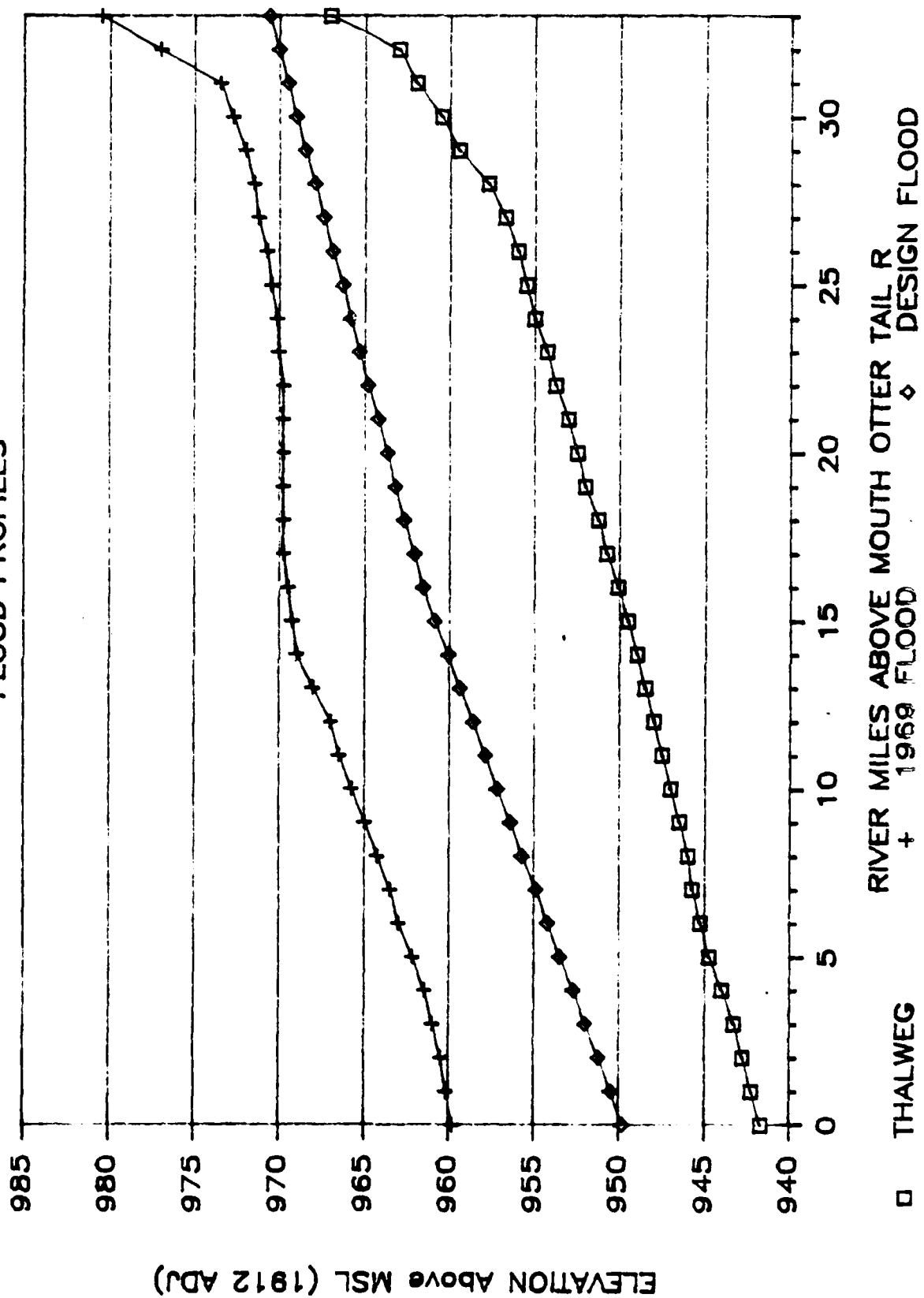


FIGURE 12

Drainage Area at Mouth	315 sq. mi.
Main Channel Length	
Mouth to South Fork Rabbit River	12.1 miles
Total Length	34.1 miles
Elevation	
At Mouth	952 ft NGVD
Headwaters	1085 ft NGVD
Channel Slope	0.073 percent
Time of Concentration (affected greatly by the flat slopes)	72 hours

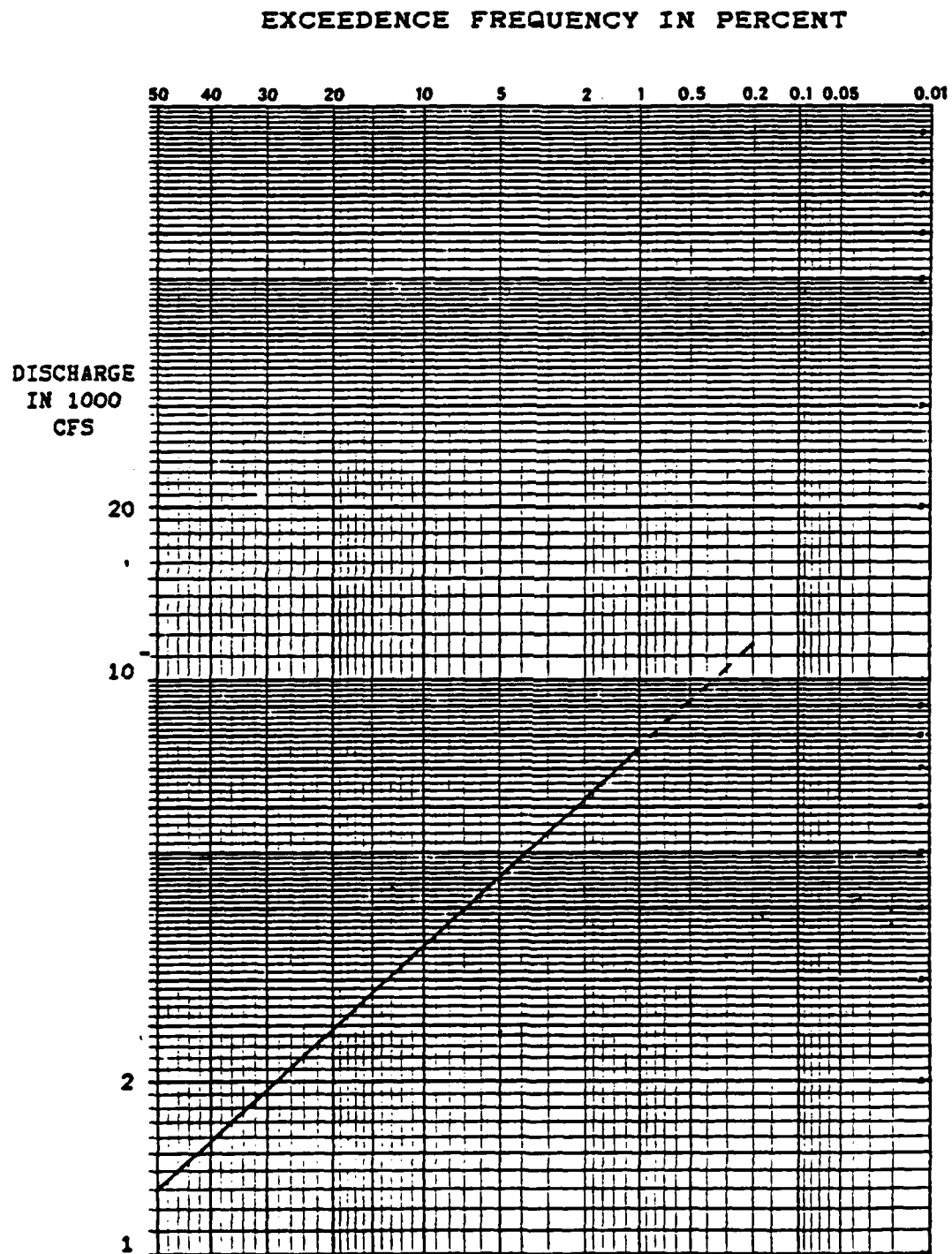
Soil Conservation Service (SCS) techniques were used to develop the synthetic unit hydrographs. A curve number of 70 was used. The peak was adjusted to reflect the effect of lakes and swamps/wetlands. Correlation to other basins nearby, as well as use of U.S. Geological Survey regression equations, did not improve this estimate of the discharge-frequency curve. The adopted results are in the following table. The plotted discharge-frequency curve is presented on figure 13.

Adopted Frequency Data, Rabbit River at Mouth

Initial Appraisal Detail			
Exceedence Frequency		Peak Discharge in CFS	
Percent	Years	SCS	Adopted
50	2-year	1,320	1,300
20	5-year	2,640	2,470
10	10-year	3,640	3,450
4	25-year	4,860	4,900
2	50-year	6,210	6,200
1	100-year	7,560	7,600
0.2	500-year	--	11,600

ADOPTED FREQUENCY DATA  
RABBIT RIVER AT MOUTH

INITIAL APPRAISAL DETAIL

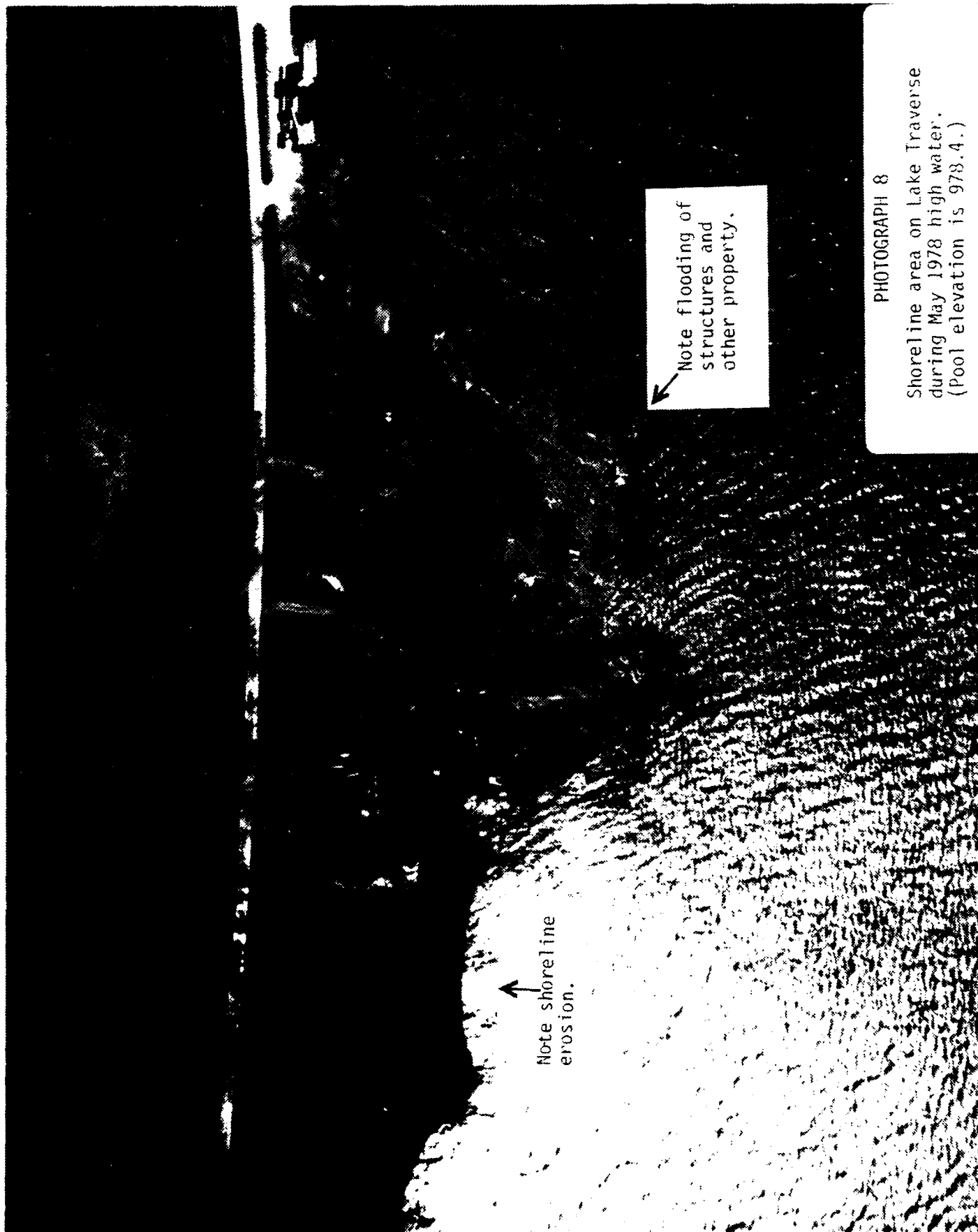


### Lake Traverse High Water Damage

Lake Traverse is surrounded by hundreds of assorted structures including: farmstead buildings, resort buildings, about 27 homes, about 114 seasonal homes, mobile homes, and other miscellaneous structures. Photograph 8 shows a typical cluster of structures on Lake Traverse. This past spring and summer high lake levels caused approximately \$500,000 damage to those structures. Significant additional damage included lost resort business, evacuation of homes and cabins, and lost crop and pasture production on adjacent agricultural land. Two resort owners have informally indicated that the recent high water has disrupted their operation to the extent that they do not presently have plans to reopen their resorts. There are also significant incomputable cumulative sociological effects on adjacent farm families who have already been struggling with economic adversity for several years.

Agricultural damage was especially significant around Mud Lake which has a much flatter basin. Approximately 2,000 acres around the lake are within the elevation range of 975 to 981. Most of this land is in pasture or cropland, and under normal conditions, it is productive. This year, however, much of the cropland was not planted, and hayland was converted to pasture. Unusable pasture required that livestock be moved to leased sites or sold early at reduced prices. Producers accounting for approximately 30 percent of the affected area reported crop and livestock losses totaling over \$100,000.

Other damage associated with the high lake levels includes shoreline erosion, debris deposits at the high water line, and reintroduction of noxious weed seeds to agricultural areas. Several of the more severe shoreline erosion areas were surveyed to determine whether the damage extended outside of the flowage easement taking line. It was found that the erosion was occurring well within the taking lines at those particular sites. Further, the survey indicated that all but a few of



PHOTOGRAPH 8

Shoreline area on Lake Traverse during May 1978 high water. (Pool elevation is 978.4.)

the structures were well within the Federal flowage easement taking lines. Several structures were even found to be within the elevation 977 permanent flowage line. See figure 14.

The losses described have occurred during 1986 as a result of the Federal Government partially using the project flowage easements acquired in the 1940's. The flowage easements were authorized and funded by Congress to provide a flood control pool in Lake Traverse to reduce downstream agricultural and urban flood damages from the Bois de Sioux River. The areas below elevation 977 are subject to a permanent flowage easement because the area was determined to be meandered land and thus already in public (State) ownership when the project area was acquired. The existing operation of the lake has produced peak elevations of the lake that have exceeded elevation 977 by a significant amount only about 6 times in the past 20 years.

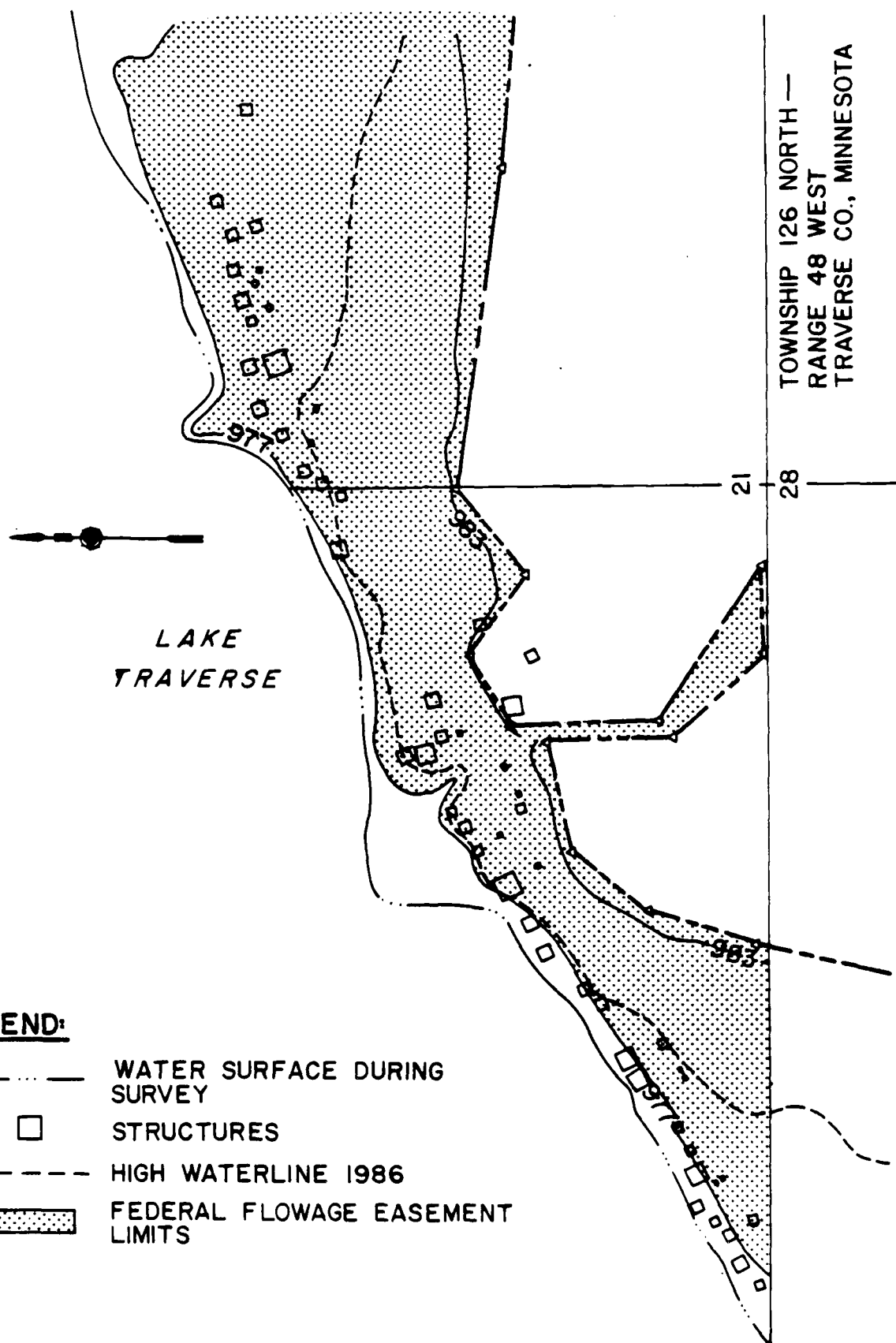
The Federal Government also acquired intermittent flowage rights to approximately elevation 983. Those flowage rights were acquired to provide storage of runoff to reduce downstream flood damages along the Bois de Sioux River. However, the flowage easement documents do not provide for Federal Government regulation of the owners' use of the elevation band between 977 and 983 for any purpose that does not interfere with the operation of the Lake Traverse project. The typical landowners' improvements within the intermittent flowage limits do not physically threaten the Federal project and, as a result, they have not been monitored by the Federal Government. This, combined with a long period of at or below conservation lake levels with fairly rare high lake levels, has probably given lakeshore owners a false sense of security that has inadvertently encouraged inappropriate development in the intermittent flowage limits.

An additional misinformation problem was identified during State Senator Charlie Berg's July 1986 public meeting. Apparently, some lakeshore owners have misread the recorded flowage easement documents to mean that



**LEGEND:**

- · — · — WATER SURFACE DURING SURVEY
- STRUCTURES
- - - - - HIGH WATERLINE 1986
- ▨ FEDERAL FLOWAGE EASEMENT LIMITS



the Federal flowage rights are located entirely within the elevation 977 (permanent flowage limits) contour. Some landowners indicate that they were unaware of the risk that the flood pool could go above elevation 977 when they either bought or improved their property. The problem is further described in a brochure developed as a result of the public meeting. A copy is included in the Coordination Appendix of this report.

The situation described above will continue, possibly at increasing rates, as a result of trends affecting flood damages, as described in the previous section. During years of average or somewhat below average precipitation, Lake Traverse levels will likely continue to approximate the conservation elevation of 976 or somewhat below at the end of summer. During years of above average precipitation, such as the past several years, there is an increased risk of damages resulting from high Lake Traverse levels. Without an updated public information program by the Corps of Engineers, the misinformation problem experienced by the lakeshore owners will likely continue to worsen. Development statistics from the Datanet system indicate that there were 54 seasonal and 20 permanent homes in 1967 and 114 seasonal and 27 permanent homes in 1982. It is likely that many of these additional structures have been built in floodplain areas, partly because of public misinformation. The existing structures around the lake would continue to be damaged by high lake levels during wet years, but some modified water control operation plan may slightly reduce the existing frequency of high lake levels.

#### **WATER CONSERVATION**

One authorized purpose of the Lake Traverse project is to store water for conservation and the preservation of fish and wildlife. Since the project was authorized some 50 years ago, the concepts of water conservation and fish and wildlife preservation have likely changed. Water conservation means different things to different groups. Various aspects are covered in several following sections of this report.

To the downstream communities, water conservation traditionally meant some storage in the reservoir for water supply. Since the passage of certain water quality laws, the cities have also become dependent on receiving minimum flows to help relax operational aspects of their wastewater treatment plants. The engineering and technology involved with wastewater treatment are continuing to develop and hopefully will improve the quality of the discharge and, at the same time, decrease the need for natural flows to dilute unacceptable concentrations of certain parameters. For the time being, minimum low flow amounts from the Lake Traverse project are needed for downstream cities.

To a fish and wildlife manager, preservation traditionally meant a minimum reservoir storage to provide a basic survival for fish in the reservoir and wildlife in the immediate project area. Since that time, the concept of instream needs for a minimum flow has developed and received widespread contemporary professional support. In other words, the riverine and aquatic environments downstream of Lake Traverse are now also recognized by the resource agencies to be significant and affected by the lake's water control plan. For example, electroshocking surveys by the Minnesota Department of Natural Resources indicate that walleye are found in the river as far downstream as Breckenridge. The fishery in the river is significantly limited by the highly variable discharges from White Rock Dam.

For this review of the Lake Traverse water control plan, the water conservation authority is addressed in terms of water supply, water quality, wastewater management, fish and wildlife conservation, and minimum instream flow requirements.

There is a potential trade-off of benefits among the purposes that require minimum water storage in the lake and those that require a minimum flow in the Bois de Sioux River. Under certain drought conditions, adequate water may not be available to satisfy needs both in the lake and downstream. The South Dakota, Minnesota, and possibly North Dakota State resource agencies are legally responsible for

allocation of water from Lake Traverse among the various purposes during water allocation emergencies such as drought. They would make the needed trade-off decisions according to their established criteria and process. The Minnesota Department of Natural Resources and two Minnesota research centers are presently reviewing the Minnesota water allocation system. The system may be drastically modified based on the review. If the changes occur, they would likely be made 5 to 10 years from the publication date of this report. Thus, any modified water control plan selected as a result of this study may need to be modified slightly in 5 to 10 years to reflect those changes in the Minnesota water allocation plan and in cooperation with South Dakota.

#### **FISH AND WILDLIFE**

Much native prairie wildlife habitat in the basin has been eliminated for agricultural production or altered by heavy grazing of livestock. Woodlands and woody and herbaceous cover in riparian communities have been converted to cropland. These actions have eliminated or reduced the quality of habitats available for wildlife resources. Wetland losses caused by draining, filling or leveling, burning, plowing, and siltation are a major problem for migratory birds and resident fauna (U.S. Army Corps of Engineers, 1979; North Central Forest Experiment Station and Minnesota State Planning Agency, no date; Souris-Red-Rainy River Basins Commission, 1972). The Souris-Red-Rainy River Basins Commission (1972) indicated an urgent need for preservation of wetlands and development of replacement habitats due to continued destruction of wetlands and unavoidable delays in authorized acquisition and protection programs.

Lake and stream environments for aquatic biota are being degraded through siltation resulting from wind erosion on nearly all lands and from wind and water erosion on slopes (Souris-Red-Rainy River Basins Commission, 1972). Water quality problems in Lake Traverse and Mud Lake are adversely affecting aquatic habitats and biota. "Winterkills" occur periodically in these two lakes as a result of depressed oxygen levels,

which has favored rough fish populations. Additionally, algal blooms and high turbidities have tended to limit habitat and spawning sites for game fish and panfish. Minnesota and South Dakota are not trying to rectify this situation (Falk et al., 1975; U.S. Army Corps of Engineers, 1979a, b). Intermittent streamflows and low dissolved oxygen levels in the Bois de Sioux River, as indicated by the South Dakota Department of Natural Resources Development (1975), are undoubtedly affecting aquatic organism populations.

Prior to project construction, Lake Traverse and Mud Lake supported a vast marsh. Since project completion, a large portion of the marsh habitat has deteriorated. Fluctuation of lake level, water turbidity caused by winds, and the shallowness of the lake have also contributed to a loss of wildlife habitat. As a result, hunting quality and activity have decreased. Through management of leased lands, the Minnesota Department of Natural Resources has begun to reverse the changes in habitat. The preservation of existing habitat and the creation of potholes in Mud Lake marsh areas have improved habitat. Additional measures to restore wildlife habitat, such as proposed by the Mud Lake Wildlife Management Plan, are necessary if the wildlife population and resulting hunting are to be significantly improved.

Because of the loss of wildlife habitat, pressure upon the remaining wildlife habitat at Lake Traverse has increased. To ease pressure and restore habitat, it will be necessary to increase the activities and land in wildlife management programs. Regulating water levels in Mud Lake to increase aquatic and shoreline vegetation may provide additional feeding and nesting resources for waterfowl. Creation of a buffer of vegetation on Corps administered lands along the lake edge may begin development of natural biotic communities creating valuable wildlife habitat. With the support of the Minnesota Department of Natural Resources, the South Dakota Department of Wildlife, Parks, and Forestry, and the Corps of Engineers, a program of this nature could be extended to private land. The visual character of the lake would be improved,

wildlife habitat increased, recreational opportunity created and improved, and property values increased.

The St. Paul District has cooperated over the past few years with the U.S. Fish and Wildlife Service, private groups, and the State resource agencies to develop a wildlife habitat improvement plan for Mud Lake. The primary management activity proposed by that plan is to control water levels in Mud Lake to systematically manipulate development of vegetation within the lake basin to improve waterfowl habitat.

Fishing is an important activity at Lake Traverse. Because of its status as a boundary water, Lake Traverse receives considerable early fishing pressure and provides valuable local fishing for Minnesotans and South Dakotans. The lake is very productive and contains a large population of rough fish, predominantly carp, buffalo fish, bullheads, and sheepshead. Fishing is best in spring and fall when the summer algal blooms can be avoided. Fishing is considered good for white bass, crappie, and bullheads and fair to poor for walleye and northern pike.

Minnesota and South Dakota participate in a program that removes rough fish and stocks walleye, northern pike, and crappie, but problems exist that directly affect the fishing and overall recreation use of Lake Traverse. Periodic winterkill is a problem, resulting in the natural selection of rough fish. Water quality due to algal blooms, and lake turbidity caused by wave and wind action tend to limit habitat and suitable spawning sites for game fish and panfish. Until water quality is improved, fishing can be expected to decrease in quality, with rough fish predominant.

The Minnesota Department of Natural Resources has fish electroshock sampling information for the Bois de Sioux River that indicates game fish, including walleye, can be present in the stream as far downstream as Breckenridge. The limiting factor for the fishery in the Bois de Sioux River is the absence of flow during sustained periods. The water

control plan should be reviewed to consider this opportunity to improve the fishery.

At the September 1986 workshop, a concern was raised that the operation of the Reservation Dam allowed game fish to move from Lake Traverse into Mud Lake and ultimately perish. It was suggested that a fishway be installed between the pools to return game fish from Mud Lake to Lake Traverse. It is doubtful that more than a few percent of the fish in Lake Traverse are lost into Mud Lake. Most of the fish species in the lake would not use a fishway. Also, fisheries management in Lake Traverse is being handled by the South Dakota and Minnesota natural resource agencies. Thus, this ROPE study will not consider the fishway or similar fishery management proposals.

#### **WATER SUPPLY**

The Bois de Sioux River basin has approximately 39,000 acres of surface water available in lakes; however, only about one-third of the acreage is in lakes over 40 acres in size. The storage potential of the lakes would be inadequate to meet the needs of a municipal water supply. Lake Traverse and Mud Lake are used primarily for flood control and are subject to extended periods of discharge and high evaporation rates from the large pool surface. The major rivers of the area (i.e., Bois de Sioux, Mustinka, and Rabbit) experience periods of no flow or low flow and are high in dissolved solids. Consequently, ground water is used for water supply throughout the basin except when surface water is available at sufficient quality and quantity.

There are many glacial drift wells in the lake plain area; however, some of the wells yield less than 10 gallons per minute (gpm) and produce water that is high in dissolved solids and iron. Public officials in Wheaton, Elbow Lake, and Browns Valley, the three largest towns in the basin, report water supply problems in recent years.

In Wheaton and Elbow Lake, additional wells have been drilled into the aquifers currently supplying the towns. Browns Valley is locating new aquifers because of possible contamination of the presently used aquifer by an overlying disposal area. The increase in the number of wells is attributed to a need for upgrading the municipal systems rather than to aquifer depletion. Additional problems experienced include high iron and manganese content at Wheaton and corrosion of water lines because of chemical properties of the soil at Browns Valley. Elbow Lake has corrected supply problems with the addition of two wells in 1978. In Wheaton, water treatment plans are being formulated and implemented. All of the towns reported that supplies were adequate to meet anticipated demands because the populations have remained stable over the past few years, and growth is expected to be very gradual.

The cities of Kent and Wolverton in Wilkin County and Georgetown in Clay County are close enough to the Red River to use it as a water supply source. However, their water use permits from the Minnesota Department of Natural Resources indicate that they all depend on wells between 137 and 290 feet deep. See the table on the following page for more information from the permit system.

#### Short-Term Problems

During coordination activities for the Orwell ROPE study, the water department representatives from Fargo, North Dakota, and Moorhead, Minnesota, indicated concern about the quantity and quality of the water in the Red River for water supply. The Red River is the main water supply source for both cities. During a telephone conversation, the Moorhead Water Department representative indicated that the December 1984 to January 1985 large releases from Lake Traverse had caused the city to expend \$80,000 over budget for water treatment chemicals. He suggested that the higher quality water from Orwell Reservoir be used to dilute releases from Lake Traverse on the Bois de Sioux River. Both are



Minnesota Department of Natural Resources 1984 Water Use Permit Data

Municipality	MNR Permit Number	Population	Number of Service Connections	Total		Reported Withdrawal Volume in MGY	Percent Commercial and Industrial	Plant Design Capacity 1,000 Gal.	Average Daily Production 1,000 Gal.	Source Name
				Permitted Pump Rate in GPM	Permitted Withdrawal in MGY					
Wilkin County, Minnesota										
Breckenridge	751162	4,500	1,250	1,500.0	210.0			115	550	Ottertail River
Breckenridge	771670	4,500	1,250		273.8	83.8	23	115	550	Well, 300 feet deep
Breckenridge	771670	4,500	1,250		273.8	50.1	23	115	550	Well, 300 feet deep
Wolverton	801138	177	80		6.2	3.6			16	Well, 165 feet deep
Wolverton	801138	177	80		6.2	2.3			16	Well, 170 feet deep
Kent	851109	132	52	50.0	3.0				7	Well, 137 feet deep
Clay County, Minnesota										
Moorhead	470014	30,000	7,370		730.0	515.1		9,000	4,190	Well, 273 feet deep
Moorhead	470014	30,000	7,370		730.0			9,000	4,190	Well, 273 feet deep
Moorhead	470014	30,000	7,370		730.0			9,000	4,190	Well, 104 feet deep
Moorhead	570389	30,000	7,370					9,000	4,190	Well, 116 feet deep
Moorhead	771850	30,000	7,370		2,363.0			9,000	4,190	
Moorhead	771850	30,000	7,370		2,363.0			9,000	4,190	
Moorhead	771851	30,000	7,370		2,363.0			9,000	4,190	Long
Moorhead	771852	30,000	7,370		2,240.0	886.7		9,000	4,190	Red River of North
Georgetown	851181	80	21	60.0	2.0				12	Well, 290 feet deep
Traverse County, Minnesota										
Browns Valley	580647	906	400	200.0	70.0	65.7	40		120	Three wells used
Wheaton	801152	2,000	800		110.0		19		235	Well, 148 feet deep
Wheaton	801152	2,000	800		110.0	49.1	19		235	Well, 143 feet deep
Wheaton	801152	2,000	800		110.0	49.7	19		235	Well, 145 feet deep
Dumont	841161	180	55	100.0	2.0	2.6	15		20	Well, 120 feet deep
Dumont	841161	180	55	100.0	2.0	2.4	15		20	Well, 175 feet deep

Corps-operated reservoirs. Another suggestion is that smaller, more gradual Lake Traverse releases should be made over a long period, rather than large volume, higher peak releases over a short period. Moorhead takes its water from the Red River when the quantity and quality are high enough. Otherwise, Moorhead uses ground water that is more expensive to pump and usually more expensive to treat. Most of the communities along the Red River use similar water supply systems. Moorhead has not experienced winter flows that were too low, and prefers to have the summer flows supplemented to flush algal blooms. Moorhead does little pumping in the winter; it does most of its pumping in the summer to satisfy peak demand.

Fargo representatives indicated that the past operation has worked well in providing water supply. The city would not like to see the Lake Traverse or Orwell Reservoir operation changed materially for water supply. However, summer operation should be reviewed to provide better pollution abatement. Fargo also has an intake and pipeline to the Sheyenne River, but the city prefers the quality of the Red River water.

Wahpeton, North Dakota, and Breckenridge, Minnesota, indicated that they no longer depend on river water for their main supply. Both cities have switched to ground water systems for their primary source of municipal and industrial water. Breckenridge maintains an intake in the Otter Tail River for an emergency supply source.

Wahpeton, Breckenridge, Fargo, and Moorhead all have systems in place to obtain ground water. In dry periods, the ground water systems should prove to be more dependable than the surface water supplies, including Orwell Reservoir. Thus, the existing reservoir operation plan, including any possible modifications, would provide little relief during a sustained drought. These four cities, most affected by the Orwell project, would have to depend on their ground water systems during a sustained drought.

### Long-Term Problems

The Fargo-Moorhead urban study considered the long-term water supply and demand needs for municipal and industrial uses. During that study, information was gathered from agencies concerned with water supply in the Red River basin. One problem, made quickly evident, was that no comprehensive effort was being made to coordinate sources with projected needs on a long-term and basin-wide basis. Also, the individual water users tend to consider their water demand and supply for no more than several years in the future. Thus, it would be impossible to determine, within the scope of this study, how the operation of Lake Traverse and Orwell Reservoir as a system would contribute to the long-term water needs of the Red River basin. However, it is likely that the trend toward total dependence on ground water will continue. Long-term and comprehensive water supply planning is needed for the Red River basin. Such planning should include water quality constraints and water conservation concepts. A HEC-3 computer model developed by the Corps during the Grand Forks-East Grand Forks urban study could be expanded and updated to be used as a tool for such comprehensive water supply planning. An agency, such as a coalition of the involved States, and possibly including the Corps of Engineers, should take the lead to provide the basin-wide perspective required to accomplish comprehensive planning. However, support and funding for the work would be needed from the three States in the basin.

### Irrigation

The eastern portion of the Bois de Sioux River basin is located in the West Central Region Planning District in Minnesota. Irrigation throughout this region has been on a constant increase since the 1930's. Although the initial investment for equipment is relatively large, many farmers who have proper soil and water conditions will invest in an irrigation system to reduce the climatic risk involved in agriculture. Between 1970 and 1974, the number of irrigated acres in the region increased from 9,400 to 32,600. Of the 1974 total regional acreage,

more than 45 percent was in Ottertail County. The region's total irrigated acreage accounts for almost 30 percent of Minnesota's total irrigated acreage.

The western portion of the subbasin has a negligible amount of irrigated acreage. Landowners have shown little interest in irrigation even though a sizeable portion of the land has been classified as suitable for irrigation. For this reason, irrigation development will probably be slow in the area. The availability of suitable water for irrigation is unknown.

County agents in Minnesota predict that the trend toward increased irrigation will continue well into the future. Increasing the irrigated acreage may lead to the development of specialty crop farming and encourage the location of additional agri-processing plants in west central Minnesota.

Long-term water supply for irrigation is a complex issue and can have basin-wide consequences. Irrigation is interrelated with municipal and industrial water supplies. Thus, any basin-wide water supply planning effort should also consider present and projected irrigation demand. Without such a comprehensive water supply plan, it is impossible to determine the complete and long-term effect that the Lake Traverse Reservoir system might have on irrigation requirements.

A very approximate assumption was made for considering the more short-term effects that the operation of Lake Traverse might have on irrigation. The assumption is that any ground-water-based irrigation would have imperceivable effects or demands on Lake Traverse and its operation. However, if any irrigators have intakes directly in the reservoir, in the Bois de Sioux River downstream of the reservoir, or in the Red River upstream of Fargo-Moorhead, their demand for water should be considered. More work is needed to inventory surface water irrigators and the existing institutional controls over them. Some of the information is available in the Minnesota Department of Natural

Resources water use permit system. Although the inventory is outside the scope of this study, it should be a part of any comprehensive water supply planning for the entire Red River basin.

#### **WATER QUALITY**

There is one common thread among the comments that we received during our public involvement and literature search for Lake Traverse. The authorized purpose of water conservation and nearly all of the significant resources affected by the water control plan for Lake Traverse are limited in some respect because of the water quality problems of Lake Traverse. The water quality problems of Lake Traverse also extend to the resources that are dependent on the Bois de Sioux and Red Rivers.

During the recent Orwell Reservoir water control (ROPE) study, water quality was identified as a concern by the municipal and industrial water supply officials at Fargo and Moorhead. Wahpeton and Breckenridge are concerned about summer low-flow periods and related aesthetic problems for recreators near the river. Neither of these two cities relies on the river for water supply any longer. All four cities mentioned that, during summer low-flow periods, Red River flows should be supplemented from Orwell Reservoir or the overall Otter Tail basin for the following reasons:

1. To help flush algal blooms in the Red River.
2. To dilute releases from Lake Traverse when those releases are of poorest quality.
3. To allow for larger releases from wastewater treatment plants.
4. To improve the aesthetic appeal of areas adjacent to the Red River.

The following five paragraphs are taken from a Bois de Sioux-Mustinka Rivers subbasin report, dated December 1980, done under contract for the St. Paul District by Gulf South Research Institute.

"On the Minnesota side of the basin, recent water quality data for the Mustinka and Bois de Sioux Rivers is lacking. In the Mustinka River watershed, problems in the past were associated with low dissolved oxygen concentrations, excessive turbidities, and moderately high nitrate and phosphorus levels (probably caused by sewage and agricultural wastes). Comparisons of old data with more recent data indicate that violations with turbidities remain likely to occur, as well as fairly high nitrate and phosphorus levels.

"Problems in the Bois de Sioux River watershed are related to high turbidities, in violation of 50 percent of the samples; fairly high phosphorus levels; and high fecal coliform concentrations, in violation in 17 percent of the samples (Minnesota Pollution Control Agency, 1975).

"In North Dakota, the area between the South Dakota line and the Wild Rice River, the problem parameter is phosphates originating from nonpoint sources that are impairing recreational usage of the Bois de Sioux River (North Dakota Department of Health, 1979). In South Dakota, problems in the Bois de Sioux River are related to low dissolved oxygen levels for fish life propagation. It is noted that the stream is essentially dry during part of most years and that extremely low stream flows have resulted in a small assimilative capacity (South Dakota Department of Natural Resources Development, 1975).

"With regard to Lake Traverse and Mud Lake, eutrophication has advanced to the point where algal blooms occur in summer and early fall. Causative factors include (1) nutrients in runoff from surrounding farmland; (2) runoff from adjacent cattle yards and direct access by cattle; (3) sewage waste from Wheaton and private residences; and (4) cattle wastes from the Mustinka River. The shallowness of the two lakes creates a problem in relation to high turbidities generated by wind and wave action. Both lakes experience decreased dissolved oxygen concentrations during the winter months, when there is high fertility, shallowness, and restricted inflows in Lake Traverse and shallowness, combined with accumulated organic muds, thickness of ice and near absence of water conduction in Mud Lake (Falk, et al., 1975; U.S. Army Corps of Engineers, 1979). Wintertime dissolved oxygen levels is one of the critical limiting factors on the fishery in Lake Traverse. The wintertime dissolved oxygen problem is of particular concern when considering alternative lower fall pool drawdown targets for the purpose of increasing flood control storage for the following spring.

"Ground water quality problems in the basin are related to undesirable levels of manganese, sulfate, iron, total dissolved solids, and fluoride (Souris-Red-Rainy River Basins Commission, 1972; South Dakota Department of Natural Resources Development, 1975). This is a critical concern to the Fargo-Moorhead water

utilities because they decide whether to use the Red River or ground water for their raw water supply, depending on the relative pumping and treatment costs for the 2 sources. For example, Moorhead officials indicated that in December 1984 they had expended \$80,000 over budget for treatment chemicals and electricity. They normally took water from the Red River at that time of the year, but couldn't because Lake Traverse discharges were unusually high and the raw water quality was very poor."

#### **WASTEWATER MANAGEMENT**

The Bois de Sioux and Mustinka Rivers are described as water quality limited because of the following conditions: (1) the streamflows are not always sufficient to provide enough dilution to maintain water quality standards after introduction of secondarily (or best practicably) treated effluents; and (2) nonpoint sources are expected to cause violations of water quality standards (Minnesota Pollution Control Agency, 1975).

The Lake Traverse water control plan affects the streamflows in the Bois de Sioux River, but low-flow supplements from the lake are constrained by the volume of inflow to the lake that can be stored during floods and released during low-flow periods. The Lake Traverse water control plan cannot affect the low flow or nonpoint source water quality problems on the Mustinka River. However, those problems with Mustinka River water quality have an effect on certain water quality parameters of Lake Traverse.

Thirteen point sources have been identified within the Minnesota portion of the basin: six municipalities, one industry, three municipal water treatment works, and three major feedlots. These dischargers are presented in the following table along with problems, treatment needs, and other planning considerations (Minnesota Pollution Control Agency, 1975). No point sources are indicated within North or South Dakota,

Problems and Treatment Needs of Point Source Dischargers in the Bois de Sioux-Mustinka Rivers Basin

Receiving Water	Discharger Description	Discussion of Problems	Treatment Needs	Other Planning Considerations
Mustinka River	Wendell	Inadequate treatment.	New facility.	Low on MNL - Will not be considered for funds in the near future. Must apply for permit 180 days before discharge.
Mustinka River	Marius Martineau Feedlot	No apparent problems if facility is maintained properly.	None if present pond is maintained properly.	----
Worm Lake	Elbow Lake Water Treatment Works	No treatment.	Treat wastes or connect to municipal system.	Contract for connection option executed by 6/30/75. Connection by 6/30/76 - Draft permit.
Worm Lake	Elbow Lake	Treatment is inadequate for all measured parameters: phosphorus removal needed.	New facility or advanced treatment.	Interim effluent limits in permit; low on MNL.
Pullman Lake	Herman	Treatment is adequate.	Treatment should be adequate.	Population projected to decline.
West Branch Mustinka River	Anthony Arens Feedlot	No apparent problems if facility is maintained properly.	None if present pond is maintained properly.	----
West Branch Mustinka River via Ditch C-4	Graceville	Treatment appears adequate.	Uncertain but ponds should be adequate.	----
West Branch Mustinka River	Zobach's Looker	No treatment.	----	----
Twelve Mile Creek via a lake	Donnelly	Inadequate treatment.	New facility.	Population decreasing rapidly. Low on MNL--must apply for permit 180 days before discharge.
Joe Pederson's Slough	Donnelly Water Treatment Works	No treatment.	Treat wastes.	Draft permit.
Twelve Mile Creek	Kenneth Baldry Feedlot	No apparent problems if facility is maintained properly.	None if present pond is maintained properly.	----
Mustinka River	Wheaton	Poor maintenance: plant is not designed to meet standards and is inadequate.	New facility or advanced treatment.	Low on needs list. Draft permit. Interim standards.
Worm Lake	Culligan Elbow Lake, Ino.	Need treatment.	Provide adequate treatment.	----
South Fork Rabbit River	Campbell	No apparent problems.	----	----

Source: Minnesota Pollution Control Agency, 1975.

Note: Some of this specific information has likely changed since 1975. This table is included here to illustrate the general types of problems found in the project area. Some of the specific problems on the table may already have been corrected.



where waste discharges are generally small and intermittent (North Dakota State Department of Health, no date; South Dakota Department of Natural Resources Development, 1975).

All of the point sources in the Mustinka River basin and the other direct contributors to Lake Traverse aggravate water quality problems for Lake Traverse. Low flow supplements from Lake Traverse, if of appropriate quality, could help relieve some downstream water quality problems through the dilution process. However, the more accepted current philosophy is to treat the problem at its (point) source. Also, the Lake Traverse water quality is too poor, for certain parameters, to provide adequate relief downstream.

Fargo is also concerned that the volume available in the Red River is used as a decision criterion by the North Dakota Health Department to limit the quantity of effluent from the Fargo wastewater treatment plant. The city is not allowed to discharge effluent under the ice, so often it must store effluent until summer. However, during the summer, the lower flows limit the amount of effluent allowed to be released. Fargo apparently does not plan to modify the wastewater treatment plant in the near future to eliminate this problem.

The discharges from Lake Traverse and Orwell Reservoir have an effect on the low flows of the Red River at Fargo. The Otter Tail River basin, including Orwell Reservoir, has adequate storage capability for spring runoff to contribute to the summer flows of the Red River. However, the Bois de Sioux River basin, including Lake Traverse, has limited ability to do so. The summer outflows from Lake Traverse are often below 100 cfs and are sometimes zero because of limited inflows and significant evaporation from the lake. The Lake Traverse summer releases can have significant water quality problems for certain parameters.

## SILTATION IN LAKE TRAVERSE

The Wilkin County Engineer and a number of others have expressed concern that siltation may have significantly decreased the water storage capacity of Lake Traverse. Correspondence about this concern is included in the coordination appendix to this report. Sedimentation in the lake is of particular concern to basin residents because of the flooding problems in the basin over the past few years.

The St. Paul District has never taken a complete sediment survey for the entire lake. In fact, the range lines required to accomplish a sediment survey have never been established. The existing elevation-storage capacity curve, figure 3, was developed from topographic survey information gathered before the project was constructed. The present cost of a sediment survey for a large lake, such as Lake Traverse, is prohibitively expensive, well into the 6-figure range. The St. Paul District has no plans to do a sediment survey for Lake Traverse.

It is estimated that the decrease in storage capacity of Lake Traverse from sedimentation has been less than 5 percent. This estimate is based on information developed for nearby Big Stone Lake. The physical factors affecting rates of sedimentation directly in the lakes are different. However, the September 1973 sedimentation design memorandum for Big Stone Lake included calculations for the annual volumes of sediment being moved by the Minnesota River near Ortonville and the Yellowbank River at its mouth. The calculations were 20.4 acre-feet per year by the Yellow Bank River and 14.9 acre-feet per year by the Minnesota River.

If you assume that the Mustinka River carries about the same sediment as the Yellow Bank River, the Mustinka River would have deposited about 1,020 acre-feet of sediment in Lake Traverse over the first 50 years of Lake Traverse operation. The U.S. Geological Survey quadrangle maps indicate that 20 to 30 other streams and ditches enter the lake. These

watercourses periodically deposit sediment in the lake, but likely at slower rates than the Mustinka River. To conservatively account for these deposits, assume that they each deposit one-fourth of the rate of the Mustinka River, 5 acre-feet each year. This indicates that, over 50 years, less than 10,000 acre-feet of storage has been lost in Lake Traverse because of sedimentation. The storage volume of Lake Traverse at the design flood elevation 982 is about 270,000 acre-feet. Thus, less than 5 percent of the flood control storage in Lake Traverse has been lost during the first 50 years of operation because of sedimentation.

The silt entering Lake Traverse most likely originates from a combination of shoreline erosion and deposits from the Mustinka River and small streams and ditches that enter the lake directly. The Minnesota Department of Natural Resources is concerned about the siltation from shoreline erosion because its deposit in the lake can hamper fisheries management in the lake. Thus, the Minnesota Department of Natural Resources carefully screens private permit applications for shoreline protection to ensure that the designs will prevent fine soil particles from being washed out from between the larger rock pieces. Properly installed shoreline protection projects at all actively eroding shoreline areas on the lake would help to reduce the total amount of sedimentation.

For information about the shoreline protection permits, please contact Mr. Robert Marts, Conservation Officer, Minnesota Department of Natural Resources, at telephone (612) 563-4409. In South Dakota, contact ----- for further information. Also, depending on the size of the shoreline protection project, a permit may be needed from the Corps of Engineers. Information about whether a Corps permit is needed can be obtained by calling telephone (612) 725-5819.

The silt being deposited in the lake by the Mustinka River and other smaller streams comes from a combination of erosion of poorly managed

agricultural fields and streambank erosion. The soil carried by the streams into the lake tends to be deposited in deltas at the points where the streams enter the lake. We have received several complaints about the increase in delta size at the mouth of the Mustinka River from the high flows during spring 1986. Apparently, boaters have noticed that the water appears to be shallower over the Mustinka River delta area.

#### **SHORELINE DAMAGE ON LAKE TRAVERSE**

We have received numerous questions and complaints concerning shoreline damage through letters, at the July 1986 public meeting, and during the September 1986 workshop. The spring 1986 high lake levels on Lake Traverse caused shoreline erosion, debris deposition, and the spread of noxious weed seeds. Numerous erosion sites were reported from several feet high to about 10 feet high. Most of the debris and weed complaints were from farmers around Mud Lake.

During high lake levels in spring 1986, there was significant public concern that shoreline erosion had progressed beyond the boundaries of the Federal flowage easements. In response to the public concern, the St. Paul District surveyed and flagged the Federal flowage easement taking line at several locations thought to be the worst erosion sites. Figure 14 on page 65 displays the findings at one location. Note that nearly all of the structures shown in the figure are located well within contour 983, the Federal flowage easement limits. The erosion sites were between these structures and the lake, well within the limits of the Federal flowage easements. Also note that about a dozen structures are located within the 977 contour, which is the limits of the permanent flowage (lake) basin. The shoreline erosion has not progressed to outside the Federal flowage easement limits at the few sites that have been surveyed.

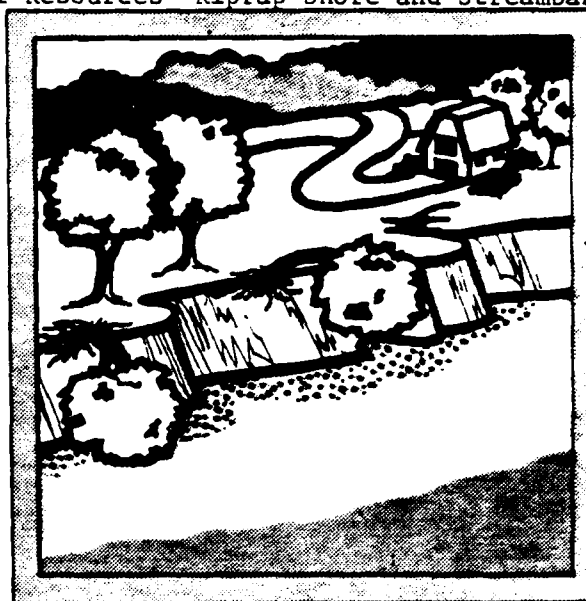
Many contacts from the public have questioned who is responsible for restoring and protecting shoreline erosion sites and removing debris deposits and noxious weeds. These tasks are the responsibility of the individual lakeshore owners. In the early 1940's, a one time payment was made to the landowners for the Federal flowage easement at the Lake Traverse project. Past court cases concerning other projects have established that the compensation paid by the Government for a given flowage easement includes just compensation for the associated damages caused by erosion and debris or any other problem reasonably expected to occur as a result of water levels up to the easement limits.

The Minnesota Department of Natural Resources (MDNR) has received requests for information concerning the need for permits for constructing private shore protection projects. For larger shore protection projects, a permit is required from the MDNR. Some smaller projects do not require a permit. Contact the MDNR Regional Hydrologist's office in Fergus Falls at telephone (218) 739-7576 for more information. A brochure is available from the MDNR concerning riprap (stone) shore protection projects. Three pages of that brochure have been reprinted on the following pages. The Corps of Engineers also has a shoreline protection brochure that shows shoreline protection methods (with an emphasis on Great Lakes shorelines). A Corps of Engineers permit to fulfill requirements of the Federal Clean Water Act may be required for some shoreline protection projects. Call the St. Paul District Office at telephone (612) 725-5819 for more information.

#### **RECREATION**

Recreation areas are concentrated in the eastern and western portions of the Bois de Sioux River basin. Problems in this region relate primarily to water quality rather than to water quantity. Lake Traverse and Mud Lake illustrate problems that are typical in the lake areas of the basin. These lakes have been declining in fishing, waterfowl hunting,

## RIPRAP SHORE AND STREAMBANK PROTECTION



### PERMIT REQUIREMENTS AND CONSTRUCTION GUIDELINES

Any project constructed below the ordinary high water mark (OHW) which alters the course, current, or cross-section of protected waters or wetlands is subject to the regulatory jurisdiction of the Department of Natural Resources. For lakes, the OHW is the highest elevation which the lake has maintained to leave evidence upon the landscape. For watercourses, the OHW is the elevation of the top of the bank of the channel. For reservoirs and flowages, the OHW is the operating elevation of the normal summer pool.

A permit is not required from the Department of Natural Resources for riprap shore and streambank protection installed within the following restrictions.

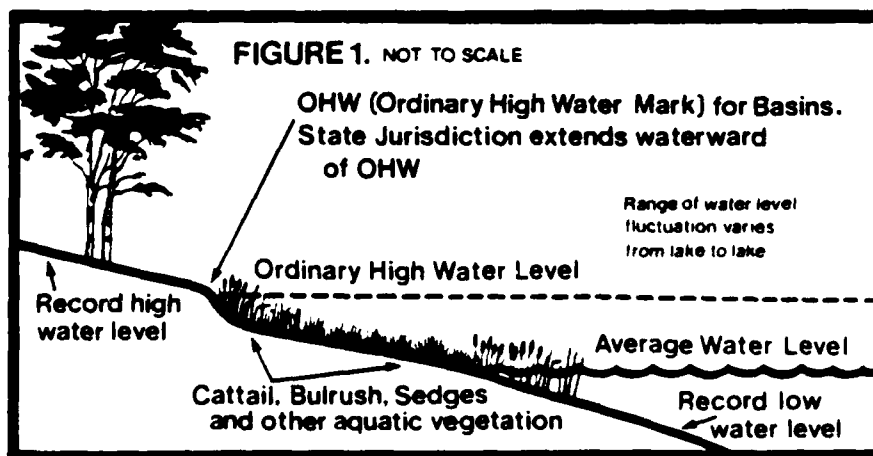
Local units of government and other agencies, however, may require a permit for this project. **BEFORE INITIATING ANY PROJECT**, contact your local Conservation Officer or the Regional Hydrologist (see map, page 4).

A Department of Natural Resources permit is not required if the riprap is installed within all of the restrictions listed below:

1. The riprap shall consist of natural rock only, measuring 12" diameter or larger.
2. The riprap shall conform to the natural alignment of the shore or streambank.
3. The minimum finished slope shall be no steeper than 3 feet horizontal to 1 foot vertical (3:1).
4. No materials shall be placed more than 5 feet waterward on the OHW.
5. A permit shall be required for the placement of riprap shore protection along Lake Superior and any designated trout stream.

If the proposed riprap shore protection cannot meet all of the preceding restrictions, a permit from the Department of Natural Resources is required. Contact the appropriate Regional DNR Office or the Division of Waters in St. Paul for the necessary application forms.

Riprap shore protection not requiring DNR permits shall be placed according to the following guidelines.



## DEFINITION

Riprap is defined as coarse stones, boulders, cobbles, or artificial broken rock fragments or concrete brick materials, loosely laid against an existing bank or shore for the purpose of preventing or controlling erosion. Only 12" diameter or larger natural rock riprap shore protection may be installed without a permit. Riprap is generally placed to prevent erosion by wave action and currents. It is also useful in preventing burrowing animals (muskrat, beaver, etc.) from undermining bank stability.

## PLACEMENT

Dumped stone is the most flexible and will adjust itself to uneven bank settlement. In most cases, dumped stone is also the least costly. Hand-placed riprap should be roughly square or rectangular to facilitate placement by hand or derrick. Handplaced riprap is easily disrupted by minor settling.

**IMPORTANT NOTE:** Please be advised that Figures 2, 3 and 4 are provided as typical situations. Due to the high cost of riprap shore and streambank protection and the variation in soil types and design, it is advisable that you consult with a professional engineer before beginning any construction.

## LOCATION

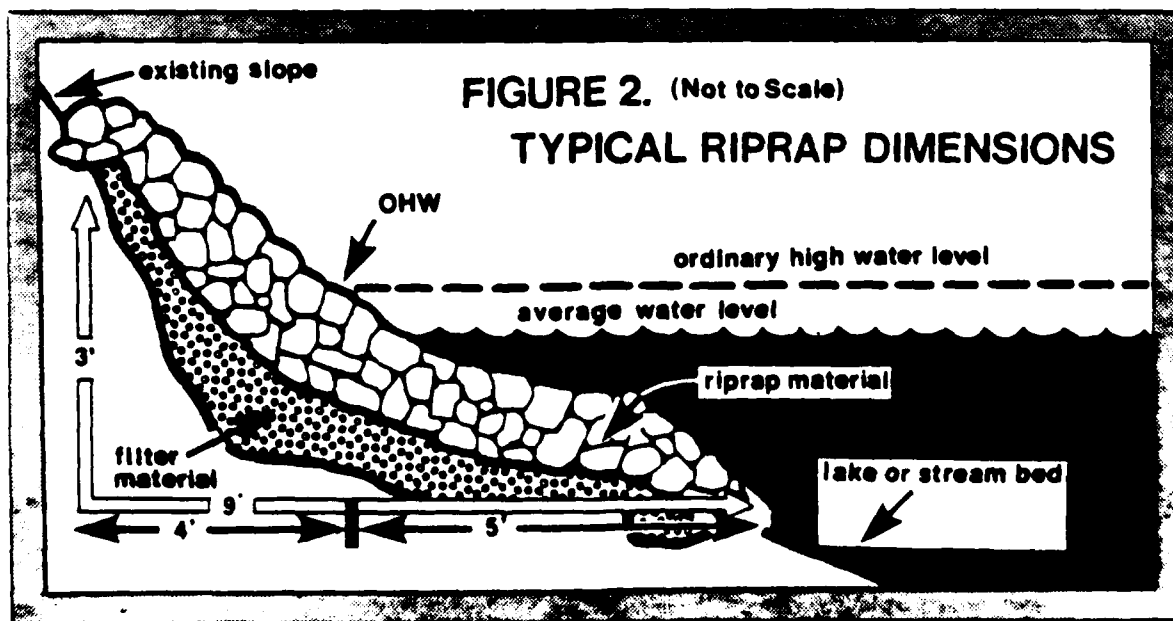
The placement of riprap should be limited to the area subject to erosion. This information pamphlet outlines guidelines for the placement of natural rock riprap without a permit. The installation of other types of riprap will require a permit.

Riprap shall be attempted only where site soils are capable of supporting riprap. Such soils may include various combinations of sand, silt, and clay. Soils such as peat and muck are not capable of supporting riprap.

## CONSTRUCTION

Riprap shall be installed with a minimum finished slope of 3:1. No riprap or filter materials shall be placed more than 5 feet waterward of the OHW (see Figure 2). A severely eroding bank may require filling in with a greater depth of natural rock before a stable slope may be achieved. Gently sloping banks are more stable for riprap and result in fewer failures. The extent of riprap into the water should be minimized since flow and wave action can cause stability problems.

A transitional layer of gravel, small stone, or fabric shall be placed between the fine material of an embankment and the riprap materials. The purposes of the filter are to (1) prevent fine embankment material from being pulled through the riprap materials, (2) distribute the weight of the overlying riprap to prevent settlement, and (3) to provide relief to hydrostatic pressures inside the embankment.



Taken from the Minnesota Department of Natural Resources "Riprap Shore and Streambank Protection Information Sheet."

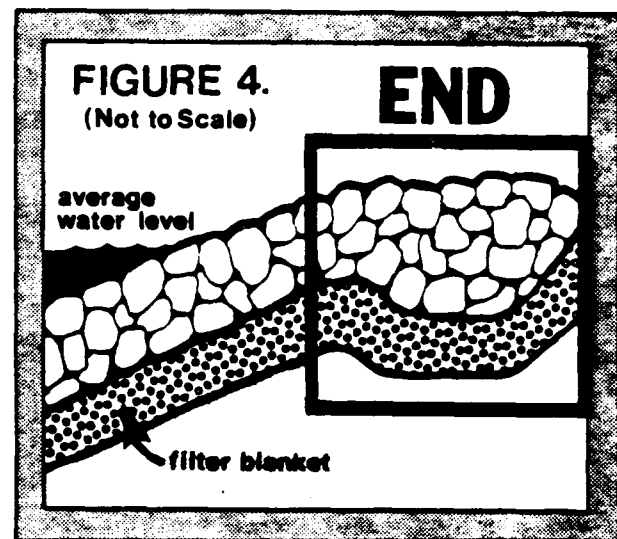
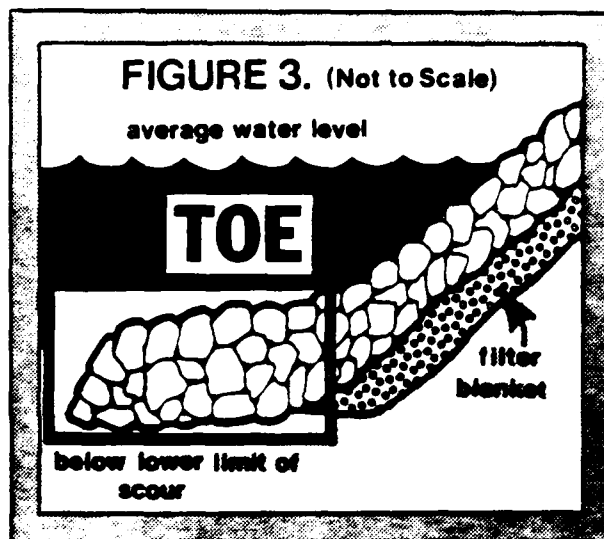
Well-graded gravel, crushed stone, and filter cloth should be used as filter materials. The sizes of the filter materials must be larger than the original bank materials and smaller than the riprap. If well-graded gravel exists naturally, no filter blanket is needed. If not, a 6" filter blanket is recommended.

Where gravel or crushed stone is unavailable or excessively costly, filter cloth is an alternative. Filter cloth, an artificial fabric which allows water to pass through while retaining the bank materials, has been used successfully with riprap. Brands\* used successfully include: Bldim-C-22 (Monsanto); Typar 3401 (DuPont); Polyfilter-X (Carthage Mills); and Mirafi 140 (Celanese).

\*THIS DOES NOT CONSTITUTE ENDORSEMENT OF THE ABOVE BRANDS.)

Rock sizes should be 12" in diameter or larger. This size natural rock will reduce movement by natural forces.

Riprap placement should include toe and end protection, particularly in controlling stream bank erosion. Toe and end protection is accomplished by placing the largest rocks and the thickest portion of the riprap in position as shown in Figures 3 and 4. In some instances, excavation may be required to provide sufficient depth of toe and end protection. If mechanized excavation is necessary, a DNR permit is required.



## MAINTENANCE REQUIREMENTS

All riprap requires maintenance. Proper filter blanket thickness, rock size, placement, and slope will prevent frequent maintenance. All riprap, however, will experience some displacement. The desired slope, thickness, and rock surface should be restored when needed.

**REMINDER:** Any riprap shore protection project which does not conform to the aforementioned criteria must be authorized prior to installation by a permit from the Department of Natural Resources pursuant to Minnesota Statutes, Section 105.42 and Minnesota Rules Part 6115.0190, Subpart 4, Item C.

## ADDITIONAL INFORMATION

If you desire additional information on shore protection, a pamphlet, "HELP YOURSELF", is available from the U.S. Army Corps of Engineers. The pamphlet discusses critical erosion problems on the Great Lakes and cites additional methods of shore protection. Address your request to:

U.S. Army Corps of Engineers  
1135 U.S. Post Office and Custom House  
St. Paul, Minnesota 55101  
1-612-725-7506

The installation of riprap not meeting these criteria without a previously obtained DNR permit is considered a violation of law and is subject to criminal prosecution (\$750 and/or 90 days in jail) and restoration as deemed appropriate by the Commissioner of Natural Resources. Contact your DNR Regional Office or the Division of Waters in St. Paul for permit applications.



and other water-related recreation activities as a result of the declining regional populations, economic woes of agri-business/farming, and slow deterioration of the lake resources that support recreation opportunities. Area lakes are basically shallow and are seriously affected by siltation, periodic low water levels, and seasonally fluctuating water levels. The introduction of agricultural wastes through runoff encourages excessive growth of algae and nuisance aquatic plants and accelerates the eutrophic condition of lakes in this region, including Lake Traverse and Mud Lake. In addition, domestic sewage disposal has adversely affected the recreational and aesthetic qualities of the lakes and streams. Resort and residential growth along lakeshores, particularly along Lake Traverse, has added to shoreline erosion and contributed to the water quality problem. However, there is hope as several communities, such as Elbow Lake and Wheaton, are upgrading sewer facilities, and efforts to control nonpoint sources of pollutants are accelerating.

Reservoir operation can have an influence on fishery and waterfowl habitats. Changes in reservoir operations that would benefit fishery and/or waterfowl habitats would result in associated recreation benefits to recreationists and to commercial interests supported via recreationist dollars. Opportunities for realizing reservoir operation improvements for recreation at Lake Traverse appear to be most promising in three areas:

1. Maintaining Lake Traverse lake levels at a target elevation that would optimize net benefits by minimizing fluctuations from that target water level during the recreation/summer season. This would benefit fishery resources, resort operations, and public recreation area operations.
2. Managing water levels in Mud Lake to benefit waterfowl habitats/production and associated hunting activities.

3. Providing low flows through the White Rock Dam to maintain the downstream fishery in the Bois de Sioux River. This would improve the river bankfishing and related day-use recreation opportunities.

A 1975 survey of the Lake Traverse area residents showed that 44 percent of the respondents rated recreation as the primary benefit of Lake Traverse. Also, resort and recreation related business is recognized as a major source of income to the communities surrounding Lake Traverse and Mud Lake. In view of the importance of Lake Traverse and Mud Lake as recreational and economic resources, measures to control water pollution and improve recreation opportunities should be actively pursued.

#### **PLANNING CONSTRAINTS**

Some concepts involved with water resources planning cannot be expressed as problems, needs, or opportunities. Such concerns are more properly labeled "planning constraints." Planning constraints also include law, national policy, physical constraints, or other limitations of the existing conditions that can be used to refine and guide formulation of alternative solutions. The following list summarizes some of the planning constraints identified for this study.

1. Federal law, State statutes, local ordinances and regulations, and national water resource policy.
2. Bank-full capacity of the Bois de Sioux River downstream of Lake Traverse is presently estimated to be less than the design of 1,100 cfs.
3. Instream flow requirements of the Bois de Sioux River downstream of Lake Traverse constrain the minimum releases on a seasonal basis. These requirements also limit the desired rate of change in reservoir releases.

4. Rates and amounts of inflow to the lake from the drainage basin and other related water quality and hydrologic constraints.
5. Rough fish in the reservoir limit the value of the aquatic habitat for more desirable fish species.
6. Physical limitations of the two dams and storage capacities of the two pools.
7. Non-point source nutrient and sediment loading on the lake.
8. Real estate (flowage easement) ownership surrounding the flood control pools.
9. The agricultural and urban flood damage centers downstream of the lake.

#### **PLANNING OBJECTIVES**

Planning objectives are resource-oriented statements intended to specify problems, needs, and opportunities identified during public involvement. The statements attempt to reflect the events and results desired by groups and individuals, as well as those declared to be in the national interest by the Congress or the Executive Branch. The objective statements may be changed as the problem definition process continues. The statements attempt to define the problems and opportunities without dictating a narrow range of alternative solutions. The objective statements are intended to define future desired conditions as well as desired present conditions. The preliminary planning objectives are stated as follows:

During the period of analysis (1986-2036):

1. Minimize agricultural flood damage in the Bois de Sioux River floodplain, as measured in dollars of average annual damages.
2. Minimize urban flood damage from the Bois de Sioux and Otter Tail Rivers at Breckenridge, Minnesota, and Wahpeton, North Dakota, as measured in dollars of average annual damages.
3. Contribute to surface water supplies from the Bois de Sioux River and the Red River of the North downstream to Fargo-Moorhead, as measured in increased river discharges during appropriate seasons and at the best possible quality.
4. Contribute, to the maximum extent possible, to the preservation of the quality of the existing Bois de Sioux riverine environment.
5. Contribute to the enhancement of recreation opportunities, particularly through improvements in water quality, substantially in accordance with the Master Plan dated May 1979.
6. Contribute to the improvement of water quality in the lakes, the Bois de Sioux River and the Red River of the North.
7. Contribute to the reduction of lakeshore erosion and sedimentation in Lake Traverse.
8. Contribute to the developing trend toward increased irrigation throughout the basin.
9. Contribute to the reduction of wastewater management problems, particularly as they relate to water quality.

10. Contribute to the quality of the wetland habitat in Mud Lake, measured in terms of improved acreages of vegetation that are valuable to waterfowl.

## **PLAN FORMULATION AND EVALUATION**

### **INTRODUCTION**

Plan formulation will not be accomplished in detail until this problem appraisal report has been coordinated with the public. However, potential project features are being collected and documented with the related problem, need, or opportunity. Later, the potential project features can be put together with other compatible features to form preliminary water control alternatives.

Evaluation of the Lake Traverse water control plan is being accomplished according to Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, dated March 10, 1983. The principles and guidelines provide standard methods to assess the magnitude of effects a project has on its purposes and significant resources. Standard engineering, environmental, and economic principles are used to determine a relative value for the project's contributions to each purpose.

### **POTENTIAL PROJECT FEATURES AND THEIR EVALUATION**

The following project features will be considered and related studies will be accomplished.

#### **Urban Flood Damages**

The urban flood control portion of the water control plan for Lake Traverse will be evaluated using an existing HEC-5 reservoir routing computer model of Lake Traverse. Hydrographs of inflows to Lake

Traverse will be computed and then routed through alternative water control plans for Lake Traverse so that the flood control performance of the alternatives at Wahpeton-Breckenridge may be compared.

Conceptual changes for the flood control operation of Lake Traverse have been received from the public in letters, at the September 1986 workshop, and by telephone. The in-house study team members also have conceptual changes to be considered for the water control plan, based on their past experiences with the project. The suggested concepts will be formed into alternative water control plans, including features for the other authorized purposes, and then tested in the computer model. Coordination of the recently modified water control plan for Orwell Reservoir may be done at the same time with the HEC-5 model.

The conceptual flood control plan changes that have been received include:

1. Select specific target elevations for fall drawdowns in both pools, ranging from the conservation pool elevations to several feet below that. The resulting economic benefits of each drawdown elevation can then be computed. Specific environmental impacts, such as winter fish kills from low dissolved oxygen under the ice at several drawdown elevations, will need to be considered. The effects on the authorized purpose of water conservation will also have to be considered.
2. Better coordination of the flood control operations of Lake Traverse and Orwell Reservoir.
3. Consider a different stage decision point on the U.S. Geological Survey gage at Wahpeton. Presently, the discharges from Lake Traverse and Orwell Reservoir are reduced when river stages exceed 10 feet on the gage at Wahpeton. A moderate increase of 1 or 2 feet

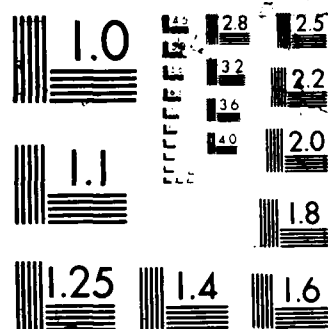
LAKE TRAVERSE ROPE (RESERVOIR OPERATION PLAN  
EVALUATION)(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL  
DISTRICT JAN 87

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in the decision stage may allow better timing of the storage in the lake and decrease the peak discharge in any given flood event.

4. Restoration of wetlands and construction of small storage areas throughout the basin were suggested by the public. However, the Corps of Engineers has no authority to implement such features. These possible alternatives will not be considered in this study.

If other ideas are received after the problem appraisal report is published, they may be evaluated if they are within the scope of this study.

#### Bois de Sioux River Agricultural Flooding

Several possible solutions have been identified for reducing agricultural flood damages. These include: restoring the Federal channelization project to the original design, installing additional discharge gaging on the Bois de Sioux River at the mouth of the Rabbit River, providing some operational flexibility and decision-making to the dam tender, beginning the reduction of White Rock Dam discharges at a lower reading on the U.S. Geological Survey gage at Wahpeton, increasing summer storage volumes in Lake Traverse by lowering summer lake levels, and removing beaver dams from the Bois de Sioux River.

Restoration of the channelization project would be expensive, possibly in the range of \$10 to \$20 million for the entire 24-mile reach. It is highly questionable that this project, including the entire 24-mile reach, is economically feasible under present conditions. Presently, economic feasibility is not a requirement for maintenance of the Congressionally authorized and previously constructed channel. However, the benefit-to-cost ratio is used as a prioritization criteria for expenditure of limited funds for the maintenance of many other worthy projects across the Nation. Thus, the economic feasibility will be

determined, but the benefit-to-cost ratio need not be greater than one to obtain funding for construction of the rechannelization.

The environmental impact of the rechannelization may be significant and must also be considered, as required by the National Environmental Policy Act. The U.S. Fish and Wildlife Service, St. Paul Field Office, has initially indicated preference for water control changes or any other nonstructural alternative, if possible, over rechannelization.

At this time, we are determining the scope of field surveys needed to evaluate the rechannelization. Channel cross section data and bridge dimension information would be used to prepare a numeric water surface profile model (HEC-2) for the entire channelized reach. The model would allow comparison of existing channel conditions with the original design conditions and water surface profiles. It is likely that these evaluation activities would identify certain limited reaches of channel that would provide the most benefit by being rechannelized. It is possible that certain limited reaches may be economically feasible, even though that is not a requirement for such maintenance activities.

The most feasible rechannelization reaches are probably located near and downstream of the mouths of the larger tributaries, such as the Rabbit River. The larger tributary streams and ditches contribute large amounts of silt into the Bois de Sioux River, and the reaches located downstream from the tributary points are most likely to be constricted by silt. These Bois de Sioux River channel reaches are likely to be the most significant problem reaches.

An additional river discharge gage at or near Fairmount, North Dakota, was suggested at the September 1986 workshop and has been evaluated initially by in-house study team members. The purpose of this gage would be to provide additional warning time so that the discharge from

White Rock Dam could be reduced sooner than under existing conditions. The gage would cost about \$12,000 to install and about \$7,000 per year to maintain and operate.

The gage would provide about an additional 4 hours of warning time, at best. The additional warning time is estimated by dividing the average water velocity, 4 feet per second during a flood, by the distance that the water travels, about 15 or 16 river miles from the Rabbit River to the U.S. Geological Survey gage at Wahpeton. The 4 hours' additional warning time would be reduced, depending on the availability of the dam tender and the water control personnel at the District office. For example, if a large rainfall event occurred during the middle of the night, then the 4 hours would be lost because of the normal duty hours of the chain of people involved in the water control action. Also, it would take at least 6 hours for the effects of reduced White Rock discharges to reach the flooding areas. The few times that the additional gage might work would not likely justify its considerable cost.

Providing water control flexibility and limited decision-making responsibility to the dam tender was suggested at the September 1986 workshop. It is not possible to allow the dam tender to have decision-making freedom for water control adjustments. Large flood control projects like Lake Traverse must be controlled systematically for the safety and benefit of the entire population of the Red River basin. However, for certain short-term situations, such as a large summer rainfall event, it would be productive to provide some standing orders to the dam tender. The standing orders would shorten the chain of people required to initiate water control adjustments for specific conditions. The standing orders would need to be specific in scope and timing so that the dam tender would know precisely what to do. This alternative is assumed to have no additional cost but may result in occasional overtime labor charges for the dam tender's time on weekends and holidays.

Several alternative standing orders will be formulated and evaluated in more detail. One possible alternative would be to provide the dam tender with standing orders for the months of June through August, as follows: When the National Weather Service predicts 2 or more inches of rain in the watershed within the next 24 hours, the discharge from White Rock Dam will be reduced to some minimum flow, possibly 25 to 50 cfs, for some specific time period, such as 2 days. Under some conditions, there may even be time to verify the standing water control orders with the St. Paul District Water Control Center prior to a predicted rainfall event.

The standing orders would also need to consider the storage available in Lake Traverse. However, during most years, the storage would be more than adequate for a series of such discharge reductions for summer rainfall events. Presently, the reduction of White Rock Dam flows is delayed until flooding is reported by the public.

Using a lower reading on the Wahpeton gage for summer flood events would reduce White Rock Dam discharges sooner than under present conditions. Presently, White Rock Dam discharges are not reduced until the Wahpeton gage reaches 10 feet or above. Using a lower gage elevation for summer floods, such as 5 or 6 feet, would reduce discharges from White Rock Dam sooner and thus reduce the likelihood of agricultural flood damages. The difficulty is to identify a gage elevation that would reduce the summer agricultural flood damage, but not unnecessarily increase the summer levels in Lake Traverse to undesirable levels.

Increasing the available summer flood control storage in Lake Traverse was suggested at the September 1986 workshop. The present summer lake levels provide a significant amount of storage for summer rainfall events. Typically, the length of time that storage in the lake is needed does not exceed a few days. Also, the typical inflows to the lake during the summer are very low. Thus, several days' worth of

storage of summer inflows to the lake does not significantly raise lake levels.

Another consideration is that the existing summer lake levels are generally acceptable to the majority of people who have expressed opinions about that topic. Lower summer lake levels would likely be perceived as having negative impacts on the summer recreation that occurs on and around the lake. Thus, we will not further consider lower summer lake elevations for providing additional flood control storage for summer rainfall events.

Removing beaver dams from the Bois de Sioux River has been suggested in numerous letters to us and during several meetings with area farmers. Minnesota Department of Natural Resources (MDNR) representatives have indicated that they prefer to consider the beaver dam problem on a case-by-case basis. If necessary, the MDNR conservation officer will remove the beavers and help with removal of the dam. Thus, we will not consider removal of beaver dams except as it would relate to rechannelization of the previously constructed Bois de Sioux River channelization.

MDNR conservation officers responding to a nuisance animal complaint from a Minnesota landowner inspect the damage site and, after consultation with the landowner, take appropriate action. In this instance (i.e., flooding of agricultural fields caused by beaver dams), the conservation officer may elect to dynamite the dam, or remove the animals, or both. The conservation officer will not permit destruction of an active beaver lodge.

Minnesota landowners contact:

Mr. Robert Marts  
Conservation Officer  
Minnesota Department of Natural Resources  
Box 43  
Wheaton, Minnesota 56296

Telephone: (612) 563-4409

North Dakota landowners contact:

Mr. Edward Cleary  
U.S. Fish and Wildlife Service  
Animal Damage Control  
Bismarck, North Dakota

Telephone: (701) 255-4011

#### Lake Traverse High Water Damages

High lake level events, such as spring 1986, happen infrequently on Lake Traverse but cause significant damages when they occur. The infrequent occurrence of high lake levels may have given a false sense of security to adjacent landowners and building officials. Most of them are unaware of exactly how high the lake levels are authorized to go in the future for downstream flood control purposes.

The public information system for Lake Traverse needs to be reviewed to determine whether the public understanding of the risk of flood damage from the lake can be improved. The theory is that if people are aware of the risk of high water, then they will act logically to reduce their exposure to that risk. We do not intend to estimate the possible economic benefit of improvements to the public information system in terms of reduced flood damages. We are assuming that the greater the increase in people's awareness, the greater the decrease in flood damages.

Another alternative solution would be to increase the available flood control storage in Lake Traverse by drawing the lake down farther in the fall. We will evaluate additional fall drawdown, including the effects

of additional drawdown on the authorized conservation purposes and environmental impacts such as wintertime fish survival in the lake. This alternative would slightly reduce the risk of high water damage but would not completely prevent its reoccurrence. This alternative may actually encourage additional encroachment into the floodplain in the long-term by providing an additional increment of a false sense of security in adjacent landowners.

Ultimately, the best method to significantly reduce damages from high water levels on Lake Traverse is to remove the structures from the floodplain areas below elevation 983, floodproof the structures, or a combination of evacuating and flood proofing the structures. This alternative would need to include appropriate floodplain measures to prevent re-encroachment into the floodplain. The study of this alternative for Federal implementation is outside the scope of this study. However, workshops could be scheduled by the Corps of Engineers, in cooperation with the Minnesota Department of Natural Resources or South Dakota, to provide floodproofing and evacuation technical information for implementation by individual property owners.

#### Water Quality

The quality of Moorhead's water supply can be adversely affected by larger discharges from Lake Traverse in late fall and early winter. However, additional information is needed to specify more completely under what conditions and to what economic extent the water supply at Fargo and Moorhead is affected by the relatively poor water quality of Lake Traverse. Additional interviews will be conducted with the officials of these two water treatment plants.

During the Orwell ROPE study, it was suggested that releases from Orwell Reservoir and Lake Traverse be timed such that the most undesirable releases from Lake Traverse might be diluted by Orwell Reservoir and

Otter Tail River basin discharges. The interviews described above may provide additional information about timing releases for water supply.

The Minnesota and South Dakota natural resource agencies will be consulted for recommendations concerning desirable low-flow discharges and decision criteria for when to request water allocation procedures by the States. Maintaining minimum flows by releasing storage from Lake Traverse may provide water quality and fish and wildlife benefits.

Several suggestions were received from the public concerning implementation of measures to reduce non-point pollution and siltation into the river basin. The Corps of Engineers does not have authority to implement such a program but could participate in an agency work group intended for that purpose. The possibility of forming such a work group will be pursued, but another agency such as the Environmental Protection Agency (EPA) or Soil Conservation Service would have to commit resources to initiate such an effort.

Point sources of pollution into the river basin also have significant negative effects on the quality of water in Lake Traverse and the Bois de Sioux River. The Corps of Engineers does not have the direct authority to implement solutions such as wastewater treatment plants. The Corps is involved through the EPA in reviewing the designs for wastewater treatment plants, but the EPA is responsible for the schedule and program of the work. Some sites in the basin may be considered for EPA assistance or may be implementing independent upgrades of their wastewater treatment systems.

The effective enforcement of existing national and State water quality standards should ultimately improve the quality of water in Lake Traverse and the Bois de Sioux River. However, Lake Traverse is presently acting as a huge sump for the nutrients deposited in the lake. If the undesirable nutrient inflow to the lake were to be stopped immediately, it would take many years, possibly many decades, before the



nutrients stored in the lake would be moved downstream so that the ambient water quality in the lake could improve.

Water quality in and downstream of Mud Lake could be significantly improved by the proposed Mud Lake habitat improvement plan. The two main water quality problems involve dissolved oxygen demand and suspension of solids in the water column by wind action in this shallow lake basin. The initial Mud Lake drawdown would oxidize and consolidate the existing undesirable bottom condition. This would reduce the short-term dissolved oxygen problem and consolidate the bottom sediment to decrease the suspension of solids. More light penetration would occur in the water column and ultimately the predominate vegetation would improve for use by waterfowl. The improved vegetation would reduce open wind reaches and thus reduce the tendency of the wind to resuspend solids. The cycle of reduced suspended solids, then more light penetration, then more desirable vegetation should tend to perpetuate itself, but will be strengthened by intermittent drawdowns in Mud Lake to reoxidize and reconsolidate bottom sediments. A reduction of suspended solids in the Mud Lake would reduce the amount of suspended solids being released downstream. This should help reduce treatment costs for suspended solids by downstream water supply plans at Fargo-Moorhead.

Several suggestions were received from the public to reduce grazing at the lake's edge and allow bands of vegetation to establish. The concept is that the vegetation band would filter out suspended sediment from runoff and prevent them from entering the lake from the surrounding farms. If properly implemented, this concept would probably reduce the nutrient problem in the lake by a small fraction. Thus, it would be difficult to justify implementation of such a limited effect measure without including it in a comprehensive plan to reduce all of the point and non-point sources. However, if properly implemented, the concept could provide wildlife benefits from habitat improvement. In fact, a wildlife habitat plan for Mud Lake, including similar measures, is being

developed by a work group including the Corps of Engineers, other State and Federal agencies, and private conservation groups.

### Water Supply

Plan formulation for water supply will pursue low flow target discharges that concurrently would benefit the instream aquatic habitat. Also, water control plans will be considered to minimize large releases of the worst quality flows from Lake Traverse and to dilute the worst flows with water from the Otter Tail River basin and Orwell Reservoir. Also see the water quality plan formulation section of this report.

### Public Information

The Lake Traverse project, particularly its flood control operation, affects many public and private interests. Thus, the review of the water control plan for the project should include a review of the public information system for the project to ensure that the appropriate publics are properly notified of project status. Some public information techniques to be considered in the plan include: newspaper articles and paid advertisements, direct mailings, recorded message telephone number, contacts by the Corps personnel in the area, floodplain/easement signage, news releases, and possibly other methods to be identified during the study. The purpose of the public information program would be to minimize confusion about the operation and project purpose, remind people about the extent of the Federal flowage easements around the lake, and inform the public about the current water control status and near future water control targets.

### Fish and Wildlife

This study will not consider alternative fishery management features for Lake Traverse or the Bois de Sioux River because that is the responsibility of the Minnesota Department of Natural Resources and the

South Dakota Department of Game, Fish, and Parks. However, low flow target releases to the Bois de Sioux River will be considered and coordinated with those two agencies.

The impacts of the alternative water control plans on fish and wildlife will be considered and properly documented according to requirements of the National Environmental Policy Act.

The St. Paul District, Corps of Engineers has been participating with the U.S. Fish and Wildlife Service, South Dakota Department of Game, Fish, and Parks, Minnesota Department of Natural Resources, and private conservation groups to develop a wildlife management plan for Mud Lake. One of the main features of the plan is to manage vegetation, of interest as waterfowl habitat, by manipulating water levels in a specific manner. The water control features of the Mud Lake wildlife plan will be evaluated to verify that they do not compromise the other authorized purposes of the project. Then, they will be incorporated into the written water control plan for the overall Lake Traverse project.

#### Water Conservation

The secondary authorized purpose of the Lake Traverse project is to store water for conservation and for preservation of fish and wildlife. Since the project was constructed in the 1940's, contemporary resource managers have recognized that the concept of water conservation for fish and wildlife should be expanded to include instream resources downstream of the dam. Thus, minimum low-flow targets will be considered and, if adequately defined, they will be included in the water control plan. Criteria for determining when to notify the Minnesota Department of Natural Resources and the South Dakota water allocation authorities will also be considered and included in the water control plan. The criteria would probably be that, if the low flow target cannot be maintained for a specified number of days, then the South Dakota and Minnesota water

allocation managers should be contacted. This study activity will require close coordination with the State resource agencies.

#### **ENVIRONMENTAL EVALUATION**

Environmental considerations will play an important part in the Lake Traverse Operating Plan Evaluation (ROPE) study. The project contains some important natural resources of the region. Input from Federal and State resource management agencies has been actively sought during the problem appraisal phase of the study. We will continue to seek input from these agencies as well as the public during the remainder of the ROPE study.

Depending on the recommendations of the ROPE study, further environmental documentation may be required. If the study recommends no change in the current reservoir operation, no further environmental documentation will likely be required. If a change in operation is proposed, environmental documents will be required to evaluate the effects of the proposed change. A minor change in the operating plan with no significant impacts would require an environmental assessment/Finding of No Significant Impact (FONSI). A significant change in the reservoir operation may require an environmental impact statement.

#### **ACTIVITY SCHEDULE**

Coordinate Problem Appraisal Report	November 1986
Draft Lake Traverse ROPE Report	September 1987
Final Lake Traverse ROPE Report	November 1987

The draft and final Lake Traverse ROPE reports will include the appropriate environmental documentation, as specified in the National

Environmental Policy Act. The draft Lake Traverse ROPE report will also likely contain tentative recommendations for testing a modified water control plan for Lake Traverse and possibly some adjustments to the Orwell Reservoir water control plan. When the ROPE report containing the recommended water control plan has been coordinated and finalized, then the test may be implemented in time for the fall 1987 drawdown. A 3- to 5-year test period would likely be used as has been done at other Corps-operated reservoirs in the St. Paul District. Following the successful testing of the water control plan, the St. Paul District Water Control Center would rewrite the reservoir regulation manual for Lake Traverse to reflect the changed conditions and water control plan.

#### **CONCLUSIONS AND RECOMMENDATIONS**

The conclusion statements in this report are preliminary and are subject to refinement. More precise and additional statements may be made in the Lake Traverse ROPE report.

#### **CONCLUSIONS**

1. The Lake Traverse ROPE study should concentrate on resources and public concerns that relate directly to the water control plan for Lake Traverse and related features of the Orwell Reservoir water control plan.
2. Water supply is a continuing concern of the four downstream cities most affected by water control operation of Lake Traverse and Orwell Reservoir. The reservoirs can affect quality and quantity of water available in the river system during normal years. However, the reservoirs would likely have little effect during sustained drought periods for which the four downstream cities have developed at least partial backup groundwater sources.

3. Flood damages continue to occur at Wahpeton and Breckenridge from the Otter Tail, Bois de Sioux, and Red Rivers. The cities have taken actions to reduce their flood risk, but they continue to receive valuable flood damage reduction benefits from the flood control operation of both Lake Traverse and Orwell Reservoir.
4. Agricultural flood damages continue to occur along the Bois de Sioux River. The condition of the 24-mile channelized reach of the Bois de Sioux River should be reviewed to determine whether maintenance rechannelization is needed. The water control plan should be reviewed to determine whether agricultural damages could be further reduced.
5. The public information program for Lake Traverse needs to be reconsidered to improve communication to affected publics of periodic water control status reports, general project news, and reminders of the extent of the Federal flowage easement at the project.
6. Shoreline erosion, debris deposition, and flood damage are problems that occur when Lake Traverse elevations exceed elevation 977, such as during flood control operation.
7. Recreation continues to be a significant benefit of the Lake Traverse project, but is constrained by the poor water quality of Lake Traverse and the Bois de Sioux River. The Public Use Development Master Plan, dated May 1979, concluded that the present scope of Corps of Engineers facilities seems to be appropriate in relation to non-Corps recreation areas in the project area.
8. Wildlife, particularly waterfowl, continues to be a significant resource in the project area. The St. Paul District should continue to support and actively promote the Wildlife Management Plan for Mud Lake to ensure its implementation. If available, the final version

of the plan should be reviewed in conjunction with the ROPE study to ensure that its water control plan for Mud Lake is compatible with the other authorized purposes of the Lake Traverse project.

9. The fishery in the project area is limited by water quality, especially the winter dissolved oxygen levels in Lake Traverse, and by undependable flows in the Bois de Sioux River. Significant amounts of rough fish are harvested commercially from Lake Traverse. Electroshock records indicate that the Bois de Sioux River can support a surprising number of gamefish when adequate sustained flow is available.
10. The downstream Bois de Sioux River channel capacity may be less than the 1,100 cfs figure presently used by the St. Paul Water Control Center. The condition of the channelized reach of the Bois de Sioux River should be evaluated to determine the existing channel capacity.
11. The recommendations and conclusions of the Lake Traverse Master Plan for Public Use Development, dated May 1979, should be used to help guide formulation and evaluation of public use aspects of the water control alternatives in the Lake Traverse ROPE study.
12. Siltation continues to hamper Lake Traverse recreation and fisheries management efforts of the State resource agencies, but it is not believed to be significantly reducing the flood storage capacity of the lake. The sedimentation probably has the most effect on the conservation pool, located in the lower elevations of the lake. The siltation could be reduced significantly through shoreline and streambank erosion projects by landowners and through land treatment measures by active watershed districts.
13. The authorized purpose of water conservation continues to be a significant project need for downstream water suppliers and fish and

wildlife in the project area. However, contemporary fish and wildlife managers have extended the need to include the instream aquatic resources of the Bois de Sioux River downstream of White Rock Dam. There is an opportunity to adopt low flow procedures of South Dakota and Minnesota water allocation and specify how to identify a low-flow emergency for implementation of State water allocation procedures.

#### **RECOMMENDATION**

It is recommended that the Lake Traverse ROPE study be completed as described in this problem appraisal report.

JOSEPH BRIGGS  
Colonel, Corps of Engineers  
District Engineer



LAKE TRAVERSE ROPE  
(RESERVOIR OPERATION PLAN EVALUATION)  
PROBLEM APPRAISAL REPORT

COORDINATION APPENDIX

LAKE TRAVERSE ROPE  
(RESERVOIR OPERATION PLAN EVALUATION)  
PROBLEM APPRAISAL REPORT

COORDINATION APPENDIX

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US Army Corps  
of Engineers  
St. Paul District

For more information  
about this study,  
contact Herb Nelson  
at (612) 725-7380

# Public Notice

**Project:** Lake Traverse Reservoir  
Bois de Sioux River - Channel Improvement

**Date:** **In Reply Refer to:**

August 1986

NCSPD-PF/Traverse

## Lake Traverse and Mud Lake Water Control Plans to Be Evaluated

The St. Paul District, Corps of Engineers, has initiated a study to review the water control plan for Reservation Dam at Lake Traverse and White Rock Dam at Mud Lake. The project, including both dams, is commonly referred to as Lake Traverse. The District assembled a study team in June 1986 and is expected to complete the review of the water control plan by summer 1987.

## Project Location and Authorized Purposes

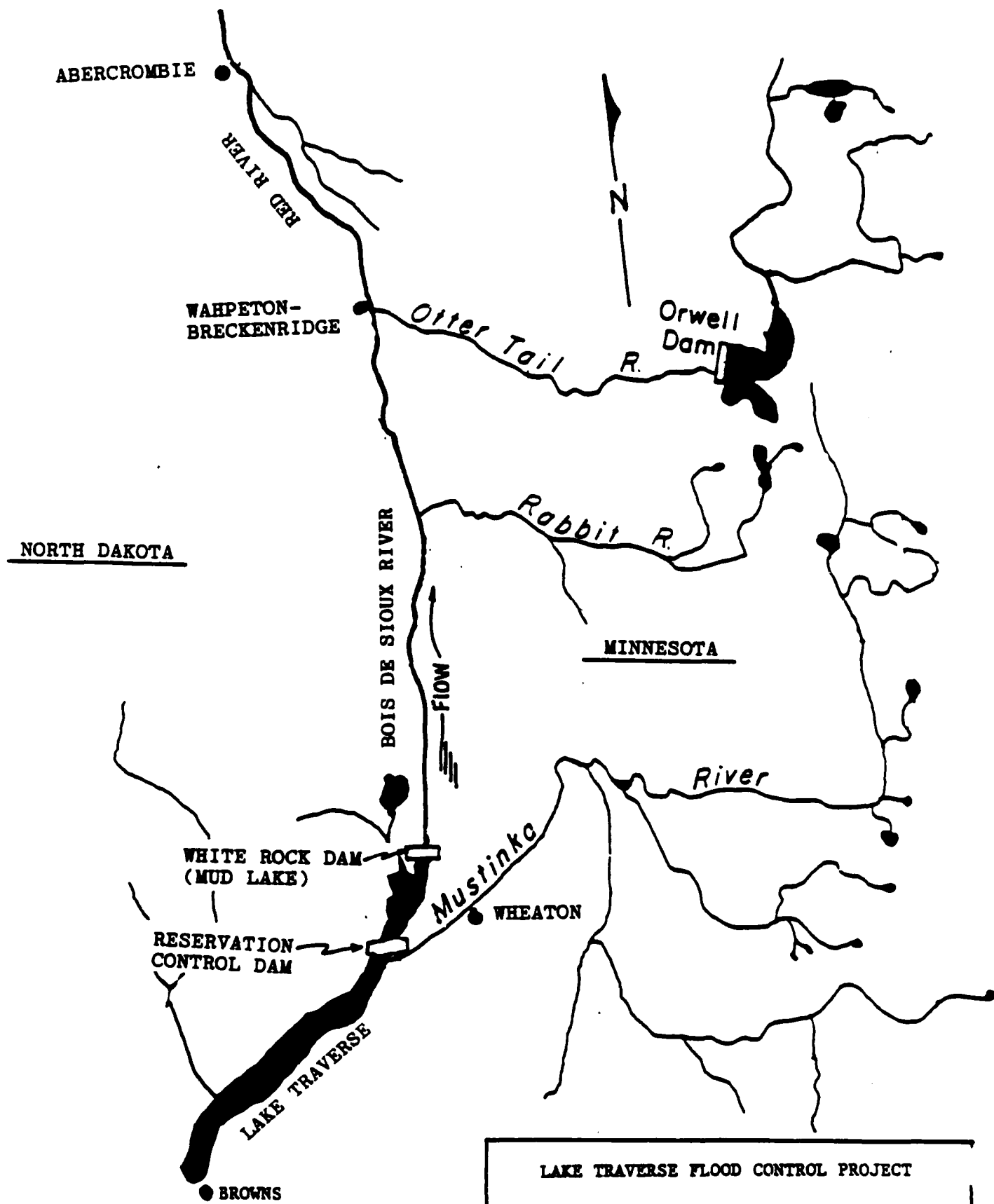
Lake Traverse is the source of the Bois de Sioux River. The Lake Traverse project is on the border between Minnesota and South Dakota about 35 miles upstream (south) of Wahpeton, North Dakota, and Breckenridge, Minnesota. See the map on page 2. The dams were completed in 1941. A lesser-known project feature is the channelization of the Bois de Sioux River for about 24 miles downstream (north) of White Rock Dam to a point about 5 miles downstream of the Rabbit River. The river was channelized to improve the flood control operation of the Lake Traverse project.

Congress authorized the project for the primary purpose of flood control for the agricultural areas along the Bois de Sioux River and for the cities of Wahpeton and Breckenridge on the Red River. Secondary authorized purposes include water conservation and fish and wildlife. In 1965, Congress added recreation as a purpose for Federal water projects.

**Flood Control:** The Lake Traverse project contributes to the authorized purpose of flood control by storing spring runoff to protect Wahpeton and Breckenridge. When the river stage at the Wahpeton gage exceeds flood stage at 10 feet, then the discharges from the Lake Traverse project are reduced to provide relief at Wahpeton and Breckenridge. The results of the recent review of the Orwell Reservoir water control plan will be coordinated with the Lake Traverse review to provide adequate flood control operation for Wahpeton and Breckenridge.

During the summer, intense rainfall runoff can cause local flooding along the Bois de Sioux River. The discharge from White Rock Dam is then reduced to provide relief from flooding for agricultural interests.

**Water Conservation:** Another authorized purpose of the Lake Traverse project is water conservation, which includes providing supplemental flows to the Bois de Sioux River. Downstream water suppliers such as Fargo, Moorhead, Wahpeton, and Breckenridge use the Bois de Sioux River at least



LAKE TRAVERSE FLOOD CONTROL PROJECT  
AREA MAP

occasionally as a water source. In addition to providing water supply benefits, supplemental river flows can be beneficial to instream demands, such as aquatic life and recreation.

Fish and Wildlife: Lake Traverse and Mud Lake provide valuable habitat for fish and wildlife, especially nesting and migrating waterfowl. Downstream wetland areas along the Bois de Sioux River are also productive and are affected by project discharge. The Corps of Engineers has been working with other agencies and groups over the past few years to develop a detailed plan to improve fish and wildlife development in Mud Lake.

#### Objectives of the Study

The District study team has been assigned to involve the public and to accomplish the following major tasks:

1. Determine how well the present project operation contributes to the authorized purposes.
2. Identify other resources or project purposes that operation of the Lake Traverse project could or does significantly affect.
3. Formulate and evaluate an array of alternative water control plans to optimize benefits from the project.
4. Consider minor project modifications to enhance beneficial effects of project operation.
5. Report the findings and make tentative recommendations, including the possibility of congressional reauthorization of project purposes, if needed.

#### Study Schedule

The public involvement for this study effectively began in July 1986 at a public meeting held by Minnesota State Senator Charlie Berg. The meeting is discussed in the enclosed brochure.

An agency scoping workshop will be scheduled for the last week in September 1986. The workshop and follow-up contacts are intended to define significant resources that are or that could be affected by the water control operation of the Lake Traverse project. The findings of this effort are to be published in the problem appraisal report, scheduled to be available in draft form in October 1986.

Plan formulation activities will start after the final problem appraisal report is completed for the study. A number of alternative water control plans will be developed and evaluated. The results of the plan formulation and evaluation, as well as the recommended plan, will be presented in a letter report in February 1987 and at a public meeting in May 1987.

The decision document containing the recommended plan and supporting recommendations will be published during summer 1987. The selected plan may be put in operation during fall 1987.

Your Involvement in the Study

The study team hopes to involve you actively in the first three major tasks (listed previously), using methods such as this notice, letters, phone calls, meetings, or other mutually agreeable techniques. Please address any correspondence containing your ideas and concerns to the following address:

District Engineer  
ATTN: NCSPD-PF/Traverse  
St. Paul District, Corps of Engineers  
1135 U.S. Post Office and Custom House  
St. Paul, Minnesota 55101-1479

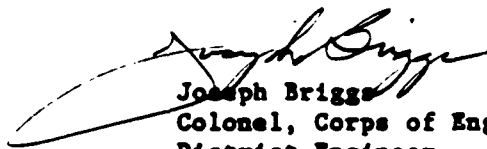
The study manager is Mr. Herb Nelson, who can be contacted at telephone number (612) 725-7380 (FTS and commercial).

If you have any concerns or know of any opportunities that the study team should consider, please contact us.

Please give this information to any other person, group, or agency you know to be interested in this project who has not received a copy of this public notice.

Thank you for your continued interest in our activities.

Enclosure  
Brochure

  
Joseph Briggs  
Colonel, Corps of Engineers  
District Engineer

This brochure was included with the August 1986 Public Notice.

## BROCHURE

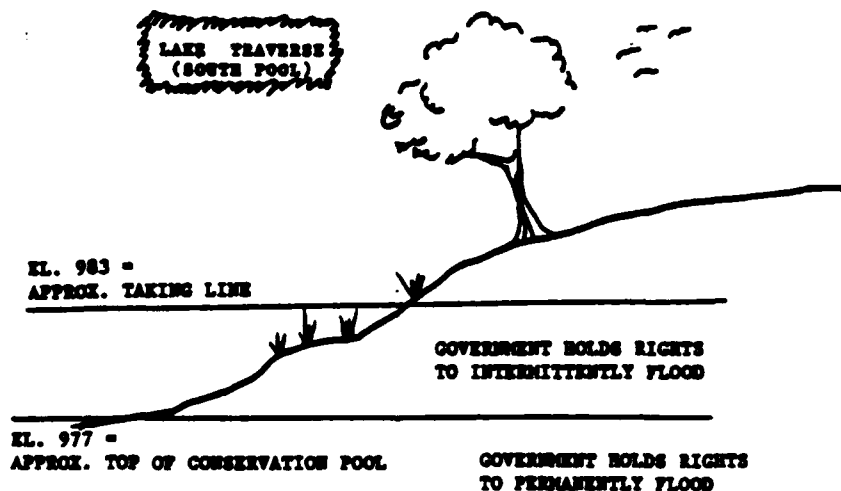
### LAKE TRAVERSE PUBLIC MEETING

On July 2, 1986, Minnesota State Senator Charlie Berg held a public meeting concerning Lake Traverse and the flooding damage caused by recent high lake levels. Lake Traverse is a Federal (Corps of Engineers) flood control project. Colonel Joseph Briggs, the St. Paul District Engineer of the Corps of Engineers, was present at the meeting to hear public concerns and to talk about the project. Many people, representing a variety of interests, attended the meeting and asked questions about the project.

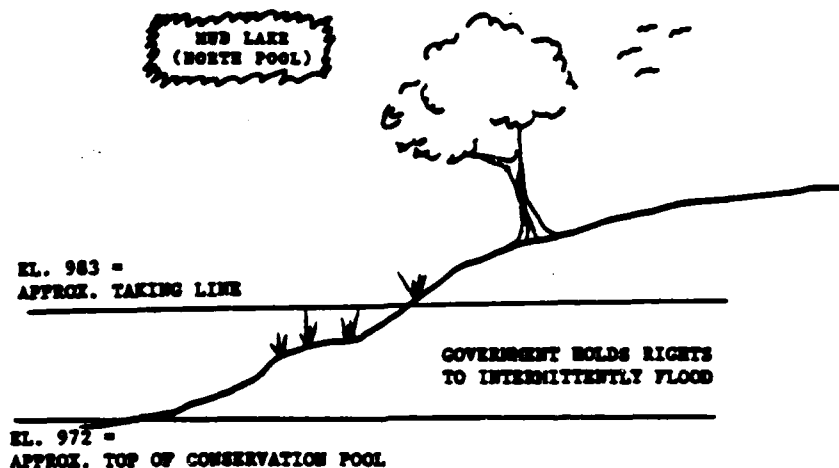
The following paragraphs summarize typical questions and answers at the public meeting. A few questions have been added to those from the meeting to help you better understand how the Lake Traverse project works.

1. Question: What real estate interest did the Federal Government purchase in the early 1940's for the Lake Traverse project?

Answer: In the Reservation pool (located between Browns Valley and Reservation Highway), the Government bought permanent flowage rights for lands lying below elevation 977.0 mean sea level (1912 adjustment). Elevation 977 is the summer conservation pool for the Reservation pool. In addition, the Government acquired the right to intermittently overflow those lands between the taking line and the summer conservation pool. This flowage easement means that Lake Traverse can permanently flood the surrounding land up to elevation 977 and can intermittently flood the surrounding land up to the taking line at approximately elevation 983 (see the answers to questions 2 and 3 for more information on the Federal taking line and the flowage easement). See the following figure.



In Mud Lake (located between Reservation Highway and White Rock Dam), the Government acquired permanent flowage rights for lands lying below elevation 972.0 msl. Elevation 972 is the summer conservation pool for Mud Lake. In addition, the Government paid for the right to intermittently overflow the land between the taking line and the summer conservation pool. See the following figure.



2. **Question:** At what elevation is the taking line for the Government flowage easements for intermittent flooding? My neighbors have always told me that it was at elevation 977.0.

**Answer:** The taking line is not at a specific elevation, but rather generally follows and is slightly higher than elevation 983.0. All lands around both pools (Mud and Reservation) at Lake Traverse are subject to at least intermittent flooding up to (and usually slightly above) elevation 983.0, the Federal taking line.

3. **Question:** I don't see elevation 983.0 mentioned anywhere on my deed or abstract. How did the Government record the taking line for the flowage easement on my property?

**Answer:** The taking line does not exactly follow elevation 983.0. The taking line is described and recorded using "metes and bounds." Metes and bounds are a series of distances and angles that exactly describe the boundary line of the Federal easement. Metes and bounds descriptions of land boundaries are commonly used by any qualified land surveyor or real estate attorney. The metes and bounds description for the taking line for Government flowage easements is recorded in the county land records and is available for anyone to see. However, qualified professionals should be used to accurately read and interpret the description.

4. **Question:** The shoreline of my property was eroded by wave action during the high lake levels, and debris was deposited on my land. Is the Federal Government going to repair the damage and remove the debris?

**Answer:** No, it is the landowner's responsibility to protect and maintain shoreline areas. In the early 1940's, a one-time payment was made to the landowner for the Federal flowage easement at the Lake Traverse project. Many past court cases concerning other projects have established that the compensation paid by the Government for a flowage easement includes the associated problems caused by erosion and debris or any other problem reasonably expected to occur because of water levels up to the easement limits.



5. Question: Do I need a permit to do shoreline protection work on my property, such as placing rock or building a bulkhead?

Answer: For larger shore protection projects, a permit is required from the Minnesota Department of Natural Resources (MDNR). Some smaller projects do not require a permit. Contact the MDNR Regional Hydrologist's office at telephone (218) 739-7576 in Fergus Falls, Minnesota, for more information. A Corps of Engineers permit to fulfill requirements of the Federal Clean Water Act may be required for some shoreline protection projects. Call the St. Paul District office at telephone (612) 725-5819 for more information.

6. Question: I thought the project was intended for flood control. Why was the lake level so high this spring that it flooded my lakeside property yet downstream areas were being protected from flooding?

Answer: The flood control pool in Lake Traverse was established by congressional authorization to store floodwaters and reduce downstream flood damages. Last fall and this spring were wet enough that a large volume of water had to be retained in the lake to prevent flood damage downstream. Unfortunately, quite a number of lakeshore property owners have built on the Government's flowage easement area since the project was established. When lake levels approach the maximum legal elevation, then many of the houses and other improvements are damaged by high water.

7. Question: Were the lake levels ever this high before? How often has the lake gone above the permanent easement elevations and the taking line?

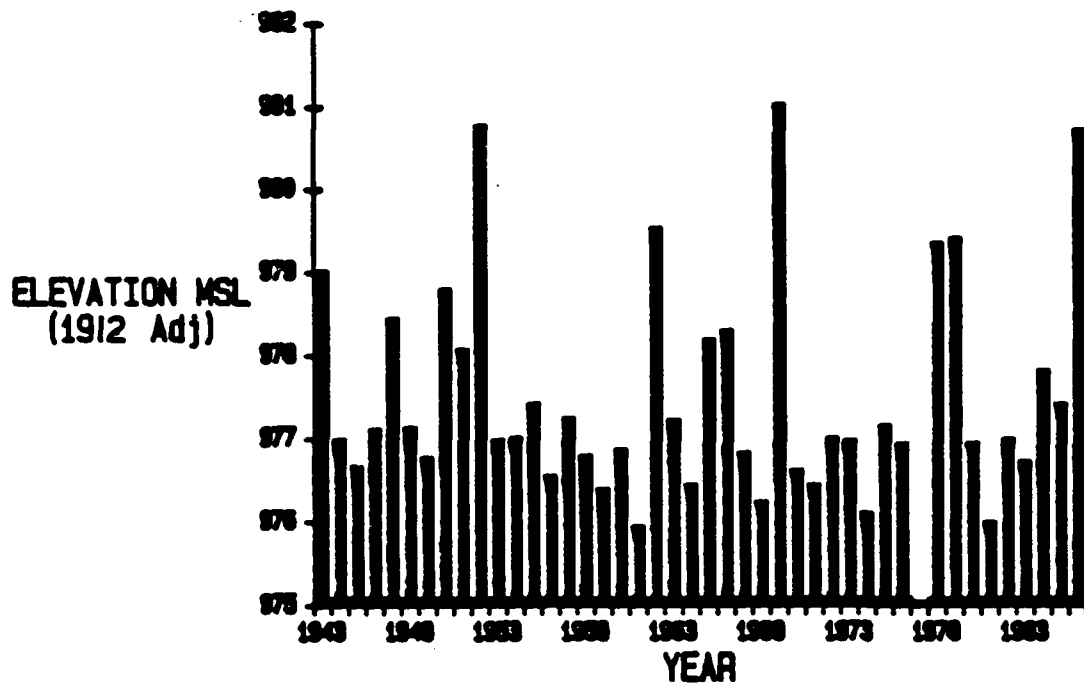
Answer: The two diagrams on the following page show the annual high water levels for each pool. The lake level has never exceeded the taking line (about elevation 983.0). Lake levels have reached this year's level (about elevation 981) twice before, in 1969 and 1952. During the project life of about 44 years, the lake levels have reached or exceeded the summer conservation pool, which is the same as the permanent flowage easement elevation, 28 times in Lake Traverse and 40 times in Mud Lake.

8. Question: Can the water control operation of Lake Traverse be changed now so that my lakeside property will not be flooded again?

Answer: The St. Paul District Engineer has the authority to modify the water control plan as long as the change is within the original Congressional authorization. We have begun a review of the water control plan, and the District Engineer may change the plan if the results of the review show that it should be. However, it is still too early to determine whether any allowable change in the water control plan could prevent future high lake levels, or even whether it could decrease the frequency of high lake levels.

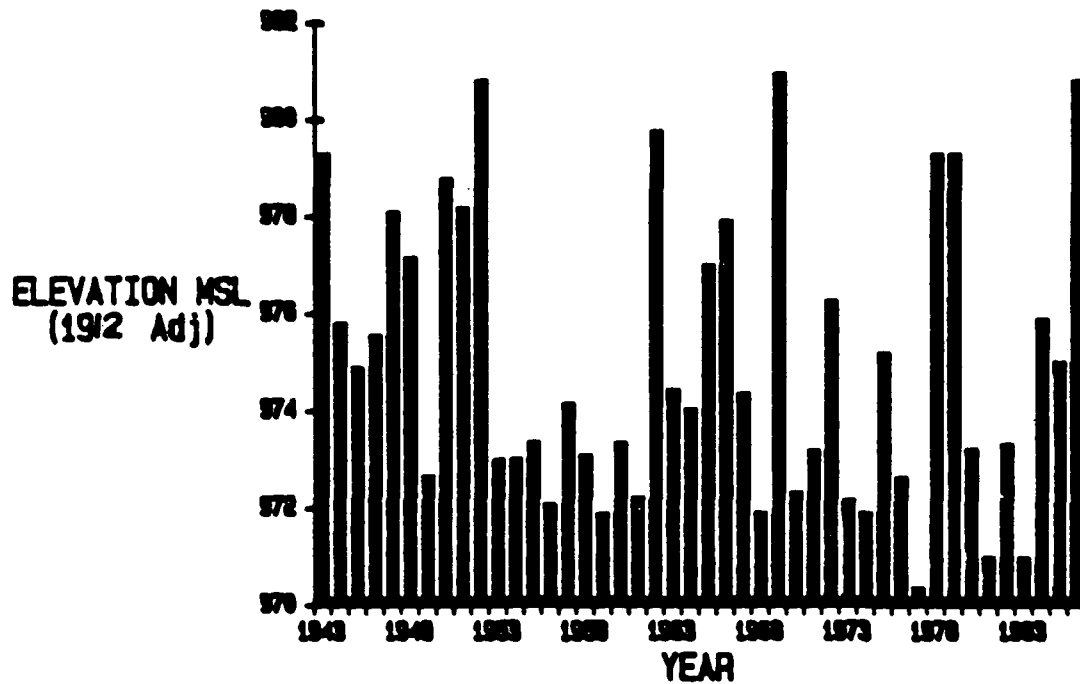
# ANNUAL HIGH WATER LEVELS

Reservation Dam Pool Gage



# ANNUAL HIGH WATER LEVELS

White Rock Dam Pool Gage



9. Question: The water control study won't be done until summer 1987, and I'm not sure that the study will reduce the risk of high lake levels when it is completed. What can I do now?

Choice 1: You can restore your property to its condition before the high water and accept the risk that there may be high water again. Even though the lake has only risen as high as 981 a total of three times, there is a risk of lake levels as high as elevation 983 in a rare situation.

Choice 2: A better alternative would be to flood proof your property so that, when the lake gets above elevation 977 again, your property will not be damaged as severely. If your lake association or other group would like some technical help on how to flood proof your property, the Corps of Engineers or Minnesota Department of Natural Resources could set up flood proofing workshops or otherwise provide flood proofing information. Typical flood proofing ideas include moving buildings to higher ground, raising the first-floor elevation by raising the existing block foundation, or simply raising utilities and appliances.

10. Question: I own farmland along the Bois de Sioux River. Over the past few summers, I've noticed that heavy thunderstorms have caused the river to flood. Can the Corps do something about that?

Answer: The Federal Government (Corps) channelized the first 23.8 miles of the river below White Rock Dam when the Traverse project was built some 40 years ago. This reach of river extends to about 5 miles downstream of the Rabbit River. Since then, siltation and beaver dams have apparently reduced the flow capacity of the channel from 1,100 cubic feet per second (cfs) to perhaps 1,000 cfs or less in some reaches of the river. It is the Federal Government's responsibility to maintain this project, and we are presently determining whether the economic benefit would be sufficient to restore the channel.

11. Question: Who is responsible for paying the real estate taxes on the property that is affected by the Government flowage easement?

Answer: Individual landowners must pay the taxes for all of the land they own. The Federal flowage easement does not change responsibility for paying taxes. Highway and utility easements are handled in the same way.





US Army Corps  
of Engineers  
St. Paul District

Newsclips

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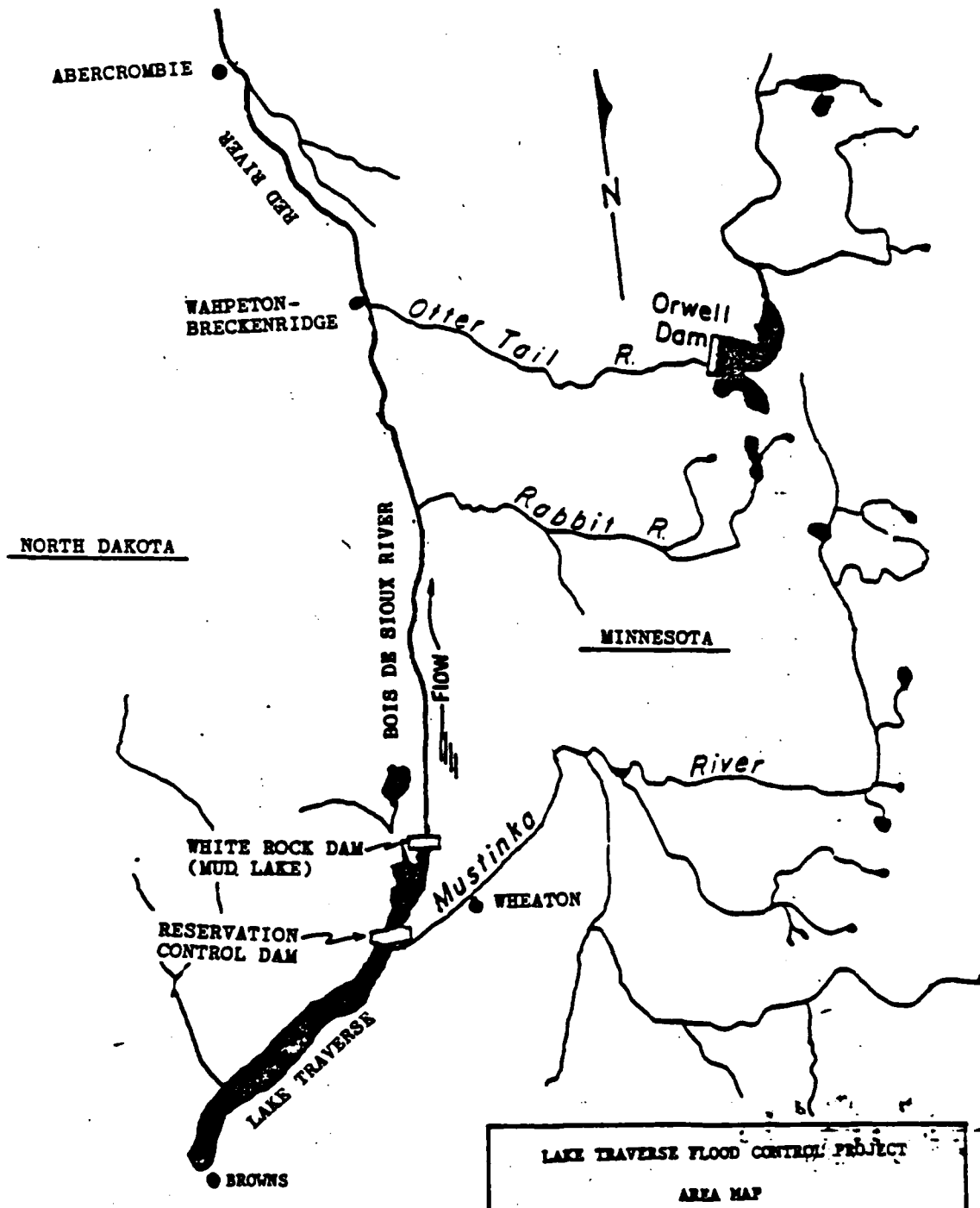
*Results To Be Published Next Summer—*

# **Corps To Re-evaluate <sup>134</sup> Lake Traverse, Mud Lake Water Control Plans**



US Army Corps  
of Engineers  
St. Paul District

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**LAKE TRAVERSE FLOOD CONTROL Project Area Map.** Lake Traverse is the source of the Bois de Sioux River. The Lake Traverse project extends about 35 miles upstream (south) from Wahpeton-Breckenridge. The dams shown were completed in 1941. A lesser-known project feature is the channelization of the

Bois de Sioux River for about 24 miles downstream (north) of White Rock Dam to a point about five miles downstream of the Rabbit River. The river was channelized to improve flood control operations of the Lake Traverse project.



**US Army Corps  
of Engineers**  
St. Paul District

**Newsclips**

PAGE 3 OF 5 PAGES

by Mike Kremer  
Managing Editor

This year's disastrous spring flood has resulted in the U.S. Army Corps of Engineers initiating a re-evaluation of the Lake Traverse and Mud Lake water control plans.

The St. Paul District, Corps of Engineers, has initiated "a study to review the water control plan for the Reservation Dam at Lake Traverse and White Rock Dam at Mud Lake," said Col. Joseph Briggs from the St. Paul District office.

Following an uproar from local landowners affected by this year's flood, the Corps assembled a study team in June to look into the situation. Briggs said he expects the review of the water control plan to be completed by the summer of 1987.

The study team, which has been assigned to involve the public, has five major objectives to accomplish: 1) determine how well the present operation contributes to the authorized purpose 2) identify other resources or project purposes that operation of the Lake Traverse project (the commonly referred to name that includes both dams) could or does significantly affect, 3) formulate and evaluate an array of alternative water control plans to optimize benefits from the project, 4) consider minor project modifications to enhance beneficial effects of project operation, and 5) report the findings and make tentative recommendations, including the possibility of congressional re-authorization of project purpose, if needed.

In 1974, Congress authorized the Lake Traverse project for the primary purpose of flood control for agricultural areas along the Bois de Sioux River and for the cities of Wahpeton and Breckenridge on the Red River. Secondary authorized purposes included water, fish and wildlife conservation. In 1985, Congress added recreation as a purpose for the federal water project.

According to Briggs, the Lake Traverse project contributes to the authorized purpose of flood control by storing spring runoff to protect Wahpeton and Breckenridge.

"When the river stage at the Wahpeton gauge exceeds flood stage at 10 feet," Briggs said, "the discharges from the Lake Traverse project are reduced to provide relief at Wahpeton and Breckenridge."

During the summer, he said, intense rainfall runoff can cause local flooding along the Bois de Sioux River. The discharge from White Rock Dam is then reduced to provide relief from flooding for agricultural interests.

As for water conservation, Briggs stated one of the purposes here is to provide supplemental flows to the Bois de Sioux River. Downstream water suppliers such as Fargo, Moorhead, Wahpeton, and Breckenridge use the Bois de Sioux River at least occasionally as a water source. In addition to providing water supply benefits, supplemental river flow can be beneficial to instream demands, such as aquatic life and recreation.

Lake Traverse and Mud Lake provide valuable habitat for fish and wildlife, especially nesting and migrating waterfowl, Briggs added. Downstream wetland areas along the Bois de Sioux River are also productive and are affected by project discharge. He said the Corps has been working with other agencies and groups over the past few years to develop a detailed plan to improve fish and wildlife development in Mud Lake.

Briggs said the Corps will combine the results of the recent review of the Orwell Reservoir water control plan with the Lake Traverse review, to provide adequate flood control operation for Wahpeton and Breckenridge.

An agency scoping workshop will be scheduled for the last week in



**US Army Corps  
of Engineers**  
St. Paul District

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September, Briggs said. The workshop and follow-up contacts are intended to define significant resources that are, or that could be, affected by the water control operation of the Lake Traverse project. The findings of this effort will then be published in a problem appraisal report scheduled to be available in draft form by October.

Plan formulation activities will start after the final problem appraisal report is completed for the study. A number of alternative water control plans will be developed and evaluated, Briggs said. The results of the plan formulation and evaluation, as well as the recommended plan, will be presented in a later report in February of 1987 and at a public meeting in May of next year.

The end result, that is the decision document containing recommended plans and supporting recommendations, will be published during the summer of 1987. Should a new water control plan be selected, Briggs said it would probably be put in operation during the fall of 1987.

Briggs said the study team hopes to involve the public as much as possible in this process. Anyone having an idea or concern dealing with the review is asked to contact: District Engineer, ATTN: NCSPD-PF Traverse, St. Paul District, Corps of Engineers, 1135 U.S. Post Office and Custom House, St. Paul, MN 55101.

As mentioned earlier, public involvement for this study began in July at a public meeting held in Browns Valley. The meeting was called by Senator Charlie Berg and the Traverse-Mud Lakes Improvement Association to discuss flood damage caused by this spring's high lake levels.

Briggs was present at the meeting to hear public concerns and to talk about the project. Many people, re-

presenting a variety of interests, were also in attendance to ask questions about the project. The following paragraphs summarize questions and answers voiced about the project:

**Question:** What real estate interest did the federal government purchase in the early 1940's for the Lake Traverse project?

**Answer:** In the reservation pool (located between Browns Valley and Reservation Highway), the government bought permanent flowage rights for lands lying below elevation 977.0 mean sea level (1912 adjustment). Elevation 977 is the summer conservation pool for the reservation pool. In addition, the government acquired the right to intermittently overflow those lands between the taking line and the summer conservation pool. This flowage easement means that Lake Traverse can permanently flood the surrounding land up to elevation 977 and can intermittently flood the surrounding land up to the taking line at approximately elevation 983.

In Mud Lake (located between Reservation Highway and White Rock Dam), the government acquired permanent flowage rights for lands lying below elevation 972.0 msl. Elevation 972 is the summer conservation pool for Mud Lake. In addition the government paid for the right to intermittently overflow the land between the taking line and the summer conservation pool.

**Question:** At what elevation is the taking line for the government flowage easements for intermittent flooding? My neighbors have always told me that it was at elevation 977.0.

**Answer:** The taking line is not at a specific elevation, but rather generally follows and is slightly higher than elevation 983.0. All lands around both pools (Mud and Reser-

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**Answer:** No, it is the landowner's responsibility to protect and maintain shoreline areas. In the early 1940's, a one-time payment was made to the landowner for the federal flowage easement at the Lake Traverse project. Many past court cases concerning other projects have established that the compensation paid by the government for a flowage easement includes the associated problems caused by erosion and debris or any other problem reasonably expected to occur because of water levels up to the easement limits.





## US Army Corps of Engineers

St. Paul District

## Newsclips

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**Answer:** For larger shore protection projects, a permit is required from the Minnesota Department of Natural Resources (MDNR). Some smaller projects do not require a permit. Contact the MDNR Regional Hydrologist's office at phone (218) 739-7575 in Bemidji, MN for more information. A Corps of Engineers permit to fulfill requirements of the Federal Clean Water Act may be required for some shoreline protection projects. Call the St. Paul District office at phone (612) 725-5819 for more information.

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**Answer:** The flood control pool in Lake Traverse was established by congressional authorization to store floodwaters and reduce downstream flood damages. Last fall and this spring were wet enough that a large volume of water had to be retained in the lake to prevent flood damage downstream. Unfortunately, quite a number of lakeshore property owners have built on the government's flowage easement area since the project was established. When lake levels approach the maximum legal elevation, then many of the houses and other improvements are damaged by high water.

**Question:** Were the lake levels ever this high before? How often has the lake gone above the permanent easement elevations and the taking line?

**Answer:** The lake level has never exceeded the taking line (about elevation 983.0). Lake levels have reached this year's level (about elevation 981) twice before, in 1969 and 1952. During the project life of about 44 years, the lake levels have reached or exceeded the summer conservation pool, which is the same as the permanent flowage easement elevation, 28 times in Lake Traverse and 40 times in Mud Lake.

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**Question:** The water control study won't be done until summer 1987, and I'm not sure that the study will reduce the risk of high lake levels when it is completed. What can I do now?

**Choice 1:** You can restore your property to its condition before the high water and accept the risk that there may be high water again. Even though the lake has only risen as high as 981 a total of three times, there is a risk of lake levels as high as elevation 983 in a rare situation.

**Choice 2:** A better alternative would be to flood proof your property so that, when the lake gets above elevation 977 again, your property will not be damaged as severely. If your lake association or other group would like some technical help on how to flood proof your property, the Corps of Engineers or Minnesota Department of Natural Resources

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could set up flood proofing workshops or otherwise provide flood proofing information. Typical flood proofing ideas include moving buildings to higher ground, raising the first-floor elevation by raising the existing block foundation, or simply raising utilities and appliances.

**Question:** I own farmland along the Bois de Sioux River. Over the past few summers, I've noticed that heavy thunderstorms have caused the river to flood. Can the Corps do something about that?

**Answer:** The Federal Government (Corps) channelized the first 23.8 miles of the river below White Rock Dam when the Traverse project was built some 40 years ago. This reach of river extends to about 5 miles downstream of the Rabbit River. Since then, siltation and beaver dams have apparently reduced the flow capacity of the channel from 1,100 cubic feet per second (cfs) to perhaps 1,000 cfs or less in some reaches of the river. It is the Federal Government's responsibility to maintain this project, and we are presently determining whether the economic benefit would be sufficient to restore the channel.

**Question:** Who is responsible for paying the real estate taxes on the property that is affected by the government flowage easement?

**Answer:** Individual landowners must pay the taxes for all of the land they own. The federal flowage easement does not change responsibility for paying taxes. Highway and utility easements are handled in the same way.

# DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL

NCSPD-PF

SUBJECT

Lake Traverse ROPE - Problem Appraisal

MEMO FOR THE RECORD

FROM NCSPD-PF

DATE

3 Sep 86

CMT 1

HNelson/jg/7380

1. Mr. Dick Tolbers, U.S. Fish and Wildlife Service, St. Paul Field Office, telephoned me twice on 29 August 1986 concerning the study initiation notice. He strongly supports our water control review at Lake Traverse and mentioned his satisfaction with the Orwell ROPE. Mr. Tolbers provided the following summary problem appraisal statements in order of relative priority.

a. Reduce cattle grazing and watering at the shoreline around both pools, but especially Mud Lake, to improve water quality and waterfowl and wildlife habitat. This would allow reestablishment of a vegetation buffer around the lake at these trampled locations to filter out nutrients from runoff. The vegetation would provide improved wildlife cover and help reduce nutrient movement to the lake.

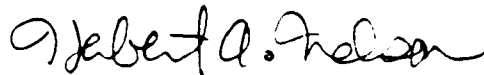
b. Pursue the U.S. EPA Clean Lakes Program or any other comprehensive land use program to reduce nutrient loading and siltation of Lake Traverse from the lake's drainage basin. Big Stone Lake was mentioned as an example.

c. Implement the wildlife management plan for Mud Lake that has been developed with the State and Federal resource agencies since 1983 to restore wildlife and waterfowl production on the project lands.

d. Flood proof or remove all structures that are damaged by pool elevations up to 983 so that the congressionally authorized flood pool up to elevation 983 may be used unhindered by concerns about flood damage around the lake. Mr. Tolbers was concerned that a reduction of the flood control storage in the lake would increase the need to rechannelize the Bois de Sioux River (first 24 miles) portion of the project.

e. Do not rechannelize the Bois de Sioux River for the first 24 miles downstream of White Rock Dam, as originally established with the Lake Traverse project, unless that is absolutely ~~needed~~ and the best available alternative. Please consider water control adjustments or anything else that would reduce the need to channelize the Bois de Sioux River.

2. Mr. Tolbers is not sure whether he or a representative will attend our 23 September 1986 agency problem appraisal workshop at the Wheaton Community Library.



HERBERT NELSON  
Study Manager  
Plan Formulation Branch  
Planning Division

Copies furnished:  
NCSED-GH/Hartman  
NCSPD-ER/Wilcox

A-17



## DEPARTMENT OF THE ARMY

ST. PAUL DISTRICT, CORPS OF ENGINEERS  
1136 U.S. POST OFFICE & CUSTOM HOUSE  
ST. PAUL, MINNESOTA 55101-1479

August 29, 1986

REPLY TO  
ATTENTION OF

### Plan Formulation Planning

The St. Paul District, Corps of Engineers is reviewing the water control plan for the Lake Traverse project, located on the South Dakota-Minnesota border. You are invited to participate in the problem identification process for this review effort by attending a workshop in the Wheaton, Minnesota, Community Library, 901 1st Ave. North on September 23, 1986, at 1 p.m. The workshop will take place in the basement meeting room area of the library.

At the workshop, we will discuss the process we intend to use for reviewing the water control plan for the project. The main purpose of the workshop is to obtain your views and concerns about the water control-related aspects of the project. We will also review the information obtained from two recent coordination activities. Minnesota State Senator Charlie Berg held a public meeting on July 2, 1986 to discuss damage to private property from the recent high lake levels. The St. Paul District has been participating with State and Federal resource agencies in development of a fish and wildlife improvement plan for Mud Lake.

The Lake Traverse Congressional authorization is primarily for flood control, with secondary purposes of water conservation, fish and wildlife, and recreation. The water control review is intended to ensure that the project provides maximum public benefit for the authorized purposes, using current policy and under current conditions. At this time, the District study team is compiling information about the significant resources that can be affected by the water control operation of the Lake Traverse project. The problem identification work will be documented in the draft problem appraisal report, scheduled for October 1986.

If you have questions about this study, or wish to make your comments about the review without attending the workshop, please call the study manager, Herb Nelson, at telephone (612) 725-7380.

*for David Schuman*  
Louis Kowalski  
Chief, Planning Division



## NORTH DAKOTA PARKS AND RECREATION DEPARTMENT

Pinehurst Office Park  
1424 West Century Avenue  
Suite 202  
Bismarck, ND 58501  
Phone: (701) 224-4887

September 5, 1986

Colonel Joseph Briggs, District Engineer  
ATTN: NCSPD-PF/Traverse  
St. Paul District, Corps of Engineers  
1135 U.S. Post Office and Custom House  
St. Paul, MN 55101-1479

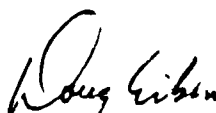
Dear Colonel Briggs:

This letter is in response to the public notice regarding the Lake Traverse Water Control Plan.

The North Dakota Parks and Recreation Department is currently conducting a Statewide River Values Assessment (SRVA). The purpose of this effort is to produce a reconnaissance level assessment of the relative value of North Dakota rivers for recreation, fish and wildlife, cultural sites, geologic features and other resources. The Bois de Sioux River is included in our assessment. Therefore, we felt the SRVA information may be helpful in your efforts to "define significant resources that are or that could be affected by the water control operation of the Lake Traverse Project." Additional information will be available on the assessment when the Draft Final Report is released in January 1987.

Thank you for the opportunity to provide input on this project.

Sincerely,

  
Doug Eiken  
Director

KK/jar



# -Wilkin County, -Minnesota

TELEPHONE (218) 643-4772

P O BOX 195  
BRECKENRIDGE, MINNESOTA 56520

October 1, 1986

Colonel Joseph Briggs  
District Engineer  
Corps of Engineers  
1135 U.S. Post Office & Custom House  
St. Paul, MN 55101-1479

Re: NCSPD - PF/Traverse  
Lake Traverse Problems

Dear Colonel Briggs:

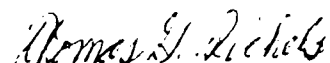
The Wilkin County Board of Commissioners have been closely following the water levels related to the White Rock Dam and Reservation Dam which discharge flows into the Bois de Sioux River. The water leaving these dams greatly affects flooding conditions in our County including the City of Breckenridge. As most everyone knows, there was tremendous damage in this area over the past several months due to overland flooding.

It appears to us that some of these downstream flood problems could be alleviated if the reservoirs were drawn down to levels lower than their conservation pools. We realize this is difficult due to the original flood control plan, however, considering the following circumstances, we feel that the fall lake levels should be substantially lower than the normal fall elevations:

1. The capacity of the reservoirs is greatly decreased from their original condition. Mostly due to siltation from extensive field drainage.
2. The sub-soil in this area is thoroughly saturated, and will remain wet into the fall freeze up. This condition could make for a 100% runoff next spring, thereby placing additional water in the drainage facilities.
3. Lake Traverse went through the 1976-1977 winter at an elevation of approximately 973 (conservation pool elevation - 976.0) without significant problems.
4. We have been in a wet cycle for the past 2-3 years and there seems to be no indication of it lessening, as we have had much more rain to date than our normal total for the entire year. Normal or above precipitation this winter could bring another disaster next spring.

We hope you will take these comments into consideration, and do whatever is possible to make this flood control project beneficial to this area. Drawing down the pool elevation in Lake Traverse to approximately 973.0 - 974.0 feet would help all affected areas. We will be available for whatever information you may need in your new project study.

Sincerely,



Thomas G. Richels  
Wilkin County Engineer

TGR/jo

cc: Traverse - Mud Lake Improvement  
Association

Ole Larson

US Army Corps  
of Engineers

St. Paul District

Newsclips

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SEP 19 1986

# Lake Traverse water control operation to be assessed

By KARAN TVETER  
Daily News Writer

138

The water control operation of Lake Traverse, which affects the Wahpeton-Breckenridge area, will be discussed next week.

A Lake Traverse agency scoping workshop to define significant resources which are or could be affected by the water control operation of the Lake Traverse project area will be held Tuesday, Sept. 23, at the Wheaton Library beginning at 1 p.m. The public is invited to attend.

Public involvement on the Lake Traverse and Mud Lake project began in July at a meeting in Wheaton chaired by Minnesota State Senator Charlie Berg. At the meeting individuals were able to discuss the flooding damage caused by recent high lake levels. Lake Traverse is a federal (Corps of Engineers) flood control project.

The flood control pool in Lake Traverse was established by congressional authorization to store floodwaters and reduce downstream flood damages. Last fall and this spring were wet enough that a large volume of water had to be retained in the lake to prevent flood damage downstream.

Unfortunately, quite a number of lakeshore property owners have built on the government's flowage easement area since the project was established. When lake levels approach the maximum level of elevation, many of the houses and other improvements are damaged by high water.

The St. Paul District Engineer has the authority to modify the water control plan as long as the change is within the original Congressional

authorization.

Along with Berg, Colonel Joseph Briggs, the St. Paul District Engineer of the Corps of Engineers, was also present at the July meeting. Many people attending represented a variety of interests and asked questions about the project.

The project, entitled Lake Traverse Reservoir Bois de Sioux River — Channel Improvement, was initiated by the St. Paul District of the Corps of Engineers. The corps developed a study to review the water control plan for Reservation Dam at Lake Traverse and White Rock Dam at Mud Lake. The project, including both dams, is commonly referred to as Lake Traverse.

The district assembled a study team in June and is expected to complete the review of the water control plan by summer 1987, according to a release from the Corps of Engineers.

The release said Lake Traverse is the source of the Bois de Sioux River which flows through Wahpeton-Breckenridge. The Lake Traverse project is on the border between Minnesota and South Dakota about 35 miles upstream (south) of Wahpeton and Breckenridge.

Information from the Corps said the dams were completed in 1941. A lesser-known project feature is the channeling of the Bois de Sioux River for about 24 miles downstream (north) of White Rock Dam to a point about 5 miles downstream of the Rabbit River. The river was channelled to improve the flood control operation of the Lake Traverse project.

According to the Corps, Congress authorized the project for the primary purpose of flood control for the agricultural areas along the Bois de Sioux River and for the cities of Wahpeton and Breckenridge on the Red River. Secondary authorized purposes include water conservation and fish and wildlife.



**US Army Corps  
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St. Paul District

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PT 25 2 OF 2

The release stated the Lake Traverse project contributes to the authorized purpose of flood control by storing spring runoff to protect Wahpeton and Breckenridge. When the river stage at the Wahpeton gauge exceeds flood stage at 10 feet, then the discharges from the Lake Traverse project are reduced to provide relief at Wahpeton and Breckenridge.

The Corps said the results of the recent review of the Orwell Reservoir water control plan will be coordinated with the Lake Traverse review to provide adequate flood control operation for Wahpeton and Breckenridge.

Another authorized purpose of the Lake Traverse project, according to the Corps, is water conservation, which includes providing supplemental flows to the Bois de Sioux River. Downstream water suppliers such as Fargo, Moorhead, Wahpeton, and Breckenridge use the Bois de Sioux River at least occasionally as a water source.

The district study team has been assigned to involve the public and to accomplish the following major tasks:

- Determine how well the present project operation contributes to the authorized purposes.

- Identify other resources or project

- purposes that operation of the Lake Traverse project could or does significantly affect.

- Formulate and evaluate an array of alternative water control plans to optimize benefits from the project.

- Consider minor project modifications to enhance beneficial effects of project operation.

- Report the findings and make tentative recommendations, including the possibility of congressional reauthorization of project purposes, if needed.





United States  
Department of  
Agriculture

Soil  
Conservation  
Service

P.O. Box 1458  
Bismarck, ND  
58502

September 23, 1986

Colonel Joseph Briggs  
St. Paul District, Corps of Engineers  
1135 U.S. Post Office and Custom House  
St. Paul, Minnesota 55101-1479

ATTN: NCSPD-PF/Traverse


Dear Colonel Briggs:

The Soil Conservation Service in North Dakota has reviewed the public notice concerning Lake Traverse Reservoir-Bois de Sioux River channel improvement of August 1986. We have the following comments:

- 1) Although the map included in the notice is too general to be certain it appears that no prime farmlands in North Dakota will be affected by the project.
- 2) Please keep us informed as specific maps, alternatives and recommendations are developed that will allow our inputs and recommendations to be more helpful.

We appreciate the early opportunity to review and comment on this study.

Sincerely,

  
AUGUST J. DORNBUSCH, JR.  
State Conservationist

**ACTING**

US Army Corps  
of Engineers

St. Paul District

Newsclips

SEP 24 1986

# Flood prevention options discussed

By KARAN TVETER  
Daily News Writer

WHEATON, Minn. — Flood control was a major concern expressed at a Lake Traverse problem appraisal workshop held Tuesday.

Approximately 50 concerned citizens from three states split into five groups and listed problems of Lake Traverse and Mud Lake at Tuesday's meeting held at the Wheaton library. The meeting was chaired by Herb Nelson from the planning division of the U.S. Corps of Engineers, St. Paul.

Nelson said the purpose of the workshop was to define significant resources which are or could be affected by the water control operation

of the Lake Traverse project area which affects the Wahpeton-Breckenridge area. Lake Traverse is the source of the Bois de Sioux River and the project is on the border between Minnesota and South Dakota about 35 miles upstream (south) of Wahpeton and Breckenridge.

Another purpose of this workshop, Nelson said, was to review and list the water control problem on both lakes and downstream. The ideas related to water control will be used to identify problems. A problem appraisal report will be distributed in October to all groups represented at this meeting.

Public involvement on the Lake

Traverse and Mud Lake project began in July at a meeting in Wheaton chaired by Minnesota State Senator Charlie Berg. At the July meeting individuals were able to discuss the flooding damage caused by recent high lake levels. Lake Traverse is a federal Corps of Engineers flood control project.

According to Nelson, in January the Corps of Engineers will be looking at options of what can actually be done to help solve the problems expressed. In the spring the options will be evaluated, he said, and by the end of the summer of 1987 the corps is hoping to have a water control project plan selected. A public meeting will then be held to discuss the plan.

The question asked when those in attendance were split into five groups was, "What are the problems of Lake Traverse and Mud Lake?" Each individual was asked to express specific problems.

A main concern was to expedite the Lake Traverse water along the Bois de Sioux through Wahpeton-Breckenridge without causing any flooding. Others mentioned that the water levels on Lake Traverse and Mud Lake are too high. Another common problem was local flooding.

It was also a consensus of the group that the channel project on the Bois

de Sioux, which flows through Wahpeton-Breckenridge, was never completed, making the capacity inadequate.

Another concern was that the existing levee system at Wahpeton aggravates flood levels of the Otter Tail and Bois de Sioux Rivers.

Some other priorities expressed included: making sure the storage at the Orwell Reservoir and the two lakes is used as advantageously as possible; controlling floods on the Bois de Sioux between Wahpeton-Breckenridge; minimizing flooding by better time releases of water from Lake Traverse and Mud Lake; completing the channeling all the way through Breckenridge-Wahpeton; setting up watershed districts; and preventing seeds and debris from the land from holding water back.

A few solutions to problems offered were to consider building a dam at White Rock, S.D., and install more river gauges along the flow of the water, such as at Fairmount.

According to Nelson, the problems listed by the group will be taken back to the St. Paul office and reviewed. Individuals not able to attend the meeting and who wish to express their problems or solutions may do so by writing Nelson at the St. Paul Corps of Engineers office.

Representing North Dakota, South Dakota and Minnesota at the workshop were several farmers, lakeshore property owners, county commissioners, city engineers, civil defense directors and Water Resource board members along with mayors and a city/county attorney.



## DEPARTMENT OF THE ARMY

ST. PAUL DISTRICT CORPS OF ENGINEERS  
1135 U.S. POST OFFICE & CUSTOM HOUSE  
ST. PAUL, MINNESOTA 55101-1479

October 15, 1986

REPLY TO  
ATTENTION OF  
**Plan Formulation  
Planning**

The St. Paul District, Corps of Engineers, held a workshop on September 23, 1986, at Wheaton, Minnesota, concerning the water control plan for Lake Traverse. The workshop brought together representatives from State and Federal agencies, county and city governments, and leaders of concerned citizens groups. We thank the people who took time from their busy fall schedules to participate in the workshop. The participants worked together to produce a list of concerns to be considered during our review of the Lake Traverse water control plan. The list of concerns, exactly as recorded on flip charts at the meeting, is included with this letter.

In another workshop activity, the participants prioritized the concerns that they identified. The results of the participants' prioritizations are indicated by the scores in parenthesis next to each item.

After the workshop, the St. Paul District study team combined the concerns into seven general categories. The team then summarized each of the concern categories and added a short statement about how the team intends to address the concern. This information is also enclosed with this letter.

If you have comments on the information included with this letter or additional concerns for the study team to consider, please contact the study manager, Mr. Herb Nelson, at telephone (612) 725-7380 or write to:

U.S. Army Corps of Engineers  
St. Paul District  
ATTN: PD-PF/Nelson  
1135 U.S. Post Office & Custom House  
St. Paul, Minnesota 55101-1479

The concerns collected at the workshop and other concerns identified throughout our public involvement program will guide formulation and evaluation of alternative water control plans for Lake Traverse. All of the problem identification information

gathered in this early portion of the study will be documented in the Problem Appraisal Report. The draft Problem Appraisal Report is scheduled to be published by the end of October 1986 for review and comment by participating and interested agencies and groups.

Sincerely,

 LTC, CE, DDE

JOSEPH BRIGGS

Colonel, Corps of Engineers  
District Engineer

2 Enclosures

1. List of concerns
2. Responses to concerns



CONCERNS RECEIVED AT LAKE TRAVERSE AGENCY WORKSHOP ON SEPTEMBER 23, 1986

- A. Local flooding. (9)
- B. Mud Lake water levels could be managed better for wildlife management. (3)
- C. Too much ditching; it should be controlled. (11)
- D. Flooding is harmful to wildlife.
- E. Timing of release from White Rock Dam is causing downstream flooding. (7)
- F. Silting of Bois de Sioux River has lessened the capacity of river. (10)
- G. Draw down lakes more, to springtime holding capacity. (6)
- H. Obstructions in Mud Lake channel prohibit complete drawdown.
- I. Complete channelizing all the way through Wahpeton-Breckenridge. (3)
- J. Set up watershed districts.
- K. Increased drainage in entire watershed prevents Lake Traverse project from operating as designed.
- L. We haven't hit high water mark at Kent, MN, even with all the ditching which is being done.
- M. Summer flooding is more serious than spring flooding.
- N. North Dakota side of the Bois de Sioux River is diked 2 1/2 miles south of Rabbit River, but Minnesota side isn't, so all water goes east. (1)
- O. Study building a dam at White Rock, South Dakota.
- P. Study to flow south from Browns Valley to Big Stone Lake.
- Q. Silting on the north end of Lake Traverse.
- R. Capacity of Lake Traverse decreased by siltation.
- S. Time releases to minimize flooding along Bois de Sioux River from White Rock Dam to Breckenridge. (2)
- T. Consider channel cleanout of Bois de Sioux River from White Rock Dam to Breckenridge, MN; flooding in this reach seems worse than in the past. (3)
- U. Bois de Sioux River channelization was never completed - project should be completed as authorized to downstream of Wahpeton-Breckenridge. (19)

V. Consider diversion & channelize Otter Tail River at downstream end to minimize flooding in Breckenridge. (5)

W. Control needed on agricultural drainage into Mustinka River; watershed area has expanded greatly through uncontrolled ditching, wetland drainage. (5)

X. More local (dam operator) authority & control over water control actions to achieve better response (shorter response time). (1)

Y. Operate dams following drawdown from flood pool levels so that Bois de Sioux River doesn't flow over bankfull (at first), then dry (later in summer). Do slower flood surcharge drawdown. This would help reduce cattail growth, siltation in Bois de Sioux river channel. (1)

Z. Is development in flowage easement zone around L. Traverse legitimate?

AA. Need in-stream flows to support fish in Bois de Sioux River; the river often dries up in summer.

BB. Pay more attention to Bois de Sioux River stages and agricultural flooding above Wahpeton - perhaps better inflow, river, and precipitation gaging is needed. (5)

CC. (Bois de Sioux) River gage is needed at Fairmont. (2)

DD. Debris accumulates above the flowage easement line; is landowner responsibility for cleanup?

EE. Windrowed seed/noxious weeds from high water.

FF. Primary (Lake Traverse) project purpose should remain flood control. (6)

GG. Control Mud Lake better for wildlife.

HH. Control Bois de Sioux River better for wildlife.

II. River channel is held too high so land west is flooding. (See Richland County Drains #39 and 3).

JJ. Foul seeds and debris left on land after flooding. (2)

KK. Holding water too high on Mud Lake and too slow on drawdown (to 972).

LL. Too much water put into system, comes too fast (compared to design).

MM. 200 acres of taxable farmland under water.

NN. Corps winter water levels are too high.

OO. Wildlife suffering from high water. (Also fish.)

PP. Summer levels too high.

QQ. Bois de Sioux River channel project was not completed, so the (channel) capacity is inadequate.

RR. "Secondary" channels are silted in. (Channels from potholes along the Bois de Sioux River.)

SS. Loss of shoreline due to high water.

TT. Loss of agricultural land.

UU. Meandered land/channels being filled in, so not used for flood storage. (2)

VV. Unauthorized draining of natural sloughs and land.

WW. Melted spring water is not discharged fast enough to help nesting; Mud Lake should be at elevation 970 to 972.

XX. No fish retention on the Rosholt Conservation Dam.

YY. Water levels on Lake Traverse and Mud Lake are too high. (38)

ZZ. More gaging stages from Wahpeton further south to White Rock Dam. (5)

AAA. Agricultural flooding downstream from dam. (3)

BBB. Define "intermittent" flooding and flood easements (around Lake Traverse). (2)

CCC. Too much drainage into lakes. (4)

DDD. Rabbit River cannot empty until Bois de Sioux River is down. (1)

EEE. Takes too long to discharge water from lakes. (9)

FFF. No private drainage control. (6)

GGG. Reservoirs aren't large enough. (1)

HHH. Timing of releases of water (from White Rock Dam) should be better. (5)

III. Use more common sense in controlling lake levels. (1)

JJJ. Debris remaining on farmland after water recedes. (6)

KKK. Why can't water level of elevation 974.3 be held in the fall on Lake Traverse? (7)

LLL. Existing levee system at Wahpeton aggravates the flood levels of the Otter Tail and Bois de Sioux Rivers. (8)

MMM. Make sure storage in Orwell Reservoir and both lakes is fully used as best possible.

NNN. Concerned about controlling floods on Bois de Sioux River between White Rock Dam and Wahpeton-Breckenridge. (4)

OOO. Management of fishery in Lake Traverse.

PPP. Concerned that inflow to Lake Traverse has increased from 1940's due to widened area being included in watershed. Ditches in Stevens/Grant/Big Stone County areas have increased drainage basin size. (11)

QQQ. Summer and fall lake (both lakes) levels are being held too high above the conservation elevations.

RRR. Kidder Dam is worsening the flooding problem in Breckenridge and Wahpeton. (7)

SSS. Concerned about the interchange of flows between Lake Traverse and Big Stone during the high water.

TTT. Expedite Lake Traverse water along Bois de Sioux River through Wahpeton and Breckenridge without causing flooding. (1)

UUU. Concerned about the debris left behind by floods. Who can help get rid of it?

VVV. Lake Traverse water should be channeled south into Big Stone Lake for flood control purposes.

WWW. The Minnesota State RIM program (Reinvest in Minnesota) should be used to set aside the marginal floodplain land along the Bois de Sioux River to help reduce agricultural flood damage.



## RESPONSES TO CONCERNS RAISED AT THE LAKE TRAVERSE AGENCY WORKSHOP

### I. COMBINE CONCERNS: C,J,K,L,W,LL,VV,CCC,FFF,PPP, AND WWW

Restatement of Publics' Concerns: There has been a significant increase in the total amount of water that flows through the project during flooding conditions. It is suspected that flooding has been increasing because of ditching and drainage of wetland areas. These areas can be used for marginal agricultural purposes when they are ditched and drained, but this land-use practice increases runoff. Some ditching in Stevens, Grant, and Big Stone Counties may have added some area to the drainage basin.

Response to Concerns: Water resources experts tend to agree that extensive drainage, such as found in the flat glacial Lake Agassiz area, can affect downstream flood levels under certain conditions. Comprehensive watershed planning, management, and public education in the project area could help control ditching, drainage, and abuse of marginal and floodplain lands. The Corps of Engineers does not have the authority to participate in watershed planning and management other than reviewing written watershed plans and some limited technical assistance along the main stream channels. Watershed districts should be activated to accomplish the planning and management needed. The Soil Conservation Service and State resources agencies can help watershed districts to plan and implement land-use measures and runoff retention projects. The RIM (Reinvest in Minnesota) program is available in Minnesota to retire marginal floodplain agricultural land, and the public needs to be made more aware of such existing programs.

### II. COMBINE CONCERNS: A,E,M,S,X,BB,CC,ZZ,DDD, AND HHH

Summary Restatement of Publics' Concerns: There should be better timing coordination of White Rock Dam releases with local runoff and Rabbit River discharges to reduce summer agricultural flood damage along the Bois de Sioux River. Two suggested solutions include installing a better river stage gaging system between White Rock Dam and Wahpeton and clarifying the role of the dam tender in water control decision-making during summer rainfall runoff events. It is felt that better gaging information at critical areas plus more involvement by the dam tender for short-term cutbacks in White Rock Dam releases could decrease agricultural damage from summer rainstorm floods.

Response to Concerns: A gage near Fairmont would provide better information about summertime floods from local runoff, especially from the Rabbit river. It is not yet certain whether the operation of White Rock Dam has a significant effect on the localized summer floods. The dam is generally only releasing from 50 to 200 cfs during the summer and completely stopping that discharge would have little effect 20 to 30 miles downstream. The gage may at least be tested though for several years to determine its effectiveness. The second part of the concern involves the dam tender's role in water control. The tender receives daily directions from the water control center in the St. Paul District Office. The dam tender merely

responds to those directions and reports meteorological and gage data back to the water control center. The water control decisions must be made based on the condition of the entire river system, not on a project-by-project basis, as suggested at the workshop.

III. COMBINE CONCERNS: A,F,N,T,U,V,II,MM,QQ,TT,UU,AAA,LLL,NNN, RRR, AND TTT

Summary Restatement of Publics' Concerns: The Bois de Sioux and Red Rivers do not have adequate channel capacity to handle flooding. The portion of the channel that was excavated in the 1940's has silted in and the downstream portion of the river was authorized for improvement, but never constructed. Also, the flashboards on Kidder Dam, agricultural levees on the South Dakota side, and Wahpeton's levee increase flood stages. Can any changes be made to the channel, dam, and levees to decrease flood damages?

Response to Concerns: We will determine the economic feasibility of the Bois de Sioux River channelization projects and estimate the effects of the levees and Kidder Dam on flooding at Wahpeton-Breckenridge. The benefits of the channelization project must be determined because many similar projects across the Nation are competing for limited funding. The greater the economic benefit that the project provides per dollar of construction cost, the greater the chances that the construction funding may be appropriated by Congress.

IV. COMBINE CONCERNS: G,Q,R,Z,FF,KK,PP,YY,EEE,III,KKK,MMM, AND QQQ

Summary Restatement of Publics' Concern: Lake Traverse should continue to be operated primarily for flood control and some specific adjustments to the water control plan should be considered to increase the flood control effectiveness. The suggestions include: (1) lower the water levels to increase flood control storage volume; (2) use the entire authorized flood control volume, but only when absolutely needed; and (3) reduce the loss of flood control storage from sedimentation in the lake.

Response to Publics' Concerns: The water control plan will be reviewed to determine whether additional flood control benefit can be obtained, within the limitations of the present congressional authorization. Lower lake levels during the fall and winter can provide some additional flood control benefit, but also have some significant environmental problems to consider. We are required by public law to consider the environmental impact. We will not evaluate the effects of sedimentation in the lake. The original project design accounted for a loss of lake storage from sedimentation. Most of the storage lost from sedimentation has occurred in the lower elevations of the reservoir. The Lake Traverse flood control operation only uses the top portion of the lake for flood control storage. A comprehensive watershed plan (see item I) by non-Federal interests would help reduce the amount of sediment movement from agricultural lands to the reservoir.

V. COMBINE CONCERNS: B,D,H,Y,AA,GG,HH,OO,RR,WW,XX, AND OOO

Summary Restatement of Publics' Concerns: Mud Lake water levels could be managed better for wildlife production and certain water control changes could improve wildlife habitat in Mud Lake and along the Bois de Sioux River.

Response to Publics' Concerns: The St. Paul District has been working with the Federal and State resources agencies to develop desirable water control techniques to improve wildlife habitat in Mud Lake and Bois de Sioux River.

Suggestions for the plan should be addressed to the U.S. Fish & Wildlife Service. Our initial appraisal of the draft wildlife plan for Mud Lake is that it is probably compatible with water control actions required for the other authorized purposes of the project. However, we will complete some detailed evaluation to ensure compatibility before the plan is completely implemented.

#### VI. COMBINE CONCERNS: O,P,GGG,SSS, AND VVV

Summary Restatement of Publics' Concerns: The Corps of Engineers should formulate and determine the feasibility of major new flood control projects for the Bois de Sioux River basin, such as a new dam, raise of the White Rock Dam, and sending flood water south into Big Stone Lake and the Minnesota River reservoir system.

Response to Publics' Concerns: New flood control projects will not be considered in this water control review. The scope of the present effort is to fine tune and consider maintenance of an existing project, not determine the feasibility of a new flood control project. Consideration of a new project could be done separately, but would require specific Congressional action for study funding and construction authorization and appropriations. A major new reservoir project is only remotely possible because of the present budgetary constraints and public attitudes about such projects. The concept of diverting flood waters into the Minnesota River system was apparently considered and rejected during the original Lake Traverse project formulation. The problem is that the Big Stone Lake basin is adjacent and tends to have flooding problems concurrently with the Lake Traverse project. For example, the Lac qui Parle Reservoir is presently at capacity, and the Minnesota River system would suffer additional agricultural flood damages from introduction of additional water from Lake Traverse.

#### VII. COMBINE CONCERNS: DD,EE,JJ,SS,BBB, AND JJJ

Summary Restatement of Publics' Concerns: The Government's flowage easement rights around Lake Traverse are unclear to many of the land owners. Also, it is unclear who has the responsibility to correct shoreline erosion, debris from high water, and weed seed deposits from high water. A number of people feel that some of the damage is occurring outside of the taking line for the flowage easement.

Response to Publics' Concerns: We will take a survey of lakeshore landowners to identify the best ways to periodically remind the landowners

about the Federal flowage easement rights. Damage from high lake levels (such as shoreline erosion, debris, and weed seed deposition) is the landowner's responsibility, as long as the damage is occurring within the taking line of the Government easement, at approximately elevation 983 or slightly higher. If the damage is occurring outside of the taking line, then it should be reported to the St. Paul District by the landowner.

END

DATE

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DTIC