5.0 WATER QUALITY AT THE INTERNATIONAL BOUNDARY

The water quality of the Red River at the international boundary, as reported herein, is based on continuous monitoring and instantaneous grab samples obtained during the 2004 water year (October 01, 2003 - September 30, 2004). The collected data are carefully scrutinized and used to determine compliance with established IJC water quality objectives at the international boundary and in meeting the provisions of the Boundary Waters Treaty of 1909. Detection of exceedances of the objectives serves as a trigger mechanism for agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence. Environment Canada carries the responsibility for providing this monitoring service for the IRRB and maintains a permanent water quality and water quantity data collection site at Emerson, Manitoba.

The five parameters for which the IJC has approved objectives are discussed below along with streamflow and *pH* characteristics for a corresponding time period.

Water quality characteristics at other locations throughout the basin are referenced in subsequent chapters of this report to provide a more complete spatial representation of water quality and aquatic ecosystem conditions in the Red River basin.

5.01 Hydrology, *pH* and Temperature

Hydrology

The Red River basin experienced a generally dry summer in 2003 with flows in the Red River and its international tributaries reaching the lower decile level by early fall. The dry conditions resulted in low soil moisture levels and increased depression storage capacity throughout the basin. Although snowfall was somewhat above average over parts of the basin in January 2004, total winter snow cover was generally below average. Further, mild weather during March resulted in considerable depletion of the accumulated snowpack. By the end of March 2004 spring runoff was underway in the U.S. portion of the basin and the flood outlook assuming normal weather conditions indicated an average to below average spring runoff for the basin.

However, on March 27-28, 2004, heavier than normal spring rains occurred [rain on snow] with observed amounts ranging from 50-80 mm (2-3.1 in.) in some parts of the basin. Frozen soil conditions combined with snow-clogged channels and culverts contributed to extensive flooding of agricultural lands. For the most part, streamflows remained in-channel, however, flood alerts were issued and localized flooding occurred at a number of communities along the Red River and its tributaries.

Major spring storms in May 2004 over much of the basin caused the Red River and many of its tributaries to rise again. Low soil moisure conditions throughout the basin initially attenuated surface runoff. However, by early June soil moisture conditions had become high in many parts of the basin resulting in ponding of agricultural lands and delay of normal planting activity. While localized showers continued throughout the month, the Red River began to recede until substantial precipitation occurred again in early August. Significant rainfall in the order of 50-75 mm over many parts of the basin occurred yet again in early September causing overland flooding in some areas. Flows on the Red River and many of its tributaries were generally above the upper decile level at this time. Persistent showers throughout September maintained high river levels and outflows.

During the 2004 water year, daily flows at the international boundary ranged from a minimum of 11.4 m^3/s (402.6 ft^3/s) in February 2004, to a maximum of about 1,280 m^3/s (45, 203 ft^3/s) in April 2004. The mean discharge of the Red River at the international boundary during the 2004 water year was approximately 177 m^3/s. The long term mean discharge is about 108 m^3/s (3, 814 ft^3/s).

The streamflow characteristics of the Red River at the international boundary for the water years 1971 through 2004, are illustrated in Figure 2 of Appendix D.

pH and Temperature

During the reporting period, the observed *pH* and temperature values for the Red River remained within the normal range.

5.02 Water Quality Objectives

As described in Appendix B, the IJC established objectives for a limited number of water quality variables for the Red River at the international boundary. These variables are *dissolved oxygen*, *total dissolved solids*, *chloride*, *sulphate*, and *fecal coliform* bacteria. The IRRB is responsible for monitoring and reporting on compliance with these objectives.

Dissolved Oxygen

During the 2004 water year, *dissolved oxygen* (DO) field measurements remained well above the IJC objective of 5.0 mg/L. DO values ranged from 17.9 mg/L in December 2003 to 6.7 mg/L in June 2004.

Total Dissolved Solids and Specific Conductance

A number of marginal exceedances of the *total dissolved solids* (TDS) objective of 500 mg/L were observed from October 2003 to April 2004, and again in July and August 2004. The observed values ranged from a high of 804.8 mg/L in December 2003 to a low of 248.0 mg/L in April 2004. The larger exceedances occurring in the fall of 2003 coincided with unusually low water conditions in the Red River. Flows in the Red River were estimated at the lower decile level during this time period.

Chloride

The *chloride* objective (100 mg/L) was exceeded in November and December 2003 with observed values of 160 mg/L and 139 mg/L respectively, and again in February and March 2004 with observed values of 139.0 mg/L and 108 mg/L respectively. Typically, *chloride* values during the 2004 water year were significantly lower than the objective ranging from 12.7 mg/L in April 2004 to 44.1 mg/L in September 2004.

Sulphate

The *sulphate* objective (250 mg/L) was not exceeded during the 2004 water year; however, elevated levels ranging from 153 mg/L to 204 mg/L were observed from October to December 2003, and 130 mg/L to 210 mg/L from June to August 2004.

Bacteriological Characteristics

The bacteriological characteristics of the Red River are assessed on the basis of observed fecal coliform bacteria for which an IJC objective (200 colonies per 100 ml) has been defined. During the 2004 water year, observed fecal coliform counts were well below the IJC objective, typically ranging from about 6 colonies per 100 ml to about 38 colonies per 100 ml. Singular higher values were observed in July and September 2004 with observed values of 82 and 63 colonies per 100 ml respectively.

There is a consesus in the science community that the presence of *e-coli* bacteria provides a more appropriate measure of bacteriological conditions. Hence, *e-coli* data collection was added to the monitoring program at the interntional boundary in August 2004. The single sample values for August and September 2004 were 50 and 150 colonies per 10,000 ml respectively.

5.03 Alert Levels

The concept of alert levels was introduced in November 1984 by the former International Red River Pollution Board to complement the existing IJC water quality objectives. Subsequently, in January 1986, alert levels for the most significant water chemistry variables were developed and approved by the Pollution Board. Further, a compendium of the analytical methods used by the member agencies was prepared in 1990 and is included in Appendix B. This compendium will be reviewed and updated in the coming months by the [IRRB] Aquatic Ecosystem Committee.

Based on a total of 12 water samples, 17 pesticides and/or herbicides with a total aggregate of 89 exceedances (>detection concentration) were recorded during the October 01, 2003 - September 30, 2004 reporting period. The exceedance level data are summarized in Table 2. Where possible, for each of the parameters, the Canadian Aquatic Life Guidelines value is provided.

The presence of pesticides/herbicides and heavy metals in the Red River will continue to be closely monitored. It is noted that low levels of cadmium, copper, lead and zinc are endemic to the Red River.

5.04 Summary of Water Quality Conditions

During the reporting period, no unusual deviations or significant exceedances of the IJC water quality objectives were observed. The records indicate, in part, a response to the prevalent hydrological conditions during the reporting period.

The TDS objective was exceeded during the fall of 2003 and winter of 2004 coinciding with low streamflow conditions, and during late summer of 2004 coinciding with above average rainfall over much of the basin. *Sulphate* concentrations, while not exceeding the objective, were elevated throughout the fall of 2003 and again in late summer of 2004. *Chloride* concentrations marginally exceeded the objective in November and December of 2003, and in February and March of 2004, but stayed well below the objective over the remaining months. Dissolved oxygen field measurements remained well above the IJC objective throughout the 2004 water year. Fecal coliform counts were well below the IJC objective over this period.

Given that the Red River basin is an agriculturally dominated region, detection of pesticides and herbicides in the Red River at low concentrations is expected. Seventeen of the pesticides and herbicides for which alert levels have been established by the former International Red River Pollution Board were

detected during the reporting period at low levels and well below the Canadian Aquatic Life Guidelines.

The IRRB recognizes that there is very little scientific information available to assess the implications of long-term exposure to low concentrations of pesticides and herbicides by aquatic organisms and humans. The IRRB continues to closely monitor trends in these concentrations and their frequency of detection with the view to updating its assessment as new scientific information becomes available.

Table 2. Exceedances of Alert Levels, Red River at International Boundary (Emerson, Manitoba) *DL = Detection Level NG = No Guideline Established

Parameter	Units	Alert Level	Number of Exceedances	Exceedance Values		Canadian Aquatic Life Guidelines
				Min	Max	
Clopyralid	ng/L	DL*	11	4.48	95.2	NG
Dicamba	ng/L	DL*	12	2.05	20.7	10,000
MCPA	ng/L	DL*	12	5.43	418	2,600
Mecoprop	ng/L	DL*	6	1.43	39.5	NG
2-4-D	ng/L	DL*	12	31	62.9	4000
2-(2,4-Dichlorprop)	ng/L	DL*	3	1.71	6.22	NG
2,4,5-T	ng/L	DL*	3	1.69	2.67	NG
Bromoxynil	ng/L	DL*	8	1.22	200	5000
Fenoprop	ng/L	DL*	1	-	0.66	NG
Atrazine	ng/L	DL*	11	13.6	348	1800
Desethylatrazine	ng/L	DL*	3	31.2	43.4	1800
Metolachlor	ng/L	DL*	3	34.2	47.2	7800
Trifluralin	ng/L	DL*	1	-	5.72	200
Imazamemethabenz-Methyl (A)	ng/L	DL*	1	-	0.61	NG
Dieldrin	ng/L	DL*	1	-	0.53	NG
Alpha-Benzenehexachloride	ng/L	DL*	1	-	0.58	10
Gamma-Benzenehexachloride	ng/L	DL*	11	0.17	1.42	10