MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION PROJECT
FINAL DESIGN – WORK PARCEL 2

2008 CONSTRUCTION SURFACE WATER MONITORING

FINAL REPORT
MARCH 2009

KGS Group Project: 05-1100-01
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March 30, 2009

File No. 05-1100-01.19.06.03

Manitoba Floodway Authority
Room 200, 155 Carlton Street
Winnipeg, Manitoba
R3C 3H8

ATTENTION: Mr. Doug Peterson, P. Eng.
Manager of Environmental Services

RE: Red River Floodway Expansion Project
2008 Construction Surface Water Monitoring Report
Final Report

Dear Mr. Peterson:

Please find enclosed twenty (20) paper copies and one (1) electronic copy of the Final Report for the 2008 Construction Surface Water Monitoring of the Red River Floodway Expansion. An electronic copy of each individual Final Monthly Monitoring Report from January to December 2008 is also provided, as supporting documents for the MFA web page.

This annual construction report describes the analysis results for samples collected from the Red River, Floodway Channel and the drains flowing into the Floodway and along the West Dyke during the 2008 construction time period. The data includes the monthly and event-based (level I) monitoring.

We sincerely appreciate the opportunity to provide ongoing services on this project. If you have any questions regarding this report please contact Ms. Katie Sinclair, or the undersigned.

Yours truly,

for Dave MacMillan, P. Eng.
Project Manager

KS/dbm/mlb
Enclosure

EXECUTIVE SUMMARY

The Red River Floodway Expansion Project Screening Report prepared for Infrastructure Canada concluded that the effects of the project on surface water quality are not likely to be significant provided that the mitigation measures proposed are followed and that a monitoring and follow-up plan for surface water quality is submitted by the Manitoba Floodway Authority. A baseline surface water quality monitoring program was undertaken in the spring – summer of 2005, prior to the start of construction of the Floodway Expansion Project. Additionally a winter baseflow program was conducted in 2005 prior to construction, to monitor the groundwater discharge into the Floodway Channel when there was no surface water contribution. The data obtained during the baseline monitoring program forms the basis for comparison to this 2008 construction monitoring report and all future construction monitoring reports that will be compiled at the end of each construction year. Comparison of the 2008 construction monitoring to baseline data allows the effects of construction to be compared to the applicable compliance criteria and to predictions made in modelling effects.

The surface water quality monitoring program for the 2008 construction year was conducted from January to December 2008 in conjunction with the on-going construction activities. This 2008 construction report outlines the analysis results for samples collected from the Red River at the Inlet and Outlet, 11 locations along the Floodway Channel including the upstream and downstream ends of the construction and revegetation zones, 11 of the outfall drains flowing into the Floodway and at 2 drains along the West Dyke. The 2008 construction monitoring data is summarized and compared to the data presented in the baseline surface water monitoring report.

There were twelve (12) monthly monitoring events, with one conducted each month following precipitation events or near the end of the month if a substantial precipitation event had not yet occurred. There was no spring or summer flood during 2008. There were fifteen (15) level I event-based monitoring events conducted between May and November, 2008 in response to precipitation levels greater than 10 mm. Additionally, an Outlet TSS Monitoring Program was conducted at the Floodway Channel Outlet from March 17 to 31, 2008 in response to the removal of the cofferdam within Contract CE1.

On-going construction contracts for the Floodway at the start of January 2008 consisted of Channel Contracts; C-3A (Stn 12+430 – 19+200 west side), C-3B (Stn 12+430 – 19+200 east side), C3C (Stn 19+715 – 20+900), C5 (Stn 25+970 – 30+140), C7A (Stn 35+100 – 40+590 west side), C7B (Stn 35+200 – 40+900 east side), C8A (Stn 40+865 – 48+500 west side) and C8B (Stn 40+900 – 50+430 east side); Bridge Contracts for PTH 59 South (T4, Stn 12+250), CNR Redditt (T11, Stn 25 + 880), CPR Emerson (T12/15, Stn 11 + 200) and CPR Keewatin (T14, Stn 30 + 220). The remaining Floodway contracts were completed prior to the start of 2008, except for the Channel contract C-6C (Stn 33+670 – 35+060 west side) that started construction during July 2008. As part of the Channel contracts during 2008, seeding and fertilizer applications occurred from May to November. Earthworks construction contracts for the West Dyke during 2008 included W6 that was completed in that year and W12, W22, W23 and W24 that are still active. Details of the construction contracts and activities that occurred during each month are summarized in each of the individual monthly monitoring reports, NM7.1 – January to NM7.12 – December, 2008.

Construction monitoring data for the key water quality parameters of interest, identified and discussed in the baseline surface water monitoring report, were compared to the baseline data under non-flood/unfrozen and non-flood/frozen conditions. These parameters included total suspended solids, nutrients (total phosphorus, ammonia, nitrate plus nitrite and potassium), specific conductance, major ions (sodium and chloride), and *E.Coli* for bacterial concerns.

Benzene, toluene, ethylbenzene and xylenes (BTEX) and hydrocarbon fractions F1 to F4 were also analyzed when samples could be collected at the upstream and downstream of construction locations during each monthly monitoring. The April monthly monitoring (spring melt) laboratory analysis also included phenoxy acid herbicide screen (2,4-D, bromoxynil, dicamba, MCPA and picloram), AMPA and glyphosate, at the upstream and downstream of revegetation locations.

Results of the 15 level I event-based monitoring events conducted between May and November have typically indicated very small changes in TSS concentration in the Red River during the 2008 construction year, except for the June 6 monitoring following a rainfall close to a 5-year storm. The mass balance using the Red River flows and the laboratory TSS concentrations indicated an approximate increase in the TSS concentrations of 22 mg/L or 40%. This increase in TSS concentrations was within the CCME criteria of an allowable increase of 25 mg/L based on the background concentrations being <250 mg/L (clear flow). Nearly all the other level I event based monitoring measured a change of less than 1.0% and over half of these were a decrease in TSS concentration, therefore, no level II event-based monitoring was required during the 2008 construction year.

Outlet TSS event-based monitoring was conducted over a sixteen day period beginning on March 17, 2008 and ending on March 31, 2008, with a day of baseline TSS monitoring conducted on March 14, 2008 prior to the commencement of any construction activities as part of the cofferdam removal at Contract CE1. High TSS concentrations were measured in the Red River upstream of Outlet on March 17 however, these are not a concern as they represent background conditions. The results of the Outlet TSS event-based monitoring indicated that the removal of the cofferdam from Contract CE1 at the Outlet Structure did not elevate TSS levels in the Red River above the CCME Freshwater Aquatic Life criteria.

Several of the key water quality parameter concentrations, in particular electrical conductivity, potassium, sodium, chloride and *E.Coli* varied spatially throughout the Floodway Channel for a given monthly monitoring during both the unfrozen and frozen non-flood conditions. Additionally they could vary temporally (with time) between the monthly monitoring events, at any given sample location.

Within the non-flood unfrozen condition in 2008, concentrations of most parameters measured in the Floodway Channel were generally within the summer baseline concentrations. During some of the months, in particular during April (spring melt), there were a few locations where parameters were elevated above the baseline concentrations. During June and September, the TSS concentrations in the Floodway Channel were elevated above the baseline concentrations at several locations, including at the Outlet. In comparison, *E.Coli* concentrations were typically elevated above baseline concentrations each month at most Floodway Channel Locations. For all of the parameters these concentrations elevated above baseline in the Floodway were typically lower than the concentration in the Red River, except specific conductance and chloride concentrations. Therefore, the elevated concentrations in the Floodway Channel would have no effect on concentrations in the Red River or result in dilution if anything.

During the non-flood unfrozen condition monthly monitoring events, parameter concentrations measured in the Red River downstream of the Outlet were typically similar to the background concentrations upstream of the Outlet, ranging from slightly lower to slightly higher, although larger downstream increases were measured for TSS, ammonia, potassium and *E.Coli* concentrations. The TSS concentration increases measured in the Red River downstream of the Outlet were all less than the CCME criteria of an allowable increase of 25 mg/L and therefore not a concern. Although the September monthly laboratory results indicate an increase of 77 mg/L 500 m downstream of the Outlet, the mass balance calculations with the measured TSS concentrations and flows indicate that only an approximate increase in TSS concentration of 0.7 mg/L would result in the Red River from the Floodway Channel inputs, indicating that these values are within CCME criteria. Although increases in potassium and *E.Coli* were measured the concentrations were within baseline concentrations. Additionally the elevated potassium and *E.Coli* concentrations have no basis for evaluation, as there is no applicable CCME criterion. The ammonia concentrations measured in the Red River during June and October resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and all locations downstream of the Outlet, whereas during July and September there were only a couple of exceedances. These exceedances are not a result of construction, because the background concentrations upstream of the Outlet and baseline concentrations, also exceeded the CCME criteria.

Concentrations of most parameters measured in the Floodway Channel were within the winter baseline concentrations (or the summer baseline if there was no winter baseline) except for one or two samples during the monthly monitoring events within the non-flood frozen condition. In particular concentrations of TSS, specific conductance, ammonia and potassium were higher than baseline concentrations in the Floodway Channel downstream of the Grande Pointe drain during the January monitoring. Likewise ammonia and *E.Coli* were elevated at the Keewatin and Spring Hill weir locations during the January monitoring. The elevated TSS concentration did not result in an exceedance of the CCME criteria and was likely a result of disturbing the channel bottom while drilling through the ice cover to collect the sample. The elevated ammonia concentrations did not result in an exceedance of the CCME un-ionized ammonia criteria. The elevated potassium concentrations in the Floodway were not related to construction activities, as the fertilizer applied over the summer did not contain potassium. The elevated *E.Coli* concentrations were not attributed to construction, as there were no construction activities that would release bacteria into the construction area. Additionally, the elevated specific conductance, potassium and *E.Coli* concentrations in the Floodway channel have no basis for evaluation, as there are no applicable CCME criteria.

Parameter concentrations measured in the Red River downstream of the Outlet during the non-flood frozen condition were typically similar to the background concentrations upstream of the Outlet ranging from slightly lower to slightly higher, although concentrations measured during December tended to show larger increases. In particular concentration increases were measured for TSS, total phosphorus, ammonia and *E.Coli*. During December minor increases in TSS concentrations (4.5%) were measured in the Red River downstream of the Outlet compared to upstream of the Outlet, however this is within the allowable CCME criteria of a 10% increase. The ammonia concentrations in the Red River downstream of the Outlet were typically higher compared to the background concentration in the Red River upstream of the Outlet, except during March when they were lower. Only the ammonia concentrations measured during March resulted in un-ionized ammonia concentrations that exceeded the CCME criteria both upstream and downstream of the Outlet. The exceedance downstream is not a result of construction because background concentrations upstream at this time and concentrations measured during baseline monitoring also exceeded the CCME criteria. Additionally, the concentration increases in the Red River were not due to construction activities within the Floodway Channel because all concentrations in the Floodway Channel were lower than Red River concentrations.

Because there were active or recently completed construction activities in the vicinity of the Manness and Domain Drains the analytical results from the West Dyke drain monthly monitoring were assessed. These drains were both sampled during the April monthly monitoring that coincided with the spring melt. During the rest of the year because of low flow and frozen conditions the Mannes Drain could only be sampled during October and November and the Domain Drain could only be sampled during May, June and November. Concentrations of most parameters measured were within the baseline concentrations during each of these monthly monitoring events. Specific conductance, sodium and chloride concentrations, however, were elevated above baseline concentrations in the Domain Drain during the June monthly monitoring. Likewise the sodium concentration in the Domain Drain during the May monthly monitoring was also elevated above baseline concentrations. These elevated concentrations were not a result of construction because the activities in the vicinity of the Domain Drain prior to May and June consisted of riprap application that was completed in March 2008.

Based on the results of the 2008 Construction monitoring events, recommendations and refinements for the ongoing monitoring should include the following;

- Continued monitoring at all of the current sample locations (including the drain locations upstream of the perimeter ditching when a drain is within an area of construction activities), following the established monthly monitoring schedule, with event-based monitoring conducted as required for the 2009 surface water monitoring program.

- The event-based monitoring in 2009 should continue to follow the protocol used in 2008 that incorporated revisions made in 2006, based on the results of a review of precipitation levels and measured TSS increases. The 2008 protocol was reviewed near the end of the 2008 monitoring program (with no changes made) and should be reviewed again during the 2009 monitoring program and revised if required as construction contracts near completion.

- The reporting protocol for the 2009 surface water monitoring program should continue to follow the slight modifications made for the start of 2008 to flag potential increases in TSS concentrations more rapidly. This included completing a level I event-based worksheet for each of the monthly monitoring events to provide an indication as to whether the sediment concentration in the Floodway will have a potential impact on the Red River downstream of the Floodway Outlet. If the worksheet indicates no potential impact then the results would be reported in the monthly monitoring report, whereas, if a potential impact is identified then MFA would be notified immediately and the laboratory would be contacted to request the TSS analysis results as soon as possible. Appropriate measures would then be developed with MFA based on the TSS laboratory results.

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FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 INTRODUCTION

The Environmental Impact Statement (EIS) prepared by TetrES Consultants Inc./Intergroup Consultants Ltd.[(1)] presented the assessment of potential effects on surface water quality resulting from the Floodway Expansion Project (Project). The EIS identified potential effects related to sedimentation associated with Project construction and the use of fertilizers (containing phosphorus, nitrogen and potassium), herbicides (glyphosate and 2,4-D amine) or spills of chemicals during Project construction or maintenance.

The EIS stated that potential effects on surface water quality would be mitigated through the use of appropriate construction management practices that would be specified in the Construction Phase Environmental Protection Plans (CPEPP) developed for each construction site. Additionally, as a component of the monitoring plans for the CPEPP, potential changes in surface water quality would be monitored during construction. Further, in the Red River Floodway Expansion Project Screening Report prepared for Infrastructure Canada [(2)] the responsible authorities concluded that the effects of the project on surface water quality are not likely to be significant provided that the mitigation measures proposed are followed and that a monitoring and follow-up plan for surface water quality is submitted by the Manitoba Floodway Authority (MFA).

A baseline surface water quality monitoring program [(3)] was undertaken in the spring – summer of 2005, prior to the start of construction of the Floodway Expansion Project. It consisted of sampling during early spring (April), the peak spring flow period (April), summer emergency operation (June) and during typical summer monthly (May to August) flow conditions. Additionally a winter baseflow program [(4)] was conducted in 2005 prior to construction, to monitor the groundwater discharge into the Floodway Channel when there was no surface water contribution. During the baseflow program, samples were collected on March 2, 2005 and these water quality results are considered representative of winter baseline data.

The data obtained during the baseline monitoring program forms the basis for comparison to this 2008 construction monitoring report and all future construction monitoring reports that will be compiled at the end of each construction year. Comparison of the 2008 monthly construction monitoring data (January to December), collected during typical monthly flow conditions, to baseline data will allow the effects of construction to be compared to the applicable compliance criteria and to predictions made in modelling effects. As well, the effectiveness of proposed mitigation measures will be assessed.

1.2 SCOPE OF WORK

The scope of work for the 2008 construction Surface Water Monitoring program conducted by KGS Group included the following:

- Collect **monthly** surface water quality data for the Red River, Floodway Channel, Drains that flow into the Floodway Channel and Drains that cross the West Dyke, preferably following a precipitation event or at the flood peak during Red River flood conditions;

- Collect **event-based** surface water quality data for compliance monitoring of applicable parameters (TSS, nutrients, herbicides or hydrocarbons) from the Floodway Channel upstream and downstream of the overall construction area, the Red River downstream of the Outlet and any additional required locations following precipitation events greater than 10 mm or a spill; and

- Provide an assessment of surface water quality comparing results of construction monthly and event-based compliance monitoring to baseline water quality and summarize in a 2008 construction monitoring report in order to;

    - compare predictions made in modelling effects
    - to assess the effectiveness of proposed mitigation measures and adapt if necessary
    - adapt the construction monitoring program in response to data and changes in mitigation measures

2.0 METHODOLOGY

2.1 OVERVIEW

The field investigation program for the 2008 construction year was conducted from January to December 2008 in conjunction with the on-going construction activities. There were twelve (12) monthly monitoring events, with one conducted each month following precipitation events as there was no spring or summer flood during 2008. There were fifteen (15) level I event-based monitoring events conducted between May and November, 2008 in response to precipitation levels greater than 10 mm. No level II event-based monitoring was required during the 2008 construction year as the results of the level I event-based monitoring indicated that the potential increase in sediment concentration in the Red River was within the Provincial Guidelines. An Outlet TSS Monitoring Program was conducted at the Floodway Channel Outlet from March 17 to 31, 2008 in response to the removal of the cofferdam within Contract CE1. No spill event-based monitoring was required because the spills that occurred during 2008 were typically small, contained and cleaned up with no potential run-off to the Floodway Channel.

The methodology used for the field program conducted by KGS Group followed the general methodology outlined in the Surface Water Monitoring – 2008 Sampling Program (Appendix A) that incorporated modifications made following the 2005 baseline and 2005, 2006, and 2007 construction monitoring programs. Deviations and changes from the general methodology used during the 2008 construction monitoring are described below.

2.2 SAMPLING LOCATIONS

The sample locations for the 2008 construction monitoring program are outlined on Figure NM7–1 and Figure NM7–2, listed in table NM7-1 and described as follows;

Red River at Inlet – Upstream of the Floodway Channel along the west shore of the river, the 3 replicate samples (S-01, S-02 and S-03) were not sampled during the 2008 monitoring program because there was no river water entering into the Floodway Channel at the Inlet during any of the monthly monitoring events.

Red River at Outlet – Upstream of the Floodway Outlet along the east shore (S-34) and downstream of the Outlet at 4 locations along the east shore at 0.5, 1, 2 and 3 kilometers (S-30, S-31, S-32 and S-33, respectively) were sampled during each of the twelve (12) monthly monitoring events. S-31 and S-34 were also sampled during each of the fifteen (15) level I event-based monitoring events. Additionally, S-30, S-31, S-33 and S-34 were sampled during the Outlet TSS Monitoring Program. These 5 river locations were sampled from the shore for safety reasons, except during the months of January to March and December at which time the river was covered by at least 6 inches of ice that had to be augured through to collect the samples.

Floodway Channel – The Floodway Channel downstream of the Inlet (S-04) was not sampled during the 2008 monitoring program because there was no river water entering into the Floodway Channel at the Inlet during any of the monthly monitoring events. There are a total of 6 other locations in the Floodway Channel that included; downstream of the Grande Pointe Diversion drop structure (S-13), downstream of the North Bibeau Drain drop structure (S-14) and at the four weir locations; Keewatin Weir (S-21), Springfield Weir (S-23), Dunning Weir (S-25) and PTH# 44 Weir (S-28). Each of these locations was sampled during all twelve (12) of the monthly monitoring events with a few exceptions. Location S-13 was not sampled during the February and March monthly monitoring and S-25 was not sampled during the March monthly monitoring because the water was frozen to the bottom of the channel.

Outfall Sources – During the non-flood frozen condition from January to March, November and December none of the 11 outfalls that drain into the Floodway Channel were sampled because the frozen condition prevented any water from flowing into the Floodway Channel, except during November. In November each of the 11 outfalls were sampled except for the Deacon Reservoir Drain (S-08) that had no flow.

During the non-flood unfrozen condition from April to October Deacon Reservoir Drain (S-08) was not sampled at all, and the Seine River Syphon Overflow (S-05) was only sampled in June, July and October. The Country Villa Estates Drain (S-11) was not sampled in April and May, the Grande Point Diversion Drop Structure (S-06) was not sampled during September and the Ashfield Drain Drop Structure (S-27) was not sampled in July because they had no flow discharging into the Floodway Channel. The Kildare Trunk-Transcona Storm Sewer Outlet (S-

12) could not be sampled during April because the flap gate was inundated by the spring melt run-off in the Floodway Channel.

West Dyke Drains –The Manness (S-35) and Domain (S-36) Drains were both sampled on the downstream side of the West Dyke during the April monthly monitoring that coincided with the spring melt. The Mannes Drain was not sampled during any other monthly sampling in 2008, except during October and November. Likewise the Domain Drain was not sampled during any other monthly sampling in 2008, except during May, June and November. The construction activities along the West Dyke in the vicinity of the Manness drain began at contracts W-22 and W-23 at the end of July 2008 and continued until the temporary suspension of activities at the end of November. Construction activities in the vicinity of the Domain drain were previously completed at contracts W-13 and W-14 during November 2007. The only activities in the vicinity of the Domain drain during 2008 included rip-rap placement (W-17) during January to March and road topping (W-18) completed during July 2008. Because there were active or recently completed construction activities the analytical results from the West Dyke drain monthly monitoring will be discussed in this construction monitoring report.

Floodway Channel Construction Areas – In addition to the sample locations shown in figures NM7.1 and NM7.2, samples were also collected from the Floodway Channel upstream and downstream of construction activities (CON U/S and CON D/S, respectively) and upstream and downstream of re-vegetation activities (VEG U/S and VEG D/S, respectively). These sample locations were based on the construction contracts, the extent of the contracts along the Floodway Channel and the construction activities that occurred for each month as summarized in each of the monthly monitoring reports, NM7.1 – January to NM7.12 – December.

For the entire 2008 monitoring program the upstream end of construction was designated at Station 11+000 associated with the construction activities in the Channel at the CPR Emerson bridge contract (T12, Station 11+200). Samples were only collected from this upstream of construction location during the April, June, July, October and November monthly monitoring and 11 of the 15 level I event-based monitoring events because there was either no flow or frozen conditions during the other monthly and event-based monitoring.

The location downstream of construction that was previously established at Station 50+500 during August 2007, was used to collect the samples during the January to June monthly monitoring and 6 of the 15 level I event-based monitoring events. This location was the furthest downstream in the Floodway Channel while still being upstream of the Outlet structure. To measure any potential effects associated with construction activities at the Outlet structure, the location downstream of construction was moved to Station 50+900, downstream of the Outlet structure. Samples were collected from this new location for the remaining monthly monitoring and level I event-based monitoring events during 2008.

Seeding during the 2008 construction year began at Contract C-3B in May, however there is potential for runoff of fertilizer resulting from snowmelt and rain runoff from areas seeded previously during 2007. The area previously seeded during 2007 extended from the CPR Emerson bridge contract (T12 Station 11+200) to the end of the Floodway Channel. The sample locations upstream and downstream of the revegetation zone were the same locations used for upstream and downstream of construction.

2.3 SAMPLING PROTOCOL

Sample Frequency – The monthly monitoring events were conducted once per month from January to December, typically following a precipitation event. Fifteen (15) level I event-based monitoring events were conducted between May and November in response to precipitation events of 10 mm as outlined in Appendix A. The Outlet TSS Monitoring Program was conducted over a sixteen day period beginning on March 17, 2008 and ending on March 31, 2008, with a day of baseline TSS monitoring conducted on March 14, 2008 prior to the commencement of any construction activities as part of the cofferdam removal at Contract CE1.

Sampling Protocol – The protocol followed the U.S. Environmental Protection Agency (EPA), Office of Water Quality (November, 1997, EPA 841-B-97-003) Monitoring Water Quality, Chapter 5 Water Quality Conditions [(5)] as outlined in Appendix A.

Field Measurements – pH, temperature, conductivity, turbidity and water depth were obtained during each of the twelve monthly monitoring and fifteen level I event-based monitoring events, as outlined in Appendix A. During the Outlet TSS Monitoring Program turbidity was obtained approximately hourly at all four sample locations between the hours of 6:00 AM and 7:00 PM.

Laboratory Analysis – The analysis package at all of the locations sampled during each of the monthly monitoring events included the following;

- Routine extractable (iron, manganese, fluoride, pH, total dissolved solids, sulphate, nitrate-nitrite, calcium, potassium magnesium, sodium, hardness, conductivity, chloride, total alkalinity, bicarbonate, carbonate and hydroxide)
- Total suspended solids (TSS) and turbidity
- Ammonia
- Ortho phosphorus, total phosphorus, total dissolved phosphorus
- Dissolved organic carbon (DOC), total organic carbon (TOC)
- Total Kjeldahl nitrogen (TKN)
- Total coliform and *E.Coli* by m-Coli Blue Membrane Filtration method

In addition to the above, at the upstream and downstream of construction locations during each monthly monitoring benzene, toluene, ethylbenzene and xylenes (BTEX) and hydrocarbon fractions F1 to F4 were also analyzed. During the April monthly monitoring (spring melt) laboratory analysis also included phenoxy acid herbicide screen (2,4-D, bromoxynil, dicamba, MCPA and picloram), AMPA and glyphosate, at the upstream and downstream of revegetation locations.

As part of the level I event-based monitoring, laboratory analysis of TSS and nutrients (pH, nitrate – nitrite+N, ammonia, total Kjeldahl nitrogen, ortho phosphorus and total dissolved phosphorus) was conducted for the samples collected in the Floodway Channel upstream and downstream of construction and on the Red River upstream and downstream (at S-31) of the Outlet. No laboratory analysis of herbicides (phenoxy acid herbicide screen, AMPA and glyphosate) was required during the event-based monitoring as there were no herbicides applied during the 2008 construction year.

As part of the Outlet TSS Monitoring Program, laboratory analysis of TSS was conducted for the samples collected three times per day at approximately 10:00 AM, 1:00 PM and 6:00 PM on the Red River upstream and downstream of the Outlet.

Quality Assurance/Quality Control Program – Quality Assurance and Quality Control (QA/QC) methods have been adopted to ensure that all samples are representative of the site. In the field, quality was assured by using experienced field staff trained to follow the U.S. EPA sampling protocol and ensuring that all sampling equipment was sterilized and/or rinsed with the sampling media a minimum of three times to eliminate cross contamination of samples. Disposable latex gloves were used for every sample retrieved. Samples were placed into EPA approved sample containers provided by the laboratory and stored in cooler chests at 4°C for transport to ALS Laboratory Group, a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory for detailed analyses.

Implementation of one field duplicate sample per monthly monitoring event and laboratory quality control including; calibration verification standards, continuing calibration verification, certified reference material, matrix spikes, laboratory control samples, duplicates and method blanks, were also used to assure that the laboratory analyses of samples collected in the field were representative of conditions encountered in the investigation. The QA/QC program for the 2008 construction sampling included the following:

- Record keeping for all aspects of sample handling and analysis, including the description of methods/standards used to analyse samples, proper records of sampling and sample handling (chain of custody), analytical result records, and QC sample records.
- Field QC duplicated samples and laboratory QC including calibration verification standards, continuing calibration verification, certified reference material, matrix spikes, laboratory control samples, duplicates and method blanks.

2.4 FLOW CALCULATIONS

Estimates of the flow in the Red River, Floodway Channel, and agricultural drains that flow into the Channel are helpful for interpreting and comparing construction test results. Additionally, flow estimates are necessary to calculate approximate mass balances for the chemical analysis results to interpret the results in particular during event-based compliance monitoring.

The estimate of flow in the Red River was based on information provided in Manitoba Water Stewardship's weekly flow reports for the Red River near Selkirk (Appendix B) [6]. Estimates of the flow in the Floodway Channel and in each of the agricultural drains that flow into the channel were based on the recorded water levels at each location. As noted in Section 2.3, water levels were recorded using staff gauges installed at each of the sampling locations. The flow was then estimated using a relationship between flow and water level (rating curve), which was developed by KGS Group at each location. The rating curves developed for the agricultural drain drop structures were based on the physical characteristics of the drop structure and approach channel. Rating curves developed for the in-channel locations were based on the physical characteristics of the Floodway channel.

3.0 RESULTS

3.1 HYDROLOGICAL CONDITIONS

Monthly Monitoring

The monthly monitoring events were generally conducted following a substantial precipitation event during the month or near the end of the month if a substantial precipitation event had not yet occurred. Full details of the hydrological conditions for each monthly monitoring are provided in each of the monthly monitoring reports, NM7.1 – January to NM7.12 – December. Details of precipitation recorded by Environment Canada at the Winnipeg International Airport, Manitoba [7] are provided in the Daily Data Report for January to December, 2008 in Appendix C. The precipitation levels during each of the monthly monitoring events and the percentage of the monthly precipitation total are summarized in the following table;

Summary of Precipitation Levels During the 2008 Monthly Monitoring

Sample Date	Amount of Precipitation (mm) for the Monitoring Event	Percent of Monthly Total	Monthly Total Precipitation (mm)	Historical Average Monthly Total Precipitation (mm) [8]
January 30 & 31	1.0	20%	5.0	19.7
February 25 & 26	1.0	8%	12.0	14.9
March 11 & 12	0.0	0%	30.0	21.5
April 25	7.5	83%	9.0	31.9
May 13	20.0	49%	40.5	58.8
June 6	38.5	37%	104.0	89.5
July 11	10.5	20%	53.0	70.6
August 12	30.5	32%	96.5	75.1
September 2	29.0	38%	77.0	52.3
October 7	13.0	26%	49.2	36.0
November 7	25.5	57%	44.5	25.0
December 18 & 19	3.5	18%	21.0	18.5
Annual Total			541.7	513.7

As evident by the table above, while 2008 had a relatively average overall amount of precipitation with an annual total precipitation of 541.7 mm compared to the historical average of 513.7 the conditions varied from month to month. January, April, May and July all had total monthly precipitation amounts substantially lower than the historical average monthly precipitation. In comparison, March, June, August, September and November had substantially higher monthly precipitation amounts compared to the historical average monthly precipitations.

Event-Based Monitoring

The level I event-based monitoring events were conducted between May and November, 2008 following precipitation events of 10 mm or greater. The amount and duration of each precipitation event and the year storm categorization (based on the Atmospheric Environment Service, Rainfall Intensity – Duration Frequency (Rainfall IDF) Values for the Winnipeg International Airport [(9)]) which triggered each of the level I event-based monitoring events are summarized in the following table;

Summary of Precipitation Levels During the 2008 Event-Based Monitoring

Sample Date	Amount of Precipitation (mm) for the Monitoring Event [1]	Approximate Duration (hours)	Year Storm [(9)]
May 13	20.0 – 24.0	11	<2
May 26	7.0 – 11.0	11	<2
June 6	23.9 – 53.0	9	<2 - <5
June 9	12.2 – 26.0	18.5	<2
June 12	11.5 – 17.0	6.5	<2
June 28	14.0 – 24.0	10.5	<2
July 11	3.8 – 21.0	3	<2
July 29	5.3 – 20.3	1.5	<2
August 12	17.5 – 80.0	28.0	<2 - <5
August 22	0.5 – 26.4	9	<2
September 2	14.6 – 29.0	4.5	<2
September 23	8.7 – 33.8	16.5	<2
October 7	8.0 – 19.0	12.5	<2
October 13	19.1 – 33.0	12	<2
November 7	11.4 – 52.3	48	<2

1 - Amount of precipitation measured varied between the different weather stations.

3.2 WATER QUALITY

The field chemistry and turbidity measured in the surface water at each location during the monthly and event-based monitoring events are listed in Table NM7–1. The general water quality results for all of the analyzed parameters collected at each location during the monthly and event-based monitoring events are summarized in Table NM7–2. The petroleum hydrocarbons and bacteria results for samples collected during the monthly monitoring and the herbicides collected during the April monthly (spring melt run-off) are summarized in Table NM7–3, Table NM7–4 and Table NM7–5 respectively. Existing CCME Surface Water Quality Guideline values are given for any parameters that have established objectives.

Construction monitoring data for the key water quality parameters of interest, identified and discussed in the baseline surface water monitoring report, were compared to the baseline data under non-flood/unfrozen and non-flood/frozen conditions. These parameters included total suspended solids, nutrients (total phosphorus, ammonia, nitrate plus nitrite and potassium), specific conductance, major ions (sodium and chloride), and *E.Coli* for bacterial concerns (Figures NM7-3 to NM7-25).

During the May to October 2008 construction monitoring there was no Red River water entering the Floodway Channel therefore these monthly monitoring events represent the non-flood/unfrozen condition. As a result the range of baseline conditions for comparison shown on the figures for the Channel are represented by the minimum and maximum concentrations observed during the summer baseline monitoring when there was no Red River water diverted. This included data from the May 10, June 13 and August 19, 2005 baseline monthly events. For the upstream end of the Floodway Channel where there was insufficient baseline data to provide a range of baseline conditions, the range was extrapolated using the data immediately downstream and following the observed trends. The Floodway Channel summer baseline conditions are representative of surface water run-off from precipitation events and therefore are comparable to the non-flood/unfrozen condition. The baseline conditions used for comparison for the drains flowing into the Floodway Channel and for the Red River at the Outlet are from the corresponding sample events as above. In addition, for the Red River at the Outlet the baseline conditions from the emergency summer operation and the July monthly event are used for comparison because these dates represent the range of Red River flow conditions that could occur in any given year during construction.

During the January to March, November and December 2008 construction monitoring there was no Red River water entering the Floodway Channel therefore these monthly monitoring events represent the non-flood/frozen condition. The Floodway Channel summer baseline conditions as discussed above are representative of surface water run-off from precipitation events and therefore for some parameters are not comparable to the frozen conditions. Under frozen conditions the surface water is primarily from groundwater discharge into the Channel, referred to as baseflow. As a result in addition to the summer baseline conditions, for applicable parameters, the monthly monitoring values during the non-flood/frozen condition are also compared to the winter baseline results from the baseflow monitoring conducted at the Floodway Channel weir locations in March 2005 [(4)].

3.2.1 Total Suspended Solids

Monthly Monitoring

The comparison of TSS concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–3 and NM7–4, respectively.

The TSS concentrations measured in the Floodway Channel were generally within or lower than the baseline concentrations during the monthly monitoring representing the non-flood/unfrozen condition, except during June and September (Figure NM7-3). A few additional TSS concentrations elevated above the baseline concentrations included the samples collected in the Floodway Channel downstream of North Bibeau Drain during April (250 mg/L) and May (260 mg/L) and at the PTH #44 weir location during August (130 mg/L). The elevated TSS concentrations measured during April and May also exceeded the CCME criteria of an allowable increase of 25 mg/L compared to background concentrations. With the exception of the elevated TSS concentrations measured during June and September, the concentrations in the Floodway Channel at the Outlet were lower than the background concentrations in the Red River upstream of the Outlet and generally resulted in dilution further downstream in the Red River.

The TSS concentrations measured in June were elevated above the baseline concentrations at several locations (Figure NM7-3). In particular, the concentrations from the Keewatin weir to downstream of construction (1700 mg/L; Station 50+500) exceeded the CCME criteria of an allowable increase of 25 mg/L compared to background concentrations. These elevated TSS concentrations were a result of areas of open soil around the Outlet structure, C8a, C8b, C7a, Ashfield Drain and Skolny Drain in combination with the heavy rain that was only slightly less than a 5 year rain event. The vegetation buffers, silt fences, surface contouring and winter mulch were in place, however, seeding had not yet occurred to vegetate the open soil and with the high level of precipitation the elevated TSS occurred although all measures were taken. The mass balance calculations indicate that an approximate increase in the TSS concentration of 22 mg/L would result in the Red River from the Floodway Channel inputs (Table NM7-6), indicating that these values are within CCME criteria. TSS measurements in the Red River upstream and downstream of the Outlet during June ranged from 49 to 79 mg/L indicative of the natural variation in the Red River.

The TSS concentrations measured in the Floodway Channel in September as noted were also elevated above the range of summer baseline concentrations at a few locations, in particular at the location downstream of construction (Station 50+500; 300 mg/L; Figure NM7-3). This elevated TSS concentration was likely a result of the unprotected upper slope of the diversion channel at the Outlet structure in combination with the heavy rain that was close to a 2-year rain event. The vegetation buffers, silt fences, surface contouring and rock riprap protection on the lower slope of the diversion channel were in place, however, geotextile had not yet been placed to cover the open soil on the upper slope and with the high level of precipitation the elevated TSS occurred although several measures were taken. Installation of the geotextile on the upper slope of the diversion channel was completed after this rain event. The TSS concentration in the Red River immediately downstream of the Outlet (S-30; 140 mg/L) was elevated compared to the background concentration upstream of the Outlet (63 mg/L), however, this was within baseline concentrations measured in the Red River and the concentrations further downstream were similar to background ranging from 62 to 68 mg/L. Although the laboratory results indicate an increase of 77 mg/L, the mass balance calculations with the measured TSS concentrations and flows indicate that only an approximate increase in TSS concentration of 0.7 mg/L would result in the Red River from the Floodway Channel inputs, indicating that these values are within CCME criteria.

The TSS concentrations were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were generally within or below the summer baseline concentrations during the monthly monitoring representing the non-flood/frozen condition, with a few exceptions (Figure NM7-6). The TSS concentrations measured at the location downstream of Grande Pointe Drain (290 mg/L) during January, downstream of North Bibeau Drain during March (120 mg/L) and November (170 mg/L) and at the Dunning weir location during February (97 mg/L) were elevated above the range of summer baseline concentrations. The elevated TSS concentration in January was likely a result of disturbing the channel bottom while drilling through the ice cover to collect the sample and not due to construction activities within the Floodway Channel. The TSS concentration measured during November in the Floodway Channel downstream of construction (36 mg/L; Stn 50+900) was higher than the concentration upstream of construction (<5 mg/L; Stn 11+000), which exceeds the CCME criteria of an allowable increase of 25 mg/L, however this elevated TSS concentration and all other locations, except downstream of the North Bibeau Drain, were within the overall range of summer baseline concentrations in the Floodway Channel. Regardless of these few TSS concentrations elevated above baseline along the Floodway Channel the concentration measured during each month at the Outlet was lower compared to the background concentration in the Red River upstream of the Outlet and would result in dilution if anything. During December minor increases in TSS concentrations were measured in the Red River downstream of the Outlet (up to 700 mg/L) compared to upstream of the Outlet (670 mg/L). This TSS concentration increase of 4.5% is within the allowable CCME criteria of a 10% increase and likely due to the natural variation in the Red River in response to flow conditions and not due to construction activities within the Floodway Channel because all TSS concentrations in the Floodway Channel were significantly lower than Red River concentrations.

The TSS concentrations measured in the Red River at the Floodway Outlet during 2008 were compared to the 10th to 90th percentile range of monthly historical data collected once a month by Manitoba Water Stewardship from the Red River at Selkirk for the period of record available from 1970 to 2003. The TSS concentrations measured each month during 2008, except for November, December and some measurements during July and September were within the 10th to 90th percentile ranges (Figure NM7-5). During July only the background TSS concentration in the Red River upstream of the Outlet (300 mg/L) and 500 m downstream (260 mg/L) were higher than the historical July 90th percentile (277 mg/L). These elevated TSS concentrations are likely a result of natural variation in the river and not related to construction, as all of the TSS concentrations in the Red River downstream of the Outlet were below the background TSS concentration. During September the TSS concentration in the Red River 500 m downstream of the Outlet (140 mg/L) was higher than the historical September 90th percentile (90 mg/L). This elevated TSS concentrations in the Red River may be associated with the higher than normal average monthly precipitation and in particular the 2-year storm event as discussed above. All of the TSS concentrations measured in the Red River during November (190 to 210 mg/L) and December (110 to 700 mg/L) were higher than the historical 90th percentile for November (76 mg/L) and December (23 mg/L) including the background concentrations upstream of the Outlet. These elevated TSS concentrations are likely in response to the higher than normal flows in the Red River during November and December (Appendix B). They are not a result of construction. As discussed above the concentrations in the Floodway Channel were substantially lower compared to the Red River and would have resulted in dilution if anything.

The TSS concentrations measured in the Manness and Domain Drains along the West Dyke ranged from <5 to 120 mg/L and 14 to 63 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These concentrations were within the baseline range of concentrations measured in the Manness and Domain Drains (11 to 300 mg/L and <5 to 100 mg/L, respectively) during the previous sampling conducted prior to the start of construction.

Event-Based Monitoring

Results of the 15 level I event-based monitoring events conducted between May and November have typically indicated very small changes in TSS concentration in the Red River during the 2008 construction year, except for the June 6 monitoring (Table NM7-6). The June 6 rainfall with approximately 24 to 53 mm of rain in 9 hours was ranged from less than a 2-year storm to close to a 5-year storm; based on the Atmospheric Environment Service, Rainfall Intensity – Duration Frequency (Rainfall IDF) Values for the Winnipeg International Airport [9]. The mass balance calculations indicated that an estimated increase in the TSS concentration of 11.06 mg/L or 21.1% would result in the Red River from the Floodway Channel inputs. Likewise the mass balance using the flows provided by MWS and the laboratory TSS concentrations indicated an approximate increase in the TSS concentrations of 22.0 mg/L or 40.1% (Table NM7-6). These increases in TSS concentrations are within the CCME criteria of an allowable increase of 25 mg/L based on the background concentrations being <250 mg/L (clear flow). Nearly all the other level I event based monitoring measured a change of less than 1.0% and over half of these were a decrease in TSS concentration. The level I event-based worksheet and the follow-up lab results fax for each rain event are provided with the monthly monitoring reports, NM7.1 – January to NM7.12 – December.

A review of the estimated and actual change in Red River sediment concentration measured during the level I event-based monitoring is provided in Table NM7-6. This review indicates that the values estimated using the mass balancing based on field measurements of turbidity and water flows, and the site-specific relationships between TSS and field turbidity are comparable to the actual increases calculated from laboratory TSS analysis and reported flows. The review also clearly demonstrates that a TSS increase exceeding the CCME criteria of an allowable 10% or 25 mg/L is very unlikely for precipitation events less than 10 mm.

The field turbidity and laboratory TSS concentrations measured during the baseline and sixteen day Outlet TSS Monitoring Program are summarized in Table NM7-7. High TSS concentrations were measured at in the Red River upstream of Outlet on March 17, 2008 at 10:30 AM (85 mg/L) and 1:30 PM (45 mg/L). These concentrations were not considered a concern, however, because all three downstream locations were much lower ranging from 17 to 20 mg/L at 10:30 AM and 8 to 18 mg/L at 1:30 PM. The high TSS concentrations in the Red River upstream of the Outlet on March 17, 2008 are considered to be an anomaly and are not a concern as these represent background conditions. The results of the field turbidity measurements and laboratory TSS values indicate that the removal of the cofferdam from Contract CE1 at the Outlet Structure did not elevate TSS levels in the Red River above the CCME Freshwater Aquatic Life criteria.

3.2.2 Specific Conductance

The comparison of specific conductance values between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–6 and NM7–7, respectively.

Specific conductance measured in the Floodway Channel during the monthly monitoring representing the non-flood/unfrozen condition was generally within the range of summer baseline, except a few elevated concentrations during April (Figure NM7–6). During April specific conductance values measured in the Floodway Channel, at the Keewatin and Spring Hill Weir locations, were elevated above the range of summer baseline concentrations. These elevated specific conductance values during April were not a concern as the specific conductance in the Floodway Channel at the Outlet (462 µS/cm) was lower compared to the values in the Red River (529 to 661 µS/cm), which would have resulted in dilution if anything. During the monthly monitoring representing the non-flood/unfrozen condition there were negligible specific conductance increases in the Red River downstream of the Outlet compared to the background values upstream of the Outlet and the values were all within the baseline range.

The specific conductance measured in the Floodway Channel downstream of construction and at most of the other Floodway locations were generally within or below the range of winter baseline values (1150 to 1730 µS/cm) during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–7). One exception was the high value measured in the Floodway Channel downstream of the Grande Pointe Drain (2840 mg/L) during the January monitoring. The specific conductance values in the Floodway Channel at the Outlet were typically slightly higher compared to those in the Red River at the Outlet. Regardless, there were negligible specific conductance increases in the Red River downstream of the Outlet compared to the background values upstream of the Outlet, except for slight increases measured during the December monthly monitoring. The slight increases in specific conductance values measured in the Red River at the Outlet were not related to construction because the values measured in the Floodway Channel were within the normal baseline range.

The specific conductance measured in the Manness and Domain Drains along the West Dyke ranged from 386 to 1040 µS/cm and 193 to 1670 µS/cm, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). The values measured in the Manness Drain were within the baseline range (177 to 1680 µS/cm). Likewise, the values measured in the Domain Drain were within the baseline range (108 to 503 µS/cm), except for the elevated specific conductance measured during the June (1679 µS/cm) monthly monitoring. This elevated specific conductance was not a result of construction because the activities in the vicinity of the Domain Drain prior to June consisted of rip rap application that was completed in March 2008.

3.2.3 Total Phosphorus

Monthly Monitoring

The comparison of total phosphorus concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–8 and NM7–9, respectively.

The total phosphorus concentrations measured in the Floodway Channel during the monthly monitoring representing the non-flood/unfrozen condition was generally lower or within the range of summer baseline, except a couple elevated concentrations during June (Figure NM7–8). During June total phosphorus concentrations measured in the Floodway Channel, at the PTH #44 Weir (0.557 mg/L) and downstream of construction (0.735 mg/L; Station 50+500) locations, were elevated above the range of summer baseline concentrations. These elevated concentrations within the Floodway Channel near the Outlet did not increase concentrations in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet. Additionally, during all other months the total phosphorus concentrations measured in the Floodway Channel at the Outlet were lower compared to the concentrations in the Red River and resulted negligible changes or dilution. One exception was a measured increase 500 m downstream of the Outlet in July, which was higher than the background concentration upstream of the Outlet. These elevated total phosphorus concentrations measured in the Floodway Channel at the Outlet and in the Red River 500 m downstream of the Outlet reflected the trends observed for TSS concentrations.

The total phosphorus concentrations measured in the Floodway Channel were within or lower than the baseline concentrations during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–9). The total phosphorus concentrations in the Red River downstream of the Outlet ranged from slightly lower to higher compared to the background concentrations upstream of the Outlet during the monthly monitoring representing the non-flood/frozen condition. The elevated concentrations in the Red River were not likely due to construction activities within the Floodway Channel because the total phosphorus concentrations measured in the Floodway Channel were much lower compared to the Red River concentrations. Likewise, concentrations in the Red River were typically within the range of baseline concentrations except for the elevated concentrations in December that reflected the trends observed for TSS concentrations.

The total phosphorus concentrations measured in the Red River at the Floodway Outlet during 2008 were compared to the 10^{th} to 90^{th} percentile range of monthly historical data collected once a month by Manitoba Water Stewardship from the Red River at Selkirk for the period of record available from 1970 to 2003. The total phosphorus concentrations measured each month during 2008, except for most of the December sample locations and some sample locations in July, October and November, were within the 10^{th} to 90^{th} percentile ranges (Figure NM7-10). During December the total phosphorus concentration in the Red River upstream of the Outlet (0.892 mg/L) and downstream of the Outlet (0.482 to 0.952 mg/L), were higher than the historical December 90^{th} percentile (0.45 mg/L), except for the location 3000 m downstream of the Outlet (0.376 mg/L). These elevated total phosphorus concentrations above historical concentrations may be associated with the elevated TSS concentrations measured downstream of the Outlet during the December monitoring as previously discussed.

The total phosphorus concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 0.238 to 0.723 mg/L and 0.142 to 0.713 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). The values measured in the Manness Drain were generally lower than the baseline range (0.329 to 0.710 mg/L), except for the slightly elevated concentration measured during the November (0.723 mg/L) monthly monitoring. This elevated total phosphorus above baseline may be associated with the higher TSS concentration measured during November and not a result of construction as there were no activities, such as seeding, conducted to date in the vicinity of the Manness Drain. In, comparison the total phosphorus concentrations measured in the Domain Drain were either lower than or within the baseline range (0.238 to 0.723 mg/L).

Event-Based Monitoring

Total phosphorus was analyzed during 12 of the 15 event-based monitoring events conducted, beginning on June 6 following the first application of fertilizer. The total phosphorus concentrations measured in the Floodway Channel downstream of active construction activities were lower than those in the Red River, except during the June 6 (0.735 mg/L; Table NM7-2) event-based monitoring. This elevated total phosphorus was an increase from the concentrations measured in the Floodway Channel upstream of construction (0.171 mg/L) and reflected the trend observed for TSS concentrations. Regardless of the elevated total phosphorus concentration in the Floodway Channel the concentration measured in the Red River downstream of the Outlet (0.201 mg/L) was lower than the background concentration upstream of the Outlet (0.233 mg/L). These results indicate that during 2008 total phosphorus was not a concern, as the concentrations in the Floodway Channel would typically have resulted in dilution in the Red River if anything. Additionally the total phosphorus concentrations measured in the Red River during the event based monitoring were lower than or within the historical 10^{th} to 90^{th} percentile ranges during the respective months, except for the October 7 monitoring that was only slightly higher than the 90^{th} percentile.

3.2.4 Ammonia (NH_3)

The water quality guidelines for ammonia vary depending on the temperature and pH concentrations of the water. For the 2008 construction monitoring program, the pH ranged from 7.59 to 9.26, which except for the 6 values above 9.0, was within the CCME criteria for the protection of freshwater aquatic life (6.5 to 9.0; Table NM7-2). For the 2008 construction monitoring program the temperature ranged from 0°C to 24.8°C. The soluble ammonia (NH_3) values reported by the laboratory were converted by KGS Group into un-ionized ammonia values based on a pH temperature relationship (Table NM7-2). The un-ionized ammonia represents all the forms of ammonia in the water, with the exception of the ammonium ion (NH_4). The corresponding un-ionized ammonia CCME criteria for the protection of freshwater aquatic life is 0.019 mg/L.

Monthly Monitoring

The comparison of ammonia concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–11 and NM7–12, respectively.

The ammonia concentrations measured in the Floodway Channel were typically similar to the range of baseline concentrations, during the monthly monitoring representing the non-flood/unfrozen condition (Figure NM7–11). Notable exceptions included the ammonia concentrations measured in the Floodway Channel location downstream of the North Bibeau Drain (0.280 mg/L) during the May monthly monitoring, at the Keewatin weir (0.372 mg/L) and the Springhill weir (0.263 mg/L) locations during the April monthly monitoring and at the Dunning Weir (0.235 mg/L) location during August. These measured concentrations were more than twice the upper summer baseline range. However, of these elevated ammonia concentrations in the Floodway Channel only the ammonia concentration measured at the Dunning weir location during August resulted in an un-ionized ammonia concentration (0.021 mg/L) that slightly exceeded the CCME criteria of 0.019 mg/L. This elevated concentration and exceedance of the CCME criteria during August may be in response to elevated ammonia concentrations flowing into the Floodway Channel from the Cooks Creek and Skholny drains.

During the non-flood/unfrozen condition the range of ammonia concentrations measured in the Red River at the Outlet varied (Figure NM7–11). Typically the ammonia concentrations measured in the Red River downstream of the Outlet were similar to or lower than the background concentrations in the Red River upstream of the Outlet, except during July and 3 km downstream of the Outlet during May. The ammonia concentrations measured in the Red River during June and October resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and all locations downstream of the Outlet. Whereas during July and September there were only a couple of ammonia concentrations that resulted in exceedances and none during the April, May and August monthly monitoring. The increases in ammonia concentrations in the Red River downstream of the Outlet and the exceedances of the CCME un-ionized ammonia criteria were not attributed to construction activities because the ammonia concentrations in the Floodway Channel at the Outlet were typically lower than the concentrations in the Red River and would have resulted in dilution if anything.

The ammonia concentrations measured in the Floodway Channel were typically within or below the range of winter baseline concentrations, with a few exceptions, during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–12). The ammonia concentrations measured in the Floodway Channel were elevated above the range of winter baseline downstream of the Grande Ponte Diversion (0.547 mg/L), at the Keewatin Weir (0.379

mg/L) and at the Spring Hill Weir (0.337 mg/L) during the January monthly monitoring and at the location downstream of construction during December (0.331 mg/L). These elevated concentrations were not attributed to construction, as there were no activities in January, or December, such as fertilizer application, that would contribute to the elevated concentration of ammonia. Additionally these concentrations above the baseline conditions did not result in an exceedance of the CCME un-ionized ammonia criteria. The ammonia concentrations in the Red River downstream of the Outlet were typically higher compared to the background concentration in the Red River upstream of the Outlet, except during March when they were lower. The ammonia concentrations measured in the Red River during March resulted in un-ionized ammonia concentrations (0.028 to 0.065 mg/L) that exceeded the CCME criteria (0.019 mg/L) both upstream and downstream of the Outlet. These elevated concentrations were not likely due to construction activities within the Floodway Channel because the ammonia concentrations measured in the Floodway Channel at the Outlet and at all other channel locations were substantially lower than in the Red River and would have resulted in dilution if anything.

The ammonia concentrations measured in the Red River at the Floodway Outlet during 2008 were compared to the 10th to 90th percentile range of monthly historical data collected once a month by Manitoba Water Stewardship from the Red River at Selkirk for the period of record available from 1970 to 2003. The ammonia concentrations measured each month during 2008 were generally within or lower than the 10th to 90th percentile ranges, except for some locations during June (Figure NM7-13). During June the ammonia concentrations in the Red River upstream of the Outlet (0.502 mg/L) and downstream of the Outlet (0.385 to 0.510 mg/L), were slightly higher than the historical December 90th percentile (0.378 mg/L). These elevated ammonia concentrations are not a result of construction as the concentrations in the Floodway Channel were substantially lower compared to the Red River and would have resulted in dilution if anything. Even though the ammonia concentrations were generally within the historical conditions in the Red River, as noted above the ammonia concentrations measured during March, June, July, September and October resulted in un-ionized ammonia concentrations that exceeded the CCME criteria. This suggests that exceedance of the CCME unionized ammonia criteria is a common occurrence in the Red River and not a result of construction activities.

The ammonia concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 0.044 to 0.150 mg/L and 0.045 to 0.373 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These concentrations were within the baseline range of concentrations measured in the Manness and Domain Drains (0.050 to 1.57 mg/L and 0.070 to 2.03 mg/L, respectively). Additionally, all of the measured ammonia concentrations resulted in un-ionized ammonia concentrations that do not exceed the CCME criteria.

Event-Based Monitoring

Ammonia was analyzed during 12 of the 15 event-based monitoring events conducted, beginning on June 6 following the first application of fertilizer. The ammonia concentrations measured in the Floodway Channel downstream of active construction activities were lower than those in the Red River, except during the August 12 (0.069 mg/L) event-based monitoring, which was only slightly higher than the concentration in the Red River (0.067 mg/L; Table NM7-2). As such the ammonia concentrations in the Red River downstream of the Outlet were lower compared to the background concentration upstream of the outlet with one except during the July 11 event based monitoring. Whereas the ammonia concentrations measured in the Red River upstream and downstream of the Outlet resulted in an exceedance of the CCME un-ionized ammonia criteria during 5 and 6 of the 12 event-based samples, respectively, none of the ammonia concentrations measured in the Floodway Channel downstream of construction resulted in an exceedance. These results indicate that during 2008 there were no potential construction effects associated with ammonia, as the concentrations in the Floodway Channel downstream of construction did not result in any exceedance of the CCME criteria and they would have resulted in dilution in the Red River if anything. Additionally the ammonia concentrations measured in the Red River during the event based monitoring were lower than or within the historical 10^{th} to 90^{th} percentile ranges during the respective months, except for the June 6 monitoring when the background concentration upstream of the Outlet was higher than the 90^{th} percentile.

3.2.5 Nitrate + Nitrite-N

Monthly Monitoring

The comparison of nitrate + nitrite-N concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–14 and NM7–15.

The nitrate + nitrite-N concentrations measured in the Floodway Channel were typically within the lower range of the baseline concentrations during the monthly monitoring representing the non-flood/unfrozen condition, except two locations that exceeded the range of baseline concentrations (Figure NM7–14). The nitrate + nitrite-N concentrations were elevated above the baseline concentrations in the Floodway Channel at the location downstream of North Bibeau Drain (1.230 mg/L) during April and at the Dunning Weir (1.170 mg/L) location during August. However, the nitrate + nitrite-N concentrations during these two months were again within the range of summer baseline concentrations in the Floodway Channel at the Outlet and they were lower than concentrations in the Red River. During most of the months, except June and July, the nitrate + nitrite-N concentrations measured in the Floodway Channel at the Outlet was lower than the concentrations in the Red River. As such during most months there was typically negligible changes or slight decreases in concentration in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet. During August a minor concentration increase in nitrate + nitrite-N was measured in the Red River downstream of the Outlet (0.830 to 1.05 mg/L) compared to the background concentration upstream of the Outlet (0.823 mg/L). Likewise during July a concentration increase was measured in the Red River 3 km downstream of the Outlet (0.402 mg/L) compared to the background concentration upstream of the Outlet (<0.005 mg/L). These concentration increases were not likely due to construction activities within the Floodway Channel because as noted the nitrate + nitrite-N concentrations within the Floodway were typically within summer baseline values and most were substantially lower than the Red River concentrations.

The nitrate + nitrite-N concentrations were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were typically within the lower range of summer baseline concentrations during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–15). An exception was the nitrate + nitrite-N concentration measured during the December monitoring in the Floodway Channel downstream of construction (0.779 mg/L mg/L), which was higher compared to the baseline concentrations. This elevated concentration in the Floodway Channel was not attributed to construction as no fertilizers were applied in the construction area at this time and all other nitrate + nitrite-N concentrations in the Floodway Channel were below summer baseline criteria. The nitrate + nitrite-N concentrations measured in the Floodway Channel Outlet each month were lower than the concentrations in the Red River and did not result in any notable concentration changes in the Red River downstream of the Outlet compared to background concentrations upstream of the Outlet.

The nitrate + nitrite-N concentrations measured in the Red River at the Floodway Outlet during 2008 were compared to the 10th to 90th percentile range of monthly historical data collected once a month by Manitoba Water Stewardship from the Red River at Selkirk for the period of record available from 1970 to 2003. The nitrate + nitrite-N concentrations measured during half of the 2008 monthly monitoring were within or below the 10th to 90th percentile ranges (Figure NM7-16). During the January, February, August, September, November and December monthly monitoring the nitrate + nitrite-N concentrations in the Red River both upstream and downstream of the Outlet were higher than their respective historical 90th percentiles. The elevated nitrate + nitrite-N concentrations above historical concentrations are not a result of construction however, as the concentrations downstream of the Outlet were very similar or lower compared to the background concentrations upstream of the Outlet, except during August. The slight concentration increases measured in August downstream of the Outlet (0.830 to 1.05 mg/L) compared to the background concentration upstream of the Outlet (0.823 mg/L) were not likely due to construction activities within the Floodway Channel because the nitrate + nitrite-N concentrations within the Floodway were substantially lower than the Red River concentrations.

The nitrate + nitrite-N concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 0.044 to 1.09 mg/L and 0.052 to 1.46 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These concentrations were within the baseline range of concentrations measured in the Manness and Domain Drains (0.040 to 4.65 mg/L and 0.010 to 3.91 mg/L, respectively).

Event-Based Monitoring

Nitrate + nitrite-N was analyzed during 12 of the 15 event-based monitoring events conducted, beginning on June 6 following the first application of fertilizer. The nitrate + nitrite-N concentrations measured in the Floodway Channel downstream of active construction activities were lower than those in the Red River during 7 of these 12 monitoring events. As such concentrations measured in the Red River downstream of the Outlet were typically similar to or lower than the background concentrations upstream of the Outlet, with two exceptions. During the June 6 and June 12 monitoring events the concentrations downstream of the Outlet increased to 0.124 mg/L and 2.310 mg/L, respectively from the background concentrations upstream of the Outlet (0.105 mg/L and 1.020 mg/L, respectively; Table NM7-2). The measured increase downstream of the Outlet during the June 6 monitoring was not a result of construction because the nitrate + nitrite-N concentration measured in the Floodway Channel upstream of construction (0.264 mg/L) representing background conditions was higher than the concentration downstream of active construction activities (0.230 mg/L). In comparison, construction activities may have contributed to the measured increase downstream of the Outlet during the June 12 monitoring because the nitrate + nitrite-N concentration measured in the Floodway Channel downstream of active construction activities (2.80 mg/L) was higher than the background concentration upstream of construction (0.031 mg/L). This increased nitrate + nitrite-N concentration measured in the Red River downstream of the outlet (2.310 mg/L) during the June 12 monitoring is not a concern because higher concentrations up to 3.81 mg/L have been previously measured in the Red River upstream of the Outlet.

3.2.6 Potassium

The comparison of potassium concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–17 to NM7–18.

The potassium concentrations measured in the Floodway Channel during the monthly monitoring representing the non-flood/unfrozen condition were generally lower or within the range of summer baseline, except a few elevated concentrations during April and October (Figure NM7–17). During April the concentrations measured in the Floodway Channel at the Keewatin weir (10.1 mg/L) and Spring Hill weir (6.46 mg/L) locations were higher than the summer baseline range. Likewise, during October the concentrations measured at the Keewatin weir (9.06 mg/L), Dunning weir (9.23 mg/L) and the PTH #44 weir (9.39 mg/L) locations and downstream of construction (9.25 mg/L; Stn 50+900) were higher than the summer baseline range. Regardless of these few elevated potassium concentrations in the Floodway Channel, the concentrations at the Outlet during each month were lower than the concentrations in the Red River upstream of Outlet and would have resulted in dilution if anything. As such, the concentrations measured in the Red River downstream of the Outlet were similar to or lower than the background concentrations upstream of the Outlet during each month except May. Slight increases in potassium concentrations were measured in the Red River downstream of the Outlet (5.94 to 6.72 mg/L) during May compared to the concentration upstream of the Outlet (5.88 mg/L). This increase is not a result of construction because the concentration in the Floodway Channel at the Outlet was lower than the concentration in the Red River. Additionally, all the concentrations measured in the Red River during each month were within the range of summer baseline concentrations.

The potassium concentrations were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were typically within the range of summer baseline concentrations during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–18). A few exceptions included the potassium concentrations measured in the Floodway Channel downstream of the Grande Pointe drain during January (17.4 mg/L) and December (11.3 mg/L). These elevated concentrations were not attributed to construction, as there were no activities in January and December, such as fertilizer application, that would contribute to the elevated concentration of potassium and potassium is not a component of the fertilizer that was used during 2008. Additionally, the elevated potassium concentration in the Floodway Channel has no basis for evaluation, as there is no applicable CCME criterion. The potassium concentrations in the Red River downstream of the Outlet where were slightly higher during the January, February and December monitoring compared to the background concentrations in the Red River upstream of the Outlet. However, these slight increases were not a concern because the concentrations were within baseline concentrations. Additionally, they were not a result of construction because the concentrations in the Floodway at the Outlet during each month were lower than in the Red River, and would have resulted in dilution if anything.

The potassium concentrations measured in the Red River at the Floodway Outlet during 2008 were compared to the 10^{th} to 90^{th} percentile range of monthly historical data collected once a month by Manitoba Water Stewardship from the Red River at Selkirk for the period of record available from 1970 to 2003. The potassium concentrations measured upstream and downstream of the Outlet during February and upstream and 500 m downstream of the Outlet during October were higher than the 90th percentile, whereas all other months during 2008 were within or lower than the 10th to 90th percentile ranges (Figure NM7-19). The elevated potassium concentrations above than the 90th percentile in October were representative of background conditions as the concentrations measured downstream of the Outlet were lower compared to upstream. The range of potassium concentrations in the Red River downstream of the Outlet (9.65 to 10.3 mg/L) during February were slightly lower to higher compared to the background concentration upstream of the Outlet (9.86 mg/L). The elevated potassium concentrations were not likely due to construction activities within the Floodway Channel because the potassium concentration measured in the Floodway Channel were lower compared to the Red River concentrations and would have resulted in dilution if anything.

The potassium concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 7.97 to 13.2 mg/L and 8.12 to 14.3 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These concentrations were within the baseline range of concentrations measured in the Manness and Domain Drains (8.4 to 17.8 mg/L and 7.99 to 18.9 mg/L, respectively).

3.2.7 Sodium

The comparison of sodium concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–20 and NM7–21.

The sodium concentrations measured in the Floodway Channel during the monthly monitoring representing the non-flood/unfrozen condition were generally within the range of summer baseline, except a few elevated concentrations during April and May (Figure NM7–20). During April the concentrations measured in the Floodway Channel at the Keewatin weir (150 mg/L) and Spring Hill weir (128 mg/L) locations were higher than the summer baseline range. Likewise, during May the concentrations measured in the Floodway Channel at the Keewatin weir (77.1 mg/L) were higher than the summer baseline range. Regardless of these few elevated sodium concentrations in the Floodway Channel, the concentrations at the Outlet during each month, except for September, were lower than the concentrations in the Red River upstream of Outlet and would have resulted in dilution if anything. As such, the concentrations measured in the Red River downstream of the Outlet were similar to or lower than the background concentrations upstream of the Outlet during each month.

The sodium concentrations measured in the Floodway Channel downstream of construction and at the other Floodway locations were all within or below the range of winter baseline values (70.5 to 165 mg/L) during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–21). The sodium concentrations in the Floodway Channel at the Outlet were generally higher than the concentrations in the Red River at the Outlet except during February. These higher concentrations in the Floodway Channel did not result in any notable changes in the sodium concentrations in the Red River downstream of the Outlet compared to background concentrations upstream of the Outlet.

The sodium concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 15.5 to 46.9 mg/L and 5.35 to 73.6 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). The concentrations measured in the Manness Drain were within the baseline range (4.79 to 76.0 mg/L). In comparison, only the concentrations measured in the Domain Drain during April (5.35 mg/L) and November (10.3 mg/L) were within the baseline range (2.36 to 18.2 mg/L). The sodium concentrations measured during the May (32.7 mg/L) and June (73.6 mg/L) monthly monitoring were elevated above the baseline range. Similar to what was already noted for specific conductance the elevated sodium concentrations were not a result of construction because the activities in the vicinity of the Domain Drain prior to May and June consisted of riprap application that was completed in March 2008.

3.2.8 Chloride

The comparison of chloride concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–22 and NM7–23.

The chloride concentrations measured in the Floodway Channel during the monthly monitoring representing the non-flood/unfrozen condition were generally within the range of summer baseline, except a few elevated concentrations during April and May (Figure NM7–22). During April the concentrations measured in the Floodway Channel at the Keewatin weir (252 mg/L) and Spring Hill weir (215 mg/L) locations were higher than the summer baseline range. Likewise, during May the concentrations measured in the Floodway Channel at the Keewatin weir (122 mg/L) were higher than the summer baseline range. Regardless of these few elevated sodium concentrations further downstream in the Floodway Channel and at the Outlet the concentrations returned to within the summer baseline range. The chloride concentrations measured in the Floodway Channel at the Outlet during May, July, September and October, were higher than the concentrations in the Red River upstream of Outlet. However, these higher concentrations did not result in any notable changes in chloride concentrations in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet, except for during July. A slight increase in chloride concentrations was measured during July in the Red River downstream of the Outlet (30 to 33 mg/L) compared to upstream of the Outlet (29 mg/L). These elevated concentrations at the downstream end of the Floodway Channel and in the Red River during July are likely in response to elevated concentrations flowing into the Floodway Channel from the Kildare Trunk-Transcona Storm Sewer (721 mg/L) and the Cooks Creek Diversion (295 mg/L) and not related to construction activities.

The chloride concentrations measured in the Floodway Channel downstream of construction and at the other Floodway locations were all within or below the range of winter baseline values (60 to 205 mg/L) during the monthly monitoring representing the non-flood/frozen condition (Figure NM7–23). The chloride concentrations in the Floodway Channel at the Outlet were generally higher than the concentrations in the Red River at the Outlet except during February. These higher concentrations in the Floodway Channel generally did not result in any notable changes in the chloride concentrations in the Red River downstream of the Outlet compared to background concentrations upstream of the Outlet, except during December. The chloride concentration measured in the Floodway Channel Outlet (61 mg/L; Stn 50+900) during December was higher than the concentration in the Red River upstream of the Outlet (53 mg/L) and may have contributed to the elevated concentration of 78 mg/L located 500 m downstream of the Outlet. This elevated concentration in the Red River is not a concern, however, as there is no applicable criteria and all other Red River concentrations further downstream of the Outlet (53 to 56 mg/L) were similar to the background concentration.

The chloride concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 59 to 188 mg/L and 12 to 80 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). The concentrations measured in the Manness Drain were within the baseline range (15 to 380 mg/L). Likewise, the concentrations measured in the Domain Drain were within the baseline range (10 to 71 mg/L), except for the elevated chloride concentration measured during the June (80 mg/L) monthly monitoring. As previously noted for specific conductance and sodium, this elevated chloride concentration was not a result of construction because the activities in the vicinity of the Domain Drain prior to June consisted of riprap application that was completed in March 2008.

3.2.9 Iron

During the 2008 construction monitoring there were several occurrences of iron concentrations above the CCME criteria for the protection of freshwater aquatic life (0.30 mg/L; Table NM7–2), similar to what was observed during the baseline and 2005, 2006 and 2007 construction monitoring. As discussed in the baseline monitoring report the iron concentrations are likely influenced, in part, by the presence of high levels of suspended sediment in the samples, which contributes to the iron when the samples are acidified for analysis.

The iron concentrations measured in the Floodway Channel varied monthly during the monitoring representing the non-flood/unfrozen condition (Table NM7–2). During April and June the iron concentrations measured at all locations in the Floodway Channel were above the CCME criteria, whereas during May only the concentration downstream of the North Bibeau Drain exceeded the CCME criteria. The elevated iron concentrations in the Floodway Channel generally ranged from 0.31 mg/L to 0.72 mg/L, which are reflective of similar exceedances (0.31 to 0.81 mg/L) measured in the Floodway Channel during the baseline monitoring. The iron concentrations measured in the Red River at all of the locations at the Outlet (0.31 to 1.49 mg/L) exceeded the CCME criteria during April, July, September and October and at a one or two of the locations the rest of the months during the non-flood/unfrozen condition. Again, these elevated iron concentrations do not differ from elevated iron concentrations (0.31 to 1.56 mg/L) measured in the Red River during the baseline monitoring.

The iron concentrations measured in the Floodway Channel were generally below the CCME criteria during the monthly monitoring representing the non-flood/frozen condition (Table NM7–2). However, elevated iron concentrations above the CCME criteria were typically measured at a couple of locations in the Floodway Channel during each month (0.37 to 0.68 mg/L). There were no elevated iron concentrations above the CCME criteria measured in the Red River at the Outlet during January to March, however elevated concentrations (0.63 to 1.96 mg/L) were measured during November and December. These elevated iron concentrations again are reflective of similar exceedances measured in the Floodway Channel (0.31 to 0.81 mg/L) and in the Red River (0.31 to 1.56 mg/L) during the baseline monitoring.

The iron concentrations measured in the Manness and Domain Drains along the West Dyke ranged from 0.18 to 0.45 mg/L and 0.36 to 0.49 mg/L, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These iron concentrations typically exceeded the CCME criteria (0.30 mg/L), except for those measured in the Manness Drain during April and October. These elevated concentrations, however are within the baseline range of concentrations measured in the Manness and Domain Drains (0.21 to 0.93 mg/L and 0.15 to 1.06 mg/L, respectively).

3.2.10 Petroleum Hydrocarbons

The concentration of petroleum hydrocarbons analyzed (Benzene, Toluene, Ethyl-benzene, Xylenes (-o,-m,-p), and hydrocarbon fractions F1 to F4) were below detection limits in the Floodway Channel downstream of the construction area during each of the monthly monitoring events, with one exception (Table NM7–3). During the March monthly monitoring a toluene concentration of 1.02 µg/L was detected, however, this was not a concern as it was below the CCME criteria Maximum Acceptable Concentration (MAC) for the protection of freshwater aquatic life (2.0 µg/L). The concentrations of petroleum hydrocarbons were below detection limits in the Floodway Channel upstream of construction when samples could be collected during the April (spring melt), June, July, October and November monthly monitoring. Although there was no water upstream of the construction area to sample as a background condition during the other monthly monitoring, as the concentration of petroleum hydrocarbons analyzed downstream of construction were typically below detection limits, petroleum hydrocarbons were not considered an issue during the monthly monitoring.

3.2.11 Bacterial

The comparison of *E.Coli* concentrations between baseline conditions and from samples collected for the Red River, Floodway Channel and drain sample locations during the monthly construction monitoring events for the non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM7–24 and NM7–25. The laboratory analysis method used for Total Coliform and *E.Coli* testing was the Mcoli Blue membrane filtration analysis method, which has an upper detection limit of 1500 to 2000 CFU/100 ml. Samples in which the bacteria exceed the upper limit of 2000 CFU/100 ml are identified as overgrown.

The *E.Coli* concentrations measured in the Floodway Channel varied along the length of the Channel and from month to month, during the monthly monitoring representing the non-flood/unfrozen condition (Figure NM7–24). The concentrations along the length of the Channel during the most months ranged from below baseline concentrations (<10 to 30 CFU/100mL), to well above baseline concentrations (1080 CFU/100mL to overgrown), except for during May (<10 to 160 CFU/100mL), which was within the baseline range. The elevated *E.Coli* concentrations in the Floodway Channel most frequently occurred at the Keewatin weir and Spring Hill weir locations, likely in response to elevated concentrations flowing in from the Kildare Trunk-Transcona Storm Sewer outlet. The elevated *E.Coli* concentrations, however, were not attributed to construction, as there were no construction activities that would release bacteria into the construction area. The *E.Coli* concentrations in the Red River downstream of the Outlet were typically higher compared to background concentrations upstream, except during June when all the concentrations in the Red River were below detection limits (<10 CFU/100mL). The elevated concentrations measured in the Floodway Channel and Red River were not attributed to construction because there were no construction activities that would immediately contribute to elevated *E.Coli* concentrations. Additionally, elevated concentrations were measured in the Red River during summer baseline monitoring (90 CFU/100 mL to overgrown).

The *E.Coli* concentrations measured in the Floodway Channel were generally below the detection limit of 10 CFU/100mL or within the summer baseline concentrations (16 to 630 CFU/100 mL) during the monthly monitoring representing the non-flood/frozen condition, with a few exceptions (Figure NM7–25). During January the concentrations measured in the Floodway Channel at the Keewatin weir (1670 CFU/100 mL) and Spring Hill weir (1090 CFU/100 mL) locations were higher than the summer baseline range. Likewise, the concentrations measured at the Keewatin weir (overgrown) were higher than the summer baseline range. The elevated *E.Coli* concentrations, however, were not attributed to construction, as there were no construction activities that would release bacteria into the construction area. The *E.Coli* concentrations in the Red River downstream of Outlet varied from sample location to sample location during each month. During February and March the concentrations in the Red River downstream of the Outlet were lower than the background concentration upstream of the Outlet. Whereas, during January, November and December the concentrations downstream of the Outlet were higher compared to upstream, in particular during November all of the downstream concentrations were substantially higher (overgrown). The elevated concentrations and increases in concentration were not attributed to construction, as noted above, as there were no construction activities that would release bacteria to the Floodway Channel and the concentrations in the Floodway at the Outlet were lower than in the Red River, which would have resulted in dilution if anything. Additionally, elevated concentrations were measured in the Red River during summer baseline monitoring (90 CFU/100 mL to overgrown).

The *E.Coli* concentrations measured in the Manness and Domain Drains along the West Dyke ranged from <10 to 190 CFU/100 mL and <10 to 240 CFU/100 mL, respectively, during the monthly monitoring in which samples could be collected (Table NM7-2). These concentrations were within the baseline range of concentrations measured in the Manness and Domain Drains (11 CFU/100 mL to overgrown and <10 to 650 CFU/100 mL, respectively).

3.2.12 Herbicides

The concentration of herbicides analyzed (2,4-D, AMPA, Bromoxynil, Dicamba, Glyphosate, MCPA and Picloram) were below the laboratory analysis detection limits for the samples collected in the Floodway Channel both upstream and downstream of the revegetation area during the spring melt represented by the April monthly monitoring (Table NM7–5). There were no herbicides applied during the 2008 construction year and therefore no other herbicide monitoring was conducted beyond the spring melt condition which was sampled to assess the run-off from agricultural fields. Based on these results herbicides were not a concern during the 2008 construction year.

4.0 SUMMARY AND CONCLUSIONS

1. The 2008 construction surface water quality monitoring program was conducted from January to December 2008 in conjunction with the on-going construction activities that occurred from Station 11+200 to 50+430. This consisted of;

   a. All the Channel contracts, except C-1, C-2, C4, C6a and C6b that were completed prior to 2008;
   b. Bridge contracts for PTH 59 South (T4), CNR Redditt (T11), CPR Emerson (T15) and CPR Keewatin (T14);
   c. The Inlet and Outlet structures; and
   d. The West Dyke earthworks contracts (W1, W2, W3, W5, W6, W12, W22, W23 and W24).

2. Samples were collected from the Red River at the Inlet and Outlet, at 11 locations along the Floodway Channel including the upstream and downstream ends of the construction and revegetation zones, at 11 of the outfall drains flowing into the Floodway and at 2 drains along the West Dyke, when there was a sufficient amount of water to collect a sample.

3. At each sampling location, field data was obtained (conductivity, pH, temperature, EC and turbidity) and water samples were submitted to an accredited laboratory for testing (including inorganic parameters, turbidity, TSS and bacteria). Benzene, toluene, ethylbenzene and xylenes (BTEX) and hydrocarbon fractions F1 to F4 were also analyzed when samples could be collected at the upstream and downstream of construction locations. During the April (spring melt) monitoring laboratory analysis also included phenoxy acid herbicide screen (2,4-D, bromoxynil, dicamba, MCPA and picloram), AMPA and glyphosate, at the upstream and downstream of revegetation locations. These results were compared to the floodway baseline surface water data, based on sampling in April to August, 2005 and applicable CCME criteria.

4. There were twelve (12) monthly monitoring events, with one conducted each month following precipitation events or near the end of the month if a substantial precipitation event had not yet occurred. There was no spring or summer flood during 2008. There were fifteen (15) level I event-based monitoring events conducted between May and November, 2008 in response to precipitation levels greater than 10 mm. Additionally, an Outlet TSS Monitoring Program was conducted at the Floodway Channel Outlet from March 17 to 31, 2008 in response to the removal of the cofferdam within Contract CE1.

5. Results of the 15 level I event-based monitoring events conducted between May and November have typically indicated very small changes in TSS concentration in the Red River during the 2008 construction year, except for the June 6 monitoring following a rainfall close to a 5-year storm. The mass balance using the Red River flows and the laboratory TSS concentrations indicated an approximate increase in the TSS concentrations of 22 mg/L or 40%. This increase in TSS concentrations was within the CCME criteria of an allowable increase of 25 mg/L based on the background concentrations being <250 mg/L (clear flow). Nearly all the other level I event based monitoring measured a change of less than 1.0% and over half of these were a

decrease in TSS concentration, therefore, no level II event-based monitoring was required during the 2008 construction year.

6. The results of the Outlet TSS event-based monitoring indicated that the removal of the cofferdam from Contract CE1 at the Outlet Structure did not elevate TSS levels in the Red River above the CCME Freshwater Aquatic Life criteria.

7. Within the non-flood unfrozen condition in 2008, concentrations of most parameters measured in the Floodway Channel were generally within the summer baseline concentrations. During some of the months, in particular during April (spring melt), there were a few locations where parameters were elevated above the baseline concentrations. During June and September TSS concentrations in the Floodway Channel were elevated above the baseline concentrations at several locations, including at the Outlet. In comparison, *E.Coli* concentrations were typically elevated above baseline concentrations each month at most Floodway Channel Locations. For all of the parameters these concentrations elevated above baseline in the Floodway were typically lower than the concentration in the Red River, except specific conductance and chloride concentrations. Therefore the elevated concentrations in the Floodway Channel would have no effect on concentrations in the Red River or result in dilution if anything.

8. During the non-flood unfrozen condition monthly monitoring events, parameter concentrations measured in the Red River downstream of the Outlet were typically similar to the background concentrations upstream of the Outlet, ranging from slightly lower to slightly higher, although larger downstream increases were measured for TSS, ammonia, potassium and *E.Coli* concentrations. The TSS concentration increases measured in the Red River downstream of the Outlet were all less than the CCME criteria of an allowable increase of 25 mg/L and therefore not a concern. Although the September monthly laboratory results indicate an increase of 77 mg/L 500 m downstream of the Outlet, the mass balance calculations with the measured TSS concentrations and flows indicate that only an approximate increase in TSS concentration of 0.7 mg/L would result in the Red River from the Floodway Channel inputs, indicating that these values are within CCME criteria. Although increases in potassium and *E.Coli* were measured the concentrations were within baseline concentrations. Additionally the elevated potassium and *E.Coli* concentrations have no basis for evaluation, as there is no applicable CCME criterion. The ammonia concentrations measured in the Red River during June and October resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and all locations downstream of the Outlet, whereas during July and September there were only a couple of exceedances. These exceedances are not a result of construction, because the background concentrations upstream of the Outlet and baseline concentrations, also exceeded the CCME criteria.

9. Concentrations of most parameters measured in the Floodway Channel were within the winter baseline concentrations (or the summer baseline if there was no winter baseline) except for one or two samples during the monthly monitoring events within the non-flood frozen condition. In particular concentrations of TSS, specific conductance, ammonia and potassium were higher than baseline concentrations in the Floodway Channel downstream of the Grande Pointe drain during the January monitoring. Likewise ammonia and *E.Coli* were elevated at the Keewatin and Spring Hill weir locations during the January monitoring. The elevated TSS concentration did not result in an exceedance

of the CCME criteria and was likely a result of disturbing the channel bottom while drilling through the ice cover to collect the sample. The elevated ammonia concentrations did not result in an exceedance of the CCME un-ionized ammonia criteria. The elevated potassium concentrations in the Floodway were not related to construction activities, as the fertilizer applied over the summer did not contain potassium. The elevated *E.Coli* concentrations were not attributed to construction, as there were no construction activities that would release bacteria into the construction area. Additionally, the elevated specific conductance, potassium and *E.Coli* concentrations in the Floodway channel have no basis for evaluation, as there are no applicable CCME criteria.

10. Parameter concentrations measured in the Red River downstream of the Outlet during the non-flood frozen condition were typically similar to the background concentrations upstream of the Outlet ranging from slightly lower to slightly higher, although concentrations measured during December tended to show larger increases. In particular concentration increases were measured for TSS, total phosphorus, ammonia and *E.Coli*. During December minor increases in TSS concentrations (4.5%) were measured in the Red River downstream of the Outlet compared to upstream of the Outlet, however this is within the allowable CCME criteria of a 10% increase. The ammonia concentrations in the Red River downstream of the Outlet were typically higher compared to the background concentration in the Red River upstream of the Outlet, except during March when they were lower. Only the ammonia concentrations measured during March resulted in un-ionized ammonia concentrations that exceeded the CCME criteria both upstream and downstream of the Outlet. The exceedance downstream is not a result of construction because background concentrations upstream at this time and concentrations measured during baseline monitoring also exceeded the CCME criteria. Additionally, the concentration increases in the Red River were not due to construction activities within the Floodway Channel because all concentrations in the Floodway Channel were lower than Red River concentrations.

11. Concentrations of most parameters measured in the Manness and Domain Drains along the West Dyke were typically within the baseline concentrations during the monthly monitoring events that samples could be collected. Specific conductance, sodium and chloride concentrations, however, were elevated above baseline concentrations in the Domain Drain during the June monthly monitoring. Likewise the sodium concentration in the Domain Drain during the May monthly monitoring was also elevated above baseline concentrations. These elevated concentrations were not a result of construction because the activities in the vicinity of the Domain Drain prior to May and June consisted of riprap application that was completed in March 2008.

5.0 RECOMMENDATIONS

Based on the results of the 2008 Construction monitoring events, recommendations and refinements for the ongoing monitoring should include the following;

- Continued monitoring at all of the current sample locations (including the drain locations upstream of the perimeter ditching when a drain is within an area of construction activities), following the established monthly monitoring schedule, with event-based monitoring conducted as required for the 2009 surface water monitoring program.

- The event-based monitoring in 2009 should continue to follow the protocol used in 2008 that incorporated revisions made in 2006, based on the results of a review of precipitation levels and measured TSS increases. The 2008 protocol was reviewed near the end of the 2008 monitoring program (with no changes made) and should be reviewed again during the 2009 monitoring program and revised if required as construction contracts near completion.

- The reporting protocol for the 2009 surface water monitoring program should continue to follow the slight modifications made for the start of 2008 to flag potential increases in TSS concentrations more rapidly. This included completing a level I event-based worksheet for each of the monthly monitoring events to provide an indication as to whether the sediment concentration in the Floodway will have a potential impact on the Red River downstream of the Floodway Outlet. If the worksheet indicates no potential impact then the results would be reported in the monthly monitoring report, whereas, if a potential impact is identified then MFA would be notified immediately and the laboratory would be contacted to request the TSS analysis results as soon as possible. Appropriate measures would then be developed with MFA based on the TSS laboratory results.

6.0 REFERENCES

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TABLES

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
Monthly							
CON D/S	Floodway Channel - Station 50+500	28-Jan-08	7.48	1550	-1.1	11.64	
		25-Feb-08	6.21	1236	-0.5	11.09	
		11-Mar-08	8.12	900	2.0	23.14	
		25-Apr-08	7.94	531	1.5	61.75	
		13-May-08	8.20	732	8.2	15.74	
		06-Jun-08	7.94	539	12.8	>1100	
	- Station 50+900	11-Jul-08	8.30	324	22.3	44.88	
		12-Aug-08	7.64	830	17.2	41.93	
		02-Sep-08	7.59	917	14.5	55.44	
		07-Oct-08	7.88	705	11.6	79.05	
		07-Nov-08	8.39	959	1.3	52.68	
		18-Dec-08	7.80	192	0.1	13.33	
CON U/S	- Station 11+000	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.60	574	2.20	3.13	
		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	8.30	424	15.4	93.15	
		11-Jul-08	8.16	399	21.6	1.77	
		12-Aug-08	-	-	-	-	CNM - No Flow
		02-Sep-08	-	-	-	-	CNM - No Flow
		07-Oct-08	6.34	589	10.9	1.60	
		07-Nov-08	8.10	451	2.2	10.13	
		19-Dec-08	-	-	-	-	CNM - Frozen
VEG D/S	Floodway Channel - Station 50+500	28-Jan-08	7.48	1550	-1.1	11.64	
		25-Feb-08	6.21	1236	-0.5	11.09	
		11-Mar-08	8.12	900	2.0	23.14	
		25-Apr-08	7.94	531	1.50	61.75	
		13-May-08	8.20	732	8.2	15.74	
		06-Jun-08	7.94	539	12.8	>1100	
	- Station 50+900	11-Jul-08	8.30	324	22.3	44.88	
		12-Aug-08	7.64	830	17.2	41.93	
		02-Sep-08	7.59	917	14.5	55.44	
		07-Oct-08	7.88	705	11.6	79.05	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
VEG D/S	Floodway Channel - Station 50+900	07-Nov-08	8.39	959	1.3	52.68	
		18-Dec-08	7.80	192	0.1	13.33	
VEG U/S	- Station 11+000	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.60	574	2.20	3.13	
		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	8.30	424	15.4	93.15	
		11-Jul-08	8.16	399	21.6	1.77	
		12-Aug-08	-	-	-	-	CNM - No flow
		02-Sep-08	-	-	-	-	CNM - No flow
		07-Oct-08	6.34	589	10.9	1.60	
		07-Nov-08	8.10	451	2.2	10.13	
		19-Dec-08	-	-	-	-	CNM - Frozen
S-01	Red River - Upstream of Inlet	30-Jan-08	-	-	-	-	CNM - No river water diverted
		25-Feb-08	-	-	-	-	CNM - No river water diverted
		12-Mar-08	-	-	-	-	CNM - No river water diverted
		25-Apr-08	-	-	-	-	CNM - No river water diverted
		13-May-08	-	-	-	-	CNM - No river water diverted
		06-Jun-08	-	-	-	-	CNM - No river water diverted
		11-Jul-08	-	-	-	-	CNM - No river water diverted
		12-Aug-08	-	-	-	-	CNM - No river water diverted
		02-Sep-08	-	-	-	-	CNM - No river water diverted
		07-Oct-08	-	-	-	-	CNM - No river water diverted
		07-Nov-08	-	-	-	-	CNM - No river water diverted
		18-Dec-08	-	-	-	-	CNM - No river water diverted
S-02	Red River - Upstream of Inlet (replicate of 1)	30-Jan-08	-	-	-	-	CNM - No river water diverted
		25-Feb-08	-	-	-	-	CNM - No river water diverted
		12-Mar-08	-	-	-	-	CNM - No river water diverted
		25-Apr-08	-	-	-	-	CNM - No river water diverted
		13-May-08	-	-	-	-	CNM - No river water diverted
		06-Jun-08	-	-	-	-	CNM - No river water diverted
		11-Jul-08	-	-	-	-	CNM - No river water diverted
		12-Aug-08	-	-	-	-	CNM - No river water diverted
		02-Sep-08	-	-	-	-	CNM - No river water diverted
		07-Oct-08	-	-	-	-	CNM - No river water diverted
		07-Nov-08	-	-	-	-	CNM - No river water diverted
		18-Dec-08	-	-	-	-	CNM - No river water diverted
S-03	Red River - Upstream of Inlet (replicate of 1)	30-Jan-08	-	-	-	-	CNM - No river water diverted
		25-Feb-08	-	-	-	-	CNM - No river water diverted
		12-Mar-08	-	-	-	-	CNM - No river water diverted

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-03	Red River - Upstream of Inlet (replicate of 1)	25-Apr-08	-	-	-	-	CNM - No river water diverted
		13-May-08	-	-	-	-	CNM - No river water diverted
		06-Jun-08	-	-	-	-	CNM - No river water diverted
		11-Jul-08	-	-	-	-	CNM - No river water diverted
		12-Aug-08	-	-	-	-	CNM - No river water diverted
		02-Sep-08	-	-	-	-	CNM - No river water diverted
		07-Oct-08	-	-	-	-	CNM - No river water diverted
		07-Nov-08	-	-	-	-	CNM - No river water diverted
		18-Dec-08	-	-	-	-	CNM - No river water diverted
S-04	Floodway Channel - Downstream of Inlet	30-Jan-08	-	-	-	-	CNM - No river water diverted
		25-Feb-08	-	-	-	-	CNM - No river water diverted
		12-Mar-08	-	-	-	-	CNM - No river water diverted
		25-Apr-08	-	-	-	-	CNM - No river water diverted
		13-May-08	-	-	-	-	CNM - No river water diverted
		06-Jun-08	-	-	-	-	CNM - No river water diverted
		11-Jul-08	-	-	-	-	CNM - No river water diverted
		12-Aug-08	-	-	-	-	CNM - No river water diverted
		02-Sep-08	-	-	-	-	CNM - No river water diverted
		07-Oct-08	-	-	-	-	CNM - No river water diverted
		07-Nov-08	-	-	-	-	CNM - No river water diverted
		18-Dec-08	-	-	-	-	CNM - No river water diverted
S-05	Seine River Syphon Overflow	30-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	-	-	-	-	CNM - No flow
U/S		25-Apr-08	-	-	-	-	CNM - No flow
		13-May-08	-	-	-	-	CNM - No flow
U/S		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	8.30	478	16.1	44.70	
U/S		06-Jun-08	8.40	466	16.0	57.66	
		11-Jul-08	7.46	489	20.5	34.88	
U/S		11-Jul-08	7.32	482	21.2	43.18	
		12-Aug-08	-	-	-	-	CNM - No Flow
U/S		12-Aug-08	-	-	-	-	CNM - No Flow
		02-Sep-08	-	-	-	-	CNM - No Flow
U/S		02-Sep-08	-	-	-	-	CNM - No Flow
		07-Oct-08	6.60	661	10.6	27.66	
U/S		07-Oct-08	6.65	655	10.7	25.07	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-05	Seine River Syphon Overflow	07-Nov-08	8.10	617	2.4	37.53	
U/S	- Upstream of Perimeter Ditches	07-Nov-08	7.60	626	2.4	34.61	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-06	Grande Pointe Diversion Drop Structure	30-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.30	524	2.2	20.14	
U/S		25-Apr-08	-	-	-	-	CNM - No flow
		13-May-08	7.28	825	8.0	15.03	
U/S		13-May-08	7.74	636	7.6	20.99	
		06-Jun-08	8.20	503	13.7	374.1	
U/S		06-Jun-08	8.10	518	14.4	413.3	
		11-Jul-08	8.49	756	24.8	18.30	
U/S		11-Jul-08	7.46	405	22.1	7.06	
		12-Aug-08	8.28	762	17.9	37.86	
U/S		12-Aug-08	7.69	441	17.9	39.82	
		02-Sep-08	-	-	-	-	CNM - No Flow
U/S		02-Sep-08	-	-	-	-	CNM - No Flow
		07-Oct-08	6.76	799	11.8	10.57	
U/S		07-Oct-08	6.62	757	10.3	12.15	
		07-Nov-08	8.00	694	1.8	31.45	
U/S		07-Nov-08	7.90	534	1.8	21.72	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-07	Centreline Drop Structure	30-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.30	593	3.6	12.05	
U/S		25-Apr-08	8.40	539	3.4	11.87	
		13-May-08	7.92	1758	12.0	41.29	
U/S		13-May-08	7.94	978	11.2	17.38	
		06-Jun-08	8.20	782	16.2	213.9	
U/S		06-Jun-08	8.00	671	14.8	217.6	
		11-Jul-08	8.70	617	23.0	10.25	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
U/S	- Upstream of Perimeter Ditches	11-Jul-08	8.45	632	22.1	14.00	
		12-Aug-08	7.96	1273	18.0	51.00	
U/S		12-Aug-08	8.39	722	18.1	42.85	
		02-Sep-08	8.02	948	15.3	24.21	
U/S		02-Sep-08	7.93	1133	16.1	28.35	
		07-Oct-08	7.29	988	11.8	98.08	
U/S		07-Oct-08	6.76	1004	11.4	26.86	
		07-Nov-08	8.00	1169	2.6	20.84	
U/S		07-Nov-08	7.90	1261	2.0	21.30	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-08	Deacon Reservoir Drain	30-Jan-08	-	-	-	-	CNM - No flow
		25-Feb-08	-	-	-	-	CNM - No flow
		12-Mar-08	-	-	-	-	CNM - No flow
		25-Apr-08	-	-	-	-	CNM - No flow
		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	-	-	-	-	CNM - No flow
		11-Jul-08	-	-	-	-	CNM - No flow
		12-Aug-08	-	-	-	-	CNM - No flow
		02-Sep-08	-	-	-	-	CNM - No flow
		07-Oct-08	-	-	-	-	CNM - No flow
		07-Nov-08	-	-	-	-	CNM - No flow
		18-Dec-08	-	-	-	-	CNM - No flow
S-09	Cooks Creek Diversion Drop Structure	31-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	31-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.60	483	4.00	35.22	
U/S		25-Apr-08	8.60	480	4.00	48.19	
		13-May-08	7.95	6441	12.3	17.45	
U/S		13-May-08	7.93	854	11.9	18.28	
		06-Jun-08	8.40	785	16.4	22.30	
U/S		06-Jun-08	8.10	690	15.8	42.17	
		11-Jul-08	9.04	1530	20.6	21.58	
U/S		11-Jul-08	8.93	1592	20.7	19.47	
		12-Aug-08	8.79	1837	20.1	28.01	
U/S		12-Aug-08	7.69	1550	18.0	34.20	
		02-Sep-08	7.91	1050	16.0	49.25	
U/S		02-Sep-08	7.83	574	14.6	33.44	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-09	Cooks Creek Diversion Drop Structure	07-Oct-08	7.03	1085	11.6	31.70	
U/S	- Upstream of Perimeter Ditches	07-Oct-08	6.76	965	11.9	15.36	
		07-Nov-08	8.00	1964	2.2	33.40	
U/S		07-Nov-08	9.00	6900	2.1	29.25	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-10	North Bibeau Drain Drop Structure	30-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	30-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.50	981	3.60	7.71	
U/S		25-Apr-08	8.20	634	2.60	9.41	
		13-May-08	8.01	2520	14.0	12.46	
U/S		13-May-08	7.23	1419	9.8	6.55	
		06-Jun-08	8.20	664	15.9	336.1	
U/S		06-Jun-08	8.00	375	15.7	285.9	
		11-Jul-08	8.31	1070	22.1	3.63	
U/S		11-Jul-08	7.22	842	19.6	2.36	
		12-Aug-08	7.98	2950	18.5	36.19	
U/S		12-Aug-08	7.45	1051	18.1	7.74	
		02-Sep-08	7.91	996	14.9	11.82	
U/S		02-Sep-08	-	-	-	-	CNM - No flow
		07-Oct-08	7.59	1509	13.1	5.11	
U/S		07-Oct-08	6.79	1064	10.8	4.49	
		07-Nov-08	7.90	368	1.3	18.93	
U/S		07-Nov-08	7.80	1295	1.0	5.54	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-11	Country Villa Estates Drain	31-Jan-08	-	-	-	-	CNM - No flow
		25-Feb-08	-	-	-	-	CNM - No flow
		11-Mar-08	-	-	-	-	CNM - No flow
		25-Apr-08	-	-	-	-	CNM - No flow
		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	7.75	918	14.6	31.44	
		11-Jul-08	7.60	352	21.1	43.61	
		12-Aug-08	7.09	670	18.4	11.74	
		02-Sep-08	7.55	535	14.5	18.95	
		07-Oct-08	8.06	899	12.0	2.58	
		07-Nov-08	8.26	964	0.7	68.81	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-11	Country Villa Estates Drain	18-Dec-08	-	-	-	-	CNM - Frozen
S-12	Kildare Trunk-Transcona Storm Sewer Outlet	31-Jan-08	-	-	-	-	CNM - No flow
		25-Feb-08	-	-	-	-	CNM - No flow
		12-Mar-08	-	-	-	-	CNM - No flow
		25-Apr-08	-	-	-	-	CNM - Water Not Accessible
		13-May-08	7.24	2080	8.8	34.61	
		06-Jun-08	8.20	694	15.1	110.5	
		11-Jul-08	6.84	2760	16.6	64.88	
		12-Aug-08	7.49	465	17.9	78.60	
		02-Sep-08	7.81	561	16.1	36.97	
		07-Oct-08	6.64	988	12.3	49.95	
		07-Nov-08	7.90	7130	4.4	144.8	
		18-Dec-08	-	-	-	-	CNM - Frozen
S-13	Floodway Channel - D/S of Grande Pointe Drain	30-Jan-08	6.82	3.52	-0.5	138.2	
		26-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.30	456	2.40	44.92	
		13-May-08	7.70	635	8.0	41.59	
		06-Jun-08	8.30	488	14.9	102.3	
		11-Jul-08	7.83	470	22.2	28.29	
		12-Aug-08	7.92	600	18.2	41.24	
		02-Sep-08	7.95	674	15.8	39.53	
		07-Oct-08	7.25	679	10.7	22.54	
		07-Nov-08	8.00	629	1.9	40.15	
		19-Dec-08	6.93	12.76	-1.5	6.93	
S-14	Floodway Channel - D/S of North Bibeau Drain	30-Jan-08	7.30	1160	-0.9	38.60	
		26-Feb-08	7.47	761	0.0	12.64	
		12-Mar-08	8.05	1100	1.4	52.62	
		25-Apr-08	8.40	451	3.50	255.5	
		13-May-08	8.00	736	12.5	160.7	
		06-Jun-08	8.40	782	17.1	82.13	
		11-Jul-08	7.81	542	21.4	80.96	
		12-Aug-08	8.28	637	18.9	33.85	
		02-Sep-08	8.04	752	16.7	58.24	
		07-Oct-08	6.83	722	12.5	38.11	
		07-Nov-08	8.00	776	1.8	158.7	
		19-Dec-08	6.52	1148	-1.4	7.2	
S-21	Floodway Channel - Keewatin Weir	31-Jan-08	7.54	1190	-0.7	8.34	
		26-Feb-08	7.75	945	1.0	9.90	
		12-Mar-08	8.13	900	1.8	17.79	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-21	Floodway Channel - Keewatin Weir	25-Apr-08	8.14	1301	3.40	70.47	
		13-May-08	7.86	829	12.6	51.99	
		06-Jun-08	7.92	345	13.4	201.5	
		11-Jul-08	8.40	368	20.7	50.07	
		12-Aug-08	7.39	449	17.2	77.31	
		02-Sep-08	7.84	323	14.4	93.66	
		07-Oct-08	7.87	787	12.8	46.02	
		07-Nov-08	8.64	1294	2.0	67.24	
		19-Dec-08	6.82	933	-0.5	3.34	
S-22	Springfield Road Drain Drop Structure	31-Jan-08	-	-	-	-	CNM - No flow, frozen
U/S	- Upstream of Perimeter Ditches	31-Jan-08	-	-	-	-	CNM - No flow, frozen
		26-Feb-08	-	-	-	-	CNM - No flow, frozen
U/S		26-Feb-08	-	-	-	-	CNM - No flow, frozen
		12-Mar-08	-	-	-	-	CNM - No flow, frozen
U/S		12-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	8.50	684	4.50	4.97	
U/S		25-Apr-08	8.06	751	2.30	0.80	
		13-May-08	8.36	896	16.0	1.95	
U/S		13-May-08	8.15	938	12.9	1.58	
		06-Jun-08	7.76	909	15.0	36.31	
U/S		06-Jun-08	7.65	889	14.0	56.43	
		11-Jul-08	8.90	284	22.4	1.96	
U/S		11-Jul-08	-	-	-	-	CNM - No flow
		12-Aug-08	7.51	880	18.2	11.35	
U/S		12-Aug-08	7.26	579	17.8	29.54	
		02-Sep-08	7.81	702	13.9	23.21	
U/S		02-Sep-08	7.62	714	14.0	3.83	
		07-Oct-08	8.44	863	12.8	4.74	
U/S		07-Oct-08	8.39	1058	12.2	6.07	
		07-Nov-08	8.40	1110	0.3	18.90	
U/S		07-Nov-08	8.39	1205	0.0	5.99	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-23	Floodway Channel - Spring Hill Weir	31-Jan-08	7.31	1276	0.0	14.30	
		26-Feb-08	7.41	967	0.3	11.21	
		12-Mar-08	8.37	900	1.2	11.5	
		25-Apr-08	8.19	1170	2.80	79.45	
		13-May-08	7.61	865	11.2	29.33	
		06-Jun-08	7.95	715	15.6	49.73	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-23	Floodway Channel - Spring Hill Weir	11-Jul-08	8.20	352	21.1	43.61	
		12-Aug-08	7.73	1017	18.2	12.02	
		02-Sep-08	7.16	296	13.5	110.9	
		07-Oct-08	7.36	489	12.3	63.50	
		07-Nov-08	8.74	884	1.7	110.8	
		18-Dec-08	8.00	65.1	0.0	13.14	
S-25	Floodway Channel - Dunning Weir	28-Jan-08	7.54	979	-1.0	11.10	
		25-Feb-08	6.49	1087	-1.0	39.18	
		11-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	6.80	504	3.10	99.56	
		13-May-08	8.51	768	11.4	42.65	
		06-Jun-08	8.13	815	14.7	96.10	
		11-Jul-08	8.50	346	22.0	45.33	
		12-Aug-08	7.88	896	18.8	41.10	
		02-Sep-08	7.93	696	15.9	45.69	
		07-Oct-08	7.98	653	11.8	62.51	
		07-Nov-08	8.57	1196	0.3	97.42	
		18-Dec-08	7.80	94.6	0.1	14.20	
S-26	Skholny Drain Drop Structure	28-Jan-08	-	-	-	-	CNM - No flow, frozen
		25-Feb-08	-	-	-	-	CNM - No flow, frozen
		11-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	7.56	343	2.50	5.05	
U/S	- Upstream of Skholny Drain	25-Apr-08	7.91	703	2.40	4.47	
		13-May-08	8.04	875	11.4	12.04	
U/S		13-May-08	8.16	1514	11.7	35.80	
		06-Jun-08	7.71	555	16.3	48.38	
U/S		06-Jun-08	7.90	1116	14.0	50.52	
		11-Jul-08	8.00	362	21.5	8.58	
U/S		11-Jul-08	8.00	384	21.7	5.99	
		12-Aug-08	7.32	734	18.4	47.27	
U/S		12-Aug-08	7.51	886	18.4	55.40	
		02-Sep-08	7.35	601	14.1	21.36	
U/S		02-Sep-08	7.49	677	14.2	18.70	
		07-Oct-08	7.85	817	12.5	5.85	
U/S		07-Oct-08	7.94	607	11.1	3.55	
		07-Nov-08	7.49	1070	-0.3	20.20	
U/S		07-Nov-08	8.25	786	0.8	6.54	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-27	Ashfield Drain Drop Structure	28-Jan-08	-	-	-	-	CNM - No flow, frozen
S-27	Ashfield Drain Drop Structure	25-Feb-08	-	-	-	-	CNM - No flow, frozen
		11-Mar-08	-	-	-	-	CNM - No flow, frozen
		25-Apr-08	7.80	669	1.80	10.77	
U/S	- Upstream of Ashfield Drain	25-Apr-08	6.67	334	1.50	12.19	
		13-May-08	8.00	658	11.3	13.83	
U/S		13-May-08	8.41	649	11.6	7.67	
		06-Jun-08	7.96	679	16.0	156.3	
U/S		06-Jun-08	7.37	752	15.9	5.14	
		11-Jul-08	-	-	-	-	CNM - No flow
U/S		11-Jul-08	-	-	-	-	CNM - No flow
		12-Aug-08	7.25	209	17.8	320.2	
U/S		12-Aug-08	7.62	359	18.0	272.0	
		02-Sep-08	7.53	676	15.0	30.29	
U/S		02-Sep-08	7.60	668	14.8	19.24	
		07-Oct-08	7.89	1067	13.6	14.14	
U/S		07-Oct-08	7.74	992	13.6	3.14	
		07-Nov-08	8.30	987	0.0	55.50	
U/S		07-Nov-08	8.25	901	-0.8	2.68	
		18-Dec-08	-	-	-	-	CNM - Frozen
U/S		18-Dec-08	-	-	-	-	CNM - Frozen
S-28	Floodway Channel - PTH #44 Weir	28-Jan-08	7.60	1626	-1.0	19.95	
		25-Feb-08	6.59	1187	-1.0	8.93	
		11-Mar-08	8.00	900	2.9	14.02	
		25-Apr-08	7.42	524	2.40	58.91	
		13-May-08	8.17	742	8.6	1510	
		06-Jun-08	8.08	595	13.0	734.3	
		11-Jul-08	8.30	321	22.3	29.13	
		12-Aug-08	7.30	665	17.2	176.4	
		02-Sep-08	7.58	978	14.3	40.73	
		07-Oct-08	7.75	713	10.9	73.50	
		07-Nov-08	8.48	1060	0.6	59.83	
		18-Dec-08	7.80	130.9	0.1	38.70	
S-30	Red River - Downstream of Outlet (500 m)	28-Jan-08	7.27	1183	-0.3	11.72	
		25-Feb-08	6.35	1243	-0.3	8.20	
		11-Mar-08	7.72	900	4.4	10.65	
		25-Apr-08	7.74	566	3.80	166.5	
		13-May-08	8.10	705	9.3	92.96	
		06-Jun-08	8.15	850	15.2	49.17	
		11-Jul-08	8.50	380	22.6	83.87	
		12-Aug-08	8.01	769	20.1	42.82	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-30	Red River - Downstream of Outlet (500 m)	02-Sep-08	7.73	639	16.8	71.47	
		07-Oct-08	7.88	721	12.0	53.42	
		07-Nov-08	8.12	914	3.2	142.7	
		18-Dec-08	7.80	1088	0.1	436.7	
S-31	Red River - Downstream of Outlet (1000 m)	28-Jan-08	6.93	1197	-0.1	10.57	
		25-Feb-08	6.30	1236	-0.1	7.80	
		11-Mar-08	7.77	900	7.8	10.09	
		25-Apr-08	7.84	664	4.50	231.1	
		13-May-08	8.00	706	9.5	91.02	
		06-Jun-08	8.09	861	15.3	45.69	
		11-Jul-08	8.50	417	22.1	52.52	
		12-Aug-08	7.81	389	21.1	48.10	
		02-Sep-08	7.66	634	17.5	71.61	
		07-Oct-08	7.74	707	11.9	54.65	
		07-Nov-08	7.86	889	3.5	150.3	
		18-Dec-08	7.90	1226	0.2	230.6	
S-32	Red River - Downstream of Outlet (2000 m)	28-Jan-08	6.78	1230	-0.6	10.62	
		25-Feb-08	6.35	1217	3.0	8.19	
		11-Mar-08	7.73	900	7.7	8.91	
		25-Apr-08	7.40	762	5.50	268.6	
		13-May-08	7.93	762	9.5	95.73	
		06-Jun-08	8.05	869	15.6	44.48	
		11-Jul-08	8.40	392	22.1	46.02	
		12-Aug-08	7.94	778	21.0	48.95	
		02-Sep-08	7.60	637	17.6	69.86	
		07-Oct-08	7.58	691	12.4	53.19	
		07-Nov-08	7.37	911	3.4	154.1	
		18-Dec-08	8.00	1272	0.8	609.5	
S-33	Red River - Downstream of Outlet (3000 m)	28-Jan-08	6.66	1220	1.2	10.82	
		25-Feb-08	6.44	1220	0.2	11.49	
		11-Mar-08	8.02	1000	1.5	10.86	
		25-Apr-08	7.23	674	7.40	265.8	
		13-May-08	8.01	700	9.5	86.28	
		06-Jun-08	7.75	844	10.3	42.46	
		11-Jul-08	8.30	837	21.6	54.37	
		12-Aug-08	7.93	782	21.1	46.27	
		02-Sep-08	7.61	633	17.7	71.76	
		07-Oct-08	6.96	721	12.1	46.97	
		07-Nov-08	7.15	909	3.4	141.1	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-33	Red River - Downstream of Outlet (3000 m)	18-Dec-08	7.80	1263	2.0	150.3	
S-34	Red River - Upstream of Outlet	28-Jan-08	7.40	1212	0.0	9.34	
		25-Feb-08	6.21	1236	-0.5	8.21	
		11-Mar-08	7.82	900	3.3	10.19	
		25-Apr-08	7.65	712	4.60	297.6	
		13-May-08	8.04	696	10.2	99.68	
		06-Jun-08	8.21	888	15.6	87.66	
		11-Jul-08	8.50	410	23.1	102.9	
		12-Aug-08	8.03	772	19.8	42.00	
		02-Sep-08	7.86	631	16.8	68.66	
		07-Oct-08	7.98	698	12.0	46.39	
		07-Nov-08	8.33	904	3.8	142.4	
		18-Dec-08	8.10	640.0	0.1	406.1	
S-35	West Dyke - Downstream of Manness Drain	30-Jan-08	-	-	-	-	CNM - No flow
		25-Feb-08	-	-	-	-	CNM - No flow
		12-Mar-08	-	-	-	-	CNM - No flow
		25-Apr-08	8.40	616	2.20	12.50	
		13-May-08	-	-	-	-	CNM - No flow
		06-Jun-08	-	-	-	-	CNM - No flow
		11-Jul-08	-	-	-	-	CNM - No flow
		12-Aug-08	-	-	-	-	CNM - No flow
		02-Sep-08	-	-	-	-	CNM - No flow
		07-Oct-08	6.39	1377	10.4	6.92	
		07-Nov-08	7.40	412	1.0	353.6	
		18-Dec-08	-	-	-	-	CNM - Frozen
S-36	West Dyke - Downstream of Domain Drain	30-Jan-08	-	-	-	-	CNM - No flow
		25-Feb-08	-	-	-	-	CNM - No flow
		12-Mar-08	-	-	-	-	CNM - No flow
		25-Apr-08	8.20	388	0.90	42.66	
		13-May-08	6.91	931	6.0	17.30	
		06-Jun-08	7.60	1794	13.6	36.75	
		11-Jul-08	-	-	-	-	CNM - No flow
		12-Aug-08	-	-	-	-	CNM - No flow
		02-Sep-08	-	-	-	-	CNM - No flow
		07-Oct-08	-	-	-	-	CNM - No flow
		07-Nov-08	7.70	205	1.3	147.5	
		18-Dec-08	-	-	-	-	CNM - Frozen

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
Level I							
CON D/S	Floodway Channel - Station 50+500	13-May-08	8.20	732	8.2	15.74	
		26-May-08	8.40	777	11.8	31.40	
		06-Jun-08	7.94	539	12.8	>1100	
		09-Jun-08	7.43	664	15.4	73.98	
		12-Jun-08	7.64	-	16.2	23.75	
		28-Jun-08	7.69	808	20.8	173.5	
	- Station 50+900	11-Jul-08	8.30	324	22.3	44.88	
		29-Jul-08	7.65	598	19.8	100.7	
		12-Aug-08	7.64	830	17.2	41.93	
		22-Aug-08	8.20	811	21.4	67.15	
		02-Sep-08	7.59	917	14.5	55.44	
		23-Sep-08	8.00	657	17.0	177.0	
		07-Oct-08	7.88	705	11.6	79.05	
		13-Oct-08	7.69	750	8.8	64.99	
		07-Nov-08	8.39	959	1.3	52.68	
CON U/S	Floodway Channel - Station 11+000	13-May-08	-	-	-	-	CNM - No Flow
		26-May-08	8.10	493	11.8	3.81	
		06-Jun-08	8.30	424	15.4	93.15	
		09-Jun-08	7.42	449	16.7	5.29	
		12-Jun-08	7.04	543	13.2	12.01	
		28-Jun-08	7.88	532	19.9	12.18	
		11-Jul-08	8.16	399	21.6	1.77	
		29-Jul-08	8.61	354	20.1	7.02	
		12-Aug-08	-	-	-	-	CNM - No flow
		22-Aug-08	-	-	-	-	CNM - No flow
		02-Sep-08	-	-	-	-	CNM - No flow
		23-Sep-08	8.10	455	17.0	114.3	
		07-Oct-08	6.34	589	10.9	1.60	
		13-Oct-08	6.77	451	7.9	10.89	
		07-Nov-08	8.10	451	2.2	10.13	
S-31	Red River - Downstream of Outlet (1000 m)	13-May-08	8.00	706	9.5	91.02	
		26-May-08	8.20	787	14.3	59.29	
		06-Jun-08	8.09	861	15.3	45.69	
		09-Jun-08	7.58	718	15.7	52.40	
		12-Jun-08	7.60	662	14.8	67.97	
		28-Jun-08	7.75	814	20.9	130.1	
		11-Jul-08	8.50	417	22.1	52.52	
		29-Jul-08	7.97	772	22.0	51.40	
		12-Aug-08	7.81	389	21.1	48.10	

TABLE NM7-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No.	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-31	Red River - Downstream of Outlet (1000 m)	22-Aug-08	8.30	720	23.5	65.23	
		02-Sep-08	7.66	634	17.5	71.61	
		23-Sep-08	8.10	473	17.3	159.6	
		07-Oct-08	7.74	707	11.9	54.65	
		13-Oct-08	6.72	764	10.6	39.81	
		07-Nov-08	7.86	889	3.5	150.3	
S-34		06-Jun-08	8.21	888	15.6	87.66	
		12-Jun-08	7.91	747	16.4	98.45	
		28-Jun-08	7.69	834	23.1	98.09	
		11-Jul-08	8.50	410	23.1	102.9	
		29-Jul-08	8.08	768	21.8	44.45	
		12-Aug-08	8.03	772	19.8	42.00	
		22-Aug-08	8.30	711	23.2	75.17	
		02-Sep-08	7.86	631	16.8	68.66	
		23-Sep-08	8.00	443	17.8	139.8	
		07-Oct-08	7.98	698	12.0	46.39	
		13-Oct-08	7.56	816	10.6	31.14	
		07-Nov-08	8.33	904	3.8	142.4	

Notes:
"-" = No Data
 * = Equipment failure
E.C. = Electrical Conductivity
CNM = Could Not Monitor

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter [2] Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia [3]	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
Detection Limit		*0.05*	*0.01*	*0.4*	*1*	*2*	*0.6*	*0.4*	*0.2*	*9*	*0.1*	*9*	*0.001*	*0.003*	*-*	*0.005*	*0.05*	*0.01*	*0.05*	*0.02*	*0.01*	*0.0002*	*1*	*0.001*	*0.001*	*5*	*5*	*0.2*	*1*	*-*
CCME [4]																														
Freshwater Aquatic Life		[5]	6.5-9.0	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	-	0.3	-	-	-	-	-	[6]	-	-	-
Monthly																														
CON D/S	28-Jan-08	6.3	7.90	1260	362	442	<0.6	<0.4	572	57	0.4	250	0.013	0.050	0.000	0.101	100	78.1	6.82	66.4	0.09	0.0222	3	0.024	0.014	776	8	0.2	3	103
	25-Feb-08	6	8.08	968	291	356	<0.6	<0.4	447	35	0.4	173	0.010	0.012	0.000	0.027	76.5	62.2	5.23	49.5	0.19	0.0137	2	0.020	0.010	576	5	0.2	2	107
	11-Mar-08	23	8.20	924	257	314	<0.6	<0.4	502	74	0.3	205	0.021	0.042	0.001	0.102	72.8	77.9	7.11	75.7	**0.44**	0.0358	4	0.040	0.012	641	14	0.3	4.0	117
	25-Apr-08	**55**	8.31	469	176	213	1.2	<0.4	215	13	0.2	57	0.110	0.053	0.001	0.031	45.1	24.8	5.72	14.0	**0.34**	0.0269	9	0.156	0.087	266	**42**	0.9	9	99
	13-May-08	13	8.41	719	239	280	5.6	<0.4	314	20	0.2	120	0.011	0.058	0.002	0.012	59.5	40.2	4.73	27.3	0.09	0.0298	9	0.047	0.018	415	<5	0.6	9.0	96.8
	6-Jun-08	**1700**	8.33	465	165	198	2.0	<0.4	671	16	0.2	61	0.439	0.078	0.004	0.230	171	59.3	4.10	17.4	**2.32**	0.3550	9	0.735	0.041	428	**1700**	1.6	10	282
	11-Jul-08	**40**	8.32	665	237	284	2.2	<0.4	313	36	0.3	80	0.192	0.069	0.007	0.385	60.8	39.2	5.05	33.9	0.30	0.0312	11	0.245	0.203	399	**44**	0.9	12	106
	12-Aug-08	32	8.29	813	285	348	<0.6	<0.4	365	34	0.3	131	0.115	0.069	0.004	0.503	61.0	51.7	4.92	32.7	0.20	0.0212	7	0.119	0.090	489	28	0.6	8	93.7
	2-Sep-08	180	8.29	871	214	261	<0.6	<0.4	472	41	0.4	216	0.066	0.105	0.005	0.224	87.3	61.7	6.02	47.3	**1.22**	0.1380	8	0.105	0.058	588	300	1.1	8.0	117
	7-Oct-08	**75**	8.09	626	208	254	<0.6	<0.4	285	38	0.4	113	0.299	0.166	0.005	0.596	57.4	34.4	9.25	30.5	**0.65**	0.0485	13	0.318	0.244	410	**57**	1.0	13	-
	7-Nov-08	**45**	8.50	910	263	302	9.4	<0.4	-	55	0.4	157	0.062	0.176	0.005	0.219	70.0	50.1	6.08	49.0	0.16	0.0214	12	0.124	0.072	-	**36**	0.8	12	97.9
	18-Dec-08	8	8.27	1250	376	458	<0.6	<0.4	567	61	0.3	265	0.125	0.331	0.005	0.779	97.8	78.3	8.21	68.9	0.08	0.0208	9	0.148	0.137	808	<5	0.9	9	98.1
CON U/S	25-Apr-08	1.9	8.49	510	146	165	6.2	<0.4	202	18	0.3	75	<0.001	0.018	0.001	0.052	48.8	19.5	7.34	16.8	0.02	0.0052	11	<0.001	0.178	273	<5	0.7	12	99.2
	6-Jun-08	85	8.27	404	178	217	<0.6	<0.4	213	12	0.3	28	0.119	0.062	0.003	0.264	49.5	21.6	5.38	10.1	**0.34**	0.0376	10	0.171	0.100	235	69	0.7	11	107
	11-Jul-08	1.5	8.84	401	147	145	17.1	<0.4	188	19	0.2	44	0.079	<0.003	0.001	0.017	41.4	20.5	5.33	15.4	0.01	0.0065	11	0.101	0.092	234	<5	0.8	11	103
	7-Oct-08	1.6	8.35	439	152	180	2.6	<0.4	186	17	0.3	62	0.129	<0.003	0.000	0.110	44.2	18.5	5.76	15.1	0.02	0.0053	7	0.145	0.139	254	<5	0.5	7	93.8
	7-Nov-08	10	8.39	447	127	150	2.6	<0.4	180	17	0.3	83	0.146	0.008	0.000	0.111	46.2	15.6	6.07	13.5	0.16	0.0087	10	0.187	0.162	258	5	0.5	10	90.7
VEG D/S	28-Jan-08	6.3	7.90	1260	362	442	<0.6	<0.4	572	57	0.4	250	0.013	0.050	0.000	0.101	100	78.1	6.82	66.4	0.09	0.0222	3	0.024	0.014	776	8	0.2	3	103
	25-Feb-08	6	8.08	968	291	356	<0.6	<0.4	447	35	0.4	173	0.010	0.012	0.000	0.027	76.5	62.2	5.23	49.5	0.19	0.0137	2	0.020	0.010	576	5	0.2	2	107
	11-Mar-08	23	8.20	924	257	314	<0.6	<0.4	502	74	0.3	205	0.021	0.042	0.001	0.102	72.8	77.9	7.11	75.7	**0.44**	0.0358	4	0.040	0.012	641	14	0.3	4.0	117
	25-Apr-08	**55**	8.31	469	176	213	1.2	<0.4	215	13	0.2	57	0.110	0.053	0.001	0.031	45.1	24.8	5.72	14.0	**0.34**	0.0269	9	0.156	0.087	266	**42**	0.9	9	99
	13-May-08	13	8.41	719	239	280	5.6	<0.4	314	20	0.2	120	0.011	0.058	0.002	0.012	59.5	40.2	4.73	27.3	0.09	0.0298	9	0.047	0.018	415	<5	0.6	9.0	96.8
	6-Jun-08	**1700**	8.33	465	165	198	2.0	<0.4	671	16	0.2	61	0.439	0.078	0.004	0.230	171	59.3	4.10	17.4	**2.32**	0.3550	9	0.735	0.041	428	**1700**	1.6	10	282
	11-Jul-08	**40**	8.32	665	237	284	2.2	<0.4	313	36	0.3	80	0.192	0.069	0.007	0.385	60.8	39.2	5.05	33.9	0.30	0.0312	11	0.245	0.203	399	**44**	0.9	12	106
	12-Aug-08	32	8.29	813	285	348	<0.6	<0.4	365	34	0.3	131	0.115	0.069	0.004	0.503	61.0	51.7	4.92	32.7	0.20	0.0212	7	0.119	0.090	489	28	0.6	8	93.7
	2-Sep-08	180	8.29	871	214	261	<0.6	<0.4	472	41	0.4	216	0.066	0.105	0.005	0.224	87.3	61.7	6.02	47.3	**1.22**	0.1380	8	0.105	0.058	588	300	1.1	8.0	117
	7-Oct-08	**75**	8.09	626	208	254	<0.6	<0.4	285	38	0.4	113	0.299	0.166	0.005	0.596	57.4	34.4	9.25	30.5	**0.65**	0.0485	13	0.318	0.244	410	**57**	1.0	13	-
	7-Nov-08	**45**	8.50	910	263	302	9.4	<0.4	-	55	0.4	157	0.062	0.176	0.005	0.219	70.0	50.1	6.08	49.0	0.16	0.0214	12	0.124	0.072	-	**36**	0.8	12	97.9
	18-Dec-08	8	8.27	1250	376	458	<0.6	<0.4	567	61	0.3	265	0.125	0.331	0.005	0.779	97.8	78.3	8.21	68.9	0.08	0.0208	9	0.148	0.137	808	<5	0.9	9	98.1
VEG U/S	25-Apr-08	1.9	8.49	510	146	165	6.2	<0.4	202	18	0.3	75	<0.001	0.018	0.001	0.052	48.8	19.5	7.34	16.8	0.02	0.0052	11	<0.001	0.178	273	<5	0.7	12	99.2
	6-Jun-08	85	8.27	404	178	217	<0.6	<0.4	213	12	0.3	28	0.119	0.062	0.003	0.264	49.5	21.6	5.38	10.1	**0.34**	0.0376	10	0.171	0.100	235	69	0.7	11	107
	11-Jul-08	1.5	8.84	401	147	145	17.1	<0.4	188	19	0.2	44	0.079	<0.003	0.001	0.017	41.4	20.5	5.33	15.4	0.01	0.0065	11	0.101	0.092	234	<5	0.8	11	103
	7-Oct-08	1.6	8.35	439	152	180	2.6	<0.4	186	17	0.3	62	0.129	<0.003	0.000	0.110	44.2	18.5	5.76	15.1	0.02	0.0053	7	0.145	0.139	254	<5	0.5	7	93.8
	7-Nov-08	10	8.39	447	127	150	2.6	<0.4	180	17	0.3	83	0.146	0.008	0.000	0.111	46.2	15.6	6.07	13.5	0.16	0.0087	10	0.187	0.162	258	5	0.5	10	90.7
S-05	6-Jun-08	50	8.29	448	220	269	<0.6	<0.4	235	13	0.2	9	0.063	0.039	0.002	0.034	59.8	20.8	2.57	10.0	**0.36**	0.0649	13	0.115	0.058	248	54	0.8	13	104
U/S	6-Jun-08	50	8.32	442	229	276	1.8	<0.4	249	12	0.3	10	0.069	0.032	0.002	0.041	63.1	22.2	2.40	7.93	**0.37**	0.0507	14	0.144	0.063	255	50	0.9	14	105
	11-Jul-08	35	8.35	468	253	302	2.9	<0.4	265	13	0.2	14	0.090	0.057	0.005	0.060	67.9	23.3	1.72	7.82	**0.35**	0.0501	16	0.144	0.094	279	31	1.1	17	99.5
U/S	11-Jul-08	39	8.39	470	255	301	4.7	<0.4	266	12	0.2	14	0.087	0.060	0.006	0.083	68.2	23.4	1.78	7.63	**0.57**	0.0513	17	0.139	0.092	280	36	1.0	17	99.5
	7-Oct-08	23	8.40	478	244	288	4.7	<0.4	234	17	0.3	21	0.148	0.036	0.002	0.011	57.5	21.9	4.47	9.93	**0.32**	0.0400	16	0.182	0.138	278	19	0.8	16	89.8
U/S	7-Oct-08	22	8.41	480	245	289	5.2	<0.4	233	16	0.3	16	0.146	0.029	0.001	0.006	57.3	21.9	4.34	9.66	**0.31**	0.0426	18	0.174	0.131	273	16	0.8	18	90.9
	7-Nov-08	32	8.46	598	210	242	6.8	<0.4	-	32	0.2	71	0.105	0.020	0.001	0.157	53.5	29.7	5.01	21.7	0.26	0.0109	15	0.158	0.105	-	20	0.7	16	93.8
U/S	7-Nov-08	30	8.48	613	225	261	6.9	<0.4	260	30	0.3	58	0.094	0.017	0.001	0.144	56.6	28.7	5.11	19.9	0.28	0.0268	16	0.155	0.103	334	23	0.7	16	93.9
S-06	25-Apr-08	15	8.41	458	150	175	3.8	<0.4	185	13	0.2	68	0.058	0.034	0.001	0.009	36.3	23.0	6.84	13.0	0.19	0.0095	11	0.098	0.081	250	10	0.7	13	92.8
	13-May-08	13	8.19	763	211	258	<0.6	<0.4	341	21	0.2	171	0.037	0.026	0.001	0.088	63.4	44.4	8.84	27.1	**0.32**	0.0249	9	0.075	0.052	463	13	9.0	0.6	97.9
U/S	13-May-08	17	8.42	573	151	177	3.8	<0.4	244	20	0.2	107	0.012	0.040	0.002	0.010	52.3	27.6	6.74	16.8	0.24	0.0377	13	0.077	0.017	322	22	1.0	13	99.2
	6-Jun-08	400	8.06	475	78	95	<0.6	<0.4	244	14	0.4	166	0.297	0.074	0.002	1.560	50.2	28.9	6.05	16.3	**0.92**	0.1000	11	0.763	0.617	335	350	1.6	11	104
U/S	6-Jun-08	500	8.04	492	87	107	<0.6	<0.4	258	17	0.4	155	0.281	0.057	0.002	1.230	53.3	30.4	6.01	16.8	**0.77**	0.1040	11	0.444	0.114	336	540	1.5	11	109
	11-Jul-08	**15**	8.78	745	247	261	19.6	<0.4	330	62	0.3	85	0.009	0.015	0.004	<0.005	42.1	54.7	6.52	46.4	**0.31**	0.0164	18	0.059	0.038	445	11	1.3	19	104
U/S	11-Jul-08	6.9	8.60	395	173	193	8.6	<0.4	186	20	0.2	13	0.005	0.032	0.005	0.049	33.3	24.9	3.88	13.8	0.11	0.0125	17	0.061	0.038	213	5	1.3	18	103
	12-Aug-08	32	8.52	743	134	151	6.3	<0.4	264	63	0.3	163	0.039	0.044	0.005	0.014	36.6	42.0	6.14	43.9	**0.53**	0.0569	17	0.071	0.036	435	29	1.1	17	93.4
U/S	12-Aug-08	32	8.27	412	121	148	<0.6	<0.4	179	30	0.2	50	0.031	0.081	0.005	0.049	31.5	24.4	4.34	15.0	0.30	0.0419	12	0.062	0.025	228	32	1.0	12	100
	7-Oct-08	9.0	8.38	614	226	267	4.0	<0.4	271	32	0.3	66	0.102	0.010	0.001	0.023	52.7	33.8	8.11	21.6	0.19	0.0353	14	0.138	0.121	350	<5	0.9	15	96.4
U/S	7-Oct-08	9.5	8.33	558	218	260	2.7	<0.4	262	31	0.3	39	0.144	0.009	0.000	0.011	60.9	26.7	6.80	13.3	0.20	0.0505	13	0.175	0.154	309	<5	0.7	14	98.9
	7-Nov-08	29	8.45	686	183	213	5.4	<0.4	278	25	0.4	141	0.077	0.016	0.000	0.073	52.7	35.5	6.17	22.7	0.17	0.0109	13	0.125	0.081	394	21	0.7	13	91.3
U/S	7-Nov-08	21	8.51	528	193	221	7.5	<0.4	238	27	0.3	48	0.047	0.013	0.000	0.013	56.7	23.4	3.72	9.95	0.22	0.0108	14	0.088	0.060	285	16	0.5	14	93.5
S-07	25-Apr-08	7.9	8.46	541	176	205	4.9	<0.4	220	14	0.3	82	0.118	0.022	0.001	0.013	39.6	29.5	7.19	18.2	0.14	0.0171	12	0.156	0.142	297	<5	0.9	18	95.4
U/S	25-Apr-08	8.1	8.43	496	176	205	4.8	<0.4	209	10	0.3	69	0.120	0.024	0.001	0.026	37.3	28.2	7.11	15.1	0.13	0.0161	13	0.161	0.148	273	6	0.9	16	95.5
	13-May-08	14	8.32	1690	203	245	1.6	<0.4	587	254	0.3	340	0.013	0.024	0.001	0.936	88.4	89.1	8.52	148	0.30	0.0393	14	0.056	0.029	1050	14	0.8	14	100
U/S	13-May-08	13	8.35	877	272	325	3.6	<0.4	406	19	0.3	200	0.028	0.023	0.001	0.008	64.8	59.2	7.12	38.2	**0.32**	0.0608	11	0.071	0.047	551	9	0.9	12	97.9

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter (2)																												
		Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia (3)	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
S-07	6-Jun-08	260	8.06	722	143	175	<0.6	<0.4	390	18	0.3	187	0.263	0.174	0.006	16.30	59.9	58.5	6.92	32.1	0.64	0.1690	13	0.433	0.187	520	300	2.4	14	111
U/S	6-Jun-08	240	7.98	630	113	138	<0.6	<0.4	282	14	0.4	157	0.368	0.211	0.006	18.60	41.1	43.7	6.32	22.8	0.40	0.1240	14	0.540	0.310	435	220	2.8	15	93.5
	11-Jul-08	9.2	9.01	604	227	212	32.3	<0.4	310	18	0.3	117	0.114	0.010	0.004	<0.005	50.2	44.9	7.18	26.7	0.17	0.0144	16	0.153	0.144	400	<5	1.3	17	100
U/S	11-Jul-08	13	8.85	621	234	241	21.8	<0.4	315	20	0.4	108	0.146	0.010	0.003	<0.005	50.6	45.7	7.45	27.6	0.23	0.0254	16	0.190	0.172	400	10	1.3	17	102
	12-Aug-08	34	8.23	1140	86	104	<0.6	<0.4	430	58	0.4	435	0.043	0.012	0.001	0.480	54.1	71.6	5.79	77.0	0.34	0.0401	11	0.067	0.013	756	39	0.9	11	97.1
U/S	12-Aug-08	35	8.59	694	179	199	9.9	<0.4	284	24	0.3	169	0.055	0.076	0.010	0.206	33.1	48.8	7.49	42.8	0.36	0.1210	18	0.161	0.050	434	35	1.7	18	98.8
	2-Sep-08	19	8.36	912	107	125	2.5	<0.4	356	54	0.4	293	0.009	0.029	0.002	0.100	44.7	59.5	5.66	61.5	0.24	0.0334	9	0.053	0.011	583	20	0.7	10	102
U/S	2-Sep-08	28	8.41	1110	217	254	5.4	<0.4	461	76	0.5	293	0.031	0.078	0.006	0.041	50.7	81.2	9.47	74.5	0.38	0.1880	15	0.137	0.039	715	43	1.7	16	101
	7-Oct-08	140	8.43	789	219	256	5.7	<0.4	372	32	0.3	199	0.336	0.034	0.002	0.039	58.9	54.5	11.0	34.5	1.27	0.1270	14	0.382	0.201	521	220	1.2	14	97.4
U/S	7-Oct-08	21	8.44	760	217	253	5.8	<0.4	337	27	0.4	188	0.234	0.034	0.002	0.036	53.1	49.7	11.0	32.8	0.33	0.0569	14	0.263	0.228	493	15	0.9	14	93.5
	7-Nov-08	20	8.47	1170	231	268	7.1	<0.4	484	41	0.4	336	0.044	0.017	0.001	0.186	64.9	78.2	7.63	56.2	0.17	0.0317	12	0.073	0.052	724	18	0.6	14	96.1
U/S	7-Nov-08	18	8.44	1240	275	321	7.1	<0.4	515	36	0.3	360	0.076	0.027	0.001	0.236	65.2	85.7	8.18	53.4	0.17	0.0508	17	0.105	0.083	775	21	0.7	17	91.4
S-09	25-Apr-08	28	8.56	440	171	192	8.0	<0.4	197	12	0.2	43	0.043	0.027	0.001	0.008	40.0	23.7	5.94	12.6	0.28	0.0186	14	0.118	0.059	240	23	1.0	15	99.8
U/S	25-Apr-08	39	8.53	441	174	198	7.2	<0.4	194	12	0.2	40	0.050	0.028	0.001	0.010	40.4	22.5	5.53	11.7	0.31	0.0222	11	0.119	0.061	237	36	1.0	16	96.8
	13-May-08	13	8.50	583	230	264	8.4	<0.4	272	17	0.3	69	0.008	0.029	0.002	<0.005	54.4	33.1	4.65	17.3	0.29	0.0285	10	0.046	0.017	334	14	0.7	12	96.5
U/S	13-May-08	13	8.42	780	235	275	5.6	<0.4	327	48	0.2	108	0.057	0.054	0.003	0.007	59.9	43.2	5.85	35.2	0.32	0.0386	12	0.067	0.037	441	13	0.7	13	99
	6-Jun-08	16	8.31	749	223	268	1.9	<0.4	351	19	0.3	171	0.020	0.057	0.004	0.100	57.8	50.2	5.27	33.2	0.17	0.0745	14	0.067	0.029	471	15	1.0	15	100
U/S	6-Jun-08	35	8.05	659	167	203	<0.6	<0.4	229	55	0.2	80	0.068	0.066	0.002	0.643	38.9	32.1	6.44	37.2	0.35	0.0683	15	0.144	0.090	352	28	1.0	15	96.4
	11-Jul-08	20	9.22	1590	282	234	54.1	<0.4	441	294	0.4	181	0.346	0.018	0.008	0.032	58.6	71.6	8.49	201	0.31	0.0250	17	0.400	0.382	985	17	1.5	19	100
U/S	11-Jul-08	18	9.26	1630	292	234	59.9	<0.4	457	295	0.4	185	0.375	0.018	0.008	<0.005	60.7	74.3	8.33	207	0.32	0.0269	17	0.426	0.417	1000	15	1.5	19	102
	12-Aug-08	22	8.93	1850	219	213	26.7	<0.4	427	391	0.3	204	0.019	0.427	0.114	0.023	40.4	79.3	8.88	240	0.18	0.1360	19	0.204	0.027	1090	24	2.6	20	97.6
U/S	12-Aug-08	28	8.26	1540	163	199	<0.6	<0.4	523	229	0.2	342	0.128	0.045	0.003	0.103	70.7	84.2	8.18	136	0.54	0.1130	17	0.202	0.122	968	28	1.3	17	98.4
	2-Sep-08	45	8.49	1010	191	218	7.1	<0.4	345	101	0.4	209	0.054	0.050	0.004	0.093	46.5	55.7	7.35	87.1	0.40	0.1330	13	0.117	0.050	621	49	1.4	13	98.6
U/S	2-Sep-08	27	8.32	531	131	156	1.9	<0.4	188	43	0.3	82	0.081	0.022	0.001	0.020	30.8	27.0	5.83	34.8	0.28	0.0339	10	0.119	0.079	302	21	0.7	10	97.6
	7-Oct-08	26	8.45	819	228	266	6.1	<0.4	300	63	0.4	126	0.413	0.015	0.001	0.023	50.6	42.2	10.9	54.8	0.41	0.0804	16	0.469	0.405	485	20	1.2	16	96.4
U/S	7-Oct-08	14	8.46	735	207	240	6.1	<0.4	253	64	0.3	90	0.306	0.009	0.001	0.036	44.2	34.8	9.44	43.4	0.24	0.0293	17	0.371	0.325	410	8	0.9	17	91.9
	7-Nov-08	30	9.06	1980	305	275	47.9	<0.4	477	312	0.4	274	0.346	0.029	0.003	0.009	46.7	87.7	11.5	216	0.13	0.0583	22	0.615	0.485	1130	62	3.6	30	93.2
U/S	7-Nov-08	25	9.18	2220	320	277	55.4	<0.4	478	427	0.5	253	0.434	0.035	0.005	0.010	40.1	91.9	12.7	270	0.15	0.0634	22	0.799	0.633	1290	72	3.8	31	91.2
S-10	25-Apr-08	5.2	8.48	889	185	213	6.3	<0.4	346	67	0.3	173	0.081	0.017	0.001	0.005	51.3	53.0	8.01	45.9	0.10	0.0069	13	0.119	0.108	509	<5	0.8	17	99.1
U/S	25-Apr-08	0.95	8.39	577	183	215	3.7	<0.4	236	20	0.3	81	0.206	0.023	0.001	0.123	39.8	33.2	8.38	20.2	0.03	0.0017	13	0.245	0.241	313	<5	0.9	17	98.1
	13-May-08	8.1	8.40	2420	289	339	6.6	<0.4	1070	230	0.2	884	0.023	0.032	0.002	0.015	139	175	11.7	150	0.34	0.0406	15	0.074	0.042	1760	7	1.0	16	91.8
U/S	13-May-08	4.4	8.14	1410	294	358	<0.6	<0.4	591	85	0.3	359	0.180	0.051	0.001	0.171	95.2	85.7	11.6	62.3	0.28	0.0535	13	0.223	0.195	875	<5	1.0	14	93.9
	6-Jun-08	390	7.94	639	110	135	<0.6	<0.4	319	25	0.3	177	0.316	0.104	0.003	3.040	51.9	46.0	6.58	33.9	0.68	0.1150	14	0.597	0.261	420	490	2.0	15	117
U/S	6-Jun-08	280	7.86	410	98	120	<0.6	<0.4	172	16	0.3	96	0.773	0.078	0.002	2.470	25.7	26.2	8.88	18.1	0.46	0.0680	17	0.884	0.585	261	100	2.3	20	96.6
	11-Jul-08	2.9	8.82	1070	273	281	25.7	<0.4	577	29	0.6	357	0.009	0.005	0.001	<0.005	59.3	104	9.14	54.9	0.13	0.0060	18	0.058	0.040	777	<5	1.4	20	103
U/S	11-Jul-08	2.0	8.25	881	334	407	<0.6	<0.4	425	49	0.3	105	0.792	0.044	0.003	0.024	68.7	61.5	9.63	47.2	0.16	0.2070	19	0.824	0.822	542	<5	1.5	19	105
	12-Aug-08	30	8.29	2800	116	142	<0.6	<0.4	1510	86	0.4	1670	0.039	0.018	0.001	0.363	153	274	7.12	170	0.44	0.0787	22	0.055	0.034	2430	38	1.3	22	95.4
U/S	12-Aug-08	6.6	8.27	987	360	440	<0.6	<0.4	451	68	0.2	122	1.390	0.163	0.011	0.513	67.5	68.6	9.16	60.4	0.31	0.7760	24	1.790	0.024	615	14	1.8	24	101
	2-Sep-08	13	8.47	948	178	205	6.2	<0.4	360	82	0.3	229	0.103	0.036	0.003	0.008	45.4	59.9	7.94	67.5	0.20	0.0214	17	0.160	0.121	599	19	1.3	18	96.9
	7-Oct-08	4.6	8.52	1220	295	337	11.4	<0.4	525	89	0.4	259	0.209	0.011	0.001	0.126	70.2	84.9	10.9	72.1	0.15	0.0145	18	0.257	0.230	763	<5	0.9	19	101
U/S	7-Oct-08	3.5	8.36	802	244	290	3.6	<0.4	374	29	0.3	185	0.462	0.007	0.000	0.014	56.9	56.3	12.4	32.3	0.17	0.0083	15	0.488	0.491	518	<5	1.0	16	96.2
	7-Nov-08	18	8.47	1340	265	306	8.4	<0.4	549	78	0.3	345	0.156	0.011	0.000	0.098	71.2	90.1	8.81	62.8	0.19	0.0205	16	0.189	0.163	815	17	0.8	16	94.7
U/S	7-Nov-08	6.1	8.46	1270	285	330	8.8	<0.4	516	90	0.3	273	0.247	0.009	0.000	<0.005	68.0	84.1	12.1	52.0	0.14	0.0231	18	0.305	0.278	751	9	1.0	18	92.4
S-11	6-Jun-08	24	7.87	825	67	82	<0.6	<0.4	353	11	0.3	378	0.033	0.102	0.002	0.971	71.0	42.8	8.42	31.1	0.16	0.0178	12	0.098	0.051	587	28	0.9	12	89.8
	11-Jul-08	1.5	7.70	675	278	339	<0.6	<0.4	265	46	0.2	17	0.060	0.008	0.000	<0.005	54.9	31.2	3.57	36.9	0.15	0.0569	18	0.106	0.097	356	<5	1.3	19	97
	12-Aug-08	10	8.01	659	80	97	<0.6	<0.4	270	<9	0.4	251	0.073	0.017	0.001	1.080	56.5	31.4	7.06	27.1	0.20	0.0046	14	0.097	0.074	425	6	0.9	15	97.8
	2-Sep-08	16	8.17	498	156	190	<0.6	<0.4	216	22	0.3	91	0.107	0.034	0.001	0.037	48.1	23.3	7.52	18.4	0.18	0.0080	13	0.136	0.101	304	8	0.9	13	94
	7-Oct-08	2.8	8.09	676	197	241	<0.6	<0.4	253	44	0.2	98	0.013	0.011	0.000	0.085	50.0	31.0	7.65	35.0	0.14	0.0114	12	0.038	0.027	-	<5	0.7	12	-
	7-Nov-08	65	8.36	870	198	235	3.1	<0.4	-	56	0.3	188	0.025	0.020	0.000	0.019	60.7	47.1	7.56	42.0	0.29	0.0158	15	0.076	0.033	-	57	0.7	16	94.3
S-12	13-May-08	29	8.19	1920	237	289	<0.6	<0.4	497	345	0.3	258	0.020	0.110	0.003	1.550	76.1	74.6	15.8	199	0.36	0.0316	13	0.126	0.070	1120	13	1.2	13	95.1
	6-Jun-08	100	7.98	671	96	118	<0.6	<0.4	194	109	0.1	65	0.130	0.140	0.004	0.938	35.7	25.5	8.67	72.2	0.66	0.0550	10	0.239	0.109	379	170	1.2	11	113
	11-Jul-08	65	8.12	2690	163	199	<0.6	<0.4	388	721	0.2	159	0.050	0.048	0.002	0.895	63.9	55.6	20.2	465	0.58	0.0498	10	0.141	0.061	1590	54	1.0	12	106
	12-Aug-08	65	8.08	451	66	81	<0.6	<0.4	139	61	<0.1	58	0.084	0.081	0.003	0.602	25.8	18.1	4.88	40.8	0.57	0.0308	7	0.113	0.058	251	65	0.9	7	109
	2-Sep-08	31	8.22	526	99	121	<0.6	<0.4	161	63	0.2	60	0.038	0.189	0.010	0.254	26.3	23.3	4.73	44.6	0.19	0.0377	7	0.137	0.019	283	31	1.3	7.0	105
	7-Oct-08	40	8.39	747	147	172	3.4	<0.4	218	105	0.2	79	0.133	<0.003	0.000	0.269	36.2	31.1	5.65	62.2	0.25	0.0472	8	0.241	0.109	408	33	1.5	10	95.3
	7-Nov-08	150	8.33	2940	139	166	1.8	<0.4	302	723	0.3	141	0.104	0.144	0.004	0.449	50.4	42.7	20.1	454	0.66	0.0598	11	0.227	0.088	1520	98	1.1	12	101
S-13	30-Jan-08	160	7.59	2840	1550	1890	<0.6	<0.4	1810	80	0.5	281	0.037	0.547	0.002	0.029	396	199	17.4	99.0	0.52	2.4000	66	0.268	0.069	2000	290	4.4	66	105
	25-Apr-08	36	8.43	407	147	171	4.0	<0.4	168	13	0.3	43	0.102	0.030	0.001	0.078	37.4	18.2	6.46	11.8	0.33	0.0243	11	0.159	0.112	218	34	0.8	11	95.8
	13-May-08	33	8.47	569	191	221	6.0	<0.4	256	18	0.2	86	0.027	0.076	0.004	0.022	56.8	27.8	6.22	18.5	0.29	0.0218	8	0.075	0.038	328	21	0.7	9.0	99.3
	6-Jun-08	75	8.12	444	136	165	<0.6	<0.4	229	10	0.3	94	0.164	0.102	0.004	0.347	58.5	20.1	6.18	10.6	0.41	0.0460	13	0.246	0.126	282	67	1.0	13	104
	11-Jul-08	29	8.41	462	248	292	5.1	<0.4	271	12	0.2	14	0.090	0.065	0.007	0.094	69.2	23.8	1.92	8.17	0.30	0.0416	19	0.157	0.103	279	22	1.1	19	104
	12-Aug-08	32	8.32	563	130	155	2.0	<0.4	248	22	0.3	143	0.091	0.085	0.006	0.061	59.0	24.3	5.24	19.9	0.32	0.0761	14	0.095	0.058	352	28	0.9	14	95.5
	2-Sep-08	33	8.32	622	146	173	2.4	<0.4	254	36	0.4	150	0.065	0.052	0.003	0.024	58.1	26.5	6.42	31.6	0.30	0.0788	10	0.100	0.057	397	21	0.7	11	93.5
	7-Oct-08	19	8.42	515	210	246	5.0	<0.4	232	24	0.3	41	0.147	0.015	0.001	0.066	51.7	25.0	6.79	16.2	0.28	0.0292	13	0.168	0.137	291	11	0.7	13	95.9
S-13	7-Nov-08	36	8.46	611	191	221	5.8	<0.4	-	29	0.3	93	0.101	0.017	0.000	0.124	52.9	31.2	5.36	21.8	0.26	0.0218	14	0.151	0.111	-	26	0.7	14	95.4
	19-Dec-08	6.2	8.18	1570	637	778	<0.6	<0.4	810	77	0.3	229	0.051	0.029	0.000	0.026	162	98.4	11.3	56.5	0.26	0.0547	15	0.101	0.072	1020	9	16	1.1	96.1

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter [2]																												
		Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia [3]	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
S-14	30-Jan-08	24	8.06	1060	222	271	<0.6	<0.4	421	52	0.3	262	0.007	0.123	0.001	0.079	72.9	58.2	5.25	80.5	**0.37**	0.0923	6.3	0.041	0.011	664	71	0.6	6	106
	26-Feb-08	7.4	8.02	676	163	199	<0.6	<0.4	259	21	0.2	137	0.013	0.089	0.001	0.110	49.2	33.1	3.25	39.5	0.20	0.0548	6	0.023	0.008	381	<5	0.5	6	104
	12-Mar-08	-	8.20	1020	229	279	<0.6	<0.4	409	53	0.3	240	0.003	0.015	0.000	0.005	70.0	57.0	4.86	77.7	**0.54**	0.1470	5	0.080	<0.001	639	120	0.8	6.0	105
	25-Apr-08	**230**	8.39	415	144	170	3.1	<0.4	197	15	0.3	85	0.235	0.118	0.003	1.230	43.8	21.4	6.35	14.6	**0.62**	0.0757	10	0.326	0.118	278	**250**	1.2	14	91.5
	13-May-08	290	8.42	666	201	236	4.8	<0.4	294	20	0.3	136	0.005	0.280	0.002	0.059	56.7	37.0	5.94	33.4	**0.47**	0.0582	8	0.255	0.014	409	260	1.0	8.0	100
	6-Jun-08	70	8.26	760	165	201	<0.6	<0.4	377	14	0.3	238	0.135	0.062	0.004	0.699	85.8	39.4	6.20	25.7	**0.33**	0.0724	13	0.152	0.075	511	84	0.9	13	101
	11-Jul-08	**70**	8.44	534	240	280	6.1	<0.4	282	20	0.3	37	0.111	0.103	0.012	0.108	63.6	29.9	4.04	18.7	**0.48**	0.0516	16	0.193	0.113	318	**52**	1.3	16	107
	12-Aug-08	28	8.63	598	222	244	13.1	<0.4	274	22	0.2	93	0.042	0.058	0.008	0.019	54.9	33.2	3.14	27.9	0.25	0.0276	14	0.057	0.031	366	15	0.8	14	96.6
	2-Sep-08	50	8.59	746	211	234	11.6	<0.4	307	46	0.3	135	0.034	0.032	0.004	0.017	60.3	38.1	4.99	47.7	**0.32**	0.0607	10	0.090	0.028	458	48	0.7	10	100
	7-Oct-08	**32**	8.43	548	205	241	4.9	<0.4	237	23	0.3	76	0.254	0.111	0.007	0.032	50.1	27.2	7.54	19.9	**0.37**	0.0474	15	0.296	0.237	328	24	1.0	15	91.1
	7-Nov-08	**150**	8.55	750	223	253	9.5	<0.4	332	28	0.4	140	0.039	0.111	0.004	0.069	69.0	38.8	5.03	27.6	**0.48**	0.0524	14	0.157	0.039	443	**170**	0.8	15	97.2
	19-Dec-08	6.7	8.17	1140	274	334	<0.6	<0.4	449	50	0.4	266	0.01	0.146	0.002	0.044	77.0	62.4	5.97	71.1	0.20	0.1330	8	0.048	0.031	697	<5	8	0.6	98.2
S-21	31-Jan-08	2.6	8.33	1020	263	314	3.1	<0.4	426	49	0.4	204	0.038	0.379	0.007	0.065	72.1	59.8	5.03	58.4	0.08	0.0303	3	0.058	0.044	607	<5	0.6	3	103
	26-Feb-08	6.1	7.99	877	245	299	<0.6	<0.4	364	33	0.4	157	0.043	0.048	0.000	0.043	63.7	49.8	4.15	43	0.16	0.0309	3	0.053	0.041	499	<5	0.3	3	101
	12-Mar-08	-	8.21	914	246	300	<0.6	<0.4	376	50	0.3	185	0.035	0.044	0.001	0.040	61.8	53.9	4.33	57.1	0.15	0.0370	3	0.041	0.019	559	8	0.3	4.0	99.2
	25-Apr-08	**60**	8.23	1190	159	194	<0.6	<0.4	238	252	0.2	67	0.135	0.372	0.007	0.273	48.2	28.6	10.1	150	**0.37**	0.0540	10	0.237	0.128	652	**73**	1.3	10	98.5
	13-May-08	50	8.17	869	141	172	<0.6	<0.4	229	122	0.1	107	0.055	0.118	0.004	0.426	43.3	29.4	6.34	77.1	0.29	0.0527	8	0.123	0.056	471	25	0.7	8.0	95
	6-Jun-08	**210**	7.81	314	82	100	<0.6	<0.4	158	16	0.2	51	0.082	0.116	0.002	0.373	35.0	17.1	3.79	14.4	**0.72**	0.0869	6	0.316	0.091	188	**200**	1.0	8	122
	11-Jul-08	**45**	8.34	748	244	291	3.0	<0.4	318	49	0.3	104	0.140	0.196	0.017	0.150	62.9	39.2	5.01	41.7	**0.66**	0.0483	13	0.206	0.143	449	**39**	1.2	13	98.4
	12-Aug-08	65	7.83	423	79	97	<0.6	<0.4	131	47	0.1	55	0.042	0.075	0.002	0.015	25.4	16.3	4.74	35.7	**0.67**	0.0464	6	0.125	0.019	232	60	0.7	7	105
	2-Sep-08	75	7.98	300	59	71	<0.6	<0.4	106	30	0.2	37	0.074	0.082	0.002	0.233	21.5	12.7	3.53	21.9	**0.56**	0.0573	4	0.172	0.046	163	78	0.9	5.0	113
	7-Oct-08	**45**	8.19	701	200	244	<0.6	<0.4	288	53	0.3	104	0.242	0.200	0.007	0.122	57.6	35.1	9.06	45.4	**0.53**	0.0614	13	0.274	0.208	425	**42**	1.0	13	-
	7-Nov-08	**60**	8.62	1200	231	253	14.1	<0.4	358	165	0.3	182	0.097	0.029	0.001	0.010	59.9	50.7	7.48	109	0.24	0.0352	14	0.210	0.114	712	**54**	1.1	15	92.5
	19-Dec-08	4.0	8.21	1150	304	371	<0.6	<0.4	442	60	0.3	227	0.022	0.176	0.002	0.058	73.7	62.6	5.45	57.4	0.11	0.0334	4	0.045	0.031	669	<5	5	0.4	91.6
S-22	25-Apr-08	3.9	8.42	614	244	288	4.8	<0.4	308	25	0.2	51	0.064	0.004	0.000	<0.005	59.7	38.7	6.48	14.1	0.09	0.0046	11	0.067	0.058	341	<5	0.8	10	104
U/S	25-Apr-08	0.6	8.39	708	283	336	4.3	<0.4	365	32	0.2	58	0.042	0.006	0.000	<0.005	71.9	45.0	4.78	16.3	0.03	0.0034	11	0.094	0.078	398	<5	0.8	11	105
	13-May-08	1.6	8.57	921	293	327	14.7	<0.4	434	39	0.2	159	0.005	0.037	0.004	<0.005	78.8	57.7	6.68	23.1	0.03	0.0067	12	0.027	0.017	540	<5	0.7	14	96
U/S	13-May-08	1.6	8.41	950	317	374	6.4	<0.4	456	50	<0.1	134	0.050	0.036	0.002	0.024	78.3	63.2	7.97	28.0	<0.01	0.0049	13	0.085	0.070	552	<5	0.7	13	99.9
	6-Jun-08	31	8.20	811	185	225	<0.6	<0.4	381	22	0.4	236	0.103	0.102	0.005	0.653	63.0	54.3	5.77	26.9	0.28	0.0432	14	0.163	0.112	522	36	8.0	14	96.1
U/S	6-Jun-08	40	8.29	789	260	317	<0.6	<0.4	341	45	0.2	111	0.630	0.501	**0.025**	0.785	55.9	48.8	23.5	23.0	**0.56**	0.0462	27	0.845	0.718	467	39	3.5	27	95.1
	11-Jul-08	2.3	8.72	568	197	210	15	<0.4	261	34	0.3	65	0.055	0.034	0.007	<0.005	42.7	37.6	5.56	13.7	0.04	0.0097	10	0.094	0.079	317	<5	1.0	11	95.1
	12-Aug-08	5.2	8.25	862	164	200	<0.6	<0.4	394	25	0.3	288	0.043	0.034	0.002	0.155	61.8	58.1	5.74	28.4	0.18	0.0238	15	0.059	0.047	566	10	1.0	15	92.4
U/S	12-Aug-08	25	8.18	561	195	238	<0.6	<0.4	237	38	0.1	58	0.700	0.043	0.002	0.439	39.5	33.6	28.6	14.8	**1.06**	0.4130	28	0.750	0.720	331	16	2.3	28	98.3
	2-Sep-08	**19**	8.46	665	240	278	7.0	<0.4	323	35	0.3	85	0.129	0.038	0.003	0.028	53.3	46.1	12.7	18.2	0.25	0.0311	13	0.209	0.133	394	23	1.1	14	100
U/S	2-Sep-08	3.1	8.44	677	254	296	6.7	<0.4	315	40	0.3	70	0.150	0.026	0.002	0.020	52.4	44.6	9.95	25.7	0.10	0.0094	16	0.180	0.169	395	<5	1.1	17	99.7
	7-Oct-08	4.6	8.59	810	314	352	15.2	<0.4	442	34	0.3	119	0.043	0.010	0.001	0.007	75.4	61.6	9.20	22.9	0.14	0.0180	13	0.063	0.058	511	5	0.7	13	-
U/S	7-Oct-08	3.3	8.53	958	366	419	13.7	<0.4	505	40	0.4	150	0.040	0.012	0.001	0.007	87.1	69.8	6.38	27.7	0.11	0.0187	12	0.061	0.056	601	7	0.8	13	-
	7-Nov-08	**17**	8.48	1000	305	353	9.6	<0.4	452	38	0.2	212	0.084	0.010	0.000	0.006	71.7	66.4	9.30	28.1	0.13	0.0239	14	0.142	0.115	608	20	0.7	14	90.5
U/S	7-Nov-08	6.1	8.51	1110	372	428	13.0	<0.4	525	45	0.3	203	0.114	0.008	0.000	0.006	79.2	79.6	8.26	32.3	0.05	0.0076	16	0.161	0.122	670	<5	0.6	16	93.5
S-23	31-Jan-08	10	8.35	1100	273	326	3.7	<0.4	473	59	0.4	224	0.028	0.337	0.007	0.061	80.4	66.2	5.49	64.4	**0.42**	0.0872	3	0.063	0.032	664	30	0.6	4	105
	26-Feb-08	6.1	8.06	830	242	295	<0.6	<0.4	350	33	0.4	136	0.031	0.031	0.000	0.029	60.8	48.1	4.00	40.2	0.14	0.0253	2	0.041	0.029	467	<5	0.3	2	103
	12-Mar-08	-	8.22	879	240	292	<0.6	<0.4	371	75	0.2	208	0.027	0.028	0.000	0.038	62.3	52.3	4.31	52.6	0.09	0.0326	3	0.040	0.011	599	22	0.2	4.0	86.3-87.3
	25-Apr-08	**74**	8.17	1060	153	187	<0.6	<0.4	230	215	0.2	62	0.122	0.263	0.004	0.285	47.3	27.2	9.21	128	**0.43**	0.0473	9	0.214	0.108	582	**61**	1.1	9	99.5
	13-May-08	26	8.25	878	218	266	<0.6	<0.4	348	38	0.2	179	0.018	0.054	0.002	0.085	53.9	51.9	5.41	50.3	0.19	0.0443	9	0.092	0.025	510	17	0.8	9.0	101
	6-Jun-08	45	8.36	634	186	221	2.9	<0.4	302	16	0.2	143	0.055	0.058	0.004	0.151	65.9	33.4	4.43	20.5	**0.31**	0.0430	12	0.115	0.057	396	48	0.8	14	98.2
	11-Jul-08	**39**	8.38	726	243	287	4.5	<0.4	315	46	0.3	99	0.142	0.156	0.016	0.203	62.5	38.6	4.96	39.9	**0.33**	0.0438	13	0.205	0.141	437	26	1.2	13	99
	12-Aug-08	6.9	8.28	939	224	273	<0.6	<0.4	419	55	0.3	240	0.022	0.115	0.008	0.008	65.9	61.8	4.79	57.8	0.16	0.0366	9	0.050	0.024	619	<5	0.6	9	99.8
	2-Sep-08	95	8.07	278	81	99	<0.6	<0.4	125	18	0.2	46	0.064	0.083	0.002	0.047	24.1	15.7	4.10	11.2	**0.70**	0.0556	5	0.192	0.028	168	90	0.8	5.0	99.5
	7-Oct-08	**60**	7.93	426	119	145	<0.6	<0.4	178	31	0.3	64	0.250	0.047	0.001	0.225	34.2	22.5	6.46	22.4	**0.56**	0.0511	9	0.295	0.178	253	**46**	0.9	10	-
	7-Nov-08	**100**	8.48	824	128	145	5.6	<0.4	-	120	0.3	114	0.125	0.035	0.001	0.200	37.7	31.4	5.85	79.7	**0.40**	0.0389	8	0.221	0.137	-	**70**	0.5	10	96.8
	18-Dec-08	4.6	8.17	1560	373	455	<0.6	<0.4	658	94	0.4	395	0.041	0.247	0.003	0.121	102	98.0	7.48	102	0.24	0.0678	5	0.07	0.05	1020	9	0.4	6	96.9
S-25	28-Jan-08	6.5	7.93	1050	297	362	<0.6	<0.4	444	46	0.3	203	0.007	0.027	0.000	0.054	76.0	61.7	5.18	51.5	0.05	0.0277	1	0.017	0.012	621	9	<0.2	1	98
	25-Feb-08	25	8.10	866	261	319	<0.6	<0.4	390	31	0.4	148	0.034	0.027	0.000	0.017	68.5	53.2	4.60	40.3	**0.42**	0.0711	2	0.071	0.013	502	97	0.4	3	105
	25-Apr-08	**38**	8.31	465	157	189	1.0	<0.4	204	16	0.3	68	0.161	0.049	0.001	0.074	42.3	23.9	6.20	17.3	**0.47**	0.0398	9	0.217	0.104	268	**71**	0.9	9	99.4
	13-May-08	37	8.57	773	226	254	10.9	<0.4	331	25	0.2	144	0.011	0.036	0.003	0.014	57.3	45.7	5.20	34.7	0.18	0.0363	8	0.074	0.014	448	35	0.6	9.0	100
	6-Jun-08	**95**	8.40	724	218	256	4.6	<0.4	343	20	0.3	158	0.056	0.062	0.004	0.114	72.5	39.4	4.35	27.7	**0.36**	0.0606	11	0.112	0.032	453	**110**	0.4	11	99.4
	11-Jul-08	**40**	8.44	689	231	269	6.4	<0.4	298	43	0.3	89	0.123	0.077	0.009	0.098	59.5	36.4	4.91	37.0	**0.64**	0.0560	12	0.190	0.128	410	**35**	1.1	13	99.9
	12-Aug-08	32	8.39	875	210	247	4.6	<0.4	380	34	0.3	229	0.081	0.235	**0.021**	1.170	69.8	49.9	5.37	39.6	0.28	0.0603	9	0.079	0.063	559	23	1.6	9	94.2
	2-Sep-08	45	8.42	661	170	198	4.7	<0.4	264	48	0.3	114	0.025	0.043	0.003	0.010	44.7	36.9	5.00	38.6	0.27	0.0463	7	0.118	0.024	390	49	1.1	8.0	99
	7-Oct-08	**60**	8.25	575	205	250	<0.6	<0.4	266	34	0.4	75	0.288	0.202	0.008	0.082	54.9	31.4	9.23	28.9	**0.60**	0.0509	13	0.305	0.242	357	**41**	1.1	13	-
	7-Nov-08	**80**	8.55	1090	270	306	11.5	<0.4	384	101	0.4	180	0.104	0.211	0.007	0.107	67.3	52.5	6.25	74.2	0.26	0.0325	13	0.209	0.122	644	**67**	0.6	13	92.0
	18-Dec-08	12	8.25	1370	360	440	<0.6	<0.4	611	71	0.4	310	0.044	0.227	0.004	0.131	99.0	88.3	7.59	80.9	0.21	0.0738	7	0.072	0.052	874	7	0.5	7	101

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TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Date	Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia (3)	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
		Parameter (2)																												
S-26	25-Apr-08	4.2	8.34	613	270	324	2.7	<0.4	314	17	0.3	48	0.011	0.005	0.000	0.017	66.7	35.8	3.61	13.0	0.07	0.0053	12	0.031	0.019	346	<5	0.7	12	101
U/S	25-Apr-08	3.9	8.36	630	269	322	3.1	<0.4	330	16	0.3	46	0.012	0.007	0.000	0.022	70.2	3.95	3.95	13.5	0.08	0.0053	11	0.031	0.020	349	<5	0.6	11	107
	13-May-08	9.8	8.27	893	279	341	<0.6	<0.4	425	55	<0.1	123	0.024	0.021	0.001	0.007	85.0	51.6	3.70	26.9	0.05	0.0122	15	0.050	0.035	513	11	0.7	16	101
U/S	13-May-08	32	8.33	1580	236	281	3.2	<0.4	618	259	0.2	278	0.012	0.077	0.004	0.016	105.0	86.4	8.43	89.1	0.26	0.0116	16	0.043	0.016	967	30	0.8	16	92.3
	6-Jun-08	35	8.09	487	148	180	<0.6	<0.4	208	25	0.2	60	0.162	0.052	0.002	0.424	40.1	26.1	3.72	19.9	**0.34**	0.0528	14	0.270	0.178	265	50	1.3	14	103
U/S	6-Jun-08	45	8.20	996	127	155	<0.6	<0.4	389	91	0.4	264	0.029	0.065	0.003	0.577	68.1	53.2	5.96	53.2	0.23	0.0199	16	0.081	0.033	614	45	1.0	16	96
	11-Jul-08	7.8	8.02	746	308	376	<0.6	<0.4	326	39	0.3	47	2.710	1.990	**0.094**	0.110	61.6	41.8	6.92	38.9	0.20	0.0516	13	2.790	2.740	420	12	3.1	14	102
U/S	11-Jul-08	5.6	8.07	754	303	369	<0.6	<0.4	333	41	0.3	57	2.370	1.560	**0.083**	0.012	60.8	44.1	6.65	38.7	0.30	0.0478	14	2.360	2.350	430	<5	2.9	14	101
	12-Aug-08	34	8.06	738	133	162	<0.6	<0.4	289	58	0.4	185	0.245	0.152	0.006	0.252	52.6	38.4	5.56	37.2	**0.32**	0.0466	15	0.260	0.235	458	42	1.7	15	92.2
U/S	12-Aug-08	65	8.13	873	119	146	<0.6	<0.4	343	70	0.5	252	0.105	0.285	0.014	0.277	61.3	46.3	5.42	43.3	**0.35**	0.0467	15	0.102	0.069	551	76	2.6	15	92
	2-Sep-08	12	8.21	566	171	208	<0.6	<0.4	245	41	0.3	80	0.075	0.041	0.002	0.020	40.0	35.1	6.00	27.6	0.25	0.0264	13	0.113	0.084	332	10	1.0	14	99.9
U/S	2-Sep-08	15	8.22	633	169	206	<0.6	<0.4	260	53	0.4	100	0.049	0.041	0.002	0.016	39.4	39.2	6.70	35.4	0.25	0.0156	14	0.079	0.045	375	12	1.0	14	99
	7-Oct-08	5.5	8.27	733	243	297	<0.6	<0.4	365	41	0.3	107	0.048	<0.003	0.000	0.010	61.8	51.1	5.95	29.3	0.15	0.0144	12	0.069	0.059	442	<5	0.6	13	-
U/S	7-Oct-08	2.9	8.31	549	244	294	1.8	<0.4	284	25	0.3	30	0.070	0.008	0.000	0.026	52.5	37.2	4.85	12.8	0.13	0.0116	11	0.088	0.082	309	<5	0.6	12	-
	7-Nov-08	**20**	8.46	1000	292	340	8.0	<0.4	442	56	0.4	201	0.041	0.008	0.000	0.014	68.3	65.9	5.09	38.2	0.13	0.0168	15	0.079	0.052	610	19	0.6	15	91.4
U/S	7-Nov-08	7.3	8.41	708	292	343	6.5	<0.4	-	27	0.2	80	0.097	0.021	0.001	0.039	66.3	43.9	5.10	13.1	0.07	0.0129	15	0.136	0.106	-	6	0.7	16	92.1
S-27	25-Apr-08	7.2	8.29	591	263	321	<0.6	<0.4	303	12	0.3	53	0.009	0.010	0.000	<0.005	58.8	38.1	2.29	9.24	0.06	0.0025	14	0.026	0.014	331	9	0.7	15	97.2
U/S	25-Apr-08	9.5	8.28	595	265	323	<0.6	<0.4	318	12	0.3	51	0.011	0.011	0.000	0.015	62.3	39.5	2.38	9.29	0.08	0.0029	15	0.026	0.013	335	<5	0.8	15	102
	13-May-08	9.2	8.35	660	308	368	3.9	<0.4	389	13	0.2	72	0.007	0.019	0.001	<0.005	78.9	46.7	1.75	7.13	0.09	0.0120	17	0.027	0.014	405	<5	0.7	17	101
U/S	13-May-08	8.0	8.33	660	308	369	3.5	<0.4	353	13	0.2	70	0.006	0.014	0.001	<0.005	73.2	41.4	1.87	7.72	0.08	0.0092	17	0.020	0.013	392	7	0.7	17	93.2
	6-Jun-08	**140**	8.35	601	251	300	2.9	<0.4	323	<9	0.3	105	0.087	0.053	0.004	0.434	64.9	39.2	2.93	11.0	**0.42**	0.0522	17	0.122	0.023	375	**150**	1.1	17	96.9
U/S	6-Jun-08	5.4	8.18	662	323	393	<0.6	<0.4	361	10	0.3	49	0.007	0.045	0.002	0.022	67.0	47.1	1.31	8.46	0.05	0.0228	22	0.033	0.022	376	8	1.0	22	98.2
	12-Aug-08	270	8.10	405	112	136	<0.6	<0.4	232	12	0.6	108	0.341	0.035	0.002	0.791	47.3	27.7	4.66	12.7	**0.99**	0.0978	13	0.332	0.034	283	**320**	1.1	13	108
U/S	12-Aug-08	290	8.17	339	88	108	<0.6	<0.4	180	23	0.6	90	0.125	0.016	0.001	0.776	37.6	20.9	4.20	10.8	**0.72**	0.0589	12	0.284	0.031	243	210	1.0	12	95.3
	2-Sep-08	23	8.24	643	190	232	<0.6	<0.4	317	22	0.4	142	0.013	0.039	0.002	0.026	52.6	45.0	3.59	21.2	0.30	0.0163	13	0.041	0.018	401	30	0.6	14	99.2
U/S	2-Sep-08	17	8.23	635	184	225	<0.6	<0.4	313	22	0.4	163	0.007	0.006	0.000	0.017	52.4	44.2	3.58	20.9	0.22	0.0122	13	0.030	0.015	417	26	0.7	14	93.9
	7-Oct-08	**12**	8.21	975	340	415	<0.6	<0.4	512	22	0.4	229	0.013	0.016	0.001	0.010	82.3	74.5	4.89	25.7	0.18	0.0103	18	0.024	0.015	643	15	0.8	19	-
U/S	7-Oct-08	1.1	8.14	899	383	468	<0.6	<0.4	534	24	0.5	141	0.003	0.006	0.000	0.005	84.2	78.7	4.39	20.7	0.16	0.0076	20	0.015	0.015	583	<5	0.8	20	-
	7-Nov-08	**45**	8.41	876	303	357	6.2	<0.4	-	22	0.4	188	0.009	0.071	0.002	0.020	74.5	63.6	3.71	21.0	0.17	0.0201	17	0.043	0.018	-	**63**	0.6	17	93.8
U/S	7-Nov-08	2.1	8.39	877	360	425	6.7	<0.4	-	23	0.3	141	<0.001	0.033	0.001	0.016	71.7	65.9	3.39	17.2	<0.01	0.0018	18	0.016	0.010	-	<5	0.6	20	91.2
S-28	28-Jan-08	10	7.95	1300	362	442	<0.6	<0.4	555	76	0.5	250	0.010	0.047	0.000	0.104	98.0	75.3	6.79	67.6	0.10	0.0245	2	0.026	0.014	791	11	0.3	2	97.1
Field Dup.	28-Jan-08	16	7.97	1360	363	443	<0.6	<0.4	581	93	0.5	252	0.013	0.046	0.000	0.113	101.0	80.0	7.26	97.6	0.15	0.0312	2	0.029	0.013	849	19	0.2	3	106
	25-Feb-08	5.4	8.12	965	290	354	<0.6	<0.4	435	33	0.3	172	0.009	0.011	0.000	0.022	74.3	60.7	5.13	49.1	0.19	0.0115	2	0.019	0.010	569	13	<0.2	2	106
Field Dup.	25-Feb-08	4.9	8.10	962	290	354	<0.6	<0.4	447	34	0.4	171	0.01	0.027	0.000	0.026	76.8	62.1	5.4	49.4	0.18	0.0112	2	0.018	0.010	573	<5	0.2	2	109
	11-Mar-08	11	8.14	953	252	308	<0.6	<0.4	376	57	0.4	174	0.019	0.013	0.000	0.073	65.3	51.8	5.53	82.8	0.12	0.0222	3	0.029	0.013	588	<5	0.2	3.0	109
Field Dup.	11-Mar-08	10	8.19	1000	254	305	2.5	<0.4	392	102	0.4	201	0.019	0.012	0.000	0.082	66.7	54.7	7.53	134	0.17	0.0252	4	0.032	0.010	656	<5	0.2	4.0	114
	25-Apr-08	**55**	8.32	462	177	213	1.5	<0.4	210	14	0.3	56	0.106	0.051	0.001	0.047	44.5	24.1	5.36	14.0	**0.31**	0.0205	10	0.158	0.086	264	**46**	0.9	10	96.7
Field Dup.	25-Apr-08	**55**	8.34	464	177	212	2.0	<0.4	218	14	0.3	57	0.109	0.055	0.001	0.030	45.5	25.5	5.56	14.3	**0.31**	0.0261	10	0.160	0.086	267	**44**	0.9	10	99.9
	13-May-08	13	8.41	729	237	278	5.4	<0.4	318	22	0.2	121	0.011	0.027	0.001	0.015	59.8	40.9	4.70	28.8	0.12	0.0307	8	0.049	0.020	420	<5	0.5	9.0	98.1
Field Dup.	13-May-08	12	8.42	730	237	277	5.8	<0.4	320	23	0.1	122	0.012	0.030	0.018	0.017	56.2	43.6	5.22	29.0	0.05	0.0270	8	0.047	0.018	421	<5	0.5	9.0	98.3
	6-Jun-08	**850**	8.34	516	191	229	2.0	<0.4	411	15	0.3	86	0.467	0.084	0.004	0.161	97.2	41.0	3.95	17.3	**1.35**	0.2050	10	0.557	0.062	375	**790**	1.8	10	150
Field Dup.	6-Jun-08	**800**	8.34	520	171	205	2.1	<0.4	407	15	0.3	87	0.415	0.076	0.004	0.416	96.6	40.2	3.87	17.1	**1.28**	0.2010	10	0.483	0.065	364	**770**	1.4	10	157
	11-Jul-08	**29**	8.38	661	228	270	3.9	<0.4	287	37	0.3	84	0.174	0.054	0.006	0.280	55.6	36.1	4.73	33.6	0.24	0.0299	12	0.219	0.179	389	26	0.9	12	99.5
Field Dup.	11-Jul-08	**28**	8.37	662	228	271	3.7	<0.4	302	37	0.3	84	0.174	0.056	0.006	0.284	58.5	37.9	5.14	35.1	0.27	0.0323	12	0.225	0.176	396	25	0.9	12	104
	12-Aug-08	160	8.22	645	207	252	<0.6	<0.4	325	29	0.2	112	0.202	0.053	0.003	0.110	62.9	40.8	4.29	28.4	**0.56**	0.0551	8	0.207	0.080	402	130	0.7	8	107
Field Dup.	12-Aug-08	170	8.29	644	217	264	<0.6	<0.4	327	28	0.2	113	0.150	0.028	0.002	0.107	61.7	42.0	4.24	29.2	**0.53**	0.0539	8	0.203	0.083	409	150	0.7	8	106
	2-Sep-08	30	8.30	934	197	237	1.6	<0.4	398	42	0.3	266	0.078	0.122	0.006	0.086	67.7	55.5	6.05	49.0	0.27	0.0387	9	0.117	0.075	605	34	1.1	8.8	95.8
Field Dup.	2-Sep-08	31	8.29	933	197	240	<0.6	<0.4	408	41	0.4	253	0.090	0.116	0.006	0.087	68.9	57.3	6.14	50.4	0.30	0.0395	8	0.122	0.074	596	33	1.1	9.0	101
	7-Oct-08	**70**	8.16	641	211	257	<0.6	<0.4	290	38	0.3	93	0.301	0.163	0.005	0.126	58.5	34.9	9.39	31.3	**0.66**	0.0504	13	0.314	0.240	393	**58**	1.1	13	-
Field Dup.	7-Oct-08	**70**	8.17	642	211	257	<0.6	<0.4	285	38	0.3	95	0.304	0.181	0.006	0.122	57.7	34.3	9.18	31.5	**0.68**	0.0520	13	0.327	0.246	393	**55**	0.9	13	-
	7-Nov-08	**50**	8.52	977	268	306	10.1	<0.4	-	58	0.4	170	0.072	0.157	0.005	0.123	71.2	52.1	6.02	56.5	0.25	0.0245	12	0.142	0.081	-	**44**	0.8	14	99.0
Field Dup.	7-Nov-08	**80**	8.55	1090	270	304	12.3	<0.4	396	101	0.4	177	0.108	0.099	0.003	0.093	69.3	54.1	6.42	77.2	**0.64**	0.0359	14	0.205	0.116	648	**68**	0.6	14	95.6
	18-Dec-08	9.3	8.21	1430	422	515	<0.6	<0.4	651	73	0.4	309	0.056	0.165	0.002	0.358	104	94.8	7.69	76.7	0.19	0.0393	7	0.083	0.065	921	5	0.6	7	97.3
Field Dup.	18-Dec-08	9.6	8.26	1430	420	512	<0.6	<0.4	652	73	0.4	295	0.056	0.167	0.003	0.373	106	94.5	7.81	78.0	0.18	0.0382	6	0.079	0.065	908	7	0.5	7	100
S-30	28-Jan-08	7.1	7.86	1000	293	358	<0.6	<0.4	406	45	0.3	168	0.383	1.970	0.013	1.060	89.8	44.2	10.4	60.7	0.12	0.0372	11	0.430	0.420	600	12	2.6	10	103
	25-Feb-08	5.2	7.95	1010	306	373	<0.6	<0.4	410	41	0.3	160	0.451	1.880	0.015	1.140	88.8	45.7	10.3	58.9	0.14	0.0357	9	0.474	0.455	593	<5	2.7	10	103
	11-Mar-08	5.6	8.17	921	299	365	<0.6	<0.4	368	30	0.3	161	0.377	1.580	**0.030**	1.290	78.8	41.7	8.43	47.5	0.04	0.0317	9	0.391	0.350	554	<5	2.2	9.0	93.8
	25-Apr-08	160	8.24	529	179	218	<0.6	<0.4	254	17	0.3	82	0.221	0.128	0.003	0.532	57.0	27.1	6.22	20.8	**0.89**	0.2090	9	0.366	0.127	319	300	1.4	9	106
	13-May-08	95	8.34	695	209	249	3.1	<0.4	294	18	0.1	138	0.122	0.394	0.001	0.382	63.1	33.3	5.94	27.9	**0.36**	0.1090	9	0.252	0.115	414	58	1.4	9.0	95.6
	6-Jun-08	45	8.50	745	227	262	7.3	<0.4	321	27	0.2	142	0.094	0.404	**0.035**	0.118	66.7	37.5	6.99	39.8	0.25	0.0872	11	0.184	0.080	457	59	1.3	11	101
	11-Jul-08	140	8.54	781	234	265	9.9	<0.4	380	31	0.3	169	0.148	0.174	**0.026**	<0.005	79.4	44.1	7.22	41.8	**0.88**	0.1990	11	0.499	0.143	512	260	1.6	11	106
	12-Aug-08	37	8.43	745	227	264	6.2	<0.4	291	34	0.2	145	0.229	0.051	0.005	0.830	59.5	34.6	7.96	40.3	0.28	0.1010	12	0.229	0.169	461	41	1.3	12	90.6
	2-Sep-08	**70**	8.32	607	171	205	2.2	<0.4	260	30	0.5	114	0.227	0.269	0.018	0.850	52.2	31.6	7.96	34.7	**0.77**	0.1560	9	0.311	0.217	377	**140**	1.3	9.0	103
	7-Oct-08	50	8.22	646	201	245	<0.6	<0.4	272	32	0.3	112	0.373	0.623	**0.023**	0.534	58.0	31.0	9.58	33.7	**0.43**	0.0641	11	0.403	0.326	399	41	1.4	11	-
S-30	7-Nov-08	130	8.43	846	238	278	6.3	<0.4	-	36	0.4	184	0.159	0.383	0.012	0.667	79.0	45.1	8.06	42.1	**0.65**	0.1650	15	0.334	0.155	-	190	1.4	16	100
	18-Dec-08	400	8.31	1120	298	360	1.6	<0.4	587	78	0.4	278	0.278	0.953	0.017	0.866	124	67.2	10.2	72.0	**1.96**	0.7670	15	0.952	0.277	813	680	3.7	16	108

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter (2)																											
		Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia (3)	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
S-31	28-Jan-08	5.9	7.77	998	293	357	<0.6	<0.4	390	44	0.3	170	0.392	2.050	0.010	1.050	86.2	42.3	10.0	59.0	0.11	0.0348	10	0.428	0.412	592	5	2.8	11	98.9
	25-Feb-08	5.2	8.01	1010	306	374	<0.6	<0.4	400	42	0.3	169	0.459	1.900	0.017	1.130	86.7	44.6	10.0	58.2	0.12	0.0348	10	0.479	0.453	599	8	2.7	10	98.7
	11-Mar-08	6.4	8.29	927	306	373	<0.6	<0.4	379	32	0.3	157	0.445	2.050	**0.065**	1.410	83.6	41.4	9.44	49.2	0.08	0.0360	10	0.474	0.427	562	<5	2.8	10	95.8
	25-Apr-08	220	8.20	605	182	221	<0.6	<0.4	280	24	0.2	116	0.299	0.185	0.004	0.962	64.6	28.9	7.26	28.9	**1.20**	0.2930	8	0.458	0.148	383	310	1.5	8	104
	13-May-08	95	8.30	694	207	249	1.4	<0.4	308	18	0.2	140	0.111	0.396	0.015	0.405	66.5	34.4	6.29	29.3	**0.46**	0.1060	9	0.244	0.107	420	77	1.4	10	100
	6-Jun-08	40	8.52	760	224	257	8.1	<0.4	323	28	0.3	149	0.107	0.385	**0.035**	0.124	67.1	37.9	7.39	42.0	0.25	0.0844	11	0.201	0.083	466	54	1.4	11	101
	11-Jul-08	50	8.51	827	233	265	9.2	<0.4	366	33	0.4	190	0.129	0.145	**0.020**	<0.005	75.1	43.4	7.64	46.1	**0.38**	0.1030	11	0.275	0.128	535	72	1.3	11	99.8
	12-Aug-08	38	8.41	755	228	267	5.4	<0.4	298	34	0.2	148	0.238	0.067	0.007	0.874	61.4	35.2	8.37	42.6	0.29	0.1030	12	0.244	0.201	471	35	1.4	13	92.6
	2-Sep-08	60	8.33	608	171	204	2.4	<0.4	243	30	0.4	116	0.227	0.391	**0.028**	0.857	48.2	29.7	8.10	35.4	**0.54**	0.1200	9	0.305	0.221	375	68	1.0	9.0	97.8
	7-Oct-08	50	8.24	649	201	245	<0.6	<0.4	249	32	0.4	110	0.375	0.652	**0.025**	0.583	53.2	28.1	8.56	31.6	**0.35**	0.0566	11	0.401	0.319	386	47	1.4	11	-
	7-Nov-08	150	8.43	844	237	277	6.2	<0.4	-	36	0.3	184	0.142	0.299	0.009	0.725	79.0	44.1	8.01	40.9	**0.66**	0.1760	14	0.377	0.158	-	200	1.7	14	98.9
	18-Dec-08	110	8.36	1180	321	384	3.9	<0.4	535	53	0.4	260	0.265	0.813	0.017	0.885	112	62.3	10.8	71.4	**1.36**	0.3220	14	0.482	0.267	765	250	2.1	15	105
S-32	28-Jan-08	5.7	7.77	996	293	357	<0.6	<0.4	397	43	0.3	172	0.397	2.070	0.012	1.060	88.7	42.7	10.4	58.5	0.11	0.0361	10	0.430	0.415	596	12	2.8	11	100
	25-Feb-08	4.9	7.94	1000	305	372	<0.6	<0.4	393	42	0.3	165	0.455	1.880	0.015	1.110	85.4	43.6	9.81	57.1	0.11	0.0344	10	0.477	0.459	590	6	2.7	10	97.9
	11-Mar-08	4.6	8.00	928	305	372	<0.6	<0.4	382	31	0.3	164	0.432	2.030	**0.034**	1.490	84.1	41.8	9.47	48.7	0.06	0.0358	10	0.463	0.427	569	<5	2.8	10	95.1
	25-Apr-08	240	8.17	642	180	219	<0.6	<0.4	300	26	0.3	129	0.321	0.217	0.004	1.280	69.0	31.0	7.76	33.8	**1.41**	0.3610	8	0.502	0.158	240	430	1.7	8	108
	13-May-08	90	8.29	691	205	250	<0.6	<0.4	318	18	0.2	143	0.115	0.418	0.015	0.421	70.3	34.7	6.72	29.2	0.30	0.0982	9	0.240	0.103	427	110	1.4	9.0	103
	6-Jun-08	38	8.53	777	225	257	8.7	<0.4	328	28	0.2	154	0.120	0.515	**0.049**	0.127	68.1	38.5	7.64	42.8	0.23	0.0815	10	0.184	0.091	475	49	1.3	11	101
	11-Jul-08	40	8.45	828	233	271	6.7	<0.4	373	30	0.3	196	0.128	0.102	0.012	0.042	77.3	43.8	7.90	45.5	**0.34**	0.0921	12	0.246	0.127	540	53	1.2	12	101
	12-Aug-08	37	8.39	757	226	266	4.8	<0.4	293	32	0.3	147	0.250	0.047	0.005	0.960	61.3	34.1	8.32	42.1	0.29	0.1020	12	0.249	0.203	466	39	1.5	13	92.3
	2-Sep-08	55	8.30	615	172	210	<0.6	<0.4	240	30	0.5	117	0.243	0.226	0.015	0.872	47.6	29.5	7.85	35.1	**0.48**	0.1160	8	0.302	0.219	374	62	1.3	7.9	96.2
	7-Oct-08	45	8.22	648	201	245	<0.6	<0.4	254	31	0.4	114	0.384	0.654	**0.025**	0.586	55.0	28.3	8.95	31.2	**0.48**	0.0733	11	0.401	0.335	391	41	1.4	11	-
	7-Nov-08	150	8.41	838	236	277	5.4	<0.4	-	34	0.4	186	0.160	0.308	0.009	0.754	79.1	43.8	8.24	40.5	**0.67**	0.1920	13	0.381	0.177	-	210	1.8	14	98.9
	18-Dec-08	400	8.35	1150	312	374	3.1	<0.4	583	54	0.3	276	0.263	0.930	**0.020**	0.899	126	65.3	10.4	70.5	**1.93**	0.875	13	0.799	0.261	793	700	3.3	14	110
S-33	28-Jan-08	7.1	7.78	1000	294	359	<0.6	<0.4	407	47	0.3	184	0.360	1.850	0.010	1.090	90.0	44.4	10.4	59.9	0.17	0.0372	11	0.401	0.378	618	11	2.6	10	99
	25-Feb-08	5.6	8.02	1010	307	375	<0.6	<0.4	403	41	0.3	168	0.406	1.580	0.015	1.170	87.1	45.1	9.65	57.9	0.14	0.0355	9	0.431	0.406	598	7	2.3	10	99.3
	11-Mar-08	5.1	7.97	925	304	370	<0.6	<0.4	380	31	0.3	167	0.367	1.460	0.014	1.430	82.7	42.2	9.14	49.0	0.05	0.0353	10	0.399	0.370	569	7	2.2	9.0	94.6
	25-Apr-08	260	8.17	652	183	223	<0.6	<0.4	302	26	0.3	129	0.299	0.240	0.006	1.320	69.2	31.4	7.80	35.0	**1.49**	0.3490	15	0.504	0.162	413	490	1.6	15	108
	13-May-08	80	8.29	689	204	249	<0.6	<0.4	294	18	0.1	143	0.124	0.513	0.019	0.423	64.9	32.0	6.22	27.3	**0.36**	0.0928	9	0.246	0.110	416	98	1.4	10	95
	6-Jun-08	39	8.53	779	222	254	8.3	<0.4	329	28	0.3	155	0.114	0.510	**0.033**	0.193	68.4	38.5	7.70	43.1	0.23	0.0806	11	0.203	0.090	475	50	1.3	11	102
	11-Jul-08	50	8.43	828	230	269	6.1	<0.4	369	30	0.3	196	0.135	0.030	0.003	0.402	76.5	43.2	7.92	45.4	**0.43**	0.1040	11	0.274	0.135	539	65	1.2	12	99.8
	12-Aug-08	37	8.38	756	226	266	4.5	<0.4	294	34	0.3	153	0.297	0.024	0.002	1.050	62.1	33.7	8.52	43.3	**0.31**	0.1060	12	0.379	0.208	475	43	1.6	12	91.2
	2-Sep-08	60	8.31	609	171	205	1.8	<0.4	239	30	0.5	116	0.249	0.278	0.019	0.875	47.1	29.4	7.86	34.8	**0.53**	0.1210	8	0.296	0.226	372	67	1.2	8.0	96.2
	7-Oct-08	45	8.21	648	199	243	<0.6	<0.4	252	31	0.4	117	0.378	0.677	**0.025**	0.582	54.2	28.4	8.97	32.3	**0.39**	0.0650	10	0.407	0.325	393	37	1.4	11	-
	7-Nov-08	130	8.41	832	234	274	5.4	<0.4	-	34	0.3	186	0.166	0.333	0.010	0.772	77.8	42.9	8.31	40.1	**0.63**	0.1790	12	0.356	0.170	-	190	2.0	13	97.9
	18-Dec-08	120	8.30	1200	321	390	1	<0.4	505	56	0.4	289	0.263	0.717	0.015	0.882	105	58.7	10.6	67.9	**0.79**	0.1800	14	0.376	0.263	784	110	2.2	14	94.3
S-34	28-Jan-08	6.3	7.83	1000	293	358	<0.6	<0.4	395	45	0.3	167	0.347	1.620	0.010	1.050	88.3	42.3	9.84	58.2	0.12	0.0369	10	0.384	0.357	591	12	2.3	10	99.7
	25-Feb-08	4.9	8.01	1010	306	374	<0.6	<0.4	398	41	0.3	163	0.442	1.730	0.016	1.090	86.6	44.1	9.86	58.7	0.11	0.0345	10	0.464	0.442	593	6	2.6	10	99.8
	11-Mar-08	4.1	8.04	937	306	373	<0.6	<0.4	376	31	0.3	161	0.445	2.200	**0.028**	1.410	83.2	41.0	9.35	48.6	0.07	0.0369	10	0.463	0.433	564	<5	2.8	10	94.5
	25-Apr-08	330	8.20	661	181	221	<0.6	<0.4	310	26	0.3	134	0.361	0.217	0.004	1.340	72.7	31.2	7.83	35.0	**1.47**	0.4370	8	0.632	0.146	421	480	2.0	8	109
	13-May-08	95	8.33	691	202	241	2.7	<0.4	307	18	0.1	143	0.104	0.383	0.016	0.424	62.5	36.6	5.88	27.4	**0.40**	0.1240	9	0.246	0.082	417	120	1.4	10	98.9
	6-Jun-08	50	8.54	792	226	258	8.7	<0.4	343	29	0.2	160	0.108	0.502	**0.048**	0.105	71.3	40.0	8.00	45.5	**0.35**	0.1160	11	0.233	0.088	491	79	1.5	11	104
	11-Jul-08	150	8.53	838	232	263	9.8	<0.4	382	29	0.3	200	0.131	0.069	0.011	<0.005	80.1	44.3	8.20	45.4	**0.61**	0.1880	11	0.343	0.124	546	300	1.4	12	102
	12-Aug-08	39	8.46	750	225	260	7.1	<0.4	297	34	0.2	144	0.226	0.061	0.007	0.823	61.5	34.9	8.54	43.1	0.30	0.1050	11	0.233	0.167	464	47	1.4	12	94.3
	2-Sep-08	55	8.35	601	170	200	3.1	<0.4	239	30	0.4	125	0.281	0.394	**0.028**	0.857	47.3	29.4	7.95	35.0	**0.52**	0.1230	8	0.307	0.225	380	63	1.1	8.0	94.4
	7-Oct-08	45	8.28	647	199	243	<0.6	<0.4	274	30	0.4	118	0.387	0.742	**0.032**	0.573	59.6	30.3	9.93	34.4	**0.41**	0.0720	11	0.418	0.330	405	40	1.4	11	-
	7-Nov-08	140	8.36	840	233	274	5.0	<0.4	-	33	0.4	187	0.160	0.263	0.007	0.747	78.5	43.3	8.22	40.3	**0.67**	0.1890	14	0.354	0.146	-	200	1.5	15	98.8
	18-Dec-08	380	8.35	1160	316	377	3.7	<0.4	589	53	0.3	279	0.265	0.817	0.016	0.894	128	65.4	10.2	70.0	**1.92**	0.7310	15	0.892	0.269	800	670	3.4	15	110
S-35	25-Apr-08	9.5	8.23	533	116	142	<0.6	<0.4	183	59	0.2	43	0.172	0.044	0.001	0.091	40.5	20.0	8.40	19.3	0.20	0.0061	13	0.238	0.219	260	5	0.9	14	96.3
	7-Oct-08	6.2	8.10	1040	162	198	<0.6	<0.4	364	188	0.3	100	0.244	0.054	0.001	0.044	74.4	43.2	13.2	46.9	0.18	0.1300	15	0.310	0.275	563	<5	0.3	16	90.6
	7-Nov-08	440	7.83	386	54	66	<0.6	<0.4	128	61	0.2	71	0.412	0.150	0.001	1.090	26.1	15.4	7.97	15.5	**0.45**	0.0316	14	0.723	0.457	234	120	1.1	18	78.9
S-36	25-Apr-08	35	8.17	342	89	108	<0.6	<0.4	133	12	0.2	63	0.207	0.045	0.001	0.273	27.0	14.3	8.12	10.3	**0.49**	0.0055	12	0.243	0.213	192	14	1.0	12	92.2
	13-May-08	20	8.18	829	178	217	<0.6	<0.4	353	33	0.2	209	0.046	0.093	0.002	0.052	78.1	38.3	12.4	32.7	**0.47**	0.0603	13	0.150	0.083	511	24	1.2	14	99.3
	6-Jun-08	36	7.94	1670	144	176	<0.6	<0.4	850	80	0.3	675	0.054	0.162	0.004	1.400	187	92.9	14.3	73.6	**0.41**	0.2420	11	0.142	0.065	1220	52	1.2	11	106
	7-Nov-08	140	8.01	193	61	75	<0.6	<0.4	74.5	18	0.3	51	0.588	0.373	0.004	1.460	17.2	7.66	8.35	5.35	**0.36**	0.0225	15	0.713	0.619	151	63	1.5	18	66.3

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter (2)																												
		Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia (3)	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)
Level I																														
CON D/S	13-May-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
	26-May-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-
	6-Jun-08	-	8.33	-	-	-	-	-	-	-	-	-	0.439	0.078	0.004	0.230	-	-	-	-	-	-	-	0.735	0.041	-	**1700**	10	-	-
	9-Jun-08	-	8.16	-	-	-	-	-	-	-	-	-	0.075	0.052	0.002	1.500	-	-	-	-	-	-	-	0.145	0.076	-	**62**	1.0	-	-
	12-Jun-08	-	8.37	-	-	-	-	-	-	-	-	-	0.082	0.014	0.001	2.800	-	-	-	-	-	-	-	-	0.101	-	9	1.2	-	-
	28-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**150**	-	-	-
	11-Jul-08	-	8.32	-	-	-	-	-	-	-	-	-	0.192	0.069	0.007	0.385	-	-	-	-	-	-	-	0.245	0.203	-	**44**	12	-	-
	29-Jul-08	-	8.18	-	-	-	-	-	-	-	-	-	0.035	0.051	0.003	<0.005	-	-	-	-	-	-	-	0.122	0.039	-	**77**	0.7	-	-
	12-Aug-08	-	8.29	-	-	-	-	-	-	-	-	-	0.115	0.069	0.004	0.503	-	-	-	-	-	-	-	0.119	0.090	-	28	0.6	-	-
	22-Aug-08	-	8.24	-	-	-	-	-	-	-	-	-	0.020	0.005	0.000	0.006	-	-	-	-	-	-	-	0.150	0.022	-	51	1.2	-	-
	2-Sep-08	-	8.29	-	-	-	-	-	-	-	-	-	0.066	0.105	0.005	0.224	-	-	-	-	-	-	-	0.105	0.058	-	300	1.1	-	-
	23-Sep-08	-	8.09	-	-	-	-	-	-	-	-	-	0.010	0.044	0.002	0.218	-	-	-	-	-	-	-	0.114	0.021	-	**140**	0.7	-	-
	7-Oct-08	-	8.09	-	-	-	-	-	-	-	-	-	0.299	0.166	0.005	0.596	-	-	-	-	-	-	-	0.318	0.244	-	**57**	1.0	-	-
	13-Oct-08	-	8.30	-	-	-	-	-	-	-	-	-	0.155	0.084	0.003	0.154	-	-	-	-	-	-	-	0.167	0.096	-	**58**	0.9	-	-
	7-Nov-08	-	8.50	-	-	-	-	-	-	-	-	-	0.062	0.176	0.005	0.219	-	-	-	-	-	-	-	0.124	0.072	-	**36**	0.8	-	-
CON U/S	26-May-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
	6-Jun-08	-	8.27	-	-	-	-	-	-	-	-	-	0.119	0.062	0.003	0.264	-	-	-	-	-	-	-	0.171	0.100	-	69	11	-	-
	9-Jun-08	-	8.27	-	-	-	-	-	-	-	-	-	0.103	0.033	0.002	0.084	-	-	-	-	-	-	-	0.136	0.118	-	<5	0.7	-	-
	12-Jun-08	-	8.04	-	-	-	-	-	-	-	-	-	0.126	0.026	0.001	0.031	-	-	-	-	-	-	-	-	0.141	-	7	0.7	-	-
	28-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-
	11-Jul-08	-	8.84	-	-	-	-	-	-	-	-	-	0.079	<0.003	0.001	0.017	-	-	-	-	-	-	-	0.101	0.092	-	<5	0.8	-	-
	29-Jul-08	-	**9.19**	-	-	-	-	-	-	-	-	-	0.230	0.104	**0.036**	<0.005	-	-	-	-	-	-	-	0.043	0.037	-	<5	1.7	-	-
	23-Sep-08	-	7.82	-	-	-	-	-	-	-	-	-	0.156	0.050	0.001	1.100	-	-	-	-	-	-	-	0.245	0.164	-	59	0.8	-	-
	7-Oct-08	-	8.35	-	-	-	-	-	-	-	-	-	0.129	<0.003	0.000	0.110	-	-	-	-	-	-	-	0.145	0.139	-	<5	0.5	-	-
	13-Oct-08	-	8.22	-	-	-	-	-	-	-	-	-	0.158	0.014	0.000	0.068	-	-	-	-	-	-	-	0.185	0.169	-	10	0.6	-	-
	7-Nov-08	-	8.39	-	-	-	-	-	-	-	-	-	0.146	0.008	0.000	0.111	-	-	-	-	-	-	-	0.187	0.162	-	5	0.5	-	-
S-31	13-May-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	77	-	-	-
	26-May-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	-	-	-
	6-Jun-08	-	8.52	-	-	-	-	-	-	-	-	-	0.107	0.385	**0.035**	0.124	-	-	-	-	-	-	-	0.201	0.083	-	54	11	-	-
	9-Jun-08	-	8.29	-	-	-	-	-	-	-	-	-	0.083	0.089	0.005	0.903	-	-	-	-	-	-	-	0.170	0.088	-	53	1.2	-	-
	12-Jun-08	-	8.27	-	-	-	-	-	-	-	-	-	0.102	0.077	0.004	2.310	-	-	-	-	-	-	-	-	0.124	-	63	1.4	-	-
	28-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**170**	-	-	-
	11-Jul-08	-	8.51	-	-	-	-	-	-	-	-	-	0.129	0.145	**0.020**	<0.005	-	-	-	-	-	-	-	0.275	0.128	-	72	11	-	-
	29-Jul-08	-	8.37	-	-	-	-	-	-	-	-	-	0.186	0.245	**0.025**	<0.005	-	-	-	-	-	-	-	0.251	0.171	-	38	1.3	-	-
	12-Aug-08	-	8.41	-	-	-	-	-	-	-	-	-	0.238	0.067	0.007	0.874	-	-	-	-	-	-	-	0.244	0.201	-	35	1.4	-	-
	22-Aug-08	-	8.30	-	-	-	-	-	-	-	-	-	0.151	0.016	0.002	0.331	-	-	-	-	-	-	-	0.304	0.165	-	88	1.4	-	-
	2-Sep-08	-	8.33	-	-	-	-	-	-	-	-	-	0.227	0.391	**0.028**	0.857	-	-	-	-	-	-	-	0.305	0.221	-	68	1.0	-	-
	23-Sep-08	-	8.08	-	-	-	-	-	-	-	-	-	0.228	0.192	0.008	0.686	-	-	-	-	-	-	-	0.346	0.219	-	**120**	0.9	-	-
	7-Oct-08	-	8.24	-	-	-	-	-	-	-	-	-	0.375	0.652	**0.025**	0.583	-	-	-	-	-	-	-	0.401	0.319	-	47	1.4	-	-
	13-Oct-08	-	8.42	-	-	-	-	-	-	-	-	-	0.262	0.482	**0.025**	0.422	-	-	-	-	-	-	-	0.292	0.245	-	37	1.2	-	-
	7-Nov-08	-	8.43	-	-	-	-	-	-	-	-	-	0.142	0.299	0.009	0.725	-	-	-	-	-	-	-	0.377	0.158	-	200	1.7	-	-
S-34	6-Jun-08	-	8.54	-	-	-	-	-	-	-	-	-	0.108	0.502	**0.048**	0.105	-	-	-	-	-	-	-	0.233	0.088	-	79	11	-	-
	12-Jun-08	-	8.47	-	-	-	-	-	-	-	-	-	0.094	0.173	0.015	1.020	-	-	-	-	-	-	-	-	0.112	-	120	1.6	-	-
	28-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	-	-	-
	11-Jul-08	-	8.53	-	-	-	-	-	-	-	-	-	0.131	0.069	0.011	<0.005	-	-	-	-	-	-	-	0.343	0.124	-	300	12	-	-
	29-Jul-08	-	8.40	-	-	-	-	-	-	-	-	-	0.162	0.297	**0.032**	0.553	-	-	-	-	-	-	-	0.271	0.170	-	41	1.3	-	-
	12-Aug-08	-	8.46	-	-	-	-	-	-	-	-	-	0.226	0.061	0.007	0.823	-	-	-	-	-	-	-	0.233	0.167	-	47	1.4	-	-
	22-Aug-08	-	8.28	-	-	-	-	-	-	-	-	-	0.185	0.016	0.001	0.359	-	-	-	-	-	-	-	0.362	0.147	-	120	1.4	-	-
	2-Sep-08	-	8.35	-	-	-	-	-	-	-	-	-	0.281	0.394	**0.028**	0.857	-	-	-	-	-	-	-	0.307	0.225	-	63	1.1	-	-
	23-Sep-08	-	8.07	-	-	-	-	-	-	-	-	-	0.253	0.314	0.013	0.807	-	-	-	-	-	-	-	0.378	0.227	-	89	0.9	-	-
	7-Oct-08	-	8.28	-	-	-	-	-	-	-	-	-	0.387	0.742	**0.032**	0.573	-	-	-	-	-	-	-	0.418	0.330	-	40	1.4	-	-
	13-Oct-08	-	8.45	-	-	-	-	-	-	-	-	-	0.298	0.593	**0.033**	0.482	-	-	-	-	-	-	-	0.336	0.282	-	58	1.3	-	-
	7-Nov-08	-	8.36	-	-	-	-	-	-	-	-	-	0.160	0.263	0.007	0.747	-	-	-	-	-	-	-	0.354	0.146	-	200	1.5	-	-

TABLE NM7-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter [2]																													
		Turbidity (NTU)	pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as HCO_3	Carbonate as CO_3	Hydroxide as OH	Hardness as $CaCO_3$	Chloride - Soluble	Fluoride - Soluble	Sulphate - Soluble	Ortho-Phosphorus Soluble as P	Ammonia (NH_3) - Soluble	Unionized Ammonia [3]	Nitrate+ Nitrite-N Soluble	Calcium	Magnesium	Potassium	Sodium	Iron	Manganese	D.O.C	Total Phosphorus	Total Dissolved Phosphorus	T.D.S. (Calc.)	T.S.S.	T.K.N.	T.O.C.	Ion Balance (%)

Notes:
"-" = No Data
E.C. = Electrical Conductivity
D.O.C. = Dissolved Organic Carbon
T.O.C. = Total Organic Carbon
T.K.N. = Total Kjeldahl Nitrogen
T.D.S. = Total Dissolved Solids
T.S.S. = Total Suspended Solids

1. See Table NM7-1 for sample location descriptions
2. All values are expressed in milligrams per litre (mg/L) unless indicated otherwise.
3. Guideline for un-ionized ammonia is 0.019 mg/L. Un-ionized ammonia is pH and Temperature dependant. See Factsheet for details.
   Unionized Ammonia = (f) x (Ammonia), f = 1/(10(pKa - pH) + 1), pKa = 0.09018+2729.92/T, where T = Temperature in Kelvins
4. CCME 2007 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Update 7.0 - 2007.
   Chapter 4 -Aquatic Life
5. Turbidity Guidelines Narrative (see fact sheet for complete details):
   Clear Flow:
      Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24 hr period).
      Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30 d period).
   High Flow or Turbid Waters:
      Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs.
      Should not increase more than 10% of background levels when background is >80 NTUs.
6. Suspended Sediments Guidelines (see fact sheet for complete details):

Clear Flow:
   Maximum increase of 25 mg/L from background levels for any short-term exposure (eg. 24 hr period).
   Maximum average increase of 5 mg/L from background levels for longer term exposures (eg. Inputs lasting between 24 hrs and 30 days).

High Flow:
   Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L.
   Should not increase more than 10% of background levels when background is >250 mg/L.

BOLD - Exceedance of Criteria

TABLE NM7-3
PETROLEUM HYDROCARBONS IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter [2]								
		Benzene	Toluene	Ethyl-benzene	Xylenes (-o,-m,-p)	F1 (C_6 - C_{10})	F2 (C_{10} - C_{16})	F3 (C_{16} - C_{34})	F4 (C_{34} - C_{50})	Total Hydrocarbons (C_6 - C_{50})
Detection Limit		*0.5*	*0.5*	*0.5*	*1.5*	*100*	*100*	*250*	*250*	*250*
CCME [3]										
Recreation and Aesthetics		-	-	-	-	-	-	-	-	-
Freshwater Aquatic Life		370 (MAC)	2 (MAC)	90 (MAC)	-	-	-	-	-	-
Monthly										
CON D/S (Stn 50+500)	28-Jan-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	25-Feb-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	11-Mar-08	<0.50	**1.02**	<0.50	<1.5	<100	<100	<250	<250	<250
	25-Apr-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	13-May-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	06-Jun-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<500	<500	<500
(Stn 50+900)	11-Jul-08	<0.50	<0.50	<0.10	<1.5	<100	<100	<500	<500	<100
	12-Aug-08	<0.50	<0.50	<0.50	<0.50	<100	<50	<50	<50	-
	02-Sep-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<500	<500	<500
	07-Oct-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	07-Nov-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	18-Dec-08	<0.5	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
CON U/S (Stn 11+000)	25-Apr-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	06-Jun-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<500	<500	<500
	11-Jul-08	<0.50	<0.50	<0.10	<1.5	<100	<100	<500	<500	<100
	07-Oct-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250
	07-Nov-08	<0.50	<0.50	<0.50	<1.5	<100	<100	<250	<250	<250

Notes:
"-" = No Data

1. See Table NM7-1 for sample location descriptions
2. All concentrations in micrograms per litre (µg/L).
3. CCME 2005 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines
   Chapter 3 - Canadian Water Quality Guidelines for Recreation and Aesthetics (Update October 2005) - Fact Sheets
   Chapter 4 - Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update October 2005) - Fact Sheets
   MAC - Maximum Acceptable Concentration
4. Oil or petrochemicals should not be present in concentrations that:
   - Can be detected as a visible film, sheen, or discoloration on the surface;
   - Can be detected by odour; or
   - Can form deposits on shorelines and bottom deposits that are detectable by sight and colour

BOLD	- Parameter Detected
BOLD & Shaded	- Exceedance of Health Related Criteria (MAC)

TABLE NM7-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Use for Sorting	Date	Parameter Total Coliform [3] CFU/100mL	 E.Coli [3] CFU/100mL
Detection Limit			*10*	*10*
CCME [2]				
Freshwater Aquatic Life			-	-
Monthly				
CON D/S (Stn 50+500)	CON D/S	28-Jan-08	30	<10
	CON D/S	25-Feb-08	<10	<10
	CON D/S	11-Mar-08	<10	130
	CON D/S	25-Apr-08	>200	3
	CON D/S	13-May-08	950	100
	CON D/S	06-Jun-08	1020	120
(Stn 50+900)	CON D/S	11-Jul-08	2020	1060
	CON D/S	12-Aug-08	OVERGROWN	OVERGROWN
	CON D/S	02-Sep-08	OVERGROWN	OVERGROWN
	CON D/S	07-Oct-08	OVERGROWN	350
	CON D/S	07-Nov-08	OVERGROWN	80
	CON D/S	18-Dec-08	260	20
CON U/S (Stn 11+ 000)	CON U/S	25-Apr-08	<10	<10
	CON U/S	06-Jun-08	810	<10
	CON U/S	11-Jul-08	3070	10
	CON U/S	07-Oct-08	1120	20
	CON U/S	07-Nov-08	OVERGROWN	160
VEG D/S (Stn 50+500)	VEG D/S	28-Jan-08	30	<10
	VEG D/S	25-Feb-08	<10	<10
	VEG D/S	11-Mar-08	<10	130
	VEG D/S	25-Apr-08	>200	3
	VEG D/S	13-May-08	950	100
	VEG D/S	06-Jun-08	1020	120
(Stn 50+900)	VEG D/S	11-Jul-08	2020	1060
	VEG D/S	12-Aug-08	OVERGROWN	OVERGROWN
	VEG D/S	02-Sep-08	OVERGROWN	OVERGROWN
	VEG D/S	07-Oct-08	OVERGROWN	350
	VEG D/S	07-Nov-08	OVERGROWN	80
	VEG D/S	18-Dec-08	260	20
VEG U/S (Stn 11+ 000)	VEG U/S	25-Apr-08	<10	<10
	VEG U/S	06-Jun-08	810	<10
	VEG U/S	11-Jul-08	3070	10
	VEG U/S	07-Oct-08	1120	20
	VEG U/S	07-Nov-08	OVERGROWN	160
S-05	S-05	06-Jun-08	OVERGROWN	790
U/S	S-05	06-Jun-08	1080	<10
	S-05	11-Jul-08	1710	40
U/S	S-05	11-Jul-08	2190	20
	S-05	07-Oct-08	OVERGROWN	50
U/S	S-05	07-Oct-08	OVERGROWN	70
	S-05	07-Nov-08	OVERGROWN	1200
U/S	S-05	07-Nov-08	OVERGROWN	20
S-06	S-06	25-Apr-08	110	10
	S-06	13-May-08	590	20
U/S	S-06	13-May-08	610	<10
	S-06	06-Jun-08	OVERGROWN	310
U/S	S-06	06-Jun-08	1520	720
	S-06	11-Jul-08	2400	20
U/S	S-06	11-Jul-08	1830	10
	S-06	12-Aug-08	OVERGROWN	800
U/S	S-06	12-Aug-08	OVERGROWN	OVERGROWN
	S-06	07-Oct-08	OVERGROWN	140
U/S	S-06	07-Oct-08	OVERGROWN	280
	S-06	07-Nov-08	OVERGROWN	190
U/S	S-06	07-Nov-08	OVERGROWN	60
S-07	S-07	25-Apr-08	60	<10
U/S	S-07	25-Apr-08	140	<10
	S-07	13-May-08	650	210
U/S	S-07	13-May-08	290	20
	S-07	06-Jun-08	780	70
S-07 U/S	S-07	06-Jun-08	820	10
	S-07	11-Jul-08	710	60
U/S	S-07	11-Jul-08	1290	100
	S-07	12-Aug-08	OVERGROWN	OVERGROWN
U/S	S-07	12-Aug-08	OVERGROWN	1060

TABLE NM7-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Use for Sorting	Date	Parameter: Total Coliform (3) CFU/100mL	Parameter: E.Coli (3) CFU/100mL
	S-07	02-Sep-08	OVERGROWN	1200
U/S	S-07	02-Sep-08	OVERGROWN	160
	S-07	07-Oct-08	OVERGROWN	370
U/S	S-07	07-Oct-08	OVERGROWN	340
	S-07	07-Nov-08	OVERGROWN	10
U/S	S-07	07-Nov-08	OVERGROWN	50
S-09	S-09	25-Apr-08	60	<10
U/S	S-09	25-Apr-08	110	<10
	S-09	13-May-08	70	<10
U/S	S-09	13-May-08	210	<10
	S-09	06-Jun-08	860	80
U/S	S-09	06-Jun-08	910	230
	S-09	11-Jul-08	1070	10
U/S	S-09	11-Jul-08	1490	20
	S-09	12-Aug-08	1820	80
U/S	S-09	12-Aug-08	OVERGROWN	OVERGROWN
	S-09	02-Sep-08	OVERGROWN	290
U/S	S-09	02-Sep-08	OVERGROWN	1240
	S-09	07-Oct-08	OVERGROWN	60
U/S	S-09	07-Oct-08	OVERGROWN	200
	S-09	07-Nov-08	1150	130
U/S	S-09	07-Nov-08	1000	100
S-10	S-10	25-Apr-08	180	<10
U/S	S-10	25-Apr-08	130	<10
	S-10	13-May-08	290	10
U/S	S-10	13-May-08	730	10
	S-10	06-Jun-08	500	170
U/S	S-10	06-Jun-08	1310	240
	S-10	11-Jul-08	1480	80
U/S	S-10	11-Jul-08	1890	10
	S-10	12-Aug-08	OVERGROWN	460
U/S	S-10	12-Aug-08	OVERGROWN	200
	S-10	02-Sep-08	OVERGROWN	1040
	S-10	07-Oct-08	OVERGROWN	40
U/S	S-10	07-Oct-08	1610	<10
	S-10	07-Nov-08	OVERGROWN	110
U/S	S-10	07-Nov-08	OVERGROWN	160
S-11	S-11	06-Jun-08	1740	10
	S-11	11-Jul-08	2940	80
	S-11	12-Aug-08	OVERGROWN	OVERGROWN
	S-11	02-Sep-08	OVERGROWN	1000
	S-11	07-Oct-08	OVERGROWN	1290
	S-11	07-Nov-08	OVERGROWN	180
S12	S-12	13-May-08	2520	530
	S-12	06-Jun-08	OVERGROWN	1200
	S-12	11-Jul-08	2520	680
	S-12	12-Aug-08	OVERGROWN	OVERGROWN
	S-12	02-Sep-08	OVERGROWN	1700
	S-12	07-Oct-08	OVERGROWN	OVERGROWN
	S-12	07-Nov-08	OVERGROWN	OVERGROWN
S-13	S-13	30-Jan-08	230	<10
	S-13	25-Apr-08	110	<10
	S-13	13-May-08	210	40
	S-13	06-Jun-08	1070	30
	S-13	11-Jul-08	250	<10
	S-13	12-Aug-08	OVERGROWN	OVERGROWN
	S-13	02-Sep-08	OVERGROWN	290
	S-13	07-Oct-08	OVERGROWN	340
	S-13	07-Nov-08	OVERGROWN	230
	S-13	19-Dec-08	330	<10
S-14	S-14	30-Jan-08	720	<10
S-14	S-14	26-Feb-08	<10	<10
	S-14	12-Mar-08	210	<10
	S-14	25-Apr-08	180	20
	S-14	13-May-08	340	<10
	S-14	06-Jun-08	550	<10
	S-14	11-Jul-08	670	120
	S-14	12-Aug-08	2330	340
	S-14	02-Sep-08	OVERGROWN	30
	S-14	07-Oct-08	OVERGROWN	830

TABLE NM7-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Use for Sorting	Date	Parameter	
			Total Coliform [3] CFU/100mL	E.Coli [3] CFU/100mL
	S-14	07-Nov-08	OVERGROWN	290
	S-14	19-Dec-08	370	10
S-21	S-21	31-Jan-08	OVERGROWN	1670
	S-21	26-Feb-08	10	<10
	S-21	12-Mar-08	20	<10
	S-21	25-Apr-08	>200	>200
	S-21	13-May-08	OVERGROWN	160
	S-21	06-Jun-08	OVERGROWN	1270
	S-21	11-Jul-08	1870	570
	S-21	12-Aug-08	OVERGROWN	OVERGROWN
	S-21	02-Sep-08	OVERGROWN	OVERGROWN
	S-21	07-Oct-08	OVERGROWN	540
	S-21	07-Nov-08	1930	260
	S-21	19-Dec-08	OVERGROWN	OVERGROWN
S-22	S-22	25-Apr-08	>200	0
U/S	S-22	25-Apr-08	>200	0
	S-22	13-May-08	OVERGROWN	<10
U/S	S-22	13-May-08	OVERGROWN	580
	S-22	06-Jun-08	OVERGROWN	1500
U/S	S-22	06-Jun-08	OVERGROWN	OVERGROWN
	S-22	11-Jul-08	1640	20
	S-22	12-Aug-08	OVERGROWN	840
U/S	S-22	12-Aug-08	OVERGROWN	OVERGROWN
	S-22	02-Sep-08	OVERGROWN	1490
U/S	S-22	02-Sep-08	OVERGROWN	1350
	S-22	07-Oct-08	OVERGROWN	230
U/S	S-22	07-Oct-08	1700	370
	S-22	07-Nov-08	OVERGROWN	440
U/S	S-22	07-Nov-08	OVERGROWN	1120
S-23	S-23	31-Jan-08	OVERGROWN	1090
	S-23	26-Feb-08	10	<10
	S-23	12-Mar-08	20	<10
	S-23	25-Apr-08	>200	>200
	S-23	13-May-08	1400	70
	S-23	06-Jun-08	1570	340
	S-23	11-Jul-08	1920	1080
	S-23	12-Aug-08	OVERGROWN	1220
	S-23	02-Sep-08	OVERGROWN	OVERGROWN
	S-23	07-Oct-08	OVERGROWN	1830
	S-23	07-Nov-08	OVERGROWN	1110
	S-23	18-Dec-08	840	30
S-25	S-25	28-Jan-08	30	<10
	S-25	25-Feb-08	150	<10
	S-25	25-Apr-08	>200	4
	S-25	13-May-08	480	30
	S-25	06-Jun-08	940	130
	S-25	11-Jul-08	1990	130
	S-25	12-Aug-08	OVERGROWN	OVERGROWN
	S-25	02-Sep-08	1530	640
	S-25	07-Oct-08	OVERGROWN	390
	S-25	07-Nov-08	1710	180
	S-25	18-Dec-08	840	<10
S-26	S-26	25-Apr-08	>200	12
U/S	S-26	25-Apr-08	>200	1
	S-26	13-May-08	780	20
U/S	S-26	13-May-08	1790	10
	S-26	06-Jun-08	OVERGROWN	80
S-26 U/S	S-26	06-Jun-08	720	<10
	S-26	11-Jul-08	2160	160
U/S	S-26	11-Jul-08	1900	120
	S-26	12-Aug-08	OVERGROWN	OVERGROWN
U/S	S-26	12-Aug-08	OVERGROWN	OVERGROWN
	S-26	02-Sep-08	OVERGROWN	1610
U/S	S-26	02-Sep-08	OVERGROWN	1550
	S-26	07-Oct-08	OVERGROWN	100
U/S	S-26	07-Oct-08	OVERGROWN	160
	S-26	07-Nov-08	OVERGROWN	20
U/S	S-26	07-Nov-08	OVERGROWN	180
S-27	S-27	25-Apr-08	145	145
U/S	S-27	25-Apr-08	200	3

TABLE NM7-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. (1)	Use for Sorting	Date	Parameter	
			Total Coliform (3) CFU/100mL	E.Coli (3) CFU/100mL
	S-27	13-May-08	1320	<10
U/S	S-27	13-May-08	840	<10
	S-27	06-Jun-08	1120	<10
U/S	S-27	06-Jun-08	320	<10
	S-27	12-Aug-08	OVERGROWN	OVERGROWN
U/S	S-27	12-Aug-08	OVERGROWN	420
	S-27	02-Sep-08	OVERGROWN	410
U/S	S-27	02-Sep-08	OVERGROWN	410
	S-27	07-Oct-08	OVERGROWN	30
U/S	S-27	07-Oct-08	580	<10
	S-27	07-Nov-08	500	<10
U/S	S-27	07-Nov-08	OVERGROWN	1020
S-28	S-28	28-Jan-08	50	<10
Field Dup.	S-28	28-Jan-08	40	<10
	S-28	25-Feb-08	10	<10
Field Dup.	S-28	25-Feb-08	<10	<10
	S-28	11-Mar-08	<10	10
Field Dup.	S-28	11-Mar-08	<10	60
	S-28	25-Apr-08	>200	6
Field Dup.	S-28	25-Apr-08	>200	8
	S-28	13-May-08	1300	40
Field Dup.	S-28	13-May-08	1380	60
	S-28	06-Jun-08	950	490
Field Dup.	S-28	06-Jun-08	680	210
	S-28	11-Jul-08	1910	680
Field Dup.	S-28	11-Jul-08	1560	790
	S-28	12-Aug-08	OVERGROWN	OVERGROWN
Field Dup.	S-28	12-Aug-08	OVERGROWN	OVERGROWN
	S-28	02-Sep-08	OVERGROWN	1070
Field Dup.	S-28	02-Sep-08	OVERGROWN	1280
	S-28	07-Oct-08	OVERGROWN	400
Field Dup.	S-28	07-Oct-08	OVERGROWN	590
	S-28	07-Nov-08	1430	20
Field Dup.	S-28	07-Nov-08	OVERGROWN	160
	S-28	18-Dec-08	360	<10
Field Dup.	S-28	18-Dec-08	270	20
S-30	S-30	28-Jan-08	1030	370
	S-30	25-Feb-08	630	260
	S-30	11-Mar-08	210	1060
	S-30	25-Apr-08	>200	>200
	S-30	13-May-08	1550	510
	S-30	06-Jun-08	540	<10
	S-30	11-Jul-08	1280	300
	S-30	12-Aug-08	OVERGROWN	230
	S-30	02-Sep-08	OVERGROWN	120
	S-30	07-Oct-08	OVERGROWN	150
	S-30	07-Nov-08	OVERGROWN	OVERGROWN
	S-30	18-Dec-08	1310	200
S-31	S-31	28-Jan-08	1030	310
	S-31	25-Feb-08	790	240
	S-31	11-Mar-08	280	1340
	S-31	25-Apr-08	>200	>200
	S-31	13-May-08	1010	310
S-31	S-31	06-Jun-08	1080	<10
	S-31	11-Jul-08	1170	140
	S-31	12-Aug-08	OVERGROWN	70
	S-31	02-Sep-08	OVERGROWN	150
	S-31	07-Oct-08	OVERGROWN	130
	S-31	07-Nov-08	OVERGROWN	OVERGROWN
	S-31	18-Dec-08	490	110
S-32	S-32	28-Jan-08	1160	470
	S-32	25-Feb-08	430	120
	S-32	11-Mar-08	300	1450
	S-32	25-Apr-08	>200	>200
	S-32	13-May-08	1490	430
	S-32	06-Jun-08	370	<10
	S-32	11-Jul-08	1430	80
	S-32	12-Aug-08	OVERGROWN	70
	S-32	02-Sep-08	OVERGROWN	130
	S-32	07-Oct-08	OVERGROWN	150

TABLE NM7-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Use for Sorting	Date	Parameter: Total Coliform [3] CFU/100mL	Parameter: E.Coli [3] CFU/100mL
	S-32	07-Nov-08	OVERGROWN	OVERGROWN
	S-32	18-Dec-08	OVERGROWN	220
S-33	S-33	28-Jan-08	950	290
	S-33	25-Feb-08	620	290
	S-33	11-Mar-08	310	1000
	S-33	25-Apr-08	>200	>200
	S-33	13-May-08	1670	490
	S-33	06-Jun-08	280	<10
	S-33	11-Jul-08	1340	60
	S-33	12-Aug-08	OVERGROWN	80
	S-33	02-Sep-08	OVERGROWN	110
	S-33	07-Oct-08	OVERGROWN	70
	S-33	07-Nov-08	OVERGROWN	OVERGROWN
	S-33	18-Dec-08	620	140
S-34	S-34	28-Jan-08	750	270
	S-34	25-Feb-08	1090	540
	S-34	11-Mar-08	420	1740
	S-34	25-Apr-08	>200	>200
	S-34	13-May-08	1370	280
	S-34	06-Jun-08	510	<10
	S-34	11-Jul-08	1020	120
	S-34	12-Aug-08	OVERGROWN	50
	S-34	02-Sep-08	OVERGROWN	90
	S-34	07-Oct-08	OVERGROWN	80
	S-34	07-Nov-08	OVERGROWN	130
	S-34	18-Dec-08	910	110
S-35	S-35	25-Apr-08	350	<10
	S-35	07-Oct-08	OVERGROWN	10
	S-35	07-Nov-08	OVERGROWN	190
S-36	S-36	25-Apr-08	210	<10
	S-36	13-May-08	430	<10
	S-36	06-Jun-08	420	<10
	S-36	07-Nov-08	OVERGROWN	240

Notes:

"-" = No Data

1. See Table NM7-1 for sample location descriptions
2. CCME 2007 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999.
   Update 7.0 - 2007.
   Chapter 4 -Aquatic Life
3. Half of the April 25 samples were processed by Quanti-Tray (QT) with a detection limit of 0 and upper count of 200 in units of Most Probable Number (MPN)/100 mL and included sampling sites S-21, S-22, S-22 U/S, S-23, S-25, S-26, S-26 U/S, S-27, S-27 U/S, S-99, S-28, CON D/S, S-30, S-31, S-32, S-33 and S-34.

BOLD - Exceedance of Criteria

TABLE NM7-5
HERBICIDES IN SURFACE WATER
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter [2]						
		2,4-D	AMPA	Bromoxynil	Dicamba	Glyphosate	MCPA	Picloram
EQL		*0.1*	*1*	*0.1*	*0.1*	*1*	*0.1*	*0.1*
CCME [3]								
Freshwater Aquatic Life		4	-	5	10	65	2.6	29
VEG D/S (Stn 50+500)	25-Apr-08	<0.1	<1	<0.1	<0.1	<1	<0.1	<0.1
VEG U/S (Stn 11+000)	25-Apr-08	<0.1	<1	<0.1	<0.1	<1	<0.1	<0.1

Notes:

"-" = No Data

EQL = Estimated Quantitation Limit = The lowest level of the parameter that can be quantified with confidence

1. See Table NM7-1 for sample location descriptions
2. All values are expressed in micrograms per lite (µg/L).
3. CCME 2003 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Update 7.0 - 2007.
   Guidelines for Canadian Drinking Water Quality.
   Chapter 4 - Aquatic Life

BOLD	- Parameter Detected
BOLD & Shaded	- Exceedance of Criteria

TABLE NM7-6
LEVEL I EVENT BASED TSS MONITORING REVIEW
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample Date	Amount of Precipitation (mm) for the Monitoring Event [1]	Approximate Duration (hrs)	Year Storm [2]	Estimated							Actual						
				Floodway - Downstream of Construction			Red River - Downstream of Outlet			Change in Red River Sediment Concentration (%)	Floodway - Downstream of Construction			Red River - Downstream of Outlet			Change in Red River Sediment Concentration (%)
				Flow (cms)	TSS (mg/L)	Sediment Load (tonne/day)	Flow (cms)	TSS (mg/L)	Sediment Load (tonne/day)		Flow (cms)	TSS (mg/L)	Sediment Load (tonne/day)	Flow (cms)	TSS (mg/L)	Sediment Load (tonne/day)	
13-May-08	20.0 - 24.0	11.0	<2	1.12	15.2	1.5	344.05	108.7	3,232	**-0.28%**	1.12	5	0.5	314.76	77	2,094	**-0.33%**
26-May-08	7.0 - 11.0	11.0	<2	3.65	26.1	8.2	302.99	70.2	1,836	**-0.75%**	3.65	24	7.6	205.93	54	961	**-0.97%**
06-Jun-08	23.9 - 53.0	9.0	<2 - <5	2.26	825.6	161.2	155.70	52.5	706	**21.08%**	2.26	1700	331.9	166.76	54	778	**40.76%**
09-Jun-08	12.2 - 26.0	18.5	<2	3.08	58.1	15.5	155.70	61.2	823	**-0.10%**	3.08	62	16.5	210.82	53	965	**0.24%**
12-Jun-08	11.5 - 17.0	6.5	<2	4.64	20.5	8.2	155.70	81.4	1,095	**-2.16%**	4.64	9	3.6	254.88	63	1,387	**-1.53%**
28-Jun-08	14.0 - 24.0	10.5	<2	1.79	132.6	20.5	506.90	162.0	7,093	**-0.06%**	1.79	150	23.2	436.53	170	6,412	**-0.05%**
11-Jul-08	3.8 - 21.0	3.0	<2	0.57	36.4	1.8	191.99	126.7	2,101	**-0.21%**	0.57	44	2.2	186.83	72	1,162	**-0.12%**
29-Jul-08	5.3 - 20.3	1.5	<2	0.57	85.6	4.2	146.39	50.9	643	**0.26%**	0.57	77	3.8	149.45	38	491	**0.39%**
12-Aug-08	17.5 - 80.0	28.0	<2 - <5	0.57	34.1	1.7	147.25	47.7	607	**-0.11%**	0.57	28	1.4	130.68	35	395	**-0.09%**
22-Aug-08	0.5 - 26.4	9.0	<2	0.57	53.0	2.6	142.43	90.7	1,116	**-0.17%**	0.57	51	2.5	140.31	88	1,067	**-0.17%**
02-Sep-08	14.6 - 29.0	4.5	<2	0.26	44.2	1.0	127.43	82.3	906	**-0.09%**	0.26	300	6.7	135.53	68	796	**0.65%**
23-Sep-08	8.7 - 33.8	16.5	<2	0.96	135.2	11.2	160.84	174.5	2,426	**-0.13%**	0.96	140	11.6	187.56	120	1,945	**0.08%**
07-Oct-08	8.0 - 19.0	12.5	<2	1.17	61.9	6.3	127.43	53.4	588	**0.14%**	1.17	57	5.8	109.23	47	444	**0.22%**
13-Oct-08	19.1 - 33.0	12.0	<2	2.65	51.4	11.8	87.38	33.6	254	**1.56%**	2.65	58	13.3	148.88	37	476	**0.99%**
07-Nov-08	11.4 - 52.3	48.0	<2	0.96	42.2	3.5	344.05	177.9	5,289	**-0.21%**	0.96	36	3.0	371.80	200	6,425	**-0.21%**

Notes:
1 - Amount of precipitation measured varied between the different weather stations
2 - Year Storm is an approximate calculation based on the Atmospheric Environment Service, Rainfall Intensity - Duration Frequency Values for the Winnipeg Int'l Airport and recorded precipitation at the unofficial rain gauge sites
5 = Laboratory value is <5

TABLE NM7-7
FLOODWAY OUTLET TSS MONITORING
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Time	Field Data	Parameter
			Turbidity (NTU) [2]	TSS (mg/L) [3]
Detection Limit				*5*
CCME [4]				
Freshwater Aquatic Life				[4]
TSS Monitoring				
S-34	14-Mar-08	10:00	8.56	6
S-30	14-Mar-08	10:15	7.75	13
S-31	14-Mar-08	10:40	15.52	7
S-33	14-Mar-08	11:15	8.05	9
S-34	14-Mar-08	13:00	8.76	<5
S-30	14-Mar-08	13:15	9.35	7
S-31	14-Mar-08	13:30	12.09	6
S-33	14-Mar-08	14:00	10.79	<5
S-34	14-Mar-08	16:45	10.44	9
S-30	14-Mar-08	16:30	10.32	<5
S-31	14-Mar-08	16:15	12.04	15
S-33	14-Mar-08	16:00	11.33	9
S-34	17-Mar-08	10:31	10.47	85
S-30	17-Mar-08	10:44	19.33	17
S-31	17-Mar-08	10:56	12.85	17
S-33	17-Mar-08	11:10	17.47	20
S-34	17-Mar-08	13:30	10.15	45
S-30	17-Mar-08	13:40	11.24	18
S-31	17-Mar-08	13:51	10.56	9
S-33	17-Mar-08	14:00	9.70	8
S-34	17-Mar-08	18:00	10.31	9
S-30	17-Mar-08	18:10	9.48	5
S-31	17-Mar-08	18:20	10.11	<5
S-33	17-Mar-08	18:30	10.53	5
S-34	18-Mar-08	10:30	8.29	5
S-30	18-Mar-08	10:42	8.34	5
S-31	18-Mar-08	10:50	8.43	<5
S-33	18-Mar-08	11:05	9.37	8
S-34	18-Mar-08	13:20	9.55	11
S-30	18-Mar-08	13:40	8.07	10
S-31	18-Mar-08	13:48	5.61	9
S-33	18-Mar-08	14:00	5.30	7
S-34	18-Mar-08	17:30	8.55	7
S-30	18-Mar-08	17:36	8.64	6
S-31	18-Mar-08	17:45	8.18	13
S-33	18-Mar-08	18:00	8.94	8
S-34	19-Mar-08	10:57	7.00	5
S-30	19-Mar-08	11:10	6.88	<5
S-31	19-Mar-08	11:50	7.12	<5
S-33	19-Mar-08	12:07	7.95	6
S-34	19-Mar-08	17:15	10.98	<5
S-30	19-Mar-08	17:28	8.82	6
S-31	19-Mar-08	17:55	8.12	5
S-33	19-Mar-08	18:17	9.55	6
S-34	20-Mar-08	10:00	12.38	9
S-30	20-Mar-08	10:10	13.58	8
S-31	20-Mar-08	10:21	12.18	9
S-33	20-Mar-08	10:40	10.86	6

TABLE NM7-7
FLOODWAY OUTLET TSS MONITORING
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

Sample No. [1]	Date	Time	Field Data	Parameter
			Turbidity (NTU) [2]	TSS (mg/L) [3]
Detection Limit				*5*
CCME [4]				
Freshwater Aquatic Life				[4]
TSS Monitoring				
S-34	20-Mar-08	13:30	11.76	8
S-30	20-Mar-08	13:40	11.33	5
S-31	20-Mar-08	13:58	11.98	6
S-33	20-Mar-08	14:10	11.81	10
S-34	20-Mar-08	17:30	10.62	8
S-30	20-Mar-08	17:40	10.78	6
S-31	20-Mar-08	17:50	10.65	7
S-33	20-Mar-08	18:00	11.50	9
S-34	21-Mar-08	10:00	9.86	7
S-30	21-Mar-08	10:10	9.62	5
S-31	21-Mar-08	10:15	9.54	7
S-33	21-Mar-08	10:30	9.70	8
S-34	21-Mar-08	13:15	10.66	7
S-30	21-Mar-08	13:25	10.56	8
S-31	21-Mar-08	13:35	10.71	6
S-33	21-Mar-08	13:45	10.26	10
S-34	21-Mar-08	17:15	11.87	9
S-30	21-Mar-08	17:25	11.52	7
S-31	21-Mar-08	17:35	11.78	9
S-33	21-Mar-08	17:50	10.80	5
S-34	22-Mar-08	10:00	11.76	12
S-30	22-Mar-08	10:08	10.93	13
S-31	22-Mar-08	10:18	10.64	10
S-33	22-Mar-08	10:31	10.56	10
S-34	22-Mar-08	14:00	11.74	7
S-30	22-Mar-08	14:10	11.32	6
S-31	22-Mar-08	14:20	11.37	6
S-33	22-Mar-08	14:30	10.79	7
S-34	23-Mar-08	10:30	10.31	5
S-30	23-Mar-08	10:40	17.41	9
S-31	23-Mar-08	10:50	10.79	5
S-33	23-Mar-08	11:05	10.07	5
S-34	23-Mar-08	13:00	10.21	6
S-30	23-Mar-08	13:10	12.30	10
S-31	23-Mar-08	13:20	11.56	7
S-33	23-Mar-08	13:25	9.99	8
S-34	24-Mar-08	10:15	9.53	5
S-30	24-Mar-08	10:25	9.13	10
S-31	24-Mar-08	10:35	8.99	10
S-33	24-Mar-08	10:45	10.11	5
S-34	24-Mar-08	13:18	9.26	8
S-30	24-Mar-08	13:24	10.14	7
S-31	24-Mar-08	13:32	9.86	9
S-33	24-Mar-08	13:49	9.72	8
S-34	24-Mar-08	17:16	9.55	7
S-30	24-Mar-08	17:23	10.31	7
S-31	24-Mar-08	17:32	11.05	11
S-33	24-Mar-08	17:42	10.13	15

TABLE NM7-7
FLOODWAY OUTLET TSS MONITORING
RED RIVER FLOODWAY - 2008 SURFACE WATER MONITORING

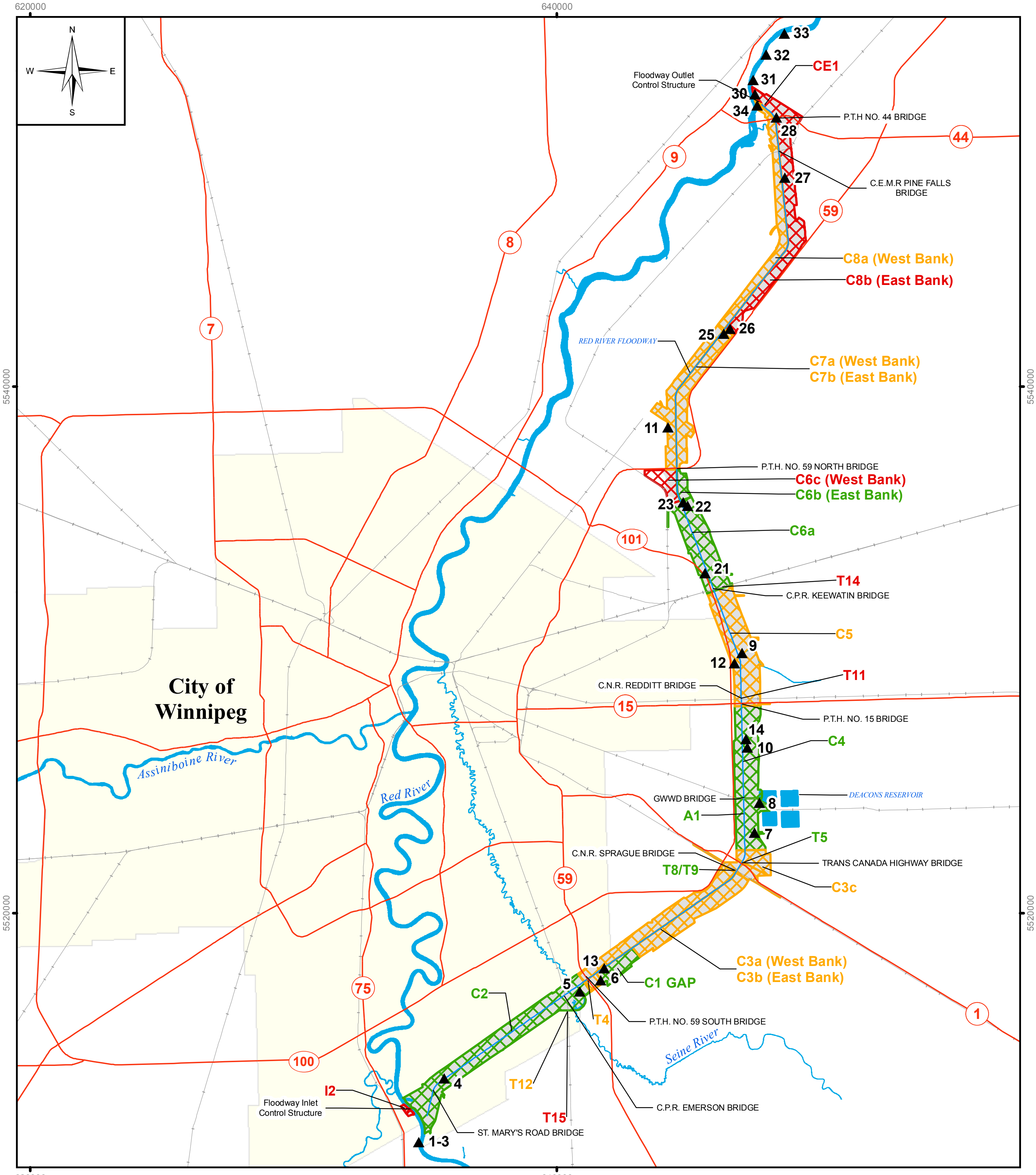
Sample No. (1)	Date	Time	Field Data	Parameter
			Turbidity (NTU) (2)	TSS (mg/L) (3)
Detection Limit				*5*
CCME (4)				
Freshwater Aquatic Life				(4)
TSS Monitoring				
S-34	25-Mar-08	9:04	8.39	<5
S-30	25-Mar-08	9:07	8.64	5
S-31	25-Mar-08	9:10	8.07	5
S-33	25-Mar-08	9:15	11.04	8
S-34	26-Mar-08	9:30	8.86	6
S-30	26-Mar-08	9:50	8.13	8
S-31	26-Mar-08	10:30	8.92	6
S-33	26-Mar-08	11:00	10.83	9
S-34	27-Mar-08	9:30	8.64	8
S-30	27-Mar-08	9:40	10.55	11
S-31	27-Mar-08	10:20	9.19	9
S-33	27-Mar-08	10:45	12.79	12
S-34	28-Mar-08	9:15	8.52	8
S-30	28-Mar-08	9:37	9.05	5
S-31	28-Mar-08	10:15	9.77	10
S-33	28-Mar-08	10:45	12.06	9
S-34	29-Mar-08	8:30	8.59	<5
S-30	29-Mar-08	8:35	7.83	<5
S-31	29-Mar-08	8:39	7.81	<5
S-33	29-Mar-08	8:42	10.16	9
S-34	30-Mar-08	9:15	11.00	6
S-30	30-Mar-08	9:40	22.73	13
S-31	30-Mar-08	10:20	21.68	11
S-33	30-Mar-08	11:00	13.08	6
S-34	31-Mar-08	11:30	22.91	14
S-30	31-Mar-08	-	-	-
S-31	31-Mar-08	13:15	23.27	17
S-33	31-Mar-08	12:45	20.44	23

Notes:

1. See Table NM7-1 for sample location descriptions.
2. Turbidity values are an average of three replicate samples.
3. Suspended Sediments Guidelines Narrative (see fact sheet for complete details):
   Clear Flow:
   Maximum increase of 25 mg/L from background levels for any short-term exposure (eg. 24 hr period).
   Maximum average increase of 5 mg/L from background levels for longer term exposures (eg. Inputs lasting between 24 hrs and 30 days).
   Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L.
   High Flow:
   Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L.
   Should not increase more than 10% of background levels when background is >250 mg/L.
4. CCME 2007 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Update 7.0 - 2007. Chapter 4 -Aquatic Life

BOLD - Exceedance of Criteria

FIGURES



MEMO REFERENCE 05-1100-01.9905241-NM7

▲10 Surface Water Sampling Locations

C0 Completed Prior to 2008

C0 Completed During 2008

C0 Still Active at End of 2008

Completed Prior to 2008

Completed During 2008

Still Active at End of 2008

1:200,000

2 0 2 4 6 8 10

Kilometres

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

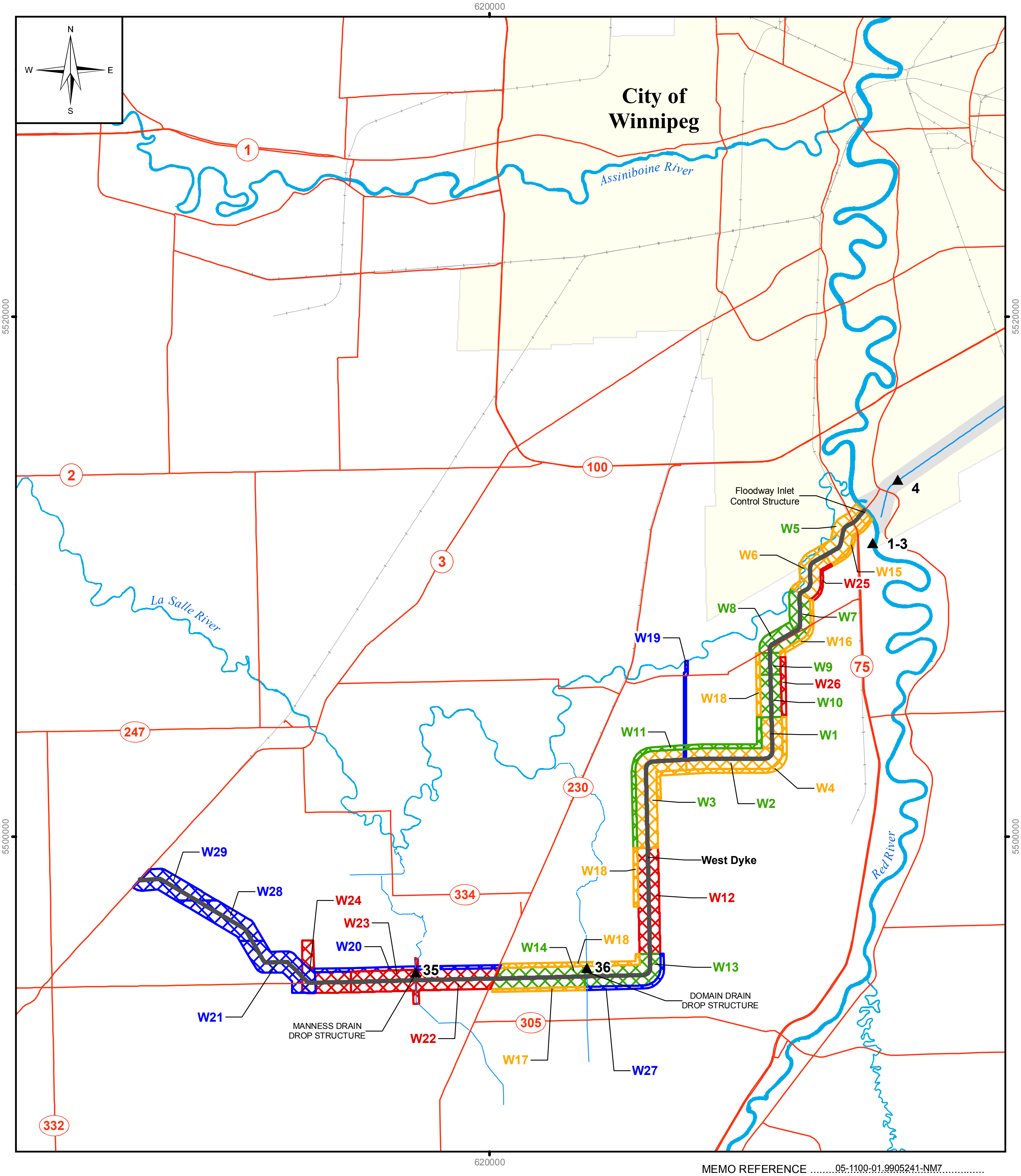
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

FLOODWAY CHANNEL SAMPLE LOCATIONS

JANUARY 2008	FIGURE NM7-1	REV 0

X:\projects\2003\03-1100-01\GIS\Archive\Contract_General\9905241\MXDs\NM7-1.mxd



▲35 Surface Water Sampling Locations

W0 Completed Prior to 2008

W0 Completed During 2008

W0 Still Active at End of 2008

W0 Future Contract in 2009

Completed Prior to 2008

Completed During 2008

Still Active at End of 2008

Future Contract in 2009

1:200,000

2 0 2 4 6 8 10

Kilometres

MEMO REFERENCE 05-1100-01.9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

FLOODWAY CHANNEL SAMPLE LOCATIONS

JANUARY 2008	FIGURE NM7-2	REV 0

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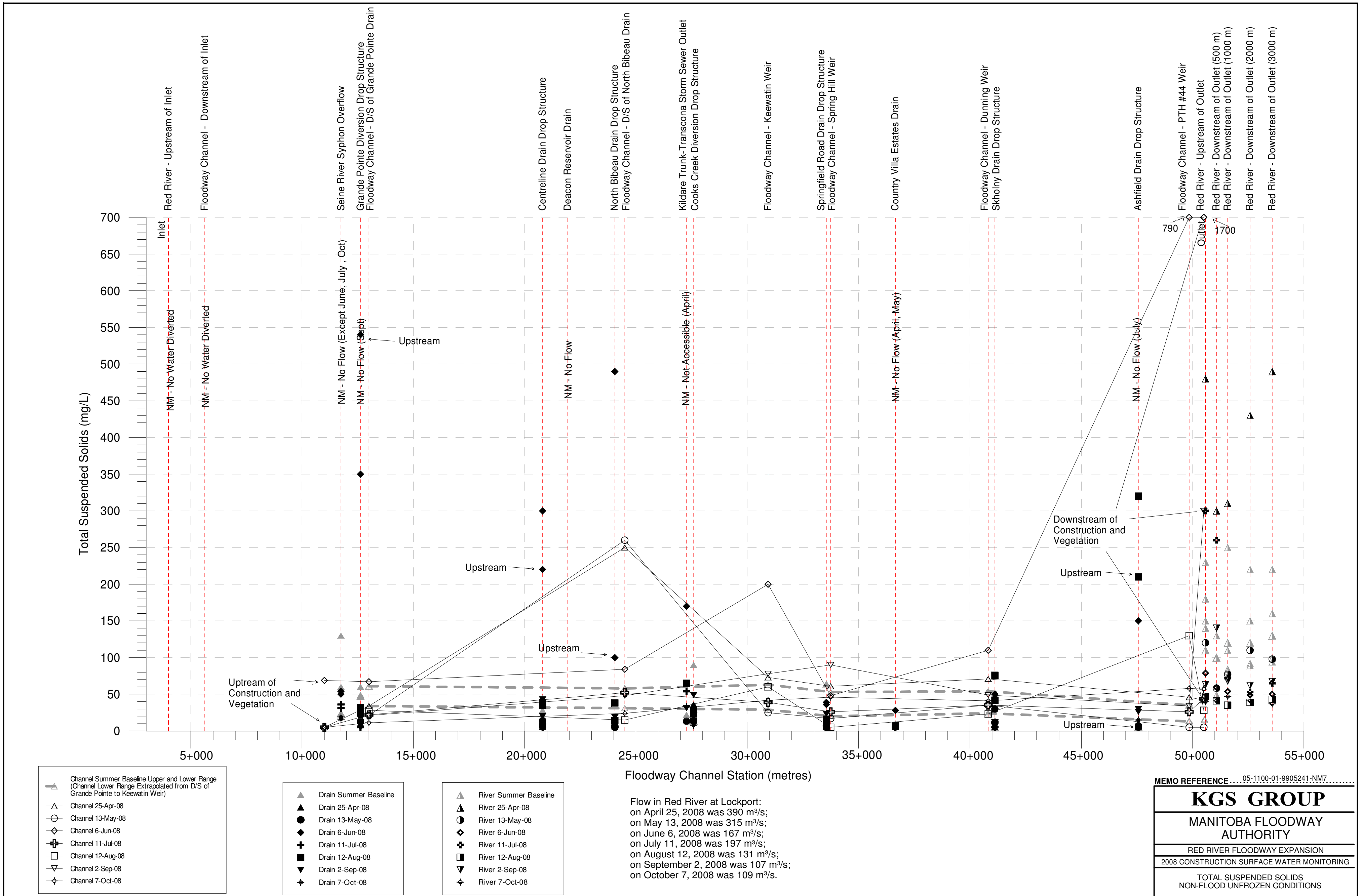


MEMO REFERENCE: 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

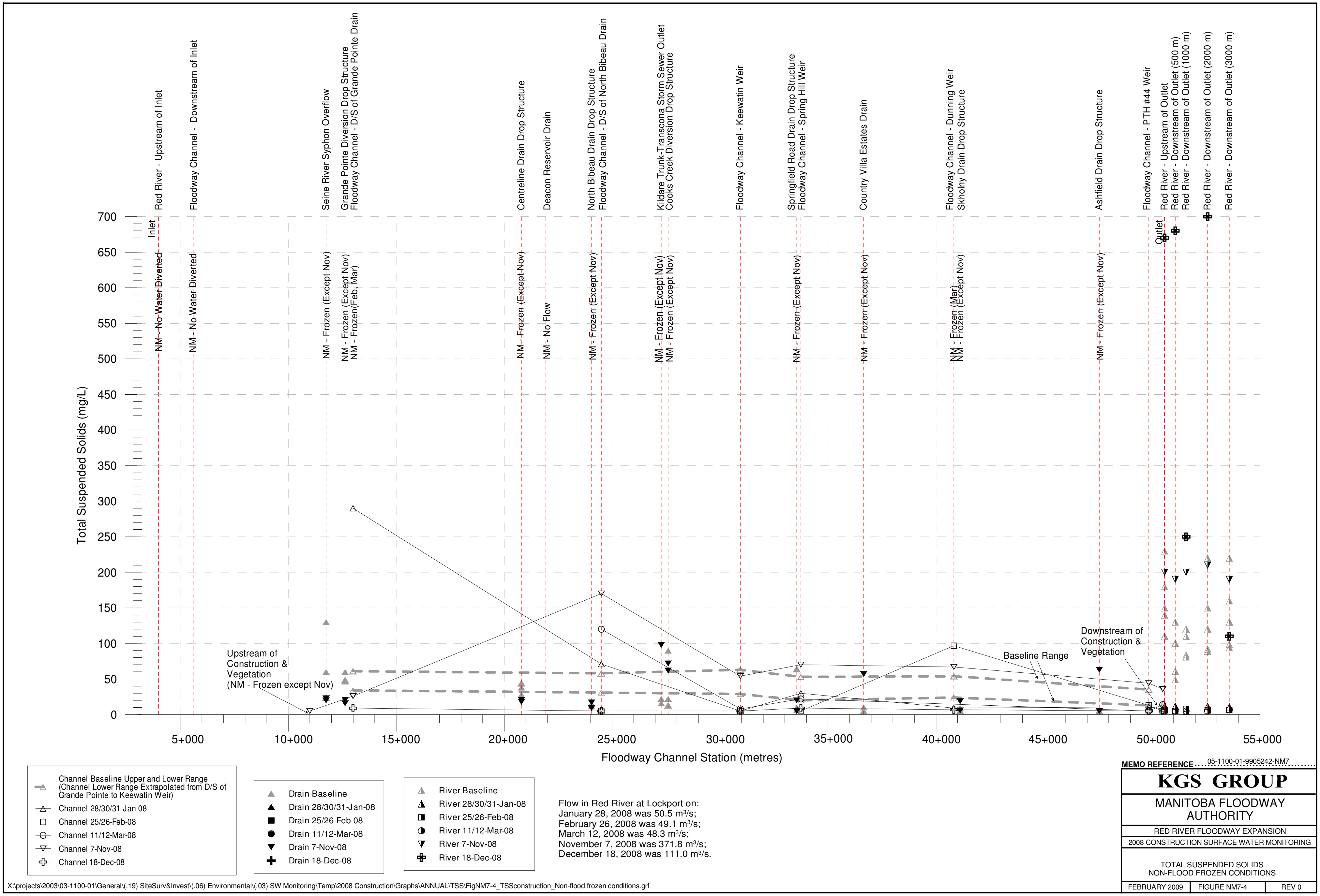
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

TOTAL SUSPENDED SOLIDS
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-3 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\TSS construction\FigNM7-3_TSS construction_Non_flood unfrozen conditions.grf


Red River - Upstream of Inlet
Floodway Channel - Downstream of Inlet
Seine River Syphon Overflow
Grande Pointe Diversion Drop Structure
Floodway Channel - D/S of Grande Pointe Drain
Centreline Drain Drop Structure
Deacon Reservoir Drain
North Bibeau Drain Drop Structure
Floodway Channel - D/S of North Bibeau Drain
Kildare Trunk-Transcona Storm Sewer Outlet
Cooks Creek Diversion Drop Structure
Floodway Channel - Keewatin Weir
Springfield Road Drain Drop Structure
Floodway Channel - Spring Hill Weir
Country Villa Estates Drain
Floodway Channel - Dunning Weir
Skholny Drain Drop Structure
Ashfield Drain Drop Structure
Floodway Channel - PTH #44 Weir
Red River - Upstream of Outlet
Red River - Downstream of Outlet (500 m)
Red River - Downstream of Outlet (1000 m)
Red River - Downstream of Outlet (2000 m)
Red River - Downstream of Outlet (3000 m)
Inlet
Outlet
NM - No Water Diverted
NM - No Water Diverted
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
NM - Frozen(Feb, Mar)
NM - Frozen (Except Nov)
NM - No Flow
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
NM - Frozen (Mar)
NM - Frozen (Except Nov)
NM - Frozen (Except Nov)
Total Suspended Solids (mg/L)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Upstream of Construction & Vegetation (NM - Frozen except Nov)
Baseline Range
Downstream of Construction & Vegetation
5+000
10+000
15+000
20+000
25+000
30+000
35+000
40+000
45+000
50+000
55+000
Floodway Channel Station (metres)
Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 28/30/31-Jan-08
Channel 25/26-Feb-08
Channel 11/12-Mar-08
Channel 7-Nov-08
Channel 18-Dec-08
Drain Baseline
Drain 28/30/31-Jan-08
Drain 25/26-Feb-08
Drain 11/12-Mar-08
Drain 7-Nov-08
Drain 18-Dec-08
River Baseline
River 28/30/31-Jan-08
River 25/26-Feb-08
River 11/12-Mar-08
River 7-Nov-08
River 18-Dec-08
Flow in Red River at Lockport on:
January 28, 2008 was 50.5 m³/s;
February 26, 2008 was 49.1 m³/s;
March 12, 2008 was 48.3 m³/s;
November 7, 2008 was 371.8 m³/s;
December 18, 2008 was 111.0 m³/s.
MEMO REFERENCE 05-1100-01-9905242-NM7
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2008 CONSTRUCTION SURFACE WATER MONITORING
TOTAL SUSPENDED SOLIDS
NON-FLOOD FROZEN CONDITIONS
FEBRUARY 2009
FIGURE NM7-4
REV 0
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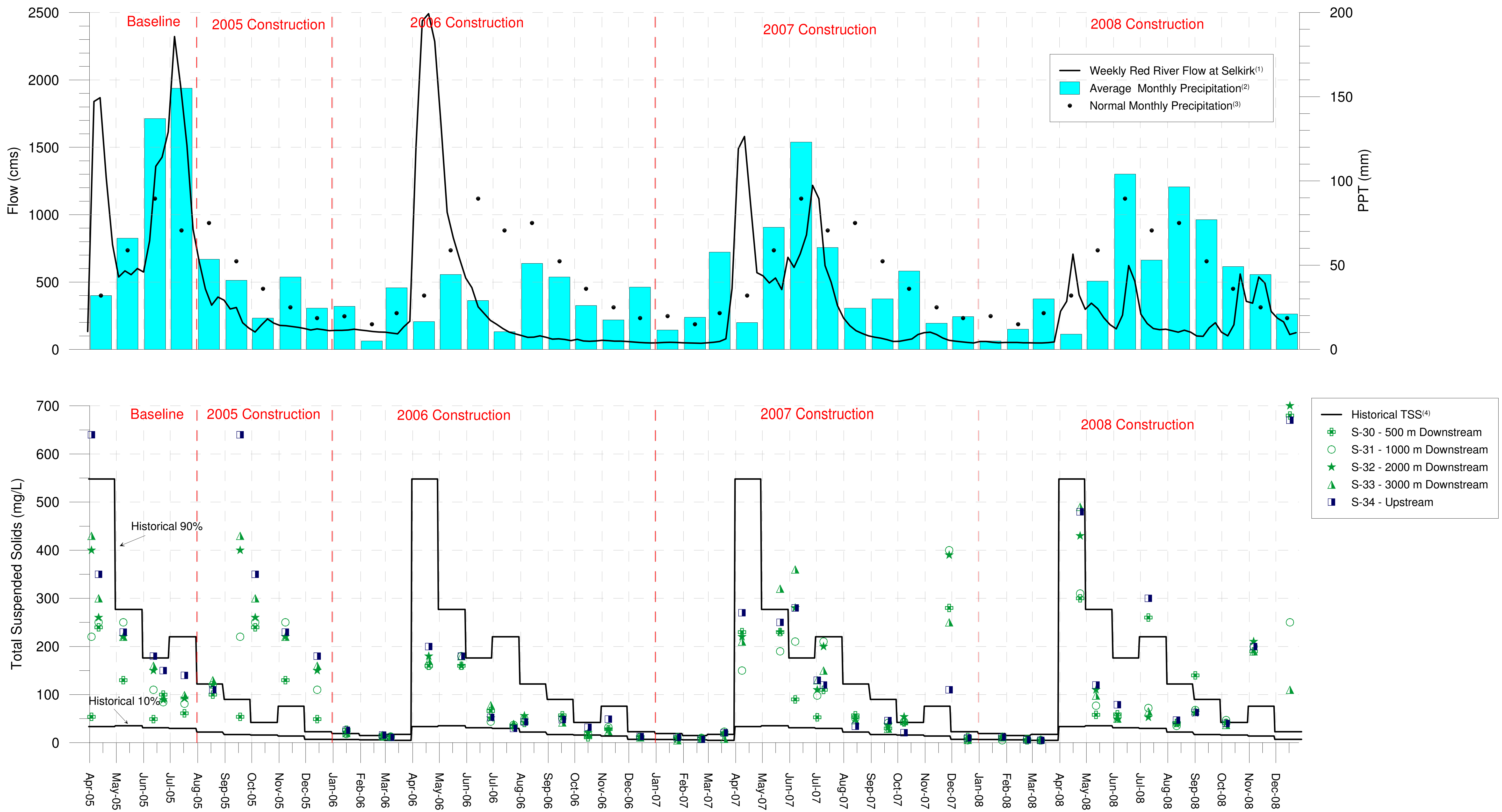

Notes

1 - Province of Manitoba, Manitoba Water Stewardship, Hydrologic Forecast Centre; Weekly River Flow Reports.
2 - Environment Canada. 2005. The Green Lane Weather Office, Climate Data Winnipeg International Airport.
3 - Environment Canada. 2001. Canadian Climate Normals 1971-200, Winnipeg International Airport, Manitoba.
4 - Historical Data obtained from the Proposed Floodway Expansion Project Environmental Assessment Report
Completed by Tetres (August 2004).Surface water quality parameters were summarized to the 10th and 90th percentile.
Monthly range based on data collected once a month by Manitoba Water Stewardship from 1970 to 2003 in the Red River at Selkirk (downstream of the Floodway Outlet).

MEMO REFERENCE 05-1100-01.9905242.NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION
2008 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
TOTAL SUSPENDED SOLIDS

FEBRUARY 2009	FIGURE NM7-5	REV 0

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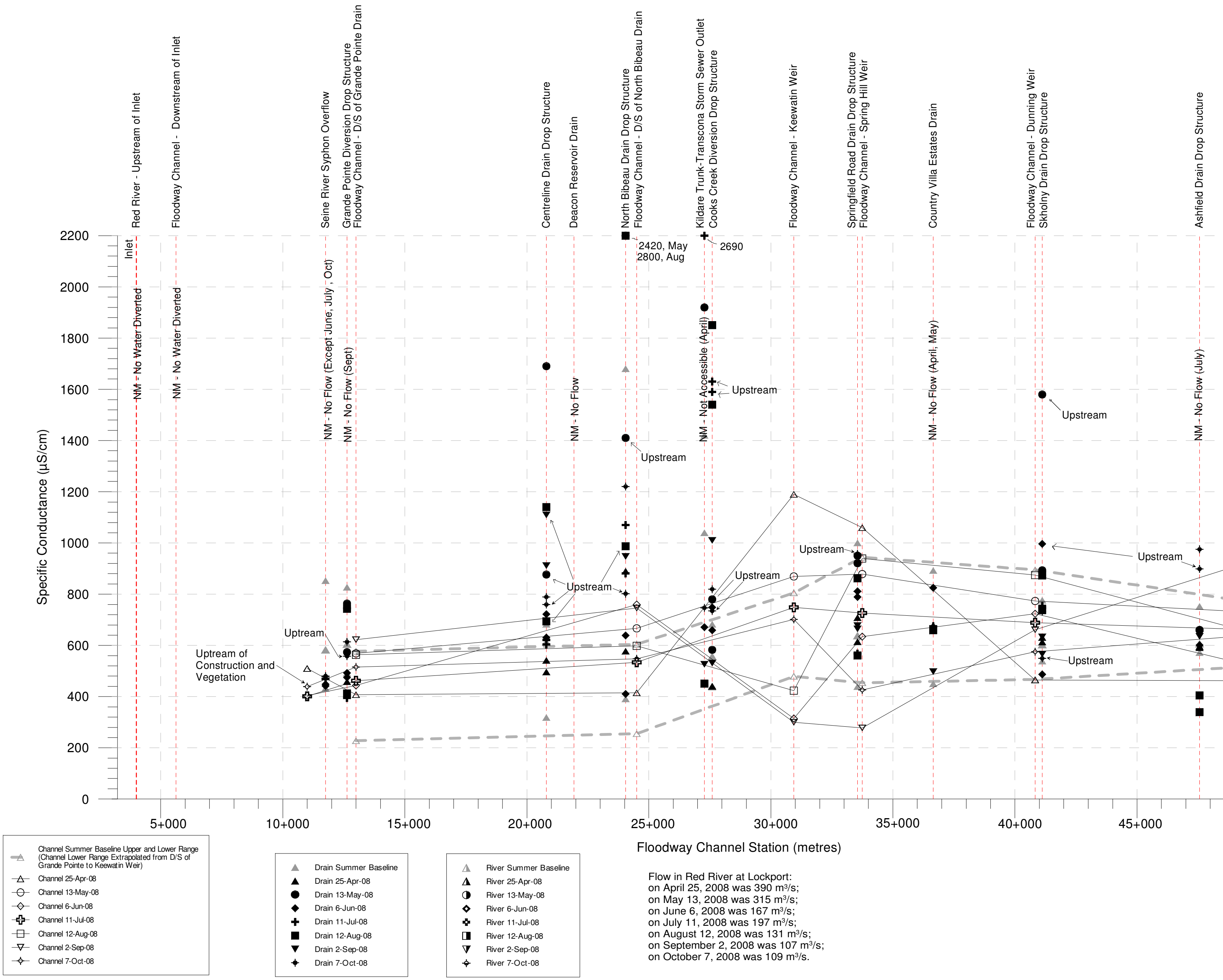

Flow in Red River at Lockport:
on April 25, 2008 was 390 m³/s;
on May 13, 2008 was 315 m³/s;
on June 6, 2008 was 167 m³/s;
on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.

MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

SPECIFIC CONDUCTANCE
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-6	REV 0

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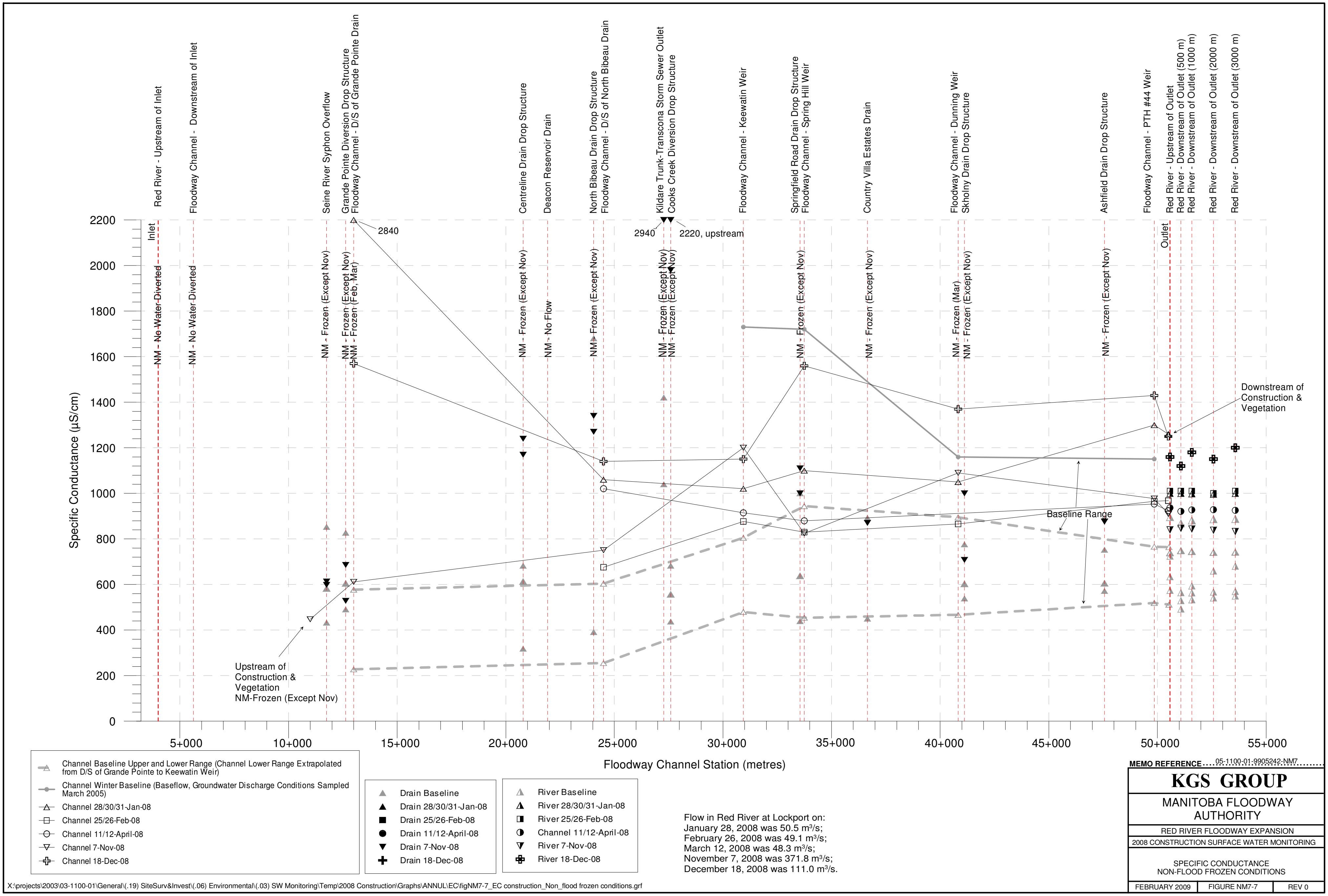
Red River - Upstream of Inlet
Floodway Channel - Downstream of Inlet
Seine River Syphon Overflow
Grande Pointe Diversion Drop Structure
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Ashfield Drain Drop Structure
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Red River - Upstream of Outlet
Red River - Downstream of Outlet (500 m)
Red River - Downstream of Outlet (1000 m)
Red River - Downstream of Outlet (2000 m)
Red River - Downstream of Outlet (3000 m)
Inlet
Outlet
NM - No Water Diverted
NM - Frozen (Except Nov)
NM - Frozen (Feb, Mar)
NM - No Flow
NM - Frozen (Mar)
2840
2940
2220, upstream
Downstream of Construction & Vegetation
Baseline Range
Upstream of Construction & Vegetation NM-Frozen (Except Nov)
Specific Conductance (µS/cm)
Floodway Channel Station (metres)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
5+000
10+000
15+000
20+000
25+000
30+000
35+000
40+000
45+000
50+000
55+000
Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel Winter Baseline (Baseflow, Groundwater Discharge Conditions Sampled March 2005)
Channel 28/30/31-Jan-08
Channel 25/26-Feb-08
Channel 11/12-April-08
Channel 7-Nov-08
Channel 18-Dec-08
Drain Baseline
Drain 28/30/31-Jan-08
Drain 25/26-Feb-08
Drain 11/12-April-08
Drain 7-Nov-08
Drain 18-Dec-08
River Baseline
River 28/30/31-Jan-08
River 25/26-Feb-08
Channel 11/12-April-08
River 7-Nov-08
River 18-Dec-08
Flow in Red River at Lockport on:
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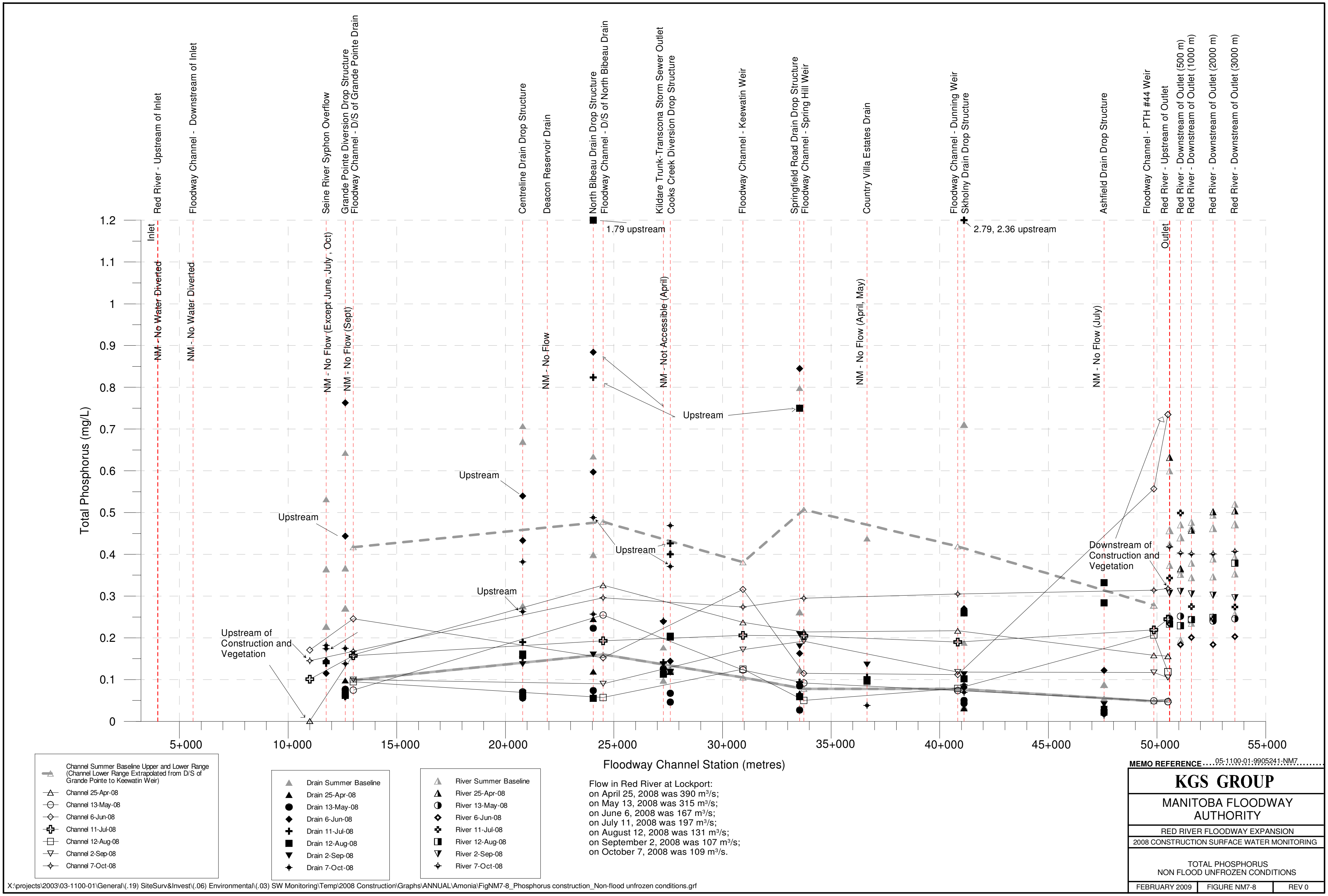
November 7, 2008 was 371.8 m³/s;
December 18, 2008 was 111.0 m³/s.
MEMO REFERENCE 05-1100-01-9905242-NM7
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2008 CONSTRUCTION SURFACE WATER MONITORING
SPECIFIC CONDUCTANCE
NON-FLOOD FROZEN CONDITIONS
FEBRUARY 2009
FIGURE NM7-7
REV 0
X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUL\EC\figNM7-7_EC construction_Non_flood frozen conditions.grf



Red River - Upstream of Inlet
Floodway Channel - Downstream of Inlet
Seine River Syphon Overflow
Grande Pointe Diversion Drop Structure
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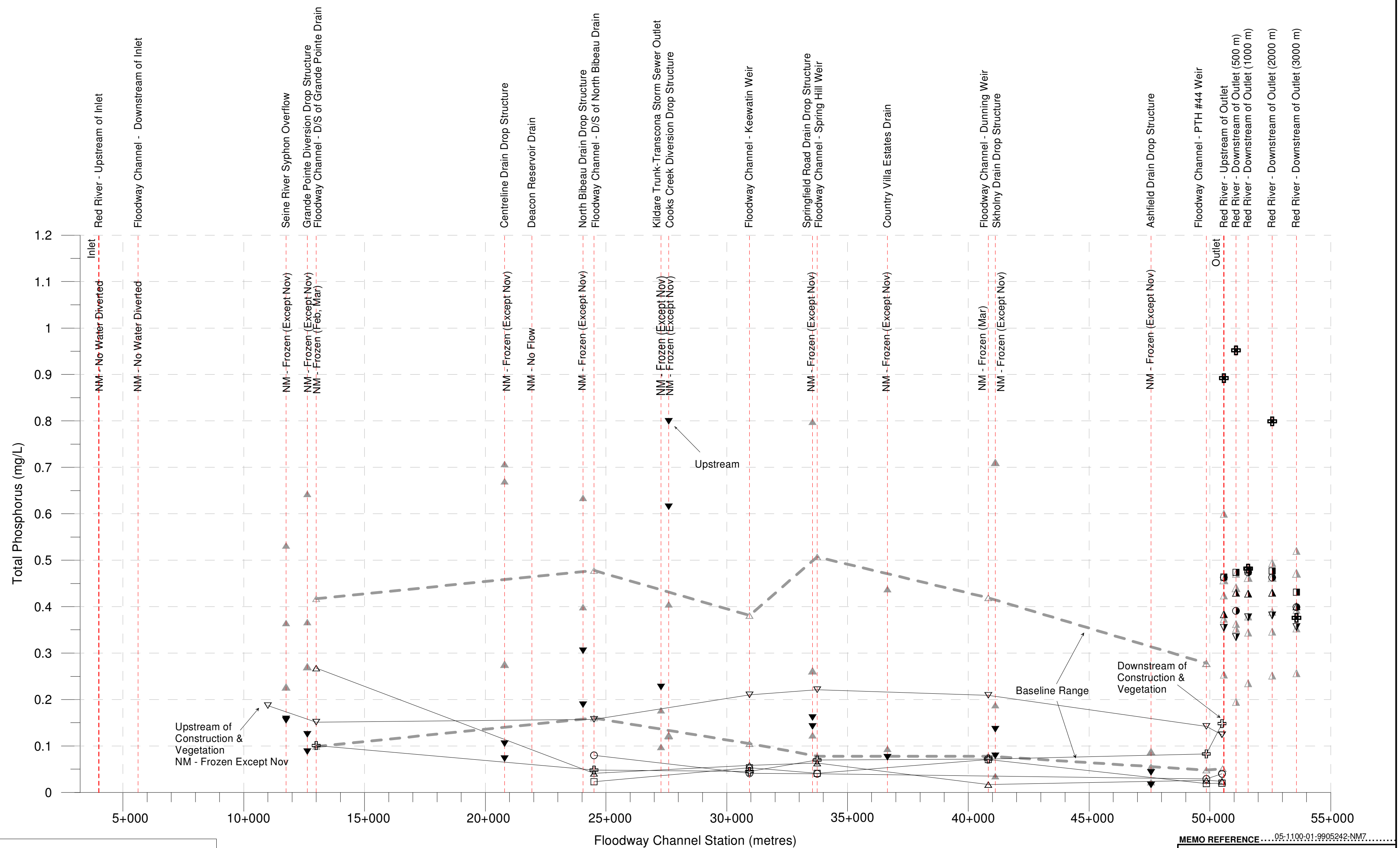
Floodway Channel - PTH #44 Weir
Red River - Upstream of Outlet
Red River - Downstream of Outlet (500 m)
Red River - Downstream of Outlet (1000 m)
Red River - Downstream of Outlet (2000 m)
Red River - Downstream of Outlet (3000 m)
Inlet
Outlet
NM - No Water Diverted
NM - No Water Diverted
NM - No Flow (Except June, July, Oct)
NM - No Flow (Sept)
NM - No Flow
NM - Not Accessible (April)
NM - No Flow (April, May)
NM - No Flow (July)
1.79 upstream
2.79, 2.36 upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream of Construction and Vegetation
Downstream of Construction and Vegetation
Total Phosphorus (mg/L)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
5+000
10+000
15+000
20+000
25+000
30+000
35+000
40+000
45+000
50+000
55+000
Floodway Channel Station (metres)
Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 25-Apr-08
Channel 13-May-08
Channel 6-Jun-08
Channel 11-Jul-08
Channel 12-Aug-08
Channel 2-Sep-08
Channel 7-Oct-08
Drain Summer Baseline
Drain 25-Apr-08
Drain 13-May-08
Drain 6-Jun-08
Drain 11-Jul-08
Drain 12-Aug-08
Drain 2-Sep-08
Drain 7-Oct-08
River Summer Baseline
River 25-Apr-08
River 13-May-08
River 6-Jun-08
River 11-Jul-08
River 12-Aug-08
River 2-Sep-08
River 7-Oct-08
Flow in Red River at Lockport:
on April 25, 2008 was 390 m³/s;
on May 13, 2008 was 315 m³/s;
on June 6, 2008 was 167 m³/s;
on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.
MEMO REFERENCE 05-1100-01-9905241-NM7
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2008 CONSTRUCTION SURFACE WATER MONITORING
TOTAL PHOSPHORUS
NON FLOOD UNFROZEN CONDITIONS
FEBRUARY 2009
FIGURE NM7-8
REV 0
X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Amonia\FigNM7-8_Phosphorus construction_Non-flood unfrozen conditions.grf



Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 28/30/31-Jan-08
Channel 25/26-Feb-08
Channel 11/12-Mar-08
Channel 7-Nov-08
Channel 18-Dec-08

Drain Baseline
Drain 28/30/31-Jan-08
Drain 25/26-Feb-08
Drain 11/12-Mar-08
Drain 7-Nov-08
Drain 18-Dec-08

River Baseline
River 28/30/31-Jan-08
River 25/26-Feb-08
River 11/12-Mar-08
River 7-Nov-08
River 18-Dec-08

Flow in Red River at Lockport on:
January 28, 2008 was 50.5 m^3/s;
February 26, 2008 was 49.1 m^3/s;
March 12, 2008 was 48.3 m^3/s;
November 7, 2008 was 371.8 m^3/s;
December 18, 2008 was 111.0 m^3/s.

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

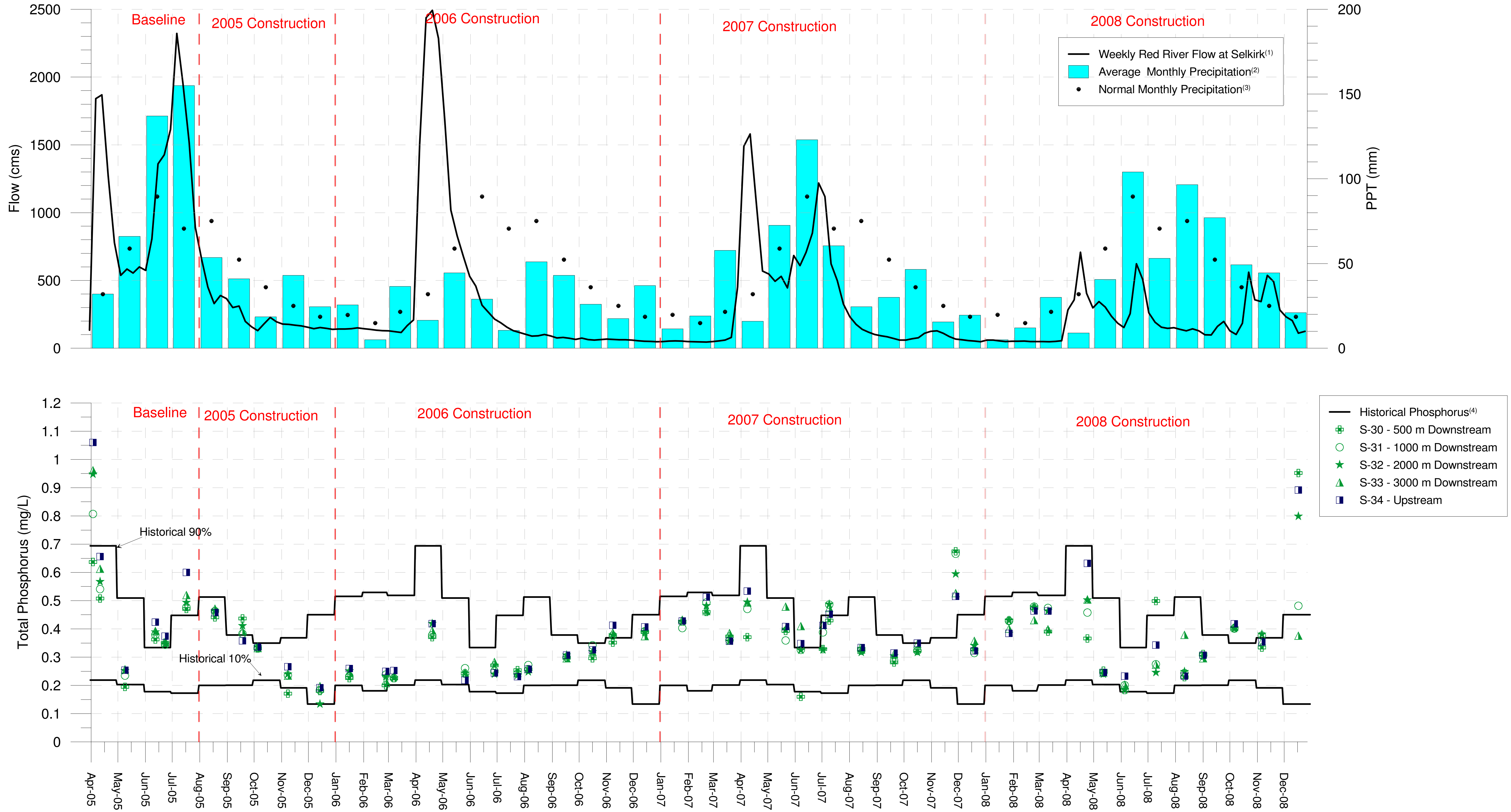
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

TOTAL PHOSPHORUS
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-9	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Phosphorus\FigNM7-9_Phosphorus construction_Non_flood frozen conditions.grf



Notes

1 - Province of Manitoba, Manitoba Water Stewardship, Hydrologic Forecast Centre; Weekly River Flow Reports.
2 - Environment Canada. 2005. The Green Lane Weather Office, Climate Data Winnipeg International Airport.
3 - Environment Canada. 2001. Canadian Climate Normals 1971-200, Winnipeg International Airport, Manitoba.
4 - Historical Data obtained from the Proposed Floodway Expansion Project Environmental Assessment Report
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Monthly range based on data collected once a month by Manitoba Water Stewardship from 1970 to 2003 in the Red River
at Selkirk (downstream of the Floodway Outlet).

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

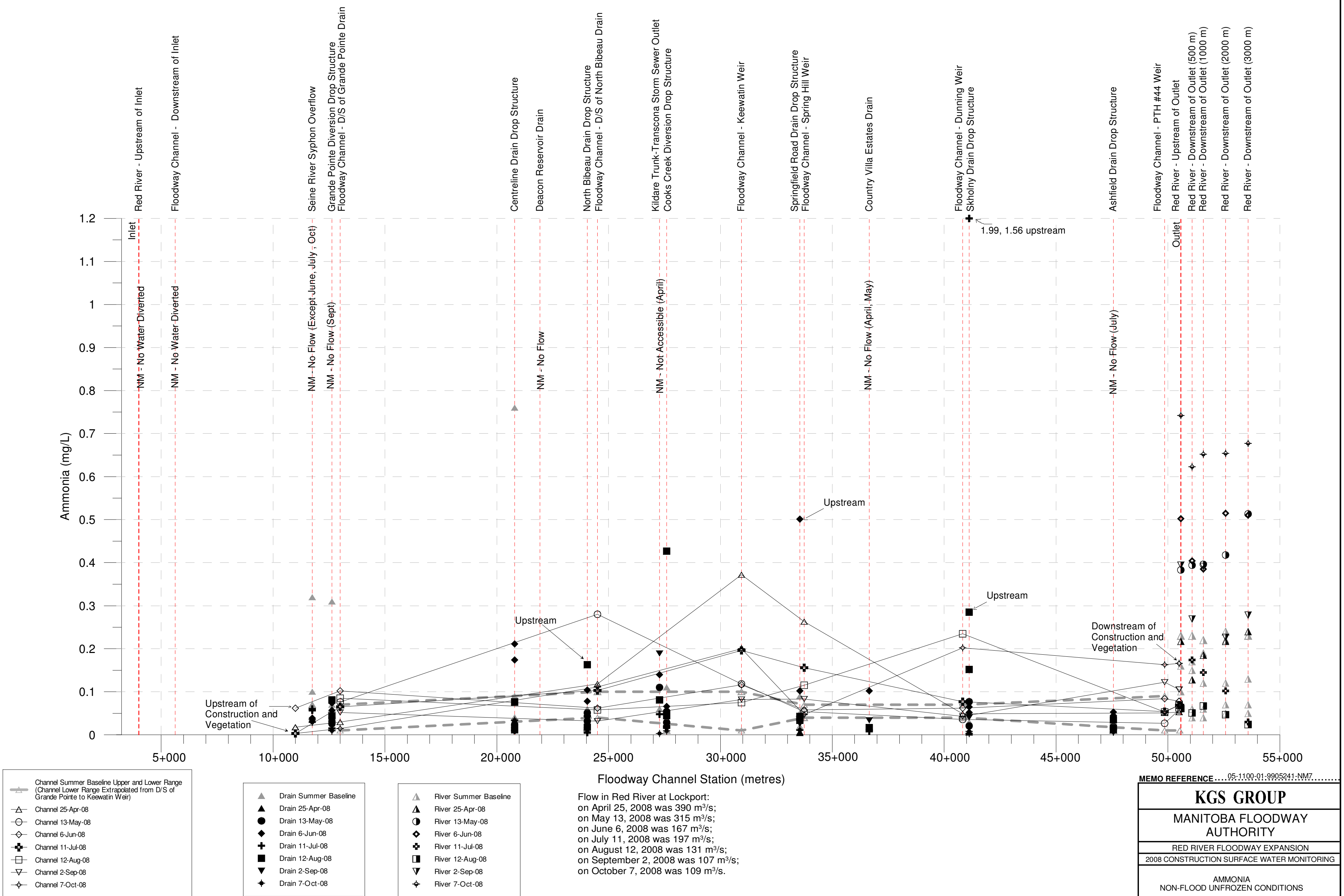
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
TOTAL PHOSPHORUS

FEBRUARY 2009	FIGURE NM7-10	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\Annual\Historical Data



Flow in Red River at Lockport:
on April 25, 2008 was 390 m³/s;
on May 13, 2008 was 315 m³/s;
on June 6, 2008 was 167 m³/s;
on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.

MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

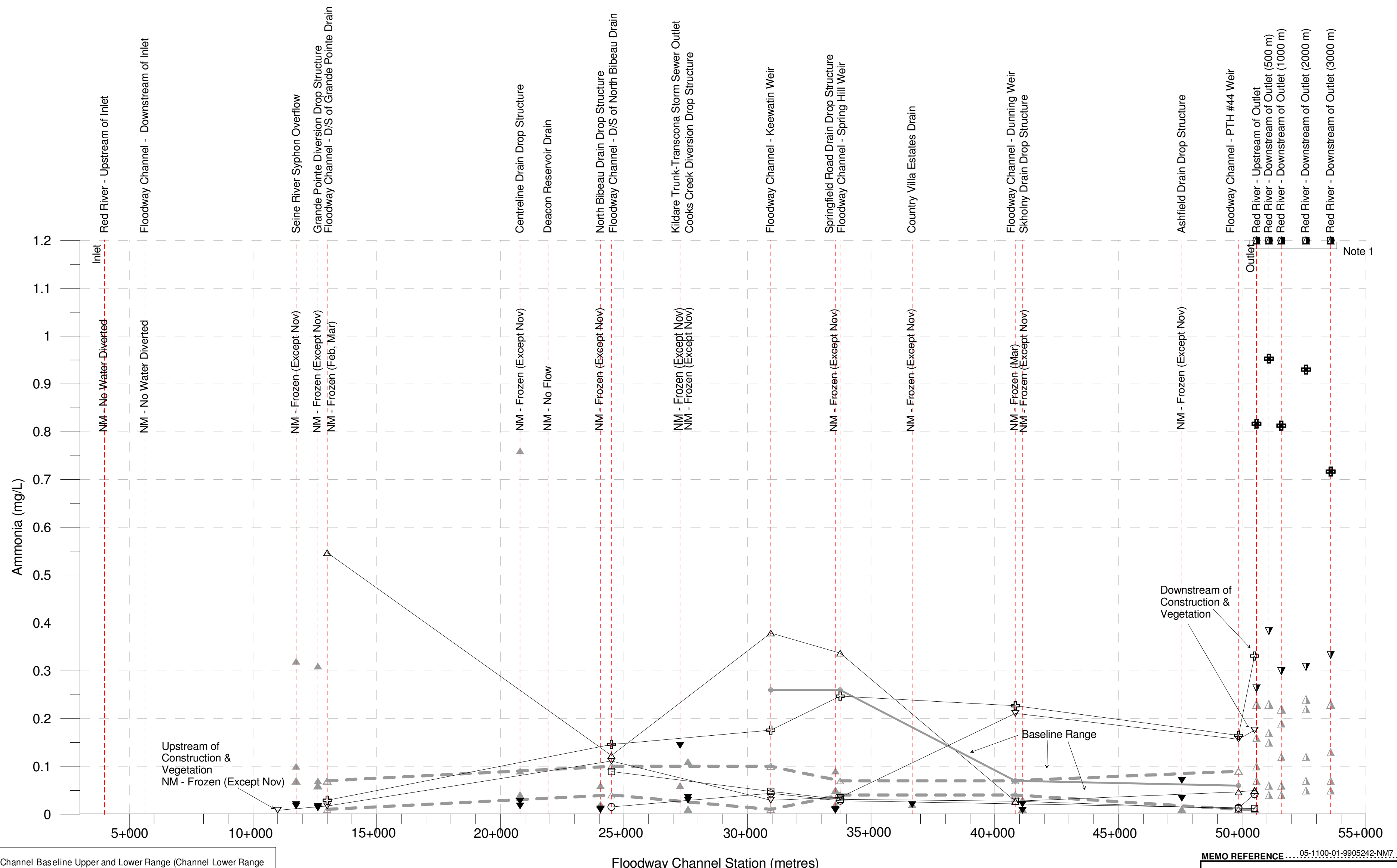
RED RIVER FLOODWAY EXPANSION

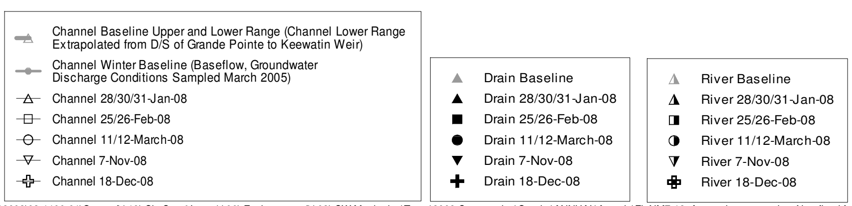
2008 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-11	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Ammonia\FigNM7-11_Ammonia constuction_Non_flood unfrozen conditions.grf





Flow in Red River at Lockport on:
January 28, 2008 was 50.5 m³/s;
February 26, 2008 was 49.1 m³/s;
March 12, 2008 was 48.3 m³/s;
November 7, 2008 was 371.8 m³/s;
December 18, 2008 was 111.0 m³/s.

Note 1,
January range: 1.62 - 2.07
February range: 1.58 - 1.90
March range: 1.46 - 2.20

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

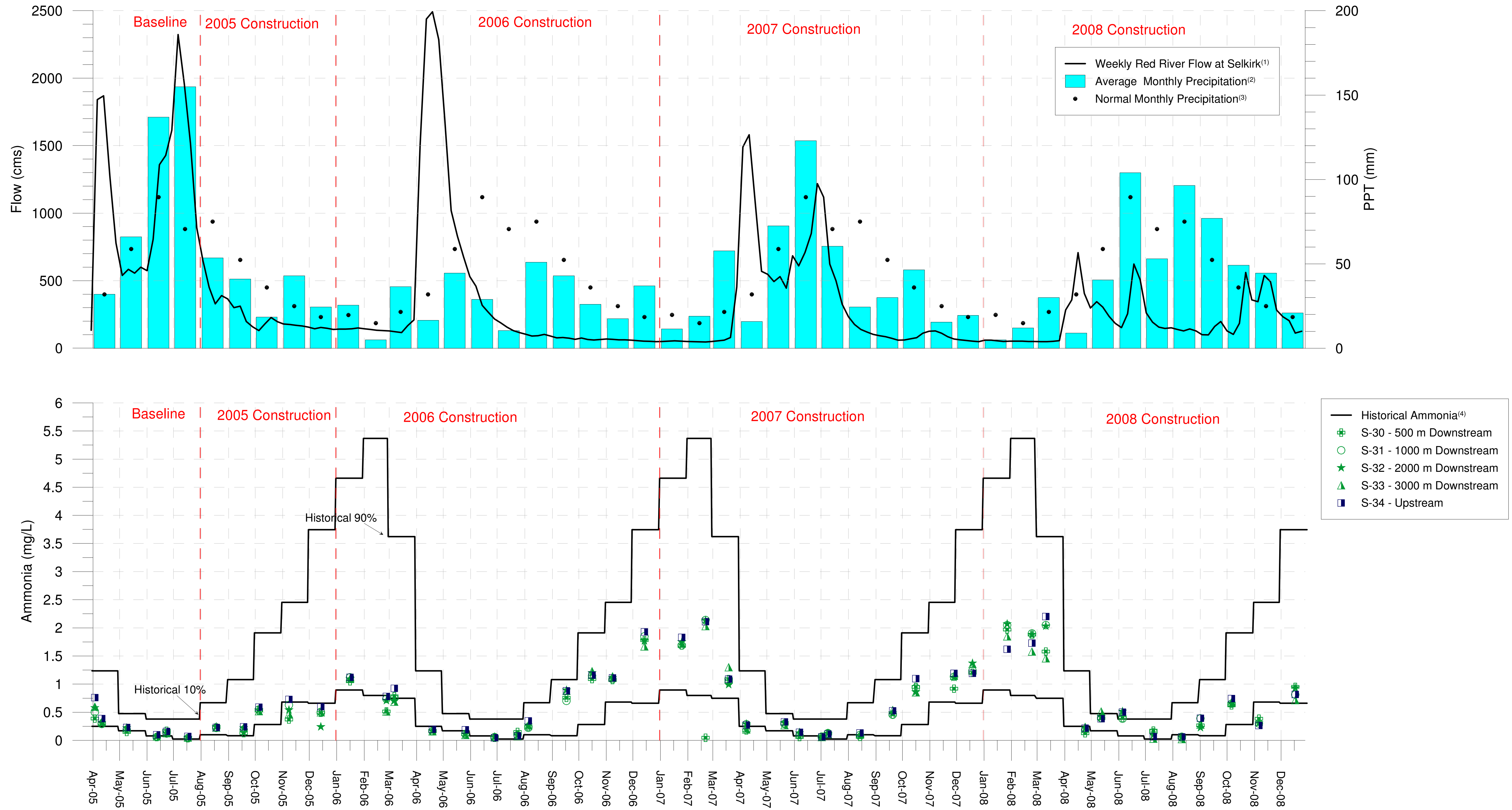
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-12	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Amonia\FigNM7-12_Ammonia construction_Non-flood frozen conditions.grf



Notes

1 - Province of Manitoba, Manitoba Water Stewardship, Hydrologic Forecast Centre; Weekly River Flow Reports.
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3 - Environment Canada. 2001. Canadian Climate Normals 1971-200, Winnipeg International Airport, Manitoba.
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Completed by Tetres (August 2004).Surface water quality parameters were summarized to the 10th and 90th percentile.
Monthly range based on data collected once a month by Manitoba Water Stewardship from 1970 to 2003 in the Red River at Selkirk (downstream of the Floodway Outlet).

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

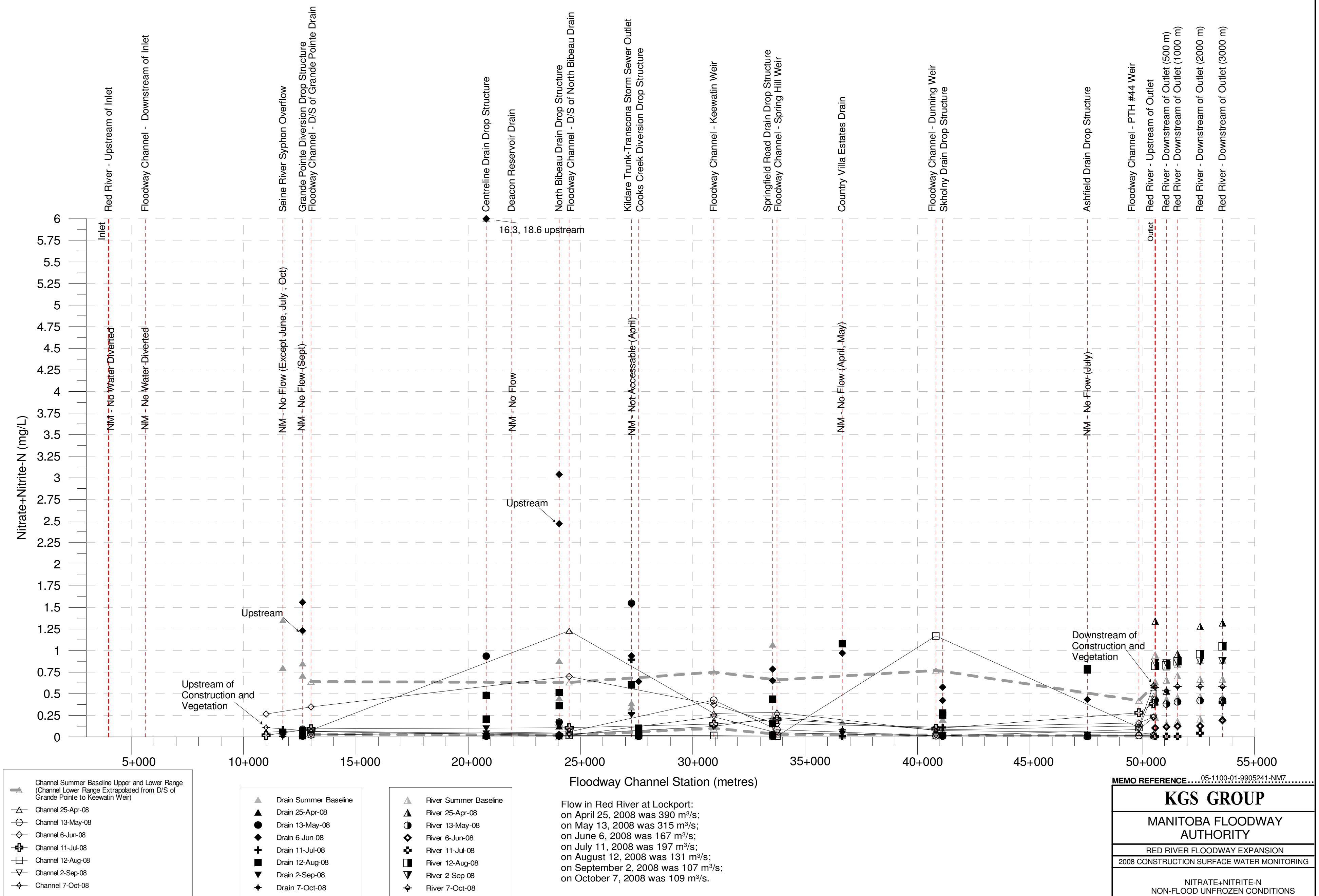
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
AMMONIA

FEBRUARY 2009	FIGURE NM7-13	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\Annual\Historical Data



Flow in Red River at Lockport:
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on June 6, 2008 was 167 m³/s;
on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.

MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

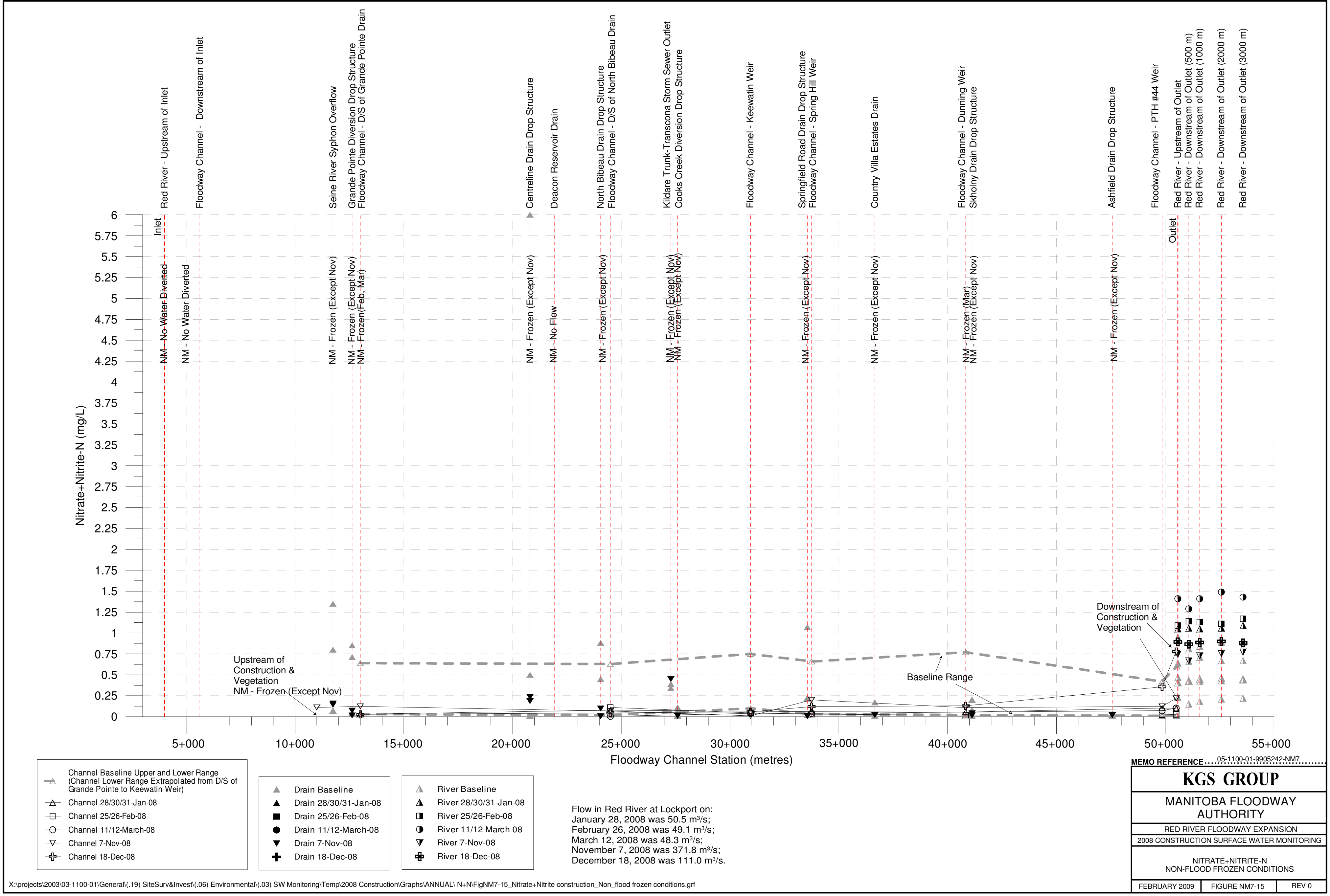
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-14	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\Annual\FigNM7.14_Nitrate+Nitrite construction_Non_flood_unfrozen conditions.grf



MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

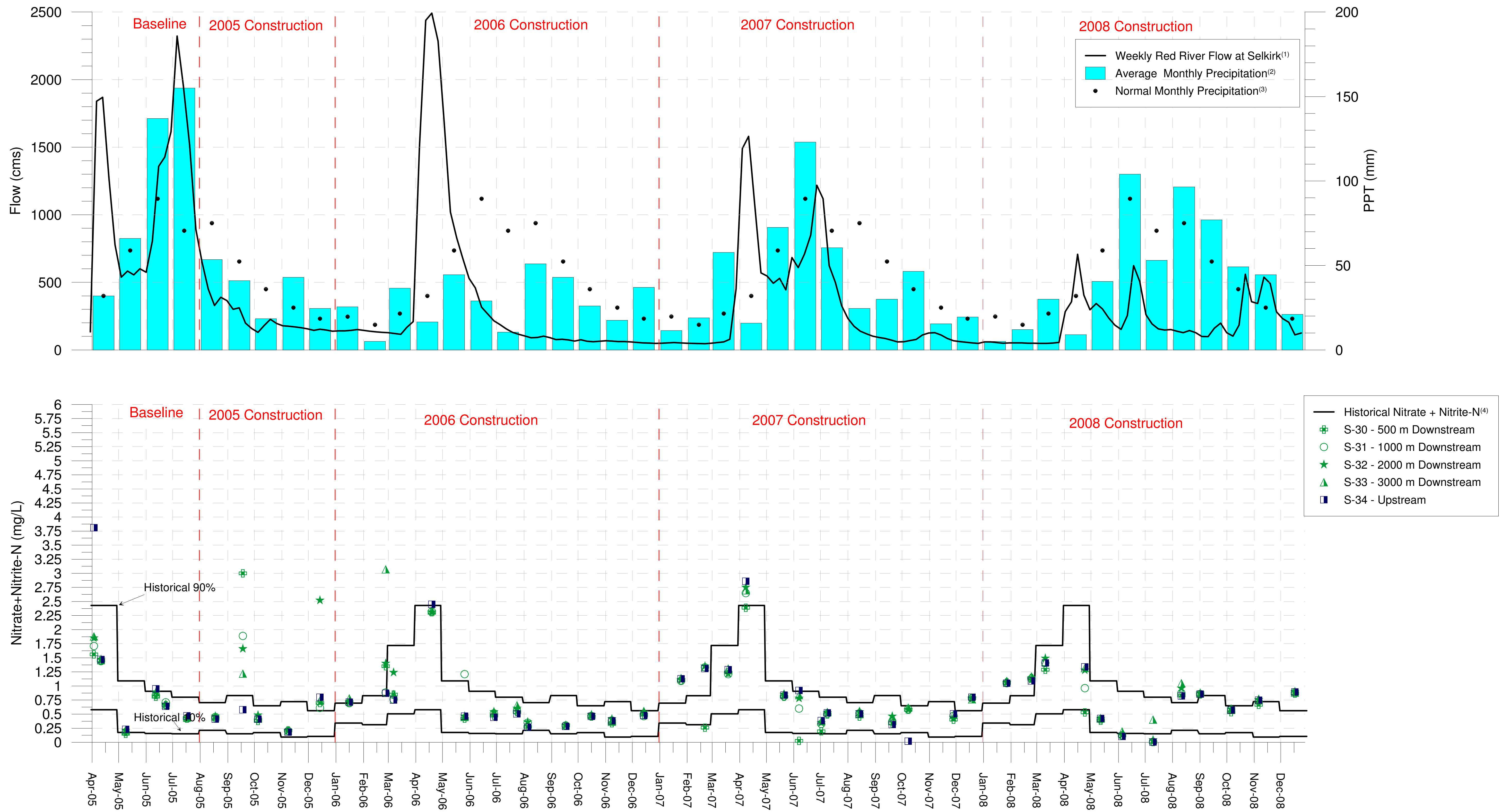
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-15 | REV 0



Notes

1 - Province of Manitoba, Manitoba Water Stewardship, Hydrologic Forecast Centre; Weekly River Flow Reports.
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3 - Environment Canada. 2001. Canadian Climate Normals 1971-200, Winnipeg International Airport, Manitoba.
4 - Historical Data obtained from the Proposed Floodway Expansion Project Environmental Assessment Report

Completed by Tetres (August 2004).Surface water quality parameters were summarized to the 10th and 90th percentile.
Monthly range based on data collected once a month by Manitoba Water Stewardship from 1970 to 2003 in the Red River at Selkirk (downstream of the Floodway Outlet).

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\Annual\Historical Tables

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

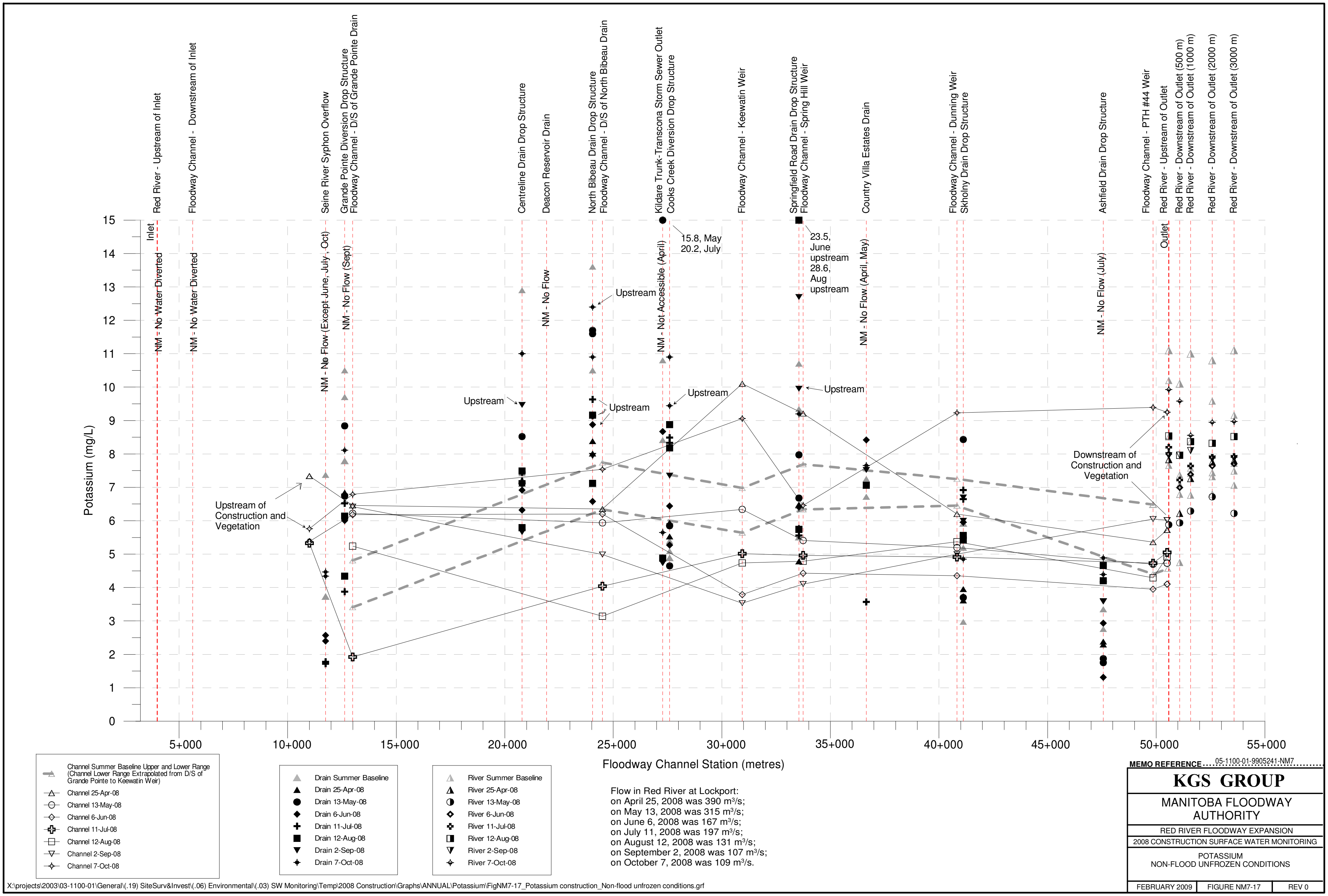
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
NITRATE + NITRITE-N

FEBRUARY 2009	FIGURE NM7-16	REV 0



Red River - Upstream of Inlet
Floodway Channel - Downstream of Inlet
Seine River Syphon Overflow
Grande Pointe Diversion Drop Structure
Floodway Channel - D/S of Grande Pointe Drain
Centreline Drain Drop Structure
Deacon Reservoir Drain
North Bibeau Drain Drop Structure
Floodway Channel - D/S of North Bibeau Drain
Kildare Trunk-Transcona Storm Sewer Outlet
Cooks Creek Diversion Drop Structure
Floodway Channel - Keewatin Weir
Springfield Road Drain Drop Structure
Floodway Channel - Spring Hill Weir
Country Villa Estates Drain
Floodway Channel - Dunning Weir
Skolny Drain Drop Structure
Ashfield Drain Drop Structure
Floodway Channel - PTH #44 Weir
Red River - Upstream of Outlet
Red River - Downstream of Outlet (500 m)
Red River - Downstream of Outlet (1000 m)
Red River - Downstream of Outlet (2000 m)
Red River - Downstream of Outlet (3000 m)
Inlet
Outlet
NM - No Water Diverted
NM - No Water Diverted
NM - No Flow (Except June, July, Oct)
NM - No Flow (Sept)
NM - No Flow
NM - Not Accessible (April)
NM - No Flow (April, May)
NM - No Flow (July)
15.8, May
20.2, July
23.5, June upstream
28.6, Aug upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream of Construction and Vegetation
Downstream of Construction and Vegetation
Potassium (mg/L)
Floodway Channel Station (metres)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
5+000
10+000
15+000
20+000
25+000
30+000
35+000
40+000
45+000
50+000
55+000
Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 25-Apr-08
Channel 13-May-08
Channel 6-Jun-08
Channel 11-Jul-08
Channel 12-Aug-08
Channel 2-Sep-08
Channel 7-Oct-08
Drain Summer Baseline
Drain 25-Apr-08
Drain 13-May-08
Drain 6-Jun-08
Drain 11-Jul-08
Drain 12-Aug-08
Drain 2-Sep-08
Drain 7-Oct-08
River Summer Baseline
River 25-Apr-08
River 13-May-08
River 6-Jun-08
River 11-Jul-08
River 12-Aug-08
River 2-Sep-08
River 7-Oct-08
Flow in Red River at Lockport:
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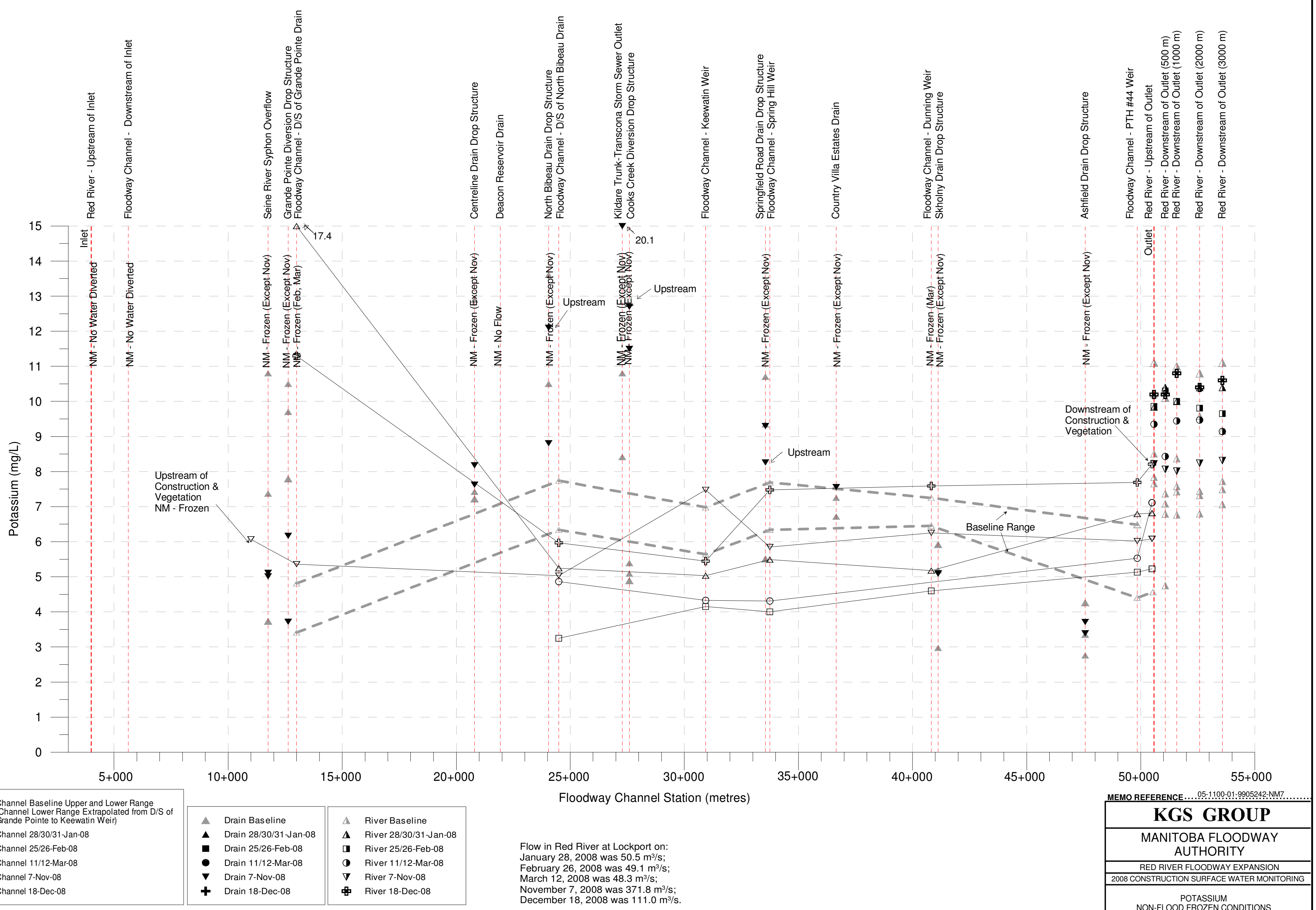
on June 6, 2008 was 167 m³/s;
on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.
MEMO REFERENCE 05-1100-01-9905241-NM7
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2008 CONSTRUCTION SURFACE WATER MONITORING
POTASSIUM
NON-FLOOD UNFROZEN CONDITIONS
FEBRUARY 2009
FIGURE NM7-17
REV 0
X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Potassium\FigNM7-17_Potassium construction_Non-flood unfrozen conditions.grf



Flow in Red River at Lockport on:
January 28, 2008 was 50.5 m³/s;
February 26, 2008 was 49.1 m³/s;
March 12, 2008 was 48.3 m³/s;
November 7, 2008 was 371.8 m³/s;
December 18, 2008 was 111.0 m³/s.

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

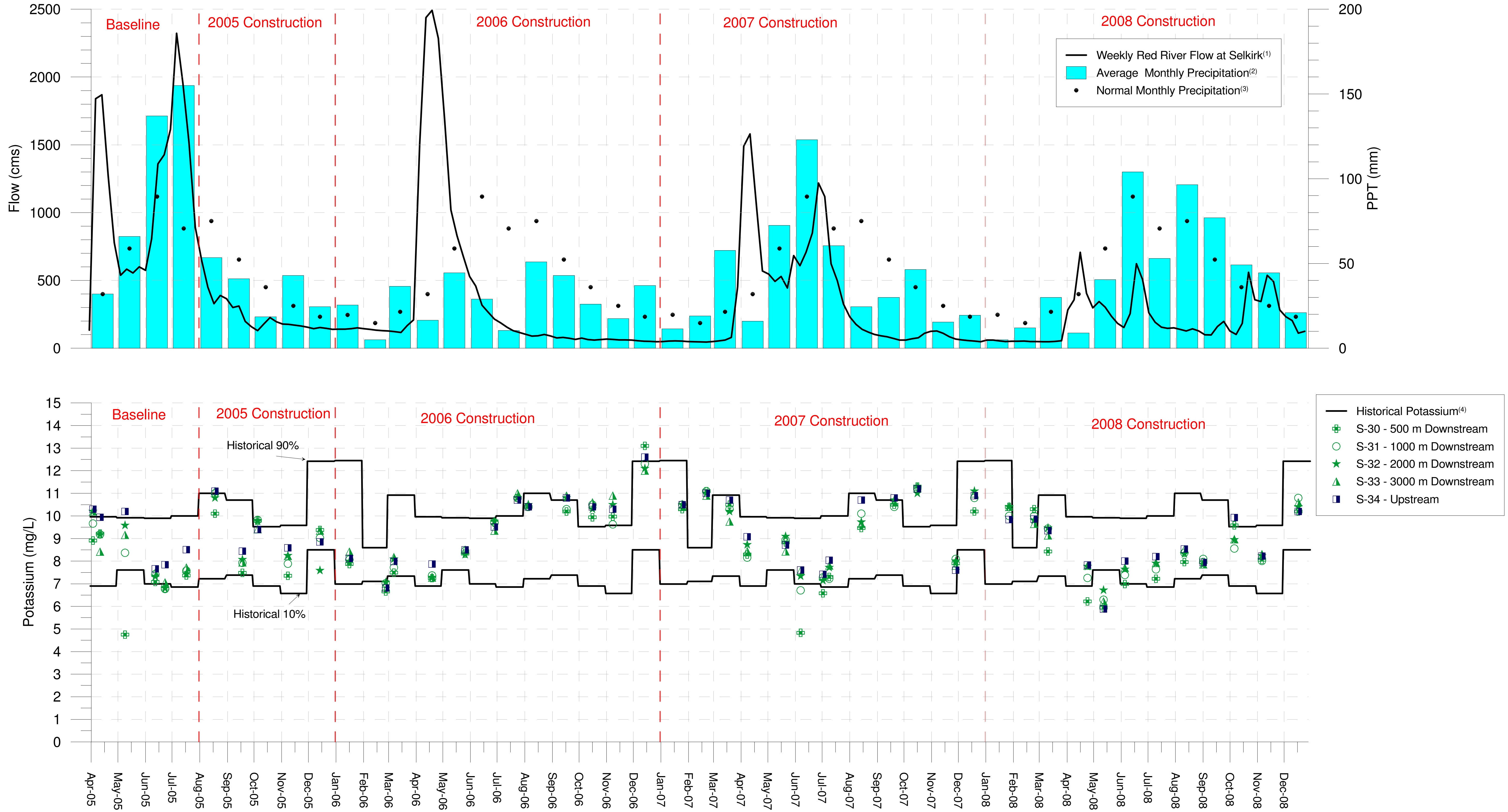
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

POTASSIUM
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-18 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Potassium\FigNM7-18_Potassium construction_Non_flood frozen conditions.grf



Notes

1 - Province of Manitoba, Manitoba Water Stewardship, Hydrologic Forecast Centre; Weekly River Flow Reports.
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3 - Environment Canada. 2001. Canadian Climate Normals 1971-200, Winnipeg International Airport, Manitoba.
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Monthly range based on data collected once a month by Manitoba Water Stewardship from 1970 to 2003 in the Red River at Selkirk (downstream of the Floodway Outlet).

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

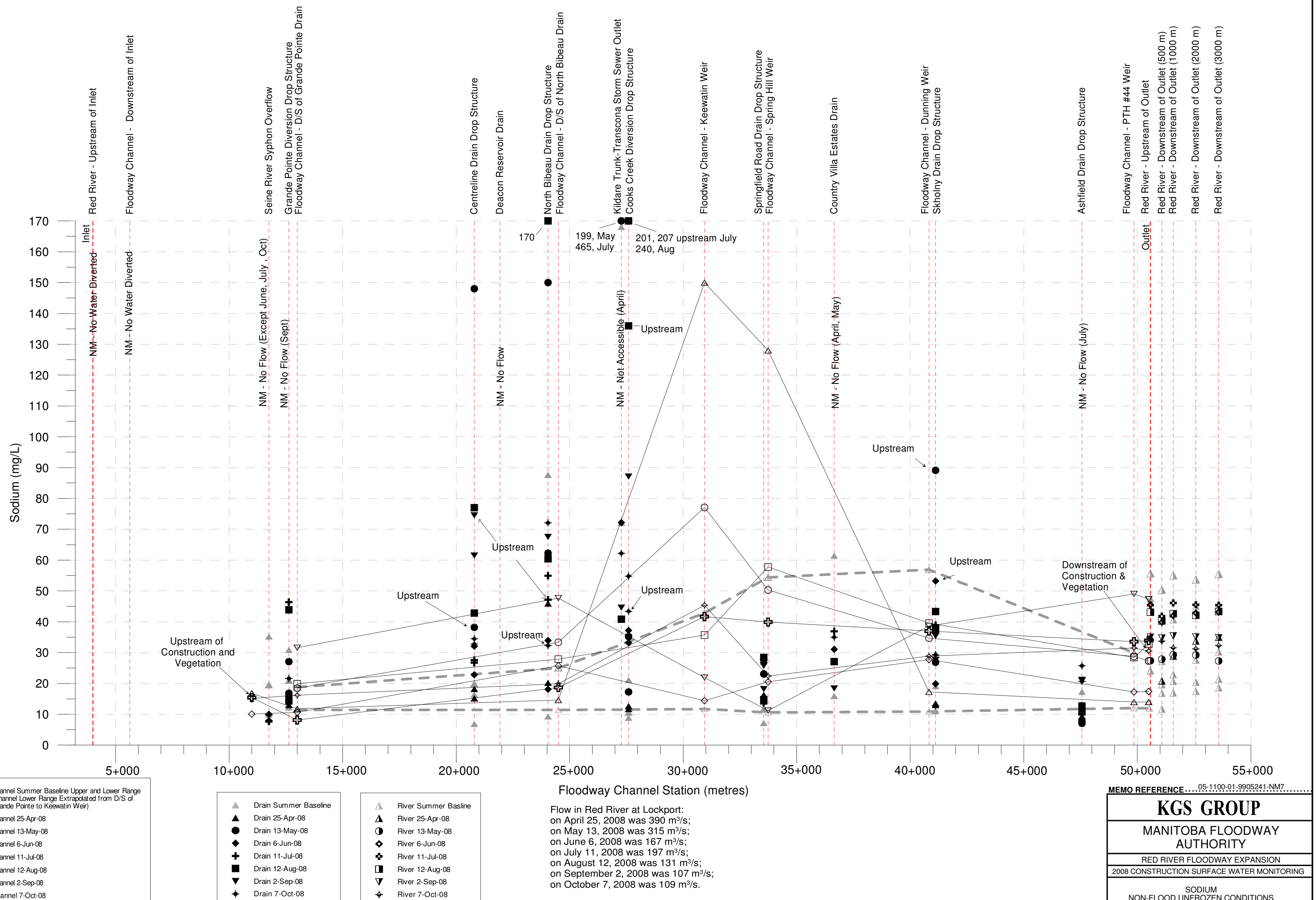
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
POTASSIUM

FEBRUARY 2009	FIGURE NM7-19	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\Annual\Historical Tables



Flow in Red River at Lockport:
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on July 11, 2008 was 197 m³/s;
on August 12, 2008 was 131 m³/s;
on September 2, 2008 was 107 m³/s;
on October 7, 2008 was 109 m³/s.

MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

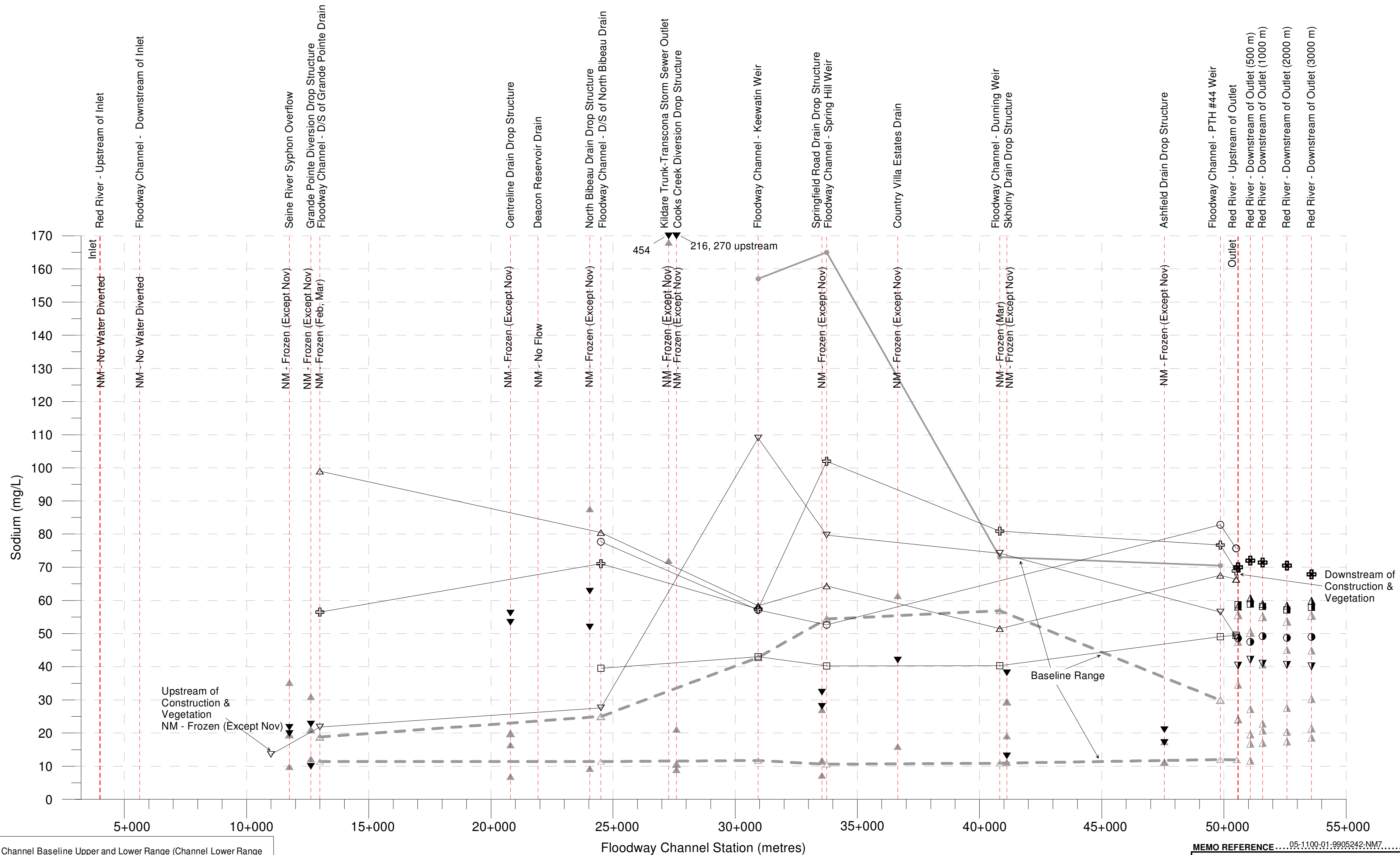
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-20 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Sodium\FigNM7-20_Sodium construction_Non_flood unfrozen conditions.grf



- Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
- Channel Winter Baseline (Baseflow, Groundwater Discharge Conditions Sampled March 2005)
- Channel 28/30/31-Jan-08
- Channel 25/26-Feb-08
- Channel 11/12-Mar-08
- Channel 7-Nov-08
- Channel 18-Dec-08

- Drain Baseline
- Drain 28/30/31-Jan-08
- Drain 25/26-Feb-08
- Drain 11/12-Mar-08
- Drain 7-Nov-08
- Drain 18-Dec-08

- River Baseline
- River 28/30/31-Jan-08
- River 25/26-Feb-08
- River 11/12-Mar-08
- River 7-Nov-08
- River 18-Dec-08

Flow in Red River at Lockport on:
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February 26, 2008 was 49.1 m³/s;
March 12, 2008 was 48.3 m³/s;
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MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

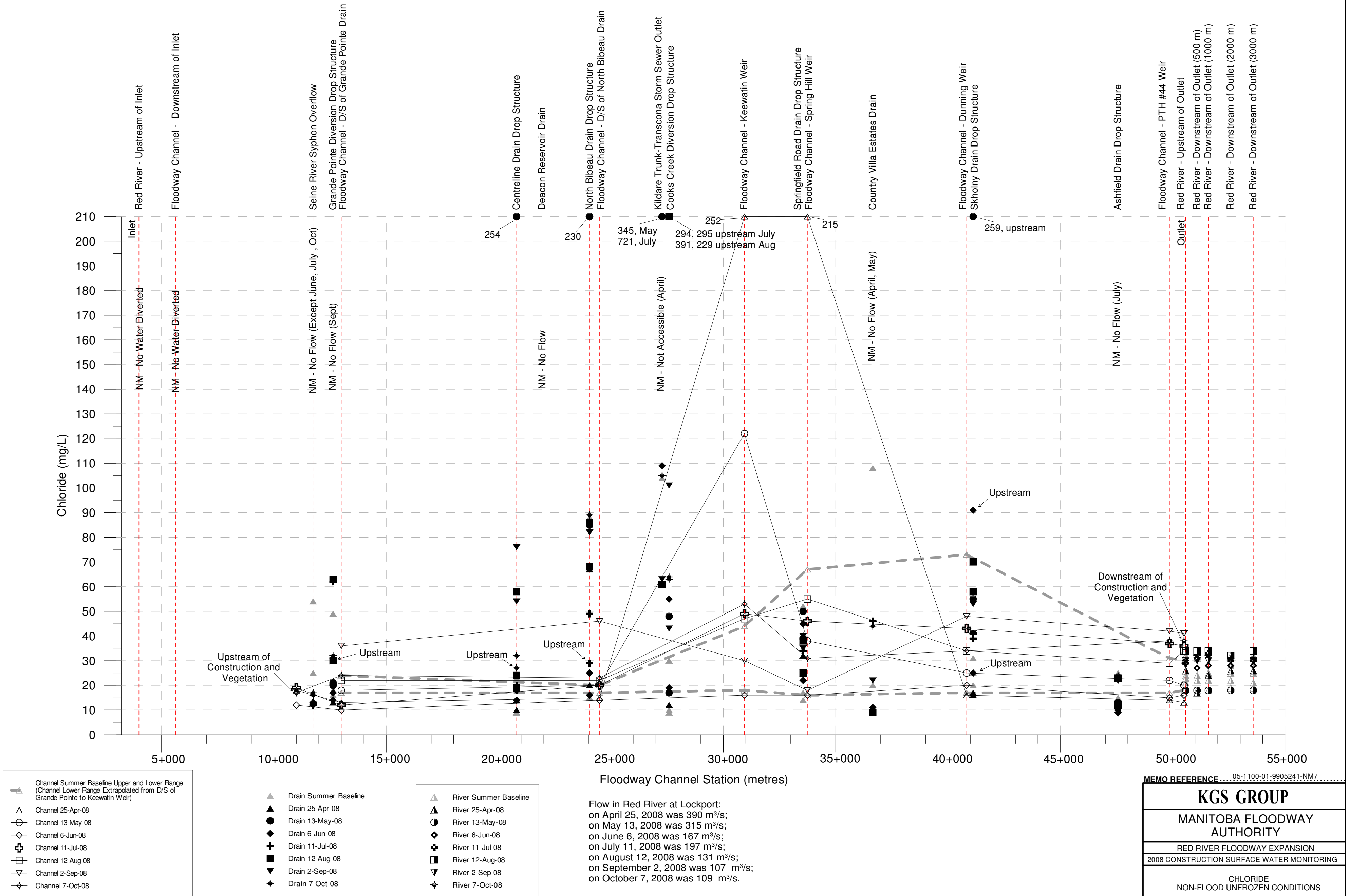
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-21 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Sodium\FigNM7-21_Sodium construction_Non_flood frozen conditions.grf



Flow in Red River at Lockport:
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on September 2, 2008 was 107 m³/s;
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MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

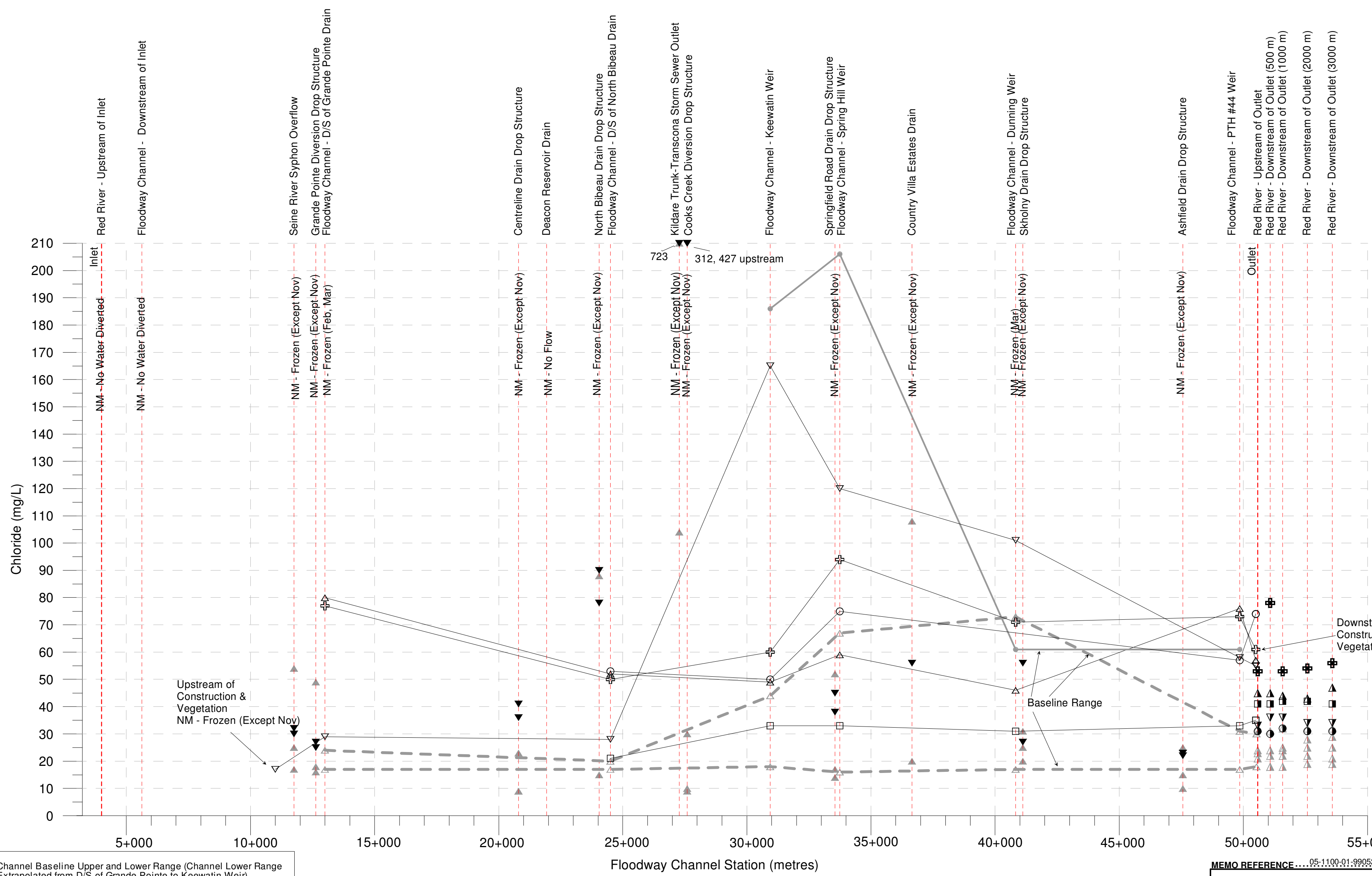
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

CHLORIDE
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-22 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\Chloride\FigNM7-22_Chloride construction_Non_flood unfrozen conditions.grf



Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel Winter Baseline (Baseflow, Groundwater Discharge Conditions Sampled March 2005)
Channel 28/30/31-Jan-08
Channel 25/26-Feb-08
Channel 11/12-Mar-08
Channel 7-Nov-08
Channel 18-Dec-08

Drain Baseline
Drain 28/30/31-Jan-08
Drain 25/26-Feb-08
Drain 11/12-Mar-08
Drain 7-Nov-08
Drain 18-Dec-08

River Baseline
River 28/30/31-Jan-08
River 25/26-Feb-08
River 11/12-Mar-08
River 7-Nov-08
River 18-Dec-08

Flow in Red River at Lockport on:
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KGS GROUP

MANITOBA FLOODWAY AUTHORITY

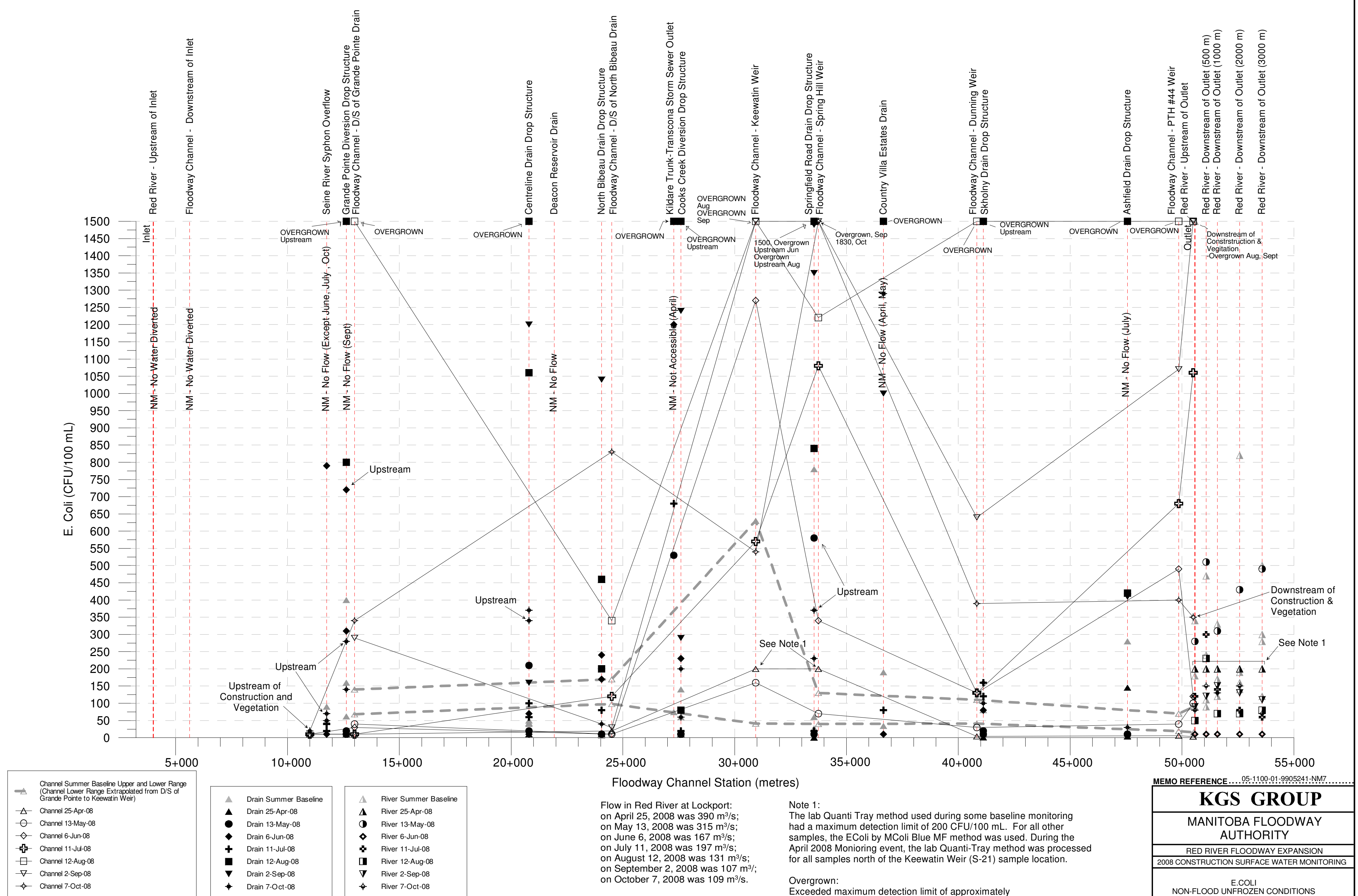
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

CHLORIDE
NON-FLOOD FROZEN CONDITIONS

FEBRUARY 2009	FIGURE NM7-23	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\ Chloride\FigNM7-23_Chloride construction_Non-flood frozen conditions.grf



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on July 11, 2008 was 197 m^3/s;
on August 12, 2008 was 131 m^3/s;
on September 2, 2008 was 107 m^3/s;
on October 7, 2008 was 109 m^3/s.

Note 1:
The lab Quanti Tray method used during some baseline monitoring had a maximum detection limit of 200 CFU/100 mL. For all other samples, the EColi by MColi Blue MF method was used. During the April 2008 Monioring event, the lab Quanti-Tray method was processed for all samples north of the Keewatin Weir (S-21) sample location.

Overgrown:
Exceeded maximum detection limit of approximately 2000 CFU/100ml using MColi Blue MF Method.

MEMO REFERENCE 05-1100-01-9905241-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

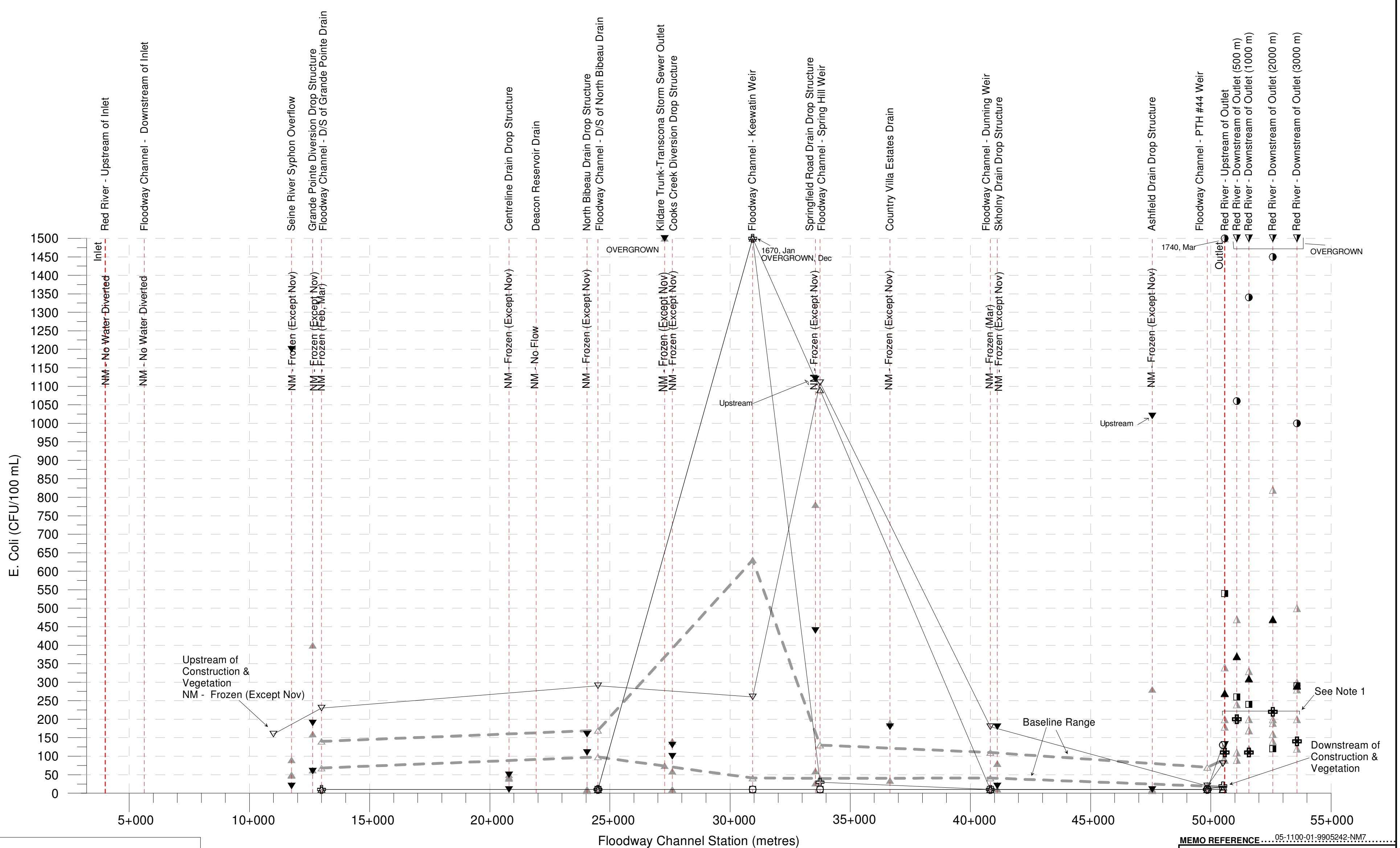
RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
NON-FLOOD UNFROZEN CONDITIONS

FEBRUARY 2009 | FIGURE NM7-24 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2008 Construction\Graphs\ANNUAL\FigNM7-24_EColi construction_Non-flood unfrozen conditions.grf



Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 28/30/31-Jan-08
Channel 25/26-Feb-08
Channel 11/12-Mar-08
Channel 7-Nov-08
Channel 18-Dec-08

Drain Baseline
Drain 28/30/31-Jan-08
Drain 25/26-Feb-08
Drain 11/12-Mar-08
Drain 7-Nov-08
Drain 18-Dec-08

River Baseline
River 28/30/31-Jan-08
River 25/26-Feb-08
River 11/12-Mar-08
River 7-Nov-08
River 18-Dec-08

Flow in Red River at Lockport on:
January 28, 2008 was 50.5 m³/s;
February 26, 2008 was 49.1 m³/s;
March 12, 2008 was 48.3 m³/s;
November 7, 2008 was 371.8 m³/s;
December 18, 2008 was 111.0 m³/s.

Note 1:
The lab Quanti Tray method used during some baseline monitoring had a maximum detection limit of 200 CFU/100 mL. For all other samples, the EColi by MColi Blue MF method was used.

Overgrown:
Exceeded maximum detection limit of approximately 2000 CFU/100ml using MColi Blue MF Method.

MEMO REFERENCE 05-1100-01-9905242-NM7

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
NON-FLOOD FROZEN CONDTIONS

FEBRUARY 2009 | FIGURE NM7-25 | REV 0

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APPENDICES

APPENDIX A

SURFACE WATER MONITORING
2008 SAMPLING PROGRAM

1.0 INTRODUCTION

This provides details and a description of the sampling events, sampling protocol, data reduction, reporting and summary tables for the 2008 Surface Water Sampling Program prepared by KGS Group.

The surface water quality monitoring program consists of Monthly monitoring during the 2008 construction year from January to December 2008 in conjunction with the on-going construction activities. It also consists of Event-based monitoring during 2008 in response to potential erosion causing precipitation and spill events.

The scope of work for the 2008 construction Surface Water Monitoring program conducted by KGS Group includes the following:

- Collect **monthly** surface water quality data for the Red River, Floodway Channel, Drains that flow into the Floodway Channel and Drains that cross the West Dyke, preferably following a precipitation event or at the flood peak during Red River flood conditions;
- Collect **event-based** surface water quality data for compliance monitoring of applicable parameters (TSS, nutrients, herbicides or hydrocarbons) from the Floodway Channel upstream and downstream of the overall construction area, the Red River upstream and downstream of the Outlet and any additional required locations following precipitation events greater than 10 mm or a spill; and
- Provide an assessment of surface water quality comparing results of construction monthly and event-based compliance monitoring to baseline water quality and summarized in an 2008 construction monitoring report in order to;
  - compare predictions made in modelling effects
  - assess the effectiveness of proposed mitigation measures and adapt if necessary
  - adapt the construction monitoring program in response to data and changes in mitigation measures.

2.0 SAMPLING LOCATIONS

The sample locations are similar to those used during the past sampling programs incorporating minor alterations as recommended in the Baseline and 2005, 2006 and 2007 Construction Surface Water Monitoring reports. These sample locations are outlined on Figure NM7-1 and Figure NM7-2 and described as follows;

Red River at Inlet

- Upstream of the Floodway channel along the west shore of the river, 3 replicate samples collected consecutively at the same location (S-01) to capture the natural variation within the Red River. During a sample event when there is no river water entering into the Floodway channel at the inlet, then these samples will not be collected during that event.

Red River at Outlet

- Upstream of the Floodway Outlet along the east shore (S-34) and downstream of the Outlet along the east shore at 500, 1000, 2000 and 3000 m (S-30, S-31, S-32 and S-33, respectively).

Floodway Channel

- Floodway Channel downstream of the Inlet (S-04), downstream of the Grande Pointe Diversion drop structure (S-13), downstream of the North Bibeau Drain drop structure (S-14) and at the four weir locations within the low flow channel used to calculate the channel base flow during the winter; Keewatin Weir (S-21), Springfield Weir (S-23), Dunning Weir (S-25) and PTH# 44 Weir (S-28). For quality control one replicate sample is collected during each sample event from one of the channel locations. Note during a sampling event if no Red River water is entering into the Floodway Channel, sample location S-04 in the channel downstream of the inlet will not be collected during that event. Likewise, during a sample event if there is less than 0.1 m water depth in the low flow channel at a sample location then that location will not be collected during that event.

Outfall Sources

- At the 11 outfalls immediately upstream of where they drain into the Floodway channel. These include; Seine River Syphon Overflow (S-05), Grande Point Diversion Drop Structure (S-06), Centreline Drain Drop Structure (S-07), Deacon Reservoir Drain (S-08), Cooks Creek Diversion Drop Structure (S-09), North Bibeau Drain Drop Structure (S-10), Country Villa Estates Drain (S-11), Kildare Trunk-Transcona Storm Sewer Outlet (S-12), Springfield

Road Drain Drop Structure (S-22), Skholny Drain Drop Structure (S-26) and Ashfield Drain Drop Structure (S-27). During a sample event if there is low flow or the water is frozen such that no water is entering into the Floodway from any of the above drains or there is insufficient amounts of water in the drain to collect a sample (< 0.10 m flow depth) then, that drain will not be sampled during that event. Additionally, during a sample event if a drain is within an area of on-going construction activities, to eliminate a potential confounding effect and in order to assess the effects from the perimeter ditches an additional sample will be collected from the drain upstream of the perimeter ditching.

West Dyke

- Downstream of the West Dyke in the Manness (S-35) and Domain (S-36) Drains. During a sample event if there is insufficient amounts of water in either of the drains to collect a sample (< 0.10 m flow depth) or the water is frozen then, that drain will not be sampled during that event.

Construction Areas

- Sample locations will be located in the Floodway Channel, upstream and downstream of the overall construction limits for all contracts (CON U/S and CON D/S) and upstream and downstream of the limits of the entire re-vegetation area for all contracts (VEG U/S and VEG D/S). Note these sample locations will change as work proceeds and the limits of construction change. During a sample event if there is less than 0.1 m water depth in the low flow channel at a sample location then that location will not be collected during that event.

The potential maximum number of sample locations, likely only for monthly sampling events in late fall, is 42, whereas on average there will likely be 30 sample locations. The sample locations used for any given sampling event will depend on the time of year, flow conditions and construction progress to date. For example, during the winter construction period no river water will be flowing into the Floodway Channel and most or all of the drains will likely be frozen and therefore samples will likely only be collected from the Floodway Channel and the Red River at the Outlet. Likewise, during the spring to fall construction period when drier conditions occur such as in 2006, if any of the source flows of water into the Floodway Channel (i.e. Red River and the 11 outfalls) are not flowing into the channel or have an insufficient amount of water to sample, then they will not be sampled.

3.0 SAMPLING PROTOCOL

As in the previous years sampling programs, the protocol follows the U.S. Environmental Protection Agency (EPA), Office of Water Quality, Monitoring Water Quality, Chapter 5 Water Quality Conditions (November, 1997, EPA 841-B-97-003). Samples are collected by wading into the water source and/or using a 3 metre sample extension rod to sample as close to the centre of the flow as possible. For safety considerations, the Red River samples are collected from the shoreline using the sample extension rod. Samples are collected by dipping a sample collector into the water to a depth of approximately 30 cm, or half the depth if there is less than 60 cm of water, and scooping the sample collector upstream into the water flow. If there is an insufficient depth of water, 10 cm or less, then sampling is not conducted as the bottom would likely be disturbed during sampling and spoil the sample. Before each sample, the collection jar is rinsed a minimum of three times with the sample water to ensure representative readings of the existing surface water conditions.

During winter when the surface water has an ice cover, an auger or other tools will be used to provide access to sample the water. The sampling health and safety plan includes: two person sampling; flotation suits during cold weather and/or high flows; Personal Floatation Devices (PFD's) during other times; use of a harness and rope to anchor personnel to a fixed object and specifications for working on ice.

4.0 PARAMETERS

While sampling during monthly monitoring, field measurements of pH, temperature, conductivity and turbidity will be obtained. Water depth is also recorded from staff gauges installed at Floodway Channel locations and in the outfalls. Staff gauges are not installed at Kildare Trunk-Transcona Storm Sewer Outlet, Country Villa Estates Drain and Deacon Reservoir Drain as it is not feasible to record the depth of water at these drains. No depth of water is recorded for any of the samples collected from the Red River or the West Dyke drains. The water depth is recorded to estimate the water discharge at each site using rating curves developed for each of the drains and the Floodway Channel at the sample locations. Estimates of the water discharge are necessary to calculate approximate mass balances for the chemical analysis results to interpret the results in particular during event-based compliance monitoring. Discharge estimates for the Red River are based on upstream and downstream measurements from Water Survey of Canada Metering Stations.

The analysis package for the monthly sampling events includes various combinations of the following;

- Routine extractable (iron, manganese, fluoride, pH, total dissolved solids, sulphate, nitrate-nitrite, calcium, potassium magnesium, sodium, hardness, conductivity, chloride, total alkalinity, bicarbonate, carbonate and hydroxide)
- Total suspended solids (TSS) and turbidity
- Ammonia
- Ortho phosphorus, total phosphorus, total dissolved phosphorus
- Dissolved organic carbon (DOC), total organic carbon (TOC)
- Total Kjeldahl nitrogen (TKN)
- Phenoxy acid herbicide screen (2,4-D, Bromoxynil, Dicamba, MCPA, Picloram), AMPA and Glyphosate
- Benzene, toluene, ethylbenzene and xylenes (BTEX)
- Hydrocarbon fractions F1 to F4
- Total coliform and *E.Coli* by m-Coli Blue Membrane Filtration method

The specific parameters assessed during monthly monitoring at each sampling location are similar to the previous sampling programs and are detailed in Table 1. Additional parameters can be added, if required and approved by MFA.

5.0 EVENT-BASED COMPLIANCE MONITORING

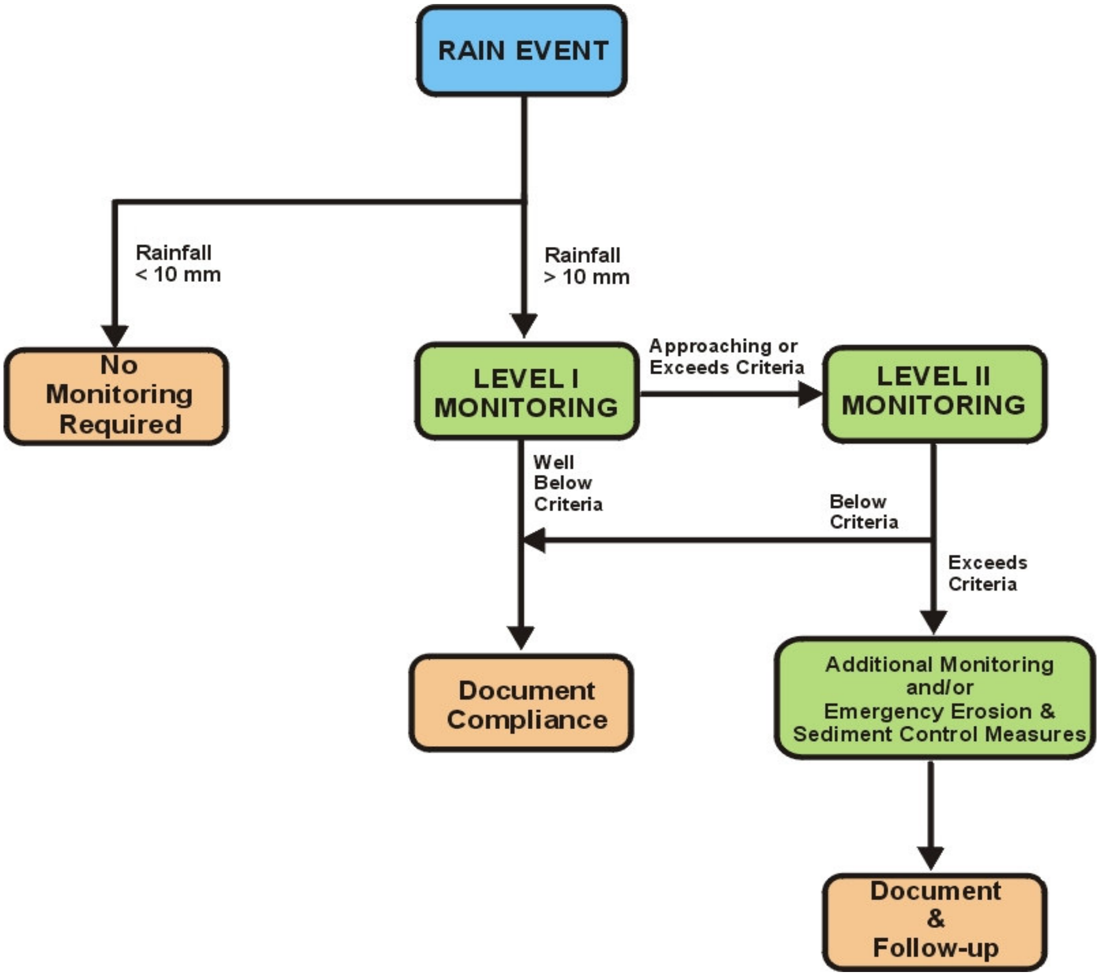
Event-based compliance monitoring will be conducted in response to rain events and spill events with samples analyzed for the following parameters of interest:

- Total Suspended Solids (as detailed in the KGS Group Memorandum 03-1100-01.37.10 Erosion and Sediment Control Plan, Event-Based Compliance Monitoring Program)
- Nutrients - field temperature, pH, nitrate-nitrite+N, ammonia, total Kjeldahl nitrogen, ortho phosphorus, total phosphorus and total dissolved phosphorus
- Herbicides - Phenoxy acid herbicide screen, AMPA and Glyphosate
- Hydrocarbons - BTEX and fraction F1 to F4

Rain Event

As outlined in the flow chart below, the event-based monitoring program will be structured so that the level of effort associated with the monitoring is consistent with the level of potential concern. The structure for the 2008 sampling program represents the modifications made during the 2006 sampling program as discussed in the 2006 Construction Surface Water Monitoring Report (March 2007) and detailed in the October 3, 2006 KGS Group Memorandum (05-1100-01.19.06.03) Red River Floodway Expansion Project; 2006 Surface Water Sampling Program – Precipitation Review.

When a rainfall is less than 10 mm no monitoring is required. When rainfall exceeds 10 mm, a relatively simple monitoring approach ("Level I") will be carried out to indicate whether the downstream conditions are approaching the CCME and Provincial limits or whether the concentration inflow to the Red River is within accepted limits. If the "Level I" downstream conditions approach the CCME and Provincial limits, more rigorous monitoring ("Level II") will be carried out to determine whether additional mitigation control measures are required.



Monitoring Program Flow Chart

Real-time precipitation data will be used to trigger the initiation of the Level I monitoring program. This real-time data will be monitored regularly whenever there are precipitation events to allow for the monitoring team to mobilize in order to carry out the surface water sampling without delay following or during rain events.

There are a couple of Environment Canada rainfall gauges within the City of Winnipeg that can be used as a source of real-time rainfall data. This data will not be accessible directly by the monitoring team and is provided by the owners of the rainfall gauge network on a daily basis. As such a network of unofficial rainfall gauges within the City of Winnipeg are used as a source of real-time rainfall data.

The rainfall/monitoring criteria have been formulated based on experience during the 2006 and 2007 sampling programs, assuming an adaptive management approach will be followed throughout the Project to ensure that the level of monitoring is consistent with the potential concern. That is, if it is regularly determined that parameter concentrations are well below the CCME and Provincial criterion for rain events greater than 10 mm even with the increased area of open excavations, the criterion for "Level I" monitoring will be revised accordingly.

Level I – The "Level I" monitoring program will consist of sampling in the Floodway Channel upstream and downstream of the construction area and in the Red River upstream and downstream of the Outlet. Field turbidity, using a hand-held turbidity meter, and the water level will be measured and used to estimate the TSS and the flow.

TSS will be estimated using the site-specific relationships between TSS and field turbidity. These were defined as part of the Baseline Surface Water Monitoring Program and updated following each monthly sampling event during the 2005, 2006 and 2007 Construction Surface Water Monitoring. Two relationships were developed, one for Red River water and a second for non-Red River water. The Red River water relationship is based on data collected from the Red River as well as data collected from the Floodway during operation of the Floodway. The non-Red River water relationship is based on data collected from the Floodway when it was not in operation and from the inflowing drains. The TSS and field turbidity relationships will continue to be updated on a monthly basis, allowing the quality of the relationships to improve as more samples are collected.

The estimated TSS and flows will be used in conjunction with a simple mass balance (see attached "Level I Compliance Monitoring Worksheet") to provide an indication as to whether an increase in sediment concentration in the Floodway will have an impact on the Red River downstream of the Floodway Outlet. Additionally, as phosphorus fertilizer and glyphosate-based herbicides readily bind to soil particles the estimated TSS will give an indication of potential nutrient and herbicide concentration increases. It should be noted that the estimate of flows and TSS values are considered to be approximate and are to be used in the mass balance to provide a best estimate of the impacts of construction. The factor that has the most sensitivity to the percent increase in sediment concentration in the Red River is the Red River flow, that is, if the Red River flow is quite low, there is a greater risk of exceeding the Provincial Criterion. The effect of the magnitude of the river flow is discussed in the Erosion and Sediment Control Plan.

In addition to measuring field turbidity, samples will be collected at the four locations for laboratory confirmation analysis of TSS. If fertilizer has been applied or if herbicides have been used within two weeks prior to the rain event, then samples will also be collected and submitted for laboratory analysis of nutrients and herbicides, respectively.

Level II – The "Level II" monitoring program considers more sample locations that allow for both the assessment of the dilution effect of the Floodway channel downstream of the construction zone and of where the potential contaminant source(s) originate. It will consist of collecting samples at all of the sample locations that would be monitored during a monthly monitoring event, however only the applicable parameters will be analyzed. These include TSS, and if used within two weeks prior to the rain event, nutrients and herbicides.

Spill Event

The event-based monitoring program in response to spills will consist of sampling in the Floodway Channel and in the Red River with samples analyzed for nutrients, herbicides or hydrocarbons as dictated by the material spilled. Samples will be collected in the Floodway Channel upstream and downstream of the spill point source, at two more locations further downstream in the Floodway Channel and in the Red River upstream and 1000 m downstream of the Outlet immediately following notification of the spill. In order to track the status of the contaminant plume as it moves downstream, these six sample locations will also be sampled at regular time intervals (based on the flow magnitude during the spill event) for a total of up to three days of monitoring following the spill event.

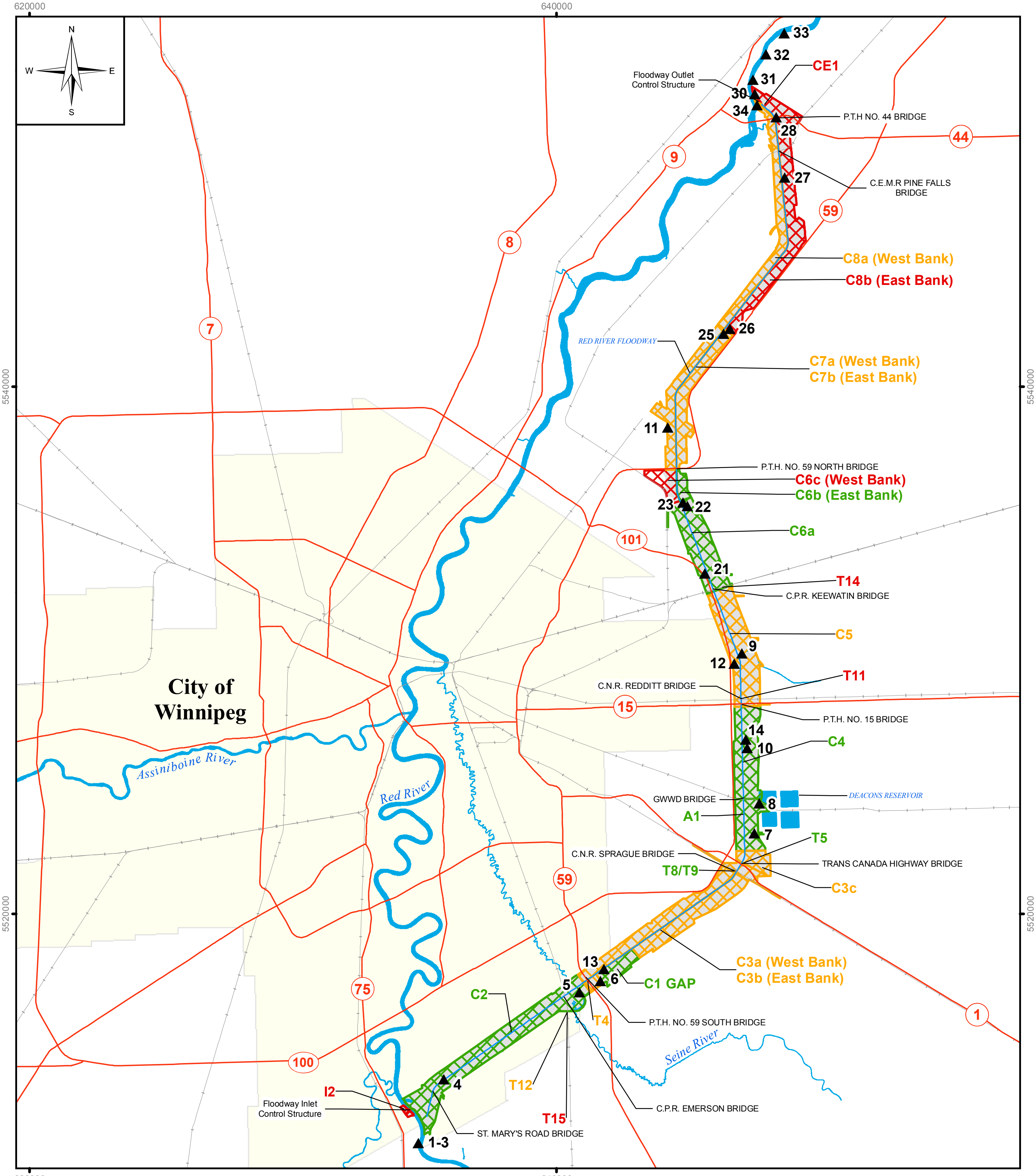
6.0 REPORTING

The data collected during the monthly monitoring and event-based compliance monitoring will be summarized in table format outlining the surface water quality. This information will be compared to the 2005 baseline data on a monthly and event basis to assess the accuracy of predictions made and the effectiveness of mitigation measures. It will also be summarized in a separate 2008 Annual Construction Monitoring Report. In addition to the annual report, documentation will be provided to MFA after each Level I, Level II, and spill monitoring events.

TABLE 1: SAMPLE PARAMETERS FOR EACH SAMPLE LOCATION DURING THE 2008 CONSTRUCTION MONTHLY MONITORING (JANUARY 2008 - DECEMBER 2008)

Sample Location	Sample Number	Parameters												
		Routine Extractable	TSS	Ammonia	Ortho - P	Total P	Total Dissolved P	DOC	TOC	TKN	Phenoxy Acid Herbicide Screen	Glyphosate	BTEX, F1 to F4	Total Coliform / E. Coli
Red River														
Upstream of Inlet (3 replicates) [1]	1 - 3	X	X	X	X	X	X	X	X	X				X
Upstream of Outlet	34	X	X	X	X	X	X	X	X	X				X
Downstream of Outlet (500, 1000, 2000 and 3000 m)	30 - 33	X	X	X	X	X	X	X	X	X				X
Floodway Channel														
Downstream of Inlet [1]	4	X	X	X	X	X	X	X	X	X				X
Downstream of Grande Pointe DS	13	X	X	X	X	X	X	X	X	X				X
Downstream of North Bibeau DS	14	X	X	X	X	X	X	X	X	X				X
Keewatin Weir	21	X	X	X	X	X	X	X	X	X				X
Spring Hill Weir	23	X	X	X	X	X	X	X	X	X				X
Dunning Weir	25	X	X	X	X	X	X	X	X	X				X
Hwy #44 Weir	28	X	X	X	X	X	X	X	X	X				X
Field Duplicate of one Channel location	99	X	X	X	X	X	X	X	X	X				X
Upstream of Construction Area	CON-U/S	X	X	X	X	X	X	X	X	X			X	X
Downstream of Construction Area	CON-D/S	X	X	X	X	X	X	X	X	X			X	X
Upstream of Revegetation Area	VEG-U/S	X	X	X	X	X	X	X	X	X	X	X		X
Downstream of Revegetation Area	VEG-D/S	X	X	X	X	X	X	X	X	X	X	X		X
Drains [1]														
Seine River Syphon Overflow	5	X	X	X	X	X	X	X	X	X				X
Grande Pointe Diversion Drop Structure	6	X	X	X	X	X	X	X	X	X				X
Centreline Drain Drop Structure	7	X	X	X	X	X	X	X	X	X				X
Deacon Reservoir Drain	8	X	X	X	X	X	X	X	X	X				X
Cooks Creek Diversion Drop Structure	9	X	X	X	X	X	X	X	X	X				X
North Bibeau Drain Drop Structure	10	X	X	X	X	X	X	X	X	X				X
Country Villa Estates Drain	11	X	X	X	X	X	X	X	X	X				X
Kildare Trunk–Transcona Storm Sewer Outlet	12	X	X	X	X	X	X	X	X	X				X
Spring Field Road Drain Drop Structure	22	X	X	X	X	X	X	X	X	X				X
Skholny Drain Drop Structure	26	X	X	X	X	X	X	X	X	X				X
Ashfield Drain Drop Structure	27	X	X	X	X	X	X	X	X	X				X
Upstream of perimeter ditch in active constructin areas		X	X	X	X	X	X	X	X	X				X
West Dyke														
Downstream of Manness Drain	35	X	X	X	X	X	X	X	X	X				X
Downstream of Domain Drain	36	X	X	X	X	X	X	X	X	X				X
Estimated Average Number of Samples/Month [2]		27	27	27	27	27	27	27	27	27	2	2	2	27

Notes:
1 - During the sampling events if there is no water flowing into the floodway channel from the Red River or a drain due to frozen or low flow conditions then sampling that location is not required.
2 - Average based on experience obtained during previous years that realizes that not every sample location visited each month will have a sample collected.



MEMO REFERENCE ....05-1100-01.9905241-NM7.............

▲10 Surface Water Sampling Locations

C0 Completed Prior to 2008

C0 Completed During 2008

C0 Still Active at End of 2008

Completed Prior to 2008

Completed During 2008

Still Active at End of 2008

1:200,000

2 0 2 4 6 8 10

Kilometres

KGS GROUP		
MANITOBA FLOODWAY AUTHORITY		
RED RIVER FLOODWAY EXPANSION		
2008 CONSTRUCTION SURFACE WATER MONITORING		
FLOODWAY CHANNEL SAMPLE LOCATIONS		
JANUARY 2008	FIGURE NM7-1	REV 0

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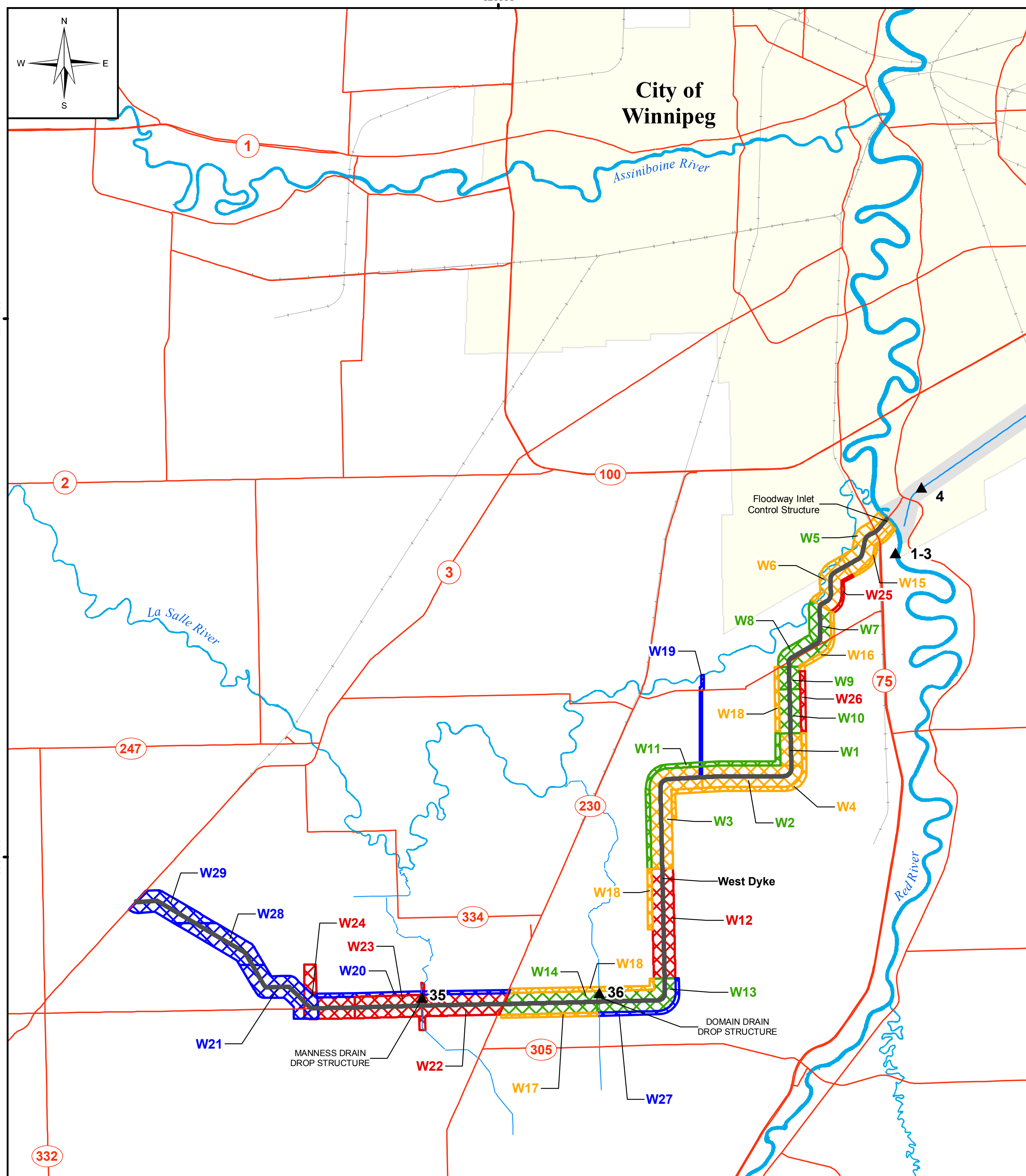

▲35 Surface Water Sampling Locations

W0 Completed Prior to 2008
W0 Completed During 2008
W0 Still Active at End of 2008
W0 Future Contract in 2009

Completed Prior to 2008
Completed During 2008
Still Active at End of 2008
Future Contract in 2009

1:200,000

2 0 2 4 6 8 10

Kilometres

MEMO REFERENCE ....05-1100-01.9905241-NM7..............

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MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2008 CONSTRUCTION SURFACE WATER MONITORING

FLOODWAY CHANNEL SAMPLE LOCATIONS

JANUARY 2008	FIGURE NM7-2	REV 0

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Manitoba
Floodway Expansion Authority

KGS GROUP

FLOODWAY EXPANSION PROJECT
SURFACE WATER MONITORING PROGRAM

LEVEL I SURFACE WATER MONITORING WORKSHEET

Recorded Flows and Turbidity Values

Note: Recorded flows and turbidity values based on field measurements

Floodway Channel – Upstream of Construction	Flow =		m^3/s **Box 1**	Turbidity =		NTU **Box 2**
Floodway Channel – Downstream of Construction	Flow =		m^3/s **Box 3**	Turbidity =		NTU **Box 4**
Red River – Upstream of Floodway Outlet	Flow =		m^3/s **Box 5**	Turbidity =		NTU **Box 6**

Sediment Concentration Values

Note: Based on recorded turbidity and appropriate regression relationship

Floodway Channel – Upstream of Construction	TSS =		mg/L	**Box 7**	**[Use Box 2 in Regression Equation]**
Floodway Channel – Downstream of Construction	TSS =		mg/L	**Box 8**	**[Use Box 4 in Regression Equation]**
Red River – Upstream of Floodway Outlet	TSS =		mg/L	**Box 9**	**[Use Box 6 in Regression Equation]**

Regression Relationships

Red River Water (ie Red River, FW Operation)

TSS = 1.297 x Turbidity – 6.781

Non – Red River Water (ie. FW non-operation, Drains)

TSS = 0.748 x Turbidity + 2.775

Sediment Load

Upstream of Construction Area	Sediment Load =		tonne/day	**Box 10 =**	**[0.0864 × Box 1 × Box 7]**
Downstream of Construction Area	Sediment Load =		tonne/day	**Box 11 =**	**[0.0864 × Box 3 × Box 8]**
Red River – Upstream of Floodway Outlet	Sediment Load =		tonne/day	**Box 12 =**	**[0.0864 × Box 5 × Box 9]**

Calculated Effect of Construction Works After Mixing in the Red River

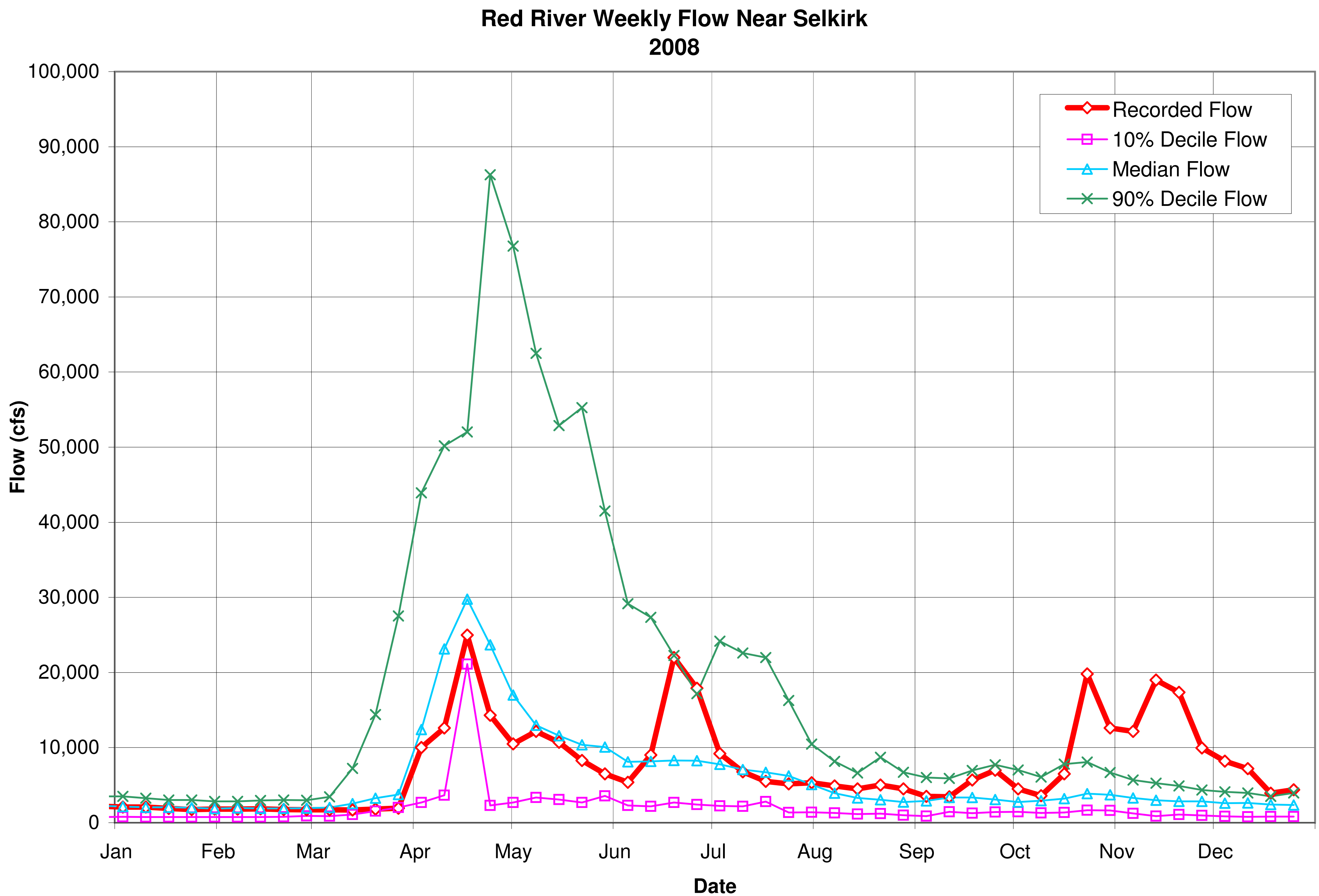
Note: Assumes no other inflows to channel except those at the downstream end of construction

Flow in Red River		m^3/s	**Box 13 =**	**[Box 3 + Box 5]**
Sediment Load in Red River		tonne/day	**Box 14 =**	**[Box 11 + Box 12]**
Sediment Concentration in Red River		mg/L	**Box 15 =**	**[11.574 × Box 14 ÷ Box 13]**
Change in Sediment Concentration in Red River		mg/L	**Box 16 =**	**[Box 15 – Box 9]**
Percent Change in Sediment Concentration in Red River		%	**Box 17 =**	**[(Box 15 – Box 9) ÷ Box 9 x 100]**

Prepared By: **Katie Sinclair** **Date Prepared:** **August 8, 2008**

APPENDIX B

MANITOBA WATER STEWARDSHIP
WEEKLY RIVER FLOW REPORT
RED RIVER NEAR SELKIRK



Red River Weekly Flow Near Selkirk
2008
Flow (cfs)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Recorded Flow
10% Decile Flow
Median Flow
90% Decile Flow

APPENDIX C

ENVIRONMENT CANADA
WINNIPEG INT'L A, MANITOBA – DAILY DATA REPORTS
JANUARY - DECEMBER 2008

Environment Canada Environnement Canada

Daily Data Report for January 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for January 2008

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	-16.5	-26.3	-21.4	39.4	0.0	M	M	0.0			<31
02†	-11.1	-26.3	-18.7	36.7	0.0	M	M	0.0		19	72
03†	-2.0	-12.2	-7.1	25.1	0.0	M	M	0.0		18	74
04†	-3.8	-12.3	-8.1	26.1	0.0	M	M	0.0		16	59
05†	-0.8	-10.6	-5.7	23.7	0.0	M	M	0.0		17	50
06†	2.9	-2.5	0.2	17.8	0.0	M	M	1.5		2	46
07†	-1.6	-12.6	-7.1	25.1	0.0	M	M	0.0			<31
08†	-8.9	-16.0	-12.5	30.5	0.0	M	M	0.0			<31
09†	-7.4	-19.1	-13.3	31.3	0.0	M	M	0.0			<31
10†	-7.6	-13.2	-10.4	28.4	0.0	M	M	0.0			<31
11†	-8.2	-11.8	-10.0	28.0	0.0	M	M	0.5			<31
12†	-9.0	-17.6	-13.3	31.3	0.0	M	M	0.5			<31
13†	-8.7	-30.5	-19.6	37.6	0.0	M	M	0.5		36	33
14†	-19.8	-32.9	-26.4	44.4	0.0	M	M	0.0		2	44
15†	-7.0	-20.1	-13.6	31.6	0.0	M	M	0.0		18	78
16†	-9.1	-25.5	-17.3	35.3	0.0	M	M	0.0		32E	54E
17†	-13.8	-25.2	-19.5	37.5	0.0	M	M	0.5		1	48
18†	-23.0	-30.1	-26.6	44.6	0.0	M	M	0.0		32	41
19†	-21.9	-31.4	-26.7	44.7	0.0	M	M	0.0		32	32
20†	-20.9	-31.8	-26.4	44.4	0.0	M	M	0.0			<31
21†	-14.4	-29.7	-22.1	40.1	0.0	M	M	0.0		20	33
22†	-15.1	-31.1	-23.1	41.1	0.0	M	M	0.0			<31
23†	-20.9	-32.5	-26.7	44.7	0.0	M	M	0.0			<31
24†	-11.8	-25.8	-18.8	36.8	0.0	M	M	0.0		19	37
25†	-14.6	-24.7	-19.7	37.7	0.0	M	M	0.0			<31
26†	-12.6	-19.8	-16.2	34.2	0.0	M	M	0.0			<31
27†	-3.6	-17.4	-10.5	28.5	0.0	M	M	0.5		18	46
28†	-4.2	-20.0	-12.1	30.1	0.0	M	M	0.0		3	70
29†	-20.0	-30.0	-25.0	43.0	0.0	M	M	0.5		32	74
30†	-25.2	-32.7	-29.0	47.0	0.0	M	M	0.0			<31
31†	-12.6	-30.4	-21.5	39.5	0.0	M	M	0.5		19	70
Sum				**1086.2**	**0.0**	**M**	**M**	**5.0**			
Avg	**-11.4**	**-22.6**	**-17.02**								
Xtrm	**2.9**	**-32.9**								**18**	**78**

Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
1971-2000 Climate Normals
Customizable Chart

Environment Canada Environnement Canada

Daily Data Report for February 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for February 2008

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	-8.4	-23.9	-16.2	34.2	0.0	M	M	1.5		18	74
02†	-19.5	-28.5	-24.0	42.0	0.0	M	M	0.0			<31
03†	-8.8	-20.7	-14.8	32.8	0.0	M	M	0.5			<31
04†	-10.7	-19.1	-14.9	32.9	0.0	M	M	0.5		1	48
05†	-19.1	-29.0	-24.1	42.1	0.0	M	M	0.0			<31
06†	-9.1	-23.1	-16.1	34.1	0.0	M	M	0.5		18	63
07†	-5.9	-15.6	-10.8	28.8	0.0	M	M	0.0		19	35
08†	-6.8	-17.5	-12.2	30.2	0.0	M	M	0.0		20	44
09†	-9.2	-27.2	-18.2	36.2	0.0	M	M	1.5		32	69
10†	-26.9	-32.7	-29.8	47.8	0.0	M	M	0.0		32	54
11†	-19.1	-31.8	-25.5	43.5	0.0	M	M	0.0		20	37
12†	-11.5	-24.6	-18.1	36.1	0.0	M	M	1.0		19	50
13†	-23.0	-31.4	-27.2	45.2	0.0	M	M	0.0			<31
14†	-24.8	-34.7	-29.8	47.8	0.0	M	M	0.0			<31
15†	-15.7	-34.3	-25.0	43.0	0.0	M	M	0.5		2	52
16†	-0.4	-15.8	-8.1	26.1	0.0	M	M	1.0		18	61
17†	-2.0	-21.6	-11.8	29.8	0.0	M	M	1.0		34	57
18†	-20.1	-29.9	-25.0	43.0	0.0	M	M	0.0		34	46
19†	-26.7	-34.6	-30.7	48.7	0.0	M	M	0.5		36	50
20†	-22.4	-34.7	-28.6	46.6	0.0	M	M	0.0		2	39
21†	-11.1	-26.5	-18.8	36.8	0.0	M	M	0.0		19	41
22†	-10.7	-24.5	-17.6	35.6	0.0	M	M	0.0			<31
23†	-5.7	-19.1	-12.4	30.4	0.0	M	M	0.0			<31
24†	-2.6	-14.9	-8.8	26.8	0.0	M	M	0.5		3	44
25†	-6.1	-17.8	-12.0	30.0	0.0	M	M	0.0		36	37
26†	-7.5	-19.3	-13.4	31.4	0.0	M	M	0.5			<31
27†	-8.8	-22.1	-15.5	33.5	0.0	M	M	0.0			<31
28†	-0.6	-14.3	-7.5	25.5	0.0	M	M	2.5		18	50
29†	-3.6	-16.7	-10.2	28.2	0.0	M	M	0.0		34	67
Sum				**1049.1**	**0.0**	**M**	**M**	**12.0**			
Avg	**-12**	**-24.3**	**-18.15**								
Xtrm	**-0.4**	**-34.7**								**18**	**74**

Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred
F = Accumulated and estimated
N = Temperature missing but known to be > 0

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
1971-2000 Climate Normals
Customizable Chart
Bulk Data (2008) [CSV] [XML]

Environment Canada Environnement Canada [français] [Back]

Daily Data Report for March 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for March 2008

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	-1.0	-14.2	-7.6	25.6	0.0	M	M	0.5		15	54
02†	-1.3	-17.3	-9.3	27.3	0.0	M	M	0.0		33	70
03†	-17.2	-22.6	-19.9	37.9	0.0	M	M	0.0		32	37
04†	-10.1	-21.8	-16.0	34.0	0.0	M	M	1.5			<31
05†	-14.7	-27.8	-21.3	39.3	0.0	M	M	0.0			<31
06†	-20.1	-32.1	-26.1	44.1	0.0	M	M	0.0		32	32
07†	-12.9	-29.2	-21.1	39.1	0.0	M	M	1.5		2	65
08†	-9.1	-16.3	-12.7	30.7	0.0	M	M	0.5		18	65
09†	-9.9	-22.7	-16.3	34.3	0.0	M	M	0.5		19	33
10†	0.4	-15.1	-7.4	25.4	0.0	M	M	0.0		19	44
11†	2.3	-7.5	-2.6	20.6	0.0	M	M	0.0			<31
12†	2.6	-4.5	-1.0	19.0	0.0	M	M	0.0		18	50
13†	1.3	-7.4	-3.1	21.1	0.0	M	M	1.0		32	50
14†	-6.1	-15.7	-10.9	28.9	0.0	M	M	0.5		33	37
15†	-7.5	-20.0	-13.8	31.8	0.0	M	M	0.0			<31
16†	-0.7	-13.8	-7.3	25.3	0.0	M	M	1.0		18	63
17†	2.0	-2.0	0.0	18.0	0.0	M	M	0.0		19	61
18†	3.7	-6.0	-1.2	19.2	0.0	M	M	0.0		19	41
19†	-3.4	-11.8	-7.6	25.6	0.0	M	M	0.0		3	32
20†	1.5	-12.5	-5.5	23.5	0.0	M	M	0.0			<31
21†	3.4	-6.5	-1.6	19.6	0.0	M	M	0.0			<31
22†	-1.0	-11.0	-6.0	24.0	0.0	M	M	0.0		34	39
23†	-2.5	-16.5	-9.5	27.5	0.0	M	M	0.0		2	33
24†	0.7	-8.4	-3.9	21.9	0.0	M	M	2.5		16	59
25†	-1.9	-9.0	-5.5	23.5	0.0	M	M	0.0		36	41
26†	-6.8	-16.7	-11.8	29.8	0.0	M	M	0.5		2	39
27†	-1.6	-17.9	-9.8	27.8	0.0	M	M	0.0			<31
28†	1.7	-4.5	-1.4	19.4	0.0	M	M	0.0		18	35
29†	2.2	0.4	1.3	16.7	0.0	M	M	17.5		2	65
30†	2.5	-4.3	-0.9	18.9	0.0	M	M	2.5		29	85
31†	0.2	-5.8	-2.8	20.8	0.0	M	M	0.0		2	32
Sum				**820.6**	**0.0**	**M**	**M**	**30.0**			
Avg	**-3.3**	**-13.6**	**-8.45**								
Xtrm	**3.7**	**-32.1**								**29**	**85**

Legend

[empty] = No data available
M = Missing

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Daily Data Report for April 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m

Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for April 2008

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	2.0	-10.1	-4.1	22.1	0.0	M	M	0.0		20	35
02†	6.0	-2.6	1.7	16.3	0.0	M	M	0.0		24	48
03†	10.5	-1.9	4.3	13.7	0.0	M	M	0.0		27	46
04†	1.5	-5.0	-1.8	19.8	0.0	M	M	1.0			<31
05†	-0.9	-13.5	-7.2	25.2	0.0	M	M	0.0		4	39
06†	2.4	-8.5	-3.1	21.1	0.0	M	M	0.0		4	37
07†	6.1	-6.7	-0.3	18.3	0.0	M	M	0.0			<31
08†	10.7	-4.3	3.2	14.8	0.0	M	M	0.0			<31
09†	9.7	-3.0	3.4	14.6	0.0	M	M	0.0			<31
10†	10.7	-0.6	5.1	12.9	0.0	M	M	0.0		7	41
11†	8.4	-2.4	3.0	15.0	0.0	M	M	0.0		4	48
12†	7.4	-5.4	1.0	17.0	0.0	M	M	0.0			<31
13†	12.7	-6.4	3.2	14.8	0.0	M	M	0.0		2	37
14†	17.2	1.4	9.3	8.7	0.0	M	M	0.0		19	76
15†	19.0	4.9	12.0	6.0	0.0	M	M	0.0		18	57
16†	14.5	-2.1	6.2	11.8	0.0	M	M	0.0		32	50
17†	15.5	-5.8	4.9	13.1	0.0	M	M	0.0			<31
18†	20.6	3.0	11.8	6.2	0.0	M	M	0.0		14	41
19†	20.2	2.9	11.6	6.4	0.0	M	M	0.0		15	33
20†	M	5.0E	M	M	M	M	M	M		11	59
21†	M	M	M	M	M	M	M	M		27	48
22†	12.2	-3.6	4.3	13.7	0.0	M	M	0.0		19	54
23†	7.3	-3.4	2.0	16.0	0.0	M	M	0.5		29	46
24†	0.7	-2.5	-0.9	18.9	0.0	M	M	7.5		5	61
25†	1.6	-3.9	-1.2	19.2	0.0	M	M	0.0		1	56
26†	3.7	-3.1	0.3	17.7	0.0	M	M	0.0		1	61
27†	6.7	-7.3	-0.3	18.3	0.0	M	M	0.0		3	41
28†	10.3	-8.4	1.0	17.0	0.0	M	M	0.0		28	35
29†	15.9	-2.9	6.5	11.5	0.0	M	M	0.0		16	35
30†	18.0	-0.2	8.9	9.1	0.0	M	M	0.0		11	48
Sum				**419.2***	**0.0***	**M**	**M**	**9.0***			
Avg	**9.7**	**-3.3E**	**3.17E**								
Xtrm	**20.6**	**-13.5E**								**19**	**76**

Legend

[empty] = No data available

M = Missing

Environment Canada Environnement Canada

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Daily Data Report for May 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m

Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for May 2008

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	13.8	-1.3	6.3	11.7	0.0	M	M	0.0		3	59
02†	10.2	-4.2	3.0	15.0	0.0	M	M	0.0		2	59
03†	10.1	-9.3	0.4	17.6	0.0	M	M	0.0		35	50
04†	4.4	-9.1	-2.4	20.4	0.0	M	M	2.0		33	33
05†	15.6	-6.7	4.5	13.5	0.0	M	M	0.0		28	37
06†	16.3	3.9	10.1	7.9	0.0	M	M	0.0		3	41
07†	11.0	-1.5	4.8	13.2	0.0	M	M	0.0		34	46
08†	12.4	-6.6	2.9	15.1	0.0	M	M	0.0		34	37
09†	8.3	-6.3	1.0	17.0	0.0	M	M	0.0		4	37
10†	9.8	-3.7	3.1	14.9	0.0	M	M	0.0		33	46
11†	16.5	-4.9	5.8	12.2	0.0	M	M	0.0		15	35
12†	10.0	4.9	7.5	10.5	0.0	M	M	14.5		9	59
13†	15.6	4.3	10.0	8.0	0.0	M	M	5.5		3	39
14†	21.2	4.3	12.8	5.2	0.0	M	M	0.0		22	41
15†	22.3	4.7	13.5	4.5	0.0	M	M	0.0		33	48
16†	22.6	8.0	15.3	2.7	0.0	M	M	0.0		32	70
17†	19.1	-0.1	9.5	8.5	0.0	M	M	0.0		31E	74E
18†	16.3	-3.3	6.5	11.5	0.0	M	M	0.0		10	32
19†	13.8	1.3	7.6	10.4	0.0	M	M	2.0		33	39
20†	16.3	-2.3	7.0	11.0	0.0	M	M	0.0		3	46
21†	16.2	-1.9	7.2	10.8	0.0	M	M	0.0		2	48
22†	17.8	-0.2	8.8	9.2	0.0	M	M	0.0		6	41
23†	22.3	5.1	13.7	4.3	0.0	M	M	0.0		12	39
24†	25.3	8.5	16.9	1.1	0.0	M	M	0.5		15	56
25†	17.5	4.4	11.0	7.0	0.0	M	M	10.0		4	63
26†	12.5	1.2	6.9	11.1	0.0	M	M	1.5		4	61
27†	18.4	-3.2	7.6	10.4	0.0	M	M	0.0			<31
28†	22.1	5.8	14.0	4.0	0.0	M	M	0.0			<31
29†	23.5	7.5	15.5	2.5	0.0	M	M	0.0		18	46
30†	20.0	10.7	15.4	2.6	0.0	M	M	2.5			<31
31†	19.9	9.7	14.8	3.2	0.0	M	M	2.0			<31
Sum				**297.0**	**0.0**	**M**	**M**	**40.5**			
Avg	**16.2**	**0.6**	**8.4**								
Xtrm	**25.3**	**-9.3**								**31E**	**74E**

Legend

[empty] = No data available

M = Missing

Environment Canada Environnement Canada

Daily Data Report for June 2008

Notes on Data Quality.

WINNIPEG RICHARDSON INT'L A
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m

Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for June 2008

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	19.7	4.2	12.0	6.0	0.0	M	M	0.5		36	35
02†	18.1	-0.1	9.0	9.0	0.0	M	M	0.0		5	35
03†	21.1	3.3	12.2	5.8	0.0	M	M	0.0		14	52
04†	17.0	7.4	12.2	5.8	0.0	M	M	0.5		15	41
05†	23.3	3.4	13.4	4.6	0.0	M	M	0.0		11	44
06†	15.4	10.7	13.1	4.9	0.0	M	M	38.5		4	57
07†	23.2	8.6	15.9	2.1	0.0	M	M	0.0		24	56
08†	24.9	5.4	15.2	2.8	0.0	M	M	0.0		25	44
09†	15.8	10.7	13.3	4.7	0.0	M	M	25.0		8	52
10†	17.8	5.7	11.8	6.2	0.0	M	M	0.0		4	32
11†	16.3	7.8	12.1	5.9	0.0	M	M	14.5		8	65
12†	19.9	8.6	14.3	3.7	0.0	M	M	2.5		11	67
13†	17.8	9.9	13.9	4.1	0.0	M	M	2.5		29	48
14†	18.3	7.2	12.8	5.2	0.0	M	M	0.5		30	50
15†	17.4	5.7	11.6	6.4	0.0	M	M	0.0		30	39
16†	23.1	3.4	13.3	4.7	0.0	M	M	0.0			<31
17†	23.9	7.9	15.9	2.1	0.0	M	M	0.0			<31
18†	26.3	10.7	18.5	0.0	0.5	M	M	0.5		30	72
19†	25.1	10.1	17.6	0.4	0.0	M	M	0.5		33	39
20†	23.0	11.7	17.4	0.6	0.0	M	M	0.0		31	46
21†	25.1	10.0	17.6	0.4	0.0	M	M	0.0		35	69
22†	24.9	8.2	16.6	1.4	0.0	M	M	0.0		3	33
23†	26.8	10.1	18.5	0.0	0.5	M	M	2.0		18	35
24†	27.5	11.9	19.7	0.0	1.7	M	M	0.5			<31
25†	25.8	14.7	20.3	0.0	2.3	M	M	0.5		28	39
26†	27.5	12.5	20.0	0.0	2.0	M	M	0.0			<31
27†	24.7	14.5	19.6	0.0	1.6	M	M	1.0		32E	37E
28†	23.9	15.0	19.5	0.0	1.5	M	M	14.5		2	61
29†	26.2	13.0	19.6	0.0	1.6	M	M	0.0		2	32
30†	29.7	14.5	22.1	0.0	4.1	M	M	0.0		24	37
Sum				**86.8**	**15.8**	**M**	**M**	**104.0**			
Avg	**22.3**	**8.9**	**15.6**								
Xtrm	**29.7**	**-0.1**								**30**	**72**

Legend

Navigation Options

Environment Canada Environnement Canada

Daily Data Report for July 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude**: 97° 13.800' W **Elevation**: 238.70 m
Climate ID: 5023226 **WMO ID**: 71852 **TC ID**: YWG

Daily Data Report for July 2008

Day	Max Ter °C	Min Ten °C	Mean Tei °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01											
02											
03†	23.6	6.8	15.2	2.8	0.0	M	M	0.0			<31
04†	29.0	13.5	21.3	0.0	3.3	M	M	0.0		22	48
05†	29.4	15.5	22.5	0.0	4.5	M	M	0.0		19	44
06†	20.9	9.1	15.0	3.0	0.0	M	M	0.0		33	44
07†	19.3	8.6	14.0	4.0	0.0	M	M	11.5		16	44
08†	20.2	12.8	16.5	1.5	0.0	M	M	1.0		32	50
09†	22.3	10.8	16.6	1.4	0.0	M	M	0.0		32	39
10†	24.8	10.5	17.7	0.3	0.0	M	M	0.0		1	41
11†	24.4	14.4	19.4	0.0	1.4	M	M	10.5		15	63
12†	16.6	12.5	14.6	3.4	0.0	M	M	11.0		28	74
13†	23.1	11.1	17.1	0.9	0.0	M	M	0.0		33	46
14†	23.7	12.0	17.9	0.1	0.0	M	M	0.0			<31
15†	23.0	10.0	16.5	1.5	0.0	M	M	2.0		33	39
16†	21.2	9.7	15.5	2.5	0.0	M	M	1.0		10	37
17†	22.9	13.1	18.0	0.0	0.0	M	M	0.0			<31
18†	24.7	9.7	17.2	0.8	0.0	M	M	0.0			<31
19†	25.6	12.9	19.3	0.0	1.3	M	M	0.0		19	33
20†	24.6	13.0	18.8	0.0	0.8	M	M	3.0		1	32
21†	25.7	10.9	18.3	0.0	0.3	M	M	0.0			<31
22†	27.5	15.1	21.3	0.0	3.3	M	M	0.5		16	35
23†	24.0	18.0	21.0	0.0	3.0	M	M	3.0		14	57
24†	27.6	18.8	23.2	0.0	5.2	M	M	0.5		20	52
25†	26.1	14.2	20.2	0.0	2.2	M	M	M		31E	48E
26†	29.5	12.6	21.1	0.0	3.1	M	M	0.0		32	41
27†	25.7	10.0	17.9	0.1	0.0	M	M	0.0			<31
28†	27.5	11.6	19.6	0.0	1.6	M	M	7.5		3	61
29†	24.0	14.6	19.3	0.0	1.3	M	M	1.0		28	57
30†	25.7	11.8	18.8	0.0	0.8	M	M	0.0			<31
31†	26.2	14.6	20.4	0.0	2.4	M	M	0.5		29	39
Sum				**22.3***	**34.5***	**M**	**M**	**53.0***			
Avg	**24.4**	**12.4**	**18.4**								
Xtrm	**29.5**	**6.8**								**28***	**74***

Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
Customizable Chart
Bulk Data (2008) [CSV] [XML]

Environment Canada Environnement Canada

Daily Data Report for August 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023226 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for August 2008

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	28.2	9.4	18.8	0.0	0.8	M	M	0.0		18	32
02†	22.3	17.5	19.9	0.0	1.9	M	M	1.0		22	65
03†	24.3	15.0	19.7	0.0	1.7	M	M	0.0		35	32
04†	24.0	13.5	18.8	0.0	0.8	M	M	0.0		24	35
05†	25.1	11.1	18.1	0.0	0.1	M	M	0.0			<31
06†	26.1	12.3	19.2	0.0	1.2	M	M	0.0		35	39
07†	27.9	9.3	18.6	0.0	0.6	M	M	0.0			<31
08†	28.7	13.5	21.1	0.0	3.1	M	M	0.0			<31
09†	27.6	10.4	19.0	0.0	1.0	M	M	0.0		7	32
10†	29.4	12.8	21.1	0.0	3.1	M	M	0.0		18	33
11†	20.5	16.2	18.4	0.0	0.4	M	M	30.5		16	39
12†	19.0	12.9	16.0	2.0	0.0	M	M	29.5		14	37
13†	26.8	12.1	19.5	0.0	1.5	M	M	1.0			<31
14†	27.5	14.6	21.1	0.0	3.1	M	M	0.0		13	41
15†	29.9	15.3	22.6	0.0	4.6	M	M	0.0			<31
16†	30.2	15.4	22.8	0.0	4.8	M	M	0.0			<31
17†	32.3	16.0	24.2	0.0	6.2	M	M	0.0		1	35
18†	24.4	12.7	18.6	0.0	0.6	M	M	0.0			<31
19†	29.6	11.9	20.8	0.0	2.8	M	M	0.0		16	41
20†	30.6	19.1	24.9	0.0	6.9	M	M	0.0		20	67
21†	30.2	19.2	24.7	0.0	6.7	M	M	13.5		19	67
22†	22.6	12.2	17.4	0.6	0.0	M	M	18.5		29	59
23†	16.6	7.2	11.9	6.1	0.0	M	M	0.0		29	50
24†	20.8	4.5	12.7	5.3	0.0	M	M	0.0			<31
25†	28.2	10.2	19.2	0.0	1.2	M	M	0.0		17	52
26†	28.1	15.7	21.9	0.0	3.9	M	M	1.5		18	72
27†	21.2	11.1	16.2	1.8	0.0	M	M	0.5		25	46
28†	23.2	11.4	17.3	0.7	0.0	M	M	0.0		30	44
29†	23.2	10.6	16.9	1.1	0.0	M	M	0.5		29	48
30†	29.3	9.6	19.5	0.0	1.5	M	M	0.0		19	65
31†	31.4	19.5	25.5	0.0	7.5	M	M	0.0		18	54
Sum				**17.6**	**66.0**	**M**	**M**	**96.5**			
Avg	**26.1**	**13**	**19.54**								
Xtrm	**32.3**	**4.5**								**18**	**72**

Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
Customizable Chart
Bulk Data (2008) [CSV] [XML]

Environment Canada Environnement Canada

Notices:
As of July 24, 2008 changes were made in how data are accessed at 25 stations.
Please click here for further details.

Daily Data Report for September 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023226 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for September 2008

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	19.5	11.6	15.6	2.4	0.0	M	M	29.0		33	35
02†	13.5	7.5	10.5	7.5	0.0	M	M	1.5		32	54
03†	20.8	5.6	13.2	4.8	0.0	M	M	0.0		29	32
04†	18.3	8.3	13.3	4.7	0.0	M	M	0.0			<31
05†	16.5	8.1	12.3	5.7	0.0	M	M	2.5			<31
06†	19.0	6.1	12.6	5.4	0.0	M	M	3.5		27	46
07†	15.3	3.5	9.4	8.6	0.0	M	M	2.5		33	50
08†	16.2	2.9	9.6	8.4	0.0	M	M	0.0		29	33
09†	22.2	4.1	13.2	4.8	0.0	M	M	M			<31
10†	21.6	10.8	16.2	1.8	0.0	M	M	0.0		19	37
11†	20.8	8.3	14.6	3.4	0.0	M	M	0.0			<31
12†	25.4	11.0	18.2	0.0	0.2	M	M	0.0		25	41
13†	18.5	11.1	14.8	3.2	0.0	M	M	0.0		1	57
14†	16.8	6.1	11.5	6.5	0.0	M	M	0.5		1	33
15†	20.4	9.6	15.0	3.0	0.0	M	M	0.0		30E	35E
16†	20.9	5.5	13.2	4.8	0.0	M	M	0.0		32	46
17†	13.8	7.2	10.5	7.5	0.0	M	M	0.5			<31
18†	29.2	9.9	19.6	0.0	1.6	M	M	0.0		18	50
19†	21.2	5.5	13.4	4.6	0.0	M	M	0.0		32	50
20†	13.8	0.3	7.1	10.9	0.0	M	M	0.0			<31
21†	24.7	7.6	16.2	1.8	0.0	M	M	0.0		14	37
22†	22.6	15.9	19.3	0.0	1.3	M	M	5.0		18	46
23†	19.3	11.9	15.6	2.4	0.0	M	M	21.0		31	44
24†	17.7	7.9	12.8	5.2	0.0	M	M	11.0		27	44
25†	22.2	9.0	15.6	2.4	0.0	M	M	0.0		20	48
26†	18.4	4.7	11.6	6.4	0.0	M	M	0.0		2	56
27†	15.1	-0.5	7.3	10.7	0.0	M	M	0.0			<31
28†	17.1	8.1	12.6	5.4	0.0	M	M	0.0		17	50
29†	10.9	3.1	7.0	11.0	0.0	M	M	0.0		34	52
30†	15.2	1.5	8.4	9.6	0.0	M	M	0.0			<31
Sum				**152.9**	**3.1**	**M**	**M**	**77.0***			
Avg	**18.9**	**7.1**	**12.99**								
Xtrm	**29.2**	**-0.5**								**1**	**57**

Legend

[empty] = No data available
M = Missing

Navigation Options

Canada Map
Manitoba Map

Environment Canada Environnement Canada

Notices:
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Daily Data Report for October 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023226 **WMO ID:** 71852 **TC ID:** YWG

Note: Outreach Officer Mr. Dale Marciski provided rain amounts to fill in missing data (M)

Daily Data Report for October 2008

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	16.9	1.7	9.3	8.7	0.0	M	M	0.0			<31
02†	14.2	2.6	8.4	9.6	0.0	M	M	0.0		4	33
03†	14.1	1.3	7.7	10.3	0.0	M	M	0.0			<31
04†	18.3	4.6	11.5	6.5	0.0	M	M	0.0		18	37
05†	18.4	6.4	12.4	5.6	0.0	M	M	0.0		13	56
06†	16.0	10.2	13.1	4.9	0.0	M	M	13.0		14	57
07†	15.0	5.6	10.3	7.7	0.0	M	M	0.0			<31
08†	14.7	5.9	10.3	7.7	0.0	M	M	0.5		3	70
09†	10.7	3.8	7.3	10.7	0.0	M	M	0.5		28	65
10†	10.3	-0.8	4.8	13.2	0.0	M	M	0.5			<31
11†	8.0	4.2	6.1	11.9	0.0	M	M	0.0		3	37
12†	9.3	5.7	7.5	10.5	0.0	M	M	24.5		3	37
13†	7.6	2.3	5.0	13.0	0.0	M	M	1.0		25	39
14†	13.5	-0.2	6.7	11.3	0.0	M	M	0.5		18	52
15†	7.6	4.4	6.0	12.0	0.0	M	M	0.0		30	54
16†	11.1	-0.2	5.5	12.5	0.0	M	M	M 0.0			<31
17†	12.0	-1.6	5.2	12.8	0.0	M	M	0.0		2	39
18†	14.4	6.3	10.4	7.6	0.0	M	M	0.0		18	50
19†	12.8	-2.5	5.2	12.8	0.0	M	M	0.0		33	37
20†	8.9	-4.8	2.1	15.9	0.0	M	M	M 0.0			<31
21†	10.7	0.1	5.4	12.6	0.0	M	M	M 2.0		18	69
22†	7.9	3.9	5.9	12.1	0.0	M	M	M 2.3		19	50
23†	8.6	1.5	5.1	12.9	0.0	M	M	0.0		20	39
24†	12.5	1.6	7.1	10.9	0.0	M	M	0.0		19	32
25†	13.5	4.0	8.8	9.2	0.0	M	M	M 2.0		33	63
26†	5.8	-1.8	2.0	16.0	0.0	M	M	M 2.4		33	80
27†	1.8	-2.9	-0.6	18.6	0.0	M	M	0.0		33	54
28†	10.3	-3.4	3.5	14.5	0.0	M	M	0.0			<31
29†	13.1	-3.0	5.1	12.9	0.0	M	M	M 0.0		18	56
30†	17.4	-1.7	7.9	10.1	0.0	M	M	M 0.0		30	48
31†	7.6E	-5.5E	1.1E	16.9E	0.0E	M	M	0.0			<31
Sum				**351.9E**	**0.0E**	**M**	**M**	**40.5*** 49.2			
Avg	**11.7E**	**1.5E**	**6.62E**								
Xtrm	**18.4E**	**-5.5E**								**33**	**80**

Legend
[empty] = No data available

Navigation Options
Canada Map

Environment Canada Environnement Canada

Notices:
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Daily Data Report for November 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023226 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for November 2008

Day	Max Ter °C	Min Ter °C	Mean Tei °C	Heat Deg D °C	Cool Deg D °C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01†	12.5	-1.0	5.8	12.2	0.0	M	M	0.0		17	50
02†	11.4	-0.3	5.6	12.4	0.0	M	M	0.0		18	44
03†	18.8	1.0	9.9	8.1	0.0	M	M	0.0		17	54
04†	15.2	2.3	8.8	9.2	0.0	M	M	0.0		23	39
05†	7.4	3.2	5.3	12.7	0.0	M	M	0.0		3	56
06†	3.8	-0.1	1.9	16.1	0.0	M	M	25.5		3	69
07†	0.1	-3.9	-1.9	19.9	0.0	M	M	4.5		3	48
08†	-3.8	-6.5	-5.2	23.2	0.0	M	M	0.0			<31
09†	-5.4	-12.6	-9.0	27.0	0.0	M	M	0.0		36	33
10†	-5.5	-14.6	-10.1	28.1	0.0	M	M	0.0			<31
11†	0.2	-8.6	-4.2	22.2	0.0	M	M	0.0		18	56
12†	0.6	0.1	0.4	17.6	0.0	M	M	2.5		19	46
13†	1.1	0.2	0.7	17.3	0.0	M	M	8.5		18	37
14†	0.3	-6.1	-2.9	20.9	0.0	M	M	0.5		35	54
15†	-2.8	-11.3	-7.1	25.1	0.0	M	M	0.0			<31
16†	-1.3	-13.5	-7.4	25.4	0.0	M	M	0.5		M	39
17†	-7.4	-16.0	-11.7	29.7	0.0	M	M	0.0			<31
18†	-2.0	-10.7	-6.4	24.4	0.0	M	M	0.5		17	48
19†	-2.7	-11.7	-7.2	25.2	0.0	M	M	0.0		33	44
20†	-10.6	-17.7	-14.2	32.2	0.0	M	M	0.0		3	39
21†	-9.3	-19.1	-14.2	32.2	0.0	M	M	0.0			<31
22†	-2.2	-14.4	-8.3	26.3	0.0	M	M	0.0		2	39
23†	1.7	-7.1	-2.7	20.7	0.0	M	M	0.0		21	37
24†	-1.0	-9.2	-5.1	23.1	0.0	M	M	0.0		34	44
25†	-0.6	-11.4	-6.0	24.0	0.0	M	M	0.0		18	46
26†	0.9	-12.2	-5.7	23.7	0.0	M	M	0.0		17	37
27†	1.2	-12.2	-5.5	23.5	0.0	M	M	2.0		33	54
28†	-6.5	-15.6	-11.1	29.1	0.0	M	M	0.0			<31
29†	-6.7	-8.5	-7.6	25.6	0.0	M	M	0.0			<31
30†	-5.8	-16.7	-11.3	29.3	0.0	M	M	0.0		33	35
Sum				**666.4**	**0.0**	**M**	**M**	**44.5**			
Avg	**0.1**	**-8.5**	**-4.21**								
Xtrm	**18.8**	**-19.1**								**3***	**69**

Legend	Navigation Options
[empty] = No data available	Canada Map
M = Missing	Manitoba Map

Environment Canada Environnement Canada Canada

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Notices:

As of July 24, 2008 changes were made in how data are accessed at 25 stations. Please click here for further details.

Daily Data Report for December 2008

Notes on Data Quality.

WINNIPEG RICHARDSON AWOS
MANITOBA

Latitude: 49° 55.200' N **Longitude:** 97° 13.800' W **Elevation:** 238.70 m
Climate ID: 5023226 **WMO ID:** 71852 **TC ID:** YWG

Previous Month December 2008 Go Next Month

Daily Data Report for December 2008

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	-5.1	-20.4	-12.8	30.8	0.0	M	M	1.5		18	63
02†	0.9	-12.4	-5.8	23.8	0.0	M	M	0.0		33	72
03†	-10.2	-18.3	-14.3	32.3	0.0	M	M	0.0		35	41
04†	-10.4	-16.5	-13.5	31.5	0.0	M	M	0.0		29	35
05†	-8.1	-14.2	-11.2	29.2	0.0	M	M	1.0		1	54
06†	-12.7	-23.8	-18.3	36.3	0.0	M	M	0.0		35	48
07†	-12.2	-23.5	-17.9	35.9	0.0	M	M	1.5		16	33
08†	-13.4	-23.6	-18.5	36.5	0.0	M	M	0.0		2	32
09†	-16.5	-24.6	-20.6	38.6	0.0	M	M	0.0			<31
10†	-12.9	-23.9	-18.4	36.4	0.0	M	M	4.0		1	37
11†	-20.6	-30.5	-25.6	43.6	0.0	M	M	0.5			<31
12†	-7.1	-26.2	-16.7	34.7	0.0	M	M	1.0		19	41
13†	-9.3	-26.0	-17.7	35.7	0.0	M	M	0.0		2	52
14†	-24.9	-26.9	-25.9	43.9	0.0	M	M	0.5		2	57
15†	-24.6	-30.4	-27.5	45.5	0.0	M	M	0.0		34	39
16†	-21.0	-26.9	-24.0	42.0	0.0	M	M	0.5		19	44
17†	-21.2	-27.7	-24.5	42.5	0.0	M	M	0.0			<31
18†	-21.2	-27.3	-24.3	42.3	0.0	M	M	0.5		4	32
19†	-17.2	-27.0	-22.1	40.1	0.0	M	M	1.0			<31
20†	-16.3	-18.9	-17.6	35.6	0.0	M	M	6.5		4	41
21†	-17.4	-26.0	-21.7	39.7	0.0	M	M	0.0		1	56
22†	-20.2	-29.2	-24.7	42.7	0.0	M	M	0.0			<31

23†	-17.3	-30.8	-24.1	42.1	0.0	M	M	1.0		<31
24†	-23.2	-30.8	-27.0	45.0	0.0	M	M	0.0		<31
25†	-10.4	-23.6	-17.0	35.0	0.0	M	M	0.5	18	44
26†	-6.9	-10.7	-8.8	26.8	0.0	M	M	0.5		<31
27†	-10.7	-21.8	-16.3	34.3	0.0	M	M	0.5		<31
28†	-15.8	-22.5	-19.2	37.2	0.0	M	M	0.0		<31
29†	-12.2	-23.7	-18.0	36.0	0.0	M	M	0.0	34	37
30†	-20.7	-27.8	-24.3	42.3	0.0	M	M	0.0		<31
31†	-15.4	-26.0	-20.7	38.7	0.0	M	M	0.0	19	41
Sum				**1157.0**	**0.0**	**M**	**M**	**21.0**		
Avg	**-14.7**	**-23.9**	**-19.29**							
Xtrm	**0.9**	**-30.8**							**33**	**72**

Previous Month | December 2008 Go | Next Month

Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred
F = Accumulated and estimated
N = Temperature missing but known to be > 0
Y = Temperature missing but known to be < 0
S = More than one occurrence
T = Trace
* = The value displayed is based on incomplete data
† = Data for this day has undergone only preliminary quality checking

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
Customizable Chart
Bulk Data (2008) [CSV] [XML]

Date Modified: 2008-10-09