REPORT ON PUBLIC HEARINGS

APPLICATION OF WATER QUALITY OBJECTIVES FOR THE WATERSHED CLASSIFICATION OF THE RED AND ASSINIBOINE RIVERS AND TRIBUTARIES WITHIN AND DOWNSTREAM OF THE CITY OF WINNIPEG

THE CLEAN ENVIRONMENT COMMISSION

Manitoba
Environment

MG 912

REPORT ON PUBLIC HEARINGS

APPLICATION OF WATER QUALITY OBJECTIVES FOR THE WATERSHED CLASSIFICATION OF THE RED AND ASSINIBOINE RIVERS AND TRIBUTARIES WITHIN AND DOWNSTREAM OF THE CITY OF WINNIPEG

THE MANITOBA CLEAN ENVIRONMENT COMMISSION
JUNE, 1992

TABLE OF CONTENTS

PREFACE

This document contains a selected summation of the evidence presented at the public hearings convened by the Manitoba Clean Environment Commission to review this matter.

A detailed account of the evidence presented before the Commission is contained in the Verbatim Transcript of the hearing, which is available for review at designated *Public Registry* locations. A list of the individuals and organizations who participated in the hearing process, along with a list of the Exhibits filed, has been included in this report as Appendix "A" and Appendix "B", respectively.

THE CLEAN ENVIRONMENT COMMISSION

Under *The Environment Act* (1988), the Clean Environment Commission provides a process for the public to participate in environmental decision making. The Commission also provides the Environment Minister with advice and recommendations on environmental issues and on environmental licensing matters.

Commission membership includes a full-time Chairperson and a maximum of 10 part-time commissioners appointed by Order in Council. Members come from a wide variety of occupations from across Manitoba.

THE PUBLIC HEARING PROCESS

Public participation in Manitoba's environmental decision-making process has been facilitated by Clean Environment Commission hearings since the establishment of *The Clean Environment Act* in 1968. This basic role and responsibility of "developing and maintaining public participation in environmental matters" continues under *The Environment Act* of 1987. The primary mechanism used in achieving this has been public hearings.

In order to facilitate and encourage public participation, the Commission has tailored procedures to accomplish this goal. Hearings are held in the community where the development under consideration is located, as well as in other centres where interest is high or where environmental impact is sufficient to provide an interest for individuals or environmental groups located elsewhere.

The Commission strives to ensure that the evidence and opinions of all presenters is treated with respect.

CLEAN ENVIRONMENT COMMISSION HEARINGS RESPECTING THE APPLICATION OF WATER QUALITY OBJECTIVES FOR THE WATERSHED CLASSIFICATION OF THE RED AND ASSINIBOINE RIVERS AND TRIBUTARIES WITHIN AND DOWNSTREAM OF THE CITY OF WINNIPEG

BACKGROUND

On November 14, 1989, the Honourable J. Glen Cummings, Minister of Environment, formally requested that the Clean Environment Commission (CEC) convene Public Hearings and provide the Minister with a report and recommendations on proposed water quality objectives for the Red and Assiniboine Rivers (and relevant tributaries) within and downstream of The City of Winnipeg. The intent of these hearings was to hear evidence and representation respecting application of Manitoba's water quality objectives for the Watershed Classification of the stated waterbodies. The terms of reference were subsequently revised in July, 1991, with additional clarification in November, 1991. (Table 1)

THE WATER QUALITY OBJECTIVE HEARINGS

A public hearing was convened by the Clean Environment Commission on the following dates:

November 25, 26, 27, and 28, 1991 in Winnipeg, Manitoba;
December 2, and 3, 1991 in Selkirk, Manitoba; and
January 13, 14, and 24, 1992 in Winnipeg, Manitoba.

Commissioners in attendance at the hearings were Mr. Dale Stewart, Chairperson; Mr. Len Flett, Mr. Ed Gramiak, Ms. Donna Plant, and Dr. Barrie Webster.

TERMS OF REFERENCE

The original terms of reference, as outlined in a letter from the Minister of Environment to the Chairperson of the Clean Environment Commission dated November, 1989, were reformulated in July 1991 and clarified in November 1991. Table 1 outlines the changes (areas emboldened indicate additions or deletions to the Terms of Reference).

At the commencement of the hearing, counsel for the City of Winnipeg pointed out that the city had focused its preparation for the hearings on information concerning river use appropriateness and the costs and benefits of applying additional protection to the various river uses. It was stressed that the public, the policy-makers, river users and the CEC must have all this information to make informed choices on issues that include environment and economic decisions. Attention was also directed to documents published by Manitoba Environment which emphasized the need to review both costs and benefits associated with attaining specific water uses. The July, 1991, Terms of Reference do not specifically mention the need to consider treatment costs and benefits.

The Town of Selkirk wanted assurances that the Commission were being guided by the 1991 Terms of Reference.

MANITOBA SURFACE WATER QUALITY OBJECTIVES

The current system of Surface Water Quality Objectives and Watershed Classifications was first proposed by the Manitoba Department of Mines, Resources, and Environmental Management in 1976. Modifications were made following a Clean Environment Commission public review in 1979. Technical revisions were again proposed in 1983, and subject to a Clean Environment Commission public review in 1984. Revised objectives were released by the Department on July 31, 1988. A summary of this document can be found in Appendix "C" of this report. The full text can be obtained from the Manitoba Department of Environment.

The water quality objectives incorporate the dimensions of ***Beneficial Water Uses, Levels of Protection, General and Specific Water Quality Objectives, Minimum and Maximum Flows and Levels, and Mixing Zones.***

TABLE 1. TERMS OF REFERENCE

TERMS OF REFERENCE	NOVEMBER, 1989	JULY, 1991	OCTOBER, 1991
OBJECTIVES	To establish, through public hearings, water quality objectives for the uses of the Red and Assiniboine Rivers within and downstream of the City of Winnipeg in order to determine discharge requirements for the City of Winnipeg and private sewage treatment plants, the City of Winnipeg combined sewers and land drainage flows, industrial discharges and other inputs to the rivers.	To recommend to the Minister of Manitoba Environment, water quality objectives for the protection of beneficial uses of the Red River and Assiniboine River within and downstream of the City of Winnipeg, as well as their tributary streams.	Same as July, 1991
GEOGRAPHIC AREA	Red River - South Floodway control structure to Lake Winnipeg. Assiniboine River - St. Francois Xavier (#1 Highway West) to Red River.	Red River - South Floodway control structure to Lake Winnipeg. Assiniboine River - St. Francois Xavier (#1 Highway West) to Red River Tributaries - Seine River, La Salle River, Cook's Creek, Bunn's Creek, Devil's Creek, Sturgeon Creek, Omand's Creek and Netley Creek	Same as July, 1991
SCOPE / TASKS	1) To identify the current uses, and their appropriateness, of the Red and Assiniboine Rivers. 2) To recommend what the future uses of the Red and Assiniboine Rivers should be considering the constraints, and current and future environmental protection policies. 3) To determine projected treatment costs and anticipated benefits, monetary and otherwise, obtained in applying the Manitoba Surface Water Quality Objectives to the Red and Assiniboine Rivers to provide protection for the current and future uses. 4) To assess the impact of downstream water quality, current and future, on the current and future uses of the Red and Assiniboine Rivers. 5) To examine the issue of seasonal use, quality criteria and the implications in terms of public health considerations, treatment costs and benefits, monetary and otherwise, thereof. 6) To determine the impacts of the use of the frozen river surface on water quality. 7) To recommend, in consideration of the current and future uses, public health protection, projected treatment costs, benefits gained, upstream impacts, water use impacts, seasonal use criteria and current environmental protection policy, what water quality objectives should be established for the Red and Assiniboine Rivers.	1) To identify the current and future uses of the Red River, Assiniboine River and their respective tributary streams within the geographic area under consideration. 2) To assess the existing water quality and compare it to the current and future uses of the Red River, Assiniboine River and their respective tributary streams within the geographic area under consideration. 3) To obtain public consensus regarding the current and future uses of the river which require protection. 4) To recommend beneficial uses, and corresponding Manitoba Surface Water Quality Objectives for the protection of the Red River, Assiniboine River and their respective tributary streams within the geographic area under consideration. 5) To recommend a mechanism for the development and coordination of water quality basin management to achieve the Water Quality Objectives.	Further clarification of July, 1991 Terms of Reference: In a letter dated November 20, 1991, the Honourable J. Glenn Cummings stated that the intent of the terms of reference was to accommodate and encourage the CEC to consider a wide range of factors including costs and benefits in reaching their conclusions

BENEFICIAL WATER USES

Manitoba Environment has developed six categories of important water uses for which protection can be provided. General and specific objectives have been defined for ***Domestic Consumption, Aquatic Life and Wildlife, Industrial Consumption, Agricultural Consumption, Recreation, and Other Uses.***

LEVELS OF PROTECTION

The Manitoba Surface Water Quality Objectives (MSWQO), as established in 1977, offer four different levels of protection for each water body within the classification area as follows:

- No Protection

  Circumstances where specific bodies of water should not be afforded protection, i.e., a small lake or marsh incorporated into a wastewater treatment system.
- Routine Protection

  Principally the development of effluent limitations such that MSWQO will not be exceeded.
- High Quality Designation

  Places greater restrictions upon development within pristine or near-pristine areas.
- Exceptional Value Designation

  The highest level of water quality protection is designated for a water course that should not receive any alterations which would, in any way, degrade its exceptional value.

GENERAL AND SPECIFIC WATER QUALITY OBJECTIVES

The following are the list of beneficial water uses to be protected:

Class 1 - Domestic Consumption

- protection of waters that are suitable for human consumption, culinary or food processing purposes, and other household purposes. Partial or complete water treatment is necessary to produce potable water from surface waters. It is the intent that man-induced alteration of water quality does not cause unacceptable public health risks or unacceptable treatment costs to water users.

Class 2 - Aquatic Life and Wildlife

Category B: Cool Water Aquatic Life and Wildlife

- the protection of cool water aquatic life and wildlife such as fish, amphibians, reptiles and other forms of life including aquatic insects and algae.

Class 3 - Industrial Consumption

- protection of all water sources which are or may be used in the future as a supply source for industrial processes or cooling water.

Class 4 - Agricultural Consumption

Category A: Greenhouse Irrigation

- where irrigation is used as the only source of water for intensive horticultural crop production, protection of soils and plants from the accumulation of substances that may be harmful and the protection of humans from the harmful effects of substances on marketable produce that may not be processed prior to consumption.

Category B: Field Crop Irrigation

- where irrigation water is used to supplement natural precipitation, protection of soils and plants from the accumulation of substances that may be harmful and the protection of humans from the harmful effects of substances on marketable produce that may not be processed prior to consumption.

Category C: Field Crop Irrigation

- where water for permanent irrigation installations on coarse soils and temporary irrigation installations on medium to fine soils is used to supplement natural precipitation, protection of soils and plants from the accumulation of substances that may be harmful and the protection of humans from the harmful effects of substances on marketable produce that may not be processed prior to consumption.

Category D: Livestock Watering

- protection of all classes and ages of livestock and poultry from inhibitory effects following water consumption.

Class 5 - Recreation

Category A: Primary Recreation

- protection of waters suitable for recreational uses where the human body comes in *direct contact* with the water (ingested accidentally or contact with certain sensitive organs such as the eyes, ears and nose) including swimming and sports such as water skiing.

Category B: Secondary Recreation

- protection of waters suitable for recreational uses where there is only *incidental, accidental or sensory human body contact* with the water such as fishing and boating.

Class 6 - Other Uses

- protection for surface water uses that are not well defined within the 5 major classes.

MINIMUM AND MAXIMUM FLOWS AND LEVELS

It is not considered practicable for dischargers to comply with Water Quality Objectives under all possible low-flow situations on specific rivers and steams. Specific water quality objectives apply at all times for rivers and streams, except during periods when flows are less than the average minimum seven day flow which occurs once in ten years ($7\text{-}Q^{10}$). MSWQO must be met on intermittent streams at all flows above 0.003 cubic metres per second (m^3/s).

MIXING ZONES

It is recognized that it is not reasonable, in some circumstances, to expect the MSWQO to be met in areas immediately adjacent to a discharge pipe. A zone of initial dilution is necessary for the mixing of wastes and water. These zones are recognized as areas subject to loss of value. Guidelines have been developed to minimize the loss of value such that beneficial water uses are not unacceptably impaired.

GENERAL BACKGROUND

Evidence on behalf of Manitoba Environment was presented by representatives from Water Standards and Studies Branch and the Approvals Branch. This presentation was assisted by a representative from the Fisheries Branch of the Department of Natural Resources. Present also was a representative from the Health Department and the Department of Justice.

The City of Winnipeg's representation included members of the Law Department, the Waterworks, Waste and Disposal Branch, and the Health Department. Much of their presentation had been developed by members of a consultant team including TetrES Consultants Inc. and Wardrop Engineering Inc.

The Town of Selkirk was supported by legal counsel and their consultant, Inter Group Consultants Ltd.

All other presenters spoke on their own behalf or on behalf of a government organization, business, or association allied with their concerns respecting surface water quality objectives.

Manitoba Environment

A representative of Manitoba Environment emphasized that the Department's recommendations were based on envisioned current and future beneficial uses which were worthy of protection.

The Department's presentation began with a review of the recommendations made by the Clean Environment Commission in 1981. At that time a water quality classification proposal was made for the entire Red River watershed. A fecal coliform limit of 400 per 100 mL was recommended as the immediate target water quality objective for the Red River, downstream of the North Perimeter Bridge, under dry weather conditions. In that regard it had been recommended that Winnipeg should undertake chlorination on a trial basis at the South End Water Pollution Control Centre. The trial was to be monitored by an inter-governmental committee in addition to which alternative methods of disinfection would be investigated. An interdepartmental committee (Senior Technical Advisory Committee) had been established which examined and reported on costs and benefits of alternate

methods of disinfection in 1983. It was noted that a pilot scale study involving ultraviolet light radiation of wastewater effluent had recently been undertaken by the City of Winnipeg.

The Commission recommended in its 1981 report that the proposed minimum dissolved oxygen (DO) level of 47% of saturation be retained for dry weather conditions and 35% of saturation level for transient storm water runoff conditions. It was noted that the City of Winnipeg had upgraded its wastewater treatment plants to meet the DO levels prescribed in the 1981 report.

The representative from Manitoba Environment continued with an overview of the rivers and tributaries within the classification area (see Figure 1).

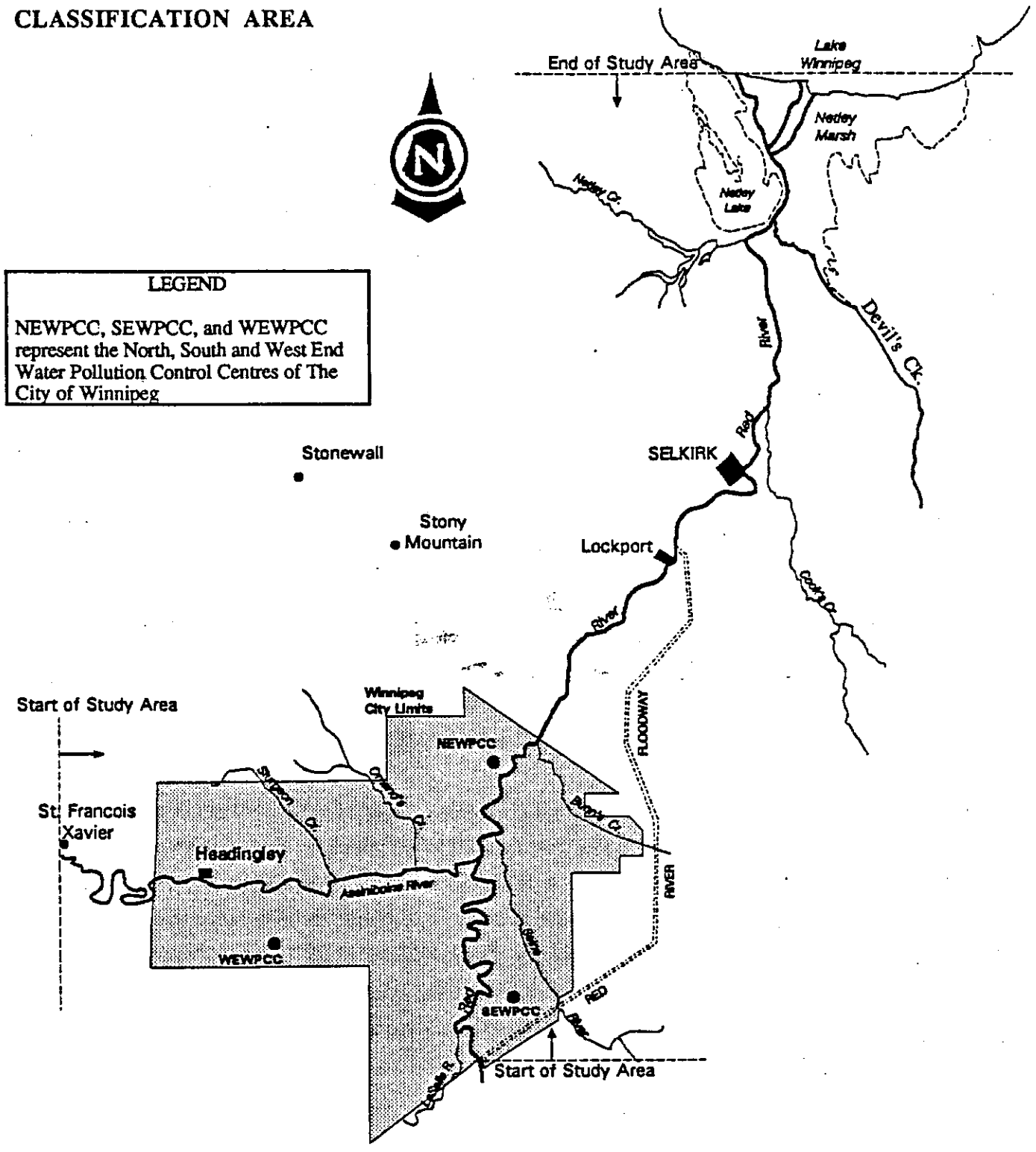
The drainage area of the Red River at St. Norbert is 124,300 km^2, and near Lockport, the drainage area increases to 287,500 km^2. Approximately 31% of the water flowing through Winnipeg is derived from the Assiniboine River and 69 % from the Red River. The combined origin of flows is described as 45% from Manitoba, 46% from the United States, and 9% from Saskatchewan. The majority of the run-off in the Red and Assiniboine watershed occurs during the spring (the Red River has a considerably higher spring run-off). The Red River has two water control structures: the floodway, which diverts flood waters 47 km around Winnipeg to a point north of Lockport; and the Lockport Dam which maintains higher levels upstream in the Red and Assiniboine Rivers.

Water quality data is collected from stations located at the south floodway, the Fort Garry Bridge, the North Perimeter, Lockport, Selkirk, Headingley and the Main Street Bridge.

Point source discharges from the City of Winnipeg were identified. The largest wastewater treatment plant is the North End Water Pollution Control Centre which handles approximately 70% of the City's wastewater. The South End plant handles 20% and the West End plant, located on the Assiniboine River, processes the remaining 10%. All of the plants employ secondary wastewater treatment processes without effluent disinfection. Other sources of pollution consist of combined sewer overflows (CSOs), sanitary sewer overflows and land drainage outfalls. Combined sewers service 36% of the Winnipeg area. Overflows occur during the spring run-off and at times of heavy rainfall at a frequency of 30 - 50 times per year. These overflows result in approximately 2% of the wastewater bypassing the treatment plants.

FIGURE 1

CLASSIFICATION AREA



Twenty private wastewater treatment facilities and a number of subdivisions in areas surrounding Winnipeg also discharge effluent into both the Red and Assiniboine Rivers. The Town of Selkirk, in addition to a wastewater treatment plant, has a number of combined sewer outfalls.

There are also a number of industrial operations having point-source wastewater discharges.

City of Winnipeg

The City prefaced its presentation by noting the importance of the rivers and the City's commitment to protecting the environment.

The extensive pollution control program undertaken to the present had been established in accordance with guidelines, accepted by both Manitoba Environment and the City of Winnipeg. It was the City's belief that additional data and analysis was required to make informed decisions concerning the basin classification program. It was suggested that the proposed Federal Government Green Plan study on the Red and Assiniboine Basin be coordinated with future research initiatives.

A description of the study approach taken by The City of Winnipeg was provided. Beginning with upstream water quality, the study then concentrated on discharges to the rivers, river uses, and water quality. The third phase focused on the pollution control options including the relative costs and benefits. In the final study on the evaluation phase, realistic river uses were defined in relation to the costs and benefits of the pollution control options and policy issues. Additional study requirements were also identified. Reference was made to a Manitoba Environment document, "Development and Use of Water Quality Objectives in Manitoba". A section of this document refers to the need for further evaluation should the existing water quality in question be impaired. One of the key questions asked was whether the cost of achieving the water quality improvement bears a reasonable relationship to the benefits associated with attaining the water use? The City asserted that Manitoba Environment had not considered this question.

The water quality model utilized by the City's study team was described noting the substantial research done in terms of the calibration to fit the local conditions.

All of the Winnipeg wastewater treatment plants have been upgraded or are in the process of being upgraded. At the completion of the program in 1995, some $200 million will have been spent on this process which will result in effective secondary treatment requirements being met at the 3 plants.

Town of Selkirk

Selkirk representatives stressed that the Clean Environment Commission should only focus on the water quality objective setting process and not on issues such as costs which should be addressed in the upcoming licensing hearings. Frustration was expressed as a result of the lack of action since the 1981 Commission report on the Red River. It was suggested that this lack of action represents a double standard in Manitoba with one set of objectives applying to Winnipeg and another set applying to communities outside of Winnipeg.

The current Manitoba Environment proposal for water quality objectives was endorsed by the Town's representative who said that the Commission should move quickly with this process, followed as quickly by licensing hearings.

In addition to the Town of Selkirk, the Rural Municipality of St. Andrews endorsed the MSWQO proposal presented by Manitoba Environment.

WATER USE CLASSIFICATION

DOMESTIC CONSUMPTION

Manitoba Environment

The representative from Manitoba Environment stressed that domestic consumption is an important use of the rivers and streams within the classification area. Only the Town of Selkirk draws water downstream from Winnipeg for domestic consumption from the Red River to augment their groundwater supply when required. Under *The Manitoba Health Act* and Regulations, the use of the Red River as a water supply for the Town of Selkirk was an approved use.

It was confirmed that under the current objectives and considering the current uses, there would be no further requirements with respect to the City of Winnipeg, to take further measures to protect the rivers.

City of Winnipeg

The City of Winnipeg agreed with the proposed classification for domestic consumption, stating, in summary, that the natural condition of the river requires exhaustive treatment of the raw water prior to consumption, and that the City of Winnipeg does not impair the downstream use of the Red River as a water supply source.

Town of Selkirk

A representative from The Town of Selkirk agreed that the Town can successfully treat raw river water for domestic consumption. He stressed, however, that the citizens suffer a "negative psychological effect" from drinking water which is sourced from the Red River.

Related Presentations

A retired medical practitioner from the Selkirk area suggested that the Town of Selkirk disinfection process did not always eliminate the danger from virus infections when the Red River was being processed for drinking water. It was also indicated that disinfection of river water by chlorination could produce trihalomethanes in the processed water which are considered carcinogenic.

A spokesperson for Concerned Citizens of Manitoba, expressed concern regarding the delay in efforts to clean up the City's rivers and spoke of the need for disinfection and sewer separation to protect uses including domestic water supplies.

A representative from the Triple S Community Development Corporation, suggested that the Town of Selkirk was in the unenviable position of discharging cleaner water from its wastewater treatment facility than the raw water which was taken into its domestic water supply system.

A realtor with Homelife Properties of Selkirk stated his belief that use of the Red River as a raw water source for the Town of Selkirk created negative perceptions of water quality which cost property owners thousands of dollars in the potential market value of their properties.

COOL WATER AQUATIC LIFE AND WILDLIFE

Manitoba Environment

A Manitoba Environment representative indicated that the surface waters within the classification area support a cool-water fishery; hence, only Category B of Class 2 objectives is considered for this classification area.

The rivers and streams within and downstream of Winnipeg support a wide variety of fish species. The Red River supports 55 fish species within the classification area and the Assiniboine River supports approximately 46 species. It was acknowledged that there was limited information on the fisheries of the tributary rivers and creeks.

Available information on the fishery was provided based on the results of a creel census undertaken during 1982-83, in the Lockport, Selkirk and Netley areas. It was estimated that upwards of $10 million is expended each year by anglers in this area. During the open water season approximately 286,000 angler hours produce a harvest of over 200,000 fish, weighing in total over 100,000 kg. This catch is dominated by freshwater drum, sauger, walleye, goldeye and channel catfish. The winter fishery represents 50,000 angler hours, with a catch dominated by pike, perch, walleye and sauger. Walleye and catfish dominate the trophy fisheries. These species, plus sauger and drum are noted for their migration along the Red and Assiniboine Rivers and north into Lake Winnipeg.

Other fisheries noted were the bow fishery for carp in the Netely-Libau Marsh - an extremely productive ecosystem; the domestic fishery in the lower Red River operated by treaty Indians; and the bait fishery for emerald shiners, worth $200,000 in 1988.

It was noted that the City of Winnipeg's poor water quality image might lead to fish being thrown back when caught at any one of Winnipeg's 100 fishing sites, yet the same fish would be kept

and eaten if caught upstream or downstream of Winnipeg. It was concluded that water quality must be improved within the City in order to maintain and develop a popular urban fishery.

In response to questioning, it was stated that there was evidence to support the contention that fish reside in effluent plumes, but the length of time during which fish were in the plumes is unknown. It was also suggested that sub-lethal impacts may have effects on smaller fish which might influence the continued abundance of trophy sized fish. While un-ionized ammonia levels had been high for many years in specific regions of the river, it was possible that river locations with lower un-ionized ammonia levels have produced and supported trophy sized fish that moved in and out of the areas of the river influenced by higher un-ionized ammonia levels.

Manitoba Environment has set a dissolved oxygen objective of not less than 47% saturation to protect growth rates, food conversion efficiency, and feeding in some fish species (standards during the winter months are 5 mg/L). Results of testing show that DO concentrations have met the 47% or 5 mg/L objective.

Excess concentrations of phosphorus can result in excessive growth of algae in the river water. The MSWQO for phosphorus is 0.05 mg/L which is exceeded 99% of the time upstream, within, and downstream of Winnipeg, although there is approximately 30% more phosphorus in the water leaving Winnipeg than in that entering from the Red River. It is estimated that the City of Winnipeg contributes 33% of the Red River's annual phosphorus loading to Lake Winnipeg.

Nitrogen can be present in an organic form or as ammonia, nitrite or nitrate. A portion of the ammonia is present in a form which can be toxic to fish at levels ranging from 0.0184 to 0.05 mg/L. Trend analyses shows increases in both ammonia and un-ionized ammonia concentrations within and below the City of Winnipeg.

Un-ionized ammonia can elicit an acute toxic or a chronic response in fish life. Chronic effects can include a reduction in hatching success, reduction in the growth rate and changes in tissues of gills, livers and kidneys. Departmental representatives confirmed that there was no physical evidence of acute lethality to fish resulting from exposure to the City's effluent nor had chronic effects (sub-lethal) been observed . The chronic effects noted had been derived from studies undertaken by or on behalf of the United States Environmental Protection Agency (U.S. EPA)

The un-ionized ammonia objective is exceeded 7% of the time upstream of the South Floodway. In the area between the Fort Garry Bridge and Lockport, the annual exceedence ranges between 24% and 29%. Monthly exceedences at the North Perimeter station range up to 59%.

The derivation of the water quality objective for un-ionized ammonia was dealt with in some detail. The objective's criteria are based on documents produced by the U.S. Environmental Protection Agency (EPA) in 1976, 1985 and 1987. In 1987, the Canadian Council of Ministers of the Environment (CCME) adopted, without modification, the 1985 U.S. EPA's un-ionized ammonia recommendations for general applicability throughout Canada. Part of Manitoba Environment's review indicated that a major uncertainty had arisen as a result of pH and temperature effects on un-ionized ammonia toxicity; the available toxicity information did not fully account for pH and temperature conditions in the Red River. In order to accommodate this uncertainty, Manitoba Environment had excluded the low temperatures and low pH data which had resulted in a reduction of the range of criteria from a factor of 70 to a factor of 3. It was noted that aquatic life similar to that found in the Red River had been exposed to un-ionized ammonia levels identified in the Manitoba Environment criteria documents in the U.S. EPA studies conducted in Monticello, Minnesota, with unacceptable impacts on growth and reproduction.

Two independent studies to review Manitoba Environment's modification to its un-ionized ammonia objective were also conducted in 1987. Both studies determined that "the data published in the U.S. EPA documents can be used to develop objectives which are appropriate locally" and that "until such scientifically credible information is advanced for this site, the present objective represents the best available information".

New evidence was presented to explain low flow requirements. The Environment Department's position follows the U.S. EPA announcement of March 1991 that the 7-Q^{10} technique has been reconfirmed as the flow at which un-ionized ammonia levels should be met.

City of Winnipeg

The City agreed with the appropriateness of the classification area for aquatic life and agreed with the objective criteria for DO. However, the City has indicated that there were uncertainties surrounding the un-ionized ammonia objective. The City agreed with the proposed watershed

classification for aquatic life, but insisted that further research be required before expenditures were undertaken to control un-ionized ammonia discharges.

The City's representative noted that DO was essential for healthy aquatic life and was often used as a measure of a healthy stream. The City's secondary treatment facilities remove 90 to 95% of the organic matter, thus reducing impacts on the DO resources in the rivers. It is expected that adequate levels of DO would be protected in the future, even during low flows.

Some exception was taken with respect to Manitoba Environment's statements regarding phosphorus loading from the Red River to Lake Winnipeg. Data obtained from a Canada Department of Fisheries and Oceans Institute report indicated that the City of Winnipeg contributed only 3.8% of the phosphorus rather than the 33% presented previously and 3.7% of the nitrogen as opposed to the 26% shown in previous evidence.

A graphical representation of the high concentrations of un-ionized ammonia being discharged from the wastewater treatment plants was shown. The graphs showed a significantly higher concentration at the North End plant versus the South End plant and the rapid reduction of un-ionized ammonia level as the nitrifying bacteria decomposed the un-ionized ammonia in the river. Lower flows in the Red River at the South End plant gave the indication of large un-ionized ammonia concentrations, whereas, the North End plant had significantly higher un-ionized ammonia input, accompanied by a higher river flow.

It was noted that although wastewater effluents increase un-ionized ammonia concentrations in the rivers, there was no direct evidence that un-ionized ammonia was having impacts on the fish population. The results of U.S. EPA tests were referenced which showed modest impacts on fish species indigenous to the Red River. In the tests, fish were continuously exposed to dosages of un-ionized ammonia which were in the same range as those encountered downstream of the North End Treatment Plant. The test results indicated a 5% decrease in length and a 15% decrease in weight of catfish and an 8% weight decline in white sucker.

The City of Winnipeg representatives disputed Manitoba Environment's assertion of increasing un-ionized ammonia levels by challenging the Environment Department's interpretation of the field data using a statistical evaluation. It was pointed out that there was a correlation between high

water flows and low un-ionized ammonia concentrations, and conversely, low water flows and high concentrations of un-ionized ammonia.

The uncertainty in the local application of U.S. EPA un-ionized ammonia criteria was discussed at length during the hearings. It was pointed out that the U.S. EPA approach was only an initial step to defining possible protective criteria. Beyond cautioning regulators to develop site-specific guidelines based on site-specific testing, the U.S. EPA criteria provided a strong suggestion to use site-specific criteria at temperatures below 20°C such as those experienced here in Manitoba. The U.S. EPA criteria document observed that there was limited data at lower temperatures and that small changes in the criteria might have significant impact on the level of treatment required. It was further added that such testing had not been undertaken in Manitoba. In the absence of site-specific data, The City of Winnipeg recommended that cool water aquatic life not be protected to the un-ionized ammonia level proposed by Manitoba Environment. The City indicated an interest in supporting these studies but preferred that senior governments provide the leadership.

The City of Winnipeg provided evidence showing the U.S. EPA's use of a formula for low water conditions, which differed from Manitoba Environment's 7-Q^{10} formula. It was asserted that the U.S. EPA has concluded that un-ionized ammonia concentrations would not cause unacceptable effects on freshwater organisms if the four day, three year average concentration was not exceeded. It was noted that the objective for un-ionized ammonia exhibited extreme sensitivity to pH and temperature. Comparisons of un-ionized ammonia compliance were presented for the Red and Assiniboine Rivers at present and for the year 2011, using the 7-Q^{10} and the four day, three year flows, for various pH's and temperatures. The 50 year return period for discharge was also compared with that of the full period of record or 78 years. Using four day, three year flows, compliance could be achieved upstream from the North End wastewater treatment plant. On the Assiniboine River, compliance could be achieved at a lower pH value than that achieved on the Red River.

Issue was taken with Manitoba Environment's interpretation of the CCME's endorsement of the U.S. EPA recommendations for un-ionized ammonia. It was suggested that there was explicit recognition in the CCME approach that Manitoba Environment should be collecting information to thoroughly understand the aquatic resources and ecosystems which we choose to protect.

It was stressed that the fish used in the U.S. EPA's study were confined and could not avoid the un-ionized ammonia. There is the point that laboratory tests can only approximate reality.

Responding to arguments from a University of Winnipeg scientist regarding fingernail clams, a City representative indicated that there were other studies which showed that this species was not a good in-situ bio-indicator for un-ionized ammonia. (See later testimony on page 23). There was also a question about the independent un-ionized ammonia evaluations undertaken for the Manitoba Water Services Board (MWSB) by the Environmental Applications Group of Willowdale, Ontario and MacLaren PlanSearch on behalf of the City of Winnipeg (1987).

Un-ionized ammonia control is normally effected by treatment of effluent through nitrification. One such process is the biological conversion of un-ionized ammonia in wastewater to nitrate nitrogen. Nitrification would require adding tankage, aeration capacity, plumbing and piping to the existing wastewater treatment plants. The process of nitrification is more difficult at lower temperatures.

Significant costs for nitrification would be required at the three wastewater treatment plants ranging from a capital cost of $120 to $175 million and annual operating costs of $2.3 to $3.7 million.

Winnipeg's consultants questioned whether nitrification costs were justifiable. It was noted that fish lethality had never been demonstrated in areas downstream of the sewer outfalls as a result of un-ionized ammonia concentrations. There was also a reminder to the panel that un-ionized ammonia concentrations were naturally reduced in the river environment and that benefits from accelerated nitrification would be localized and would accrue only to those species which were consistently exposed. It was suggested that the magnitude of these benefits were dependent on factors including the sensitivity of the fish to un-ionized ammonia concentrations, the extent of sustained exposure to un-ionized ammonia, and the relative importance of other factors which also contribute to fish health, distribution or abundance of fish, the vertical and horizontal mixing in the water column, and the likelihood of downstream concentrations intersecting with fish habitat or populations.

A number of questions were raised that indicated the need for additional studies such as fish avoidance of un-ionized ammonia, impacts on indigenous fish, fish type, habitat and distribution implications, etc. It was suggested that studies to answer these questions be undertaken over a 5 year period and that they would enable informed water quality management decisions to be made.

According to the City of Winnipeg, the only known benefit of nitrification was compliance with the un-ionized ammonia objective. On the other hand nitrification may lead to an increase in algae

growth in the river. With present knowledge, it was not possible to estimate the nature and magnitude of the benefits to the local fish populations from nitrification.

Town of Selkirk

The Town of Selkirk's representative noted that they would consider adding a nitrification wastewater facility at their wastewater treatment plant if required by the un-ionized ammonia objective.

Related Presentations

A Lake Winnipeg commercial fisherman spoke of the thriving commercial fishing industry on Lake Winnipeg. The question was raised as to how long the City of Winnipeg would continue to dump raw sewage into the Red River and emphasized the impact of the City's population and industry in relation to the future of the large commercial fishing industry on Lake Winnipeg.

A scientist from the University of Winnipeg expressed her difference of opinion with the City of Winnipeg study team by noting that the organisims that now inhabits most of the waters in the area under consideration were neither healthy nor abundant. It was suggested that un-ionized ammonia toxicity testing should take into account the possible amplifying effect of other wastewater toxic chemicals. It was also noted that testing did not include toxic effects on smaller organisms in the food chain, which could be far more sensitive to pollution than the fish themselves. In response to questioning, it was confirmed that the species of fish used in the U.S. EPA testing were in fact more sensitive to un-ionized ammonia than other classes of organisms. The speaker refered to her own studies undertaken on the rivers at a site both above and below Winnipeg. The upstream site was identified as being in close proximity to the confluence of the La Salle and Red Rivers. The confluence was used because of the extremely high flow rates in the main stem of the Red River. The downstream site was located upstream from Lockport.

The need to consider freshwater clam species, many of which were unique to Manitoba was also raised. It was noted, in response to a question, that the fingernail clam had been identified upstream of the City but not downstream. It was recommended that a high quality designation be adopted for the Assiniboine River in the Headingley and Beaudry Park regions in order to protect species diversity at those sites. A suggestion was made by an aquatic biologist and an aquatic environmental chemist, both from the Manitoba Environmental Council, that sediment quality should

be evaluated since toxic chemicals tend to be associated with sediment particles and the particles are easily suspended and readily ingested by filter-feeding aquatic organisms.

A representative from Ducks Unlimited Canada spoke of the value of rivers, streams and marshes to wildlife. He noted the many chemicals and pesticides end up in stormwater retention ponds, an important habitat for waterfowl. Problems of greatest concern include the presence of pesticides and un-ionized ammonia and the removal of aquatic and emergent plants from storm water retention ponds. A suggestion was made that the use of artificial wetlands and the encouragement of plant growth in retention ponds would be alternative methods of treating wastewater. Harvesting of plants on an annual basis would be required to remove the toxic materials which had accumulated. Such a development would also provide additional wildlife habitat within or near the city. More education was needed to reduce the sources of toxic materials. Bio-accumulation of heavy metals and pesticides in the food chain was cited as a concern.

A representative from the North Dakota State Department of Health representing both the International Joint Commission (IJC) and the State, noted that water quality at the international boarder rarely fails to meet international objectives. North Dakota communities had spent in excess of $120 million to improve wastewater treatment in the Red River basin (this sum included federal government grants which varied from 50% to 75%). The City of Fargo was currently adding a nitrification process at their wastewater treatment plant at a cost of $10 million. The un-ionized ammonia objective in North Dakota was based on U.S. EPA criteria. He underscored the importance of downstream discharges in affecting a biological community, including the migration of fish in upstream areas. The need for equal protection (compared with that achieved by upstream users) for the Red River through Manitoba was stressed.

Support for the proposed water quality objectives was also read into the record from the Water Quality Division of the Minnesota Pollution Control Agency who are also members of the IJC Red River Pollution Board.

A representative of the Lake Winnipeg Commercial Fishermen's Advisory Board, spoke of the 863 licensed fishermen and the many other people employed by the industry on Lake Winnipeg who have a vested interest in clean, pollution-free water. He noted that of $60 million received by the Freshwater Fish Marketing Board in 1988, $38 million was paid directly to Manitoba fishermen. The Advisory Board strongly recommended adoption of the proposed water quality standards. A high

level of litter in the south basin of Lake Winnipeg following rainstorms was linked to combined sewer overflows in Winnipeg.

A professor from the Department of Zoology of the University of Manitoba, representing Fish Futures Inc., presented a brief based on sampling experiences on the Red River since 1966 and data collected by graduate students and associated scientists. A suggestion was made that more accurate information on the occurrence, distribution, and habitat use by different life history stages of fish within the Winnipeg area would be of great value in deciding the uses and water quality criteria in specific areas. It was noted that existing toxicity standards were based on fish not always found locally. Further, locally abundant fish, such as the silver chub, might be extremely intolerant of reduced DO and chlorine, yet such species had not been part of the toxicity research. There was a concern that the results of local research might prompt the imposition of more stringent standards than those presently in existence. In response to questioning, the speaker indicated that he had no evidence of fish movement being impeded but suggested that research on stream barriers was required to determine the effects on very young channel catfish (2 cm) versus 20 pound sexually mature fish. It was noted that the classification area represented the third most diverse fish fauna in Canada with 55 species of fish divided among 16 families, and 63% of all freshwater fish species in Manitoba being present. The marked expansion in the distribution of warm water species (e.g., stonecat, white and black crappie and bluegill) was noted, attributed possibly to global or local warming. The great species diversity contributed to the apparent long-term stability and productivity of the system. It was stressed that the loss or severe reduction of even small uncommon species would decrease the ability of the system as a whole to absorb and recover from environmental pressure, whether man-made or natural. The mobility of various species such as walleye and channel catfish was reiterated. This mobility necessitated that management be based on the entire system as loss of important spawning and nursery areas could cause the fisheries to suffer.

A number of other issues related to aquatic life were raised in the fisheries brief. Included was the fact that nitrates and phosphates from municipal and agricultural sources accelerate the eutrophication of Lake Winnipeg. There was a concern that 20 years or more might be required for sub-lethal effects of un-ionized ammonia to become apparent in channel catfish. Adoption of un-ionized ammonia levels as prescribed in the Manitoba Objectives document was recommended, as was the evaluation of these objectives with respect to local fish species.

One other concern was related to heavy metals. It was noted that there is a lack of data on metals in the river system.

In response to questioning it was suggested that the Master Angler's Awards might be a questionable basis upon which to rate the fishery, because of the large reporting bias and the infrequent reports of non-preferred angling species.

It was also noted that it was the responsibility of a proponent to prove that what is being proposed would cause insignificant harm. It was also suggested, that in the absence of data, objectives should be made more, rather than less stringent. An assertion was made regarding the U.S. EPA un-ionized ammonia testing, that length and weight reductions in fish species (if additive over a 20 year period) would result in the end of the current trophy fishery.

A number of other water quality issues were mentioned including fish barriers (found on tributary streams such as Sturgeon Creek and The Seine River), water supply demands on river systems and the introduction of unwanted species, with the bowfin and zebra mussels being cited as examples.

A fisheries specialist speaking on behalf of the Mid-Canada Chapter of the American Fisheries Society and the Fishery Resources of the Red-Assiniboine River System suggested that more effort was needed in the separation of combined sewers and reductions in wastewater nutrient concentrations. The findings of two researchers were cited which had shown that chlorination of sewage treatment plant effluent (without declorination) was the single most injurious threat to fish and fish habitat, and that disinfection, if required, must be achieved in some other form. These same studies also found that un-ionized ammonia was generally not a problem in terms of fish toxicity. In answering questions on the subject of un-ionized ammonia, he stated that the U.S. EPA studies cited by Manitoba Environment only explained effects if fish were held in the effluent plume in the river. The tests did not describe whether the species inhabited the plume long enough to cause a problem. Data regarding the plumes and the mixing zones were lacking. Reference was made to studies which found that the least damage was found in effluent discharged in the near-shore area of a stream. It is known, however, that the outfalls from both the North and South End Water Pollution Control Centres are located within the channel of the river, whereas, the West End plant discharges at the shoreline.

Although evidence was inconclusive that the fish populations in the Red-Assiniboine system were stable and healthy at the moment, it was suggested that there should be a concern with less obvious cumulative changes to fish habitat. This concern gave rise to a suggestion that there was an urgent need for an international cooperative body to oversee improvements in nutrient and fish habitat management for the entire Red-Assiniboine basin.

The fisheries specialist agreed with the use classification identified by Manitoba Environment with a suggestion that the system might be even further improved.

INDUSTRIAL CONSUMPTION

The industrial consumption objective is intended to ensure that industrial water users will not incur unacceptable additional treatment costs as a result of water quality. Specific requirement have not been established in view of the varying requirements for quality control of water. Objectives will be developed when necessary, using industry-specific requirements.

Industrial consumption within the classification area is limited, with Manitoba Hydro and Manitoba Sugar being the primary users of river water for cooling or industrial processes. Currently, only the Red River is classified for industrial consumption.

City of Winnipeg representatives noted that the Red and Assiniboine Rivers had limited withdrawals for industrial consumption and water quality was considered suitable for these current operations. In their view, the La Salle and Seine Rivers should be removed from the industrial consumption classification.

Manitoba Hydro representatives provided a description of the Selkirk Thermal Generating Station's use of Red River water for cooling purposes and the return of the water to the Red River via Cook's Creek. It was noted that Red River water quality was adequate to meet the station's needs. The station was used infrequently; however, it represented an important component of the electrical supply. Although the facility was licensed to draw in excess of 350 million m^3 of water on an annual basis, a significantly smaller amount of water had been used. The station's use and discharge of waters was in compliance with existing licences and approvals. Discharge streams and groundwater were being monitored on an ongoing basis.

A description of the fish screen located on Cook's Creek (developed to prevent fish from coming into contact with the Station's hot water discharge) was provided.

IRRIGATION

Manitoba Environment

Objective criteria are similar for the three classes of irrigation. All of the receiving waters within the classification area were to be protected in Category B of the irrigation classification. All but Bunns and Omand Creeks were proposed in Category D. Only the Red and Assiniboine Rivers were proposed in Category A.

The Departmental representative noted that the bacterial quality of the river water often did not meet fecal coliform objective of 1,000 organisms per 100 mL and more frequently did not meet the 200 per 100 mL, which had been set for irrigation water which comes in direct contact with humans. As to the basis for the selection of the objective for direct contact, the Department advised that this was their "best guess", with immersion as in primary body contact recreation.

A major irrigation use in the classification area is lawn watering in riverbank parks and golf courses. It was pointed out that the times of irrigation often coincide with day-time use of the areas where there is a concern with people coming in direct contact with the water. Particular concern was voiced regarding the assumption by passers-by that the water coming out of sprinklers was treated drinking water. It was also noted that fecal coliform and salmonella bacteria have been reported to survive on grass for 6 to 42 days.*

A list of crops which are irrigated by waters in the classification area was identified. These include cereal and forage crops, bedding plants, fruits, and vegetables. Concerns were noted regarding the ability of pathogenic bacteria to survive on produce for extended periods of time (e.g., salmonella has been found to survive on vegetables from 5 to 40 days). Fruit and vegetables may not be adequately washed prior to consumption, thus presenting a potential problem.

*On the other hand, it was observed by the Commission that fecal coliform levels in the rivers were highest following rainfall events which largely obviated the need for irrigation for the several days when the coliform count was highest.

City of Winnipeg

The City of Winnipeg indicated that there are uncertainties surrounding the microbiological objective for irrigation. Therefore, while the City agreed with the proposed watershed classification for irrigation, its agreement was qualified by the limited appropriateness of use, and the uncertainty of the microbiological objective.

Aside from microbiological considerations, it was noted that objective criteria for total dissolved solids, conductivity, pH, and chlorides were frequently exceeded before the rivers reached the City of Winnipeg. It was also indicated that the City of Winnipeg discharges did not contribute significantly to background levels of constituents that resulted in phytotoxicity.

The City's consultants did not believe that irrigation of bedding plants and watering of parks or golf courses was covered by the MSWQO. In addition, because Manitoba Environment did not indicate any use for the Livestock Watering Class, the City of Winnipeg did not consider livestock watering in their analysis.

Another concern noted by the City was the lack of documentation explaining the rationale for the 1,000 and 200 organism per 100 mL fecal coliform criteria. Risks to subjects in proximity to irrigation could, in the view of the City, be alleviated by disinfection of irrigation water at the intake, public education, and by ensuring that parks and golf courses were irrigated during late night and early morning hours only.

In terms of fruits and vegetables eaten without cooking, food preparation methods such as washing and cooking are an effective barrier against disease transmission from irrigated crops. Studies undertaken in 1986 concluded that the risk associated with microbiologically borne aerosols during irrigation is too low to be quantified. There was insufficient data to evaluate the risk from pathogens accumulating on crops; however, the study team concluded that this risk would be too low to quantify.

Related Presentations

A representative from the North Dakota State Department of Health confirmed that neither North Dakota or Minnesota have microbiological standards for irrigation water.

A medical doctor, employed in the study and treatment of infectious diseases, responded to a question regarding risks from microbial aerosols. There is a lack of evidence to suggest that disease producing bacterial or viral organisms are spread through aerosols in irrigation water. Viruses have short periods of survival outside of the body. In summary, the risk of illness from river water is very low.

PRIMARY RECREATION

Manitoba Environment

Although the river is used infrequently for swimming, the Winnipeg Harbour Master has indicated that people immerse themselves in the river. It is recognized that the Red River is sometimes unsuitable for swimming because of the nature of the river bottom and the turbidity, yet this reduction in clarity does not impair other frequent primary recreation uses such as water skiing, jet skiing, dabbling, and wading while fishing. It was noted that individuals fishing downstream of the locks in Lockport likely breathed in aerosols carrying bacteria and virus. There has been, however, no evidence available indicating that breathing aerosols at Lockport dam is causing illness. Further, Manitoba Environment has not done epidemiological studies regarding risk of ear, eye and respiratory illnesses from bacteria or viruses in the river.

A public attitude survey was cited that had been undertaken for the City of Winnipeg which indicated that over 60% of respondents said they would use the rivers for swimming more if the rivers were less pollution.

Reference was made to a memorandum received from provincial health authorities indicating that swimming and water-skiing in the Red and Assiniboine Rivers is not recommended within the Winnipeg area.

The fecal coliform level set by the Province of Manitoba for primary recreation waters is 200 organisms per 100 mL.

Upstream of Winnipeg, levels of fecal coliforms are below the objectives close to 100% of the time during the recreation period, May 1 to September 30. Data was presented to show how fecal coliform levels increase as water travels through the City of Winnipeg. At the North Perimeter, fecal

coliform levels are above the objective level 96% of the time with a maximum of 284,956 organisms per 100 mL. over the period of record (10 years). At Lockport the objective level of 200 is exceeded 70% of the time during the recreation period.

On the Assiniboine River, objective exceedences are low upstream of Winnipeg with exceedences of the objectives occurring 67-96% of the time during the recreation season at the confluence of the Assiniboine and Red Rivers in the centre of Winnipeg.

It was noted that current analysis did not indicate clear or consistent improvement/deterioration trends in the microbiological quality of the Red and Assiniboine Rivers. The analysis of fecal coliform levels, in the health risk assessment, used logarithmic equations to show the relationships of number of gastrointestinal (GI) cases to fecal coliform densities. It was also agreed that doubling the user numbers would have a far greater effect on the number of GI cases than an increase in the fecal coliform level.

A survey undertaken by Manitoba Environment to determine the wastewater effluent disinfection practises of other but similar communities in North America indicated that 11 of 16 communities surveyed currently disinfect and that 3 more are planning to disinfect in the future. Europe has a uniform standard of disinfection practice with a fecal coliform guide of 100 organisms per 100 mL and a maximum limit of 2,000 fecal organisms per 100 mL. Disinfection of wastewater is not practised however in the U.K.

City of Winnipeg

The City agreed with the fecal coliform level established in the objectives for primary recreation but did not agree with the appropriateness of the river use classification proposed for primary recreational activities. The City of Winnipeg did not agree with the proposed classification for this area. It was stressed that the natural conditions of the rivers such as turbidity, fast currents, and steep banks are safety concerns which limit the rivers' use for primary recreation.

Fecal coliforms found in the watercourses of Winnipeg originate from various sources, including wastewater treatment plant discharges, combined sewer overflows, land drainage, and other sources. The major contributor of coliforms to the rivers in dry weather is the effluent from the three

Water Pollution Control Centres. In wet weather the major sources of pollution are combined sewer overflows, followed by land drainage sewer runoff, and treatment plant effluent.

It was explained that fecal coliforms were highest below the North End Water Pollution Control Centre with geometric means of 6000 organisms per 100 mL and maximum levels well in excess of 200,000. Die-off of the organisms occured within a few days resulting in fecal coliform levels at Selkirk of 200/100 mL. The variability of the data was discussed as a function of the season, river flows, wastewater discharges and averaging periods. It was pointed out that Manitoba Environment uses full year values for the coliform geometric means; whereas, the City of Winnipeg presented open water values which represented the recreation period (April 1 - Sept. 30). The full year geometric mean figures can range from being 15% smaller (at the floodway control structure) to 314% larger (at Selkirk) than the recreation season figures. There was discussion concerning risks from coliform levels in association with ice fishing. It was suggested that there was a low risk from splashing while ice fishing and ingestion of coliforms would be prevented by proper cleaning and cooking practices.

Chlorination/de-chlorination and ultraviolet (UV) light radiation were presented as two major methods of effluent wastewater disinfection. Chlorination yields compounds which have toxic effects on aquatic life; thus, de-chlorination of the disinfected effluent must be undertaken prior to discharge. Total annual costs for effluent disinfection for the City's three wastewater treatment plants, based on chlorination/de-chlorination or UV radiation, including debt amortization, were estimated to range from $1.9 to $3.1 million dollars (1990).

Based upon modelling, wastewater treatment plant disinfection would reduce coliform levels below 200/100 mL at some point above Lockport. Combined sewer overflow (CSO) regulation/treatment would be required to meet the objectives for primary recreation at all times.

Ultra-Violet Light (UV) disinfection was estimated to be a little higher in cost but did not result in the formation of toxic by-products. Unlike chlorine, however, its effectiveness cannot be monitored in-situ*. UV is being used in Banff and Quebec City. UV has not been used with success on CSOs because of the presence of suspended sediments. One method of disinfecting CSOs would involve effluent storage during heavy rainfalls, preceded by screening, and chlorination/dechlorination.

*A chlorine residue in treated water provides evidence of adequate treatment. UV treatment yields no such residue.

With over 70 individual combined sewer overflows, cost estimates for removal of solids, followed by chlorination/de-chlorination ranged from $400 to $700 million. Aside from the costs there are environmental and land-use implications associated with CSOs regulation/treatment facilities in residential areas. In place of retention treatment basins, vortex solids separation systems were also examined as a method of removing suspended solids and floating material from CSOs.

The City of Winnipeg raised the issue that published medical literature did not reveal a single case of serious gastrointestinal illness in water skiers as a result of their activity. It was also observed that most cases of gastrointestinal illness, while being unpleasant, are not serious enough to require formal medical attention and are, therefore, unrecorded.

It was further noted that disinfection of the treatment plant effluents and the CSOs would cost a great amount of money per case of gastroenteritis prevented. The speaker continued by stating that the United Kingdom had not implemented wastewater disinfection with little evident impact on public health. No reference was made, however, to British water quality objectives.

Testimony was given that revealed few recorded instances where the recreational use of surface water has led to illness or hospitalization. There was epidemiological evidence that infections of the ears, eyes and the lungs had been associated with recreational water use. Studies were used to reflect the number of times river users became totally immersed pursuing recreational activities. The estimate for total immersions in both the Winnipeg and Selkirk area, on an annual basis, was 4,200 as a result of swimming, water and jet skiing. Based upon the epidemiological studies, GI cases per 1,000 immersions would be 17 at current microbiological concentrations and would decline to 14/1,000 immersions with wastewater treatment plant effluent disinfection and 9 cases/1,000 resultant from microbiological regulation of both wastewater treatment plant and CSO treatment including disinfection. It was pointed out that the measurable benefits of disinfection would be extremely low due to the small number of cases of GI that are actually reported or that appear to occur.

Related Presentations

A retired medical practitioner from the Selkirk area read a letter from a City of Winnipeg Health Officer stating that the Red River, from the Roseau River to below Selkirk is unsuitable for any form of body contact recreational water activity such as water skiing because of elevated bacteria levels. Emphasis was placed on GI infections, but the speaker had seen as many respiratory infections

as GI infections resulting from river contact. The point was made that swimming was unsafe owing to strong currents, muddy bottom and access. It was further noted that water skiing was dangerous due to river turbidity and the potential for accidents.

A scientist from the University of Winnipeg expressed concern regarding the limitation of the geographic area under consideration, specifically the need to consider Lake Winnipeg. She also expressed the need to consider bacteria such as Streptococci. She took exception to the use of geometric means rather than maxima in microbiological analyses. The thesis was also advanced that heavy metals and organic chemicals should be included in a definitive health risk assessment. The view was held that there is a moral obligation to disinfect wastewater effluent.

A representative from Fish Futures Inc, expressed concern regarding the use of chlorination/dechlorination for disinfection of wastewater. Since toxic by-products may be produced as a result of disinfection of wastewater, other disinfection methods should be considered.

SECONDARY RECREATION

Manitoba Environment

Survey information indicated that there were approximately 50,000 people using the Red and Assiniboine Rivers for power boating, canoeing, and rowing in 1990. A public attitude survey conducted on behalf of the City indicated that over 70% of respondents said they would use the rivers for boating more often if the rivers were less polluted. It was noted that the banks of the Red River were continuing to be developed to enhance their recreational value (e.g., The Forks) and that the City's riverbank parks offered water access points for recreational activities, yet the river quality itself was unsuitable for much of the recreational use that this development encouraged.

A defense of the need for a secondary recreation fecal coliform standard was made by noting that 15% of people surveyed indicated that there was either accidental or intentional immersion during power boating. Questioning of Manitoba Environment representatives revealed that there was a lack of information for the assessment of risks associated with general water based recreational activities such as boating, and further that the fecal coliform objective for secondary recreation was speculative.

The microbiological level set for fecal coliform in secondary recreational waters is 1,000 fecal coliform organisms per 100 mL; whereas, the draft Guidelines for Canadian Recreational Water Quality (Health and Welfare Canada 1990) proposes a limit of 200 for all recreational activities.

Upstream of Winnipeg, fecal coliforms in the Red River are normally *below* the objective level of 1,000/100 mL. At the North Perimeter the 1,000 organism level is *exceeded* between 39% and 91% during the recreation period. At Lockport, exceedences occur 27% - 43% of the time.

On the Assiniboine River, exceedences are very infrequent upstream of Winnipeg; however, at the Main Street Bridge, levels exceed the 1,000 organism objective 17-63% of the time during the open water recreation period.

There is limited microbiological information on the tributaries in the Winnipeg area, with the exception of the La Salle River. It is believed that there is limited recreation on these tributaries in view of their intermittent flow nature.

City of Winnipeg

The problem of riverbank litter and debris was the most significant problem and hindrance to the use and enjoyment of the tributary streams for secondary recreation.

The City questioned the rationale used to establish the microbiological objective of 1,000 fecal coliforms per 100 mL for secondary recreation.

The City's consultant refuted the evidence that the Canadian Recreational Water Quality Guidelines utilize an objective of 200 organisms per 100 mL for secondary recreation. The objective is used solely for "sports in which the user comes into frequent contact with the water". The City had substantiated this contention through correspondence with Dr. Richard Tobin, of Health and Welfare Canada, who stated that "the microbiological guidelines are not intended for use with those waters used principally for secondary recreational activities. In these waters, characteristics other than microbiological quality should be considered...".

Based on the City's projections, wastewater treatment plant disinfection would increase fecal coliform compliance from 50% to 68% of the time to between 65% and 80% within the City, and

downstream of Winnipeg to 65% to 90% of the time for secondary recreation. Disinfection of CSOs as well as the wastewater treatment plant outflows would allow the City to meet the objective for secondary recreation.

Use of power boats is the most popular and high-use activity for the Rivers in this classification area. Immersions from this activity have been estimated by the City to be in the range of 1,800 per year in the Winnipeg area and 400 per year in Selkirk. Immersions resulting from canoeing and rowing are estimated at 100 in Winnipeg and 10 in Selkirk with the assumption that 5% of all boaters will fall into the water. Accidental immersions from fishing activities have only been considered when combined with boating.

Only nominal benefits will accrue from wastewater effluent and CSO disinfection as a result of the very low number of secondary recreation immersions. The City has estimated that the number of GI cases would decrease from 33 to 17 with the advent of disinfection of both wastewater treatment plant effluents and CSOs.

Related Presentations

Evidence from the North Dakota representative confirmed that in North Dakota and Minnesota fecal coliform standards apply to both primary and secondary recreation.

A number of presenters drew attention to the fact that boat rentals at the The Forks implied that secondary recreation was safe at that location within Winnipeg.

COMBINED SEWER OVERFLOWS

Historically, the City of Winnipeg including the suburbs began the installation of combined sewers from the outset (Figure 2, 3 & 4). This practise continued until the 1960's. These sewers handled both storm water drainage as well as household and industrial wastes.

Until the middle of the 1930's, all of these sewers discharged directly to the Red and Assiniboine Rivers without any treatment. At that time, a sewage treatment plant was constructed at the present north end site. As part of this program, pumping stations were installed near many of the

FIGURE 2

SOURCES OF WASTEWATER DISCHARGES TO THE RED AND ASSINIBOINE RIVERS

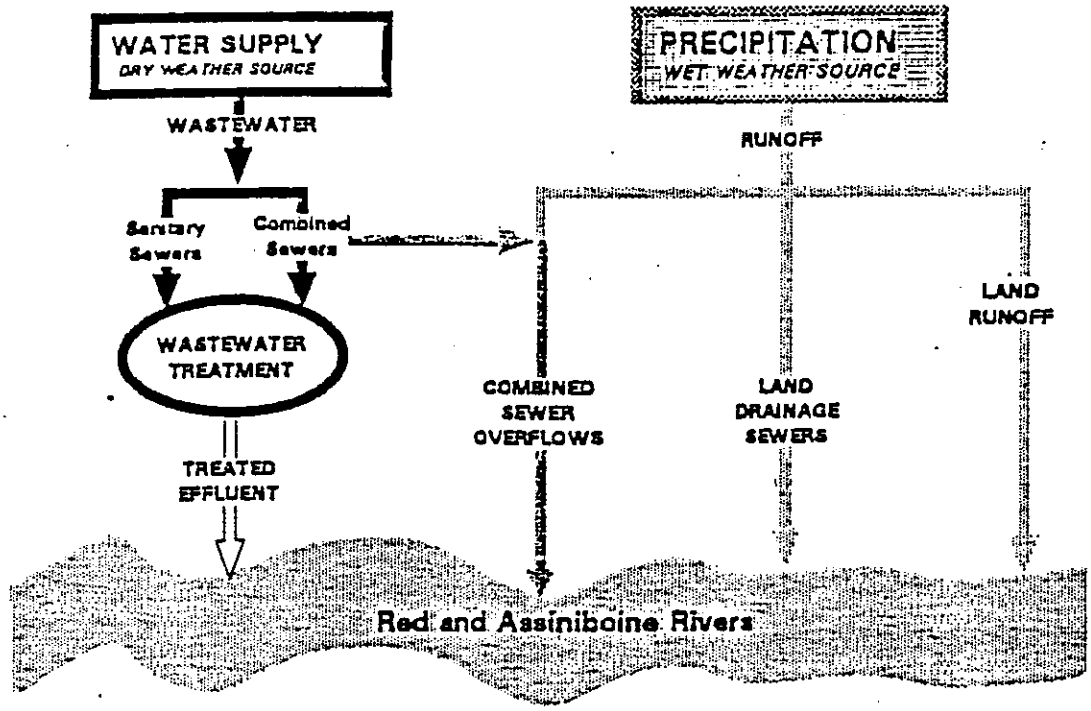


FIGURE 3

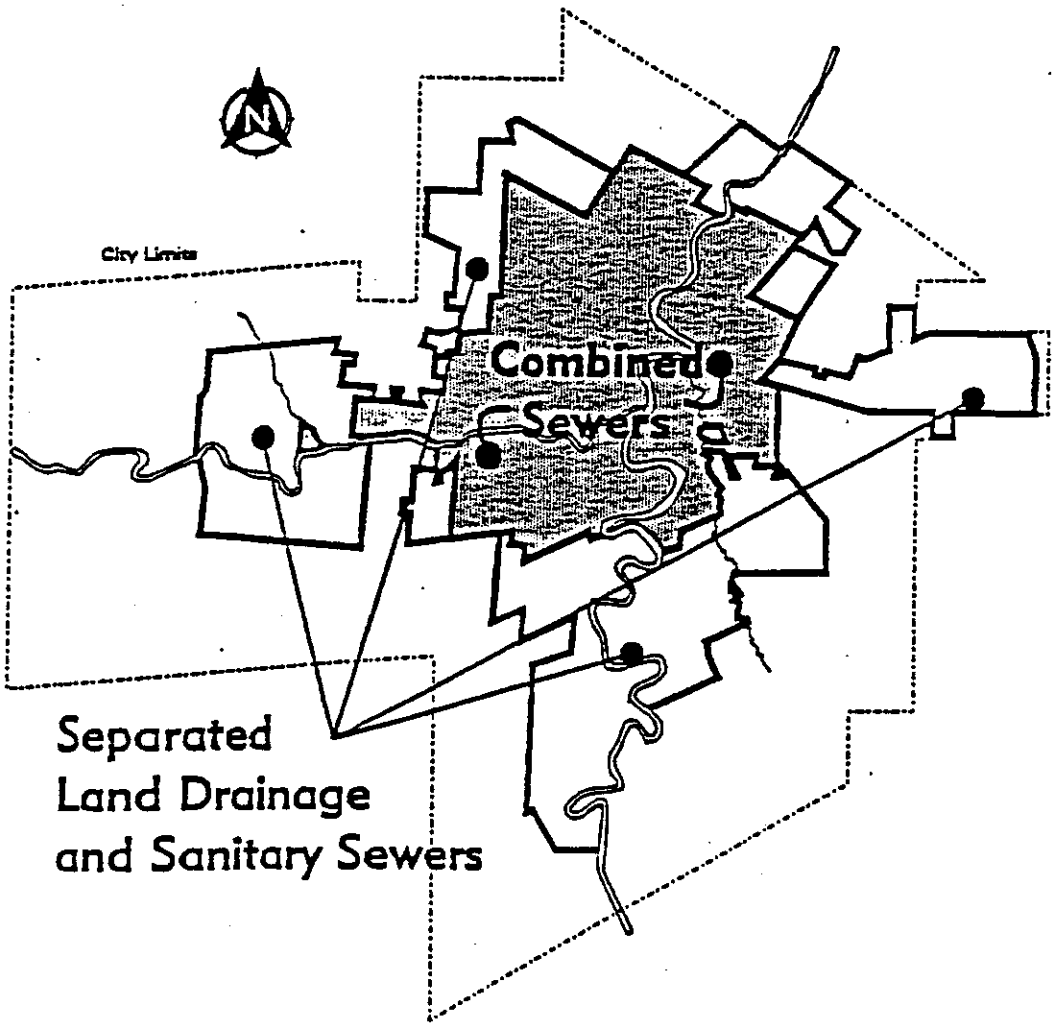
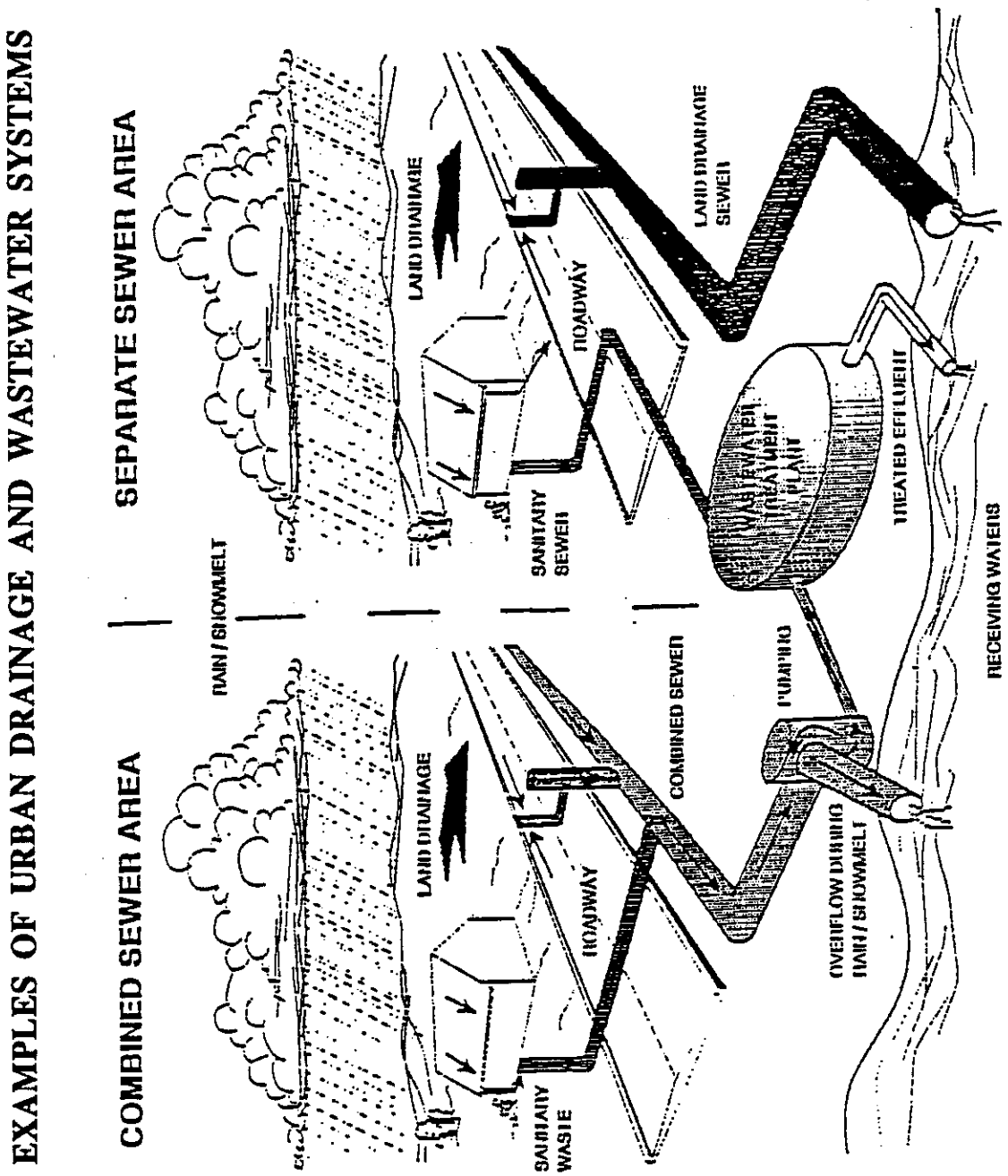

City of Winnipeg
Sewered Areas
City Limits
Combined
Sewers
Separated
Land Drainage
and Sanitary Sewers

FIGURE 4


EXAMPLES OF URBAN DRAINAGE AND WASTEWATER SYSTEMS
COMBINED SEWER AREA
SEPARATE SEWER AREA
RAIN / SNOWMELT
LAND DRAINAGE
ROADWAY
SANITARY WASTE
COMBINED SEWER
TURNING
OVERFLOW DURING RAIN / SNOWMELT
SANITARY SEWER
LAND DRAINAGE SEWER
WASTEWATER TREATMENT PLANT
TREATED EFFLUENT
RECEIVING WATERS

river outfalls within Winnipeg. A main interceptor pipe was installed which diverted the flow from the pumping stations to the treatment plant. During rainfalls and snow melt events, a control structure near the outfall diverted the excess water (greater than 2.75 times dry weather flow) directly to the river. The water diverted to the river was, therefore, diluted sewage. Without this overflowmechanism,backups in the wastewater collection system would occur and cause basement flooding. As time went on, more of the Winnipeg area was serviced by means of wastewater treatment including an infrastructure consisting of pumping stations, interceptor pipes, and treatment plants. Following the decade of the 60's, all new housing developments were serviced by separate sewers with one pipe to accommodate land drainage and the second pipe to handle household and industrial wastewater. Storm water was discharged directly to the rivers or indirectly through storm water management ponds. Sanitary wastewater was directed to one of the three wastewater treatment plants. Currently the City's building code requires subsoil drainage from weeping tile from residential development to be discharged to landscaped areas adjacent to the building and not to the sanitary sewers. Attention to the grading of building lots, removal of household rain spouts from sewer service connections and inlet restrictors on catch basins on streets has also resulted in a reduction of extraneous flow to sanitary sewers. A combined sewer relief program in the mid seventies also resulted in some limited sewer separation in combined sewers in the older portions of Winnipeg.

Overflows from combined sewers still occur during rainfall and spring run-off events in those areas of the City still serviced by combined sewers. The overflows are a function of the snow melt and rainfall intensity, duration, and distribution. Overflows from combined sewers to the rivers occur from 30 - 50 times per year.

One response to the problem of combined sewer overflows is to completely separate storm and sanitary wastewater. This is a very costly program but might be reasonable to contemplate if the life expectancy of the particular sewer has been exceeded. Inspections have shown that many of the combined sewers, although 60 years old, still have considerable life remaining. It was also noted that the City does not have enough data to know whether sewer separation would solve all of the problem. Tentatively, it appears that all of the combined sewers might have to be regulated and treated or separated to meet fecal coliform objectives in the rivers. Prevalent in the wastewater industry elsewhere is a move towards storage and treatment in the combined wastewater collection system. Underground structures are put in place at a location adjacent to the combined sewer outfall that results in some removal of floating and suspended solids. This process is followed by chlorination and de-chlorination in order to ensure that fecal coliform objectives are met in the river. The costs of

retention/treatment basins are less than those for sewer separation and the results have been shown to be effective. A number of private residential properties adjacent to the river would be required to be leveled to accommodate such a remedy.

The City have projected that studies are to be undertaken on their combined sewers to respond to such questions as relative impacts from the various combined sewer overflows on fecal coliforms. The studies will also examine the impact from combined sewers on debris and floating matter.

Evidence was heard from Selkirk's representative that combined sewers in Selkirk would be the subject of an engineering investigation shortly.

The representative from North Dakota State Department of Health indicated that all combined sewer overflows within North Dakota and Minnesota have been or were being eliminated.

WATER BASIN MANAGEMENT

The Terms of Reference of the hearings included a clause soliciting recommendations for a mechanism for the development and coordination of a basin management structure to achieve the water quality objectives. An overview of Manitoba Environment's vision of a multi-participant Water Basin Management Plan was provided.

The Department of Environment recommended that a steering committee be established with representation from the public, proponents, and downstream users. The Town of Selkirk, the City of Winnipeg, rural municipalities, industry, the provincial government, and the federal government would have some involvement. The Steering Committee would receive feedback from public meetings and make amendments to the plan as necessary.

The Water Basin Management Plan would be considered when Manitoba Environment goes through the process of licensing the 29 facilities which had previously been under the control of the City of Winnipeg. The point was made that if the proposed water quality objectives were not accepted, human and aquatic life might not be protected. Certain uses of the rivers might have to be prohibited

and as a result the citizens of the area would have to lower their expectations regarding water quality within the river.

Representatives from the City of Winnipeg disagreed with the establishment of a Steering Committee as suggested by Manitoba Environment. A number of questions come to mind such as terms of reference, membership, reporting relationships, and sources of funding.

The City recommended that this consultation process be referred to the Environment Issues Committee formed several years ago by the Province and City of Winnipeg. Membership of this Committee included senior officials from Manitoba Environment and the Department of Urban Affairs and the Winnipeg Commissioner of Works and Operations.

Selkirk expressed support for the Water Basin Management Plan. It was stressed that all parties with an interest be given full opportunity to participate in the decision making process.

LEGISLATION, LICENSING AND PROCESS

A Manitoba Environment representative noted that Manitoba Environment has the legislative responsibility, through *The Environment Act*, to protect the environment, including surface water quality. The City of Winnipeg was previously given authority by Order-in-Council under the former *Clean Environment Act*, to control discharges to surface waters within its area of jurisdiction. As a result of the City's jurisdiction, Manitoba Environment had not been able to charge the City for violations under the Act. The authority, by order-in-Council, was repealed with advent of *The Environment Act* in 1988. The City of Winnipeg must now obtain approval under *The Environment Act* for its wastewater treatment plants and for other liquid effluent discharges to the Red and Assiniboine Rivers and tributaries.

The City submitted proposals for its three treatment plants in February 1990. As a result of these submissions, Manitoba Environment requested that the CEC hold a public environmental review in two stages:

1. determination of the surface water quality objectives required for the protection of current and future uses of the study area waters (which is the current program), and

2. review of strategies, measures, and courses of action (including time frames) required to implement the recommended water quality objectives determined in the first stage.

Manitoba Environment recognized that costs and benefits, in accordance with the principles of sustainable development, are an integral part of the final decision making when setting objectives. Manitoba Environment contended that costs and benefits should only be addressed once the objectives were set and in a forum where action from a regulatory perspective was being discussed (e.g., licensing). It was also suggested that such a forum would consider whether or not the objectives could be achieved and whether the costs could be met. It was noted that information such as costs and benefits were required to be brought forward by the Environment Act and that such information was to be provided by the proponent. The City of Winnipeg will be the proponent during licensing hearings.

In response to questioning regarding the appropriateness of changing the objectives based on evidence presented at the hearings, a representative of Manitoba Environment stated that the objectives were current and were appropriate for application to the matter under consideration. It was also noted that there was an ongoing process of research to affirm or change the objectives. It was further pointed out that, in the view of Manitoba Environment, there had been no new information advanced at these hearings to prompt changes to the objectives. It was further noted that a review of the objectives would be initiated in 1992. That review, and not the current hearings, would be the forum for changing the objectives. It was added that if changes to the objectives were considered major, a public review would be recommended.

In response to a question regarding the classification of river zones rather than the entire classification area, it was stated that this was a possibility but that downstream users in the basin must be considered. It was observed that licences were in place for upstream dischargers on the Red River.

A point was made that the objectives were not enforceable but that they were used in the regulatory program and were translated into discharge licensing requirements. As a footnote, it was stated that the objectives had been successful and appropriate in that use.

FINAL REMARKS AND CONCLUDING STATEMENTS

Manitoba Environment

In Manitoba Environment's concluding statement it was noted that in almost all cases, the presentations agreed with the proposed MSWQO and called for action by the City of Winnipeg to improve the water quality in the rivers and streams. The importance of the various river uses was underscored during the hearings with the following summary of specific objectives stressed:

- the objective for un-ionized ammonia reflects the best scientific judgement concerning levels that will protect the aquatic community.
- the fecal coliform objective, for primary recreation, and irrigation water which comes in contact with people or is used in public places, provides reasonable protection for users. The primary recreation objective is consistent with neighboring jurisdictions.
- the fecal coliform objective, for secondary recreation, and irrigation of produce is deemed appropriate to provide a reasonable level of protection. It is recognized that there is a large degree of uncertainty with the value.
- The minimum low flow rate for meeting the objectives is *either* the $7\text{-}Q^{10}$ or the $4\text{-}Q^{3}$.

In response to a criticism from the City of Winnipeg that Manitoba Environment's report "A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans" was inappropriate, it was stated that this report was to be presented at the licensing phase but since the Terms of Reference of the current hearings provided such latitude, a decision was reached to include them in this process.

Attention was drawn to the national and international implications of water quality issues. It was suggested that the City of Winnipeg's current approach to disinfection and CSOs might appear to contradict their positive efforts in the past. The benefits of the multi-stakeholder water quality management process was reiterated. In conclusion, Manitoba Environment stated that the time was right to proceed to the next step in improving the water quality of our rivers and streams.

City of Winnipeg

The City of Winnipeg's representative indicated that the sewer utility has $104 million of debt which is essentially recent and current capital programs. This debt is expected to increase to $210 million by 1996, based on continuing commitments to wastewater treatment.

The position of the City of Winnipeg, regarding each water quality objective area, had been noted at appropriate junctures throughout their presentation and are not repeated.

The City's view was that Manitoba Environment used a simplified procedure and did not carry out the necessary studies required to make decisions on site-specific water quality objectives. Manitoba Environment clearly is the Proponent in setting objectives. The City of Winnipeg believes that the setting of numerical objectives hinges, to a large measure, on the costs and benefits involved in obtaining those objectives.

The City demonstrated clearly that the health risk to current users was much less than what Manitoba Environment had suggested. The spending of up to $700 million to deal with this risk was of doubtful benefit in their opinion.

Evidence of an excellent fishery had been presented to the Commission. The City contended that suggesting aquatic life was unacceptably affected by present un-ionized ammonia conditions was speculation. Further research would satisfy uncertainties regarding the un-ionized ammonia objective and would assist in the development of a site-specific objective with a study to follow examining nitrification options.

The City stated that, in recognition of the need to improve the aesthetic condition of the rivers, a master plan for reducing combined sewer overflows would be developed.

In closing, the Commission was urged to ensure itself that real benefits existed and that adequate information was available prior to committing the City to their estimated expenditure of a billion dollars associated with the water quality objectives proposed by Manitoba Environment.

Town of Selkirk

The Town of Selkirk, stated that it concured with the overwhelming public opinion that the uses provided for in the classification were both appropriate and necessary to improve water quality. It was noted that the basic underlying science as found in the approach developed by the U.S. EPA had not been challenged at these hearings. While the need for further research has been identified, the interveners with scientific backgrounds advocated, without exception, the adoption of the objectives, followed by further research. Given the potential size of expenditures and the public's expectation of timely change, a planned, prioritized, phased approach would be necessary.

CITIZEN AND GROUP PRESENTATIONS

Ms. Karen Jodoin of the Save Our Seine, Lorette Chapter presented the results of a questionnaire completed during 1991 by 52 respondents. She stated that her group felt that the Seine River should be protected for primary recreation. Poor water quality, agricultural practises, low flow and water levels were cited as the main impediments to present or future use of the river.

Mr. Robert Hudson of Roseisle, Manitoba, on behalf of concerned citizens in the region of Stephenfield, Manitoba, asked that the CEC set the highest standards feasible for drinking, livestock and irrigation uses, and review the consequences of upstream diversions and reductions in volume.

The presentation of Dr. I. Reid from the Selkirk area included a listing of numerous uses which underscore the importance of the Red River including recreation, commercial use, air bases, security forces, agricultural use, riverbank use and community drinking water. He also noted the problem of pleasure and commercial boats discharging their sewage holding tanks directly into the river. Dr. Reid also spoke of the need to separate the City's combined sewers, Selkirk's fines resulting from not following CEC directives, various options to chlorination, the similarities of the 1991 hearings to those in 1981, and cost/benefit issues. He concluded by stressing that the real problem to address was the cross-connected sewers.

Ms Peg Venables, of the Save Our Seine Residents Committee, presented evidence on behalf of resident in St. Vital and St. Boniface. She spoke of the river's degradation over the past 25 years. Aside from the adoption of the secondary recreation classification for the Seine River, the balance of the recommendations dealt with stream obstructions and flow.

Mr. Edwin Yee, representing the Manitoba Hazardous Waste Management Corporation (MHWMC), discussed the issue of hazardous waste and many of the activities of the MHWMC. Mr. Yee recommended that the City of Winnipeg and Manitoba Environment of Manitoba ensure effective enforcement of their pollution control regulations, specifically with regard to sewering chemicals. He also recommended that water quality monitoring and objectives include hazardous waste indicators. Mr. Yee indicated that the MHWMC was supportive of the proposed water quality objectives.

Mr. Max Morelli, Canadian Member of the International Joint Commission Red River Pollution Board read the Board's presentation written by Mr. Max Dodson, U.S. Co-Chairman. In 1967, the Board recommended that the governments of Canada and the United States accept the following water quality objectives:

Fecal Coliform	200 organisms/100 mL
Chloride	100 mg/L
Sulphate	250 mg/L
Total Dissolved Solids	500 mg/L
Dissolved Oxygen	5 mg/L

In response to questioning, Mr. Morelli noted that the jurisdiction of the IJC is at the boundary. He also noted that North Dakota and Minnesota have adopted the U.S. EPA's un-ionized ammonia criteria.

Mr. Dodson, in his letter, noted that "as more information on indigenous fish migration across the International Boundary becomes available, it is increasingly apparent that downstream releases of contaminants can affect the quality of the fishery in upstream areas". He concluded by supporting the proposed water quality objective and suggested that a whole basin approach to water quality protection be adopted.

Mr. Morelli noted that the Board did not have specific information or data of the migratory species at risk, the extent of the risk, nor the magnitude of any possible effects - the statement made by Mr. Dodson was a hypothesis.

Mr. William Gummer, Chief of the Water Quality Branch, Conservation and Protection, Environment Canada, focused his presentation on the Red and Assiniboine main stem river systems. The brief contained a series of recommendations (a number of which applied directly to this program of applying objectives as follows):

1. that the CCME statement on "Inter-jurisdictional Co-operation on Environmental Matters" be endorsed;
2. true-cost water pricing be used as a means of improving conservation and quality;
3. a basin-wide approach to water quality management be adopted;
4. the proposed water quality uses be adopted;
5. the proposed un-ionized ammonia objective be adopted; and
6. the proposed fecal coliform objectives be adopted.

A number of other recommendations related to the Water Quality Objectives document itself.

In closing, Mr. Gummer noted that we must give nature the benefit of the doubt, and err on the side of protecting the environment. The increasing number and complexity of environmental issues demand that we adopt a more integrated approach.

Mr. Brian Oborne, Canadian Coordinator for the International Coalition for Land and Water Stewardship in the Red River Basin spoke of the need to balance economic realities with environmental necessities and focused on the stewardship of the river. Mr. Oborne referred to the Twin Cities in Minnesota as an example of improved water quality through facility upgrading. The International Coalition offered its experience in non-confrontational consensus building and networking services to Manitoba Environment, the City and others involved in the pursuit of increased water quality.

Mr. Oborne confirmed that the total estimated cost to date of separating the sewers in the Twin Cities was US $287 million (since 1984) with the area population close to 2 million. He also confirmed that 2/3s of the original combined drainage area had been separated through ongoing

programs prior to the start of the $287 million 10 year program. (The City of Winnipeg has approx. 10,000 hectares of combined sewers versus 8,400 hetares in the Twin Cities 10 year program) The previous construction of large trunks may account for the large difference in cost estimates.

Dr. Pete Sarsfield, Director Health Promotion, Protection and Disease Prevention, Manitoba Health, gave a presentation stressing the broad view of ecosystem health and sustainable development. He suggested that without clear water quality objectives, sustainable development was not possible. He presented 5 of the 14 principles for public policy shown in the European Charter on Environment and Health:

- Good health and well being require a clean and harmonious environment;
- The preferred approach would be to promote the principle of "prevention is better than cure";
- Action on problems of the environment should be based on best available scientific information;
- The health of individuals and communities should take clear precedence over considerations of economy and trade.

Dr. Sarsfield suggested that there was not a major difference between primary and secondary recreation in terms of exposure and his contention was that the 200 fecal coliform level should apply to all recreational use.

Mr. Dennis Windsor, presenting on behalf of the Water and Wetlands Research Group of the Canadian Plains Research Center, outlined a number of relevant points made at a recent Symposium of the Plains Aquatic Research Conference. Relative to the current process were statements dealing with a need to apply technology to nutrient removal and a need to consider water basin and regional management perspectives.

Mr. Jerry Moskalyk, operator of a mobile park in the Rural Municipality of St. Andrews, described his lagoon operation.

Ms Mary Davies, representing the Selkirk and District Chamber of Commerce, expressed her support for the proposed water quality objectives and disagreed with the vision of water quality put forth by the City of Winnipeg. She stated that poor water quality in the Red River was partially

attributed to the loss of a bid for a pharmaceutical company to locate in Selkirk. She emphasized that Winnipeg should not be excluded from the objectives set for the rest of the Province.

Mr. Frank Weins, representing the Selkirk Rotary Club, expressed the organization's support for the establishment of safer water quality standards for the Red River. He stressed that the City of Winnipeg should implement improvements on an incremental basis so it will eventually meet the same water quality objectives as the rest of the Province.

Mr. Alvin Merinuk, Reeve of the Rural Municipality of St. Clements, spoke of the poor river water quality (specifically solid litter) which he has personally experienced, living beside the river. He also read a Council resolution supporting the proposed MSWQO.

Mundeep Kaur, Susan Peters, and Jackie Lussier, students representing Lord Selkirk High School students, made a presentation focusing on the results of a student survey which showed that the majority of respondents felt that improvements should be made to the Red River water quality. Reference was made to similar hearings held in 1981. The hope was expressed that it would not be necessary to repeat the group's points in another 10 years as a result of further inaction.

Mr. Russell Skalesky, representative of the Triple S Community Development Corporation, based in Selkirk, gave a presentation in support of the proposed water quality objectives. He emphasized the Corporation's dismay in learning that the Red River water quality was frequently not suitable for its intended uses. Mr. Skalesky noted the many uses of the Red River and Netley Marsh, and the importance of these waterbodies to tourism, manufacturing, agriculture, recreation and residences in the Triple S area. The significance of consistently enforcing the objectives across all jurisdictions was stressed.

Mr. Joe Smolinski, representing the Selkirk and District Hospital Board, read into the record, a resolution in support of the proposed water quality objectives. The water quality of the Red River was considered to be a very important health issue for people of the area and all Manitobans.

Mr. Harvey Benson, Councillor with the Town of Gimli, was very much concerned with government inaction and approval of projects in isolation. It was recommended that the CEC try to influence the establishment of a long-range plan for water use in Manitoba. Mr. Benson also read a resolution from the Town of Gimili which was supportive of the proposed water quality objectives.

Mr. Wayne Faires, Chairman of the Red River Advisory Group and Vice-President of the Lockport Merchants Association, showed a video, taken in August of 1991, of the Red River just north of the St. Andrews lock and dam. The video clearly showed visual debris and litter which floated for miles north of the dam. Mr. Faires asserted that the debris is collected just above the dam, and is cleared away from time-to-time(several times per summer) by passing the material over the dam. He noted logs, planks with nails, plastic bottles, aerosol cans, condoms etc. during the presentation. Following a description of the lower Red River fishery value, Mr. Faires suggested that a solution to the Winnipeg sewage problem must be examined carefully so that the fishery is not jeopardized in any way (e.g., the negative effects from chlorine disinfection). The complex biological diversity must be maintained for the future at all costs.

In response to questioning, Mr. Faires stated that the area south of the dam should be protected as well as taking measures to stop the dumping of collected materials.

Mr. Ron Dalmyn spoke of numerous pollution problem which he has experienced over the years and the problems encountered with government officials and engineers. He stated his support for the proposed water quality objectives and stressed that enforcement of regulations will be required.

Mr. Clyde Rennie, citizen of the Town of Selkirk, suggested that if Selkirk was upstream of Winnipeg, the City of Winnipeg would complain about downstream water quality downstream of Selkirk.

Mr. Jean-Paul Boily and Mr. Robin Wiens of the Saint Boniface Residents Association and the Saint Boniface Riverbank Preservation Committee, spoke of the importance of the Red and Seine Rivers to the community. Mr. Boily suggested that if the proposed objectives were implemented, the river would be better utilized. Implementing the objectives would also remove inconsistences in public policy encouraging use of the river while permitting the current levels of contamination. Full support was given to the proposed water quality objectives and the mechanism for river management.

Dr. Allan Lansdown, Dr. Diane Malley and Dr. Derek Muir presented on behalf of the Manitoba Environment Council. The main points of the Council's brief are shown below as related to the classification process being undertaken.

1. The present classification of rivers and streams in Winnipeg should not be done in isolation from the classification of the upstream and downstream stretches of the rivers.

2. Water quality objectives are required following classification and they should be updated as relevant new information becomes available.
3. Support is given for the proposed water quality objectives with the exception that all waterways be protected for domestic consumption and primary recreation.
4. The following stretches of river should be protected with a high quality designation: the Assiniboine River west of Headingley, the Red River upstream of Winnipeg, and the Netley-Libau Marsh.
5. The City's cost estimates for sewage treatment options should include the impact of vigorous water conservation programs.
6. The Province and City are urged to be active partners in the proposed Green Plan-funded ecosystem study of the Red - Assiniboine Basin.

A number of other points were raised by the Council delegation in connection with the "Water Quality Objectives Process".

Dr. Malley concluded by stressing the need for environmental monitoring to compare the environments against the objectives and that the objectives should be enforced to ensure that total discharges will maintain the watercourses within those objectives.

In response to questioning, Dr. Malley suggested that if site-specific information was not available, there was a necessity to proceed with the best data on hand, and set water quality objectives. The Council's position was that we should proceed with the proposed objectives.

Dr. Malley agreed that it would not be realistic to have 620,000 people live in one location without any impact whatsoever on the river; rather, she stressed minimization of impact. She also agreed that all current river uses did not deserve equivalent degrees of protection. She stated that an educated guess was sufficient to justify the application of an objective having a price tag of hundreds of millions of dollars, and suggested that there were many examples of this, specifically the pulp and paper industry in relation to organochlorines. Dr. Malley stated that if the 200 coliform level for primary recreation was met, the river would be considered safe, even when considering other natural hazards (turbidity, current, steep banks, boards etc.).

Ms. Deborah Smith on behalf of CHOICES, A Coalition for Social Justice discussed the issues involved with water quality in the context of the Group's principles of fair taxation, spending choices, full employment and social justice. She stressed that the use of waterways as dumps for sewage, chemicals and garbage cannot continue.

She suggested that large expenditures required could be handled by amortizing or spending the money over 25 years.

Mr. William Kocay and Mr. Doug Symington, representing the Manitoba Recreational Canoeing Association, spoke of the recreational uses of Winnipeg's rivers. Health concerns result in the rivers being under-used. Mr. Symington also noted many impacts on other users resulting from poor water quality. He recommended that the rivers of Winnipeg should be clean enough to allow body contact, and anticipated accidental ingestion of water. He also recommended that a 5 or 10 year plan be developed to clean up the rivers. In the absence of a clean up or until a clean up occured clearly visible signs should be posted, indicating the dangers of contact with the water.

Dr. Alan Ronald, a medical practitioner of Winnipeg, had practiced in the field of infectious diseases in Winnipeg since 1968 having seen approximately 10,500 Manitobans with infections during that time. During the past 10 years, he had not recalled treating one person infected from Winnipeg's rivers. He stated that there was no evidence to suggest the rivers were causing disease. He expressed his concern about the setting of artificial standards which were not scientifically set and that as much science as possible should be considered in making critical decisions.

Mr. Dennis Breed of Winnipeg expressed his concern for the welfare of the rivers in the classification area. He spoke of the need to consider wildlife and fish as well as humans and the need to address the biological aspects of the whole ecosystem. He focused on the need to control pesticides.

Mr. Gerard Lecuyer of the Enviraction Group based in St. Boniface spoke of the need to improve the quality of our rivers and river banks. He suggested that a detailed plan be developed for the next 25 years dealing with sewer separation and a longer term plan to cover the following 50 or 100 years. He expressed his qualified support for the proposed water quality objectives and recommended increased consultation with the citizens of Winnipeg.

Mr. Lyle Ross of the National Farmer's Union, spoke of the farm community's need to be assured of water supply and quality.

Dr. Gerry McKenny representing Manitobans against the Assiniboine Diversion, spoke of the need for water resources planning and management to consider both the quantity and quality of the resource. He noted that future withdrawals and damming will have negative impacts on downstream users.

Mr. Michael Tokarz, a citizen of Winnipeg, presented information on water conservation, combined sewers, recreation, irrigation as well as dissolved oxygen, and un-ionized ammonia. He suggested that when sewage from combined sewers is discharged into the river, the public should be informed by radio broadcast. He also suggested that north of Winnipeg should be proposed as unacceptable for swimming and water-skiing at present with a view towards making the quality suitable for primary recreation.

Mr. Ronald Basarab of the Winnipeg Rowing Club and the Manitoba Rowing Association suggested that re-development of Winnipeg's waterways could not stop at the water's edge and that the quality of the water must not be allowed to deteriorate any further. He also discussed the need for public announcements of water quality.

Mr. David Blicq of Winnipeg a member of the Save Our Seine River Committee and a concerned city resident noted that it is imperative that the Seine River be included in any planning for a "Rivers Initiative". He discussed the grassroots-level cleanup, the extent of the problem including large-scale obstructions, access to the river and compliance with water quality objectives.

Dr. Jim Ross, President of the Manitoba Medical Association, asked that surface water quality objectives be respected throughout the Province and that environmental impact assessments be done prior to implementation of any remedial measures. The Association acknowledged the health risk from pollutants but noted that illnesses do not occur with any frequency and with much severity.

Mr. Jim Duncan of Winnipeg sent a letter to the Commission indicating that current and potential uses of the waterways should be safeguarded and improved. He suggested an economically feasible time frame for improvements.

Mr. Arthur Turner of Headingley sent a letter, of qualified support for the proposed water quality objectives, to the Commission.

Mr. Ron Ellis of the Manitoba Paddling Association Inc. sent a letter supporting the primary recreation designation for the Red River and suggested the same classification be given to the tributaries to maintain the water quality level in the Red River.

Ms. Kathy Palsson of Hnausa, Manitoba sent a letter to the Commission which expressed her concern regarding the accelerated deterioration of Lake Winnipeg's water quality during recent years. She suggested that the City of Winnipeg's disregard of the water quality guidelines would have severe consequences for the future of our Province.

Resolutions in support of the proposed water quality objectives were received from Selkirk and District Planning Area Board, the Village of Dunnottar, the Rural Municipality of Victoria Beach, the Rural Municipality of St. Andrews, the Selkirk Army, Navy & Air Force Veterans in Canada, the Selkirk Kinsmen and Kinette Clubs, and the Maritime Museum of Manitoba.

Dr. William Paton, Associate Professor, Department of Botany/Biology, Brandon University, in a written submission drew attention to water quality problems in a southern Manitoba watershed and the applicability of certain water quality parametres and indicators.

Dr. Gordon Goldsborough of Brandon University, forwarded a presentation reviewing the document "Water Quality Monitoring and Modelling of the Red and Assiniboine Rivers". The review document had been prepared and presented by the City's consultant as evidence to the hearing.

A letter concerning the water quality objectives from Mr. Rick Hnatiuk of the Selkirk and Area Weed Control District stated that the District supported the proposed water quality objectives.

Miss Jessica Schafer representing Ms Marianne Cerilli presented a group of slides from a canoe trip on the Assiniboine River in the summer of 1991. Attention was drawn to litter and debris in and beside the river, private developments, wastewater and disposal treatment and domestic consumption.

Paula Harding, Regional Manager, Federal Facilities Accommodation, Public Works Canada, responded in writing to Manitoba Environment, regarding the dumping of debris over the St. Andrews Lock and Dam. She stated that operating staff will manually remove debris which has been collected at the dam, if it can be safely handled. Remaining debris is cleared by manipulating the dam's curtains and frames in order to prevent damage to the facility. Plans have been made to review the present system of handling debris.

DISCUSSION

Terms of Reference and Geographic Area of Consideration

The Clean Environment Commission has been asked to recommend water quality objectives for the protection of beneficial uses for rivers and tributaries within and downstream of the City of Winnipeg. Prior to and during the hearings, there was some ambiguity resulting from the terms of reference which were to guide the hearing process and the geographic boundaries for the classification area.

The original terms of reference for the Clean Environment Commission Hearings, announced in November 1989, required a detailed review of water quality issues including projected treatment costs and anticipated benefits for the Red and Assiniboine Rivers. In July 1991, the Minister of Environment revised the terms of reference, stressing the current and future uses of the rivers without mention of the costs and benefits associated with the adoption of water quality objectives. In November 1991, the Minister of Environment provided further clarification in a letter to the City of Winnipeg. At that time, the Minister acknowledged the appropriateness of the Commission considering a wide range of factors, including costs and benefits, in reaching their conclusions. The City of Winnipeg indicated their frustration with the changing terms of reference. The City's preparation for the hearings had been primarily based upon the original terms of reference. The consideration of costs and benefits was seen to be crucial when establishing water quality objectives. The City also expressed the view that Manitoba Environment was responsible for presenting cost/benefit information as the hearing's proponent. However, during the hearing process, Manitoba Environment did not deal with the costs and benefits of implementing the objectives. The Town of Selkirk's representative noted the difficulties associated with having various parties discussing water quality objectives based on differing terms of reference and the interpretation of letters.

The most recent terms of reference also enlarged the geographic area to include eight tributaries of the Red and Assiniboine Rivers within and downstream of the City of Winnipeg. The Commission has assumed that the classification for the La Salle and Seine Rivers above the Winnipeg boundary will remain as established in the 1981 Clean Environment Commission classification process. This would also apply to Devil's, Netley and Cook's Creek. The significant portion of both Omand's and Bunn Creek are within the Winnipeg Area and will be classified in this process. The reach of Sturgeon Creek within Winnipeg will be classified as part of this process. The upper reach of Sturgeon Creek can be classified when the balance of the Assiniboine River is classified (i.e. above the Trans Canada Highway at St. Francois Xavier). The earlier classification will have to be modified to fit the 1988 Water Quality Objectives Document.

The City of Winnipeg stressed the costs and benefits of protecting various water uses and questioned the parameters of the MSWQO specific requirements, particularly the objectives for un-ionized ammonia and fecal coliform. Manitoba Environment, The Town of Selkirk, and most of the other presenters have focused their evidence on the current and future uses of the watercourses and the current water quality problems and the 1988 Manitoba Water Quality Objectives.

The Commission were also requested to recommend a specific mechanism for the development and coordination of water quality basin management to achieve the Water Quality Objectives. As a first stage towards such a goal, a number of studies have been identified on un-ionized ammonia and combined sewer overflows. The recommendations that deal with these studies, includes a requirement to put in place a steering or advisory committee to both assist in the definition of the study and advise on the conduct of the study. The need for any further coordinating committee could be examined during subsequent hearings.

General Overview

In general, most presenters indicated their agreement with Manitoba Environment's proposed water quality objectives. In some cases, presenters called for higher quality designations, specifically for sections of the Assiniboine and La Salle Rivers. There was general consensus that the quality of our rivers and streams has a direct impact on aquatic life, wildlife, and human life, especially for communities in close association with the water environment. There was also a general consensus that the body of site specific knowledge surrounding water quality issues in the classification area was lacking in a number of areas. However, most presenters did not see the lack of knowledge as a

significant reason to postpone the improvement of water quality which had been advocated throughout the hearings.

The costs to implement various treatment options were presented to the hearings as rough estimates only. Estimates ranged from $20 million to over $1 billion depending on the level of treatment required. The effectiveness of various options was questioned as were certain negative side effects. Regardless of the costs estimates, many presenters considered that *now* was the time to begin a clean-up of the rivers and that costs would only increase in the future. The City of Winnipeg delegation and several witnesses questioned the benefits that would accrue from the expending of large amounts of capital. It was noted that increased operating costs would also be significant.

Another concern identified at the hearing was that the water quality objectives respecting un-ionized ammonia had been in place for some time and communities such as Brandon, which were close to the functional design stage of a new wastewater treatment system, were being required under their licences to meet un-ionized ammonia limits.

Individual Presenters and Interest Groups

In addition to Manitoba Environment, The City of Winnipeg, and the Town of Selkirk, there were over 50 individual presenters or interest groups providing evidence to the Commission. Many of these presenters stressed the value of the watercourses to their personal interests, livelihood, or group activities. This had been exemplified by the personal involvement of local volunteers groups and individuals in river and stream clean-up programs. Many viewed river and stream management from an ecosystem approach and stressed the need to implement improvements from this perspective. Several speakers reminded the Commission of the requirements of the concept of sustainable development. Many presenters recognized the need to set reasonable time-frames for improvements. Water conservation, utilization, and pricing were raised as approaches to consider in conjunction with the application of water quality objectives.

There was concern expressed that application of water quality objectives to sections of rivers and tributaries was not appropriate and that a water basin approach, including upstream areas and Lake Winnipeg, was required. Further, the need to consider watercourse sediments and riverbanks in conjunction with surface water quality was noted. A number of presenters discussed problems of floating debris, noting the dangers to users and the aesthetic degradation of the

waterways. The method of clearing debris collected at the St. Andrews Locks was of particular concern.

Under the Green Plan, Environment Canada is believed to be planning a thorough water quality study of the entire Canadian section of the Red River basin. The original plan was timed to coincide with a study in the U.S. reach of the Red River being undertaken by the United States Geological Survey. The completion of these studies should significantly improve knowledge of the basin.

Other concerns noted by various presenters included the discharge of sewage from holding tanks of boats; the need to remove various stream obstructions; the need to ensure adequate inspection and enforcement capabilities; and finally, the desire of some to disallow recreational power boating, jet-skiing, and water-skiing within the designated area of the rivers, noting safety concerns, noise, and riverbank degradation.

PREVIOUS CEC RECOMMENDATIONS

It was noteworthy that several of the recommendations from the 1981 Red River Watershed Classification, as applied to the Winnipeg region, had not been implemented. Other than a study involving ultraviolet irradiation of waste water, action had not been taken to meet a fecal coliform limit set at 400 organisms per 100 mL. A study - Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluent was jointly authorized by Manitoba Environment and the City. No decision was reached to disinfect wastewater effluents at the City of Winnipeg Wastewater Treatment Plants.

SPECIFIC MANITOBA SURFACE WATER QUALITY OBJECTIVES

Class 1 - Domestic Consumption

Manitoba Environment has proposed that the Red and Assiniboine Rivers be protected for domestic consumption. The Department has agreed that the current impact of the City of Winnipeg on the Red River does not impair the use of river water for downstream users, specifically, the Town of Selkirk. The Town of Selkirk has approval from Manitoba Health to produce drinking water from the Red River as needed. The City of Winnipeg has shown that complete treatment of raw river water is required because of natural and upstream exceedences of drinking water objectives. The City agrees with the classification and has recommended that the Assiniboine River also be so classified since it is used as a source of drinking water for the Headingley Jail. The City does not agree with the

classification of the La Salle River for domestic consumption as there are no current nor anticipated uses within the City of Winnipeg.

There was general consensus from the Town of Selkirk and other presenters that the proposed classifications should be implemented. A concern remained that treated water from the Red River would always be perceived by some as unacceptable for domestic use.

Class 2 - Category B - Cool Water Aquatic Life and Wildlife

There was complete agreement from all parties that watercourses within the classification area should be protected for aquatic life and wildlife. The major area of disagreement was the application of MSWQO for un-ionized ammonia concentrations. The City contends that un-ionized ammonia levels have been relatively stable from 1965 to 1991 and that there is no evidence of lethal or sub-lethal effects on the fishery. The City of Winnipeg identified uncertainties in the un-ionized ammonia objectives. While Manitoba Environment agreed that site-specific research had not been used to establish the MSWQO for un-ionized ammonia, the Department was confident that the objectives (based on U.S. EPA research) are relevant and have scientific credibility. Fish biologists reported differing views regarding the river's current ability to support a strong and diverse fish population. One biologist reported that fingernail clams were found only upstream of the City of Winnipeg. A biologist from Fish Futures Inc. drew attention to the detriment to fish passage from barriers on both the mainstem rivers and tributaries. Another biologist asserted that the entire watershed should be investigated in terms of its fishery and fish habitat. There was some disagreement on the merits of various low-flow conditions which have been used to test for compliance with MSWQO.

There appeared to be uncertainty with respect to the level of un-ionized ammonia control required for sustainable aquatic life. Site-specific research would reveal the nature and extent of effluent plumes and the chronic-exposure sensitivity of local species. The determination of requirements for effective control options for un-ionized ammonia, in conjunction with site specific research, would allow the refinement of water quality objectives for cool water aquatic life and habitat. In the interim, best available information faces the City and the Province with costly remediation requirements which may, in the long run, not represent money well spent.

Class 3 - Industrial Consumption

Manitoba Environment has proposed that the Red, Assiniboine, Seine and La Salle Rivers, and Cook's, Netley and Devil's Creeks, be classified for industrial consumption. The City of

Winnipeg has agreed with these classifications with the exception of the Seine and La Salle Rivers because of the low-flow character of these rivers. There was general agreement with the proposed classifications from other presenters.

Class 4 - Irrigation, Categories A, B and D, Greenhouse Irrigation, Field Crop Irrigation, & Livestock Watering

There was significant disagreement as to the interpretation of the MSWQO for irrigation. Manitoba Environment has included lawn watering, park and golf course watering, and cereal crops in their definition of agricultural consumption although these uses are not specifically designated as such under the MSWQO. The City of Winnipeg believes that these new inclusions should be scrutinized and subject to public review. Further, the City observes that irrigation uses are limited by factors such as conductivity, pH, and chlorides and that the fecal coliform objective is questionable (1,000 organisms per 100 mL for irrigating water and 200 organisms per 100 mL for waters which may come in contact with field workers, children, golfers, etc.).

The Commission notes that little irrigation takes place during wet-weather flows when CSO effluents have a substantial impact by raising fecal coliform levels.

Class 5 - Categories A & B - Primary & Secondary Recreation

Manitoba Environment has proposed that only the Red River be classified for primary recreation and that all rivers and streams within the classification area be classified for secondary recreation. The Department provided evidence to show significant use for both categories of recreation and has indicated that use numbers would increase if river quality was improved. Numerous individual presenters and interest groups stressed their agreement with the proposed classification.

The key specific requirement for recreational use is the fecal coliform objective. Primary recreation advocates a 200 organisms per 100 mL and secondary recreation a 1,000 organisms per 100 mL level. The City of Winnipeg considers that natural river conditions make the Red River unsafe as well as unsuitable for primary recreation and the most prominent use - water-skiing - is so limited that benefits do not justify the costs of disinfection. Disinfection of wastewater treatment plant effluent would likely bring the City of Winnipeg into full compliance with the primary and secondary recreation objectives during dry-weather flows. During wet-weather flows, objectives would not be met because of the impact of combined sewer overflows. Land drainage also contributes to the coliform load. This

would also require that discharges of raw sewage to storm or combined sewers during dry weather would have to be limited to emergency situations only.

The Commission feels there is insufficient site-specific information on the composition and impact of CSOs to advocate a blanket requirement for all CSOs to be regulated and treated or to separate combined sewers. It is known from Winnipeg's estimates and from experience elsewhere that the costs are high. It may be that, even with complete regulation and treatment of CSOs, fecal coliform objectives could not be met at all times.

RECOMMENDATIONS

The Clean Environment Commission recommends that the Manitoba Department of Environment classify the Red and Assiniboine Rivers and tributaries, within and downstream of the City of Winnipeg, according to the following Manitoba Surface Water Quality Objectives:

Recommendation 1 (Class 1 - Domestic Consumption)

The Red and Assiniboine Rivers should be protected for domestic consumption use according to the MSWQO.

Recommendation 2 (Class 2 - Category B - Cool Water Aquatic Life and Wildlife)

Rivers and streams specified within the classification area should be classified for the protection of cool water aquatic life and wildlife. However, the acceptance of the proposed classification is qualified because there is uncertainty regarding the related objective's specified un-ionized ammonia parameters. The Commission recommends that the specific requirements for un-ionized ammonia be set at those prescribed by the U.S. EPA by 1997 unless site specific research has determined otherwise. Research requirements have been specified in Recommendation 7.

Recommendation 3 (Class 3 - Industrial Consumption)

The Red, Assiniboine, Seine, and La Salle Rivers, within the classification area, should be classified for industrial consumption according to the MSWQO.

Recommendation 4 (Class 4 - Categories A, B and D, Greenhouse and Field Crop Irrigation and Livestock Watering)

The following watercourses and uses should be protected according to the MSWQO, during dry-weather flows:

- The Red and Assiniboine Rivers should be protected for greenhouse irrigation;
- all rivers and streams, specified within the classification area, should be protected for field crop irrigation;
- all rivers and streams, specified within the classification area, with the exception of Omand's and Bunn's Creeks, should be protected for livestock watering.

Classification of these uses during wet-weather flows should be postponed until site-specific research can provide adequate information for informed decision-making. Research requirements have been specified in Recommendation 7.

Recommendation 5 (Class 5 - Categories A & B, Primary and Secondary Recreation)

The Red River should be protected for primary recreation, and all watercourses specified within the classification area be classified for secondary recreation, according to the MSWQO, during dry-weather flows.

Classification for these uses during wet-weather flows should be postponed until site-specific research can provide adequate information for informed decision-making. Research requirements have been specified in Recommendation 7. Until this information is available, the rivers within the prescribed area should be posted with cautionary notices regarding the risks of primary and secondary recreation following rainfall events of sufficient volume to cause combined sewer overflow impact to the rivers.

Recommendation 6 (Un-Ionized Ammonia Study)

Detailed site-specific studies should be undertaken to determine both the acute toxic and chronic effects of un-ionized ammonia from wastewater effluent on the cool water aquatic life of the rivers. Members of the scientific community within Manitoba should be invited to collaborate in the study design. Recommendations should be available before July, 1997 as to the program required to deal with un-ionized ammonia in wastewater at the water pollution control sites along the river system being considered.

The study results will be utilized to establish the un-ionized ammonia objective at a public hearing to be held within six months of the completion of the study.

Recommendation 7 (Fecal Coliform Study)

Site specific studies should be undertaken to determine water quality impacts of the combined sewer system on the rivers with the study including but not limited to:

- a physical inventory of the combined sewer system and the reaches of the rivers affected
- a project schedule in order to ensure that a sufficient number of flow events are monitored to understand the impacts of the combined sewer overflow on water quality in the river particularly during low river flows
- an understanding of routing through the sewer system during dry and wet weather flow events
- flow monitoring of the sewers and the rivers
- rainfall monitoring network
- water quality monitoring during overflow events at the overflows and in the receiving stream
- the establishment of parameters concerning storm frequency and the duration that fecal coliform levels must be met.

The data should be used to establish the cause of water quality violations in the river and subsequently result in the formulation of remedial measures to reduce the impact.

Members of the scientific community in Manitoba should be invited to collaborate in the study design and an advisory or steering committee should be established during implementation of the study. Recommendations should be available before July, 1997 regarding changes to the design and operation of the combined sewer overflows in The City of Winnipeg. Hearings should be held within six months of the completion of the study to determine the implementation schedule for fecal coliform objectives.

In the interim, following rainfall events of sufficient volume to cause combined sewer overflows to the rivers, the rivers in the prescribed area should be posted with health related cautionary notices regarding the safety of primary recreation.

Recommendation 8 (Warning System for High Coliform Levels)

The Minister of Environment, in conjunction with other Departments and the City of Winnipeg, should research and develop an appropriate high fecal coliform level *public warning system* for operation during the recreation season. The warning system should alert river and tributary users within the classification area of fecal coliform standard exceedances. It should be operational in the recreation season following attainment of dry-weather flow compliance with fecal coliform objectives.

Recommendation 9 (Floating Debris Procedures - St. Andrews Locks)

The Minister of Environment should encourage and facilitate improved operations by Public Works Canada to minimize the release of floating debris passing over the St. Andrews Locks.

Recommendation 10 (Wastewater Discharge From Boats)

As soon as possible, legislation should be developed to prohibit the discharge of wastewater from boats into the rivers and streams of Manitoba.

Recommendation 11 (Upgrading of 1981 Red River Classification)

The watershed classification program for the Red River, undertaken in 1981, should be upgraded to reflect the revisions made to the "Manitoba Surface Water Quality Objectives" document of 1988.

Recommendation 12 (Barriers and Flow Interruptions on The Seine River)

Manitoba Environment should refer concerns raised at the hearings regarding barriers and interruptions to flow, particularly on the Seine River, to the appropriate authorities for investigation.

Recommendation 13 (Review of Manitoba Surface Water Quality Objectives)

Manitoba Environment should consider a number of recommendations made respecting the need to re-examine the Manitoba Surface Water Quality Objectives. If, following such an examination, substantive changes are contemplated, a public review of any proposed revisions should be undertaken.

Recommendation 14 (Riverbank and Riverbottom Clean-up)

Manitoba Environment should continue to assist initiatives of volunteer groups designed to clean-up river banks and riverbottoms, particularly in the Winnipeg area.

GLOSSARY OF TERMS

Aerosol - Colloidal particles dispersed in a gas, smoke, or fog.

Ammonia - A pungent, colorless, gaseous, alkaline compound of nitrogen and hydrogen that is highly soluble in water. Normally present in most waters as a biological degradation product. Some of the ammonia (NH_3) reacts in water to form ammonium ions (NH_4^+). The toxicity of aqueous solutions of ammonia is attributed to the NH_3 (un-ionized ammonia).

Chlorination - The application of chlorine or chlorine compounds to water or wastewater, generally for the purpose of disinfection, but frequently for chemical oxidation and odor control.

Combined Sewer - A sewer intended to receive both wastewater and storm or surface water.

CSO - Combined Sewer Overflows carries both sewage and storm water run-off.

Dechlorination - The partial or complete reduction of residual chlorine by any chemical or physical process.

Disinfection - (1) The killing of waterborne fecal and pathogenic bacteria and viruses in potable water supplies or wastewater effluents with a disinfectant; an operational term that must be defined within limits, such as achieving an effluent with no more than 200 colonies fecal coliform per 100 ml. (2) The killing of the larger portion of microorganisms, excluding bacterial spores, in or on a substance with the probability that all pathogenic forms are killed, inactivated, or otherwise rendered non-virulent.

Dissolved Oxygen (DO) - The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per litre (mg/L), or percent saturation.

Dry Weather Flow - (1) The flow of wastewater in a combined sewer during dry weather. Such flow consists mainly of wastewater, with no storm water included. (2) The flow of water in a stream during dry weather, usually contributed entirely by groundwater.

Fecal Coliform - Aerobic and facultative, gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5°C, and associated with fecal matter of warm-blooded animals. Fecal coliforms are used as an indicator of disease producing bacteria.

Gastrointestinal Illness (GI) - A mild illness resulting in an inflammation of the stomach and intestines that may cause stomach cramps, headaches, vomiting and diarrhea.

MSWQO - Manitoba Surface Water Quality Objectives.

NEWPCC - North End Water Pollution Control Centre.

Nitrification - The oxidation of ammonia nitrogen to nitrate nitrogen in wastewater by biological or chemical reactions.

Outfall Sewer - A sewer that receives wastewater from a collecting system or from a treatment plant and carries it to a point of final discharge.

Oxygen Saturation - The maximum quantity of dissolved oxygen that liquid of given chemical characteristics, in equilibrium with the atmosphere, can contain at a given temperature and pressure.

Ozonation - The process of contacting water, wastewater, or air with ozone for purposes of disinfection, oxidation, or odor control.

Primary Recreation Period - Between May 1 to September 30 as defined by Environmental Management Division.

7-Q^{10} - Average minimum flow over a 7-day period which has a probability of occurring once in 10 years.

4-Q^{3} - Average minimum flow over a 4-day period which has a probability of occurring once in 3 years.

Sanitary Sewer - A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of ground, storm, and surface waters that are not admitted intentionally.

Sanitary Wastewater - Wastewater discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial, plants, or institutions.

Saturation - The condition of a liquid when it has taken into solution the maximum possible quantity of a given substance at a given temperature and pressure.

Secondary Treatment - The second step in most wastewater treatment systems in which bacteria consumes the organic parts of the wastes. It is accomplished by bringing the sewage and bacteria together in a trickling filter or activated sludge process.

Separate Sewer - A sewer intended to receive only wastewater or storm water or surface water.

SEWPCC - South End Water Pollution Control Centre.

Storm Sewer - A sewer that carries storm water and surface water, street wash and other wash waters, or drainage, but excludes domestic waste water and industrial wastes.

Storm Water - Surface water from rain, snow, or ice melting and running off from the surface of a drainage area. It is normally collected in sewers separate from the sanitary sewer, and receives minimal, if any, treatment prior to discharge to a receiving water. When collected in a combined sewer system, the resulting mixture of sewage and stormwater is called combined wastewater.

Tertiary Treatment - The treatment of wastewater beyond the secondary or biological stage often implying the removal of nutrients, such as phosphorous and nitrogen, and of a high percentage of suspended solids.

Ultraviolet Radiation - Light waves shorter than visible blue-violet waves of the spectrum, having wave lengths of less than 390 nanometres. Has application in the disinfection of water and wastewater.

USEPA - United States Environmental Protection Agency. The Federal Environmental Regulatory Agency in the U.S.A.

VSS - Vortex Solids Separator.

Wastewater - The spent or used water of a community or industry which contains dissolved and suspended matter.

Water Quality Criteria - Scientific standards on which a decision or judgement may be based concerning the suitability of water of a specific quality to support a designated use.

WEWPCC - West End Water Pollution Control Centre.

WWF - Wet Weather Flows, increased flows to the WPCC resulting from rainfall or snowmelt.

APPENDIX A: CITIZEN AND GROUP PRESENTATIONS

Ms. Karen Jodoin of the Save Our Seine, Lorette Chapter

Mr. Robert Hudson of Roseisle, Manitoba, on behalf of concerned citizens in the region of Stephenfield, Manitoba

Dr. I. Reid

Ms Peg Venables, of the Save Our Seine Residents Committee

Mr. Edwin Yee, representing the Manitoba Hazardous Waste Management Corporation (MHWMC)

Mr. Max Morelli, Canadian Member of the International Joint Commission Red River Pollution Board

Mr. William Gummer, Chief of the Water Quality Branch, Conservation and Protection, Environment Canada

Mr. Brian Oborne, Canadian Coordinator for the International Coalition for Land and Water Stewardship in the Red River Basin

Dr. Pete Sarsfield, Director Health Promotion, Protection and Disease Prevention, Manitoba Health

Mr. Dennis Windsor, presenting on behalf of the Water and Wetlands Research Group of the Canadian Plains Research Center

Mr. Jerry Moskalyk

Ms Mary Davies, representing the Selkirk and District Chamber of Commerce

Mr. Weins, representing the Selkirk Rotary Club

Mr. Alvin Merinuk, Reeve of the Rural Municipality of St. Clements

Mundeep Kaur, Susan Peters, and Jackie Lussier, students representing Lord Selkirk High School students

Mr. Russell Skalesky, representative of the Triple S Community Development Corporation, based in Selkirk

Mr. Joe Smolinski, representing the Selkirk and District Hospital Board

Mr. Harvey Benson, Councillor with the Town of Gimli

Mr. Wayne Faires, Chairman of the Red River Advisory Group and Vice-President of the Lockport Merchants Association

Mr. Ron Dalmyn

Mr. Clyde Rennie

Mr. Jean-Paul Boily and Mr. Robin Wiens of the Saint Boniface Residents Association and the Saint Boniface Riverbank Preservation Committee

Dr. Allan Lansdown, Dr. Diane Malley and Dr. Derek Muir presented on behalf of the Manitoba Environment Council

Ms. Deborah Smith on behalf of CHOICES - A Coalition for Social Justice

Mr. William Kocay and Mr. Doug Symington, representing the Manitoba Recreational Canoeing Association

Dr. Alan Ronald

Mr. Dennis Breed

Mr. Gerard Lecuyer of the Enviraction Group

Mr. Lyle Ross of the National Farmer's Union

Dr. Gerry McKenny representing Manitobans Against the Assiniboine Diversion

Mr. Michael Tokarz

Mr. Ronald Basarab of the Winnipeg Rowing Club and the Manitoba Rowing Association

Mr. David Blicq, a member of the Save Our Seine River Committee

Dr. Jim Ross, President of the Manitoba Medical Association

Mr. Jim Duncan

Mr. Arthur Turner

Mr. Ron Ellis of the Manitoba Paddling Association Inc.

Ms. Kathy Palsson

Selkirk and District Planning Area Board

Village of Dunnotta

Rural Municipality of Victoria Beach

Rural Municipality of St. Andrews

Selkirk Army, Navy & Air Force Veterans in Canada

Selkirk Kinsmen and Kinette Clubs

Maritime Museum of Manitoba

Dr. William Paton, Associate Professor, Department of Botany/Biology, Brandon University

Dr. Gordon Goldsborough of Brandon University

Mr. Rick Hnatiuk of the Selkirk and Area Weed Control District

Miss Jessica Schafer representing Ms Marianne Cerilli

Paula Harding, Regional Manager, Federal Facilities Accommodation, Public Works Canada

APPENDIX B: LIST OF EXHIBITS

1. Letter, dated July 10, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Stan Eagleton, Chairman, Manitoba Clean Environment Commission, with attachment (Terms of Reference: CEC Hearings to Recommend Water Quality Objectives for the Red River, Assiniboine River and Their Tributaries, Within and Downstream of the City of Winnipeg).

2. Letter, dated October 7, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Mayor William Norrie, Q.C., Mayor, City of Winnipeg.

3. Letter, dated November 20, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Mayor William Norrie, Q.C., Mayor, City of Winnipeg.

4. CEC Presentation - Rivers: Introductory and Closing Remarks, November 25, 1991. Submitted by **Manitoba Environment.**

5. Clean Environment Commission Presentation. Submitted by **Manitoba Environment.**

6. Overhead Transparencies, presented November 25, 1991 by Dennis Brown, Manitoba Environment. Submitted by **Manitoba Environment.**

7. Red and Assiniboine Rivers and Their Tributaries Within and Downstream of the City of Winnipeg: Technical Document. Sharon Gurney, Water Quality Management Section, Environmental Management Division, Manitoba Environment. Submitted by **Manitoba Environment.**

8. Slides, presented November 25, 1991 by Sharon Gurney, Manitoba Environment. Submitted by **Manitoba Environment.**

9. Red River Fisheries. Joe O'Connor, Manitoba Natural Resources. Submitted by **Manitoba Environment.**

10. Slides, presented November 25, 1991 by Joe O'Connor, Manitoba Natural Resources. Submitted by **Manitoba Environment.**

11. Red and Assiniboine Basin - Public Hearing: Water Quality Management Plan. Submitted by **Manitoba Environment.**

12. Overhead Transparencies, presented November 25, 1991 by Doug Peterson, Manitoba Environment. Submitted by **Manitoba Environment.**

13. Curriculum Vitae, for Michael A. Shkolny, P. Eng., Arnold H. Permut, M.Sc., P. Eng., George Rempel, P. Eng., McKernan, J. Michael, Ruth Marr, Gladding, Robert J. and Barry D. MacBride, M.Sc., M.B.A., P. Eng. Submitted by the **City of Winnipeg.**

14. The Red and Assiniboine Rivers Surface Water Quality Objectives: Summary Report. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, August, 1991. Submitted by the **City of Winnipeg.**

15. The Red and Assiniboine Rivers Surface Water Quality Objectives: Technical Report. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, September, 1991. Submitted by the **City of Winnipeg.**

16. The Red and Assiniboine Rivers Surface Water Quality Objectives: Appendices. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, September, 1991. Submitted by the **City of Winnipeg.**

17. The Red and Assiniboine Rivers Surface Water Quality Objectives: Biophysical Survey. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, November, 1991. Submitted by the **City of Winnipeg.**

18. Water Quality and Uses for Winnipeg's Rivers: A Review of Options and Priorities For the Future, October, 1991. Submitted by the **City of Winnipeg.**

19. City of Winnipeg Presentation Outline, November 26 and 27, 1991. (Including *Introductory Statements* from William Norrie Q.C., Mayor, City of Winnipeg and R.J. McRae, Commissioner, City of Winnipeg.) Submitted by the **City of Winnipeg** [(a) & (b)].

20. Letter, dated August 19, 1991 from **M.A. Shkolny**, P. Eng., Water Pollution Control Planning Engineer, Waterworks, Waste, and Disposal Department, City of Winnipeg to C. Conyette, P. Eng., Manitoba Environment.

21. Brief, untitled, submitted by **Robert H. Hudson.**

22. Curriculum Vitae, for Linda A. Poffenroth and Richard Stephen Stanwick. Submitted by the **City of Winnipeg.**

23. Technical Presentation Schedule and Panel, Wednesday , November 27, 1991. Submitted by the **City of Winnipeg.**

24. Comments Re: Provincial Proposal on Steering Committee. Submitted by the **City of Winnipeg.**

25. Ambient Water Quality Criteria for Ammonia - 1984. United States Environmental Protection Agency. Submitted by the **City of Winnipeg.**

26. Brief, "Clean Environment Commission Hearings, November, 1991", submitted by **Ian L. Reid**, CM; MD; FRCS.

27. Brief, "Presentation to the Clean Environment Commission Re: Water Quality of the Red and Assiniboine Rivers and Tributaries", submitted by Dave Taylor, **Concerned Citizens of Manitoba.**

28. Brief, untitled, submitted by **Save Our Seine (Lorette Chapter).**

29. Brief, "Brief to the Clean Environment Commission on the Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers", submitted by **Dr. Eva Pip**, University of Winnipeg.

30. Brief, "Save our Seine Residents Committee Brief Submission to the Manitoba Clean Environment Commission, November, 1991", submitted by the **Save our Seine Coordinating Committee.**

31. Brief, "Brief to Manitoba Clean Environment Commission Regarding Red and Assiniboine Water Quality Within and Downstream of Winnipeg", submitted by **Ducks Unlimited Canada.**

32. Brief, "Clean Environment Commission Water Quality Objectives Hearings Red and Assiniboine Rivers, November, 1991", submitted by the **Manitoba Hazardous Waste Management Corporation.**

33. Attitudes and Perceptions Toward The Construction of a Hazardous Waste Facility in Winnipeg. Results Group. July 10, 1990. Submitted by the **Manitoba Hazardous Waste Management Corporation.**

34. Letter, dated November 26, 1991 from **Max H. Dodson,** U.S. Co-Chairman, Red River Pollution Board, International Joint Commission, to Manitoba Clean Environment Commission, with attachment (Thirtieth Progress Report to the International Joint Commission - Red River. International Red River Pollution Board, October, 1990).

35. Brief, "Manitoba Clean Environment Commission Hearings November 28, 1991 Red and Assiniboine Rivers Surface Water Quality Objectives", submitted by **Environment Canada,** with attachments (Federal Water Policy, Environment Canada; and, Souris River Basin International Water Quality Objectives for the Saskatchewan/North Dakota and North Dakota/Manitoba Boundary Crossings, Souris River Bilateral Water Quality Monitoring Group).

36. Brief, "Manitoba Clean Environment Commission Public Hearings Regarding Manitoba Environment's Proposed Water Quality Objectives for the Red and Assiniboine Rivers and their Tributaries Within and Downstream of the City of Winnipeg (November 28, 1991)", submitted by the **International Coalition.**

37. Brief, "Presentation to: Clean Environment Commission, Re: Application of Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries (File # 3012.00)", submitted by **Manitoba Health.**

38. CEC Presentation - Rivers Introductory and Closing Remarks Selkirk, Manitoba December 2, 1991. Submitted by **Manitoba Environment.**

39. (a) Rationale Document Supporting Revisions to Manitoba Surface Water Quality Objectives. D.A. Williamson, Manitoba Department of Environment and Workplace Safety and Health, July 15, 1988. (b) Manitoba Surface Water Quality Objectives. D.A. Williamson, Manitoba Department of Environment and Workplace Safety and Health, July 15, 1988. (c) The Development and Use of Water Quality Objectives in Manitoba. D.A. Williamson, Manitoba Environment. (d) Report on a Proposal for the Classification of Manitoba's Surface Water: Red River Principal Watershed Division. The Clean Environment Commission, November, 1981. Submitted by **Manitoba Environment.**

40. Graph/Chart, "Control/Jurisdiction", submitted by **Manitoba Environment.**

41. Red River Toxic Profile Study. United States Environmental Protection Agency, Environment Canada, North Dakota Dept. of Health, Minnesota Pollution Control Agency and Manitoba Department of Environment and Workplace Safety and Health. Submitted by **Manitoba Environment.**

42. "Pollution Control: Bathing water quality - its status in EC countries" World Water, July /August, 1989. Submitted by **Manitoba Environment.**

43. Brief, "The Town of Selkirk Presentation to the Clean Environment Commission December 3, 1991". Submitted by Bud Oliver, Mayor, **Town of Selkirk,** with attachments.

44. Brief, "Presentation to the Clean Environment Commission on the Proposed Classification of the Red & Assiniboine Rivers and their Tributaries - Manitoba Hydro, December 1991", submitted by **Manitoba Hydro.**

45. Letter, undated, from **Dennis C. Windsor** to D. Stewart, Chairman, Manitoba Clean Environment Commission, with attachment (Proceedings of the Great Plains Aquatic Research Workshop - Technologies and Strategies Used to Develop or Access Water Supplies in the Great Plains, November 4, 1991. Dennis C Windsor, Manager of Environmental Protection and Codes, Manitoba Hydro).

46. Brief, "Presentation to the Clean Environment Commission Public Hearing held December 3, 1991, Selkirk, Manitoba", submitted by the **Selkirk and District Chamber of Commerce.**

47. Brief, "Rotary Club of Selkirk Presentation to the Clean Environment Commission Public Hearing Held December 3, 1991, Selkirk, Manitoba", submitted by the Rotary Club of Selkirk.

48. Resolution, dated November 25, 1991 from the **Rural Municipality of St. Clements.**

49. Letter, dated December 3, 1991 from **R. S. "Bud" Oliver,** Mayor, Town of Selkirk, to Dale Stewart, Chairman, Manitoba Clean Environment Commission.

50. Letter, dated November 27, 1991 from **Francis J. Schwindt,** Chief, Environmental Health Section, North Dakota State Department of Health and Consolidated Laboratories, to the Manitoba Clean Environment Commission.

51. Letter, dated December 2, 1991 from **Kathy Svanda,** Manager, Non-point Source Section, Water Quality Division, Minnesota Pollution Control Agency, to the Manitoba Clean Environment Commission.

52. (a) A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans: Their Potential Application to the Red and Assiniboine Rivers: Executive Summary. Charles S. Conyette, P.Eng., Environmental Management Division, Manitoba Environment, October, 1991.(b) A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans: Their Potential Application to the Red and Assiniboine Rivers: Technical Report. Charles S. Conyette, P.Eng., Environmental Management Division, Manitoba Environment, October, 1991 Submitted by **Manitoba Environment.**

53. Brief, "Submission of the Triple S Community Development Corporation to the Clean Environment Commission, November, 1991", submitted by **Triple S Community Development Corporation.**

54. Red & Assiniboine Rivers Surface Water Quality Objectives Presentation to the Clean Environment Commission - Selkirk, December 3, 1991. Submitted by the **City of Winnipeg**

55. Resolution, dated November 28, 1991, from the **Selkirk & District General Hospital.**

56. Brief, "Brief to the Clean Environment Commission Public Hearings on Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers Within and Downstream of the City of Winnipeg", submitted by **Dr. Kenneth W. Stewart** and **Fish Futures Inc.**.

57. Brief, "Brief to Clean Environment Commission, December 2, 1991", submitted by **Harvey Benson**, Councillor, **Town of Gimli**, with attachments.

58. Letter, dated November 29, 1991, from **D. Hall**, Asst. Secretary - Treasurer, the **Town of Gimli**, to Bud Oliver, Mayor, Town of Selkirk.

59. Brief, untitled, submitted by **Red River Advisory Group**, with attachment (Manitoba Fishing & Hunting Adventures, 1991. Travel Manitoba).

60. Brief, untitled, submitted by **Rick Epp**, Realtor, **HomeLife Properties Inc.**

61. Letter, dated December 2, 1991, from **Eva Pip**, Professor, Department of Biology, University of Winnipeg, to the Manitoba Clean Environment Commission.

62. Separating Combined Sewers to Improve and Protect Mississippi River Quality: A Ten Year Commitment - Annual Progress Report. Cities of Minneapolis, Saint Paul, South Saint Paul and the Metropolitan Waste Control Commission, March 1991. Submitted by Bryan Oborne, Canadian Coordinator, **International Coalition for Land and Water Stewardship in the Red River Basin.**

63. Letter, dated December 12, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Dale Stewart, Chairman, Manitoba Clean Environment Commission, with attachments.

64. Letter, dated December 16, 1991 from **Francis J. Schwindt**, Chief, Environmental Health Section, **North Dakota State Department of Health and Consolidated Laboratories**, to Manitoba Clean Environment Commission, with attachment (Standards of Water Quality for State of North Dakota).

65. Letter, dated December 20, 1991 from **Ron Dalmyn** to Manitoba Clean Environment Commission, with attachment (Brief, untitled, submitted by Ron Dalmyn).

66. Letter, dated December 31, 1991 from **Greg Michie**, Managing Director, **Triple S Business Development Corporation**, to Chairman, Manitoba Clean Environment Commission, with attachment.

67. Review of Ammonia Criteria for Surface Waters. Environmental Applications Group Ltd. June, 1987. Submitted by **Manitoba Environment.**

68. Ammonia Toxicity and Red River Fish: Report to City of Winnipeg Waterworks, Waste and Disposal Department. MacLaren Plansearch Inc. Lavalin. June, 1987. Submitted by **Manitoba Environment.**

69. Overhead Transparencies, various, presented January 13, 1992 by Dwight Williamson, Manitoba Environment. Submitted by **Manitoba Environment.**

70. Overhead Transparencies, various, presented January 13, 1992 by Mike McKernan, Wardrop/TetrES. Submitted by the **City of Winnipeg.**

71. Presentation Notes, Wardrop TetrES, January 13, 1992. Submitted by the **City of Winnipeg.**

72. Letter, dated December 13, 1991 from **D. C. Windsor**, Manger, Environmental Protection and Codes Department, **Manitoba Hydro**, to Dale Stewart, Chairman, Manitoba Clean Environment Commission.

73. Brief, "The Saint-Boniface Riverbank Preservation Committee Presentation to Manitoba Clean Environment Commission Re: Water Quality Objectives for Winnipeg's Rivers, November 28, 1991". Submitted by the **Saint-Boniface Residents Association.**

74. (a) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Technical Report. October, 1986. MacLaren Engineers, Lavalin. (b) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Appendices. October, 1986. MacLaren Engineers, Lavalin. (c) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Executive Summary. October, 1986. MacLaren Engineers, Lavalin. Submitted by the **City of Winnipeg.**

75. Letter, dated March 11, 1991 from **Margaret Fast**, M.D. FRCPC, Director, **CDC & Pete Sarsfield**, M.D. FRCPC, Director, **Environmental Health**, to Sharon Gurney, Environment Officer, Manitoba Environment, with attachment. (Submitted by Manitoba Environment)

76. Brief, "Brief to the Clean Environment Commission from the Manitoba Environmental Council on the Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries, Public Hearings, 25-28 November and 2 December 1991, Winnipeg and Selkirk", submitted by the **Manitoba Environmental Council.**

77. Overhead Transparency, "PCBs and organochlorine pesticides in a single Red River Sediment sample from Lockport - below the dam and comparison with N.W. Ontario remote lake sediments", presented January 13, 1992 by Derek Muir, Manitoba Environmental Council. Submitted by the **Manitoba Environmental Council.**

78. Brief, untitled, submitted by **CHOICES**, A Coalition for social justice.

79. Brief, "Report for the Winnipeg Water Quality Hearings", submitted by the **Manitoba Recreational Canoeing Association.**

80. Brief, "Application of water quality objectives for the watershed classification of the Red and Assiniboine Rivers and their tributaries", submitted by **Gerard Lecuyer for ENVIRACTION.**

81. Brief, "Presentation to the Manitoba Clean Environment Commission Water Quality Objectives Hearings, November, 1991", submitted by **Manitobans Against the Assiniboine Diversion.**

82. Overhead Transparencies, "Ammonia: Monthly Mass Loads (Tonne)", presented January 14 1992 by Mike McKernan, Wardrop/TetrES. Submitted by the **City of Winnipeg.**

83. Overhead Transparencies, "Components of the nitrogen cycle at the North Perimeter, Lockport and Selkirk", presented January 14, 1992 by Dwight Williamson, Manitoba Environment. Submitted by **Manitoba Environment.**

84. Brief, "Classification of the Red and Assiniboine Rivers", submitted by **Michael B. Tokarz,** with attachments.

85. Brief, "Winnipeg Rowing Club/Manitoba Rowing Association Position Paper to the Manitoba Clean Environment Commission, submitted by the **Manitoba Rowing Association.**

86. Overhead Transparencies, various, presented January 14, 1992 by George Rempel, Wardrop/TetrES. Submitted by the **City of Winnipeg.**

87. Overhead Transparencies, "City of Winnipeg Pollution Control Initiatives", presented January 14, 1992 by Mike Shkolny, City of Winnipeg. Submitted by the **City of Winnipeg.**

88. Order in Council, # 152, dated February 2, 1972. Submitted by **Manitoba Environment.**

89. Letter, dated November 12, 1991, from **David M. Blicq** to the Manitoba Clean Environment Commission.

90. Letter, dated November 15, 1991, from **Jim Ross,** President, **Manitoba Medical Association** to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission, with attachment (Submission to the Clean Environment Commission Re: Water Quality of Red and Assiniboine Rivers).

91. Letter, dated October 25, 1991, from **Jim Duncan** to Manitoba Clean Environment Commission.

92. Letter, dated November 26, 1991, from **Arthur Reid Turner** to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission.

93. Letter, dated November 27, 1991, from **Ron Ellis,** President, **Manitoba Paddling Association Inc.** to Rory A. Grewar, Secretary Manitoba Clean Environment Commission.

94. Letter, dated December 20, 1991, from **Kathy Paulson** to Manitoba Clean Environment Commission.

95. Resolution, dated December 3, 1991 from the **Selkirk and District Planning Area Board.**

96. Resolution, dated November 20, 1991 from the **Village of Dunnottar.**

97. Resolution, dated November 19, 1991 from the **Rural Municipality of Victoria Beach.**

98. Resolution, dated November 26, 1991 from the **Rural Municipality of St. Andrews.**

99. Letter, dated November 25, 1991, from **Rick Hnatiuk**, Weed Supervisor, **Selkirk and Area Weed Control District**, to Gloria Vinnie, Secretary Treasurer, Town of Selkirk. (Submitted by the Town of Selkirk.)

100. Letter, dated November 25, 1991, from **Mary Myall**, Secretary Unit 151, **Army, Navy and Air Force Veterans in Canada**, to His Worship The Mayor, Town of Selkirk. (Submitted by the Town of Selkirk.)

101. Letter, dated December 2, 1991, from **Sandy Huff**, Secretary, **Kinette Club of Selkirk**, to R. S. "Bud" Oliver, Mayor, Town of Selkirk. (Submitted by the Town of Selkirk.)

102. Letter, dated November 21, 1991, from **Ted Francis**, Chairman, **Marine Museum of Manitoba**, to the Manitoba Clean Environment Commission.

103. Brief, "Submission to the Clean Environment Commission on Water Quality Objectives", submitted by **Dr. William H. N. Paton**, Associate Professor, Department of Botany/Biology, Faculty of Science, Brandon University.

104. Letter, dated January 10, 1992 from **Dr. L.G. Goldsborough**, Assistant Professor, Department of Botany, Brandon University, to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission, with attachment (Review: "Water quality monitoring and modelling of the Red and Assiniboine Rivers". Appendix A of a Report to the City of Winnipeg, Waterworks, Waste and Disposal Department by Wardrop/TetrES consultants. September, 1991.)

105. Letter, dated January 13, 1992, from **R. S. "Bud" Oliver**, Mayor, **Town of Selkirk**, to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission.

106. Brief, "Brief to the Clean Environment Commission Public Hearings on Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers Within and Downstream of The City of Winnipeg", submitted by **The Mid-Canada Chapter, American Fisheries Society and The Fishery Resources of the Red - Assiniboine River System**, with attachment (AFS Overview Policy on Man-Induced Ecological Problems: Human Population Growth and Technology. W. R. Carter III).

107. Letter, dated January 17, 1992 from **Larry Strachan**, Director, Environmental Approvals, **Manitoba Environment**, to Dale Stewart, Chairman, Manitoba Clean Environment Commission, with attachment (letter, dated December 27, 1991 from Paula V. Harding, A/Regional Manager, Federal Facilities Accommodations, Public Works Canada, to Larry Strachan, Director, Environmental Approvals, Manitoba Environment).

108. Letter, dated January 24, 1992 from **G. Rempel, TetrES Consultants Inc.**, to Dale Stewart, Chairman, Manitoba Clean Environment Commission.

109. Overhead Transparency, "Aquatic Life Protection Present Approaches", presented January 24, 1992 by Dwight Williamson, Manitoba Environment. Submitted by the **Manitoba Environment.**

110. Survey of Winnipeg Resident Perceptions of River Water Quality. Prairie Research Associates Inc. November 15, 1990. Submitted by the **City of Winnipeg.**

111. Excerpt, pages 58-59, from Benefit Cost Analysis Guide. Treasury Board Secretariat, Government of Canada. March, 1976. Submitted by the **Town of Selkirk.**

112. Town of Selkirk Concluding Comments. Submitted by the **Town of Selkirk.**

113. The Red and Assiniboine Rivers Surface Water Quality Objectives - Closing Statement. City of Winnipeg Waterworks, Waste and Disposal Department. Submitted by the **City of Winnipeg.**

114. Concluding Statement - Surface Water Quality Objectives for Red and Assiniboine Rivers and Tributary Streams. Larry Strachan, Director, Environmental Approvals, Manitoba Environment. January 24, 1992. Submitted by **Manitoba Environment.**

APPENDIX C:
SUMMARY OF MANITOBA SURFACE WATER QUALITY OBJECTIVES

The surface waters of Manitoba are used for numerous purposes including domestic consumption, industrial uses and agricultural purposes such as irrigation and livestock watering. In addition, many surface waters are used for recreational pursuits such as swimming, water skiing, boating and the enjoyment of pleasant scenery. Most waters are also inhabited by fish life, amphibians (frogs), reptiles (turtles), aquatic insects and algae. Large forms of wildlife, small furbearing mammals, waterfowl and some birds of prey rely upon surface waters for drinking purposes, habitat and sources of food supplies.

The quality of surface water has the potential to become degraded through many other legitimate but sometimes conflicting uses such as the disposal of industrial and municipal effluents, development of hydroelectrical generating sites and land-use practices such as agriculture and forestry.

In order to achieve harmony between the various uses, surface water quality objectives were developed which define minimum levels of quality for each of the uses that requires protection. The objectives, when not exceeded, will protect an organism, a community of organisms, a prescribed water use, or a designated multiple purpose water use with an adequate degree of safety. Specific objectives have been developed for over eighty substances.

These objectives affect all Manitobans, since if they do not offer adequate protection, surface water quality may become degraded. Conversely, if they are too restrictive, an unnecessary burden may be imposed on taxpayers and industry in order to pay for additional waste treatment facilities.

Surface water quality objectives are primarily used by government agencies, such as the Department of Environment and Workplace Safety and Health, in order to assist in developing effluent discharge restrictions for industrial and municipal waste discharges. Similarly, developers can use these objectives in planning processes. With information on downstream water uses, existing water quality characteristics and stream discharge volumes, predictions can be made regarding the treatment costs likely to be associated with any specific location. Although this is the principal role of surface water quality objectives within Manitoba, they may also be used for other purposes. For example, the objectives may be used to assist in developing strategies to control land-use practices that may have effects on water quality, such as cottage development. The objectives may be used in combination with environmental monitoring programs to assist in assessing the quality of our surface water resources. The objectives may also be used to assist in determining if certain waters are suitable for uses such as irrigation.

In cases where the objectives are exceeded, the Department of Environment and Workplace Safety and Health may conduct the necessary studies in order to determine the cause of the pollution. Should the cause be waste effluents, direct regulatory enforcement action could not be taken. Rather, existing discharge licences may be revised to provide the necessary degree of protection.

These objectives are intended to apply to conditions in water that are caused by man's activities. Waters may have natural characteristics outside certain objectives. In such cases, the objectives for those charateristics do not apply. However, if a certain parameter exceeds its objective due to natural conditions, it would be unwise to further increase that parameter by man-made activities, unless such additions would not jeopardize any beneficial use as shown through site-specific investigations.

It is important to realize that scientific information is limited on all the possible effects of a pollutant in the environment. New information, however, is continually being reported. Thus, the objectives must be revised periodically in order to include the most recent scientific knowledge. Based upon the available information, these objectives are designed to afford adequate protection without being unreasonably restrictive yet providing an adequate degree of protection. However, while these objectives are appropriate for most applications within Manitoba, objective modifications may be required at some unique sites. Modifications of objectives could be required for example, to account for the lower or greater sensitivity of resident aquatic species.

Objectives have not been developed for all possible substances that could affect water quality. Manitoba's surface waters could potentially be contaminated with virtually hundreds of substances. These include, for example, agricultural chemicals, or hazardous goods that may be transported through Manitoba. However, given reasonable information that such substances are present, objectives will be developed using the best available scientific information.

Because specific numerical objectives cannot reasonably be developed for every possible chemical, physical or biological parameter, general statements concerning environmental quality are also used to protect water quality. These requirements, although written in general terms, are nevertheless water quality objectives. For example, these may be used to establish effluent limits even though there may be no specific numerical objectives applicable in the receiving water. General statements have been developed for colour, odour, taste, turbidity, deposits, floating materials, flow, litter, nutrients, oil and grease and toxic substances.

Ideally, objectives should be maintained at all times. It is however, generally accepted that to require objective maintenance at all times is unreasonable. Thus, a specific low flow level has been chosen below which the objectives do not have to be met in most streams. This

flow, for large streams and rivers, is the average minimum flow which, on a statistical basis, would occur for a seven consecutive day period once every ten years. For small intermittent streams this minimum flow is 0.003 m^3/s. However, the flows in many streams in southern Manitoba are regulated by control structures. The minimum flows for these streams are often determined based upon the operating policy of the Water Resources Branch, Department of Natural Resources. The objectives should be maintained at all times in lakes.

Mixing zones are areas adjacent to a discharge, where the stream or lake may not meet all the water quality objectives. This is allowed for practical reasons, since for most pollutants, it would be unreasonable to expect the objectives to be met at the end of the discharge pipe. Mixing zones are therefore recognized as areas subject to a loss of value. Nevertheless, certain guidelines should be followed to ensure that the loss is kept as small as possible. These include, for example, ensuring that the entire width of rivers are not completely influenced by a discharge in such a manner that fish movement is prohibited or that bathing areas are not included in mixing zones.

Certain pristine waters support important major uses, such as recreation on surface waters within Provincial Parks. These waters may be given a "High Quality" designation. It is the intent that discharges or other activities that may affect the water quality of these areas should be very strictly controlled. Thus, development within "High Quality" surface water areas will likely be more costly than in other areas of the Province, since all available measures should be used to control environmental disturbances.

Some pristine waters of the Province may be preserved in their natural state for the future. These waters may be given an "Exceptional Value" designation. Development of any type that may affect water quality should be discouraged from these areas.

Objectives have been developed for each of the general surface water uses within Manitoba that requires protection. These are designated as classes and include domestic consumption, aquatic life and wildlife, industrial consumption, agricultural consumption, recreation and other uses. Where possible, these general classes are further divided into categories to provide protection, for example, to the different types of recreation.

CLASS 1: DOMESTIC CONSUMPTION defines objectives that will ensure the protection of waters that are used for human consumption after treatment. All surface waters of Manitoba are susceptible to uncontrolled microbiological contamination, for example, by wildlife. Consequently, minimum treatment consisting of disinfection is required for all surface waters prior to consumption. Objectives are included for substances that may have

harmful health effects, such as pesticides, toxic metals and radioactive materials and for substances that may present a nuisance to the consumer, such as excessive hardness and iron.

CLASS 2: AQUATIC LIFE AND WILDLIFE will ensure the protection of waters that are inhabited by aquatic life such as fish, amphibians (frogs), reptiles (turtles) and other forms of life including aquatic insects and algae. By ensuring protection of the aquatic communities, protection is indirectly offered to those forms of wildlife that rely upon surface waters for habitat and for food supplies. These include ducks, geese, furbearing mammals such as the muskrat and birds of prey such as the eagle and osprey. Protection is also provided to those animals that use these waters for drinking purposes.

Objectives are included for numerous parameters including dissolved oxygen, toxic metals and pesticides. The presence of dissolved oxygen in water is essential for aquatic life, and the type of aquatic community is dependent to a large extent on the amount of dissolved oxygen present. Toxic metals, such as zinc and cadmium, in small concentrations, can have harmful effects on growth and reproduction, and in large concentrations, can be lethal. Others, such as mercury and PCB's, even though present in small quantities, can slowly bio-accumulate in the tissue of organisms, until higher harmful levels are reached such that the fisheries resource becomes unsuitable for human consumption.

Some metals, such as cadmium, are more or less toxic depending upon the hardness of the water. For this reason, a mathematical equation is used to establish an objective based upon the relationship between toxicity and hardness.

The existence and composition of an aquatic community also depends upon temperature characteristics. An excessive increase in temperature can be harmful by interfering with fish spawning cycles, causing changes in growth and respiration, and causing more heat tolerant species to replace heat sensitive ones. Heat related winter fish kills can occur when a heated discharge is suddenly stopped. Fish that have been attracted to a heated area are suddenly exposed to the cold ambient temperature.

Developing site-specific temperature objectives is complex and time consuming. Therefore, a method is included by which temperature objectives will be developed for specific discharges.

CLASS 2: AQUATIC LIFE AND WILDLIFE is subdivided into two categories in order to provide specific protection to different general groups of aquatic life in Manitoba.

CATEGORY A: COLD WATER AQUATIC LIFE, COOL WATER AQUATIC LIFE AND WILDLIFE defines objectives that will provide protection to all types of aquatic life inhabiting the surface waters of Manitoba, including the protection of wildlife.

CATEGORY B: COOL WATER AQUATIC LIFE AND WILDLIFE defines objectives that will provide protection to cool water aquatic life such as walleye, sauger and pike, including the protection of wildlife. This category, however, will not provide adequate protection to cold water aquatic organisms such as trout and whitefish.

CLASS 3: INDUSTRIAL CONSUMPTION defines objectives that will ensure the protection of waters that are used for industrial purposes. However, objectives will not be developed at present due to the large number of present and potential industrial users, each with different quality requirements for water.

CLASS 4: AGRICULTURAL CONSUMPTION defines objectives that will provide protection to waters used by the market garden and farming industries for irrigation and livestock watering purposes. Objectives are included for parameters, such as sodium, that will protect variously textured soils. Other objectives, such as boron, will protect sensitive plants. In addition, others, for example, fecal coliform bacteria, are included that are intended to protect humans following consumption of raw vegetables irrigated with waters of this class.

This class is subdivided into four categories in order to provide protection to three different general irrigation practices plus to provide protection for livestock watering.

CATEGORY A: GREENHOUSE IRRIGATION defines objectives that will provide protection to waters that are used by the greenhouse industry where such water is the only source of moisture for the greenhouse plants.

CATEGORY B: FIELD CROP IRRIGATION defines objectives that will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall.

CATEGORY C: FIELD CROP IRRIGATION defines objectives that will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall. These waters, however, may damage certain soil types if used for long periods of time.

CATEGORY D: LIVESTOCK defines objectives that will provide protection to waters that are used by livestock for drinking purposes.

CLASS 5: RECREATION defines objectives that will ensure that surface waters may be safely used for swimming and boating purposes and also may provide for the enjoyment of pleasant scenery. These waters provide outdoor recreational opportunities for both Manitoba residents and for tourists.

This class is further subdivided into two categories in order to provide protection to the different types of water related recreation depending upon the extent of contact with the water.

CATEGORY A: PRIMARY RECREATION defines objectives that will ensure the protection of waters that may be used for purposes such as swimming and water skiing, where contact with the water is an important aspect of the activity.

CATEGORY B: SECONDARY RECREATION defines objectives that will ensure the protection of waters that may be used for purposes such as fishing and boating, where contact with the water is only incidental to the activity.

CLASS 6: OTHER USES: Manitoba's surface waters may be used for other purposes that do not require protection through the establishment of objectives. These include, for example, the disposal of wastes or the generation of hydroelectrical power. Because of social or economic reasons, certain waters may be used only for these uses.