

# A Red Lake Project History 1909-2002

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October 22, 1947  
PROCEEDINGS OF THE  
GENERAL COUNCIL OF  
THE RED LAKE BAND  
OF CHIPPEWA INDIANS  
Resolution No. 1  
Serial No. 366

1. No costs of construction shall be charged to the Red Lake Band of Chippewa Indians.
2. No costs of repair or maintenance shall be charged to the Red Lake Band of Chippewa Indians.
3. Control of the lake levels to be vested in the Department of the Army.
4. The tribe shall not be liable for any damages that may be caused by such improvements.
5. The tribe reserves the right to present a claim against the United States for any damages that may result from the construction, maintenance or operation of this project.
6. Members of the Red Lake Band of Chippewa Indians shall be employed on any work within the Red Lake Indian Reservation wherever possible.

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April 17, 1949  
Resolution No. 4  
Serial No. 449

... IT IS FURTHER RESOLVED that any damages that may be caused by excavations within the Red Lake Indian Reservation must be properly estimated and the amount of damage must be paid to the Red Lake Band of Chippewa Indians.

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October 28, 1948  
Resolution No. 5  
Serial No. 425

NOW THEREFORE, BE, AND IT IS HEREBY RESOLVED that the area adjacent to the Red Lake River channel on the Reservation be kept in its present flooded state as recommended by the Fish and Wildlife Director, Minneapolis, Minnesota.

IT IS FURTHER RESOLVED that the established water level of 1174.0 from May 1 to June 15, annually, be maintained, and the recommendations of the Fish and Wildlife Director as to further study for the development of marshes, streams, and ponds for fur production and waterfowl are to be followed;

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December 2, 1949  
Department of Interior  
Office of Secretary

The Department of the Army is hereby authorized to commence construction work on the right of way at its own risk, subject to the conditions set forth in the three tribal resolutions...

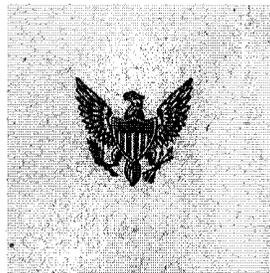
William E. Warne  
Acting Secretary of the  
Interior

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## LETTER FROM THE SECRETARY OF WAR TRANSMITTING

*A LETTER FROM THE  
CHIEF OF ENGINEERS,  
UNITED STATES ARMY,  
DATED JUNE 19, 1943,  
SUBMITTING A REPORT,  
TOGETHER WITH  
ACCOMPANYING PAPERS  
AND ILLUSTRATIONS, ON  
A PRELIMINARY  
EXAMINATION AND  
SURVEY OF RED LAKE  
RIVER AND IT'S  
TRIBUTARIES,  
MINNESOTA, INCLUDING  
CLEARWATER RIVER,  
MINNESOTA,  
AUTHORIZED BY THE  
FLOOD CONTROL ACT  
APPROVED ON  
JUNE 28, 1938*



# **A Red Lake Project History**

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## **Introduction**

In 1951, the Corps of Engineers replaced stop logs in a Bureau of Indian Affairs (BIA) dam with slide gates, and channelized portions of the Red Lake River both within and outside the Red Lake Indian Reservation. On the reservation, this channelization work took place within a large marsh complex estimated to be from 10,000 to 25,000 acres. No land was acquired from the Red Lake Band of Chippewa Indians to perform this work. Instead, the Tribe allowed the Corps to enter the reservation and construct the Red Lake and Clearwater Rivers project under conditions set forth in Tribal Council Resolutions. These resolutions, written between 1947 and 1949, stipulated that, among other things, no costs for construction, repair, or maintenance would be charged to the Red Lake Band, the Tribe would not be liable for any damages that might be caused by such improvements, the Tribe reserved the right to present a claim against the United States for any damages resulting from the project, and “the area adjacent to the Red Lake and Clearwater River channels on the reservation be kept in its present flooded state....” Since 1951, the Corps has struggled to meet the conditions set forth in the tribal resolutions.

## **Origins of the Project**

In its natural state, the Red Lake River drainage was sluggish and a large portion of the watershed remained constantly wet. There were extensive open marshes to the north of the Red Lakes, and almost impassable bogs were scattered over the entire watershed. Farmlands adjacent to the river and these wetlands were affected by the poor natural drainage and lack of topographical relief. In June 1906, an act of Congress (the Volstead Act) authorized the “Drainage of certain wet, overflowed, or marshy lands ceded by the Chippewa Indians in the State of Minnesota with a view of determining the possibilities of their reclamation by drainage.” The U.S. Geological Survey executed a survey in 1907-1908. In connection with this survey, maps and plans for a comprehensive drainage program for the Red Lake River Basin were submitted in 1909. On the basis of these plans, judicial drainage districts and other local interests carried out the construction of drainage ditches on a large scale during the period 1910-1916. While the drainage system was beneficial to certain lands with favorable elevation and slope, it soon became apparent that the effectiveness of the drainage system was overestimated. Much of the lowlands, except in extremely dry years, remained too wet for agriculture. These lands became delinquent either in taxes or in the obligations incurred by the construction of the ditches. By the late 1930s, it was determined that the drainage system in the basin was not satisfactory, primarily because the main ditches were constructed along the shortest possible alignments. These main ditches had flat slopes and often had to run parallel to the river until they reached a point where channel capacity was considered adequate to accommodate both the river and the ditch. As a result, the main ditches were filled with slowly moving water that frequently overtopped the banks. Lateral farm drains were not constructed to these main ditches because they would permit overflow from the main ditches to flood the farms and thus cause, rather than prevent, flood damages.

After the floods of 1919, the Red Lake Drainage and Conservancy District was organized (1920) for the express purpose of improving the channels of the Red Lake and Clearwater Rivers so as to decrease direct overflow and provide adequate outlets for drainage ditches. Plans were set forth for such improvement but, primarily because of difficulty in arranging for financing, the

improvements were not carried out. *Creativity, Conflict & Controversy: A History of the St. Paul District, U.S. Army Corps of Engineers*, states, “In September, 1922, it appeared that the Corps might enter into a unique arrangement for a large, multi-purpose improvement of Red Lake. The district engineer was asked to supervise the activities of the Red Lake Drainage and Conservancy District by the state of Minnesota, which planned to build a hydroelectric dam at the lake’s outlet, construct drainage canals, provide municipal water supplies, and improve the channel of the Red Lake River through dredging and jetties...After a public hearing on the project a Minnesota court denied permission for its construction.”

Numerous reports were drafted for Congress and the State of Minnesota on the flooding conditions in the Red Lake River between 1928 and 1941. Most of these reports recommended construction of a flood control dam at Red Lake and/or channelization of the Red Lake River from the dam downstream for from 27 to 45 miles.



Upstream view of Red Lake Control Structure  
(July 1941)

In 1931, the Indian Service (now the Bureau of Indian Affairs) constructed the Red Lake River dam for the reported “purpose of lake regulation and flood control below the lake” (as stated in the 1943 letter report referenced below). A 1995 letter from the Red Lake Band to the Corps regarding an Environmental Assessment references a “February 21, 1921 Federal bill that authorized improvement of the Red Lake and the Red Lake River. The essential points of this bill were to:

- a) establish operating lake levels
- b) To build a controlling dam...to conserve water for power purposes,...and straighten the Red Lake River channel to carry off flood waters...”

Limited information was found regarding what occurred between the 1921 bill and construction of the dam by the Indian Service in 1931. The benefits to the Red Lake Band from the construction of the original dam revolved around the drainage of wetlands north of the Red Lakes that were having an impact on lake levels. An excerpt from Cultural Resources Statement for the U.S. Army Corps of Engineer’s dam at the outlet of Lower Red Lake and the Red Lake River, prepared by Pamela May, states, “Considering the problems generated by drainage of the peatlands, Red Lake leaders could support a dam that would also regulate the water level of Red Lake.”

[Information for this section was taken from the 1943 Chief of Engineers letter report to Congress, House Document No. 345, 78<sup>th</sup> Congress, 1<sup>st</sup> Session, except where noted.]

## **Flood Control, Water Supply, Low Flow Plan**

The Flood Control Act of 1938 authorized the Corps to do a preliminary investigation of the Red Lake and Clearwater Rivers. In 1943, the Chief of Engineers submitted a letter report to Congress (House Document No. 345, 78<sup>th</sup> Congress, 1<sup>st</sup> Session) with recommendations for construction of a flood control project on the two rivers. The Flood Control Act of 1944 authorized construction of the project “substantially in accordance with the recommendations of the Chief of Engineers” in the letter report. The stated purpose of the project in the 1944 Flood Control Act was flood control; however, the letter report stated, “The proposed regulation of outflow from Red Lake would provide adequate low-water flows in Red Lake River to meet the requirements of water supply and sanitation.” Many of the flood control benefits mentioned were to agricultural lands rather than communities.

According to the St. Paul District Water Control Section, ED-H, no downstream communities or entities own water rights for water in Red Lake; therefore, releases of water cannot be demanded of the Corps. Historically, though, communities and/or entities such as American Sugar Corporation have requested the release of water for pollution abatement, and the Corps has accommodated those requests when lake water levels permitted.

The St. Paul District Office of Counsel has stated:

“the 3 highest priorities [for the Red Lake Project] are (a) flood control, (b) water supply and in particular ‘sufficient water from the lake to meet the needs at all times of municipalities along the Red Lake River’ and (c) ‘benefit to the fishing industry carried on by the Indians’; that flood control and water supply (the purposes directly mentioned by the Chief of Engineers) are of equal rank and have a somewhat higher priority than benefit to the Band’s fishing industry. However, it should be noted that this listing of priorities pertains only to operational decisions that are within the discretion of the District and that an attempt should be made to accommodate all 3 of the priorities...the district has very little discretion with respect to operation of lake levels if such operation would not ensure

‘that the water levels on the Red Lakes be held as closely as practicable to the ordinary level of 1174.0 feet from May 1 to June 15.’”

Low flow releases as identified in the Red Lake Regulation Manual are based on target lake levels. When the reservoir level is between 1174.0 feet above mean sea level (ft msl) and 1172.0 ft msl, discharge is limited to that required for water supply. When the reservoir level is between 1172.0 ft msl and 1171.0 ft msl, the total annual release will not exceed 50,000 acre-feet during a calendar year or a proportionate share thereof for the part of the year that the lakes are between these elevations. When the reservoir level drops below 1171.0 ft msl, the maximum discharge will be limited to about 15 cubic feet per second (cfs). Minimum discharge will not be less than 5 cfs.

Upper and Lower Red Lakes have only one outlet, the Red Lake River. The water release capacity of the control structure is very small in relationship to the size of the drainage area; control efforts to release high water can take years. The current outflow capacity, which averages approximately 1,000 cfs over the four seasons (maximum capacity of 1,200 cfs), can drop lake levels only 0.2 foot per month, assuming no inflow is occurring. In contrast, normal evaporation during the summer may be equivalent to 2,000 cfs and can drop the lake level 0.4 foot per month. Furthermore, the full outflow capacity is usually not available during high water conditions because of the governing outflow restraints imposed by the downstream farming interests in accordance with project criteria. Inflow generally is also quite high in wet years.



Red Lake Dam (May 1972)

## What The Corps Built In 1951

The Red Lake and Clearwater Rivers Project consisted of channel improvements on the Red Lake River beginning at the outlet and extending downstream 3.2 miles, and a reach extending from mile 178.5 about 4.5 miles east of the west boundary of the Indian Reservation, to mile 154.3 near High Landing, Minnesota; modification of the 1931 Indian Service stop-log structure at the outlet of Lower Red Lake; raising 6.9 miles of Highway 1 at the west end of Lower Red Lake; and construction of a channel control works near the head of the downstream improved channel at mile 178.8. There are approximately 7 miles of original stream channel between the two dredged areas. The project also included rectification, clearing, and enlargement of 47.3 miles of the Clearwater River channel. Only improvements on the Red Lake River within the Indian Reservation are pertinent to this report.

The channel control works (rock/brush dam) at mile 178.8 on the Red Lake River was designed to retain water stages in the Red Lake Indian Reservation upstream from the structure at levels that would approximate preproject conditions; this represented a departure from the authorized project plan which provided for continuous channel improvement on the Red Lake River through the Indian Reservation. The General Council of the Red Lake Band of Chippewa Indians determined the location of the structure at the point selected to permit functioning of a drainage ditch that enters from the north about 2,000 feet downstream from the control works.

Channel improvements on the Red Lake River in the Indian Reservation were initiated during the summer of 1950 and were largely completed by the spring of 1951. The St. Paul District took over operation of the Red Lake Dam on 1 April 1951, although work on the road raise and modification of the outlet structure were not completed until the fall of 1952.

For the project to be built, local cooperation agreements needed to be acquired. Local cooperation requirements included assurances that local interests would provide all flowage easements and rights-of-way; hold and save the United States free from damages due to the construction works and operation; take over the maintenance and subsequent replacement of all bridges improved by the United States; maintain the improved river channels; control contamination of the river; and prevent construction of any new dams or raising of any existing dams affecting the project, unless authorized by the Department of the Army.

The Red Lake Drainage and Conservancy District furnished the necessary assurances of local cooperation, except those related to prevention of river contamination which were furnished by the Minnesota Water Pollution Control Commission. The assurances were accepted on 3 October 1947, and the necessary cash contribution was received in July 1948. All rights-of-way and easements required for construction of the project outside the Indian Reservation were acquired by the conservancy district.

Authority for construction of that portion of the project located within the limits of the Indian Reservation was granted on 2 December 1949 by the Department of the Interior subject to conditions set forth in three tribal resolutions. The initial resolution, adopted 22 October 1947, authorized the Department of the Army to make the necessary improvements subject to the conditions that:

“(1) no cost of the construction shall be charged to the Red Lake Band of Chippewa Indians; (2) no cost of repair or maintenance shall be charged to the Red Lake Band of Chippewa Indians; (3) control of the lake levels to be vested in the Department of the Army; (4) the tribe shall not be liable for any damages that may be caused by such improvements; (5) the tribe reserves the right to present a claim against the Government for any damages by construction, operation and maintenance of the project; and (6) members of the Red Lake Band shall be employed on any work within the Red Lake Reservation whenever possible.”

The second tribal resolution, adopted 28 October 1948, amended the 1947 resolution by providing that the area adjacent to the Red Lake and Clearwater Rivers be kept in its present flooded state as recommended by the U.S. Fish and Wildlife Service (USFWS) and that the established water level of 1174.0 between 1 May and 15 June be maintained annually. The third resolution, adopted 17 April 1949, further amended the 1947 resolution as follows:

“\*\*\*WHEREAS, in Resolution number 1, Serial number 366, dated October 22, 1947, the Council approved the improvement of the Red Lake and Clearwater River channels for flood control purposes, and

“WHEREAS, the question now arises as to whether the adjacent lands should be subject to drainage or be left as much as possible as they are at the present for the conservation of waters for propagation of wild life on the Reservation;

“NOW THEREFORE, BE, AND IT IS HEREBY RESOLVED that the area adjacent to the Red Lake River channel on the Reservation be kept in its present flooded state as recommended by the Fish and Wildlife Director, Minneapolis, Minnesota, with the following exceptions.

“(a) The channel of Red Lake River shall be improved for a distance of about 3-1/2 miles downstream from the dam at Lower Red Lake to permit greater discharge from the lakes when they are above the normal level of 1174.0.

“(b) the channel of Red Lake River shall be improved from the western boundary of the Reservation to a point about 4-1/2 miles east to facilitate drainage from the existing lateral ditch.

[From the 1957 USFWS report, “The purpose of this dredged section was to facilitate drainage from an existing north-south lateral ditch which is located about 4.5 miles inside the west reservation boundary and ties into the Red Lake River from the north. This phase of the project was included AT THE REQUEST OF THE SUPERINTENDENT OF THE RED LAKE INDIAN RESERVATION and was approved by resolution of the tribal council. It was hoped that this action would encourage the Indians to convert a strip along the west edge of the reservation to agriculture. This hope has never been realized.”] [Note: During a conversation with Joel Rhode, Red Lake Department of Natural Resources (DNR) (not to be confused with Colonel Otto J. Rhode, St. Paul

District Engineer), on 5 November 2002, Joel stated that some tribal members in fact farm the northwest area of the reservation.]

[In Colonel Rhode's 1957 report, it is stated, "Part of the reduction in wildlife values was anticipated by the Indian Service when it requested that the channel improvement be continued into the reservation about 4.5 miles eastward of the west boundary and was in accordance with that agency's plans to provide drainage for agricultural land in the northwestern portion of the reservation and thereby to encourage farming and develop a more stable economy for the Indians on the reservation. It is believed reasonable to expect that further agricultural development in the northwestern part of the reservation will gradually take place. However, it was clearly the intent of the Indians that natural marsh conditions in the area bordering on the unimproved reach of Red Lake River be retained insofar as possible as evidenced by the 1949 tribal resolution which provided that a dam should be constructed in the channel upstream from the lower improved section to preserve the area above the dam in its natural flooded state."]

"(c) a control shall be constructed in the channel of Red Lake River upstream from said lateral ditch, to assist in flooding the area upstream;

[This structure was referenced in the 1957 USFWS report, "A rock-brush detention type dam was constructed across the river channel about one-half mile above the lower ditched section. The purpose of this structure was to maintain the water level in the marshes adjacent to the unditched portion of the river."]

"IT IS FURTHER RESOLVED that water levels on the Red Lakes be held as closely as practicable to the established level of 1174.0 from May 1, to June 15, annually;

IT IS FURTHER RESOLVED that any damages that may be caused by excavations within the Red Lake Indian Reservation must be properly estimated and the amount of damage must be paid to the Red Lake Band of Chippewa Indians; \*\*\*"

## **First Problems Reported on the Marsh – 1955**

(Continued excerpts from Colonel Rhode's 1957 report)

"The matter of a reported gradual drying up of the marshes in the Indian reservation adjacent to the Red Lake River was brought to the attention of Representative John A. Blatnik and this office in the fall of 1955 by representatives of a Duluth sportsmen's organization who contended that the condition was directly attributable to the flood control improvements on the Red Lake River. As a result it was stated that duck hunting and muskrat trapping in the reservation had been seriously affected and that the livelihood of the Indians was jeopardized because of the loss of guide fees and revenues from hunting permit sales."

An inspection of the marsh was conducted on 28 May 1956. On this date, the flow in the channel was reported to be about 150 cfs and the tail-water gage at the outlet structure read 1169.9. Colonel Rhode's report stated, "Marshes adjacent to the channel were generally dry, no

muskrats were observed, and waterfowl was scarce.” Subsequently, advice received from the BIA by letter dated 6 June 1956 indicated that at a recent Tribal council meeting of the Red Lake Band it had been reported that an 80 percent reduction in trapping had occurred in the area, apparently brought about by the flood control project. At that time, the Indians had requested that the Indian agency investigate the effect of the flood control project on the wildlife resources of the Indian Reservation. The BIA requested the USFWS to prepare a report.

In March 1957, the USFWS completed a special report on marsh restoration possibilities adjacent to the Red Lake River within the reservation. The report stated, “Largely due to the dredging and straightening of portions of the Red Lake River, extensive areas of marsh habitat adjacent to the stream which is dependent upon overflow and backwater for their water supply have gradually dried up. This has resulted in a serious loss of waterfowl and aquatic fur-bearer habitat.” In the report, the USFWS determined the dollar value lost by the tribe due to loss of hunting and trapping to be \$29,500 annually.

## THE MARSH

From the 1957 USFWS report, page 3, “The Red Lake River, within the Indian reservation, is bordered by extensive marshes. In fact, this area represents one of the last remaining extensive tracts of pristine marsh in the North Central States. The country is essentially a wilderness area and is relatively inaccessible. The marsh area is 3 to 4 miles wide at the outlet of Lower Red Lake, narrowing to about 1 mile in width at the western boundary of the reservation. The varied habitat consisting of large marshes; potholes; peat burnouts; and small, meandering streams made the Red Lake Marshes one of the best waterfowl areas in Minnesota.

“As mentioned earlier, the construction phases of the project were completed in the spring of 1951 (the Corps took over control of the dam in April 1951). The year 1950 was one of extremely high water and the marsh habitat reflected this condition. The effect of the ditching in lowering water levels in the marshes was not felt immediately. Much water was trapped in pockets, potholes, old oxbows, and burnout and seepage into the ditched section of the river was slow. It was not until 1953 that the effects of drainage, seepage, and evaporation combined with the absence of spring and summer flooding conditions necessary to recharge the marshes became serious. Marsh habitat conditions have steadily deteriorated since that time until today the huge marshes are virtually dry.

“Beyond the effects of the project on waterfowl and furbearers, there has been created a serious fire hazard. No attempt has been made to assess the waste of timber, manpower, equipment, etc., chargeable to fires such as the one in October, 1956, which burned over a minimum of 50,000 acres between the Clearwater and Red Lake Rivers on the Indian reservation.”

## USFWS SUGGESTED MEANS FOR MARSH RESTORATION

The 1957 report was the first to propose building intake structures, canals, outlet works, and dikes that are much like the Zah Gheeng Marsh structures seen today. The report went on to recommend construction of dikes along both sides of the 4.5-mile lower dredged portion of the river to the reservation’s western boundary. Additional dikes were proposed along the west

boundary to prevent flooding of privately owned lands. Water would be provided by improving or altering the rock and brush weir at the head of the lower dredged section and thereby diverting water into the marshes behind the dikes.

## **Colonel Rhode's Marsh Restoration – 1957**

In 1957, Colonel Rhode determined that the appropriate action to restore the marsh would be to repair the rock and brush weir at the head of the lower unimproved section of the Red Lake River. By 1957, this weir had already been repaired twice by the Corps, and studies indicated that it had settled again. In addition to repairing the weir, Colonel Rhode authorized closing the spoil banks on each side of the 3.2 miles of improved channel immediately downstream of the dam and constructing tieback dikes. The USFWS proposed closing the spoil banks (the downstream ends of some of the cutoff meanders were left open to the improved channel and subsequently acted as drains to the marsh) and construction of intake structures, both north and south of the dam outlet works, to allow water to gravity feed into the marsh. Colonel Rhode did not believe that the construction of the intake structures was necessary at the time. The 1957 report states, "The principal purposes of the Red Lake-Clearwater River project are flood control and improvement of low flows in the interest of water supply and pollution abatement for the cities and towns downstream along the Red Lake River. In view of the rapidly growing demands for more water for urban and industrial use throughout the entire country and the limitations of available supplies as demonstrated during the current drought, particularly in the Midwestern and southwestern States, it does not appear advisable at this time to give further consideration to the diversion of water from Lower Red Lake for conservation purposes until the results of the remedial measures proposed herein can be evaluated."

In 1958, the rock/brush weir located at mile 178.8 was replaced with an 80-foot concrete weir, gaps in the spoil banks along the 3.2 miles of channelized river were closed, and tieback dikes were built at the lower end of the spoil banks.

### **ALLOCATION OF COSTS:**

Colonel Rhode's report stated, "At this time it would appear that all costs should be assumed by the Federal Government and administered through the Corps of Engineers inasmuch as the improvements contemplated would only serve to restore certain wildlife values which the Indians stipulated in their resolution of 17 April 1949 should be preserved and which have been adversely affected primarily because of the settlement of the rock brush weir at the head of the 4.5-mile channel improvement near the western boundary of the reservation and by drainage into the improved 3.2-mile reach."

## **1963**

In 1963, a field investigation was conducted to determine the effects of the work completed in 1958 to restore the marsh. It was reported that,

"Marshes adjacent to the improved channel appeared generally dry except for oxbows near the spoil banks... However, marshes adjacent to the unimproved channel

reach downstream from about mile 185 to the control structure were in excellent condition, hundreds of ducks were present and many muskrat houses were observed, some of which were about one half mile distant from the channel. These observations have led to the conclusion that the concrete control structure, modified in 1958, has functioned effectively in restoring suitable marsh conditions along the unimproved channel upstream. [This opinion of the effectiveness of the weir was also held by the USFWS and the BIA as stated in the Final Environmental Impact Statement (EIS) dated 1975, page 43.] However, the raised river levels attributable to this structure have had no significant effect on marsh levels as far upstream as the improved channel reach. Also, the spoil bank closures and tie-back dikes along the 3.2 mile improved channel reach, constructed in 1958, have not resulted in any significant restoration of adjacent marshes, previously drained by the Red Lake River channel improvement project.”

The 1963 field investigation led to a Design Memorandum in 1965 for improvements to the marsh lands adjacent to the 3.2 miles of channelized river immediately downstream from the Red Lake dam. This report was signed by Lieutenant Colonel Leslie B. Harding, District Engineer for the St. Paul District. As stated above, the marsh land adjacent to the unchannelized 7 miles of Red Lake River appeared to be in good condition, and no work was required for this section of river.

### **Lieutenant Colonel Harding’s Plan of Improvement – 1965**

The Zah Gheeng Marsh that we know today, with its intake structures and outlet works, was constructed in 1965. The intake structures designed by the Corps were much the same type of structure as originally proposed in the 1957 USFWS report referenced above. Two intake structures, one about 0.5 mile north of the Lower Red Lake outlet and the other about 0.8 mile south, were designed so that marsh levels could be raised from elevation 1172.5 to a maximum elevation of about 1174.0. Two outlet works were also constructed near the lower ends of the marsh to allow for release of water in autumn to lower pool levels for winter from elevation 1174.0 to 1173.0. It was estimated that it would take only two weeks to raise water levels in the spring and lower the water in the fall. The spoil banks alongside the channel and tieback dikes would also be improved. These structures would be raised to elevation 1176.0 to provide 2-foot freeboard to the impounded marsh. Also, a trench was excavated through any sand or peat encountered at the marsh-side toe of the spoil banks and backfilled with clay to prevent seepage. All dikes had a top width of 12 feet, 1 on 3 side slopes, and a height varying from 1 to 5 feet. All dikes were constructed of impervious clay, and all sand or peat encountered was to be removed to prevent seepage. As constructed, the north marsh was to contain 1,200 acres and the south marsh about 2,100 acres.

#### **ALLOCATION OF COSTS:**

Lieutenant Colonel Harding stated in the 1965 Design Memorandum, “It would appear that all costs should be assumed by the Federal Government and administered through the Corps of Engineers as the contemplated improvements would only serve to restore certain wildlife values which the Indians stipulated in their resolution of 17 April 1949 should be preserved and which

have been adversely affected by drainage into the improved 3.2 mile reach of the Red Lake River channel just below the lake outlet.”

## **The Environmental Impact Statement – 1975**

In 1963, investigative studies found that the marsh adjacent to the unimproved 7 miles of the Red Lake River was effectively restored and that major modifications including intake structures, outlet works, and dike raises and improvements were necessary to restore the marsh alongside the 3.2 miles of channelized river. By 1973, just the opposite was true.

In 1973, North Star, a Corps contractor working on the EIS, reported:

“Examination of the channel control structure (concrete weir) at mile 178.8 on the Red Lake River by means of aerial photographs and during site visitation in January 1973 raises questions as to the purpose of this structure. It appears that the weir succeeds in raising the water level to the extent that it broadens the river bed to the east, but it does not contribute significantly to restoration of marshes north and south of the river bed. Several residents and persons acquainted with the area stated that adjacent marshes are affected only slightly by the weir.

“This view is also shared by University of Minnesota Agricultural Extension Agent Floyd W. Jorgensen, who has been operating the regulated marshes for many years. At the present time the reason for this apparent deterioration of conditions has not been determined.”

In contrast to this, the 1975 EIS stated that the 1965 efforts to restore the Zah Gheeng Marsh had been successful on those acres within the dikes:

“The marsh restoration project in the Zah Gheeng area near the outlet has been successful in returning approximately 3,300 acres to wildlife habitat and has thus reduced the detrimental impact of the earlier project.”

However, the EIS went on to state:

“This [the 3,300 acres within the Zah Gheeng] is approximately one-sixth of the former extent of the marsh. The remainder of the Zah Gheeng Marsh area is now practically unproductive and useless: often too wet to farm, usually too dry to support vigorous waterfowl and fur-bearer populations, and a potential fire hazard.

“A survey and plans drawn up by the USFWS suggest strongly that 10,000 to 15,000 acres of presently dry marshes could be restored to a semblance of their original state by the erection of low dikes and use of outlet controls for the extensively drained marshes east and west of the large “off-take” drainage ditch extending northward from the Red Lake River at mile 175.5 to State Highway No. 1. (The “off-take” ditch receives some water from an area north of State Highway 1, which reportedly has been developed as wild rice paddies.) By raising the level of the road along the ditch, building dikes along

four presently drained areas (two on the east side of the road, two on the west side), and equipping the dikes with control gates, approximately 10,000 acres could be inundated under 2 feet of water. The areas involved are townships 152 and 152N, ranges 37 and 38W. It is assumed that wildlife habitat would be significantly improved by such a project and downstream flow of waters which enter this area from the north would be better controlled.” [While the idea of constructing low dikes along the “off-take” dike is mentioned in the 1975 EIS, a similar idea was presented to the tribal council in 1962 by the U.S. Soil Conservation Service for the expansion of wild rice cultivation and was not approved via Resolution No. 94-62 dated November 13, 1962. Yet, in 1995 the Red Lake Watershed District, in cooperation with the Red Lake Band completed the Good Lake Impoundment on the Red Lake Indian Reservation in much the same area.]

## **Colonel Richard Craig – 1992**

During the 1980s, investigations were conducted to determine if improvements in reservoir regulation could reduce the impacts of downstream flooding and other water resource related problems. A reconnaissance report, completed in January 1992, stated:

“Over the past two decades, the effectiveness of the marsh project has deteriorated due primarily to siltation problems. The Red Lake Band of Indians has been concerned about this situation and has brought its concerns to the St. Paul District, Corps of Engineers, the constructing and primary operating agency. In response to these concerns, the Corps has developed a siltation dredging plan that would restore the bottom depths of the north and south inlet structures. Other project features would also be evaluated by the Corps with assistance from the Red Lake Band to insure that remedial actions needed are identified...Preliminary estimates of the cost to accomplish this work range from \$15,000 to \$30,000 and are being included in future Corps operation and maintenance budgets. These costs are part of the normal operation and maintenance responsibilities of the project and do not require an economic justification.”

The report went on to state, “fish and wildlife habitat restoration planned for when the marsh restoration project was implemented has not been fully realized. There is a need to further evaluate the project to see if additional habitat enhancement/restoration opportunity exists.”

However, instead of assuming that the responsibility for funding these enhancement/restoration investigations should be accomplished with operations and maintenance money, as District Engineers had done in the past, the report stated that “this can be accomplished under a new environmental projects authority, Section 1135 of the 1986, Water Resource Development Act, and should be further coordinated with the Red Lake Band and other interested parties.” Section 1135 requires a 25 percent non-Federal cost share sponsor.

Colonel Craig stated in the 1992 reconnaissance report recommendations that: “The Corps should fully restore the existing project below the Red Lake control structure on the Red Lake Indian Reservation and work with the Indians to realize additional wetland restoration on the Indian Reservation...The above Federal actions should be actively pursued using available

Federal operations and maintenance funding and, whenever a cost-sharing sponsor can be found, through funds provided under Section 1135 of the 1986 WRDA.”

Dredging of the intake structures in the marsh was completed in the mid 1990s using Corps operation and maintenance funds.

## **Red Lake Band of Chippewa Indians Marsh Restoration Comments on the 1995 Environmental Assessment**

In 1995, the Red Lake Band of Chippewa Indians sent formal comments on an Environmental Assessment the Corps of Engineers had drafted to address proposed modifications to the Red Lake Water Control Manual. In these comments, the Band stated:

### “Marsh Restoration

In the Environmental Assessment the Corps states that “...the Zah-Gheeng marsh restoration project was completed in 1967.” In fact, the Zah-Gheeng marsh restoration has never been accomplished. While it is true that after the 1967 alterations the area was reflooded, this does not equate to restoration. To this date, the Zah-Gheeng does not function to any semblance of its former self, does not support the species assemblage that existed in the pre-project condition, and still requires extensive alterations in order to reach an acceptable degree of waterfowl and furbearer production.”

The Red Lake Band concluded that the Corps Environmental Assessment was not detailed enough to determine that there would be a Finding of No Significant Impact due to changes in the Water Control Manual. One of the Band’s summarizing comments was:

“2) There is no question in most peoples’ minds that the Red Lakes Project has caused significant environmental impacts for nearly five decades, and continues to do so today. It is not appropriate, under any circumstances, to conclude that a change in operation of the project does not pose a significant environmental impact relative to the baseline, when the baseline itself causes significant environmental impacts. This should make intuitive sense.”

## **1997 Quality Control Plan**

During the mid 1990s, the Corps began investigations to determine what was occurring in the marsh. Corps biologist Peter Fasbender wrote, “Current conditions in Zah Gheeng indicate excessive high water. The main vegetative component within this system is floating cattail/sedge. Root masses in peat pulls away from mineral soils or from peat layers during excessive high water conditions and creates the floating mats of cattail. Biological productivity is very low in these situations - and is low in Zah Gheeng.”

A statement in a comment letter from the USFWS included in the 1975 EIS has significance in light of the floating bog conditions currently found in the north marsh. The letter, dated February 1995, states, “We have been advised by Mr. Floyd W. Jorgensen, University of Minnesota Agricultural Extension Agent, that under normal conditions the north Zah Gheeng

marsh area can be drained only back into Lower Red Lake.” Preliminary gage reading data indicates that the water levels in the north marsh continue to be higher than the lake.

In October 1996, a Quality Control Plan (QCP) was drafted to review the habitat and operational deficiencies of the Zah Gheeng Marsh. The QCP was finalized in December 1997 with the following objectives:

“This is the first of a two step process to evaluate the operation and maintenance plan for the Zah Gheeng Marsh. The operation and maintenance plan for the Zah Gheeng Marsh was developed in 1965. The environmental requirements for the operation of the Zah Gheeng marsh will be evaluated and used to review and update the plan as necessary. The draft plan will be coordinated with the Bureau of Indian Affairs and the U.S. Fish and Wildlife Service. The Red Lake Band of Chippewa Indians will be consulted. This work will also include the installation of staff gages at the inlet and outlet structures to the Zah Gheeng Marsh. Water Control Section will oversee the operation of the plan and the Mississippi River Headwaters Project Office will perform the field operations. An annual letter from the FWS may be required to determine how the project is operated. The Red Lake Band of Chippewa Indians will be asked to add a weekly reading of the Zah Gheeng Marsh gages to their weekly readings. If the marsh cannot be operated or does not respond to operation according to the plan then the second step, which will require further studies, will be implemented.”

Gages were installed in 1998, and the Red Lake Department of Natural Resources began recording gage readings in the spring of 1999. At this time, the QCP is yet to be completed, but work is currently occurring on rectifying and analyzing the gage reading data.

## **NOTES:**

*The 1975 EIS stated:*

*[Page 56]*

*“Past, present and proposed actions and their associated impacts must be considered not only in relation to the specific lake plain affected but also to the greater area and public served by the project.*

*“In pursuit of greater agricultural productivity this project was conceived and undertaken in 1948. Clearly, the natural resources of the Indian lands assigned to future agricultural development were undervalued. Both Government and local leaders overestimated Indian interest in farming. The judgment that farming would better support the local population proved to be either faulty or, perhaps, premature.*

*“In the case of the dried-up marshlands the logical question arises as to whether all or part of the land should be saved for future agricultural development, or should it, in response to the present needs and preferences of the local inhabitants, be restored....”*

[Page 57]

*“As far as the marshes are concerned, it is possible that extensive restoration can be successfully undertaken. One way would be to restore the River to its original channel, as most of the Reservation residents interviewed would prefer, but if this is infeasible, the loss of its original meandering, slower velocity and larger fish would constitute an irreversible and irretrievable commitment of resources. The period of years which have passed since the 1948-1952 project have undoubtedly brought forth severely diminished wildlife species.”*

*Regarding Marsh Operations:*

*Chapter 9 - COORDINATION, Letters of Comment:*

[Page 82]

*“1.11 Marsh Outlets: We have been advised by Mr. Floyd W. Jorgensen, University of Minnesota Agricultural Extension Agent, that under normal conditions the north Zah Gheen marsh area can be drained only back into Lower Red Lake.”*

*The 1943 Corps of Engineers Letter Report to Congress*

*Regarding why the River was Channelized at the Dam*

*Section 39 – “Prior to the construction of the dam at the outlet of lower Red Lake the maximum outflow from the lake is estimated to have been about 2,000 second-feet. During the period 1931-41, inclusive, since the construction of the dam, the maximum discharge was 516 second-feet on November 16, 1941.”*

*Section 122 – “Determination of outflow capacity – In view of the vast amount of storage capacity in Red Lakes, a relatively large increase in the discharge, within economic limits of channel capacity, would hardly any appreciable effect on the height to which the lakes would rise as the result of an intense storm. Therefore, the rate of discharge should be only such as to permit lowering the lakes, after an intense storm, sufficiently to accommodate the inflow from the next large storm. Assuming that an intense storm should occur as late as October, a discharge of 1,000 second-feet during the fall and winter months would lower Red Lakes a sufficient amount to provide storage to care for the run-off from the following snow melt and spring rains, which studies indicate does not normally exceed one foot. This rate of discharge is therefore chosen for the outflow capacity of the Red Lake Dam.”*

*Section 130 – “General considerations for channel improvement – The improvement of the Red Lake Channel should provide capacity for the transportation of maximum proposed release from Red Lake Dam (1,000 second-feet) below bankfull stage, thereby providing outlets into the channel for normal drainage from tributary ditches.”*

## History of the Fish Escapement Problem

The 1931 dam structure built by the Indian Service consisted of four stop log bays. In 1951, the Corps completed work on the structure including converting three of those bays to slide gates. Reportedly, the combination of the conversion to slide gates and the increased head differential resulting from the channelization of the river, which slightly increased velocity of the water leaving the lake (approximately 0.2 ft/s increase), may have caused fish to congregate below the dam. The Red Lake Band has expressed concerns regarding the congregation of fish and their apparent inability to negotiate the structure since 1951. No records have been located that indicated whether fish congregated below the dam, or were able to negotiate the former structure prior to 1951.

The Corps took over the project from the Department of the Interior Indian Service in April 1951; by May of that year, it received the first concerns voiced by the Red Lake Band regarding fish passage. Mr. Frell Owl, Superintendent of the Red Lake Indian Agency, had reported that northern pike were congregating below the outlet structure on their return to Red Lake from their annual spring migration. To facilitate their migration, Mr. Owl asked the Corps to remove some of the stop logs from the bay – which they did. As a result of that experience, the USFWS suggested that consideration be given to installing a fishway in the outlet structure. The Indian Service referred the question of the fishway to the Minnesota State Department of Conservation, and specifically to Dr. Lloyd Smith, University of Minnesota, who was making an annual study of the Red Lake fishery. The Department of Conservation did not believe the loss of fish would have a detrimental effect on the fishery and did not recommend a fishway be built.

In May 1952, Mr. Owl reported, “There are literally thousands of suckers milling about below the structure.” Northern pike were also seen below the dam. Mr. Owl stated that manipulation of the stop logs the previous year had allowed fish to pass through the dam, but this year it appeared that more fish were failing to negotiate the structure. He asked that the Corps and the USFWS study the fish passage condition. Mr. Robert Buselmeier, biologist with the Corps Planning & Reports Branch, met with Mr. Owl at the dam. Mr. Buselmeier wrote that while there were large numbers of suckers below the dam and some northern pike, perch, and walleye, it appeared that fish were able to negotiate the dam after a few tries.

While Dr. Smith did not believe a fishway would have any impact on the fishery, all were beginning to recognize the political implications of it. In 1953, a non-Tribal member, Chester Wilson from Baudette, Minnesota, wrote a letter regarding a large fish kill of suckers below the dam that presumably could not get through the outlet. Mr. Wilson stated, “Why isn’t there a fishway made in the dam so the fish can get in the lake?” The question of placing a temporary Denil-type fishway, while not justified economically or biologically, was considered seriously by Mr. Buselmeier because “considerable unnecessary time and expense to this office might be eliminated each spring when the problem recurs, if a fishway were provided, as requested by the Indian superintendent.”

The Corps of Engineers placed a temporary fishway at the dam in 1954. In 1954 and 1956, fish coming through the fishway were netted to check its effectiveness. These netting operations revealed that fish using the fishway were almost entirely “undesirable species.” Additionally,

the lower end of the structure was often out of water below the dam due to fluctuating river levels. In consultation with the Bureau of Indian Affairs, the fishway was determined to be ineffective and was abandoned.

While the fishway could not be justified economically or biologically, the Red Lake Band still wanted fish to have the ability to move freely from lake to river and back again. On April 18, 1962, Tribal Resolution No. 28-61 was passed which requested, among other things, that a fish ladder be constructed at the dam. The Corps did not build the fish ladder.

## **The 1975 Environmental Impact Statement and Fish Escapement**

The 1954-1956 fishway trial noted above and the out-migration of fish were explored in the 1975 EIS. The report states that the “dam probably has little effect on production of walleyes” and the Red Lake River is of comparatively little importance in walleye spawning activity, whereas the Tamarack and Blackduck Rivers “are the most important spawning streams for walleye in the spring.” However, the EIS states, “The effects of the dam on fish harvest, as perceived by the tribe, are significant. Many, and perhaps the majority, of the tribal members and tribal authorities believe that the dam is taking away fish and minnows which rightfully belong to the lake. They appear to be frustrated and angered by the inability of the fish to return to the lake.” The EIS stated, “A physical device, such as a channel or fishtrap which would allow fish to return to the lake may be necessary to alleviate this concern of the tribal members.”

## **The Environmental Assessment – 1995**

The 1995 Environmental Assessment for the Modifications to the Water Control Manual states:

“The outmigration of fish through the dam and the inability of fish to migrate from the Red Lake River to Red Lakes has been and remains a source of concern to tribal interests. A study of the passage of fish through Red Lake Dam was completed as part of this project review process [1995 USFWS Red Lake Dam Fish Study]. The results of this study indicate that the passage of fish through Red Lake Dam is related to discharge. Higher discharges result in more fish passing through the dam. There also appears to be a seasonal aspect to the fish passage phenomenon. Few fish pass through the dam during the winter months. The hydraulic conditions present at the dam serve as an effective barrier to migration of fish from the Red Lake River to Red Lakes. As a result, large concentrations of fish congregate below the dam during the spring and early summer of the year. It is assumed many of these fish would migrate into Red Lakes if the dam were not in place, however, the tailwater area of the dam may also serve as an important spawning area for the riverine species that reside in the Red Lake River throughout the year. The effects of the dam on both the commercial harvest of fish from Red Lakes and more generally the fish populations of Red Lakes was assessed by comparing commercial harvest figures to the estimated number of fish “lost” from Red Lakes as a result of passage through the dam. This assessment reveals that, when compared to commercial harvest of fish from Red Lakes, the passage of fish through Red Lakes Dam is comparatively small (Yager 1995). Prevention of fish outmigration might result in minor increases in fish harvest.”

The Environmental Assessment stated: “Reducing or eliminating the loss of fish over Red Lake dam could provide very minor benefits to the fish populations of Red Lakes. Additionally, a fishway might restore ‘connectivity’ between the river and lakes. However, the influence of harvest, both regulated and unregulated, would overshadow these benefits.”

## **Red Lake Band of Chippewa Indians Fishway Comments to the 1995 Environmental Assessment**

Tribal members have long held that fish going through the dam and not being able to return to the lake are both an economic and a spiritual loss for the Tribe. Commenting on the 1995 Environmental Assessment, the Band wrote:

“Fish loss through movement under the Corps-modified dam has been a problem ever since it was installed. It is not likely that this was a problem prior to then, as the BIA-constructed dam acted as a fixed crest spillway, which produces much less current to entrap fish. The fish escapement issue will be very difficult to resolve...we believe the solution to the problem is within [the Corps of Engineers’] means.

“Each fish has a spiritual significance, one fish itself has great meaning. Their spirits cannot return to their home.”

In the same document, the Band makes the following comments regarding their financial loss:

“To illustrate our point that fish out migration results in substantial revenue loss, using data prepared by the Corps, the value of fishery resource to the Band during just the 1990s, which would have been realized had fish out migration been prevented, approaches \$.5 million.”

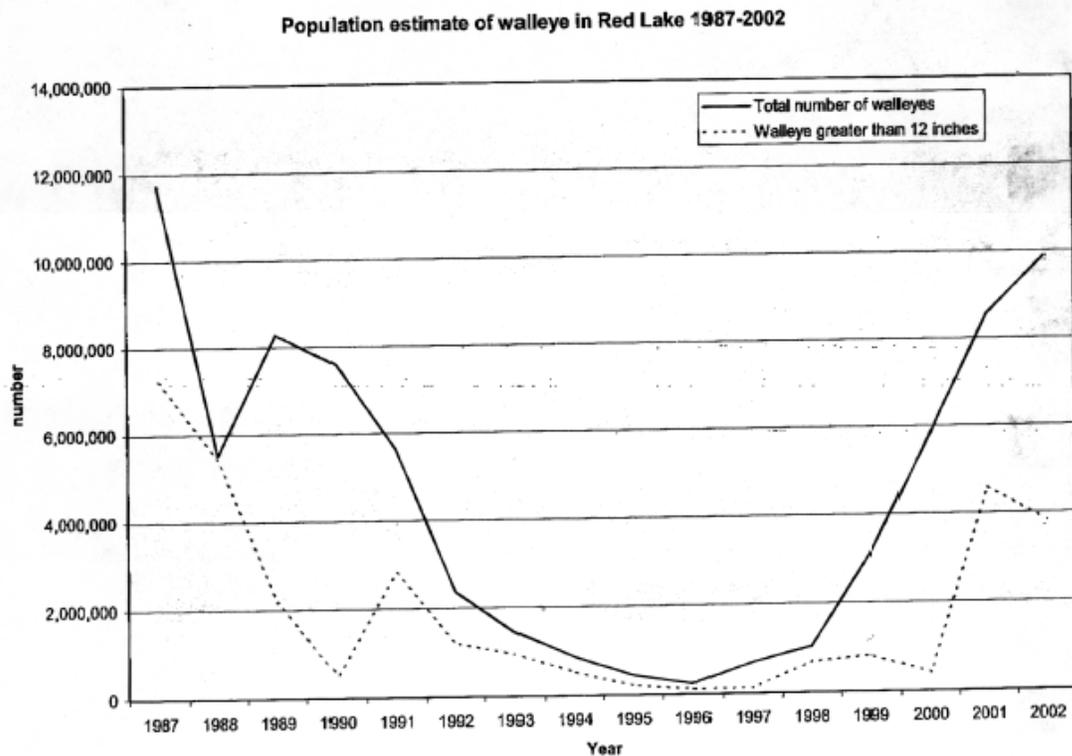
## **Additional Studies 1995-1999**

In 1995, the USFWS completed the Red Lake Dam Fish Study. In this study, the USFWS confirmed that, “fish do pass through the dam gates during all seasons and under various discharges. More fish passed through the dam at higher discharge rates. Due to the hydraulic conditions of the stilling basin, the dam also serves as a barrier for the upstream migration of fish into the Red Lakes.” Additional information on this study was mentioned in the 1995 Environmental Assessment referenced above.

In 1997, the Corps contracted with Stanley Consultants to investigate “alternatives to reduce the permanent out-migration of fish from Lower Red Lake through the dam into the Red Lake River.” The alternatives examined the prevention of all life stages of all fish species through the Red Lake dam and the restoration/enhancement of the upstream passage of all life stages of all fish species through the dam into Red Lake. Numerous alternatives were examined, of which nine were selected for comparison of costs and operation and maintenance requirements.

Discussions were held with the Red Lake DNR and the Red Lake Tribal Council regarding approaches to stop the out-migration of fish. In 2000, a verbal agreement was reached with the Tribal Council to attempt to stop fish out-migration by placing stop logs in front of the dam's slide gates. In June 2002, the Red Lake DNR informed the Corps that this approach was not working. Not enough stop logs were placed in front of the slide gates to stop fish from going through the dam. Additional stop logs could not be added without negatively affecting discharge rates.

In 1999, the USFWS, in cooperation with the Red Lake DNR, surveyed the Red Lake River downstream of the dam to determine if carp were established within the Red Lake River on the Red Lake Indian Reservation. The study found no carp, but did capture 12 walleyes that were later found to have come from Red Lake (the walleyes were marked upon their release during stocking efforts). The USFWS survey report states that the fish out-migration problem "will continue to be of major importance to the Tribe and should be addressed."



In November 2002, Pat Brown, Red Lake DNR Fisheries biologist, wrote that the fish surveys conducted by the USFWS, the Corps, and the Red Lake DNR in 1995 did not find any walleye migrating through the dam; "however, when looking at the population data, walleye were at an all time low during this time, and it is not surprising that during this limited study period walleye were not seen. Currently the Red Lake Band is in the 6<sup>th</sup> year in trying to recover the walleye stocks and the population has dramatically increased since this [1995] study was conducted. Since 1999 the Band and the State have stocked over 79 million walleye fry in Red Lake... We have not done a follow up study [to the 1999 study noted above] but walleye captures under the dam have dramatically increased over the last few years and the majority of the walleye caught

are the same size as the stocked 1999 year class, strongly suggesting that they also originated from Red Lake and are attempting to return to Red Lake...walleye lost through the dam will not be able to spawn in the lake to assist in the recovery effort in the future. If a fish bypass was constructed walleye would be able to return to the lake and assist in the recovery effort.”

Pat Brown concluded, “The fish out migration issue is not going to go away and is one of the most important resource issues on the Reservation. Most tribal members feel that the dam is not being operated for the benefit of the Band, but solely used for downstream flood control interest. Construction of a fish bypass around the dam will greatly help the ACOE [Army Corps of Engineers] reputation on the Reservation. It will also show the people of Red Lake that the ACOE is listening to their concerns and is working to address these concerns. This will not take care of all the issues concerning the dam, but will be a huge step in the right direction in resolving them.”

### **Colonel Kenneth Kasprisin - 2001**

During a visit to the Red Lake Indian Reservation in May 2001, Colonel Kenneth Kasprisin, St. Paul District Engineer, discussed the fish passage issue with Tribal leaders. Upon his return from that visit, Colonel Kasprisin asked that a fish passage structure be included in a Red Lake dam rehabilitation contract that was under construction at that time. After some research, the Corps Office of Counsel determined that the existing contract could not be modified to include constructing a fish passage, as such a modification was outside the scope of the original contract.

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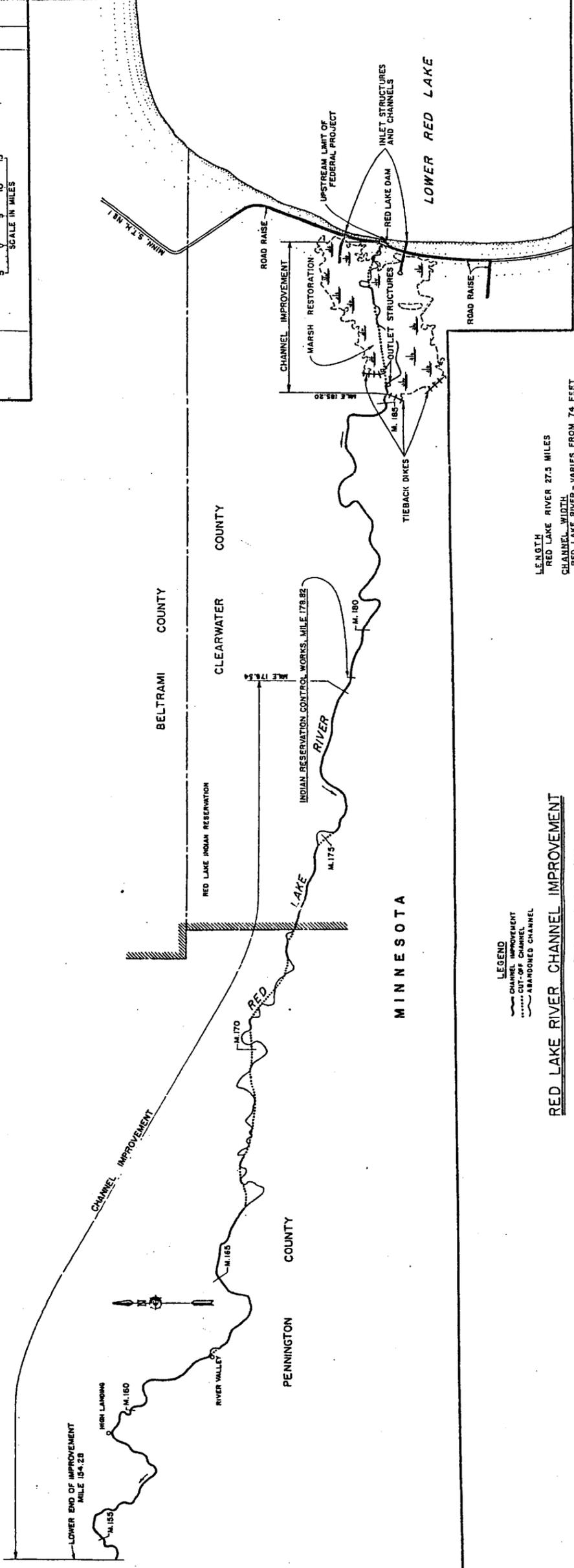
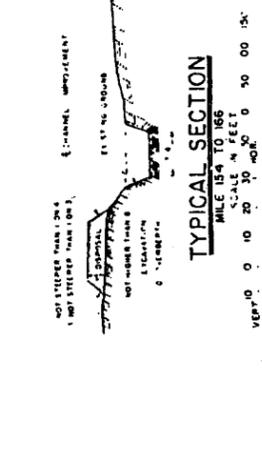
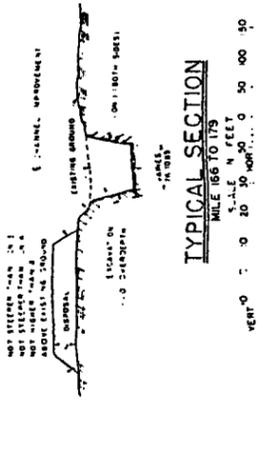
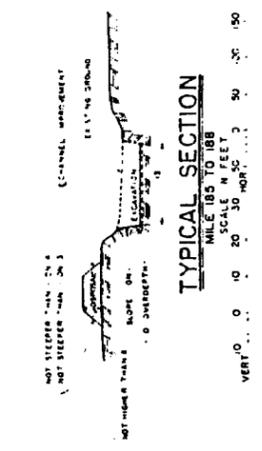
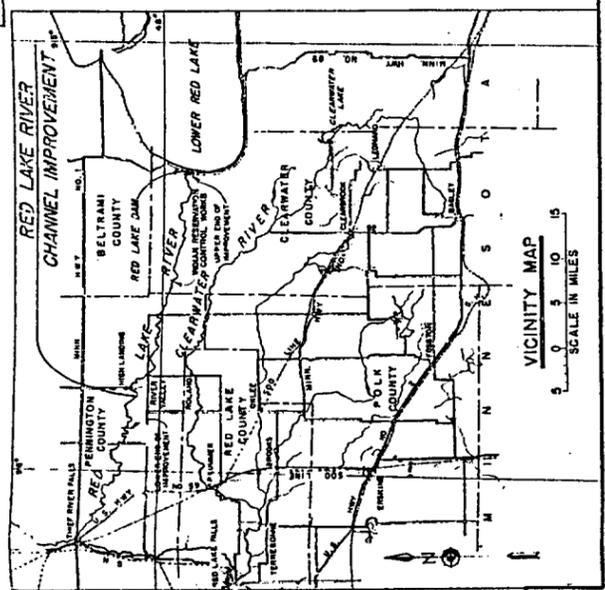
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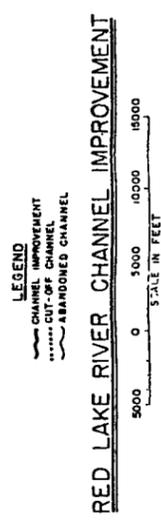
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LENGTH  
RED LAKE RIVER 27.5 MILES  
CHANNEL WIDTH  
RED LAKE RIVER - VARIES FROM 74 FEET  
TO 113 FEET.

DESIGN CAPACITY, RED LAKE RIVER, 1,000 SEC.-FT.  
AT UPPER END TO 1,520 SEC.-FT. AT LOWER END.  
THIS WILL PROVIDE FOR FLOODS WITH 10 YEAR  
FREQUENCY WITH APPROXIMATELY 1 FT. FREEBOARD.



FLOOD CONTROL PROJECT  
RED LAKE RIVER, MINN.

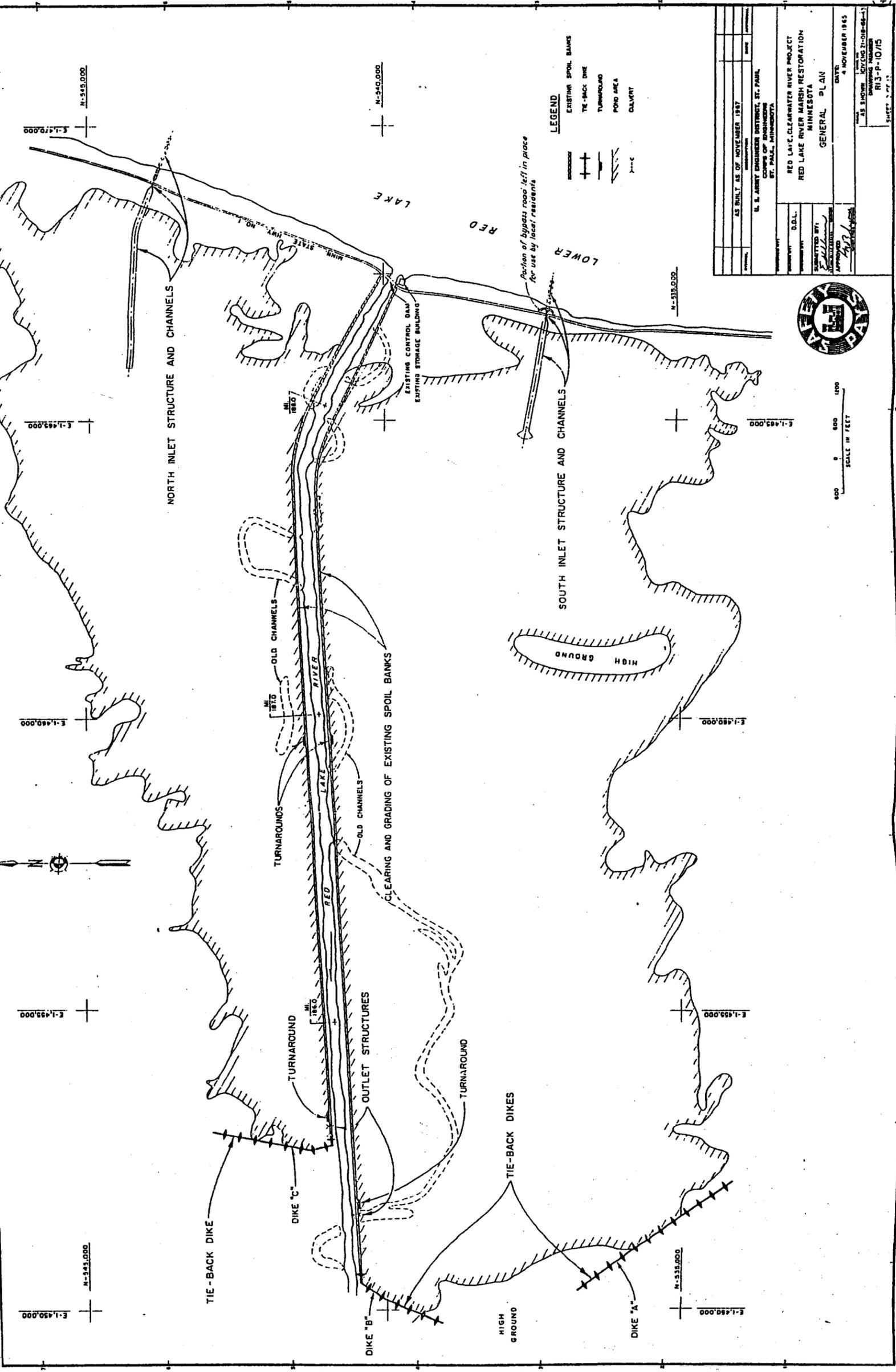
PROJECT MAP

M. 150 - MILES ABOVE MOUTH

IN 2 SHEETS SCALE AS SHOWN SHEET NO. 1

CORPS OF ENGINEERS U. S. ARMY  
OFFICE OF THE DISTRICT ENGINEER  
ST. PAUL DISTRICT ST. PAUL, MINN.  
30 SEPTEMBER 1977

STANLEY CONSULTANTS



Portion of bypass road left in place for use by local residents

- LEGEND**
- EXISTING SPOIL BANKS
  - TIE-BACK DIKE
  - TURNAROUND
  - POND AREA
  - CULVERT



DESIGNED BY	AS BUILT AS OF NOVEMBER 1987
DRAWN BY	U. S. ARMY ENGINEER DISTRICT, ST. PAUL, MINNESOTA
CHECKED BY	RED LAKE RIVER MARSH RESTORATION MINNESOTA
APPROVED BY	GENERAL PLAN
DATE	4 NOVEMBER 1965
PROJECT NUMBER	713-P-10/15
SHEET NUMBER	2 OF 2

FIGURE I-2 PROJECT PLAN  
SOURCE: CORPS OF ENGINEERS