REPORT OF THE

INTERNATIONAL JOINT COMMISSION

CANADA AND UNITED STATES

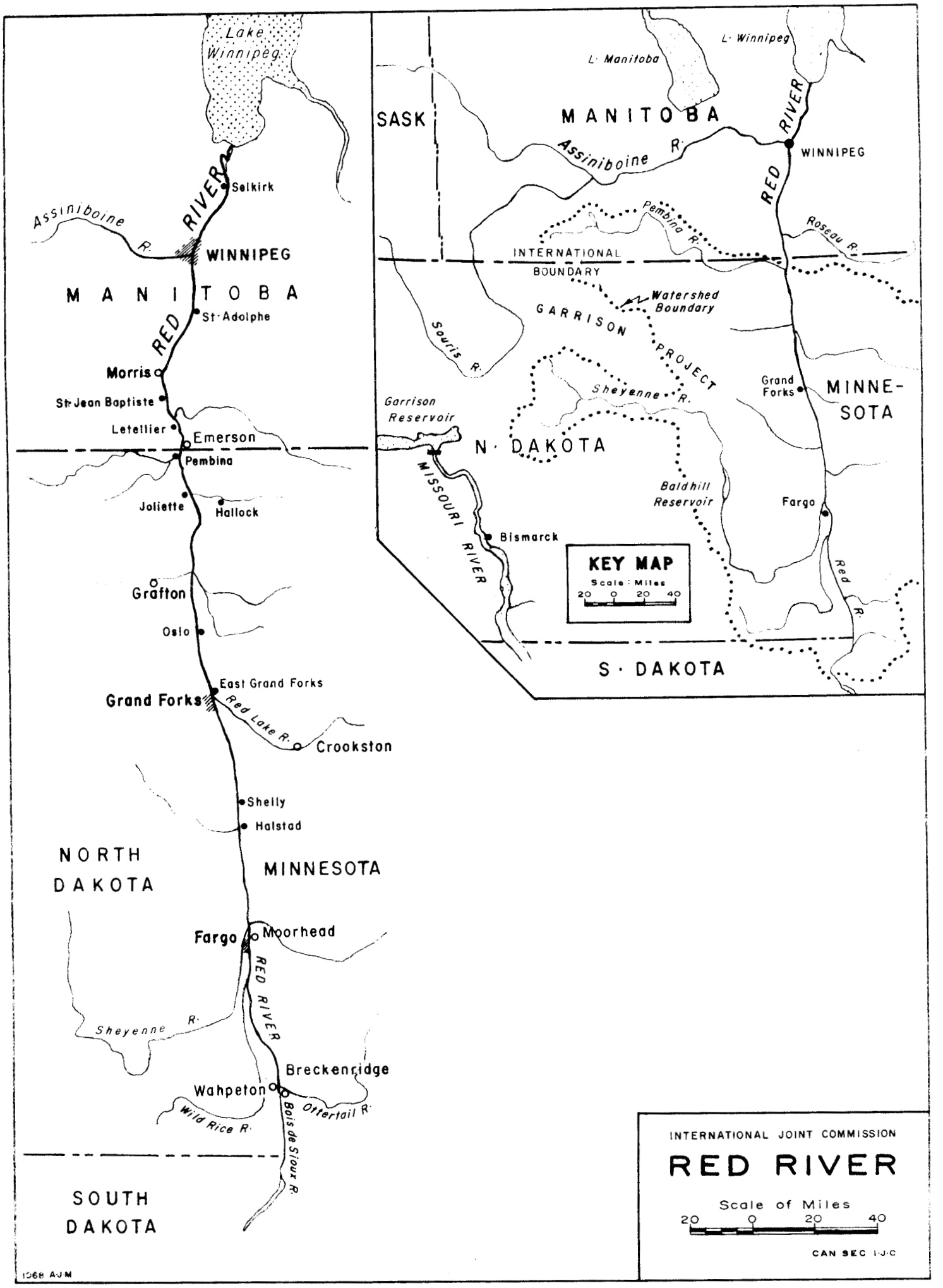
ON THE

POLLUTION

OF THE

RED RIVER

APRIL 1968


Lake Winnipeg
Selkirk
RED RIVER
Assiniboine R.
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MANITOBA
St-Adolphe
Morris
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Letellier
Emerson
Pembina
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Hallock
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East Grand Forks
Grand Forks
Red Lake R.
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Breckenridge
Wahpeton
Wild Rice R.
Ottertail R.
Bois de Sioux R.
SOUTH DAKOTA
L. Manitoba
L. Winnipeg
SASK
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RED RIVER
WINNIPEG
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INTERNATIONAL BOUNDARY
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Souris R.
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KEY MAP
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Report on the

POLLUTION OF THE RED RIVER

The Red River (known in the United States as the Red River of the North) is close to the geographical centre of North America. It forms the boundary between the States of Minnesota and North Dakota before corssing the international boundary into the Province of Manitoba. The direction of flow is from south to north.

Public authorities in the several jurisdictions involved have been aware that the Red River suffers from a degree of pollution; and that the recent increase in urbanization and industrialization of the area has aggravated the problem.

On October 1, 1964 the Governments of Canada and the United States requested the International Joint Commission to inquire into and report on whether the waters of the Red River are being polluted to an extent which is causing or likely to cause injury to health or property on the other side of the boundary; if answered in the affirmative, to what extent, by what causes, and in what localities is such pollution taking place, and what remedial measures would be the most practicable from the economic, sanitary and other points of view.

The text of the Reference is quoted in full in the Appendix.

CONDUCT OF THE INQUIRY

In accordance with its usual procedure in such investigations the Commission created the International Red River Pollution Board and in December 1964 appointed to it senior officials from the appropriate agencies in the five jurisdictions concerned with pollution of the Red River. They were engineers from the Canadian Department of National Health and Welfare, the Manitoba Department of Health, the Water Control and Conservation Branch of the Manitoba Department of Highways, the United States Federal Water Pollution Control Administration, the Minnesota Departments of Health and of Conservation, the North Dakota Department of Health and the State Water Conservation Commission. A list of members of the Board and participating agencies is set out in the Appendix.

The Board was directed to undertake, through appropriate agencies in Canada and the United States, the necessary technical investigations and studies, and, to avoid unnecessary duplication, make use of relevant information acquired by agencies in Canada and the United States.

During the course of its investigation the Board presented four semi-annual progress reports. At the conclusion of its studies the Board submitted a report in two volumes dated October, 1967. Volume I is a summation of data acquired

during the 1965-66 investigation. Volume II contains the basic data of the water quality survey, reports from the various committees and summaries of other recent reports relevant to the Commission's inquiry.

The Commission inspected the Red River from Lake Winnipeg to Fargo on November 8, 9 and 10, 1966 when the sugar beet and potato processing plants in the United States were in full operation. The Commission examined typical industrial and municipal waste treatment facilities along the Red River from the international boundary to Fargo.

The Commission made the Board's Report available to the public and then held public hearings at Grand Forks, North Dakota and Winnipeg, Manitoba on December 4 and 5, 1967.

The primary concern of the Commission in this investigation was the water quality of the Red River at or immediately south of the Canada-United States boundary. In order to provide a complete picture it was necessary to consider the usage of the River in both countries, the sources of waste and their treatment.

THE RED RIVER

The Red River originates near the south-east corner of North Dakota and flows in a northerly direction for 550 miles to Lake Winnipeg. Approximately 395 miles of the Red River are in the United States, 155 in Canada. It forms the boundary between the States of Minnesota and North Dakota. The principle communities on the banks of the River are Breckenridge, Moorhead and East Grand Forks in Minnesota; Fargo, Grand Forks and Pembina in North Dakota; and Emerson, Morris and Metropolitan Winnipeg in Manitoba.

Physical Features

The Red River meanders in the centre of a broad, flat, featureless plain which was once the bed of an ancient glacial lake. This fertile plain varies in width from 15 miles in the headwaters area in the United States to 100 miles in the downstream area near Winnipeg. Its elevation gradually drops from 980 feet above mean sea level at the source to 790 feet at the international boundary, and to 720 feet at Lake Winnipeg. The drainage area at the international boundary is 40,200 square miles of which 2,000 are in Canada.

The average slope of the River is about six inches per mile. Between Grand Forks and Winnipeg the slope is three

inches per mile. In this reach the channel width is approximately 500 feet and the average depth about 40 feet. The flow is usually sluggish.

The principal tributaries are the Wild Rice, Sheyenne, Pembina and Red Lake Rivers in the United States and Assiniboine River in Canada.

Hydrology

The climate of the Red River Basin is characterized by wide variations in temperature and precipitation. The average annual precipitation varies from 25 inches in the southern portion to 20 inches in the northern portion of the Basin. Snowfall accounts for 25 per cent of the precipitation at Winnipeg and 15 per cent at Fargo. The ice cover on the River at Fargo breaks up several weeks before ice bound conditions disappear at Winnipeg.

Most of the runoff from the watershed occurs during the spring. Rains when combined with the melting of accumulated snow have been responsible for major floods. After the spring flood has passed the flows gradually drop to a minimum during the late fall and winter months. Natural storage in the eastern part of the Basin reduces rapid fluctuations in flow resulting from deficient or excessive precipitation. Ground water contributes little to the flow of the river due to the impervious subsoil of the watershed.

This not only reduces the base flow of the River, but also minimizes the natural salt content in its waters.

The annual discharge of the Red River during the period of record, 1912 to 1966, at Emerson has ranged from 241,000 acre-feet in 1934 to 9,000,000 acre-feet in 1950.

February is usually the critical month for low flows. The mean monthly discharges for that month during the period 1956 to 1966 have ranged from 200 cfs in 1962 to 1,650 cfs in 1966. During the periods from 1912 to 1966 the average mean monthly flow was 590 cfs; and from 1956 to 1966 it was 700 cfs.

Economy

The economic study considered only those counties that border the main stem of the Red River in Minnesota and North Dakota and the rural municipalities bordering the River from the international boundary to the south limit of Metropolitan Winnipeg.

Population in the United States study area was 303,000 in 1960. By the year 2000 the population is expected to reach 575,000, with 495,000 concentrated in urban centres.

The population in the Canadian study area in 1966 was 21,000, with 75 per cent residing in rural areas. The total population is expected to remain stable and the trend to urbanization will continue.

Agriculture, its related food processing industries, trade and service enterprises is and will continue to be the most dominant element in the economy of the Red River Valley in North Dakota and Minnesota. Sugar beets and potatoes are the most profitable crops grown. The rich black loams are also well adapted to raising small grains and flax. About two-thirds of the farm income is from the sale of crops; the remaining one-third from livestock.

Potatoes and sugar beets are processed near the production areas because of their bulkiness and weight. In 1966, four sugar beet refineries in the United States processed approximately 1.7 million tons of sugar beets. The sugar beet production is controlled by the Sugar Act of 1948. If acreage allotments are not imposed, sugar beet production could increase 400 per cent by the year 2000. In 1962 only 12 per cent of the total potato production was processed in the area, 21 per cent was shipped out for potato chip processing and the remaining 67 per cent was sold for fresh and tablestock use. Potato processing is expected to increase about 20 per cent by the year 2000.

The economy in the Manitoba portion of the Red River Valley is based almost entirely on agriculture. The primary crops are small grains but some specialty crops, such as sugar beets and sunflowers, are also grown. Turkey raising

is an important factor. The manufacturing industries include a vegetable oil plant, welding and iron works and a garment factory. Sugar beets are shipped to Winnipeg for processing.

THE BOARD'S INVESTIGATION

A water quality survey south of the international boundary was initiated by the United States Public Health Service before this Commission received the Reference of October 1, 1964. This survey was conducted in three periods, September 1964, November 1964 and January 1965, to obtain the effect of wastes on the chemical, biological and bacterial quality of the River under three distinct types of loading. The first period was during open water with no discharge from sugar beet and potato processing plants; the second when those wastes were being discharged under open water conditions; and the third when municipal and industrial wastes were being discharged under an ice cover. There was no need for the International Board to repeat the survey of the River in the United States the following year.

The results of the above survey were considered at an interstate enforcement conference on pollution of the Red River of the North and its tributaries held in Fargo on September 14, 1965. The conferees were officials from the United States Public Health Service, the State of Minnesota and the State of North Dakota. The results of the survey and the conference were made available to the Board and were incorporated in its report to the Commission.

The Commission's International Red River Water Pollution Board made a similar survey of the River north of the international boundary between September 1965 and August 1966. The field work was conducted by the Manitoba Department of Health in collaboration with the Minnesota and North Dakota Departments of Health.

Water samples were analysed for coliform organisms, pH (hydrogen ion concentration), temperature, dissolved oxygen, biochemical oxygen demand, suspended solids, alkilinity, hardness, chlorides and sulphates. The analytical procedures employed in this survey and in the United States survey described above conformed to standard methods. A water quality monitor was installed at the water treatment plant at Emerson to provide continuous measurement of dissolved oxygen, temperature, conductivity, pH and chlorides. In addition, a comprehensive biological study assessed the benthic organisms in the Red River north of the boundary during the open water period in September and October, 1965, and the ice-bound conditions in December, 1965 and January, 1966.

The Board selected two stations in the United States to correlate the 1964-65 and 1965-66 surveys. The only variations of any significance were higher dissolved oxygen values and lower concentrations of sulphates and chlorides. These were due to cooler water temperatures and higher flows in the river.

PUBLIC HEARINGS

Following receipt and review of the Board's report on the water quality of the Red River, the Commission sent copies to appropriate Federal, Provincial, State and Municipal officials. Copies were also made available for public inspection at the seven locations in the area as indicated in the Public Notices. In accordance with the Commission's Rules of Procedure notice of Public Hearings were published in the Canada Gazette, in the United States Federal Register, and in two local newspapers on each side of the boundary.

Public Hearings were held at Grand Forks, North Dakota and Winnipeg, Manitoba on December 4 and 5, 1967. All present were encouraged to convey relevant information to the Commission and express their views.

Although ample opportunity was provided, no one expressed any dissent or wished to supplement the conclusions and recommendations set out in the Board's report and read at both Public Hearings.

FINDINGS

After considering the results of the investigation and reviewing the transcript of the Public Hearings, the Commission arrived at the series of findings outlined below.

Multiple Uses of the Red River

Domestic Water Supply: The Red River and its tributaries are used as a source of domestic water supply for 56,000 people in Minnesota, 104,000 in North Dakota and 2,600 in Manitoba. The Red River is the sole source of water for the Canadian communities of Emerson, St Jean and Morris. Ground water supplies in the area between the international boundary and Metropolitan Winnipeg and west of the River are generally brackish and unfit for most uses.

Industrial Water Supply: Industrial use in the United States is estimated to be 15 mgd (million gallons per day). The principle users are sugar beet and potato processing plants. The steam-electric generating plants at Fargo and Grand Forks use approximately 30 mgd of river water for cooling purposes. In Metropolitan Winnipeg a sugar beet refinery, an oil refinery and numerous smaller industries use the river water for both process and cooling purposes.

Recreation: The Red River is not extensively developed for recreation. Water contact sports such as swimming are very limited and future development of this form of recreation is not anticipated. Fishing was observed in all areas particularly near Fargo and East Grand Forks.

Irrigation and Stockwatering: Surface water is used for some irrigation and for stockwatering. The quality of ground water supplies is not chemically suitable for these purposes.

Waste Disposal: The Red River and its tributaries are used for the final disposal of wastes from the treatment plants and waste stabilization lagoons of adjacent municipalities and industries.

Potential Sources of Pollution

In the area under study over 68,000 persons in Minnesota and 129,000 persons in North Dakota were served by sanitary sewers in 1965. All municipalities had waste treatment facilities with the exception of Halstad, Minnesota with a population of 580, Climax, Minnesota with a population of 280, and Walhalla, North Dakota with a population of 1,500. Halstad had secondary treatment facilities with chlorination under construction in 1967. Climax is under orders to have its facilities in operation in 1968. It is expected that Walhalla will have a treatment plant in operation by November 1968.

Half of the above population are served by the conventional treatment facilities at Fargo and Moorhead; approximately 45 per cent utilize municipal waste stabilization ponds; and the remaining 5 per cent are served by either primary or secondary treatment plants.

The Red River receives continuous discharge from the treatment facilities at Fargo and Moorhead. Fargo has a conventional secondary treatment plant. Moorhead, in 1967, was expanding its primary treatment facilities to provide secondary treatment with chlorination.

Discharge from the municipal waste stabilization ponds or lagoons to the River or its tributaries is now controlled and is permitted only during the spring flush in April and May. The practice of emptying lagoons in the fall to make ample space available for winter storage has been discontinued.

The sugar beet processing plants at Moorhead, Crookston, East Grand Forks and Drayton use holding ponds designed primarily for storage of sugar beet wastes which contain a high level of organic matter, sugars and nutrients. The ponds have provided good removal of solids and incidental reductions in BOD (biological oxygen demand). Discharge from these lagoons is permitted only during the spring flush. Wastes from three food processing industries in Grand

Forks now are given primary treatment before direct discharge to the Red River, but plans are under way to divert these wastes into the municipal lagoon system. Potato washing and processing plants for the most part provide some treatment before their wastes are introduced to municipal lagoons. The remaining industries discharge their wastes into the municipal systems.

Implementation of the Garrison Diversion unit is expected to yield return flows from some 80,000 irrigated acres to the Sheyenne and Wild Rice Rivers, tributaries of the Red. The return flow, estimated to be 67,000 acre-feet annually, would enter the Red during the summer or early fall when the natural flow is low. The total dissolved solids content of the return flows, primarily sodium salts, is estimated to be about 1,350 ppm (parts per million). As a result, about 130,000 tons of salts could be introduced to the Red River each irrigation season and could have an adverse effect on the quality of water crossing the international boundary.

Water Quality at the International Boundary

The water quality of the Red River at the international boundary did not have the excessive concentrations of bacterial pollution and suspended solids or the low dissolved

oxygen values found below the municipal and industrial out-falls upstream in the United States. The degree of pollution which existed at the boundary, during the 1965-66 investigation, was determined using eleven parameters. A summary of the field data collected at Emerson, a mile north of the boundary, is in the Appendix. Only the parameters with significant concentrations are discussed below.

Coliform density: Domestic waste effluents contain enormous numbers of bacteria which include pathogenic organisms and bacteria of the coliform group. Pathogenic organisms can cause illness to humans since they are responsible for such gastro-intestinal diseases as typhoid and para-typhoid fever and diarrhea. Methods for the detection of pathogens are too complicated for practical use in extensive field determinations. The coliform group of bacteria which can be readily detected, are used to indicate the probable presence of pathogenic organisms because they always occur in excreta. The possibility of pathogenic bacteria being present in the absence of coliforms is extremely remote.

Wastes from the processing of sugar beets also have a high level of coliform concentrations. Studies are underway to establish the reason for this phenomenon.

Surface waters, particularly those subjected to human pollution, require treatment before they can be used as a safe source of drinking water. Such waters can be treated by conventional purification processes to provide a potable supply when the coliform densities are in excess of 5,000 per 100 ml. (Millilitres)

The highest mean monthly coliform density at the boundary occurred in January 1966. It was 4,550 MPN/100 ml (most probable number of coliform organisms per 100 ml when calculated from multiple tube dilution tests). In March the mean coliform density was 3,630 MPN/100 ml. By way of contrast the mean monthly coliform count for March at Oslo, Minnesota, 120 river miles upstream, was 63,000 per 100 ml.

Biochemical Oxygen Demand: Aerobic decomposition of organic matter requires oxygen. The amount of decomposable material contained in water can be estimated by determining the amount and rate of oxygen utilization. This determination is called the biochemical oxygen demand or BOD and usually designates the amount of oxygen consumed over a 5-day period at a constant temperature of 20^{o}C. Some of the oxygen deficiency in a stream can be replaced by acquisition of oxygen from the atmosphere and by photosynthesis, but normal levels will not be attained until all organic matter has been decomposed. A British Royal Commission on sewage

disposal to river systems suggested, with respect to BOD levels, the following river classification based on the standard 5-day BOD test: BOD - 1ppm "very clean", 2 ppm "clean", 5 ppm "doubtful" and 10 ppm "bad". One ppm (part per million is equal to one mg/l (milligram per litre).

The mean monthly BOD levels at the international boundary varied from 0.8 to 5.1 mg/l.

Dissolved Oxygen: Since oxygen is utilized in the bio-oxidation process which decomposes organic wastes, a measure of the dissolved oxygen level establishes the influence of organic pollution on the water quality of a stream. The dissolved oxygen content of water varies with the temperature. For example, at the elevation of this area water with a 100 per cent dissolved oxygen saturation contains approximately 14 milligrams of oxygen per litre when the water temperature is $0^{o}C$ (centigrade) and 8 mg/l when the temperature is $24^{o}C$.

A substantial reduction in dissolved oxygen causes suffocation of fish. Under average stream conditions 3.0 mg/l of dissolved oxygen or less should be regarded as hazardous; and to maintain the varied fish fauna in good condition the dissolved oxygen content should remain 5.0 mg/l or higher.

At the international boundary the mean monthly level of dissolved oxygen varied from 6.3 to 11.8 mg/l. The recorded minimum was 5.4 mg/l.

Suspended Solids: The concentration of suspended solids indicates the extent of pollution due to the discharge of solids into the river. All settleable solids including silt are suspended solids until they have settled on the bottom of the water course. The concentration of volatile solids is the measure of the organic material present. Analytical data on the concentration of suspended solids excludes floating material and bottom deposits.

The mean monthly value of the total suspended solids varied from 4 to 233 mg/l; volatile suspended solids varied from 2 to 44 mg/l.

There was a sharp increase in suspended solids at the international boundary in March 1966. It is believed to have been the result of a release from a lagoon when ice conditions still prevailed at the boundary.

Chlorides and Sulphates: The United States Public Health Service drinking water standards recommend a maximum concentration of 250 mg/l for chlorides and the same for sulphate constituents.

The mean monthly concentration of chlorides varied from 18 to 66 mg/l and of sulphates from 55 to 137.

Benthic Organisms: Under natural conditions a river can support a variety of benthic or bottom organisms. Any departure from ideal conditions can change the existing balance by causing a reduction in the number and variety of pollution-intolerant organisms and a corresponding increase in the number of the more tolerant forms.

The Board's biological survey found that the benthos in the Red River between the international boundary and St Adolphe was primarily composed of pollution-intolerant benthic organisms such as bivalve molluscs. This confirmed the water quality conditions of the River found at the international boundary as indicated by the above bacteriological and chemical data.

Recurrence of low flow conditions

The average flow of the Red River at Emerson during the 1965-66 investigation was 8,600 cfs. This was the second highest annual flow in 54 years of record. Although it is not expected that future flows will be as low as 330 cfs, the average flow in 1933-34, it should be recognized that there will be low flow conditions again.

The effects of control works existing in the Red River Basin on low flow conditions were evaluated by the U.S. Corps of Engineers in 1960. The recorded flows during the

critical period, 1930-1942, were routed through the control works, recognizing the flood control provisions of the reservoirs and the water demand at critical locations. The findings, summarized in the following table, indicate the average discharge for various durations that may be expected in the Red River at Emerson, Manitoba for several recurrence intervals.

Recurrence Interval In Years	AVERAGE DISCHARGE FOR A DURATION OF		
	7 days	15 days	30 days
	cubic feet per second		
20	48	54	63
30	32	38	45
40	25	28	39
50	19	22	36

The above flow-frequency relationship indicates, for example, that under existing conditions the average flow for one month could be as low as 45 cfs in any 30 year period.

State Standards and Programmes

The United States Federal Water Quality Act of 1965 provides for the establishment of water quality standards for interstate waters. The Clean Water Restoration Act of

1966 provides for comprehensive pollution control on a basin-wide approach.

Under authority of Minnesota Statutes, Chapter 115, the "Classification and Standards of Water Quality and Purity for the Red River of the North", were adopted and established in 1966. The Minnesota Pollution Control Agency now administers matters relating to water pollution in that State.

In North Dakota an Act to Authorize the Control, Prevention and Abatement of Pollution of the Surface Waters of the State, became effective on July 1, 1967. The State Department of Health, acting under the advice and direction of the State Water Pollution Control Board, is the official pollution control agency. As provided in the Act, "Standards of Surface Water Quality for the State of North Dakota" have been promulgated.

The Minnesota and North Dakota standards of water quality for the Red River and its tributaries are included in the Appendix of this report. These standards take into account requirements for all flow conditions including possible critical low flows. Although not identical, these standards are very similar and are also compatible with the indices of pollution set out in a policy statement adopted by the Manitoba Sanitary Control Commission in 1953. If the

Minnesota and North Dakota standards are met, the quality of the waters in the Red River at the international boundary should meet the IJC Objectives set forth in the Recommendations of this report.

As mentioned earlier, the Secretary of the United States Department of Health, Education and Welfare called a conference in 1964 in relation to pollution of the interstate waters of the Red River of the North and its tributaries. After three meetings, the conferees adopted the following conclusion: "Required remedial action is to be accomplished in accordance with the following schedule:

(a) All municipalities in the conference area are to have adequate treatment facilities completed and in operation by April 1, 1968.

(b) Necessary industrial waste reduction is to be accomplished by April 1, 1968. The North Dakota State Department of Health or the Minnesota Water Pollution Control Commission may grant specific industries the extension of the deadline for one year, until April 1, 1969 where extensive construction is necessary".

The Minnesota and North Dakota agencies responsible for the control of pollution have issued Orders or Compliance Schedules for the completion of the remedial works required by municipalities and industries within the Red River Basin.

The removal of nutrients, including phosphorous from waste discharges should be accomplished in 1971, if by that time a feasible method of nutrient removal has been developed.

Monitoring of Water Quality

The projected increase in urban population and industrial expansion in the Red River Valley south of the international boundary coupled with a recurrence of low flow conditions might create the need for a higher degree of removal of pollutants from municipal and industrial wastes. The implementation of the Garrison Project could possibly increase the salt content of the waters of the Red River above a tolerable limit. The natural lag in ice break-up along the River creates the need for coordinated releases from the lagoons. All these demonstrate the need for continuous monitoring of the quality of water in the River at the boundary.

The installation of a monitoring unit in the water treatment plant at Emerson supplemented by occasional water quality surveys and continuous liaison with the pollution control authorities concerned would provide the necessary surveillance. This would ensure that wastes discharged into the Red River in Minnesota and North Dakota would be adequately treated at all times so that they would not cause injury to health and property in Manitoba.

CONCLUSIONS

1. In response to the first question of the Reference as to whether the waters crossing the international boundary in the Red River are being polluted on either side of the international boundary to an extent which is causing, or likely to cause injury to health or property on the other side of the boundary, the Commission concludes:

   (a) During the survey period, the waters crossing the boundary were not polluted to an extent that caused injury to health or property in Canada.

   (b) It is not likely that injury to health or property in Canada will be caused by pollution of waters crossing the boundary if the standards which have been established pursuant to legislation in Minnesota and North Dakota are adhered to in those states.

2. In view of the foregoing, which constitutes a negative answer to the first question, the Commission concludes that there is no basis or need for a specific reply to the second and third questions of the Reference relating

to extent, causes and locations of pollution and specification of remedial measures and their costs.

3. The Commission further concludes that, to ensure maintenance of satisfactory water quality conditions at the boundary, there is need for adoption of mutually acceptable water quality objectives for the Red River at the international boundary and for continuous supervision to attain compliance with such objectives.

RECOMMENDATIONS

1. The Commission recommends that the "Water Quality Objectives for the Red River at the International Boundary" as set forth below be accepted by the two Governments as criteria to be met in maintaining the water crossing the international boundary in the Red River in satisfactory condition as contemplated by Article IV of the Boundary Waters Treaty of 1909. The Commission also recommends that the State of Minnesota and the State of North Dakota recognize these Objectives in the administration of their water quality standards and pollution abatement programmes for the Red River.

WATER QUALITY OBJECTIVES
for the
RED RIVER AT THE INTERNATIONAL BOUNDARY

General Objective

The water quality at the boundary shall be such that after treatment by conventional purification processes, it will be safe for human consumption; will not cause damage to property; will permit its use for industrial cooling without a high degree of treatment; will permit the propagation and life of fish species native to the vicinity under natural conditions; will permit its use by livestock and wildlife without inhibition or injurious effects; will permit its use for irrigation without adverse effects upon crops or vegetation; and will be suitable for boating and fishing.

Specific Objectives

(a) The density of coliform organisms shall not exceed 5,000 MPN/100 ml (most probable number per 100 millilitres).

(b) The dissolved oxygen content shall not fall below 5 mg/l (milligrams per litre) at the monthly average flow which is exceeded 90 per cent of the time for that month.

(c) The concentration of nutrients and sugars shall be kept to a minimum or reduced to the extent possible by economically feasible technical processes.

(d) Additional specific objectives will be established when required for water quality parameters including but not restricted to toxic wastes, salinity, pH, phenols, oils, floating solids, colour, turbidity and odour.

2. The Commission recommends that it be specifically authorized by the two Governments to establish and maintain continuous supervision over the quality of waters crossing the international boundary in the Red River and to recommend amendments or additions to the above specific objectives when the Commission, after a review of uses made of and wastes discharged into the Red River, is of the opinion that such amendments or additions are warranted. The Commission would establish an international board to assist

it in carrying out these supervisory functions, to keep the Commission currently informed as to the quality of the water crossing the international boundary in the River and to facilitate coordination of controlled releases from waste stabilization ponds or lagoons. In the event that the Objectives were not being met, the Commission would so notify the Governors of the States of Minnesota and North Dakota and the Governments of the United States and Canada.

SIGNED this 11th day of April, 1968.

A.D.P. Heeney

René Dupuis

Matthew E. Welsh

Charles R. Ross

Eugene W. Weber

APPENDIX

TEXT OF IJC REFERENCE

On October 1, 1964 the Minister for External Affairs, for the Government of Canada, and the Secretary of State, for the Government of the United States, sent the following Reference to the International Joint Commission through identical letters addressed respectively to the Canadian and United States Sections of the Commission:

> I have the honour to advise you that the Governments of the United States and Canada have been informed that the waters crossing the international boundary in the Red River are polluted by sewage and industrial wastes. Having in mind the provisions of Article IV of the Boundary Waters Treaty signed January 11, 1909, that boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other side, the two Governments have agreed upon a joint reference of the matter to the International Joint Commission, pursuant to the provisions of Article IX of the said treaty. The Commission is requested to inquire into and to report to the two Governments upon the following questions:
>
> 1) Are the waters referred to in the preceding paragraph being polluted on either side of the international boundary to an extent which is causing, or likely to cause, injury to health or property on the other side of the boundary?
>
> 2) If the foregoing question is answered in the affirmative, to what extent, by what causes, and in what localities is such pollution taking place?
>
> 3) If the Commission should find that pollution of the character just referred to is taking place, what remedial measures would, in its judgement, be most practicable from the economic, sanitary and other points of view and what would be the probable cost thereof?

For the purpose of assisting the Commission in making the investigation and recommendations provided for in this Reference, the two Governments will, upon request, make available to the Commission the services of engineers and other specially qualified personnel of their governmental agencies, and such information and technical data as may have been acquired by such agencies or as may be acquired by them during the course of the investigation.

It would be appreciated if the Commission would submit its report and recommendations to the two Governments as soon as practicable.

MEMBERSHIP OF THE BOARD

The International Joint Commission appointed the International Red River Water Pollution Board on December 2, 1964. When the Board's report was submitted to the Commission the Board consisted of:

Canadian Section

R.E. Tait, Chairman, Assistant Chief, Water Quality Studies, Public Health Engineering Division, Department of National Health and Welfare.

K.A. Mellish, Regional Engineer, Western Region, Public Health Engineering Division, Department of National Health and Welfare.

L.A. Kay, Director, Environmental Sanitation Section, Manitoba Department of Health.

T.E. Weber, Director, Water Control and Conservation Branch, Manitoba Department of Highways.

United States Section

E.J. Anderson, Chairman, Assistant Commissioner, Technical Programs, Federal Water Pollution Control Administration, U.S. Department of the Interior.

H.C. Clare, Regional Director, Missouri Basin Region, Federal Water Pollution Control Administration, U.S. Department of the Interior.

F.L. Woodward, Director, Division of Environmental Sanitation, Minnesota Department of Health.

S.A. Frellsen, Hydrologist, Division of Waters, Soils & Minerals, Minnesota Department of Conservation.

W. Van Huevelen, Chief, Environmental Sanitation Service, North Dakota Department of Health.

M.W. Hoisveen, Secretary and Chief Engineer, North Dakota Water Conservation Commission.

Previous Members

L.F. Warrick, Chairman of the United States Section, December 1964 to February 1966, Technical Consultant, Federal Water Pollution Control Administration, U.S. Department of Health, Education and Welfare.

K.S. Krause, Chairman of the United States Section, February 1966 to September 1966, Acting Assistant Commissioner, Federal Water Pollution Control Administration, U.S. Department of the Interior.

J.A. Griffiths, (Deceased), Director, Water Control and Conservation Branch, Manitoba Department of Agriculture and Conservation.

As authorized by the Commission, the Board established several working committees. In addition to the above Board members the following served on the various committees:

J.N. Warner, Public Health Engineer, Environmental Sanitation Section, Manitoba Department of Health.

W.M. Ward, Chief Public Health Chemist, Environmental Sanitation Section, Manitoba Department of Health.

J.F. Hendrickson, Program Advisor, Technical Programs, FWPCA, U.S. Department of the Interior.

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PARTICIPATING AGENCIES

Valuable and cooperative assistance was provided by the following agencies:

In Canada

Canada Department of National Health and Welfare
Public Health Engineering Division.

Manitoba Department of Highways
Water Control and Conservation Branch.

Manitoba Department of Health
Environmental Sanitation Section.

In the United States

United States Department of the Interior
Federal Water Pollution Control Administration.

Minnesota Department of Health
Division of Environmental Sanitation.

Minnesota Department of Conservation
Division of Water, Soils and Minerals.

North Dakota Department of Health
Environmental Sanitation Service.

North Dakota Water Conservation Commission.

SUMMARY OF FIELD DATA
COLLECTED AT EMERSON, MANITOBA
DURING THE 1965-66 INVESTIGATION

Note - All tabulated figures are mean monthly values

Month	Flow cfs	Temp °C	pH	DO mg/l	5-Day BOD mg/l	Coliforms MPN/100ml	Suspended Solids mg/l		Chlorides mg/l	Sulphates mg/l
							Total	Volatile		
Sept	2,100	12	8.5	11.3	3.0	690	65	15	66	88
Oct	4,400	9	8.2	9.5	2.6	4,200	--	--	38	137
Nov	3,300	1	8.1	11.8	5.1	3,980	33	11	41	118
Dec	2,800	1	7.8	10.3	2.4	1,600	20	7	42	101
Jan	1,900	0	7.7	10.7	1.9	4,550	6	2	26	86
Feb	1,700	0	7.6	10.0	1.8	4,080	4	2	21	55
Mar	5,800	0	7.6	9.1	3.0	3,630	15	5	18	68
May	20,200	15	8.0	7.9	1.5	1,240	97	14	20	113
June	7,000	19	8.1	7.1	1.6	1,010	160	43	21	114
July	4,700	24	8.2	6.3	0.8	930	233	44	38	102
Aug	3,800	23	8.2	7.3	0.8	1,840	223	36	24	91

STATE OF MINNESOTA

WATER POLLUTION CONTROL COMMISSION

CLASSIFICATION AND ESTABLISHMENT OF STANDARDS OF WATER QUALITY AND PURITY FOR THE RED RIVER OF THE NORTH, THE OTTER TAIL RIVER FROM FERGUS FALLS TO THE MOUTH, AND THE RED LAKE RIVER FROM CROOKSTON TO THE MOUTH.

WPC 10 The classification for use and the standards of quality and purity as hereinafter set forth are hereby adopted and established for the Red River of the North from its origin at the junction of the Bois de Sioux and Otter Tail rivers in Breckenridge to the United States - Canada boundary; the Otter Tail River from the Pisgah Dam located approximately at the northward extension of Wendell Road in Fergus Falls to the mouth in Breckenridge; and the Red Lake River from the dam located approximately at the extensions of Loring Street and Cascade Avenue in Crookston to the mouth in East Grand Forks.

(a) Classification for Use.

(1) The present and potential uses of the waters which require maintenance of water quality in accordance with the standards hereinafter prescribed are domestic consumption, fisheries and recreation, industrial consumption, agriculture and wildlife, and waste disposal.

(2) The waters may also be used for navigation or any other uses for which the waters may be suitable in this state or other areas through which the waters may flow.

(b) Related Conditions.

(1) The quality of the waters shall be such that with treatment consisting of coagulation, sedimentation, filtration, storage and chlorination, or other equivalent treatment processes, the treated water will meet in all respects both the mandatory and recommended requirements of the Public Health Service Drinking Water Standards - 1962 for drinking water as specified in Publication No. 956, published by the Public Health Service of the U.S. Department of Health, Education and Welfare, and any revisions or amendments thereto.

(2) The quality of the waters shall be such as to permit the propagation and maintenance of fish of species commonly inhabiting the waters of the vicinity under natural conditions, and be suitable for boating and other forms of aquatic recreation not involving prolonged intimate contact with the water.

(3) The quality of the waters shall be such as to permit their use for industrial cooling and materials transport without a high degree of treatment being necessary to avoid severe fouling, corrosion, scaling or other unsatisfactory conditions.

(4) The quality of the waters shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation usually grown in the area.

(5) The quality of the waters shall be such as to permit their use for livestock and wildlife without inhibition or injurious effects.

(6) The quality of the waters shall be such as to be suitable for esthetic enjoyment of scenery and avoidance of any damaging effects on property.

(c) Standards.

(1) No untreated sewage, and no untreated industrial wastes or other wastes containing viable pathogenic organisms or any substances which may cause disease or endanger the public health, shall be discharged into the waters.

(2) No treated sewage, and no treated industrial wastes or other wastes containing viable pathogenic organisms, shall be discharged into the waters without effective disinfection. Effective disinfection of any discharges, including combined flows of sewage and storm water, may be required to protect the aforesaid uses of the waters. Separation of sanitary sewage from natural runoff may be required, if necessary, to enable continuous effective treatment of sewage or conformance with the applicable standards. In any case where the discharge of sewage, industrial wastes or other wastes, whether treated or untreated and whether from existing or new sources, may be such as to constitute an actual or potential hazard to the safety of a municipal water supply, facilities for storage of the effluents over critical river flow periods may be required. All units of treatment works discharging effluent into the waters shall be operated continuously at their maximum capability and reports on the operation of the treatment works shall be submitted regularly at monthly intervals.

(3) The discharge of oxygen demanding sewage, industrial wastes or other wastes, shall be restricted so that after reasonable opportunity for mixing and dilution thereof with the receiving waters the dissolved oxygen content of such waters will be maintained at not less than 5 milligrams per liter, based on the minimum monthly average flow which is exceeded by 90 per cent of the monthly flows of record for January or February, whichever is lower; except that seasonal discharge of certain agricultural products processing wastes shall be controlled so as to maintain at least 5 milligrams of dissolved oxygen per liter in the receiving waters at all river flows equal to or greater than the minimum monthly average flow which is exceeded by 90 per cent of the monthly flows for April or May, whichever is lower, and so as to maintain during the same seasonal discharge period at least 3 milligrams of dissolved oxygen per liter in the receiving waters at all lower river flows.

(4) The discharge of industrial wastes or other wastes shall be controlled so that the heat content of such discharges after reasonable opportunity for mixing and dilution thereof with the receiving waters does not raise the temperature of such waters above 93°F based on the minimum monthly average flow which is exceeded by 90 per cent of the monthly flows for July or August, whichever is lower.

(5) The discharge of sewage, industrial wastes or other wastes shall be restricted so that at any river flow the maximum limits for chemicals in the waters shall be such that after treatment consisting of coagulation, sedimentation, filtration, storage and chlorination, or other equivalent treatment, the following concentrations will not be exceeded in the treated water:

Substance or Characteristic	Maximum Limit or Range
Turbidity value	5
Color value	15
Threshold odor number	3
Methylene blue active substance (MBAS)	0.5 milligram per liter
Arsenic (As)	0.01 milligram per liter
Carbon chloroform extract	0.2 milligram per liter
Iron (Fe)	0.3 milligram per liter
Manganese (Mn)	0.05 milligram per liter
Phenol	1 microgram per liter
Sulphates (SO_4)	250 milligrams per liter
Total dissolved solids	500 milligrams per liter

(6) The concentrations given below shall not be exceeded at any river flow at any point in the river after reasonable opportunity for mixing and dilution of the sewage, industrial waste or other waste with the receiving waters:

Substance or Characteristic	Maximum Limit or Range
Coliform group organisms	5,000 most probable number per 100 milliliters
Ammonia (N)	2 milligrams per liter
Barium (Ba)	1 milligram per liter
Bicarbonates (HCO_3)	5 milliequivalents per liter
Boron (B)*	0.5 milligram per liter
Cadmium (Cd)	0.01 milligram per liter
Chromium (Hexavalent Cr)	0.05 milligram per liter
Chromium (Total Cr)	1 milligram per liter
Chlorides (Cl)	250 milligrams per liter
Copper (Cu)	0.2 milligram per liter
Cyanides (CN)	0.02 milligram per liter
Fluorides (F)	1.5 milligrams per liter
Hardness ($CaCO_3$)	500 milligrams per liter
Lead (Pb)	0.05 milligram per liter
Oil	10 milligrams per liter
pH value	6.0 - 9.0
Selenium (Se)	Not to exceed a trace
Silver (Ag)	0.05 milligram per liter
Sodium (Na)*	60% of total cations as milliequivalents per liter
Zinc	1 milligram per liter
Radioactive materials	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate Federal authority or by the State Board of Health.
Other unspecified substances	None at levels harmful or detrimental either directly or indirectly.

* May be based on the July or August river flow as specified in paragraph (4) above.

(7) The natural aquatic habitat, which includes the waters and stream bed shall not be degraded in any material manner, there shall be no material increase in slime growths or undesirable aquatic plants, nor shall there be any material increase in harmful pesticide residues in the waters, sediments and aquatic flora and fauna; the natural fishery or the use thereof, and lower aquatic biota upon which it is dependent, shall not be degraded or endangered significantly, the species composition shall not be altered substantially, and the normal propagation of the fish and other biota shall not be prevented or seriously hindered by the discharge of sewage, industrial waste or other waste effluents to these waters.

(8) No sewage, industrial waste or other wastes shall be discharged into these waters so as to cause any nuisance conditions such as the presence of substantial amounts of floating or suspended solids, scums, or slicks, material discoloration, obnoxious odors, visible gassing, excessive fungus growths, deleterious sludge deposits or other offensive or objectionable effects.

(9) In addition to the above listed standards, no sewage, industrial waste or other wastes, treated or untreated, shall be discharged in such quantity or in such manner, alone or in combination with other substances, or permitted by any person to gain access to these waters, so as to cause any material undesirable increase in the taste or corrosiveness or nutrient content of the river waters or in any other manner to impair the natural quality or value of the waters or render them unsuitable or objectionable for the stated uses. The maximum practical reduction of nutrients, including nitrogen, phosphorus and sugars, in the sewage and wastes shall be accomplished as soon as practicable. Existing discharges of untreated or inadequately treated sewage, industrial wastes or other wastes shall be abated, treated or otherwise controlled so as to comply with these standards.

(10) Means for expediting mixing and dispersion of sewage, industrial waste or other waste effluents in the receiving waters shall be provided so far as practicable when deemed necessary by the Commission to maintain the quality of the receiving waters in accordance with the applicable standards.

In any instance where it is evident that it may not be feasible to provide for effective mixing or dispersion of an effluent or if at the applicable stream flows mentioned in the preceding paragraphs of the standards it is evident that the specified stream flow may be less than the effluent flow, these standards may be interpreted as effluent standards for control purposes where applicable.

(11) The following effluent standards are herein established and made applicable to all persons responsible for sewage discharges to these waters, both existing and new. Treatment facilities shall be provided which will produce an effluent with characteristics, originating directly from or directly attributable to the sewage per se, not exceeding the following:

Biochemical oxygen demand 5-day	25 milligrams per liter
Total suspended solids	30 milligrams per liter
Coliform group organisms	5,000 most probable number per 100 milliliters

Allowance shall not be made in the design of treatment works for low stream flow augmentation unless such flow augmentation or minimum flow is dependable under applicable laws and regulations.

(12) It shall be encumbent on all persons responsible for existing or new sources of any sewage, industrial wastes or other wastes which are or will be discharged to these waters to treat or control their wastes so as to produce effluents having a common level or concentration, of pollutants of a comparable nature, as may be necessary to meet the standards, or better, and in no case shall the concentration of polluting substances in any individual effluent be permitted to exceed the common concentration or level required of the other sources discharging to these waters, except for controlled discharges of certain agricultural products processing wastes during the spring flush under special permit of the Commission, regardless of differences in the amount of pollutional substances discharged or degree of treatment which may be involved.

(13) Liquid substances which are not commonly considered to be sewage or industrial wastes but which could constitute a pollution hazard shall be stored in accordance with Regulation WPC 4. Other wastes as defined by law or other substances which could constitute a pollution hazard shall not be deposited in any manner such that the same may be likely to gain entry into these waters in excess of or contrary to any of the standards herein adopted or cause pollution as defined by law.

(14) The discharge of sewage, industrial wastes or other wastes to waters of the state which are tributary to these waters shall be controlled so that no violation of the standards for these waters shall occur by reason of such discharges to the tributary waters.

(15) Some of the waters may in a state of nature have characteristics or properties approaching or exceeding some of the limits specified in the standards. The standards shall be construed as regulating or limiting the addition of pollutants of human origin to those of natural origin, if such be present, so that in total the specified limiting concentrations will not be exceeded in the waters by reason of such controllable additions, except that if the background level of natural origin is reasonably definable and is higher than the specified standard such natural background level may be used as the standard for controlling such additions of human origin.

(16) In any case where, upon application of the responsible person or persons, the Commission finds that by reason of exceptional circumstances the strict enforcement of any provision of these standards would cause undue hardship; and that disposal of the sewage, industrial waste or other waste is necessary for the public health, safety or welfare; and that strict conformity with the standards would be unreasonable, impractical or not feasible under the circumstances; then the Commission in its discretion may permit a variance therefrom upon such conditions as it may prescribe for prevention, control or abatement of pollution in harmony with the general purposes of these classifications and standards and the intent of the applicable state and national laws.

Adopted: July 28, 1966
Amended: June 5, 1967

STANDARDS OF SURFACE WATER QUALITY

STATE OF NORTH DAKOTA
(State Department of Health and State Water Commission)

I. Declaration of Policy

It is declared to be the public policy of the State of North Dakota to maintain reasonable standards of quality and purity of the waters of the State. These standards are promulgated to be consistent with the public health and public enjoyment of such waters, for the propagation and protection of the fish and wildlife, and the economic, industrial, and social development of the State. The waters of the State shall include those waters within the State and those rivers, streams, and lakes forming boundaries between North Dakota and other states or Canada. All known and reasonable methods to control and prevent pollution of the waters of the State of North Dakota shall be required.

The standards may be amended, or additions added, if justified by future developments that are consistent with the preservation or enhancement of the quality of the waters in the State.

II. Definition of Terms Used

A. Water Usage

The best usage for the waters shall be those uses determined to be most consistent with the present and potential uses, and the economical and social development of the area.

B. Municipal and Domestic Water

Waters that are suitable for use as a source of water supply for drinking and culinary purposes after treatment approved by the State Health Department. The treated municipal water shall meet the requirements of the United States Public Health Service Drinking Water Standards.

C. Industrial Water

Waters that are suitable for industrial purposes, including food processing, after treatment. Treatment may include that necessary for prevention of boiler scale and corrosion.

D. Recreation, Fishing and Wildlife

Waters that are suitable for the propagation of fish and other aquatic life, will not adversely affect wildlife in the area and is suitable for boating and swimming.* Natural high turbidities and physical characteristics of banks and stream beds of many streams are safety factors that limit their value for bathing. Low flows or natural conditions in some waters may limit their value for fish propagation or aquatic life.

E. Agricultural Uses

Water suitable for irrigation, stock watering, and other farm uses, but not as a source of domestic supply for the farm unless satisfactory treatment is provided.

F. Pollution

Pollution shall mean such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the State, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

III. General Requirements

The following are general requirements for all waste discharges:

A. No untreated domestic sewage shall be discharged into the surface waters of the State of North Dakota.

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* In general, waters with a coliform count of 1,000/100 ml or less are considered relatively safe for swimming. Natural physical characteristics of the river banks and bed and natural water turbidities in the area must also be considered.

B. No untreated industrial wastes or other wastes which contain substances or organisms which may endanger public health or other water users shall be discharged into the waters of the State of North Dakota.

NOTE: Municipalities and industries located on streams of intermittent or low winter flows should give primary consideration to the use of the waste stabilization lagoon method of waste treatment when a new treatment plant or replacement is being contemplated. The design should provide for complete retention of the wastes during periods of ice coverage on the stream.

IV. General Conditions

The following minimum conditions are applicable to all waters in the State of North Dakota, at all places and at all times:

A. There shall be no material or substances attributable to municipal, industrial, or other wastes discharged into any rivers, streams, lakes, or other bodies of water in the State that will:

(1) Settle to form putrescent or otherwise objectionable sludge deposits, cause bottom slime formations, or in any manner adversely affect the intended usage of the water.

(2) Cause conditions that result in odors so as to create a nuisance, or color the water, to such a degree that its intended use is impaired.

(3) Result in floating debris, solids, oil slicks, scum or other floating materials that will be unsightly or have a deleterious affect on water usage.

(4) Either in concentrations or combinations, result in the waters being toxic or harmful to human, animal, or aquatic life.

B. There shall be no material such as garbage, rubbish, trash, cans, bottles, or any unwanted or discarded material disposed of into the waters of the State which may interfere with stream flow or cause unsightly conditions.

It is recognized that some waters may, at some times and some places, contain natural characteristics or properties approaching the limits set in the standards. It should be understood that the standards are to only regulate or limit the addition of pollutants other than those of natural causes or origin.

The analytical procedures used to determine compliance or noncompliance with the quality standards adopted for the surface waters shall be in accordance with the latest edition of "Standard Methods of the Examination of Water and Sewage," as published by the American Public Health Association. Tests for radioactivity shall be in conformance with the publication "Laboratory Manual of Methodology, Radionuclide Analysis of Environmental Samples, Technical Report R59-6," published by the United States Public Health Service.

STATE OF NORTH DAKOTA
WATER QUALITY AND PURITY STANDARDS FOR THE RED RIVER OF THE NORTH, THE BOISE DE SIOUX, AND PARTS OF THE SHEYENNE AND PEMBINA RIVERS

These standards of quality as hereinafter set forth are hereby adopted and established for the Red River of the North from its origin at Wahpeton to the United States-Canada boundary; the Boise de Sioux from the South Dakota-North Dakota boundary to its junction with the Red River; the Sheyenne River from its junction with the Red River due north of Fargo to and including Lake Ashtabula; and the Pembina River from its junction with the Red River at Pembina to its entrance into North Dakota from Canada northwest of Walhalla.

The general policy, definition of terms used, general requirements and general conditions applicable to all surface waters in the State of North Dakota are a part of these standards.

These standards may be amended, or additions added, if justified by future developments that are consistent with the preservation or enhancement of the quality of these waters.

I. Water Usage

The quality of water in the streams shall be maintained in accordance with these standards which have been promulgated for the following best intended uses of these waters: (1) Municipal water supplies, (2) Industrial water supplies, including food processing, (3) Recreation, fishing and wildlife, and (4) Agricultural uses. These uses, as listed, are not meant to indicate any priority of use, nor are they considered exclusive, nor is it the intention to prohibit other beneficial uses if they do not interfere with the water quality in the stream as designated by these standards.

A. The quality of waters shall be such that after treatment consisting of coagulation, settling, filtration, and chlorination, or equivalent treatment processes, the treated water shall meet the bacteriological, physical, and chemical requirements of the latest edition of the United States Public Health Service Drinking Water Standards and any revisions or amendments thereto.

B. The quality of waters shall permit their use for industrial purposes, including food processing, with such treatment as may be necessary to prevent scaling, corrosion, or other unsatisfactory conditions, or as may be required by the processed materials.

C. The quality of waters shall permit the propagation and life of fish species native to the vicinity under natural conditions and shall be suitable for boating and other water recreations not involving prolonged intimate contact with the water.* There shall be no inhibition or injurious effects to wildlife using the waters. Low flows or natural conditions in the rivers may at times limit the value of the waters for fishing.

D. The quality of the water shall permit its use for agricultural irrigation without adverse effects or significant damage to any crops or vegetation normally grown in the area. It will be suitable for stock watering.

II. Specific Standards

A. The dissolved oxygen in the waters shall be maintained at not less than five (5) milligrams per liter based on the minimum monthly average flow of record after January 1, 1955, except that seasonal discharge of certain agricultural products processing wastes shall be based on the average of the lowest 10% of all average monthly flows of record for either the months of April or May, using whichever month is lower.

The dissolved oxygen determinations shall be made after the wastes have had a reasonable**opportunity to mix and be diluted by the receiving waters.

B. No municipal, industrial, or other wastes discharges, after reasonable**opportunity to mix and dilute with the receiving waters, shall cause the following

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* Prolonged intimate contact shall mean swimming or bathing. Water skiing or similar water sports, if constant body contact with the water for long periods of time is not indicated, shall not necessarily be limited only to this category.

** The distance of river flow to allow for a reasonable opportunity to mix and dilute wastes shall be at the discretion of the State Department of Health and will be based upon stream flow conditions at the time of sampling, except where such discharges may adversely affect a beneficial water use immediately downstream or in close proximity to the waste discharge point. In such instances, a change in the method of waste discharge or other control measures may be required.

minimum conditions or concentrations to be exceeded in the waters:

1. Temperature

   (a) Not to exceed 93°F based on the minimum monthly average flow of record for the months of July or August, whichever is lower, since July 1, 1955.

   (b) No waste from any single source shall cause an increase or decrease in receiving water temperature of more than 10°F.

2. Coliform Organisms

   (a) A monthly arithmetical average (MPN) of 5,000 per 100 milliliters or in an MPN exceeding this number in more than 20% of the samples collected during any one month or in an MPN exceeding 10,000 in more than 5% of such samples per month.

   (b) The average arithmetical monthly (MPN) shall not exceed 1,000/100 ml in Lake Ashtabula and Homme Dam Reservoirs.

3. pH

   (a) Minimum 6.0. Maximum 9.0.

   (b) No waste from any single source shall cause an increase or decrease of more than 0.5 units within the range noted in (a).

4. Specific Toxic Chemicals or Substances

Ammonia	2.0 milligrams per liter
Barium	1.0 mg/l
Boron	0.5 mg/l
Cadmium	0.01 mg/l
Chromium (Total)	1.0 mg/l
Chromium (Trivalent or Hexavalent)	0.05 mg/l
Copper	0.1 mg/l
Cyanides	0.02 mg/l
Lead	0.05 mg/l
Selenium	Trace amounts
Sodium	60% of total cations as milliequivalents per liter

5. Radioactive Materials

No discharge permitted unless the materials are readily soluble or dispensable in water and of acceptable quantities as recognized by the State Health Department and other appropriate State or Federal agencies.

6. Unspecified Substances

None in concentrations or combinations that interfere with, or prove hazardous to, the intended water usage.

C. The maximum practical reduction of nutrients, including nitrogen, phosphorus and sugars, in sewage, industrial, and other wastes shall be accomplished as soon as a practical method is developed.

D. The discharge of treated sewage, industrial wastes, or other wastes to surface waters not specifically mentioned but which are tributary to these waters, shall not, by reason of such discharges, cause the standards for these waters to be exceeded.

E. It shall be the responsibility of all communities, industries, or others, owning or responsible for operating treatment facilities, to operate such plants continuously and at their maximum efficiency.

F. Effective disinfection of any treated discharges, whether sewage, industrial wastes, or other wastes, or overflow discharges from combined storm water and sanitary systems, if such discharges constitute a potential or actual interference with the intended usage of these waters, may be required by the State Health Department. Separation of storm waters and sanitary wastes should be accomplished as soon as possible.

G. For design purposes and for operation of present sewage, industrial, or other waste treatment facilities, the following effluent standards are established and made applicable:

1. 5-day biochemical oxygen demand (BOD):

25 mg/l daily average with no peak exceeding 50 mg/l

2. Suspended Solids:

30 mg/l daily average with no peak exceeding 60 mg/l

Wastes resulting from the processing of certain agricultural products, discharging under control only during the spring flush, may exceed the above limits but under no conditions will such discharges cause conditions in the stream which interfere with the intended uses of the waters. This does not provide for the discharge of untreated wastes of any origin if such wastes are amenable to treatment.

H. These standards shall be met at all times, regardless of flow, unless an exception is granted by the State Water Pollution Control Agency and the United State Department of the Interior for all interstate waters and the State Water Pollution Control Agency for intrastate waters.