MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION PROJECT
FINAL DESIGN – WORK PARCEL 2

2007 CONSTRUCTION SURFACE WATER MONITORING

FINAL REPORT
MARCH 2008

KGS Group Project: 05-1100-01
Reference Number: .9905221 NM6

KGS Group
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March 28, 2008 File No. 05-1100-01.19.06.03

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

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

RE: Red River Floodway Expansion Project
2007 Construction Surface Water Monitoring Report
Reference Number: .9905221 NM06
Final Report

Dear Mr. Peterson:

Please find enclosed twenty (20) paper copies and one (1) electronic copy of the Final Report for the 2007 Construction Surface Water Monitoring of the Red River Floodway Expansion. An electronic copy of each individual Final Monthly Monitoring Report from January to December, 2007 is provided separately, 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 2007 construction time period. The data includes the monthly and event-based (level I and spill) monitoring. We would appreciate receiving your comments by March 17, 2008, to ensure the final report is issued to Manitoba Conservation by March 31, 2008 as required.

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

Yours truly,

Dave MacMillan, P. Eng.
Project Manager

SM/dbm/mlb
Enclosure

cc: Mr. Doug McNeil, Vice President Engineering and Construction – MFA

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EXECUTIVE SUMMARY

The Red River Floodway Expansion Project Screening Report prepared for the federal 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. 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 will form the basis for comparison to this 2007 construction monitoring report and all future construction monitoring reports that will be compiled at the end of each construction year. Comparison of the 2007 construction monitoring to baseline data will allow 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 2007 construction year was conducted from January to December 2007 in conjunction with the on-going construction activities. This 2007 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 2007 construction monitoring data is summarized and compared to the data presented in the baseline surface water monitoring report.

There were thirteen (13) monthly monitoring events, with one conducted each month following precipitation events or at the spring flood peak and an additional monitoring event on July 3, 2007 during the summer Red River flood condition. There were fifteen (15) level I event-based monitoring events conducted between March and October 2007 in response to precipitation events of 10 mm or greater. Additionally, spill event-based monitoring was conducted on February 13, 16 and 19 and again on March 5 in the vicinity of the Kildare Trunk-Transcona Storm Sewer Outlet, as well as in the Floodway Channel further downstream and in the Red River. The monitoring was conducted in response to the contractor at Contract C5 reporting that a “slug” of oily material was flowing down the active Kildare land drainage system (LDS) and passing through the construction site, resulting in oily material identified on top of the ice in the Floodway Low Flow Channel and at the Kildare LDS outlet structure.

Construction activities for the floodway at the start of January 2007 consisted of Channel Contracts; C-3A (Stn 12+430 – 19+200 west side), C-3B (Stn 12+430 – 19+200 east side), C4 (Stn 22+250 – 25+650), C5 (Stn 25+970 – 30+140) and C6A (Stn 30+280 – 33+750 west side); bridge Contracts for PTH 59 South (T4, Stn 12+250), Trans-Canada Highway (T5, Stn 19+600), CNR Sprague (T8/T9, Stn 19+300) and CNR Redditt (T11, Stn 25 + 880); as well as the Aqueduct (A1, Stn 20+300 – 22+073). The remaining Channel contracts that started construction during 2007 were as follows: C7b (Stn 35+200 – 40+900 east side) in June; C3C (Stn 19+715 – 20+900), C8A (Stn 40+865 – 48+500 west side) and C8B (Stn 40+900 – 50+430 east side) in July; C6B (Stn 33+670 – 35+060 east side) in August; and C7A (Stn 35+100 – 40+590 west side) in September. The two remaining bridge contracts CPR Emerson (T12, Stn 11+200) and CPR Keewatin (T14, Stn 30+220) started construction in May and December 2007, respectively. Construction on the Inlet and Outlet structures started in August and July

2007, respectively. As part of the Channel contracts during 2007, seeding and fertilizer applications occurred from July to November. Construction activities for the West Dyke included earthworks initiated in June (W5), July (W7, W8 and W10), August (W6, W9, W13 and W14) and September (W12). Most of these contracts were completed by the end of November, with the exception of W5, W9 and W12, as well as a new Contract W17 that was initiated in December. Supply and placement of granular topping along Contracts W1 to W3 (W11) was also completed during July and August. Details of the construction contracts and activities that occurred during each month are summarized in each of the individual monthly monitoring reports, NM6.1 – January to NM6.12 – December, 2007.

The Manness and Domain Drains downstream of the West Dyke were only sampled during the April monthly monitoring (coincident with the spring flooding), summer flood (July 3), and the May, June and July monthly monitoring because they were dry or frozen during all the other monthly monitoring dates. This monitoring conducted along the West Dyke in 2007 is representative of baseline conditions because there were no construction activities in the vicinity of the Manness drain during 2007 construction period and the construction activities (W13 and W14) in the vicinity of the Domain drain during 2007 began after the July monthly monitoring was completed. Therefore analytical results from the April to July monthly monitoring will not be discussed in this construction monitoring report.

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 spring flooding, summer flooding, 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 and each of the locations sampled during the spill event-based monitoring. During the April monthly monitoring (spring flood) 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 March and October have typically indicated very small changes in TSS concentration in the Red River during the 2007 construction year. The only TSS concentration increase in the Red River was an increase of 0.07% following the June 18 monitoring that occurred following a rain that was less than a 2-year event. This potential increase in sediment concentration in the Red River downstream of the Channel discharge at the Outlet was well below the Provincial Guidelines and CCME criteria of an allowable 10% increase. Nearly all the other level I event based monitoring measured a decrease of less than 1.0%, therefore, no level II event-based monitoring was required during the 2007 construction year.

Spill event-based monitoring was conducted on February 13, 16 and 19, 2007 in response to the oily material that was flowing down the active Kildare LDS and passing through the construction site to the Floodway Low Flow Channel at the end of the Kildare LDS discharge channel. This spill was not a result of construction activities, as the hydrocarbon material was originating from the upstream side of the Kildare LDS, which is the responsibility of the City of Winnipeg. The laboratory analysis of the source hydrocarbon material collected from within the pipe measured concentrations of hydrocarbon fractions F2 (227,000 µg/L), F3 (12,200,000 µg/L) and F4 (5,320,000 µg/L). The carbon range for the product is characteristic of hydrocarbons such as heavy oils. Laboratory surface water sampling results for the samples collected in the Floodway Channel and Red River did not show any concentration of hydrocarbons attributable to the heavy oil contained and removed from the Kildare LDS site, nor above the applicable CCME criteria.

The results of the hydrocarbon analysis show that BTEX are below detection limits for all of the sample locations on each of the three spill event sampling days, including the sample of the hydrocarbon material. Hydrocarbon fractions F1 to F4 were below detection limits in nearly all the samples collected from the Floodway Channel and the Red River during each of the three sample days. The sample collected in the Red River upstream of the Outlet on February 13, 2007 had a low F3 fraction concentration (570 µg/L), however, this sample represents the background condition as it is located upstream of the Outlet and is not a result of the spill or construction activities. Very low concentrations of F1 fraction were measured in the samples collected on February 16, 2007 from the Floodway Channel at the Outlet (200 µg/L) and in the Red River upstream of the Outlet (100 µg/L). These detectable concentrations were not related to the spill at the Kildare LDS as the source material did not contain the hydrocarbon fraction F1.

A final spill event-based monitoring was conducted on March 5, 2007 as a follow-up to the clean-up activities completed. The results of the hydrocarbon analysis show that all hydrocarbon parameters analyzed were below detection limits for all of the samples collected from the Floodway Channel and the Red River, except for a small concentration of toluene (0.6 µg/L) measured in the Floodway Channel at the Outlet. This detectable concentration was below the applicable CCME criteria (2.0 µg/L) and was not related to the spill at the Kildare LDS as the source material did not contain toluene.

The spring flood condition, represented by the April monthly monitoring event, had elevated concentrations of all parameters of interest including total suspended solids (TSS), specific conductance, total phosphorus, ammonia, nitrate + nitrite-N, potassium, sodium, chloride and *E.Coli* in the Floodway Channel, compared to spring flood baseline conditions. The concentrations of these parameters generally fluctuated within the Floodway Channel compared to spring flood baseline concentrations and may be due to agricultural runoff from drains entering into the Floodway Channel during the April 2007 spring flood period. Baseline flood conditions measured in the Floodway Channel during the spring peak flow period in April 2005 was primarily inflow from the Red River and not the drains, whereas, the April 2007 flood had a larger inflow of water from drains entering into the Floodway Channel compared to inflow from the Red River. The elevated concentrations above spring flood baseline values were not likely attributed to construction activities because most parameter concentrations downstream of construction were lower than parameter concentrations upstream of construction, except for increases in total phosphorus and potassium. Additionally, parameter concentrations in the Red River downstream of the Outlet were lower than concentrations upstream of the Outlet, except for ammonia. The slight elevated ammonia concentration was within the range of natural variation observed in the Red River during the spring flood baseline monitoring.

The summer flood condition, represented by the July 3 monitoring event, had concentrations for the parameters of interest measured in the Floodway Channel that were within or lower than the summer flood baseline concentrations. Most parameter concentrations in the Floodway Channel downstream of construction were lower compared to the background concentrations upstream of construction, indicating no effect from construction except for a minimal increase in ammonia and moderate increase in *E.Coli*. Similarly, most parameter concentrations in the Red River downstream of the Outlet were generally lower compared to the background concentration upstream of the Outlet with the exception of minimal increases in total phosphorus, ammonia and *E.Coli*.

Several of the key water quality parameter concentrations, in particular electrical conductivity, ammonia, 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, concentrations of total phosphorus, ammonia, nitrate + nitrite-N and potassium measured in the Floodway Channel were generally within the summer baseline concentrations with only one or two samples having elevated concentrations. TSS concentrations in the Floodway Channel were also typically within the baseline concentrations except during June and July when concentrations were higher than baseline from downstream of North Bibeau to the Outlet. In comparison, specific conductance, sodium and chloride concentrations in the Floodway Channel were within baseline concentrations during June and July and higher for the other months during the non-flood unfrozen condition. *E.Coli* concentrations were typically elevated above baseline concentrations at most Floodway Channel Locations. For all of the parameters, these concentrations elevated above baseline in the floodway were lower than the concentration in the Red River, except specific conductance, sodium and chloride concentrations in September and October. Therefore the elevated concentrations would have no effect on concentrations in the Red River or result in dilution if anything. The elevated levels of specific conductance, sodium and chloride above summer baseline concentrations were a result of the dry conditions during August and September with little surface water contribution to the Low Flow Channel relative to natural groundwater infiltration and the temporary construction groundwater dewatering.

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, total phosphorus and *E.Coli* concentrations. The TSS concentration increases measured in the Red River downstream of the Outlet were typically less than the CCME criteria of an allowable increase of 25 mg/L. During May and June the TSS concentration increases measured 3 km downstream of the Outlet exceeded the CCME criteria, however, this was likely a result of natural variation in the river and not related construction, because all other TSS concentrations in the Red River downstream of the Outlet during May and June were below the background TSS concentration. The increases in total phosphorus downstream of the Outlet reflected the changes observed for TSS concentrations. Although increases in total phosphorus were measured, the concentrations were within the range of Red River baseline concentrations. Likewise, although increases in *E.Coli* were measured the concentrations were within baseline concentrations. Additionally the elevated total phosphorus and *E.Coli* concentrations have no basis for evaluation, as there is no applicable CCME criterion. The ammonia concentrations measured in the Red River downstream of the Outlet during September and October resulted in exceedances of the CCME un-ionized ammonia criteria. These exceedances are not a result of construction, because the background concentrations upstream of the Outlet during September and October as well as May and August, and the 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 specific conductance, ammonia, potassium, sodium and chloride were higher than baseline concentrations in the Floodway Channel downstream of the Grande Pointe drain during the January or March monitoring. These elevated concentrations were not attributed to construction because they were typically isolated to a single sample in the Floodway Channel. The elevated specific conductance, sodium and chloride measured in March may potentially be from road salts running into the Floodway Channel off of the nearby bridge crossings. 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. Additionally, the elevated potassium concentration in the Floodway Channel has no basis for evaluation, as there is no applicable CCME criterion.

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 November and December tended to show larger increases. The ammonia concentrations measured in the Red River at the Outlet during January, February and November resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and downstream. 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. The concentration increases downstream of the Outlet were not attributed to construction activities within the Floodway Channel, as the parameter concentrations in the Floodway Channel were typically within baseline concentrations and most were lower compared to the Red River, such that they would have resulted in dilution if anything. However, the increase in TSS and total phosphorus concentrations measured in November were likely associated with construction activities at the Outlet structure.

The elevated TSS concentrations measured in the Red River downstream of the Outlet during the November monthly monitoring exceeded the CCME criteria of an allowable increase of 25 mg/L above background concentrations upstream of the Outlet. This exceedance appears to be a result of adjustments made to the cofferdam dewatering settling pond, in combination with significant pumping being conducted through to the end of November. Any sediments disturbed while adjusting the settling pond would not have had sufficient time to resettle before overflowing into the Outlet channel on the Red River. This exceedance appears to be a short term occurrence as no further adjustments were made to the settling pond and further monthly monitoring during December 2007 confirmed that concentrations in the Red River returned to typical low winter values. The increase in total phosphorus concentrations measured in the Red River downstream of the Outlet during November may be associated with this increase in TSS concentrations. Disturbed sediments in the rivers edge downstream of the Outlet may be releasing total phosphorus accumulated in these sediments over time from agricultural drains. However, the elevated total phosphorus concentration in the Red River has no basis for evaluation, as there is no applicable CCME criterion.

The results of the 2007 Construction monitoring events are within the environmental effects predictions made during the engineering design and modelling as reported in the project EIS. Based on the 2007 results, recommendations and refinements for the ongoing monitoring 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 2008 surface water monitoring program.

- The Event-based monitoring in 2008 should continue to follow the protocol used in 2007 that incorporated revisions made in 2006, based on the results of a review of precipitation levels and measured TSS increases. The 2007 protocol was reviewed near the end of the 2007 monitoring program (with no changes made) and should be reviewed again during the 2008 monitoring program and revised if required as construction contracts near completion.

- The reporting protocol for the 2008 surface water monitoring program should be modified slightly from that used in 2007 in order to flag potential increases in TSS concentrations more rapidly. A level I event-based worksheet should be filled out for each of the Monthly monitoring events in order 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 following the current 2007 protocols. In comparison, 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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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, Fisheries and Oceans Canada, and Transport 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 form the basis for comparison to this 2007 construction monitoring report and all future construction monitoring reports that will be compiled at the end of each construction year in 2008 and 2009. Comparison of the 2007 monthly construction monitoring (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 2007 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 summarized in an 2007 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 2007 construction year was conducted from January to December 2007 in conjunction with the on-going construction activities. There were thirteen (13) monthly monitoring events, with one conducted each month following precipitation events or at the spring flood peak and an additional monitoring event on July 3, 2007 during the summer Red River flood condition. There were fifteen (15) level I event-based monitoring events conducted between March and October, 2007 in response to precipitation levels. Additionally, spill event-based monitoring was conducted on February 13, 16 and 19 and again on March 5 in the vicinity of the Kildare Trunk-Transcona Storm Sewer Outlet as well as in the Floodway Channel further downstream and in the Red River. The monitoring was conducted in response to the contractor at Contract C5 reporting that a "slug" of oily material was flowing down the active Kildare land drainage system (LDS) and passing through the construction site; resulting in oily material identified on top of the ice in the Floodway Low Flow Channel and at the Kildare LDS outlet structure. No level II event-based monitoring was required during the 2007 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.

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

2.2 SAMPLING LOCATIONS

The sample locations for the 2007 construction monitoring program are outlined on Figure NM6–1 and Figure NM6–2, listed in table NM6-1 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 only sampled during the April monthly monitoring that coincided with the spring flooding and the July 3 summer flood sampling because there was no river water entering into the Floodway Channel at the Inlet during all of the other 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 kilometres (S-30, S-31, S-32 and S-33, respectively) were sampled during each of the thirteen (13) monthly monitoring events. Additionally, S-31 was also sampled during each of the fifteen (15) level I event-based monitoring events. 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 only sampled during the April monthly monitoring that coincided with the spring flooding and the July 3 summer flood sampling because there was no river water entering into the Floodway Channel at the Inlet during all of the other 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 were sampled during all thirteen (13) of the monthly monitoring events, except for S-13 that was not sampled during the February monthly monitoring because the water was frozen to the bottom of the channel and S-21 that was not sampled during the March monthly monitoring because of unsafe ice conditions.

Outfall Sources – Each of the 11 outfalls that drain into the Floodway Channel were sampled during the April monthly monitoring that coincided with the spring flooding and the July 3 summer flood sampling, except the Deacon Reservoir Drain (S-08), Country Villa Estates Drain (S-11), and the Kildare Trunk-Transcona Storm Sewer Outlet (S-12). These three were not sampled because they were not flowing and during the April spring flood the flap gate of the Kildare Trunk-Transcona Storm Sewer Outlet was inundated by flood waters.

None of the 11 outfalls were sampled during the non-flood frozen condition from January to March and November to December because the frozen condition prevented any water from flowing into the Floodway Channel.

During the non-flood unfrozen condition from May to October the Kildare Trunk-Transcona Storm Sewer Outlet (S-12) was not sampled at all, the Deacon Reservoir Drain (S-08) was only sampled in May and the Country Villa Estates Drain (S-11) was only sampled in May and June, because they were dry during all other monthly sampling events. The other 8 drains were each sampled during May, June, July and October, except for Seine River Syphon Overflow (S-05) that was not sampled during May and October and the Grande Point Diversion Drop Structure (S-06) was not sampled during October because they had no flow into the Floodway Channel. Most of the drains were dry and not sampled during August and September with the exception of the Skholny Drain Drop Structure (S-26) and Ashfield Drain Drop Structure (S-27) that were sampled in August and the Cooks Creek Diversion Drop Structure (S-09), Springfield Road Drain Drop Structure (S-22) and Ashfield Drain Drop Structure (S-27) that were sampled in September.

West Dyke – Two drains, the Manness (S-35) and Domain (S-36) Drains downstream of the West Dyke were sampled during the April monthly monitoring that coincided with the spring flooding and the July 3 summer flood sampling as well as during the May, June and July monthly monitoring during the non-flood unfrozen condition. These locations were dry or frozen during each of the other monthly monitoring events. There were no construction activities in the vicinity of the Manness drain along the West Dyke during the 2007 construction monitoring period. The construction activities in the vicinity of the Domain drain during 2007 began at the West Dyke Contracts W-13 and W-14, the weeks of August 6 and 20, respectively; after the July monthly monitoring was completed. As such the monitoring conducted along the west dyke in 2007 is representative of baseline conditions and will be included in the baseline data. Therefore analytical results from the April to July monthly monitoring will not be discussed in this construction monitoring report.

Construction Areas – In addition to the sample locations shown in figures NM6.1 and NM6.2, 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, NM6.1 – January to NM6.12 – December.

For the entire 2007 monitoring program the upstream end of construction was designated at Station 7+650. Although construction activities were completed in November, 2006 for the channel Contract C2 (Station 4+400 – 12+098), samples were collected from station 7+650 to represent the upstream conditions while the vegetation in the seeded areas downstream of this location was establishing. Samples were only collected from this upstream of construction location during the April monthly monitoring (Spring Flood) to the July monthly monitoring and 9 of the fifteen (15) level I event-based monitoring events because there was no flow during the other monthly and event-based monitoring.

Beginning in January 2007 the location downstream of construction was designated at Station 33+900, downstream of Contract C6A (Station 30+280 – 33+750) that began in November 2006. The location downstream of the construction zone was relocated to Station 40+850 in the Low Flow Channel after the level I event based sampling on June 18, 2007, as channel excavation began in Contract C7B (Station 35+200 – 40+900 east side). After July 16, 2007, the location downstream of the construction zone was relocated to Station 50+500, the furthest downstream extent of the Floodway Channel, following the start of channel excavation in Contract C8B (Station 40+900 – 50+430 east side). Samples were collected downstream of construction from these various locations during each of the thirteen (13) monthly and fifteen (15) level I event-based monitoring events.

For the entire 2007 monitoring program the location upstream of the revegetation zone was designated at Station 7+650, while vegetation in the areas of channel Contract C2 that were seeded in 2006, was establishing. Samples were only collected from this upstream of construction location during the April monthly monitoring (Spring Flood) to the July monthly monitoring because there was no flow during the other monthly monitoring events.

Seeding during the 2007 construction year did not begin until July 16, 2007 at Contract C5, however there is potential for runoff of fertilizer because of snowmelt and rain from areas seeded previously during 2006. No sample was collected in the Floodway Channel downstream of the revegetation zone during the January to March monthly monitoring because the previous 2006 revegetation activities were frozen and snow covered with no potential for nutrient run-off to the floodway. For the start of the 2007 monitoring program the location downstream of the revegetation zone was designated at Station 20+500 based on seeding conducted at the Trans-Canada Highway bridge contract (T5 Station 19+600) late in September, 2006. After the seeding began at Contract C5 (Station 25+970 – 30+140) and Contract C6A (Station 30+280 – 33+750 west side) in mid July, the location downstream of the revegetation zone was relocated to Station 34+500. After August 16, 2007, the location downstream of the revegetation zone was relocated to Station 50+500, the furthest downstream extent of the Floodway Channel, following the start of revegetation activities in Contracts C-7B (Station 35+200 – 40+900 east side) and C-8A (Station 40+865 – 48+500 west side) and eventually in November C-8B (Station 40+900 – 50+430 east side).

In addition to the above sample locations, during the spill event-based monitoring surface water samples were also collected from the Floodway Channel upstream (Station 27+385) and downstream (Station 27+535) of the spill area as well as further downstream at the Spring Hill (S-23) and PTH #44 (S28) weir locations and in the Red River upstream (S-34) and 1000 m downstream (S-31) of the Outlet. These samples were collected to assess potential hydrocarbon concerns associated with the oily material observed flowing down the active Kildare land drainage system (LDS) and passing through the construction site into the Floodway Channel.

2.3 SAMPLING PROTOCOL

Sample Frequency – The monthly monitoring events were conducted once per month from January to December, following a precipitation event or the spring flood. An additional monthly monitoring was also conducted on July 3 in response to the summer flooding conditions. Fifteen (15) level I event-based monitoring events were conducted between March and October in response to precipitation events of 10 mm as outlined in Appendix A. One spill event-based monitoring was conducted with four days of monitoring on February 13, 16 and 19 and March 5.

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 thirteen monthly monitoring, fifteen level I event-based monitoring events and the spill event-based monitoring, as outlined in Appendix A.

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 and each of the locations sampled during the spill event-based monitoring, benzene, toluene, ethylbenzene and xylenes (BTEX) and hydrocarbon fractions F1 to F4 were also analyzed. During the April monthly monitoring (spring flood) 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 downstream of the Outlet (S-31). No laboratory analysis of herbicides (phenoxy acid herbicide screen, AMPA and glyphosate) were required during the event-based monitoring as there were no herbicides applied during the 2007 construction year.

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 Accredited Environmental Analytical Laboratory (CAEAL) 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 2007 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 in either the low flow channel of the floodway or at the agricultural drain drop structure. 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 and allow for estimating flows in the low flow channel and when the water level overtops the banks of the low flow channel banks. While water levels from gauge readings are recorded in the winter the flow estimates are not calculated and reported anywhere unless they have been used in the mass balance calculations as part of the event based worksheets.

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. The April monthly monitoring and the additional July summer flood monitoring, however, were conducted based on the respective Red River flood peaks (Appendix B). Full details of the hydrological conditions for each monthly monitoring are provided in each of the monthly monitoring reports, NM6.1 – January to NM6.12 – 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, 2007 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 2007 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 25 & 26	1.0	9%	11.5	19.7
February 22	6.0	32%	19.0	14.9
March 19 & 20	10.0	17%	57.7	21.5
April 9	-	-	15.9	31.9
May 22	27.0	37%	72.5	58.8
June 8	15.5	13%	123.0	89.5
July 3	-	-	60.5	70.6
July 10	11.5	19%	60.5	70.6
August 15	3.5	14%	24.5	75.1
September 21	4.0	13%	30.0	52.3
October 9	19.5	42%	46.5	36.0
November 29	1.5	16%	9.5	25.0
December 20 & 21	3.5	18%	19.5	18.5
Annual Total			490.1	513.7

As evident by the table above, while 2007 had a relatively average amount of precipitation with an annual total precipitation of 490.1 mm compared to the historical average of 513.7 the conditions varied from month to month. January, April, August, September and November all had total monthly precipitation amounts substantially lower than the historical average monthly precipitation. In comparison, March and June both 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 March and October, 2007 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 2007 Event-Based Monitoring

Sample Date	Amount of Precipitation (mm) for the Monitoring Event [1]	Approximate Duration (hours)	Year Storm [(9)]
March 29	13.2 - 20.0	4	<2
May 5	4.3 - 16.5	10	<2
May 22	15 - 31 / 12.2 - 29.5	4 / 3.5	<2 / <2
May 26	7.1 - 19.1	9	<2
May 29	6.4 - 21.3	3	<2
June 7	15.2 - 24.3	6	<2
June 13	9.0 - 23.1	10	<2
June 18	14.2 - 24.6	1.75	<2
June 24	8.9 - 31.4	2	<2 - 2
June 25	15.7 - 26.0	6	<2
July 10	11.4 - 32.0	9	<2
July 26	10.2 - 24.2	5	<2
September 24	11.7 - 29.2	3	<2
October 9	10.0 - 36.6	17	<2
October 19	18.8 - 24.4	25	<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 NM6–1. 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 NM6–2. The petroleum hydrocarbons and bacteria results for samples collected during the monthly monitoring and the herbicide results for samples collected during the April monthly (spring flood) monitoring are summarized in Table NM6–3, Table NM6–4 and Table NM6–5, 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 spring flood, summer flood, 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 NM6-3 to NM6-43).

The April 2007 monthly monitoring was conducted during the 2007 spring flood peak and therefore represents the spring flood condition. As a result the baseline conditions for comparison shown on the figures for the Red River, Floodway Channel and drains that flow into the Floodway Channel are represented by the concentrations from the samples collected on April 12, 2005 during the Baseline Monitoring peak spring flood.

An additional July 2007 monthly monitoring was conducted on July 3, 2007 during the summer flood peak and therefore represents the summer flood condition. As such the baseline monitoring data obtained for the Red River, Floodway Channel and drains that flow into the Floodway Channel during the Baseline Monitoring summer flood period (June 24 and July 18, 2005) will form the basis for comparison to the 2007 summer flood condition.

During the May to October 2007 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 2005 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 2007 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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–3 to NM6–6.

The total suspended solids (TSS) concentrations measured in the Floodway Channel were below the spring flood baseline concentrations, except for the Dunning Weir location (280 mg/L; Figure NM6-3). This elevated TSS concentration was not attributed to construction as the TSS downstream of construction (47 mg/L) was lower compared to the background concentration upstream of construction (90 mg/L). Additionally, the elevated TSS at the Dunning Weir location did not effect concentrations further downstream in the Floodway Channel as observed by the concentration at the Outlet (100 mg/L) that was lower than concentrations in the Red River. This resulted in a slight dilution in TSS concentrations downstream of the Outlet (150 to 230 mg/L) compared to the background concentration upstream of the Outlet (270 mg/L).

The TSS concentration measured in the Floodway Channel downstream of construction (24 mg/L) was slightly lower compared to the background concentration upstream of construction (29 mg/L) during the summer flood condition (Figure NM6-4). Additionally, all of the TSS concentrations measured in the Floodway Channel were below the summer flood baseline concentrations. The TSS concentrations in the Red River downstream of the Outlet (53 to 130 mg/L) where also lower to similar compared to the background concentration in the Red River upstream of the Outlet (130 mg/L), indicating no construction effects during the summer flood event.

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 July (Figure NM6–5). During June and July the TSS concentrations were typically elevated above baseline concentrations in the Floodway Channel from downstream of the North Bibeau Drain to the Outlet. A few additional concentrations elevated above the baseline concentrations included the samples collected in the Floodway Channel downstream of vegetation in May (220 mg/L), at the Keewatin weir location in September (85 mg/L), at the Springhill weir location in October (69 mg/L) and at the PTH #44 weir location in August (170 mg/L). Although the TSS concentrations at the Outlet were elevated above the baseline concentrations during June and July, these concentrations along with the other monthly concentrations were lower than the background concentrations in the Red River upstream of the Outlet and would have resulted in dilution if anything.

Changes in TSS concentrations measured in the Red River downstream of the Outlet compared to the background concentration upstream or the Outlet varied during the months representing the non-flood/unfrozen condition (Figure NM6–5). The TSS concentrations measured downstream of the Outlet were generally lower compared to upstream during May and June (250 and 280 mg/L, respectively), except for the sample location 3 km downstream of the Outlet (320 and 360 mg/L, respectively). Although these concentration increases exceeded the CCME criteria of an allowable increase of 25 mg/L (compared to background levels), they were likely a result of natural variation in the river and not related construction, as all other TSS concentrations in the Red River downstream of the Outlet during May and June were below the background TSS concentration. Similarly, during July the TSS concentration immediately downstream of the Outlet was lower compared to upstream whereas further downstream the concentrations were higher. In comparison, during August and October, the TSS concentrations measured in the Red River downstream of the Outlet were slightly elevated compared to upstream of Outlet, although these concentration increases were less than the CCME criteria of an allowable increase of 25 mg/L. As noted above the concentrations in the Floodway Channel at the Outlet during the non-flood unfrozen condition were below the concentration in the Red River and would have resulted in dilution if anything. Additionally, except for a few of the May and June samples the TSS concentrations measured in the Red River at the Outlet were within the range of baseline TSS concentrations.

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 below the summer baseline concentrations during the monthly monitoring representing the non-flood/frozen condition, with two exceptions (Figure NM6-6). The TSS concentration measured at the location downstream of construction (49 mg/L; Station 50+500) during November and the PTH #44 weir location (68 mg/L) during December were both elevated above the baseline concentrations. The elevated TSS concentration in December was likely a result of disturbing the channel bottom when drilling through the ice cover to collect the sample and not due to construction activities within the Floodway Channel. This was shown by all the other sampling locations within the Channel, including the sample approximately 700 m further downstream, being below the summer baseline criteria. Additionally, the TSS concentrations measured in the Red River downstream of the Outlet during December (<5 to 12 mg/L) were similar or lower than the background concentration upstream of the Outlet (10 mg/L). Likewise, concentrations in the Red River downstream of the Outlet from January to March were either similar to or lower than upstream. In comparison, although the elevated TSS concentration measured downstream of construction in November was within the overall baseline range and below the concentrations in the Red River, the concentrations measured in the Red River downstream of the Outlet (250 to 400 mg/L) were elevated compared to the background concentration upstream of the Outlet (110 mg/L). These elevated TSS concentrations measured in the Red River during the November monthly monitoring exceeded the CCME criteria of an allowable increase of 25 mg/L above background concentrations. This exceedance appears to be a result of adjustments made on November 26 and 28 to the cofferdam dewatering settling pond that was initially constructed on November 21. Because there was significant pumping being conducted through to the end of November any sediments disturbed while adjusting the settling pond would not have had sufficient time to resettle before overflowing into the Outlet channel on the Red River. This exceedance appears to be a short term occurrence as no further adjustments were made to the settling pond and further monthly monitoring during December 2007 confirmed that concentrations in the Red River returned to typical low winter values ranging between below detection limits (<5 mg/L) to 12 mg/L.

The TSS concentrations measured in the Red River at the Floodway Outlet during 2007 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 2007, except November and some of the sample locations in May and June, were very close to the 10th to 90th percentile ranges (Figure NM6-7). During May only the TSS concentration in the Red River 3,000 m downstream of the Outlet (320 mg/L) was higher than the historical May 90th percentile (277 mg/L). During June the background TSS concentration in the Red River upstream of the Outlet (280 mg/L) and all the concentrations downstream (210 to 360 mg/L), except the location 500 m downstream were higher than the historical May 90th percentile (176 mg/L). These elevated TSS concentrations in the Red River may be associated with the higher than normal average monthly precipitations. Additionally, as discussed above the elevated TSS concentrations 3,000 m downstream of the Outlet are likely a result of natural variation in the river and not related to construction, as all of the other TSS concentrations in the Red River downstream of the Outlet were below the background TSS concentration. In comparison all of the TSS concentrations measured in the Red River during November (110 to 400 mg/L) were higher than the historical November 90th percentile (76 mg/L). While the background concentration upstream of the Outlet (110 mg/L) was higher than the 90th percentile as discussed above the concentrations downstream were even higher, exceeding the CCME criteria, likely in response to activities at the Outlet structure.

Event-Based Monitoring

Results of the 15 level I event-based monitoring events conducted between March and October have typically indicated very small changes in TSS concentration in the Red River during the 2007 construction year (Table NM6-6). The only measurable TSS concentration increase in the Red River was an increase of 0.07% following the June 18, which was well below the CCME criteria of an allowable increase of 10%. The June 18 rainfall with approximately 14 to 25 mm of rain in 1.75 hours was less than a 2-year storm; based on the Atmospheric Environment Service, Rainfall Intensity – Duration Frequency (Rainfall IDF) Values for the Winnipeg International Airport [(9)]. Nearly all the other level I event based monitoring measured a decrease of less than 1.0%. The level I event-based worksheet and the follow-up lab results fax for each rain event are provided with the monthly monitoring reports, NM6.1 – January to NM6.12 – 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 NM6-6. 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% is very unlikely for precipitation events less than 10 mm.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–8 to NM6–11.

Specific conductance measured in the Floodway Channel was generally similar to the baseline values during the monthly monitoring representing the spring flood condition, with the exception of slightly elevated values at the upstream end (Figure NM6-8). The elevated specific conductance was not attributed to construction because it was measured upstream of construction (547 µS/cm) and was similar to those measured in the Red River at the Inlet (550 µS/cm). Specific conductance measured downstream of construction was within spring flood baseline concentrations. The specific conductance values in the downstream end of the Floodway Channel were lower than in the Red River and resulted in a slight dilution downstream of the Outlet (445 to 523 µS/cm), compared to the background concentration upstream of the Outlet (548 µS/cm).

The specific conductance value measured in the Floodway Channel downstream of construction (413 µS/cm) was lower compared to the background concentration upstream of construction (591 µS/cm) during the summer flood condition (Figure NM6-9). Additionally, all of the specific conductance values measured in the Floodway Channel were within or below the summer flood baseline values. The specific conductance values in the Red River downstream of the Outlet (478 to 578 µS/cm) where also lower to similar compared to the background value in the Red River upstream of the Outlet (596 µS/cm), indicating no construction effects during the summer flood event.

The specific conductance measured in the Floodway Channel during June and July were generally within the range of summer baseline whereas during the other monthly monitoring representing the non-flood/unfrozen condition the values were generally above the range of summer baseline values (Figure NM6–10). In particular the values in the Floodway Channel at the Outlet were elevated above the baseline values during the May, September and October monthly monitoring. However, these elevated values did not result in any noticeable specific conductance increases in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet. The dry conditions during August and September resulted in less surface water contribution to the low flow channel compared to during the baseline conditions. Therefore, the relatively greater contribution of groundwater from infiltration and temporary construction groundwater dewatering likely contributed to the elevated specific conductance that was similar to winter baseline (1150 to 1730 µS/cm) conditions.

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 NM6–11). One exception was the high value measured in the Floodway Channel downstream of the Grande Pointe Drain (3100 μS/cm) during the March monitoring. The specific conductance values in the Floodway Channel at the Outlet were slightly higher compared to those in the Red River at the Outlet. This contributed to specific conductance increases in the Red River downstream of the Outlet compared to the background values upstream of the Outlet. However, most increases were very small and several decreases were also measured. 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.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–12 to NM6–15.

Total phosphorus concentrations measured in the Floodway Channel were generally within or below the range of spring flood baseline values, except for downstream of the North Bibeau drain (0.64 mg/L; Figure NM6-12). This elevated concentration is likely a result of the elevated phosphorus flowing into the floodway from the North Bibeau drain (0.661 mg/L) and is not attributed to construction, as the total phosphorus concentration downstream of construction (0.436 mg/L) was within spring flood baseline values and only slightly higher than the concentration upstream of construction (0.426 mg/L). Additionally, this elevated total phosphorus concentration measured in the Floodway Channel did not effect concentrations further downstream or in the Red River. The concentration in the Floodway Channel at the Outlet was lower than in the Red River with a slight dilution measured downstream of the Outlet

(0.371 to 0.495 mg/L) compared to the background concentration upstream of the Outlet (0.534 mg/L).

The total phosphorus concentration measured in the Floodway Channel downstream of construction (0.289 mg/L) was lower compared to the background concentration upstream of construction (0.342 mg/L) during the summer flood condition (Figure NM6-13). Additionally, all of the total phosphorus concentrations measured in the Floodway Channel were below the summer flood baseline concentrations. The total phosphorus concentrations in the Red River downstream of the Outlet (0.326 to 0.415 mg/L) where also lower to similar compared to the background concentration in the Red River upstream of the Outlet (0.412 mg/L), indicating no construction effects during the summer flood event.

The total phosphorus concentrations measured in the Floodway Channel were lower or within the baseline concentrations, during the monthly monitoring representing the non-flood/unfrozen condition (Figure NM6–14). Additionally, the total phosphorus concentrations measured in the Floodway Channel at the Outlet were lower compared to the concentrations in the Red River and would have resulted in dilution if anything. The total phosphorus concentrations measured in the Red River downstream of the Outlet during the August to October monitoring were slightly lower compared to the background concentration upstream of Outlet. In comparison from May to July the total phosphorus concentrations reflected the trends observed for TSS concentrations. During May and June the total phosphorus concentrations measured downstream of the Outlet were generally lower compared to upstream (0.408 and 0.348 mg/L, respectively), except for the sample location 3 km downstream of the Outlet (0.479 and 0.410 mg/L, respectively). Similarly, during July the total phosphorus concentration immediately downstream of the Outlet was lower compared to upstream whereas further downstream the concentrations were higher. These concentrations increases observed are not a result of construction activities in the Floodway Channel, as noted above the concentrations in the Floodway Channel at the Outlet were below the concentration in the Red River and would have resulted in dilution if anything. Additionally, the total phosphorus concentrations measured in the Red River at the Outlet were within the range of baseline total phosphorus concentrations.

The total phosphorus concentrations were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were almost always lower than the summer baseline concentrations, with a few samples within the lower part of the range, during the monthly monitoring representing the non-flood/frozen condition (Figure NM6–15). Likewise, concentrations in the Red River were typically within the range of baseline concentrations and the concentrations downstream of the Outlet were either similar to or lower than the background concentrations upstream of the Outlet. Slight concentration increases were measured during the March and December monitoring however, these were not attributed to construction, as the total phosphorus concentrations in the Floodway Channel were lower than the concentrations in the Red River and would have resulted in dilution if anything. In comparison during the November monitoring the range of total phosphorus concentrations in the Red River downstream of the Outlet (0.527 to 0.675 mg/L) were moderately higher compared to concentration upstream of the Outlet (0.515 mg/L). The elevated total phosphorus concentrations have no basis for evaluation, as there is no applicable CCME criterion. The elevated concentrations were not likely due to construction activities within the Floodway Channel because the total phosphorus concentration measured in the Floodway Channel at the Outlet (0.030 mg/L) and at all other channel locations were much lower compared to the Red River concentrations. However, the increase in total phosphorus may be associated with the increase in TSS concentrations measured downstream of the Outlet from activities at the Outlet structure, as previously discussed. Disturbed sediments in the rivers edge downstream of the Outlet may be releasing total phosphorus accumulated in these sediments over time from agricultural drains.

The total phosphorus concentrations measured in the Red River at the Floodway Outlet during 2007 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 2007, except November and some of the sample locations in June and July (10^{th}), were within the 10^{th} to 90^{th} percentile ranges (Figure NM6-16). During November the total phosphorus concentration in the Red River upstream of the Outlet (0.515 mg/L) and downstream of the Outlet (0.527 to 0.675 mg/L) were higher than the historical November 90^{th} percentile (0.37 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 November monitoring as previously discussed.

Event-Based Monitoring

Total phosphorus was only analyzed during 4 of the 15 event-based monitoring events conducted, beginning on July 26 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 generally by an order of magnitude, except during the July 26 (0.211 mg/L) event-based monitoring, which was still lower than the concentration in the Red River (0.307 mg/L; Table NM6-2). These results indicate that during 2007 total phosphorus was not a concern, as the concentrations in the Floodway Channel would have resulted in dilution in the Red River if anything. Additionally the total phosphorus concentrations measured in the Floodway Channel and 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.

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 2007 construction monitoring program, the pH ranged from 7.38 to 9.16, which except for the highest value of 9.16 measured on October 9 in the Centreline drain upstream of construction, was within the CCME criteria for the protection of freshwater aquatic life (6.5 to 9.0; Table NM6-2). For the 2007 construction monitoring program the temperature ranged from 0°C to 25°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 NM6-2). 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 spring flooding, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–17 to NM6–20.

The ammonia concentration measured in the Floodway Channel during the spring flood condition were below the range of spring baseline concentrations, except for downstream of the inlet (0.292 mg/L) and the location upstream of construction and revegetation (0.279 mg/L; Figure NM6-17). These elevated concentrations were similar to the Red River concentrations upstream of the Inlet and because they are upstream of construction activities they are representative of background conditions. The ammonia concentrations in the remainder of the Floodway Channel were much lower than the concentrations in the Red River. As such the concentrations measured in the Red River downstream of the Outlet (0.175 to 0.291 mg/L) where lower to similar compared to the background concentration in the Red River upstream of the Outlet (0.274 mg/L). All of the ammonia concentrations measured during the spring flood condition resulted in acceptable un-ionized ammonia concentrations below the CCME criteria.

The ammonia concentration measured in the Floodway Channel downstream of construction (0.059 mg/L) was slightly elevated compared to the background concentration upstream of construction (0.028 mg/L) during the summer flood condition (Figure NM6-18). However, all of the ammonia concentrations measured in the Floodway Channel were within or below summer flood baseline values. Additionally, the ammonia concentrations measured in the Floodway Channel were lower compared to the Red River resulting in negligible concentration changes downstream of the Outlet (0.060 to 0.064 mg/L) compared to the background concentration upstream of the Outlet (0.062 mg/L). All of the ammonia concentrations measured in the Floodway Channel, Red River and drains that flow into the Floodway during the summer flood condition resulted in acceptable un-ionized ammonia concentrations below the CCME criteria.

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 NM6–19). A few notable exceptions included the ammonia concentrations measured in the Floodway Channel downstream of the revegetation zone (stn. 20+500) during May (0.537 mg/L), at the Springhill weir location in August (0.121 mg/L) and at the Springhill (0.159 mg/L) and Dunning (0.127 mg/L) weir locations and downstream of the construction zone (0.119 mg/L) during the July monthly monitoring, which were higher than the summer baseline range. However, all of these ammonia concentrations elevated above baseline in the Floodway Channel resulted in un-ionized ammonia concentrations between 0.012 and 0.017 mg/L, which do not exceed the CCME criteria of 0.019 mg/L. During the non-flood/unfrozen condition the range of ammonia concentrations measured in the Red River at the Outlet varied (Figure NM6–19). The ammonia concentrations measured in the Red River during September and October resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and downstream of the Outlet, whereas in May and August only the concentration upstream of the Outlet resulted in an exceedance. The ammonia concentrations in the Red River downstream of the Outlet compared to the background concentrations upstream were typically lower, except during July and the location 3 km downstream during June, which slightly higher. The slight increases in ammonia concentrations in the Red River downstream of the Outlet and the exceedance 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 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, during the monthly monitoring representing the non-flood/frozen condition (Figure NM6–20). The ammonia concentrations measured in the Floodway Channel downstream of the Grande Ponte Diversion (0.279 mg/L) during January and downstream of the North Bibeau Drain (0.296 mg/L) in December were elevated above the range of winter baseline concentrations (0.06 to 0.26 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 where generally similar to lower compared to the background concentration in the Red River upstream of the Outlet, except for slight increases in February and December. The ammonia concentrations in the Red River downstream of the Outlet (1.200 to 1.370 mg/L) during December were all higher compared to the background concentration upstream of the Outlet (1.190 mg/L). 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 an order of magnitude lower than in the Red River and would have resulted in dilution if anything. The ammonia concentrations measured in the Red River at the Outlet during January, February and November resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and downstream.

The ammonia concentrations measured in the Red River at the Floodway Outlet during 2007 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 2007 were within or lower than the 10th to 90th percentile ranges (Figure NM6-21). Even though the ammonia concentrations were within the historical conditions in the Red River, as noted above the ammonia concentrations measured during January, February and from September to November typically resulted in un-ionized ammonia concentrations that exceeded the CCME criteria. This suggests that exceedance of the CCME unionized ammonia criteria is a regular occurrence in the Red River and not a result of construction activities.

Event-Based Monitoring

Ammonia was only analyzed during 4 of the 15 event-based monitoring events conducted, beginning on July 26 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 generally by an order of magnitude, except during the July 26 (0.047 mg/L) event-based monitoring, which was still lower than the concentration in the Red River (0.056 mg/L; Table NM6-2). Whereas the ammonia concentrations measured in the Red River resulted in an exceedance of the CCME un-ionized ammonia criteria during 3 of the 4 event-based samples, none of the ammonia concentrations measured in the floodway resulted in an exceedance. These results indicate that during 2007 there were no potential construction effects associated with ammonia, as the concentrations in the Floodway Channel did not result in any exceedance of the CCME criteria and they would have resulted in dilution in the Red River if anything.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–22 to NM6–25.

The majority of nitrate + nitrite-N concentrations observed in the Floodway Channel during the spring flood condition were above the baseline data and reflected the high nitrate and nitrite-N concentrations flowing into the Floodway from the Red River and some of the agricultural drains (Figure NM6-22). The elevated concentrations in the Floodway Channel were not attributed to construction as the background nitrate + nitrite-N concentration upstream of construction (2.87 mg/L) was also above spring flood baseline values and higher than the concentration downstream of construction (1.8 mg/L). Additionally, the nitrate + nitrite-N concentration in the Floodway Channel at the Outlet (2.44 mg/L) was generally lower than the concentrations in the Red River. As such a slight dilution was measured in the concentrations in the Red River downstream of the Outlet (2.39 to 2.75 mg/L) compared to the background concentration upstream of the Outlet (2.86 mg/L).

The nitrate + nitrite-N concentration measured in the Floodway Channel downstream of construction (0.068 mg/L) was lower compared to the background concentration upstream of construction (0.343 mg/L) during the summer flood condition (Figure NM6-23). Additionally, nearly all of the nitrate + nitrite-N concentrations measured in the Floodway Channel were below the summer flood baseline concentrations. The nitrate + nitrite-N concentrations in the Red River downstream of the Outlet (0.196 to 0.374 mg/L) where also lower to similar compared to the background concentration in the Red River upstream of the Outlet (0.386 mg/L), indicating no construction effects during the summer flood event.

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 at two locations (Figure NM6–24). During the May monthly monitoring the nitrate + nitrite-N concentrations were elevated above the baseline concentrations at the Floodway Channel locations upstream of construction/revegetation (1.05 mg/L) and downstream of revegetation (4.48 mg/L). The elevated concentration upstream of construction is representative of the background conditions and not a result of construction, while the elevated concentration downstream of the revegetation zone is likely in response to the elevated concentration flowing from the Centreline drain (4.91 mg/L). The nitrate + nitrite-N concentrations measured in the Red River during the October monitoring were substantially higher downstream of the Outlet (0.580 to 0.616 mg/L) compared to the background concentration upstream of the Outlet (0.019 mg/L). During the other monthly monitoring representing the non-flood/unfrozen condition the concentrations downstream of the Outlet ranged from only slightly higher to lower compared to upstream. The concentration increases measured downstream of the Outlet were not likely due to construction activities within the Floodway Channel because all nitrate + nitrite-N concentrations within the floodway were within summer baseline values and substantially lower than the Red River concentrations measured downstream of the Outlet. The elevated nitrate + nitrite-N concentrations in the Red River were also within the observed summer baseline values. These results indicate that there were no potential construction effects associated with nitrate + nitrite-N during 2007.

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 NM6–25). An exception was the nitrate + nitrite-N concentrations measured during the February monitoring in the Floodway Channel downstream of construction (1.52 mg/L) and further downstream at the Dunning weir (7.52 mg/L) location, which were higher compared to the baseline concentrations. This increase and elevated concentrations in the Floodway Channel were not attributed to construction as no fertilizers were applied in the construction area at this time. Additionally, they did not affect nitrate + nitrite-N concentrations further downstream in the Floodway Channel as the concentration at the Outlet (0.13 mg/L) was within baseline and lower than the concentrations in the Red River. The nitrate + nitrite-N concentrations in the Red River downstream of the Outlet where generally similar to lower compared to the background concentration in the Red River upstream of the Outlet, with only a few samples slightly higher.

The nitrate + nitrite-N concentrations measured in the Red River at the Floodway Outlet during 2007 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 most month during 2007 were within the 10th to 90th percentile ranges (Figure NM6-26). During the January, February and December monthly monitoring and the April Spring monitoring the nitrate + nitrite-N concentrations in the Red River both upstream and downstream of the Outlet were higher than the historical February 90th percentile (0.83 mg/L). 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.

Event-Based Monitoring

Nitrate + nitrite-N was only analyzed during 4 of the 15 event-based monitoring events conducted, beginning on July 26 following the first application of fertilizer. The nitrate + nitrite-N concentrations measured in the Floodway Channel downstream of active construction activities (0.068 to 0.242 mg/L) were substantially lower than those in the Red River (0.416 to 0.613 mg/L; Table NM6-2). These results indicate that during 2007 there were no potential nitrate + nitrite-N effects associated with construction as the concentrations in the Floodway Channel would have resulted in dilution in the Red River if anything. Additionally the nitrate + nitrite-N concentrations measured in the Floodway Channel and the Red River during the event-based monitoring were lower than or within the historical 10th to 90th percentile ranges during the respective months.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–27 to NM6–30.

The potassium measured in the Floodway Channel at several locations was elevated above baseline concentrations during the spring flood condition (Figure NM6-27). In particular, the potassium concentration measured downstream of construction (10 mg/L) was slightly higher compared to background concentration upstream of construction (9.38 mg/L). The elevated potassium concentration may in part be due to the high concentration flowing into the Floodway Channel from the North Bibeau Drain (11.1 mg/L). However, the elevated potassium concentration in the Floodway Channel has no basis for evaluation, as there is no applicable CCME criterion. Additionally, the concentration in the Floodway Channel at the Outlet (8.19 mg/L) was lower compared to the concentrations in the Red River and resulted in a slight dilution downstream of the Outlet (8.16 to 8.73 mg/L) compared to the background concentration upstream of the Outlet (9.08 mg/L).

The potassium concentration measured in the Floodway Channel downstream of construction (5.77 mg/L) was lower compared to the background concentration upstream of construction (7.79 mg/L) during the summer flood condition (Figure NM6-28). Additionally, nearly all of the potassium concentrations measured in the Floodway Channel were below the summer flood baseline concentrations. The potassium concentrations in the Red River downstream of the Outlet (6.58 to 7.31 mg/L) where also lower compared to the background concentration in the Red River upstream of the Outlet (7.42 mg/L), indicating no construction effects during the summer flood event.

The potassium concentrations measured in the Floodway Channel when samples could be collected at the location upstream of construction from May to June were higher than the baseline concentrations, during the monthly monitoring representing the non-flood/unfrozen condition (Figure NM6–29). These elevated concentrations are not a result of construction as they are representative of the background conditions. In comparison, the potassium concentrations measured in the rest of the Floodway Channel, except a few locations were typically similar to the range of baseline concentrations. The concentrations measured at the Keewatin weir location (8.26 mg/L) during September and the Springhill weir (8.28 mg/L) and downstream of revegetation (8.07 mg/L) locations during August were slightly higher than the summer baseline range (3.4 to 7.8 mg/L). The few elevated potassium concentrations measured in the Floodway Channel have no basis for evaluation, as there is no applicable CCME criterion. The potassium concentrations measured in the Red River downstream of

Outlet were lower compared to the background concentration upstream of the Outlet from June to September, with only slight increases measured during May and October. The slight increases in potassium concentrations observed in the Red River downstream of the Outlet were not attributed to construction activities, as potassium was not a component of the fertilizer applied during construction activities. Additionally the potassium concentrations in the Floodway Channel at the Outlet were lower than the concentrations in the Red River and would have resulted in dilution if anything.

The potassium concentrations were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were generally within the summer baseline concentrations (3.4 to 7.8 mg/L) during the monthly monitoring representing the non-flood/frozen condition (Figure NM6–30). A few exceptions included the potassium concentrations measured in the Floodway Channel downstream of the Grande Pointe drain during January (8.93 mg/L) and March (25.9 mg/L), which were higher than the baseline concentrations. These elevated concentrations were not attributed to construction, as there were no activities in January and March, such as fertilizer application, that would contribute to the elevated concentration of potassium and as already noted potassium is not a component of the fertilizer that was used during 2007. 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 generally similar to the background concentrations in the Red River upstream of the Outlet, except during November when increases were measured. The range of potassium concentrations measured in the Red River downstream of the Outlet (7.84 to 8.09 mg/L) during November were slightly elevated compared to upstream of the Outlet (7.58 mg/L), however, all of these concentrations were within summer baseline concentrations. The slight increase observed in November were not a result of construction, as noted above, and the concentration in the Floodway at the Outlet was lower than in the Red River, which would have resulted in dilution if anything.

The potassium concentrations measured in the Red River at the Floodway Outlet during 2007 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 potassium concentrations measured upstream and downstream of the Outlet during February and October and upstream of the Outlet during September were higher than the 90th percentile, whereas all other months during 2007 were within or slightly lower than the 10th to 90th percentile ranges (Figure NM6-31). The elevated potassium concentrations above than the 90th percentile were representative of background conditions as there was very little difference in concentrations measured downstream of the Outlet compared to upstream. Additionally as discussed above the potassium concentrations are not a result of construction activities as the concentrations in the Floodway Channel at the Outlet were generally lower than the concentrations in the Red River and would have resulted in dilution if anything.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–32 to NM6–35.

The sodium concentrations measured in the Floodway Channel during the spring flood condition were generally within or below the range of baseline concentrations except those measured downstream of the Outlet (21.2 mg/L) and upstream of construction (23.0 mg/L; Figure NM6–32). These are representative of background concentrations and were similar to the Red River (19.4 to 20.4 mg/L). The sodium concentration in the Floodway Channel at the Outlet (16.8 mg/L) was slightly lower than the concentrations in the Red River. As such a negligible change was measured in the concentrations downstream of the Outlet (16.5 to 20.5 mg/L) compared to upstream of the Outlet (21.4 mg/L).

The sodium concentration measured in the Floodway Channel downstream of construction (8.91 mg/L) was lower compared to the background concentration upstream of construction (19.9 mg/L) during the summer flood condition (Figure NM6-33). Additionally, the sodium concentrations measured in the Floodway Channel were within or below the summer flood baseline concentrations. The sodium concentrations in the Red River downstream of the Outlet (13.5 to 19.9 mg/L) where also lower compared to the background concentration in the Red

River upstream of the Outlet (21.2 mg/L), indicating no construction effects during the summer flood event.

The sodium concentrations measured in the Floodway Channel during June and July were generally within the summer baseline concentrations, whereas, during the other monthly monitoring representing the non-flood/unfrozen condition the concentrations were generally above the summer baseline (Figure NM6–34). In particular the concentrations in the Floodway Channel at the Outlet were elevated above the baseline concentrations during the May, September and October monthly monitoring, with the October concentration also being noticeably higher than the concentrations in the Red River. However, these elevated concentrations did not result in any noticeable sodium concentration increases in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet. From June to September concentrations downstream of the Outlet were lower compared to the background concentration upstream, whereas, during May and October only slight increases were measured at some of the sample locations downstream of the Outlet. The dry conditions during August and September resulted in less surface water contribution to the low flow channel compared to during the baseline conditions. Therefore, the relatively greater contribution of groundwater from infiltration and temporary construction groundwater dewatering likely contributed to the elevated sodium concentrations in the Floodway Channel that were similar to winter baseline (70.5 to 165 mg/L) conditions.

The sodium concentrations measured in the Floodway Channel downstream of construction and at the other Floodway locations were generally 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 NM6–35). An exception included the sodium concentration measured in the Floodway Channel downstream of the Grande Pointe drain during March (192 mg/L), which was higher than the baseline concentrations. This elevated sodium concentration along with the other concentrations measured in the Floodway Channel during March was higher compared to the other months. These higher concentrations are potentially from road salts running into the Floodway Channel off of the numerous bridge crossings, as there were temperatures at and above the freezing point during the month prior to the sampling event. The Department of Transportation applies either calcium chloride or magnesium chloride as road salt, however, sodium chloride is also a common road salt used. The sodium concentrations in the Floodway

Channel at the Outlet were generally lower than the concentrations in the Red River at the Outlet, except during March and November. The higher concentration in the Floodway Channel during March did not effect concentrations in the Red River downstream of the Outlet, which were all lower compared to the background concentration upstream of the Outlet. In comparison the higher November concentration may have contributed to the increase of 5.1 mg/L. Likewise during January, February and December concentrations in the Red River downstream of the Outlet varied from slightly lower to slightly higher compared to upstream. The slight increases in sodium concentrations measured in the Red River at the Outlet were not related to construction because the concentrations measured in the Floodway Channel are representative of baseline conditions.

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 spring flood, summer, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–36 to NM6–39.

The chloride concentrations measured along the length of the Floodway Channel (14 to 25 mg/L) and in the Red River downstream of the Outlet (22 to 24 mg/L) were very similar to their respective background conditions and within the range of baseline concentrations during the spring flood condition (Figure NM6–36). These results indicate no chloride construction effects during the spring flood in 2007.

The chloride concentrations measured along the length of the Floodway Channel (16 to 21 mg/L) and in the Red River downstream of the Outlet (19 to 21 mg/L) were very similar to their background conditions (20 and 21 mg/L, respectively) and within the baseline concentrations during the summer flood condition (Figure NM6–37). These results indicate no chloride construction effects during the summer flood event.

The chloride concentrations measured in the Floodway Channel during June and July were generally within the summer baseline concentrations (16 to 73 mg/L), whereas, during the other monthly monitoring representing the non-flood/unfrozen condition the concentrations were generally above the summer baseline (Figure NM6–38). In particular the concentrations in the Floodway Channel at the Outlet were elevated above the baseline concentrations and the concentrations in the Red River during the May and August to October monthly monitoring. However, these elevated concentrations only resulted in slight chloride concentration increases in the Red River downstream of the Outlet compared to the background concentrations upstream of the Outlet. These elevated chloride concentrations in the Floodway Channel and Red River have no basis for evaluation, as there is no established CCME criterion for the protection of freshwater aquatic life for chloride. During the June and July monitoring concentrations downstream of the Outlet were lower compared to the background concentration upstream. The dry conditions during August and September resulted in less surface water contribution to the low flow channel compared to during the baseline conditions. Therefore, the relatively greater contribution of groundwater from infiltration and temporary construction groundwater dewatering likely contributed to the elevated chloride concentrations in the Floodway Channel that were similar to winter baseline (60 to 205 mg/L) conditions.

The chloride concentrations measured in the Floodway Channel downstream of construction and at the other Floodway locations were generally 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 NM6–39). An exception included the sodium concentration measured in the Floodway Channel downstream of the Grande Pointe drain during March (217 mg/L), which was slightly higher than the baseline concentrations. This elevated chloride concentration along with the other concentrations measured in the Floodway Channel during March was higher compared to the other months. Similar to what was discussed for sodium the higher chloride concentrations are potentially from road salts running into the Floodway Channel off of the numerous bridge crossings, as there were temperatures at and above the freezing point during March prior to the sampling event. The chloride concentrations in the Floodway Channel at the Outlet were generally similar to or lower than the concentrations in the Red River at the Outlet, except during March. The higher concentration in the Floodway Channel during March did not effect concentrations in the Red River downstream of the Outlet (64 to 68 mg/L), which were very similar compared to the background concentration upstream of the Outlet (66 mg/L). Likewise during the other months representing the non-flood/frozen condition the concentrations in the Red River downstream of the Outlet were similar compared to upstream.

3.2.9 Iron

During the 2007 construction monitoring there were fewer occurrences of iron concentrations above the CCME criteria for the protection of freshwater aquatic life (Table NM6–2), compared to what was observed during the baseline and 2005 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 during the spring flood condition ranged from 0.17 to 0.95 mg/L which exceeded the CCME iron criteria (0.3 mg/L) at all locations except immediately downstream of the Grande Pointe and North Bibeau drains (Table NM6–2). Likewise the iron concentration at all of the Red River (0.66 to 1.01 mg/L) sample locations, as well as in the Seine River (0.42 mg/L) and Centreline Drain (0.69 mg/L) exceeded the CCME iron criteria. The elevated iron concentrations in the Floodway Channel and in the Red River downstream of the Outlet are not attributed to construction because they were very similar to their respective background conditions and within the range of elevated iron concentrations (0.32 to 3.34 mg/L) measured during the spring flood baseline.

The iron concentrations measured in the Floodway Channel during the summer flood condition ranged from 0.19 to 0.49 mg/L, which exceeded the CCME iron criteria (0.3 mg/L) at all locations except immediately downstream of the Inlet and the location upstream of construction and revegetation (Table NM6–2). Likewise the iron concentration at all of the Red River (0.33 to 0.48 mg/L) sample locations, as well as in the Seine River (0.54 mg/L), Grande Pointe Drain (0.40 mg/L), Centreline Drain (0.57 mg/L) and Cooks Creek Drain (0.56 mg/L) exceeded the CCME iron criteria. The elevated iron concentrations in the Floodway Channel and in the Red River downstream of the Outlet are not attributed to construction because they were very similar to their respective background conditions and within the range of elevated iron concentrations (0.33 to 0.81 mg/L) measured during the summer flood baseline.

The iron concentrations measured in the Floodway Channel varied monthly during the monitoring representing the non-flood/unfrozen condition (Table NM6–2). During May and from August to October the iron concentrations were generally below the CCME criteria with the exception of a few sample locations. In comparison during June and July elevated iron concentrations above the CCME criteria were measured in the Floodway Channel generally from downstream of the North Bibeau Drain to the Outlet (0.42 to 0.87 mg/L). These elevated iron concentrations, however, 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 (0.41 to 1.35 mg/L) exceeded the CCME criteria during May, June and July, and at one or two of the locations in August and September during the non-flood/unfrozen condition. Again, these elevated iron concentrations do not differ from elevated iron concentrations (0.29 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 NM6–2). Elevated iron concentrations above the CCME criteria were measured in the Floodway Channel at the Springhill weir location (0.35 mg/L) in January; downstream of Grande Pointe (1.04 mg/L) and North Bibeau (0.33 mg/L) drains in March; and downstream of Grande Pointe drain (0.35 mg/L) and PTH # 44 weir location (0.44 mg/L) in December. Elevated iron concentrations above the CCME criteria were also measured in the Red River at the Outlet (0.31 to 1.06 mg/L), primarily only during March and November.

3.2.10 Petroleum Hydrocarbons

Monthly Monitoring

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 (Table NM6–3). Likewise the concentration of petroleum hydrocarbons were below detection limits in the Floodway Channel upstream of construction when samples could be collected during the spring flood (April), summer flood (July 3) and May to June 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 below detection limits, petroleum hydrocarbons were not considered an issue during the monthly monitoring.

Event-Based Monitoring

During the January monthly monitoring an initial spill event-based monitoring was conducted in response to the sheen observed and contained within the catch basin of the Kildare Trunk-Transcona Storm Sewer Outlet structure. Spill event-based monitoring was then conducted on February 13, 16 and 19, 2007 in response to the contractor at Contract C5 reporting that oily material was flowing down the active Kildare LDS and passing through the construction site to the Floodway Low Flow Channel at the end of the Kildare LDS discharge channel. As noted in the January and February monthly reports this spill was not a result of construction activities, as the hydrocarbon material was originating from the upstream side of the Kildare LDS, which is the responsibility of the City of Winnipeg. However, because the material was released into the Floodway Channel the MFA directed KGS Group to conduct the spill event-based monitoring and conduct activities to contain and clean up the spill. Details of the clean up activities were provided separately in the letter report Kildare Flood Pumping Station-Environmental Oil Clean-up Activities (KGS File 06-1100-02.48) dated April 11 2007. A final spill event-based monitoring was then conducted on March 5, 2007 as a follow-up to the clean-up activities completed. The results of the spill event-based sampling conducted are described in the following paragraphs.

The field chemistry of samples collected from the Floodway Channel and Red River during the various spill event-based monitoring are summarized in Table NM6.2–1. The results of the laboratory analysis of hydrocarbons for the samples collected are summarized in Table NM6.2–3.

The sheen observed during the January monthly monitoring was not a result of construction activities as a sheen was also visible during earlier monthly sampling events prior to construction in the area when there was no flow out of the flap gate. Because the hydrocarbons sit on top of the water column they likely accumulate throughout the year from an external source when minimal flow comes out of the Kildare Trunk-Transcona Storm Sewer Outlet. The results of the hydrocarbon analysis show that BTEX and hydrocarbon fraction F1 (C_6 - C_{10}) are below detection limits, however fractions F2 to F3 (C_{10} - C_{34}) had a concentration of 39,000 micrograms/L. The carbon range for fractions F2 and F3 is characteristic of diesel and heavier hydrocarbons such as oils. Currently there are no established CCME guidelines for the protection of freshwater aquatic life. However the CCME criteria for Recreation and Aesthetics states that oil or petrochemicals should not be present in concentrations that can be detected as a visible film or sheen on the surface. The hydrocarbons measured and observed in the catch basin of the outlet were not detectable in the Floodway Channel further downstream at the sample location downstream of construction.

The laboratory analysis of the source hydrocarbon material collected on February 13 from within the pipe (S-12); measured concentrations of hydrocarbon fractions F2 (227,000 µg/L), F3 (12,200,000 µg/L) and F4 (5,320,000 µg/L). The carbon range for the product is characteristic of hydrocarbons such as heavy oils. Laboratory surface water sampling results for the samples collected in the Floodway Channel and Red River did not show any concentration of hydrocarbons attributable to the heavy oil contained and removed from the Kildare LDS site, nor above the applicable CCME criteria.

The results of the hydrocarbon analysis show that BTEX are below detection limits for all of the sample locations on each of the three days, including the sample of the hydrocarbon material collected from the upstream end of the LDS. The results of the hydrocarbon analysis show that hydrocarbon fractions F1 to F4 are below detection limits in nearly all the samples collected from the Floodway Channel and the Red River during each of the three sample days. The sample collected in the Red River upstream of the Outlet on February 13, 2007 had a low F3 fraction concentration (570 µg/L), however, this sample represents the background condition as it is located upstream of the Outlet and is not a result of the spill or construction activities. Very low concentrations of F1 fraction were measured in the samples collected on February 16, 2007 from the Floodway Channel at the Outlet (200 µg/L) and in the Red River upstream of the Outlet (100 µg/L). These detectable concentrations were not related to the spill at the Kildare LDS as the source material did not contain the hydrocarbon fraction F1.

The results of the hydrocarbon analysis for the March 5 post clean-up follow-up monitoring show that all hydrocarbon parameters analyzed were below detection limits for all of the samples collected from the Floodway Channel and the Red River, except for a small concentration of toluene (0.6 µg/L) measured in the Floodway Channel at the Outlet (S-28; Table NM6-3). This detectable concentration was below the applicable CCME criteria (2.0 µg/L) and was not related to the spill at the Kildare LDS as the source material did not contain toluene.

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 spring flood, summer flood, non-flood/unfrozen and non-flood/frozen conditions are shown on Figures NM6–40 to NM6–43. 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.

E.Coli concentrations measured in the Floodway Channel were very similar to the baseline values during the monthly monitoring representing the flood condition, except for the elevated concentration at the Dunning Weir location (120 CFU/100 ml; Figure NM6–40). Likewise, *E.Coli* concentrations measured in the Red River were similar to lower compared to the baseline values (0 to 200 CFU/100 ml), indicating no construction effects. Additionally the range of concentrations downstream of the Outlet (20 to 110 CFU/100 ml) were lower compared to the background condition upstream of the Outlet (140 CFU/100 ml).

The *E.Coli* concentration measured in the Floodway Channel downstream of construction (90 CFU/100 mL) was elevated compared to the background concentration upstream of construction (10 CFU/100 mL), however all of the concentrations measured in the Floodway Channel were within or below the summer flood baseline concentrations (Figure NM6-41). There were no construction activities during the summer flood that would release bacteria into the construction area to account for the increase. The *E.Coli* concentrations measured in the Red River downstream of the Outlet (20 to 70 CFU/100mL) ranged from lower to higher compared to the background concentration upstream of the Outlet (40 CFU/100mL). The slight increase in concentration in the Red River however, is well below concentrations observed in the Red River during summer flood baseline monitoring (90 CFU/100 mL to overgrown (> 2000)).

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 NM6–42). The concentrations along the length of the Channel during the most months ranged from below detection limits (<10 CFU/100mL), which is below baseline concentrations to overgrown (>2000 CFU/100mL), which is well above baseline. 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. In particular during the May to July monitoring substantial increases were measured, whereas only slight increases were measured during the August to October monitoring. 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 were not compared to winter baseline concentrations as there are none available, however, the concentrations measured in the Floodway Channel were generally below the detection limit of 10 CFU/100mL and therefore below the summer baseline concentrations (16 to 630 CFU/100 mL) during the monthly monitoring representing the non-flood/frozen condition (Figure NM6–43). Two locations measured during March in the Floodway Channel at the Spring Hill Weir (430 CFU/100mL) and downstream of construction (520 CFU/100mL) were elevated above site-specific baseline concentrations, however, they were within the overall range of baseline concentrations. There were no construction activities during March that would release bacteria into the construction area therefore these elevated concentrations are likely due to runoff from off-site. The *E.Coli* concentrations in the Red River downstream of Outlet varied from sample location to sample location during each month ranging from higher to lower compared to the background concentrations upstream. However, these concentrations were generally within the range of baseline concentrations measured for the Red River. 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. Additionally, the concentrations in the Floodway at the Outlet were lower than in the Red River, which would have resulted in dilution if anything.

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 flood condition (Table NM6–5). There were no herbicides applied during the 2007 construction year and therefore no other herbicide monitoring was conducted beyond the spring flood condition. Based on these results herbicides were not a concern during the 2007 construction year.

4.0 SUMMARY AND CONCLUSIONS

1. The 2007 construction surface water quality monitoring program was conducted from January to December 2007 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 and C-2 that were completed in 2006 and C6C that will start in 2008;
   b. Bridge contracts for PTH 59 South (T4), Trans-Canada Highway (T5), CNR Sprague (T8/T9), CNR Redditt (T11), CPR Emerson (T12) and CPR Keewatin (T14);
   c. The Aqueduct (A1);
   d. The Inlet and Outlet structures; and
   e. The West Dyke (W4, W5, W6, W7, W8, W9, W10, W11, W12, W13, W14 and W17).

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. The results of the 2007 Construction monitoring events are within the environmental effects predictions made during the engineering design and modelling as reported in the project EIS.

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 and each of the locations sampled during the spill event-based monitoring. During the spring flood 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 thirteen (13) monthly monitoring events, with one conducted each month following precipitation events or at the spring flood peak and an additional monitoring event on July 3, 2007 during the summer Red River flood condition. There were fifteen (15) level I event-based monitoring events conducted between March and October 2007 in response to precipitation events of 10 mm or greater. Additionally, spill event-based monitoring was conducted on February 13, 16 and 19 and again on March 5 in response to the contractor at Contract C5 reporting that a “slug” of oily material was flowing down the active Kildare land drainage system (LDS) and passing through the construction site to the Floodway Low Flow Channel.

5. Results of the 15 level I event-based monitoring events conducted between March and October have typically indicated very small changes in TSS concentration in the Red River during the 2007 construction year. The only TSS concentration increase in the Red River was an increase of 0.07% following the June 18 monitoring that occurred following a rain that was less than a 2 year event. This potential increase in sediment

concentration in the Red River downstream of the Channel discharge at the Outlet was well below the Provincial Guidelines and CCME criteria of an allowable 10% increase. Nearly all the other level I event based monitoring measured a decrease of less than 1.0%, therefore, no level II event-based monitoring was required during the 2007 construction year.

6. Laboratory analysis of the source hydrocarbon material reported flowing down the active Kildare LDS and collected from within the pipe measured concentrations of hydrocarbon fractions F2 (227,000 µg/L), F3 (12,200,000 µg/L) and F4 (5,320,000 µg/L). The carbon range for the product is characteristic of hydrocarbons such as heavy oils. Laboratory surface water sampling results for the samples collected in the Floodway Channel and Red River did not show any concentration of hydrocarbons attributable to the heavy oil contained and removed from the Kildare LDS site, nor above the applicable CCME criteria. BTEX concentrations were below detection limits for all of the sample locations on each of the three spill event sampling days, including the sample of the hydrocarbon material. Hydrocarbon fractions F1 to F4 were below detection limits in nearly all the samples collected. Detectable concentrations of F3 fraction (570 µg/L) and F1 fraction (100 µg/L) were measured in background samples collected in the Red River upstream of the Outlet. Additionally, a very low concentration of F1 fraction was measured in the sample collected from the Floodway Channel at the Outlet (200 µg/L), although this was not related to the spill as the source material did not contain the hydrocarbon fraction F1.

7. The results of the hydrocarbon analysis for the spill event-based monitoring conducted following the clean-up activities show that all hydrocarbon parameters analyzed were below detection limits for all of the samples collected from the Floodway Channel and the Red River, except for a small concentration of toluene (0.6 µg/L) measured in the Floodway Channel at the Outlet. This detectable concentration was below the applicable CCME criteria (2.0 µg/L) and was not related to the spill at the Kildare LDS as the source material did not contain toluene.

8. The spring flood condition, represented by the April monthly monitoring event, had elevated concentrations of all parameters of interest including total suspended solids (TSS), specific conductance, total phosphorus, ammonia, nitrate + nitrite-N, potassium, sodium, chloride and *E.Coli* in the Floodway Channel, compared to spring flood baseline conditions. The concentrations of these parameters generally fluctuated within the Floodway Channel compared to spring flood baseline concentrations and may be due to agricultural runoff from drains entering into the Floodway Channel during the April 2007 spring flood period. Baseline flood conditions measured in the Floodway Channel during the spring peak flow period in April 2005 was primarily inflow from the Red River and not the drains, whereas, the April 2007 flood had a larger inflow of water from drains entering into the Floodway Channel compared to inflow from the Red River. The elevated concentrations above spring flood baseline values were not likely attributed to construction activities because most parameter concentrations downstream of construction were lower than parameter concentrations upstream of construction, except for increases in total phosphorus and potassium. Additionally, parameter concentrations in the Red River downstream of the Outlet were lower than concentrations upstream of the Outlet, except for ammonia. The slight elevated ammonia concentration was within the range of natural variation observed in the Red River during the spring flood baseline monitoring.

9. The summer flood condition, represented by the July 3 monitoring event, had concentrations for the parameters of interest measured in the Floodway Channel that were within or lower than the summer flood baseline concentrations. Most parameter concentrations in the Floodway Channel downstream of construction were lower compared to the background concentrations upstream of construction, indicating no effect from construction except for a minimal increase in ammonia and moderate increase in *E.Coli*. Similarly, most parameter concentrations in the Red River downstream of the Outlet were generally lower compared to the background concentration upstream of the Outlet with the exception of minimal increases in total phosphorus, ammonia and *E.Coli*.

10. Within the non-flood unfrozen condition in 2007, concentrations of total phosphorus, ammonia, nitrate + nitrite-N and potassium measured in the Floodway Channel were generally within the summer baseline concentrations. TSS concentrations in the Floodway Channel were also typically within the baseline concentrations except during June and July when concentrations were higher than baseline from downstream of North Bibeau to the Outlet. In comparison, specific conductance, sodium and chloride concentrations in the Floodway Channel were within baseline concentrations during June and July and higher during the other months. *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 lower than the concentration in the Red River, except specific conductance, sodium and chloride concentrations in September and October. Therefore the elevated concentrations would have no effect on concentrations in the Red River or result in dilution if anything.

11. 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, total phosphorus and *E.Coli* concentrations. The TSS concentration increases measured in the Red River downstream of the Outlet were typically less than the CCME criteria of an allowable increase of 25 mg/L. During May and June the TSS concentration increases measured 3 km downstream of the Outlet exceeded the CCME criteria, however, this was likely a result of natural variation in the river and not related construction, because all other TSS concentrations in the Red River downstream of the Outlet during May and June were below the background TSS concentration. The increases in total phosphorus downstream of the Outlet reflected the changes observed for TSS concentrations. Although increases in total phosphorus were measured, the concentrations were within the range of Red River baseline concentrations. Likewise, although increases in *E.Coli* were measured the concentrations were within baseline concentrations. Additionally the elevated total phosphorus and *E.Coli* concentrations have no basis for evaluation, as there is no applicable CCME criterion. The ammonia concentrations measured in the Red River downstream of the Outlet during September and October resulted in exceedances of the CCME un-ionized ammonia criteria. These exceedances are not a result of construction, because the background concentrations upstream of the Outlet during September and October as well as May and August, and the baseline concentrations, also exceeded the CCME criteria.

12. 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 specific conductance, ammonia, potassium, sodium and chloride were higher than baseline concentrations in the Floodway Channel downstream of the Grande Pointe drain during the January or March monitoring. These elevated concentrations were not attributed to construction because they were typically isolated to a single sample in the Floodway Channel. The elevated specific conductance, sodium and chloride measured in March may potentially be from road salts running into the Floodway Channel off of the nearby bridge crossings. 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. Additionally, the elevated potassium concentration in the Floodway Channel has no basis for evaluation, as there is no applicable CCME criterion.

13. 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 November and December tended to show larger increases. The ammonia concentrations measured in the Red River at the Outlet during January, February and November resulted in exceedances of the CCME un-ionized ammonia criteria both upstream and downstream. 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. The concentration increases downstream of the Outlet were not attributed to construction activities within the Floodway Channel, as the parameter concentrations in the Floodway Channel were typically within baseline concentrations and most were lower compared to the Red River, such that they would have resulted in dilution if anything. However, the increase in TSS and total phosphorus concentrations measured in November were likely associated with construction activities at the Outlet structure.

14. The elevated TSS concentrations measured in the Red River downstream of the Outlet during the November monthly monitoring exceeded the CCME criteria of an allowable increase of 25 mg/L above background concentrations upstream of the Outlet. This exceedance appears to be a result of adjustments made to the cofferdam dewatering settling pond, in combination with significant pumping being conducted through to the end of November. Any sediments disturbed while adjusting the settling pond would not have had sufficient time to resettle before overflowing into the Outlet channel on the Red River. This exceedance appears to be an isolated occurrence as no further adjustments were made to the settling pond and further monthly monitoring during December 2007 confirmed that concentrations in the Red River returned to typical low winter values. The increase in total phosphorus concentrations measured in the Red River downstream of the Outlet during November may be associated with this increase in TSS concentrations. Disturbed sediments in the rivers edge downstream of the Outlet may be releasing total phosphorus accumulated in these sediments over time from agricultural drains. However, the elevated total phosphorus concentration in the Red River has no basis for evaluation, as there is no applicable CCME criterion.

5.0 RECOMMENDATIONS

Based on the results of the 2007 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 2008 surface water monitoring program.

- The Event-based monitoring in 2008 should continue to follow the protocol used in 2007 that incorporated revisions made in 2006, based on the results of a review of precipitation levels and measured TSS increases. The 2007 protocol was reviewed near the end of the 2007 monitoring program (with no changes made) and should be reviewed again during the 2008 monitoring program and revised if required as construction contracts near completion.

- The reporting protocol for the 2008 surface water monitoring program should be modified slightly from that used in 2007 in order to flag potential increases in TSS concentrations more rapidly. A level I event-based worksheet should be filled out for each of the Monthly monitoring events in order 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 following the current 2007 protocols. In comparison, 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

1. TetrES Consultants Inc. / Intergroup Consultants Ltd. 2004. Proposed Floodway Expansion Project, Environmental Assessment, Environmental Impact Statement, Volumes 1 to 4. Submitted by the Manitoba Floodway Authority.

2. Gartner Lee Limited and Falk Environmental Inc. 2005. Screening Report – Red River Floodway Expansion Project. Prepared for Infrastructure Canada.

3. KGS Group. 2005. Red River Floodway Expansion Baseline Surface Water Monitoring, Final Report.

4. KGS Group. April 2005. February 2005 Pilot Channel Baseflow Program. Memorandum 05-1100-01.19.12.07.

5. U.S. Environmental Protection Agency (EPA), Office of Water Quality. November, 1997. Monitoring Water Quality, Chapter 5 Water Quality Conditions (EPA 841-B-97-003).

6. Province of Manitoba, Manitoba Water Stewardship. 2007. Water Information – Flood Forecasting Reports, Weekly River Flow Report Red River near Selkirk http://www.gov.mb.ca/waterstewardship/water_info/flood_forecasting/index.html.

7. Environment Canada. 2005. The Green Lane, Weather Office, Climate Data. http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html

8. Environment Canada. 2001. Canadian Climate Normals 1971 – 2000, Winnipeg Manitoba. http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html

9. Atmospheric Environment Service. 1990. Rainfall Intensity - Duration Frequency Values, Table 2 – Winnipeg Int'l Airport, Manitoba

TABLES

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
Monthly								
CON D/S	CON D/S	Floodway Channel - Station 33+900	26-Jan-07	7.84	1111	0.4	4.37	
	CON D/S		22-Feb-07	7.95	1110	0.2	4.41	
	CON D/S		19-Mar-07	6.40	1330	0.1	18.56	
	CON D/S		09-Apr-07	6.14	434	1.7	46.01	
	CON D/S		22-May-07	6.19	1065	20.3	17.10	
	CON D/S		08-Jun-07	7.68	669	11.2	87.63	
	CON D/S	- Station 40+850	03-Jul-07	7.00	457	22.4	57.66	
	CON D/S		10-Jul-07	7.56	601	18.1	91.94	
	CON D/S	- Station 50+500	15-Aug-07	6.82	696	22.3	107.6	
	CON D/S		21-Sep-07	7.77	1074	13.8	11.43	
	CON D/S		09-Oct-07	6.82	1034	5.0	24.27	
	CON D/S		29-Nov-07	8.00	1212	1.6	34.04	
	CON D/S		20-Dec-07	7.70	601	1.4	845.0	
CON U/S	CON U/S	Floodway Channel - Station 7+650	25-Jan-07	-	-	-	-	CNM - No flow
	CON U/S		22-Feb-07	-	-	-	-	CNM - No flow
	CON U/S		19-Mar-07	-	-	-	-	CNM - No flow
	CON U/S		09-Apr-07	8.20	624	4.6	121.5	
	CON U/S		22-May-07	7.22	899	5.1	15.41	
	CON U/S		08-Jun-07	8.30	*	14.0	3.05	
	CON U/S		03-Jul-07	7.81	648	19.8	21.00	
	CON U/S		10-Jul-07	6.91	658	20.4	8.74	
	CON U/S		15-Aug-07	-	-	-	-	CNM - No flow
	CON U/S		21-Sep-07	-	-	-	-	CNM - No flow
	CON U/S		09-Oct-07	-	-	-	-	CNM - No flow
	CON U/S		29-Nov-07	-	-	-	-	CNM - No flow
	CON U/S		20-Dec-07	-	-	-	-	CNM - No flow
VEG D/S	VEG D/S	Floodway Channel - Station 20+500	25-Jan-07	-	-	-	-	CNM - No active re-vegetation
	VEG D/S		22-Feb-07	-	-	-	-	CNM - No active re-vegetation
	VEG D/S		19-Mar-07	-	-	-	-	CNM - No active re-vegetation
	VEG D/S		09-Apr-07	8.00	437	5.7	66.84	
	VEG D/S		22-May-07	7.90	580	15.0	209.1	
	VEG D/S		08-Jun-07	8.30	*	17.5	49.55	
	VEG D/S		03-Jul-07	7.61	500	22.2	18.64	
	VEG D/S		10-Jul-07	6.21	548	19.0	67.73	
	VEG D/S	- Station 34+500	15-Aug-07	7.80	1189	22.7	42.35	
	VEG D/S	- Station 50+500	21-Sep-07	7.77	1074	13.8	11.43	
	VEG D/S		09-Oct-07	6.82	1034	5.0	24.27	
	VEG D/S		29-Nov-07	8.00	1212	1.6	34.04	
	VEG D/S		20-Dec-07	7.70	601	1.4	845.0	
VEG U/S	VEG U/S	Floodway Channel - Station 7+650	25-Jan-07	-	-	-	-	CNM - No flow
	VEG U/S		22-Feb-07	-	-	-	-	CNM - No flow
	VEG U/S		19-Mar-07	-	-	-	-	CNM - No flow

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
VEG U/S	VEG U/S	Floodway Channel - Station 7+650	09-Apr-07	8.20	624	4.6	121.5	
	VEG U/S		22-May-07	7.22	899	5.1	15.41	
	VEG U/S		08-Jun-07	8.30	*	14.0	3.05	
	VEG U/S		03-Jul-07	7.81	648	19.8	21.00	
	VEG U/S		10-Jul-07	6.91	658	20.4	8.74	
	VEG U/S		15-Aug-07	-	-	-	-	CNM - No flow
	VEG U/S		21-Sep-07	-	-	-	-	CNM - No flow
	VEG U/S		09-Oct-07	-	-	-	-	CNM - No flow
	VEG U/S		29-Nov-07	-	-	-	-	CNM - No flow
	VEG U/S		20-Dec-07	-	-	-	-	CNM - No flow
S-01	S-01	Red River - Upstream of Inlet	26-Jan-07	-	-	-	-	CNM - No river water diverted
	S-01		22-Feb-07	-	-	-	-	CNM - No river water diverted
	S-01		19-Mar-07	-	-	-	-	CNM - No river water diverted
	S-01		09-Apr-07	7.80	612	4.6	224.9	
	S-01		22-May-07	-	-	-	-	CNM - No river water diverted
	S-01		08-Jun-07	-	-	-	-	CNM - No river water diverted
	S-01		03-Jul-07	7.56	657	17.6	55.24	
	S-01		10-Jul-07	-	-	-	-	CNM - No river water diverted
	S-01		15-Aug-07	-	-	-	-	CNM - No river water diverted
	S-01		21-Sep-07	-	-	-	-	CNM - No river water diverted
	S-01		09-Oct-07	-	-	-	-	CNM - No river water diverted
	S-01		29-Nov-07	-	-	-	-	CNM - No river water diverted
	S-01		20-Dec-07	-	-	-	-	CNM - No river water diverted
S-02	S-02	Red River - Upstream of Inlet (replicate of 1)	26-Jan-07	-	-	-	-	CNM - No river water diverted
	S-02		22-Feb-07	-	-	-	-	CNM - No river water diverted
	S-02		19-Mar-07	-	-	-	-	CNM - No river water diverted
	S-02		09-Apr-07	8.10	625	3.1	230.1	
	S-02		22-May-07	-	-	-	-	CNM - No river water diverted
	S-02		08-Jun-07	-	-	-	-	CNM - No river water diverted
	S-02		03-Jul-07	7.71	674	18.0	57.06	
	S-02		10-Jul-07	-	-	-	-	CNM - No river water diverted
	S-02		15-Aug-07	-	-	-	-	CNM - No river water diverted
	S-02		21-Sep-07	-	-	-	-	CNM - No river water diverted
	S-02		09-Oct-07	-	-	-	-	CNM - No river water diverted
	S-02		29-Nov-07	-	-	-	-	CNM - No river water diverted
	S-02		20-Dec-07	-	-	-	-	CNM - No river water diverted
S-03	S-03	Red River - Upstream of Inlet (replicate of 1)	26-Jan-07	-	-	-	-	CNM - No river water diverted
	S-03		22-Feb-07	-	-	-	-	CNM - No river water diverted
	S-03		19-Mar-07	-	-	-	-	CNM - No river water diverted
	S-03		09-Apr-07	8.00	618	2.8	227.0	
	S-03		22-May-07	-	-	-	-	CNM - No river water diverted
	S-03		08-Jun-07	-	-	-	-	CNM - No river water diverted
	S-03		03-Jul-07	7.68	666	18.6	55.76	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-03	S-03	Red River - Upstream of Inlet (replicate of 1)	10-Jul-07	-	-	-	-	CNM - No river water diverted
	S-03		15-Aug-07	-	-	-	-	CNM - No river water diverted
	S-03		21-Sep-07	-	-	-	-	CNM - No river water diverted
	S-03		09-Oct-07	-	-	-	-	CNM - No river water diverted
	S-03		29-Nov-07	-	-	-	-	CNM - No river water diverted
	S-03		20-Dec-07	-	-	-	-	CNM - No river water diverted
S-04	S-04	Floodway Channel - Downstream of Inlet	26-Jan-07	-	-	-	-	CNM - No river water diverted
	S-04		22-Feb-07	-	-	-	-	CNM - No river water diverted
	S-04		19-Mar-07	-	-	-	-	CNM - No river water diverted
	S-04		09-Apr-07	8.00	645	3.6	152.4	
	S-04		22-May-07	-	-	-	-	CNM - No river water diverted
	S-04		08-Jun-07	-	-	-	-	CNM - No river water diverted
	S-04		03-Jul-07	7.83	659	19.0	22.40	
	S-04		10-Jul-07	-	-	-	-	CNM - No river water diverted
	S-04		15-Aug-07	-	-	-	-	CNM - No river water diverted
	S-04		21-Sep-07	-	-	-	-	CNM - No river water diverted
	S-04		09-Oct-07	-	-	-	-	CNM - No river water diverted
	S-04		29-Nov-07	-	-	-	-	CNM - No river water diverted
	S-04		20-Dec-07	-	-	-	-	CNM - No river water diverted
S-05	S-05	Seine River Syphon Overflow	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-05		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-05		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-05		09-Apr-07	8.20	382	5.1	21.90	
	S-05		22-May-07	-	-	-	-	CNM - No flow
	S-05		08-Jun-07	8.30	*	14.5	414.6	
	S-05		03-Jul-07	8.02	473	18.4	70.18	
	S-05		10-Jul-07	7.32	526	20.8	38.05	
	S-05		15-Aug-07	-	-	-	-	CNM - No flow
	S-05		21-Sep-07	-	-	-	-	CNM - No flow
	S-05		09-Oct-07	-	-	-	-	CNM - No flow
	S-05		29-Nov-07	-	-	-	-	CNM - No flow
	S-05		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-05 U/S	S-05 U/S	Seine River Syphon Overflow - Upstream of Perimeter Ditches	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-05 U/S		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-05 U/S		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-05 U/S		09-Apr-07	8.20	395	3.7	29.68	
	S-05 U/S		22-May-07	-	-	-	-	CNM - No flow
	S-05 U/S		08-Jun-07	8.30	*	14.0	40.49	
	S-05 U/S		03-Jul-07	7.99	466	17.9	83.57	
	S-05 U/S		10-Jul-07	7.84	513	21.9	39.28	
	S-05 U/S		15-Aug-07	-	-	-	-	CNM - No flow
	S-05 U/S		21-Sep-07	-	-	-	-	CNM - No flow
	S-05 U/S		09-Oct-07	-	-	-	-	CNM - No flow
S-05 U/S	S-05 U/S	Seine River Syphon Overflow - Upstream of Perimeter Ditches	29-Nov-07	-	-	-		CNM - No flow
	S-05 U/S		20-Dec-07	-	-	-	-	CNM - No flow, frozen

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-06	S-06	Grande Pointe Diversion Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow
	S-06		22-Feb-07	-	-	-	-	CNM - No flow
	S-06		19-Mar-07	-	-	-	-	CNM - No flow
	S-06		09-Apr-07	8.20	396	5.3	30.96	
	S-06		22-May-07	7.92	815	16.0	49.48	
	S-06		08-Jun-07	8.60	*	17.0	47.01	
	S-06		03-Jul-07	8.02	478	20.2	19.56	
	S-06		10-Jul-07	8.20	709	24.3	44.20	
	S-06		15-Aug-07	-	-	-	-	CNM - No flow
	S-06		21-Sep-07	-	-	-	-	CNM - No flow
	S-06		09-Oct-07	-	-	-	-	CNM - No flow
	S-06		29-Nov-07	-	-	-	-	CNM - No flow
	S-06		20-Dec-07	-	-	-	-	CNM - No flow
S-06 U/S	S-06	Grande Pointe Diversion Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow
	S-06	- Upstream of Perimeter Ditches	22-Feb-07	-	-	-	-	CNM - No flow
	S-06		19-Mar-07	-	-	-	-	CNM - No flow
	S-06		09-Apr-07	8.20	394	3.7	23.42	
	S-06		22-May-07	8.27	886	16.3	33.86	
	S-06		08-Jun-07	8.60	*	19.0	35.90	
	S-06		03-Jul-07	7.97	458	20.2	35.06	
	S-06		10-Jul-07	8.06	476	24.0	83.59	
	S-06		15-Aug-07	-	-	-	-	CNM - No flow
	S-06		21-Sep-07	-	-	-	-	CNM - No flow
	S-06		09-Oct-07	-	-	-	-	CNM - No flow
	S-06		29-Nov-07	-	-	-		CNM - No flow
	S-06		20-Dec-07	-	-	-	-	CNM - No flow
S-07	S-07	Centreline Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-07		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-07		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-07		09-Apr-07	8.00	186	3.1	51.53	
	S-07		22-May-07	7.94	1079	15.4	21.37	
	S-07		08-Jun-07	8.40	*	17.0	18.28	
	S-07		03-Jul-07	8.00	431	21.8	26.26	
	S-07		10-Jul-07	5.92	605	20.7	10.14	
	S-07		15-Aug-07	-	-	-	-	CNM - No flow
	S-07		21-Sep-07	-	-	-	-	CNM - No flow
	S-07		09-Oct-07	7.53	1612	6.3	44.29	
	S-07		29-Nov-07	-	-	-	-	CNM - Under construction
	S-07		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-07 U/S	S-07	Centreline Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-07	- Upstream of Perimeter Ditches	22-Feb-07	-	-	-	-	CNM - No flow, frozen

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-07 U/S	S-07	Centreline Drop Structure	19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-07	- Upstream of Perimeter Ditches	09-Apr-07	8.00	179	3.2	55.22	
	S-07		22-May-07	7.66	450	15.6	230.0	
	S-07		08-Jun-07	8.40	*	16.0	18.59	
	S-07		03-Jul-07	7.74	417	21.2	23.60	
	S-07		10-Jul-07	6.40	554	21.2	15.64	
	S-07		15-Aug-07	-	-	-	-	CNM - No flow
	S-07		21-Sep-07	-	-	-	-	CNM - No flow
	S-07		09-Oct-07	8.83	3070	7.3	32.6	
	S-07		29-Nov-07	-	-	-	-	CNM - Under construction
	S-07		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-08	S-08	Deacon Reservoir Drain	25-Jan-07	-	-	-	-	CNM - No flow
	S-08		22-Feb-07	-	-	-	-	CNM - No flow
	S-08		19-Mar-07	-	-	-	-	CNM - No flow
	S-08		09-Apr-07	-	-	-	-	CNM - No flow
	S-08		22-May-07	7.76	1004	18.0	>1000	
	S-08		08-Jun-07	-	-	-	-	CNM - No flow
	S-08		03-Jul-07	-	-	-	-	CNM - No flow
	S-08		10-Jul-07	-	-	-	-	CNM - No flow
	S-08		15-Aug-07	-	-	-	-	CNM - No flow
	S-08		21-Sep-07	-	-	-	-	CNM - No flow
	S-08		09-Oct-07	-	-	-	-	CNM - No flow
	S-08		29-Nov-07	-	-	-	-	CNM - No flow
	S-08		20-Dec-07	-	-	-	-	CNM - No flow
S-09	S-09	Cooks Creek Diversion Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-09		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-09		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-09		09-Apr-07	8.20	317	3.7	34.22	
	S-09		22-May-07	8.30	888	18.1	14.82	
	S-09		08-Jun-07	7.46	617	13.2	117.7	
	S-09		03-Jul-07	7.04	455	24.8	121.9	
	S-09		10-Jul-07	7.32	522	17.6	58.48	
	S-09		15-Aug-07	-	-	-	-	CNM - No flow
	S-09		21-Sep-07	8.21	2950	14.4	28.48	
	S-09		09-Oct-07	8.08	2640	7.9	25.40	
	S-09		29-Nov-07	-	-	-	-	CNM - No flow
	S-09		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-09 U/S	S-09	Cooks Creek Diversion Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-09	- Upstream of Perimeter Ditches	22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-09		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-09		09-Apr-07	8.20	319	4.3	17.14	
	S-09		22-May-07	7.38	624	16.0	77.25	
	S-09		08-Jun-07	7.86	585	10.1	113.4	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-09 U/S	S-09	Cooks Creek Diversion Drop Structure	03-Jul-07	7.01	455	24.1	110.6	
	S-09	- Upstream of Perimeter Ditches	10-Jul-07	7.34	512	16.0	92.35	
	S-09		15-Aug-07	-	-	-	-	CNM - No flow
	S-09		21-Sep-07	8.41	2760	15.7	26.32	
	S-09		09-Oct-07	8.07	1877	6.6	28.94	
	S-09		29-Nov-07	-	-	-	-	CNM - No flow
	S-09		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-10	S-10	North Bibeau Drain Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-10		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-10		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-10		09-Apr-07	8.00	266	5.3	7.25	
	S-10		22-May-07	7.33	994	17.1	277.1	
	S-10		08-Jun-07	8.10	*	19.0	8.17	
	S-10		03-Jul-07	7.62	522	21.0	8.27	
	S-10		10-Jul-07	6.82	845	19.2	3.93	
	S-10		15-Aug-07	-	-	-	-	CNM - No flow
	S-10		21-Sep-07	-	-	-	-	CNM - No flow
	S-10		09-Oct-07	7.15	1733	7.1	15.99	
	S-10		29-Nov-07	-	-	-	-	CNM - No flow
	S-10		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-10 U/S	S-10	North Bibeau Drain Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-10	- Upstream of Perimeter Ditches	22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-10		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-10		09-Apr-07	8.00	187	3.9	10.04	
	S-10		22-May-07	7.26	532	17.1	324.6	
	S-10		08-Jun-07	8.10	*	16.0	15.92	
	S-10		03-Jul-07	7.87	483	23.4	8.69	
	S-10		10-Jul-07	6.89	1158	19.3	5.39	
	S-10		15-Aug-07	-	-	-	-	CNM - No flow
	S-10		21-Sep-07	-	-	-	-	CNM - No flow
	S-10		09-Oct-07	7.12	1987	6.2	10.06	
	S-10		29-Nov-07	-	-	-		CNM - No flow
	S-10		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-11	S-11	Country Villa Estates Drain	26-Jan-07	-	-	-	-	CNM - No flow
	S-11		22-Feb-07	-	-	-	-	CNM - No flow
	S-11		19-Mar-07	-	-	-	-	CNM - No flow
	S-11		09-Apr-07	-	-	-	-	CNM - No flow
	S-11		22-May-07	6.79	1468	18.1	1.86	
	S-11		08-Jun-07	7.12	845	14.5	2.70	
	S-11		03-Jul-07	-	-	-	-	CNM - No flow
	S-11		10-Jul-07	-	-	-	-	CNM - No flow
	S-11		15-Aug-07	-	-	-	-	CNM - No flow
	S-11		21-Sep-07	-	-	-	-	CNM - No flow
S-11	S-11	Country Villa Estates Drain	09-Oct-07	-	-	-	-	CNM - No flow
	S-11		29-Nov-07	-	-	-	-	CNM - No flow
	S-11		20-Dec-07	-	-	-	-	CNM - No flow

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-12	S-12	Kildare Trunk-Transcona Storm Sewer Outlet	26-Jan-07	-	-	-	-	CNM - No flow
	S-12		22-Feb-07	-	-	-	-	CNM - No flow
	S-12		19-Mar-07	-	-	-	-	CNM - No flow
	S-12		09-Apr-07	-	-	-	-	CNM - Outlet inundated
	S-12		22-May-07	-	-	-	-	CNM - No flow
	S-12		08-Jun-07	-	-	-	-	CNM - No flow
	S-12		03-Jul-07	-	-	-	-	CNM - No flow
	S-12		10-Jul-07	-	-	-	-	CNM - No flow
	S-12		15-Aug-07	-	-	-	-	CNM - No flow
	S-12		21-Sep-07	-	-	-	-	CNM - No flow
	S-12		09-Oct-07	-	-	-	-	CNM - No flow
	S-12		29-Nov-07	-	-	-	-	CNM - No flow
	S-12		20-Dec-07	-	-	-	-	CNM - No flow
S-13	S-13	Floodway Channel - D/S of Grande Pointe Drain	25-Jan-07	6.90	1625	2.2	6.88	
	S-13		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-13		19-Mar-07	6.92	3630	1.5	47.44	
	S-13		09-Apr-07	8.20	390	5.2	22.40	
	S-13		22-May-07	8.17	625	15.5	33.86	
	S-13		08-Jun-07	8.30	*	15.5	34.12	
	S-13		03-Jul-07	7.90	525	19.9	33.92	
	S-13		10-Jul-07	6.02	529	22.4	34.63	
	S-13		15-Aug-07	7.81	709	17.9	87.80	
	S-13		21-Sep-07	8.34	542	14.0	25.57	
	S-13		09-Oct-07	7.33	530	7.4	39.42	
	S-13		29-Nov-07	8.79	700	0.5	21.50	
	S-13		21-Dec-07	7.70	1155	1.5	9.99	
S-14	S-14	Floodway Channel - D/S of North Bibeau Drain	25-Jan-07	6.30	885	1.3	4.20	
	S-14		22-Feb-07	7.40	1123	1.5	13.09	
	S-14		19-Mar-07	6.10	1360	0.5	47.63	
	S-14		09-Apr-07	8.00	301	4.5	22.13	
	S-14		22-May-07	7.69	896	16.7	29.62	
	S-14		08-Jun-07	8.40	*	18.0	60.09	
	S-14		03-Jul-07	7.79	479	22.8	27.96	
	S-14		10-Jul-07	7.32	536	20.2	80.90	
	S-14		15-Aug-07	6.80	908	21.5	18.27	
	S-14		21-Sep-07	8.07	1122	13.8	17.26	
	S-14		09-Oct-07	7.60	1101	7.0	26.57	
	S-14		29-Nov-07	8.72	500	1.0	12.45	
	S-14		21-Dec-07	7.80	530	2.0	7.43	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-21	S-21	Floodway Channel - Keewatin Weir	25-Jan-07	6.80	1111	0.4	5.03	
	S-21		22-Feb-07	8.12	1109	0.5	5.61	
	S-21		19-Mar-07	-	-	-	-	CNM - Unsafe ice condition
	S-21		09-Apr-07	6.39	451	3.0	284.7	
	S-21		22-May-07	7.80	1150	17.8	21.91	
	S-21		08-Jun-07	7.95	657	10.4	91.13	
	S-21		03-Jul-07	7.32	481	20.6	44.60	
	S-21		10-Jul-07	7.59	582	15.5	92.77	
	S-21		15-Aug-07	6.51	1384	22.0	18.49	
	S-21		21-Sep-07	7.74	1849	14.2	69.94	
	S-21		09-Oct-07	7.47	851	9.8	55.56	
	S-21		29-Nov-07	8.36	1000	1.0	11.49	
	S-21		21-Dec-07	8.00	554	2.7	11.64	
S-22	S-22	Springfield Road Drain Drop Structure	25-Jan-07	-	-	-	-	CNM - Under Construction
	S-22		22-Feb-07	-	-	-	-	CNM - Under Construction
	S-22		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-22		09-Apr-07	6.12	396	1.8	9.89	
	S-22		22-May-07	6.84	825	17.9	7.57	
	S-22		08-Jun-07	7.07	772	11.0	4.38	
	S-22		03-Jul-07	7.06	472	21.6	6.28	
	S-22		10-Jul-07	7.68	637	16.0	1.77	
	S-22		15-Aug-07	-	-	-	-	CNM - No flow
	S-22		21-Sep-07	7.60	580	14.5	6.63	
	S-22		09-Oct-07	7.87	1249	7.9	5.15	
	S-22		29-Nov-07	-	-	-	-	CNM - No flow
	S-22		21-Dec-07	-	-	-	-	CNM - No flow, frozen
S-22 U/S	S-22	Springfield Road Drain Drop Structure	25-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-22	- Upstream of Perimeter Ditches	22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-22		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-22		09-Apr-07	6.15	414	1.2	3.84	
	S-22		22-May-07	7.22	657	18.6	22.67	
	S-22		08-Jun-07	7.52	893	12.2	2.60	
	S-22		03-Jul-07	7.04	674	20.8	4.48	
	S-22		10-Jul-07	7.50	801	14.9	4.03	
	S-22		15-Aug-07	-	-	-	-	CNM - No flow
	S-22		21-Sep-07	-	-	-	-	CNM - No Flow
	S-22		09-Oct-07	-	-	-	-	CNM - No flow
	S-22		29-Nov-07	-	-	-	-	CNM - No flow
	S-22		21-Dec-07	-	-	-	-	CNM - No flow, frozen
S-23	S-23	Floodway Channel - Spring Hill Weir	26-Jan-07	6.70	1096	0.8	4.04	
	S-23		22-Feb-07	7.94	1274	1.4	4.78	
	S-23		19-Mar-07	6.51	1330	0.3	12.71	
	S-23		09-Apr-07	6.22	446	2.6	57.14	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-23	S-23	Floodway Channel - Spring Hill Weir	22-May-07	6.31	1076	17.0	21.32	
	S-23		08-Jun-07	7.62	655	13.5	87.63	
	S-23		03-Jul-07	7.22	473	21.8	98.86	
	S-23		10-Jul-07	7.73	614	16.4	97.98	
	S-23		15-Aug-07	6.73	1355	22.0	34.95	
	S-23		21-Sep-07	7.85	1851	14.7	17.64	
	S-23		09-Oct-07	6.84	473	9.7	60.85	
	S-23		29-Nov-07	8.43	1000	0.5	10.58	
	S-23		21-Dec-07	8.10	1127	1.7	7.98	
S-25	S-25	Floodway Channel - Dunning Weir	26-Jan-07	7.53	1093	0.8	11.41	
	S-25		22-Feb-07	7.50	1120	0.5	8.60	
	S-25		20-Mar-07	6.13	1260	1.0	13.11	
	S-25		09-Apr-07	6.41	507	2.6	409.8	
	S-25		22-May-07	7.21	906	17.9	29.68	
	S-25		08-Jun-07	7.25	673	12.1	79.45	
	S-25		03-Jul-07	7.13	457	22.0	51.07	
	S-25		10-Jul-07	7.52	610	17.0	88.91	
	S-25		15-Aug-07	8.16	916	22.2	31.21	
	S-25		21-Sep-07	7.53	1160	16.6	32.95	
	S-25		09-Oct-07	7.91	1121	6.5	-	
	S-25		29-Nov-07	8.42	1000	0.5	12.71	
	S-25		20-Dec-07	7.70	570	1.4	11.18	
S-26	S-26	Skholny Drain Drop Structure	26-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-26		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-26		20-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-26		09-Apr-07	6.70	608	1.9	3.78	
	S-26		22-May-07	6.61	661	18.0	5.49	
	S-26		08-Jun-07	7.33	750	12.7	1.57	
	S-26		03-Jul-07	7.06	714	21.3	2.52	
	S-26		10-Jul-07	7.80	736	16.1	2.85	
	S-26		15-Aug-07	7.20	346	21.0	19.14	
	S-26		21-Sep-07	7.16	590	14.3	7.65	
	S-26		09-Oct-07	7.08	685	6.2	21.07	
	S-26		29-Nov-07	-	-	-	-	CNM - No flow
	S-26		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-26 U/S	S-26	Skholny Drain Drop Structure - Upstream of Perimeter Ditches	03-Jul-07	7.01	770	23.1	1.74	
	S-26		10-Jul-07	7.83	767	16.8	14.28	
	S-26		15-Aug-07	7.08	333	19.7	17.33	
	S-26		21-Sep-07	6.68	588	13.6	16.42	
	S-26		09-Oct-07	6.88	956	6.4	30.86	
	S-26		29-Nov-07	-	-	-	-	CNM - No flow
	S-26		20-Dec-07	-	-	-	-	CNM - No flow, frozen

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-27	S-27	Ashfield Drain Drop Structure	26-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-27		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-27		20-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-27		09-Apr-07	6.79	865	2.6	2.21	
	S-27		22-May-07	7.11	745	19.1	1.83	
	S-27		08-Jun-07	7.53	804	14.1	2.17	
	S-27		03-Jul-07	7.06	630	22.5	1.73	
	S-27		10-Jul-07	7.76	694	16.8	0.62	
	S-27		15-Aug-07	7.00	577	21.8	2.52	
	S-27		21-Sep-07	-	-	-	-	CNM - No flow
	S-27		09-Oct-07	6.38	896	7.0	6.68	
	S-27		29-Nov-07	-	-	-	-	CNM - No flow
	S-27		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-27 U/S	S-27	Ashfield Drain Drop Structure	15-Aug-07	6.78	539	19.8	1.67	
	S-27	- Upstream of Perimeter Ditches	21-Sep-07	-	-	-	-	CNM - No Flow
	S-27		09-Oct-07	7.33	966	6.7	5.99	
	S-27		29-Nov-07	-	-	-	-	CNM - No flow
	S-27		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-28	S-28	Floodway Channel - PTH #44 Weir	26-Jan-07	7.90	1065	0.4	24.82	
	S-28		22-Feb-07	7.11	1336	0.1	9.62	
	S-28		20-Mar-07	6.88	1490	1.0	8.23	
	S-28		09-Apr-07	6.34	485	1.7	118.7	
	S-28		22-May-07	7.04	861	18.3	18.31	
	S-28		08-Jun-07	7.30	-	13.5	75.60	
	S-28		03-Jul-07	7.12	432	22.7	26.03	
	S-28		10-Jul-07	7.31	601	18.2	77.35	
	S-28		15-Aug-07	6.44	713	20.8	235.0	
	S-28		21-Sep-07	6.91	1074	13.3	11.84	
	S-28		09-Oct-07	6.70	1055	5.2	21.09	
	S-28		29-Nov-07	8.00	1200	1.5	10.73	
	S-28		20-Dec-07	7.60	594	1.5	27.64	
S-30	S-30	Red River - Downstream of Outlet (500 m)	26-Jan-07	7.81	1134	1.0	10.55	
	S-30		22-Feb-07	7.50	1210	0.0	8.10	
	S-30		20-Mar-07	7.22	1184	0.7	17.49	
	S-30		09-Apr-07	6.59	570	2.4	287.8	
	S-30		22-May-07	7.15	963	16.8	161.9	
	S-30		08-Jun-07	7.28	631	13.2	88.18	
	S-30		03-Jul-07	7.09	506	23.6	66.77	
	S-30		10-Jul-07	7.43	777	20.9	96.22	
	S-30		15-Aug-07	7.49	852	23.1	50.78	
	S-30		21-Sep-07	7.56	930	14.0	35.93	
	S-30		09-Oct-07	7.12	846	8.2	33.27	
S-30	S-30	Red River - Downstream of Outlet (500 m)	29-Nov-07	8.20	991	2.0	91.61	
	S-30		20-Dec-07	8.00	535	1.7	17.96	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-31	S-31	Red River - Downstream of Outlet (1000 m)	26-Jan-07	7.50	1172	0.0	8.10	
	S-31		22-Feb-07	7.95	1201	0.1	8.34	
	S-31		20-Mar-07	6.79	1192	0.5	16.85	
	S-31		09-Apr-07	6.48	636	1.8	174.3	
	S-31		22-May-07	7.18	863	16.9	149.4	
	S-31		08-Jun-07	7.38	743	14.4	146.1	
	S-31		03-Jul-07	7.11	599	24.0	73.75	
	S-31		10-Jul-07	7.50	791	21.3	109.4	
	S-31		15-Aug-07	7.59	874	21.8	43.66	
	S-31		21-Sep-07	8.03	936	14.2	40.27	
	S-31		09-Oct-07	7.28	842	8.8	30.85	
	S-31		29-Nov-07	8.30	941	2.0	103.0	
	S-31		20-Dec-07	8.00	534	1.9	16.52	
S-32	S-32	Red River - Downstream of Outlet (2000 m)	26-Jan-07	7.81	1134	0.7	8.85	
	S-32		22-Feb-07	7.85	1209	0.1	8.01	
	S-32		20-Mar-07	6.61	1189	0.9	24.08	
	S-32		09-Apr-07	6.51	664	1.9	224.9	
	S-32		22-May-07	7.49	869	17.0	158.6	
	S-32		08-Jun-07	7.30	777	14.8	172.7	
	S-32		03-Jul-07	7.06	621	24.6	72.48	
	S-32		10-Jul-07	7.67	788	20.9	101.1	
	S-32		15-Aug-07	7.85	867	21.7	47.04	
	S-32		21-Sep-07	8.12	965	13.4	37.23	
	S-32		09-Oct-07	7.12	854	8.8	30.38	
	S-32		29-Nov-07	8.40	996	2.0	115.6	
	S-32		20-Dec-07	8.00	533	1.6	16.64	
S-33	S-33	Red River - Downstream of Outlet (3000 m)	26-Jan-07	7.85	1132	2.6	9.04	
	S-33		22-Feb-07	7.18	1223	0.2	9.76	
	S-33		20-Mar-07	6.71	1203	0.8	17.06	
	S-33		09-Apr-07	6.97	693	1.8	207.2	
	S-33		22-May-07	7.43	860	17.2	203.9	
	S-33		08-Jun-07	7.39	784	15.3	224.9	
	S-33		03-Jul-07	7.19	610	25.0	88.16	
	S-33		10-Jul-07	7.63	807	21.1	88.46	
	S-33		15-Aug-07	8.23	875	20.4	37.17	
	S-33		21-Sep-07	7.52	974	13.0	35.17	
	S-33		09-Oct-07	7.39	833	9.1	31.92	
	S-33		29-Nov-07	8.20	937	2.0	42.60	
	S-33		20-Dec-07	8.00	545	1.7	16.13	
S-34	S-34	Red River - Upstream of Outlet	26-Jan-07	7.72	1153	0.2	10.43	
	S-34		22-Feb-07	8.07	1174	0.0	8.36	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
S-34	S-34	Red River - Upstream of Outlet	20-Mar-07	7.01	1132	1.6	18.52	
	S-34		09-Apr-07	6.87	672	1.1	250.6	
	S-34		22-May-07	6.76	861	16.3	163.7	
	S-34		08-Jun-07	7.52	805	14.6	165.9	
	S-34		03-Jul-07	7.11	635	23.0	78.72	
	S-34		10-Jul-07	7.36	812	20.6	89.66	
	S-34		15-Aug-07	6.98	863	23.8	39.91	
	S-34		21-Sep-07	8.26	930	14.4	48.03	
	S-34		09-Oct-07	7.20	843	8.6	30.92	
	S-34		29-Nov-07	8.40	981	1.5	39.63	
	S-34		20-Dec-07	8.00	506	1.6	70.68	
S-35	S-35	West Dyke - Downstream of Manness Drain	26-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-35		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-35		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-35		09-Apr-07	8.60	260	5.4	81.58	
	S-35		22-May-07	6.64	1575	13.3	28.07	
	S-35		08-Jun-07	8.00	*	10.5	43.88	
	S-35		03-Jul-07	6.73	606	18.2	59.31	
	S-35		10-Jul-07	6.60	283	18.1	326.1	
	S-35		15-Aug-07	-	-	-	-	CNM - No flow
	S-35		21-Sep-07	-	-	-	-	CNM - No flow
	S-35		09-Oct-07	-	-	-	-	CNM - No flow
	S-35		29-Nov-07	-	-	-	-	CNM - No flow
	S-35		20-Dec-07	-	-	-	-	CNM - No flow, frozen
S-36	S-36	West Dyke - Downstream of Domain Drain	26-Jan-07	-	-	-	-	CNM - No flow, frozen
	S-36		22-Feb-07	-	-	-	-	CNM - No flow, frozen
	S-36		19-Mar-07	-	-	-	-	CNM - No flow, frozen
	S-36		09-Apr-07	8.30	154	5.0	39.88	
	S-36		22-May-07	7.52	117	12.8	547.7	
	S-36		08-Jun-07	7.80	*	10.0	64.13	
	S-36		03-Jul-07	6.93	283	18.1	47.03	
	S-36		10-Jul-07	6.67	421	17.5	80.71	
	S-36		15-Aug-07	-	-	-	-	CNM - No flow
	S-36		21-Sep-07	-	-	-	-	CNM - No flow
	S-36		09-Oct-07	-	-	-	-	CNM - No flow
	S-36		29-Nov-07	-	-	-	-	CNM - No flow
	S-36		20-Dec-07	-	-	-	-	CNM - No flow, frozen
Level I								
CON D/S	CON D/S	Floodway Channel - Station 33+900	29-Mar-07	6.25	305	2.7	98.53	
	CON D/S		05-May-07	7.70	883	8.1	17.02	
	CON D/S		22-May-07	6.19	1065	20.3	17.10	
	CON D/S		26-May-07	7.89	557	7.4	43.27	
	CON D/S		29-May-07	7.27	583	13.6	30.36	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
CON D/S	CON D/S	Floodway Channel - Station 33+900	07-Jun-07	6.87	650	10.4	91.43	
	CON D/S		13-Jun-07	7.63	640	19.2	64.10	
	CON D/S		18-Jun-07	7.16	790	15.9	125.4	
	CON D/S	- Station 40+850	24-Jun-07	7.14	635	17.2	61.92	
	CON D/S		25-Jun-07	7.33	582	18.3	107.4	
	CON D/S		10-Jul-07	7.56	601	18.1	91.94	
	CON D/S	- Station 50+500	26-Jul-07	7.10	1331	20.8	25.36	
	CON D/S		24-Sep-07	7.48	1255	14.4	15.42	
	CON D/S		09-Oct-07	6.82	1034	5.0	24.27	
	CON D/S		19-Oct-07	7.92	882	9.1	41.30	
CON U/S	CON U/S	Floodway Channel - Station 7+650	29-Mar-07	6.05	190	3.6	8.87	
	CON U/S		05-May-07	-	-	-	-	CNM - No flow
	CON U/S		22-May-07	7.22	9	5.1	15.41	
	CON U/S		26-May-07	7.35	767	7.5	4.85	
	CON U/S		29-May-07	8.22	691	13.3	4.05	
	CON U/S		07-Jun-07	7.14	857	11.2	1.73	
	CON U/S		13-Jun-07	7.02	799	17.1	3.21	
	CON U/S		18-Jun-07	6.75	572	14.6	26.98	
	CON U/S		24-Jun-07	-	738	16.8	6.31	
	CON U/S		25-Jun-07	7.12	658	15.9	4.84	
	CON U/S		10-Jul-07	-	-	-	-	CNM - No flow
	CON U/S		26-Jul-07	-	-	-	-	CNM - No flow
	CON U/S		24-Sep-07	-	-	-	-	CNM - No flow
	CON U/S		09-Oct-07	-	-	-	-	CNM - No flow
	CON U/S		19-Oct-07	-	-	-	-	CNM - No flow
S-31	S-31	Red River - Downstream of Outlet (1000 m)	29-Mar-07	6.50	630	1.8	264.1	
	S-31		05-May-07	7.19	761	9.7	204.6	
	S-31		22-May-07	7.18	863	16.9	149.4	
	S-31		26-May-07	7.99	597	8.1	65.20	
	S-31		29-May-07	7.42	569	14.0	123.5	
	S-31		07-Jun-07	7.08	701	12.0	160.2	
	S-31		13-Jun-07	7.35	780	16.9	202.5	
	S-31		18-Jun-07	7.27	670	16.7	193.0	
	S-31		24-Jun-07	7.16	720	17.8	204.6	
	S-31		25-Jun-07	7.23	563	19.3	173.8	
	S-31		10-Jul-07	7.50	791	21.3	109.4	
	S-31		26-Jul-07	7.21	857	23.3	55.19	
	S-31		24-Sep-07	8.07	1003	14.6	32.80	
	S-31		09-Oct-07	7.28	842	8.8	30.85	
	S-31		19-Oct-07	8.15	1016	9.9	25.54	
Spill								
S-12	S-12	Kildare Trunk-Transcona Storm Sewer Outlet	13-Feb-07	-	-	-	-	In pipe sample - no chemistry
SPILL U/S	SPILL U/S	Floodway Channel - Station 27+385	13-Feb-07	*	1351	3.0	1.73	
	SPILL U/S		16-Feb-07	*	1169	2.3	11.14	
	SPILL U/S		19-Feb-07	*	*	*	1.86	
	SPILL U/S		05-Mar-07	6.04	843	4.1	19.63	

TABLE NM6-1
FIELD SURFACE WATER CHEMISTRY
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No.	Use for Sorting	Location	Date	pH (units)	E.C. (µS/cm)	Temp. (°C)	Turbidity (NTU)	Comments
SPILL D/S	SPILL D/S	Floodway Channel - Station 27+535	13-Feb-07	*	1219	4.3	3.53	
	SPILL D/S		16-Feb-07	*	1161	4.0	6.36	
	SPILL D/S		19-Feb-07	*	*	*	1.99	
	SPILL D/S		05-Mar-07	6.95	1025	4.1	15.30	
S-23	S-23	Floodway Channel - Spring Hill Weir	13-Feb-07	*	1357	0.2	5.11	
	S-23		16-Feb-07	*	1232	3.6	5.36	
	S-23		19-Feb-07	*	*	*	9.78	
	S-23		05-Mar-07	6.31	1161	2.5	9.50	
S-28	S-28	Floodway Channel - PTH #44 Weir	13-Feb-07	*	1157	0.0	10.30	
	S-28		16-Feb-07	*	1543	4.6	6.97	
	S-28		19-Feb-07	*	*	*	7.03	
	S-28		05-Mar-07	7.64	1460	2.4	5.24	
S-31	S-31	Red River - Downstream of Outlet (1000 m)	13-Feb-07	*	583	0.0	9.91	
	S-31		16-Feb-07	*	1326	3.2	8.56	
	S-31		19-Feb-07	*	*	*	8.22	
	S-31		05-Mar-07	6.80	1103	2.5	8.69	
S-34	S-34	Red River - Upstream of Outlet	13-Feb-07	*	1001	0.1	11.97	
	S-34		16-Feb-07	*	1289	2.3	9.23	
	S-34		19-Feb-07	*	*	*	8.84	
	S-34		05-Mar-07	7.61	1073	2.5	9.40	

Notes:

"-" = No Data

* = Equipment failure

E.C. = Electrical Conductivity

CNM = Could Not Monitor

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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)																												
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	26-Jan-07	3.1	8.11	1020	282	344	<0.6	<0.4	441	47	0.4	202	<0.001	0.077	0.001	0.064	70.8	64.3	5.04	54.1	0.17	0.0195	5	0.018	0.009	613	5	<0.1	<0.2	101
	22-Feb-07	2.9	8.60	1060	290	326	13.9	<0.4	450	47	0.4	215	0.006	0.061	0.002	1.520	68.9	67.5	4.49	48.8	0.03	0.0178	6	0.008	0.008	632	<5	0.2	6.0	95.7
	19-Mar-07	11	8.25	1180	264	322	<0.6	<0.4	471	85	0.4	238	0.027	0.221	0.003	0.061	73.5	69.8	5.75	79.4	0.27	0.0303	3	0.039	0.022	710	10	0.6	5.0	103
	09-Apr-07	40	7.97	409	128	157	<0.6	<0.4	180	18	0.3	59	0.402	0.094	0.001	1.800	38.0	20.8	10.0	12.9	**0.46**	0.0428	18	0.436	0.387	244	47	1.4	19	99.4
	22-May-07	16	8.42	1030	223	258	6.8	<0.4	420	56	0.4	257	0.006	0.014	0.001	0.022	72.4	58.2	6.72	60.0	0.26	0.0415	10	0.044	0.011	644	16	8.0	0.6	98
	08-Jun-07	75	8.20	572	249	277	13.3	<0.4	293	22	0.3	24	0.062	0.095	0.003	0.084	66.8	30.6	5.00	16.5	**0.53**	0.0550	20	0.133	0.061	316	80	21	3.2	109
	03-Jul-07	25	8.31	413	180	217	1.1	<0.4	185	17	0.2	23	0.061	0.059	0.006	0.068	42.2	19.5	5.77	8.91	**0.43**	0.0789	16	0.289	0.262	224	24	16	1.2	93
	10-Jul-07	83	8.50	547	230	265	7.9	<0.4	264	19	0.2	60	0.132	0.119	0.012	0.182	58.7	28.5	5.24	15.9	**0.43**	0.0618	14	0.282	0.200	326	72	15	1.2	95.1
	15-Aug-07	99	8.41	674	212	249	5.0	<0.4	319	34	0.2	106	0.019	0.050	0.006	0.197	55.8	43.6	4.29	31.7	0.30	0.0608	9	0.123	0.022	403	49	0.9	10	106
	21-Sep-07	6.2	8.38	1000	249	295	4.1	<0.4	423	53	0.2	214	0.006	0.024	0.001	0.064	66.4	62.6	5.32	55.5	0.06	0.0233	5	0.035	0.013	606	15	0.4	6.0	101
	09-Oct-07	20	8.40	1150	233	275	4.6	<0.4	441	109	0.4	222	0.057	0.106	0.003	0.117	70.3	64.6	6.70	93.5	0.08	0.0174	7	0.091	0.060	706	15	7.0	0.5	105
	29-Nov-07	34	8.18	1210	272	332	<0.6	<0.4	525	68	0.4	273	0.005	0.024	0.000	0.080	83.7	76.8	5.86	85.1	0.23	0.0467	4	0.117	0.012	757	49	5.0	1.0	110
	20-Dec-07	4.4	7.94	1150	295	360	<0.6	<0.4	457	59	0.4	254	0.008	0.133	0.001	0.195	76.2	64.9	5.42	62.5	0.13	0.0246	4	0.018	0.013	699	<5	4	0.4	93.1
CON U/S	09-Apr-07	110	8.06	547	124	152	<0.6	<0.4	233	25	0.3	127	0.386	0.279	0.004	2.870	53.1	24.3	9.38	23.0	**0.61**	0.1180	15	0.426	0.272	350	90	1.8	15	97.2
	22-May-07	11	8.13	868	141	165	3.1	<0.4	392	27	0.3	246	0.058	0.021	0.000	1.050	92.3	39.3	9.40	31.4	0.17	0.0272	10	0.097	0.083	534	12	0.6	8.0	108
	08-Jun-07	1.7	8.15	795	219	252	7.5	<0.4	374	23	0.3	190	0.044	0.005	0.000	0.023	87.2	37.9	9.27	28.4	0.02	0.0126	8	0.066	0.051	507	9	9	0.7	99.3
	03-Jul-07	10	8.36	591	191	227	2.6	<0.4	256	20	0.3	109	0.218	0.028	0.002	0.343	58.0	27.2	7.79	19.9	0.22	0.1780	15	0.342	0.315	358	29	15	1.2	92.8
	10-Jul-07	6.0	8.45	623	213	247	6.0	<0.4	295	18	0.2	99	0.128	0.110	0.012	0.460	68.6	30.0	8.63	22.0	0.15	0.0710	13	0.322	0.253	376	<5	1.2	12	103
VEG D/S	09-Apr-07	55	8.03	412	116	142	<0.6	<0.4	160	17	0.3	59	0.341	0.043	0.001	1.940	36.4	16.7	7.83	13.0	**0.32**	0.0322	16	0.417	0.316	228	67	1.3	16	94.4
	22-May-07	180	8.04	541	104	125	1.2	<0.4	230	24	0.4	129	0.187	0.537	0.017	4.480	36.5	33.8	6.29	26.2	**0.94**	0.0539	13	0.409	0.187	339	220	1.8	11	102
	08-Jun-07	38	8.13	637	233	266	9.0	<0.4	308	24	0.3	101	0.143	0.106	0.005	0.222	66.3	34.7	6.33	21.6	0.24	0.0656	17	0.204	0.144	395	18	17	1.2	97.3
	03-Jul-07	14	8.36	457	186	222	2.4	<0.4	209	17	0.2	40	0.132	0.057	0.006	0.081	47.9	21.6	6.89	11.7	**0.41**	0.0792	16	0.306	0.295	257	6	16	1.2	96.2
	10-Jul-07	53	8.54	505	231	259	11.3	<0.4	259	17	0.3	27	0.193	0.108	0.013	0.158	59.7	26.7	7.31	19.7	0.13	0.0690	16	0.322	0.268	297	52	1.2	17	109
	15-Aug-07	22	8.51	1170	169	194	5.6	<0.4	317	181	0.2	146	0.013	0.091	0.013	0.036	53.9	44.2	8.07	117	0.27	0.0512	8	0.074	0.019	653	25	0.6	6.0	101
	21-Sep-07	6.2	8.38	1000	249	295	4.1	<0.4	423	53	0.2	214	0.006	0.024	0.001	0.064	66.4	62.6	5.32	55.5	0.06	0.0233	5	0.035	0.013	606	15	0.4	6.0	101
	09-Oct-07	20	8.40	1150	233	275	4.6	<0.4	441	109	0.4	222	0.057	0.106	0.003	0.117	70.3	64.6	6.70	93.5	0.08	0.0174	7	0.091	0.060	706	15	7.0	0.5	105
	29-Nov-07	34	8.18	1210	272	332	<0.6	<0.4	525	68	0.4	273	0.005	0.024	0.000	0.080	83.7	76.8	5.86	85.1	0.23	0.0467	4	0.117	0.012	757	49	5.0	1.0	110
	20-Dec-07	4.4	7.94	1150	295	360	<0.6	<0.4	457	59	0.4	254	0.008	0.133	0.001	0.195	76.2	64.9	5.42	62.5	0.13	0.0246	4	0.018	0.013	699	<5	4	0.4	93.1
VEG U/S	09-Apr-07	110	8.06	547	124	152	<0.6	<0.4	233	25	0.3	127	0.386	0.279	0.004	2.870	53.1	24.3	9.38	23.0	**0.61**	0.1180	15	0.426	0.272	350	90	1.8	15	97.2
	22-May-07	11	8.13	868	141	165	3.1	<0.4	392	27	0.3	246	0.058	0.021	0.000	1.050	92.3	39.3	9.40	31.4	0.17	0.0272	10	0.097	0.083	534	12	0.6	8.0	108
	08-Jun-07	1.7	8.15	795	219	252	7.5	<0.4	374	23	0.3	190	0.044	0.005	0.000	0.023	87.2	37.9	9.27	28.4	0.02	0.0126	8	0.066	0.051	507	9	9.0	0.7	99.3
	03-Jul-07	10	8.36	591	191	227	2.6	<0.4	256	20	0.3	109	0.218	0.028	0.002	0.343	58.0	27.2	7.79	19.9	0.22	0.1780	15	0.342	0.315	358	29	15	1.2	92.8
	10-Jul-07	6.0	8.45	623	213	247	6.0	<0.4	295	18	0.2	99	0.128	0.110	0.012	0.460	68.6	30.0	8.63	22.0	0.15	0.0710	13	0.322	0.253	376	<5	1.2	12	103
S-01	09-Apr-07	180	8.07	550	126	154	<0.6	<0.4	237	25	0.3	128	0.510	0.358	0.005	3.260	54.8	24.2	8.22	19.4	**0.85**	0.2720	15	0.606	0.290	350	230	2.0	16	94.1
	03-Jul-07	30	8.37	602	190	225	3.1	<0.4	263	21	0.3	116	0.174	0.040	0.003	0.298	59.6	27.7	7.63	21.6	**0.36**	0.1340	15	0.392	0.329	369	91	15	1.2	93.5
S-02	09-Apr-07	200	8.09	551	130	158	<0.6	<0.4	241	25	0.3	128	0.471	0.352	0.005	3.250	55.4	24.9	8.31	20.2	**0.91**	0.2790	17	0.602	0.289	354	270	2.0	15	95.1
	03-Jul-07	34	8.37	605	190	227	2.6	<0.4	269	21	0.3	117	0.296	0.040	0.003	0.290	60.7	28.6	7.57	21.7	**0.37**	0.1390	15	0.379	0.326	372	85	15	1.2	94.9
S-03	09-Apr-07	230	8.11	550	128	156	<0.6	<0.4	236	25	0.3	128	0.481	0.342	0.005	3.270	54.6	24.2	8.10	20.4	**0.89**	0.2740	15	0.589	0.280	351	270	2.0	15	94.1
	03-Jul-07	34	8.38	602	190	225	3.1	<0.4	268	21	0.3	120	0.294	0.042	0.004	0.285	60.9	28.1	7.65	22.0	**0.33**	0.1430	15	0.394	0.320	375	92	15	1.2	94
S-04	09-Apr-07	160	8.06	553	125	153	<0.6	<0.4	222	25	0.3	128	0.425	0.292	0.004	3.050	51.2	22.9	8.30	21.2	**0.61**	0.1490	14	0.494	0.275	346	130	1.7	16	91.2
	03-Jul-07	14	8.38	599	192	228	3.1	<0.4	257	21	0.3	113	0.170	0.013	0.001	0.202	58.0	27.1	7.61	21.2	0.19	0.0736	15	0.348	0.324	364	19	15	1.2	91.6
S-05	09-Apr-07	18	8.08	332	132	162	<0.6	<0.4	147	16	0.3	17	0.303	0.091	0.001	1.190	33.0	15.6	7.98	8.12	0.25	0.0247	18	0.360	0.309	183	13	1.2	18	98
U/S	09-Apr-07	22	8.11	332	134	164	<0.6	<0.4	143	16	0.3	17	0.299	0.087	0.001	1.180	32.1	15.2	7.21	7.18	**0.42**	0.0360	17	0.360	0.311	181	70	1.2	18	93.2
	08-Jun-07	45	8.08	542	243	278	8.9	<0.4	262	22	0.3	13	0.145	0.082	0.003	0.104	58.6	28.0	4.82	14.6	**0.31**	0.0512	21	0.218	0.151	288	34	21	1.3	104
U/S	08-Jun-07	28	8.13	541	244	279	9.0	<0.4	258	22	0.2	13	0.147	0.074	0.003	0.107	60.7	27.7	4.65	14.0	0.30	0.0486	20	0.212	0.148	285	27	21	1.2	104
	03-Jul-07	48	8.47	423	208	243	5.6	<0.4	207	17	0.2	23	0.129	0.063	0.006	0.073	46.6	22.2	4.90	8.06	**0.49**	0.0501	17	0.306	0.256	247	67	17	1.2	90
U/S	03-Jul-07	50	8.48	420	210	244	5.8	<0.4	211	16	0.3	21	0.105	0.063	0.006	0.076	47.8	22.2	4.88	7.99	**0.54**	0.0640	17	0.326	0.257	245	100	17	1.2	91.8
	10-Jul-07	17	8.55	488	244	272	12.5	<0.4	268	16	0.2	19	0.119	0.019	0.003	0.082	63.2	26.7	3.72	9.54	**0.34**	0.0530	22	0.251	0.205	285	25	1.1	19	102
U/S	10-Jul-07	24	8.56	477	247	275	13.0	<0.4	266	13	0.2	16	0.130	0.025	0.004	0.075	63.7	26.0	3.68	8.97	0.29	0.0426	21	0.256	0.212	280	63	1.1	21	103

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-06	09-Apr-07	16	8.11	339	130	159	<0.6	<0.4	159	12	0.3	28	0.252	0.024	0.000	1.420	32.0	19.1	8.33	7.44	0.22	0.0102	16	0.305	0.264	191	60	1.1	16	102
U/S	09-Apr-07	20	8.08	327	129	157	<0.6	<0.4	148	16	0.3	18	0.305	0.072	0.001	1.310	33.3	15.8	7.87	7.82	0.26	0.0196	18	0.364	0.320	181	18	1.2	18	99.9
	22-May-07	40	8.17	817	173	201	4.9	<0.4	390	24	0.4	235	0.031	0.059	0.003	0.143	73.8	50.0	10.1	28.0	**0.37**	0.0613	16	0.129	0.055	525	39	1.2	17	102
U/S	22-May-07	34	8.21	846	122	145	1.8	<0.4	298	76	0.3	204	0.011	0.034	0.002	0.111	60.2	35.8	7.67	59.8	**0.44**	0.0292	9	0.068	0.011	517	34	0.7	9.0	98.8
	08-Jun-07	37	8.13	760	278	317	11.1	<0.4	374	28	0.3	127	0.170	0.073	0.003	0.590	68.4	49.3	8.23	27.6	**0.32**	0.0760	16	0.244	0.170	477	35	16	1.2	98.1
U/S	08-Jun-07	22	8.45	700	249	279	11.7	<0.4	340	29	0.4	116	0.083	0.025	0.003	0.024	75.0	37.1	6.32	24.5	**0.31**	0.0907	14	0.130	0.076	437	17	14	1.0	97.6
	03-Jul-07	14	8.44	428	207	243	4.9	<0.4	201	17	0.2	18	0.116	0.083	0.009	0.067	43.8	22.2	5.31	8.92	0.25	0.0530	17	0.277	0.272	240	10	17	1.2	90.5
U/S	03-Jul-07	34	8.47	411	204	237	5.6	<0.4	203	15	0.3	19	0.147	0.082	0.009	0.091	46.1	21.5	5.24	7.68	**0.40**	0.0502	17	0.281	0.263	237	22	17	1.3	92.4
	10-Jul-07	29	8.64	677	257	284	14.7	<0.4	320	25	0.3	96	0.062	0.023	0.005	0.008	52.5	45.9	5.96	28.8	**0.43**	0.0762	16	0.179	0.119	408	29	1.2	16	99.2
U/S	10-Jul-07	72	8.61	454	190	211	10.3	<0.4	233	16	0.2	43	0.059	0.053	0.010	0.007	49.4	26.7	6.26	12.0	**0.65**	0.1690	13	0.257	0.099	267	62	1.5	15	104
S-07	09-Apr-07	55	7.86	194	85	103	<0.6	<0.4	85.1	<9	0.3	20	0.385	0.046	0.000	1.210	17.5	10.1	6.35	3.31	**0.69**	0.0259	15	0.465	0.373	113	73	1.1	15	91.1
U/S	09-Apr-07	55	7.87	198	78	95	<0.6	<0.4	86.8	<9	0.3	19	0.382	0.048	0.000	1.190	17.7	10.4	6.45	3.45	**0.65**	0.0264	15	0.470	0.373	110	63	1.1	15	100
	22-May-07	17	8.17	1090	209	239	7.8	<0.4	542	10	0.3	446	0.006	0.030	0.001	0.066	102	69.9	8.51	36.5	0.30	0.0545	9	0.041	0.017	798	9	0.6	8.0	91.9
U/S	22-May-07	180	7.94	414	95	115	<0.6	<0.4	178	15	0.4	102	0.256	0.665	0.017	4.910	28.6	25.9	5.83	15.7	**0.53**	0.0456	17	0.500	0.252	272	240	2.2	16	91.4
	08-Jun-07	14	8.18	988	301	339	13.7	<0.4	481	35	0.4	228	0.106	0.020	0.001	0.307	72.6	72.9	6.94	46.2	0.22	0.0452	16	0.156	0.121	643	16	17	1.2	100
U/S	08-Jun-07	12	8.26	863	308	346	14.5	<0.4	432	23	0.4	179	0.136	0.021	0.001	0.096	66.0	64.9	6.68	34.9	0.25	0.0383	16	0.179	0.143	559	24	17	1.2	97.8
	03-Jul-07	18	8.41	391	182	216	3.3	<0.4	177	12	0.3	23	0.253	0.037	0.004	0.041	31.2	24.0	6.35	10.1	**0.44**	0.0380	16	0.459	0.451	216	18	16	1.2	92.2
U/S	03-Jul-07	19	8.41	372	179	211	3.7	<0.4	170	<9	0.3	21	0.305	0.036	0.004	0.046	30.7	22.8	6.41	9.02	**0.57**	0.0393	17	0.476	0.465	197	11	17	1.3	98.2
	10-Jul-07	7.9	8.48	564	211	242	7.7	<0.4	256	21	0.3	69	0.229	0.014	0.002	0.080	42.6	36.5	6.67	23.5	0.17	0.0372	15	0.352	0.311	327	15	1.2	15	101
U/S	10-Jul-07	11	8.55	509	234	263	11.4	<0.4	249	9	0.3	42	0.233	0.009	0.001	<0.005	39.3	36.7	7.18	15.9	0.19	0.0717	17	0.376	0.344	291	14	1.4	17	100
	09-Oct-07	35	8.36	1540	113	132	2.7	<0.4	519	171	0.6	400	0.066	0.009	0.000	2.420	72.2	82.2	8.80	132	**0.86**	0.0350	13	0.148	0.075	944	38	12	1.3	105
U/S	09-Oct-07	22	**9.16**	2840	299	256	53.8	<0.4	573	571	0.7	374	0.655	0.019	0.004	0.014	60.8	102	12.7	402	0.05	0.0672	23	1.040	0.735	1700	47	29	3.4	97.7
S-08	22-May-07	21000	8.17	1010	70	86	<0.6	<0.4	4580	33	0.4	423	0.005	0.510	**0.026**	1.690	1200	387	9.93	49.0	0.30	7.0800	7	0.771	0.014	2150	25000	6.0	22.9	834
S-09	09-Apr-07	33	8.09	272	102	124	<0.6	<0.4	111	13	0.2	19	0.267	0.077	0.001	1.490	22.6	13.3	8.38	5.75	0.27	0.0250	17	0.322	0.265	149	37	1.2	17	92.3
U/S	09-Apr-07	16	8.08	277	103	126	<0.6	<0.4	113	13	0.2	16	0.246	0.061	0.001	1.490	23.0	13.5	8.47	6.27	0.13	0.0211	17	0.300	0.264	149	17	1.2	17	95.4
	22-May-07	9.9	8.47	850	176	200	7.3	<0.4	348	63	0.4	205	0.006	0.028	0.003	0.025	61.4	47.3	7.46	46.0	0.19	0.0166	14	0.031	0.008	535	10	13	0.9	95.4
U/S	22-May-07	65	8.06	581	112	137	<0.6	<0.4	212	67	0.3	113	0.108	0.139	0.005	0.227	36.8	29.3	6.61	40.2	**0.73**	0.0630	14	0.262	0.141	361	78	14	1.1	94.6
	08-Jun-07	110	8.23	490	253	286	10.7	<0.4	274	12	0.3	14	0.038	0.114	0.005	0.051	67.6	25.6	4.24	7.99	**0.65**	0.0571	22	0.139	0.046	284	130	24	0.9	104
U/S	08-Jun-07	110	8.21	490	251	285	10.5	<0.4	278	13	0.3	15	0.049	0.098	0.003	0.060	67.7	26.4	4.37	8.15	**0.68**	0.0551	22	0.137	0.047	285	120	23	1.0	105
	03-Jul-07	110	8.49	418	222	255	8.1	<0.4	221	9	0.2	26	0.021	0.074	0.012	0.039	54.2	20.8	2.37	4.41	**0.56**	0.0595	20	0.121	0.036	250	100	19	1.2	88.8
U/S	03-Jul-07	90	8.48	417	222	256	7.3	<0.4	217	9	0.2	22	0.015	0.073	0.011	0.033	52.4	21.0	2.32	4.24	**0.50**	0.0519	20	0.108	0.037	245	84	19	1.2	88.8
	10-Jul-07	47	8.62	465	246	273	13.3	<0.4	244	9	0.2	26	0.011	0.049	0.006	0.015	59.1	23.4	2.26	5.78	**0.34**	0.0504	19	0.088	0.026	273	48	18	1.3	90.6
U/S	10-Jul-07	75	8.64	459	241	262	15.7	<0.4	247	11	0.2	31	0.011	0.058	0.007	0.018	59.7	23.8	2.30	5.74	**0.51**	0.0654	19	0.117	0.027	277	96	19	1.2	90.7
	21-Sep-07	23	8.57	2960	397	447	18.3	<0.4	761	683	0.4	432	0.363	0.122	0.012	0.047	88.1	131	12.6	404	0.25	0.0305	72	0.466	0.430	1990	20	2.1	69	91.3
U/S	21-Sep-07	17	8.76	2870	399	423	31.5	<0.4	701	649	0.5	434	0.553	0.126	**0.019**	0.037	77.3	123	12.3	384	0.18	0.0321	31	0.677	0.625	1920	15	2.0	29	87.7
	09-Oct-07	18	8.75	2740	353	379	25.6	<0.4	634	551	0.4	294	0.304	0.105	0.009	0.032	69.1	112	11.0	346	0.17	0.0406	22	0.357	0.335	1600	22	22	1.8	97.4
U/S	09-Oct-07	21	8.69	1970	260	283	17	<0.4	471	349	0.4	220	0.259	0.067	0.005	0.081	55.4	80.9	10.5	234	0.15	0.0282	18	0.297	0.266	1110	24	19	1.5	101
S-10	09-Apr-07	6.6	7.87	239	86	105	<0.6	<0.4	90.2	13	0.2	14	0.578	0.024	0.000	0.875	17.7	11.1	11.1	3.86	0.08	0.0081	16	0.661	0.610	127	10	1.2	16	91.7
U/S	09-Apr-07	9.4	7.82	202	72	88	<0.6	<0.4	75.8	12	0.2	14	0.687	0.037	0.000	0.585	15.9	8.79	12.4	2.83	0.10	0.0051	16	0.764	0.715	112	<5	1.1	15	92.1
	22-May-07	200	8.11	934	161	196	<0.6	<0.4	419	83	0.3	283	0.116	0.297	0.013	0.919	62.4	63.9	7.77	48.1	**1.03**	0.1120	19	0.442	0.153	649	380	17	2.2	92.5
U/S	22-May-07	230	7.98	494	121	147	<0.6	<0.4	222	27	0.3	116	0.410	1.180	**0.038**	6.660	35.0	32.7	9.54	20.2	**0.50**	0.0554	18	0.748	0.324	342	430	17	4.8	91.5
	08-Jun-07	5.6	8.00	1390	294	335	11.8	<0.4	656	64	0.3	448	0.147	0.015	0.001	0.042	91.5	104	12.7	78.0	0.17	0.0300	16	0.194	0.164	975	5	16	1.1	98.9
U/S	08-Jun-07	11	7.99	1310	298	339	11.6	<0.4	619	51	0.3	418	0.206	0.020	0.001	0.041	87.0	97.6	13.0	70.4	0.20	0.0176	16	0.251	0.211	916	15	16	1.1	97.9
	03-Jul-07	6.9	8.41	476	187	220	3.8	<0.4	202	18	0.3	48	0.317	0.026	0.003	0.137	35.9	27.4	9.98	11.6	0.23	0.0172	15	0.616	0.543	264	<5	15	1.1	91.3
U/S	03-Jul-07	5.7	8.43	440	184	216	4.5	<0.4	193	19	0.2	23	0.244	0.023	0.003	0.049	36.3	24.8	11.9	10.2	0.17	0.0098	14	0.642	0.566	236	10	15	1.1	97.5
	10-Jul-07	2.5	8.51	787	259	296	10.1	<0.4	388	24	0.3	158	0.306	0.026	0.003	0.021	62.2	56.6	9.94	29.9	0.11	0.0346	16	0.410	0.406	497	<5	1.1	17	102
U/S	10-Jul-07	64	8.55	1070	355	403	14.6	<0.4	513	37	0.4	265	0.236	0.026	0.003	0.008	83.2	74.3	11.4	49.3	**0.60**	0.0852	21	0.507	0.434	732	140	1.8	21	92.9
	09-Oct-07	9.0	8.25	1920	110	134	<0.6	<0.4	877	83	0.6	836	0.249	0.059	0.002	0.572	118	141	9.80	106	0.11	0.0259	16	0.288	0.253	1360	23	16	1.3	102
U/S	09-Oct-07	3.2	8.14	2070	108	132	<0.6	<0.4	1090	25	0.6	1210	1.240	0.904	0.018	0.360	157	169	14.2	98.9	<0.01	0.0368	16	1.310	1.270	1740	<5	17	5.6	93.9
S-11	22-May-07	2.1	7.94	1410	270	310	9.8	<0.4	479	229	0.3	176	0.025	0.016	0.001	0.422	91.8	60.7	9.17	108	0.20	0.0515	21	0.080	0.066	839	<5	20	1.0	93.1
	08-Jun-07	3.5	7.69	688	199	228	7.2	<0.4	264	57	0.2	84	0.020	0.007	0.000	0.079	51.2	33.1	4.53	40.8	0.10	0.0100	15	0.047	0.037	391	<5	16	0.7	97.6

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-13	25-Jan-07	5.9	8.06	1470	713	869	<0.6	<0.4	659	112	0.2	31	0.002	0.279	0.003	0.021	144	72.8	8.93	72.5	0.20	0.7180	56	0.046	0.020	869	5	1.3	59	91.7
	19-Mar-07	35	7.67	3100	1040	1270	<0.6	<0.4	1700	217	0.6	760	0.028	0.263	0.001	0.213	322	219	25.9	192	**1.04**	0.6860	39	0.087	0.043	2360	53	3.5	42	101
	09-Apr-07	18	8.13	339	128	156	<0.6	<0.4	153	16	0.3	28	0.291	0.067	0.001	1.450	33.7	16.7	8.13	9.23	0.24	0.0191	17	0.343	0.307	194	22	1.1	18	98.8
	22-May-07	28	8.45	608	215	242	9.7	<0.4	293	22	0.3	87	0.005	0.044	0.003	0.058	66.2	31.1	6.43	17.9	0.18	0.0195	13	0.055	0.015	360	20	1.0	13	101
	08-Jun-07	25	8.10	682	221	253	7.7	<0.4	332	24	0.3	135	0.143	0.108	0.004	0.200	72.9	36.4	8.04	23.8	0.29	0.0914	14	0.205	0.144	433	22	15	1.2	99.4
	03-Jul-07	27	8.43	479	198	232	4.6	<0.4	219	18	0.3	35	0.120	0.057	0.006	0.092	50.1	22.9	6.24	12.3	**0.33**	0.0612	16	0.304	0.276	263	25	16	1.3	97.4
	10-Jul-07	28	8.53	494	242	269	12.6	<0.4	266	14	0.2	22	0.166	0.056	0.008	0.114	62.6	26.7	4.20	10.7	0.28	0.0530	19	0.255	0.217	285	15	1.1	19	103
	15-Aug-07	82	8.59	667	154	173	7.2	<0.4	272	29	0.3	151	0.034	0.030	0.004	0.026	50.3	35.6	7.84	34.0	**0.34**	0.0888	18	0.241	0.034	401	56	2.1	19	101
	21-Sep-07	20	8.53	526	209	238	8.0	<0.4	241	18	0.2	58	0.008	0.024	0.002	0.008	43.8	32.1	6.23	21.4	0.18	0.0167	21	0.049	0.026	306	11	1.3	34	100
	09-Oct-07	26	8.60	481	190	214	8.9	<0.4	218	17	0.3	47	0.011	0.058	0.004	0.022	41.2	27.9	4.96	17.1	0.20	0.0198	12	0.061	0.010	269	18	12	0.8	99.2
	29-Nov-07	21	8.27	737	221	269	<0.6	<0.4	334	33	0.3	135	0.009	0.049	0.001	0.017	65.1	41.6	6.26	32.1	0.14	0.0182	12	0.040	0.016	446	15	0.8	12	101
	21-Dec-07	8.4	8.03	892	453	553	<0.6	<0.4	-	20	0.4	13	0.016	0.155	0.002	0.012	108	46.9	5.63	21.6	**0.35**	0.5930	18	0.054	0.018	-	<5	18	1.4	104
S-14	25-Jan-07	3.8	8.21	829	192	234	<0.6	<0.4	322	38	1.0	199	0.129	0.081	0.001	0.029	59.7	42.0	3.95	56.4	0.09	0.0848	9	0.195	0.175	515	5	0.5	9.0	98.7
	22-Feb-07	11	8.52	1060	246	280	9.8	<0.4	398	50	0.4	239	0.013	0.098	0.003	0.105	72.3	52.8	4.87	68.5	0.17	0.0565	12	0.012	0.015	635	9	0.6	12	97.6
	19-Mar-07	30	8.06	1180	239	291	<0.6	<0.4	453	64	0.3	286	0.025	0.101	0.001	0.084	77.7	62.8	5.48	83.4	**0.33**	0.0711	6	0.037	0.008	723	47	0.6	6.0	102
	09-Apr-07	19	7.91	261	88	108	<0.6	<0.4	103	14	0.2	19	0.571	0.048	0.001	1.040	21.4	12.1	11.4	5.52	0.17	0.0200	16	0.640	0.579	141	27	1.2	15	98.1
	22-May-07	19	8.41	833	170	200	3.7	<0.4	359	37	0.3	231	0.013	0.082	0.006	0.142	71.3	43.9	7.82	45.6	0.19	0.0222	12	0.069	0.034	540	9	10	1.5	101
	08-Jun-07	50	8.23	667	239	270	10.4	<0.4	322	24	0.3	117	0.152	0.113	0.007	0.196	66.3	38.0	6.56	24.7	0.28	0.0436	17	0.210	0.140	420	27	17	1.3	97.0
	03-Jul-07	13	8.40	437	180	212	3.7	<0.4	200	17	0.3	34	0.111	0.039	0.005	0.566	44.8	21.5	6.89	11.2	**0.45**	0.0621	15	0.310	0.323	245	5	16	1.0	96.4
	10-Jul-07	56	8.55	490	227	254	11.3	<0.4	262	17	0.3	35	0.206	0.060	0.008	0.183	57.9	28.4	5.95	12.9	**0.42**	0.0707	18	0.368	0.291	294	82	1.2	17	103
	15-Aug-07	14	8.70	868	220	237	15.6	<0.4	349	37	0.3	201	0.010	0.027	0.005	0.009	61.8	47.4	5.67	50.9	0.10	0.0119	12	0.062	0.021	536	9	0.8	13	96.8
	21-Sep-07	13	8.42	1100	203	236	5.4	<0.4	399	57	0.2	280	0.006	0.027	0.002	0.017	64.3	58.0	5.64	79.4	0.11	0.0477	29	0.028	0.010	667	12	0.5	31	101
	09-Oct-07	17	8.53	1130	188	214	7.8	<0.4	423	57	0.3	296	0.008	0.073	0.004	0.079	68.6	61.1	5.66	85.5	0.08	0.0328	6	0.024	0.012	687	21	6.0	0.5	107
	29-Nov-07	10	8.12	528	154	188	<0.6	<0.4	222	23	0.2	21	0.005	0.052	0.001	0.149	45.4	28.1	3.01	29.3	0.12	0.0226	8	0.041	0.010	313	16	0.7	9.0	105
	21-Dec-07	4.0	8.01	1030	227	277	<0.6	<0.4	-	48	0.4	241	0.007	0.296	0.003	0.056	68.7	53.3	4.97	72.8	0.27	0.2050	5	0.021	0.015	-	<5	5	0.7	102
S-21	25-Jan-07	4.0	8.30	992	282	340	1.8	<0.4	424	50	0.3	208	<0.001	0.080	0.001	0.024	67.7	62.0	4.77	52.5	0.12	0.0227	6	0.012	0.004	615	10	0.3	6.0	95.6
Field Dup.	26-Jan-07	3.3	8.41	1010	283	336	4.9	<0.4	442	49	0.4	203	<0.001	0.081	0.002	0.028	71.4	64.1	5.01	55.4	0.10	0.0222	5	0.011	0.005	618	<5	0.3	6.0	101
	22-Feb-07	4.3	8.59	1060	290	327	13.5	<0.4	453	47	0.4	216	0.007	0.079	0.003	0.025	70.1	67.6	4.52	48.2	0.06	0.0212	6	0.012	0.010	627	<5	0.2	7.0	96.7
	09-Apr-07	100	7.96	392	115	140	<0.6	<0.4	167	19	0.3	64	0.397	0.183	0.002	2.110	37.4	17.8	9.01	12.3	**0.60**	0.0592	16	0.427	0.333	238	83	1.4	17	94.6
	22-May-07	17	8.36	1100	225	254	10.0	<0.4	440	63	0.4	279	0.008	0.036	0.003	0.053	75.2	61.4	6.83	65.9	0.24	0.0412	9	0.049	0.016	686	16	10	0.5	97.9
	08-Jun-07	80	8.21	552	249	281	11.2	<0.4	284	20	0.3	19	0.056	0.097	0.003	0.074	65.8	29.0	4.76	14.5	**0.56**	0.0563	21	0.124	0.057	303	98	21	1.0	108
	03-Jul-07	28	8.32	433	188	226	1.5	<0.4	200	17	0.2	22	0.099	0.077	0.007	0.080	45.2	21.2	5.66	9.97	**0.40**	0.0784	16	0.263	0.237	234	17	16	1.1	97.3
	10-Jul-07	100	8.29	526	192	235	<0.6	<0.4	260	24	0.2	65	0.062	0.065	0.004	0.120	55.3	29.6	4.86	18.6	**0.87**	0.1190	13	0.303	0.130	313	140	14	1.4	104
	15-Aug-07	14	8.60	1330	262	294	12.4	<0.4	492	114	0.4	289	0.013	0.035	0.006	0.011	72.1	75.8	6.79	101	0.19	0.0757	10	0.066	0.024	815	17	0.7	11	99.4
	21-Sep-07	40	8.11	1760	262	320	<0.6	<0.4	567	270	0.2	267	0.080	0.033	0.001	0.209	82.4	87.7	8.26	191	**0.57**	0.1020	17	0.232	0.110	1060	85	1.6	18	108
Field Dup.	21-Sep-07	55	8.17	1730	261	319	<0.6	<0.4	534	259	0.3	254	0.072	0.041	0.002	0.189	78.2	82.3	7.78	175	**0.49**	0.0912	13	0.262	0.101	1010	93	1.4	12	104
	09-Oct-07	45	8.14	934	122	149	<0.6	<0.4	269	129	0.3	161	0.104	0.068	0.002	0.263	44.2	38.4	7.34	92.6	**0.38**	0.0318	5	0.181	0.098	547	39	6.0	0.7	101
	29-Nov-07	7.6	7.89	872	234	286	<0.6	<0.4	350	44	0.3	158	0.005	0.046	0.000	0.061	60.5	48.4	4.57	46.7	0.06	0.0220	3	0.019	0.009	503	8.0	0.3	3.0	99.1
	21-Dec-07	15	7.99	1030	264	322	<0.6	<0.4	-	59	0.4	200	0.007	0.151	0.002	0.054	73.8	61.1	4.89	64.1	0.28	0.0795	2	0.030	0.018	-	18	2	0.4	104
S-22	09-Apr-07	14	7.87	362	134	164	<0.6	<0.4	152	14	0.3	26	0.426	0.049	0.000	1.530	30.1	18.6	8.70	8.18	0.11	0.0083	21	0.480	0.480	193	15	1.4	21	96.3
U/S	09-Apr-07	5.6	7.98	371	133	162	<0.6	<0.4	149	16	0.4	24	0.405	0.005	0.000	2.240	29.4	18.4	5.99	11.1	0.02	0.0025	22	0.439	0.415	195	<5	1.2	21	95.5
	22-May-07	5.4	8.15	792	250	291	7.1	<0.4	430	46	0.3	149	0.021	0.020	0.001	0.059	74.8	59.2	5.03	20.7	0.17	0.0523	19	0.070	0.051	504	6	17	1.1	102
U/S	22-May-07	14	8.16	601	187	214	6.9	<0.4	285	38	0.3	105	0.085	0.024	0.001	0.033	52.0	37.6	6.75	14.7	**0.35**	0.0223	17	0.166	0.134	366	11	15	1.0	92.7
	08-Jun-07	2.8	7.97	657	295	334	12.6	<0.4	335	28	0.3	27	0.130	0.018	0.000	0.038	62.9	43.2	4.49	16.5	0.09	0.0083	18	0.159	0.143	359	<5	19	1.0	104
U/S	08-Jun-07	1.7	8.23	760	309	345	15.6	<0.4	377	44	0.3	55	0.028	0.009	0.000	0.017	70.8	48.7	3.97	25.6	0.10	0.0083	19	0.055	0.045	433	<5	22	1.0	102
	03-Jul-07	1.6	8.25	422	207	253	<0.6	<0.4	206	16	0.2	27	0.163	0.021	0.002	0.028	40.3	25.5	8.38	5.16	0.12	0.0241	18	0.440	0.454	246	<5	18	1.2	87.9
U/S	03-Jul-07	1.0	8.40	616	303	361	4.7	<0.4	313	24	0.2	19	0.126	0.009	0.001	0.015	63.2	37.8	5.49	10.8	0.10	0.0198	21	0.431	0.414	342	<5	21	1.2	96.1
	10-Jul-07	1.5	8.44	571	269	316	6.2	<0.4	280	22	0.2	14	0.225	0.010	0.001	0.108	54.6	34.9	6.04	10.3	0.08	0.0223	13	0.339	0.334	304	<5	14	0.9	98.2
U/S	10-Jul-07	3.4	8.41	722	330	390	6.3	<0.4	361	27	0.2	19	0.123	0.022	0.002	0.052	69.2	45.8	3.71	16.9	0.15	0.0502	17	0.292	0.231	380	<5	18	1.1	104
	21-Sep-07	4.7	8.16	568	220	268	<0.6	<0.4	281	19	0.2	67	0.006	0.022	0.001	0.010	54.2	35.4	4.04	7.02	0.07	0.0224	4	0.034	0.014	318	<5	0.3	4.0	95.1
	09-Oct-07	3.7	8.37	1380	159	187	3.5	<0.4	756	34	0.5	598	0.008	0.023	0.001	0.638	116	113	6.62	53.4	0.06	0.0153	11	0.027	0.015	1020	6	11	0.8	106

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-23	26-Jan-07	3.7	8.02	1000	281	343	<0.6	<0.4	433	47	0.4	202	0.002	0.078	0.001	0.027	68.4	63.8	4.94	53.0	**0.35**	0.0204	5	0.016	0.007	608	9	0.2	5.0	99.3
	22-Feb-07	3.4	8.61	1260	341	382	16.4	<0.4	521	59	0.5	260	0.007	0.075	0.003	0.184	77.8	79.4	5.59	59.3	0.04	0.0210	11	0.006	0.010	746	<5	0.3	11	94.4
	19-Mar-07	7.7	8.21	1150	257	314	<0.6	<0.4	451	84	0.4	230	0.026	0.236	0.003	0.060	71.4	66.3	5.67	79.2	0.24	0.0298	3	0.037	0.022	691	5	0.6	3.0	102
	09-Apr-07	45	7.98	398	126	153	<0.6	<0.4	176	18	0.3	58	0.399	0.100	0.001	1.770	37.5	20.0	9.95	12.2	**0.50**	0.0430	20	0.436	0.367	239	53	1.3	19	98.6
	22-May-07	17	8.42	1030	223	258	7.1	<0.4	406	57	0.4	269	0.006	0.018	0.001	0.015	70.0	56.1	6.35	58.8	0.19	0.0392	10	0.051	0.012	651	22	8.0	0.7	92.6
	08-Jun-07	75	8.22	569	249	280	11.6	<0.4	287	23	0.3	24	0.062	0.088	0.004	0.094	65.3	30.0	4.82	16.2	**0.52**	0.0537	20	0.130	0.064	313	84	21	0.9	107
	03-Jul-07	25	8.33	429	190	228	1.6	<0.4	196	18	0.3	22	0.090	0.071	0.007	0.062	43.7	21.1	6.03	9.09	**0.49**	0.0719	17	0.301	0.274	234	28	17	1.2	93.5
	10-Jul-07	91	8.48	552	233	270	7.3	<0.4	272	20	0.2	61	0.136	0.159	0.014	0.164	59.7	30.0	5.17	16.7	**0.51**	0.0802	14	0.338	0.211	333	94	15	1.2	96.7
	15-Aug-07	23	8.34	1280	205	233	8.2	<0.4	387	173	0.2	218	0.019	0.121	0.012	0.024	59.5	57.9	8.28	121	**0.36**	0.0558	8	0.067	0.025	761	21	0.6	8.0	97.7
	21-Sep-07	14	8.44	1860	256	298	7.1	<0.4	631	238	0.3	409	0.010	0.030	0.002	0.014	90.8	98.1	7.89	188	0.14	0.0326	9	0.050	0.023	1190	10	0.9	10	103
	09-Oct-07	60	7.94	519	86	104	<0.6	<0.4	171	47	0.2	99	0.165	0.068	0.001	0.184	29.7	23.6	5.29	41.4	0.30	0.0323	5	0.260	0.152	299	69	5.0	0.8	105
	29-Nov-07	7.5	8.06	1030	229	279	<0.6	<0.4	432	63	0.3	227	0.005	0.034	0.000	0.088	67.3	64.4	4.96	73.2	0.08	0.0211	5	0.022	0.008	637	8	0.4	5.0	108
	21-Dec-07	6.1	8.02	817	250	305	<0.6	<0.4	-	35	0.4	135	0.010	0.095	0.001	0.042	65.1	51.0	4.37	41.5	0.24	0.0471	2	0.017	0.012	-	<5	2	0.3	106
S-25	26-Jan-07	8.3	8.05	1000	296	361	<0.6	<0.4	414	46	0.4	187	<0.001	0.059	0.001	0.035	66.9	59.9	4.73	47.9	0.20	0.0152	4	0.022	0.005	590	8	0.8	6.0	94.1
	22-Feb-07	5.9	8.56	1060	295	336	12.1	<0.4	453	44	0.5	198	0.007	0.038	0.001	7.520	72.5	66.0	4.82	46.2	0.10	0.0134	10	0.012	0.010	642	7	<0.2	13	94.5
	20-Mar-07	9.6	8.07	1090	263	321	<0.6	<0.4	436	62	0.3	235	0.023	0.165	0.002	0.048	69.4	63.8	4.94	62.8	0.19	0.0195	3	0.036	0.022	656	6	0.4	3.0	97.1
Field Dup.	20-Mar-07	9.5	8.20	1100	264	322	<0.6	<0.4	416	62	0.4	228	0.024	0.161	0.002	0.047	65.3	61.5	4.80	60.9	0.15	0.0192	4	-	-	642	6	0.4	3.0	94.0
	09-Apr-07	160	7.98	460	113	138	<0.6	<0.4	205	22	0.3	95	0.486	0.203	0.002	2.390	48.0	20.7	8.17	17.3	**0.95**	0.2850	16	0.529	0.293	290	280	1.9	16	100
Field Dup.	09-Apr-07	190	8.03	457	114	139	<0.6	<0.4	188	22	0.3	94	0.396	0.174	0.002	2.410	43.2	19.4	8.11	17.2	**0.65**	0.1740	15	0.415	0.291	283	120	1.5	15	93.3
	22-May-07	22	8.52	852	213	245	7.4	<0.4	363	43	0.3	200	0.011	0.024	0.003	0.019	70.1	45.6	7.14	51.5	0.21	0.0303	9	0.047	0.008	546	25	8.0	0.6	100
Field Dup.	22-May-07	21	8.52	855	213	246	7.0	<0.4	352	43	0.4	203	0.013	0.023	0.002	0.110	64.4	46.5	6.43	45.1	0.16	0.0315	9	0.047	0.013	537	24	8.0	0.6	94.2
	08-Jun-07	70	8.20	578	227	255	10.6	<0.4	267	30	0.3	39	0.056	0.057	0.002	0.133	60.7	28.1	5.02	21.6	**0.48**	0.0589	18	0.142	0.062	322	78	19	0.9	103
	03-Jul-07	26	8.34	418	181	217	2.0	<0.4	198	17	0.2	24	0.058	0.066	0.006	0.077	45.4	20.6	5.91	9.87	**0.36**	0.0585	15	0.280	0.258	232	23	15	1.1	98.3
	10-Jul-07	78	8.50	546	230	265	7.7	<0.4	266	19	0.2	62	0.121	0.127	0.012	0.195	59.6	28.4	5.29	16.5	**0.48**	0.0605	14	0.280	0.202	329	74	15	1.2	95.6
	15-Aug-07	25	8.48	884	186	210	8.1	<0.4	349	49	0.3	200	0.006	0.055	0.007	0.188	53.4	52.4	5.32	53.0	0.20	0.0343	7	0.051	0.011	525	27	0.7	7.0	101
	21-Sep-07	27	8.34	1180	257	306	3.7	<0.4	505	69	0.2	274	0.005	0.023	0.002	0.019	78.8	74.9	6.25	76.4	0.23	0.0416	11	0.051	0.019	734	30	0.4	10	106
	09-Oct-07	38	8.45	1240	249	290	7.2	<0.4	481	122	0.4	238	0.034	0.071	0.003	0.052	73.5	72.2	6.72	107	0.20	0.0271	6	0.079	0.040	770	38	6.0	0.6	108
	29-Nov-07	10	8.11	955	226	276	<0.6	<0.4	404	48	0.3	209	0.005	0.011	0.000	0.049	64.2	59.2	4.69	60.5	0.08	0.0147	4	0.024	0.009	581	8	0.4	5.0	106
	20-Dec-07	11	7.98	1110	280	342	<0.6	<0.4	458	55	0.4	246	0.017	0.166	0.002	0.110	74.3	66.1	5.83	59.0	0.20	0.0461	3	0.025	0.016	675	<5	3	0.3	96.4
S-26	09-Apr-07	4.3	8.23	559	239	291	<0.6	<0.4	268	22	0.3	34	0.034	0.022	0.000	0.140	55.8	31.2	4.27	9.73	0.01	0.0052	18	0.064	0.046	301	<5	0.9	17	96.1
	22-May-07	4.0	8.21	624	215	253	4.3	<0.4	261	44	0.3	57	0.055	0.009	0.001	0.022	51.1	32.4	2.92	25.9	0.10	0.0130	19	0.101	0.086	342	<5	18	0.9	95.3
	08-Jun-07	2.0	8.17	644	272	303	14.1	<0.4	307	31	0.3	28	0.030	0.005	0.000	0.016	62.9	36.5	2.87	18.1	0.06	0.0094	19	0.052	0.044	342	6	21	0.8	104
	03-Jul-07	1.0	8.46	646	318	373	7.5	<0.4	330	23	0.2	15	0.129	0.054	0.006	0.020	69.1	38.2	3.52	13.9	0.05	0.0452	19	0.256	0.242	354	<5	19	1.1	99.3
U/S	03-Jul-07	0.6	8.38	708	304	362	4.1	<0.4	311	33	0.3	23	0.089	0.036	0.004	0.012	57.9	40.6	6.05	23.2	0.08	0.1230	26	0.231	0.227	366	<5	26	1.5	98.7
	10-Jul-07	1.9	8.46	666	307	360	7.2	<0.4	307	29	0.2	13	0.601	0.016	0.001	0.082	62.4	36.8	4.52	25.0	0.13	0.0482	14	0.930	0.934	355	<5	15	1.1	101
U/S	10-Jul-07	8.1	8.48	659	305	354	9.0	<0.4	301	28	0.3	13	0.625	0.015	0.001	0.061	60.7	36.3	4.44	23.7	0.11	0.0548	13	1.050	0.921	349	34	14	1.6	99.7
	15-Aug-07	15	8.14	333	111	135	<0.6	<0.4	137	21	0.2	31	0.134	0.045	0.003	0.058	29.0	15.8	3.92	12.6	0.30	0.0130	14	0.185	0.146	180	14	1.0	15	98
Field Dup.	15-Aug-07	15	8.12	332	111	135	<0.6	<0.4	137	21	0.2	31	0.135	0.048	0.003	0.054	28.7	15.9	3.89	12.6	0.30	0.0136	14	0.186	0.149	180	12	1.0	14	97.8
U/S	15-Aug-07	13	8.54	316	109	133	<0.6	<0.4	132	20	0.2	22	0.191	0.059	0.007	0.080	27.6	15.5	4.40	10.6	**0.32**	0.0126	15	0.241	0.202	166	8	1.1	14	100
S-26	21-Sep-07	6.2	8.19	586	245	298	<0.6	<0.4	252	30	0.2	23	1.020	0.008	0.000	0.248	49.3	31.2	13.7	28.7	**0.34**	0.5160	9	1.210	1.090	324	54	0.9	10	106
U/S	21-Sep-07	22	7.81	558	247	301	<0.6	<0.4	280	28	0.1	21	0.229	0.026	0.000	0.009	61.2	30.8	13.2	18.7	**0.84**	2.1600	10	1.150	0.345	321	300	2.5	9.0	109
	09-Oct-07	21	8.22	745	168	205	<0.6	<0.4	318	59	0.4	144	0.082	0.007	0.000	0.049	58.8	41.6	6.25	36.0	0.25	0.0316	11	0.144	0.092	447	47	11	0.8	100
U/S	09-Oct-07	27	8.17	1060	140	171	<0.6	<0.4	439	110	0.6	262	0.008	0.019	0.000	0.096	77.7	59.5	6.80	64.7	0.24	0.0311	13	0.049	0.014	665	32	13	0.8	103

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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)																												
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)	-	-	-
S-27	09-Apr-07	3.0	8.00	752	208	254	<0.6	<0.4	342	32	0.3	144	0.015	0.003	0.000	4.940	67.6	42.1	6.32	19.8	<0.01	0.0037	29	0.049	0.043	459	<5	1.4	28	93.2
	22-May-07	2.3	8.27	712	314	361	10.9	<0.4	367	15	0.4	96	0.008	0.006	0.000	<0.005	74.4	52.6	2.42	9.18	0.03	0.0260	35	0.034	0.039	430	<5	33	1.3	97.5
	08-Jun-07	1.2	8.19	689	325	358	19.2	<0.4	363	17	0.4	22	0.006	0.004	0.000	0.013	69.7	46.0	2.04	12.4	0.06	0.0109	26	0.020	0.017	365	5	28	0.9	105
	03-Jul-07	0.5	8.42	565	303	359	5.5	<0.4	319	12	0.3	19	0.015	0.004	0.000	0.015	63.2	39.1	2.51	6.84	0.02	0.0123	26	0.048	0.050	325	<5	26	1.1	98.8
	10-Jul-07	0.5	8.43	616	342	401	7.7	<0.4	334	10	0.3	16	0.006	0.007	0.001	0.009	66.0	41.1	1.83	7.89	0.03	0.0086	25	0.983	0.022	348	<5	26	1.1	94.7
	15-Aug-07	0.9	8.23	553	173	211	<0.6	<0.4	273	20	0.3	104	0.007	0.015	0.001	0.007	58.0	31.1	2.54	12.6	0.08	0.0042	14	0.025	0.019	332	<5	0.7	15	97.8
U/S	15-Aug-07	0.8	8.17	518	172	209	<0.6	<0.4	254	18	0.2	88	0.006	0.012	0.001	0.007	56.8	27.2	2.37	10.9	0.10	0.0067	14	0.022	0.017	306	<5	0.7	14	97.1
	09-Oct-07	5.6	8.15	984	187	228	<0.6	<0.4	454	64	0.3	267	0.006	0.007	0.000	0.014	73.1	66.0	6.90	36.7	0.10	0.0173	12	0.024	0.011	626	12	13	0.7	97.6
U/S	09-Oct-07	6.3	8.17	1040	204	249	<0.6	<0.4	490	66	0.3	277	0.006	0.006	0.000	0.006	79.5	70.9	7.39	38.0	0.07	0.0196	12	0.023	0.012	662	9	13	0.7	99.3
S-28	26-Jan-07	9.8	8.30	934	298	361	1.4	<0.4	458	40	0.3	176	<0.001	0.059	0.001	0.177	74.6	65.9	4.90	44.7	0.17	0.0169	5	0.021	0.005	586	8	0.3	6.0	104
	22-Feb-07	9.1	8.44	1270	365	428	8.3	<0.4	567	56	0.5	249	0.008	0.048	0.001	0.134	90.2	83.0	6.02	59.0	0.03	0.0116	12	0.009	0.011	763	11	0.3	10	99.7
Field Dup.	22-Feb-07	7.6	8.47	1260	368	429	9.8	<0.4	556	56	0.5	255	0.008	0.046	0.001	0.057	88.8	81.2	5.91	60.0	0.04	0.0106	12	0.009	0.010	768	8	0.2	11	97.2
	20-Mar-07	7.7	7.94	1250	255	311	<0.6	<0.4	428	126	0.4	227	0.014	0.160	0.001	0.107	69.2	62.0	6.60	96.6	0.17	0.0267	4	0.037	0.016	741	8	0.6	5.0	96.4
	09-Apr-07	110	8.02	452	113	138	<0.6	<0.4	177	22	0.3	89	0.410	0.189	0.002	2.440	40.9	18.1	8.19	16.8	**0.56**	0.0996	14	0.415	0.292	274	100	1.5	15	90.8
	22-May-07	14	8.34	836	211	248	4.6	<0.4	353	58	0.3	168	0.009	0.031	0.002	0.122	63.0	47.6	5.68	47.4	0.18	0.0367	9	0.055	0.017	517	19	8.0	1.1	98.9
	08-Jun-07	65	8.23	568	242	271	11.9	<0.4	281	24	0.3	28	0.062	0.056	0.002	0.084	63.3	29.9	5.01	17.9	**0.56**	0.0599	19	0.149	0.064	314	80	20	1.0	107
Field Dup.	08-Jun-07	65	8.23	569	242	271	11.6	<0.4	277	24	0.3	29	0.060	0.056	0.002	0.074	62.5	29.5	4.89	17.8	**0.54**	0.0573	19	0.144	0.065	314	68	20	1.0	105
	03-Jul-07	19	8.34	390	172	206	1.8	<0.4	180	16	0.2	26	0.090	0.023	0.002	0.025	40.1	19.3	6.04	8.32	**0.44**	0.0544	16	0.252	0.238	219	6	16	1.0	92.5
Field Dup.	03-Jul-07	19	8.23	391	172	210	<0.6	<0.4	174	16	0.2	20	0.102	0.026	0.002	0.028	39.9	18.2	6.23	8.48	**0.50**	0.0546	6	0.262	0.230	213	9	15	1.1	93
	10-Jul-07	72	8.54	547	231	263	9.3	<0.4	263	18	0.3	60	0.135	0.079	0.009	0.261	58.6	28.4	5.21	15.2	**0.43**	0.0526	14	0.308	0.240	326	66	14	1.1	94.5
Field Dup.	10-Jul-07	73	8.52	543	231	264	9.2	<0.4	264	19	0.2	61	0.123	0.076	0.008	0.264	59.0	28.3	5.10	14.8	**0.37**	0.0532	14	0.314	0.238	327	66	14	1.1	93.5
	15-Aug-07	41	8.36	682	192	230	2.0	<0.4	398	51	0.3	131	0.026	0.074	0.007	0.217	79.8	48.2	4.12	31.9	**0.95**	0.2020	10	0.208	0.027	462	170	1.0	10	118
	21-Sep-07	8.0	8.33	1000	248	297	3.1	<0.4	431	52	0.2	213	0.009	0.027	0.001	0.073	67.2	63.9	5.32	56.1	0.09	0.0251	5	0.036	0.013	607	11	0.4	5.0	103
Field Dup.	21-Sep-07	8.8	8.34	1000	249	297	3.0	<0.4	435	52	0.2	212	0.007	0.028	0.001	0.073	68.5	64.1	5.42	57.4	0.10	0.0260	5	0.245	0.013	608	11	0.3	5.0	104
	09-Oct-07	18	8.39	1170	233	275	4.9	<0.4	435	109	0.4	236	0.055	0.101	0.003	0.115	69.9	63.3	6.66	94.4	0.10	0.0153	7	0.086	0.060	720	23	7.0	0.6	102
Field Dup.	09-Oct-07	17	8.43	1170	234	274	5.4	<0.4	434	109	0.4	233	0.055	0.098	0.003	0.101	70.4	62.8	6.62	94.5	0.10	0.0161	7	0.087	0.060	717	23	7.0	0.7	103
	29-Nov-07	8.1	8.19	1210	272	331	<0.6	<0.4	515	72	0.3	280	0.006	0.015	0.000	0.085	80.1	76.5	5.81	86.0	0.07	0.0140	5	0.030	0.013	764	8.0	5.0	1.2	107
Field Dup.	29-Nov-07	13	8.20	1190	266	324	<0.6	<0.4	477	71	0.2	276	0.005	0.016	0.000	0.085	74.6	70.6	5.43	80.4	0.10	0.0221	5	0.035	0.013	737	19	5.0	0.5	101
	20-Dec-07	39	7.88	1190	295	360	<0.6	<0.4	479	75	0.5	255	0.008	0.139	0.001	0.194	81.6	66.9	5.79	71.8	**0.44**	0.0669	4	0.099	0.016	734	68	4	0.7	96.1
Field Dup.	20-Dec-07	25	7.90	1180	295	360	<0.6	<0.4	499	68	0.4	254	0.008	0.159	0.001	0.190	84.1	70.1	6.13	72.4	**0.44**	0.0594	4	0.105	0.014	732	44	4	0.4	101
S-30	26-Jan-07	8.5	8.29	1020	298	364	<0.6	<0.4	371	59	0.3	182	0.236	1.690	**0.031**	1.100	78.5	42.4	10.3	66.3	0.13	0.0395	15	0.426	0.324	623	12	2.8	15	91.7
	22-Feb-07	6.5	8.56	1120	316	359	13.0	<0.4	413	56	0.4	192	0.454	0.048	0.002	0.260	86.0	48.1	11.1	67.4	0.08	0.0380	21	0.460	0.520	652	8	3.1	20	96.1
	20-Mar-07	14	7.97	1010	290	354	<0.6	<0.4	393	56	0.3	170	0.313	1.090	0.010	1.240	81.0	46.3	10.5	62.3	**0.35**	0.0509	10	0.373	0.346	605	17	2.0	10	98.2
	09-Apr-07	190	8.03	445	115	140	<0.6	<0.4	178	22	0.3	89	0.339	0.175	0.002	2.390	41.1	18.3	8.30	16.5	**0.87**	0.1190	14	0.371	0.283	275	230	1.7	16	90.6
	22-May-07	160	8.22	830	196	233	2.8	<0.4	363	41	0.3	214	0.119	0.303	0.016	0.810	76.4	41.9	8.83	43.8	**0.99**	0.2820	12	0.393	0.181	548	230	11	1.5	97.9
	08-Jun-07	75	8.03	543	230	261	9.9	<0.4	269	21	0.3	39	0.052	0.060	0.002	0.026	60.3	28.8	4.83	15.8	**0.56**	0.0743	17	0.160	0.054	307	90	18	0.8	103
	03-Jul-07	46	8.27	478	182	222	<0.6	<0.4	213	19	0.3	54	0.125	0.064	0.006	0.196	48.5	22.4	6.58	13.5	**0.48**	0.1040	15	0.329	0.276	274	53	15	1.2	94.2
	10-Jul-07	77	8.47	724	226	260	7.4	<0.4	302	26	0.3	132	0.148	0.118	0.014	0.493	67.1	32.7	7.30	32.9	**0.47**	0.1800	13	0.430	0.319	436	110	14	1.3	95.2
	15-Aug-07	50	8.62	822	228	249	14.2	<0.4	341	31	0.3	177	0.174	0.063	0.011	0.457	70.6	39.9	9.47	46.9	**0.49**	0.1440	12	0.330	0.190	513	57	1.5	13	99.2
	21-Sep-07	28	8.56	880	253	286	11.1	<0.4	363	38	0.2	170	0.165	0.462	**0.042**	0.335	73.4	43.6	10.5	54.0	0.24	0.1300	10	0.281	0.201	543	30	1.6	9.0	102
	09-Oct-07	26	8.43	909	243	284	6.2	<0.4	346	56	0.4	161	0.252	0.953	**0.043**	0.580	71.6	40.6	11.3	67.1	0.17	0.1120	9	0.322	0.262	556	42	12	1.9	103
	29-Nov-07	50	8.28	993	261	318	<0.6	<0.4	422	64	0.3	181	0.102	0.918	0.018	0.401	84.1	51.5	7.89	70.5	**0.78**	0.2030	11	0.675	0.155	617	280	13	3.8	108
	20-Dec-07	14	8.09	1050	282	345	<0.6	<0.4	389	53	0.4	210	0.280	1.200	0.015	0.785	78.9	46.7	10.2	67.4	**0.31**	0.0454	9	0.327	0.275	638	12	10	2.0	94.6

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-31	26-Jan-07	6.5	8.30	1010	300	366	<0.6	<0.4	411	57	0.3	181	0.200	1.690	**0.030**	1.090	84.0	49.0	10.5	67.6	0.17	0.0390	13	0.403	0.299	633	7	2.6	14	99.7
	22-Feb-07	6.7	8.56	1110	313	358	12.0	<0.4	404	55	0.4	191	0.465	2.140	**0.068**	1.330	84.8	46.8	11.1	67.1	0.06	0.0382	20	0.494	0.526	650	10	3.1	22	94.8
	20-Mar-07	15	8.01	1010	288	352	<0.6	<0.4	382	57	0.3	167	0.306	1.040	0.010	1.210	79.1	44.8	10.3	61.0	0.24	0.0504	9	0.359	0.314	598	23	2.0	11	96.3
	09-Apr-07	170	8.07	506	118	144	<0.6	<0.4	202	24	0.3	112	0.434	0.287	0.003	2.650	46.6	20.9	8.16	19.1	**0.66**	0.1820	14	0.471	0.282	313	150	1.7	16	91.2
	22-May-07	140	8.22	833	195	231	3.1	<0.4	357	39	0.3	219	0.147	0.288	0.015	0.818	75.9	40.8	8.93	44.5	**0.85**	0.2390	12	0.359	0.180	549	190	11	1.8	96.7
	08-Jun-07	160	8.12	646	204	231	9.0	<0.4	300	25	0.3	121	0.124	0.094	0.003	0.599	66.8	32.4	6.71	28.6	**1.00**	0.2150	14	0.326	0.119	406	210	14	0.9	101
	03-Jul-07	20	8.29	557	185	226	<0.6	<0.4	248	21	0.3	94	0.163	0.063	0.006	0.327	56.2	26.3	7.28	18.6	**0.44**	0.1490	14	0.388	0.301	335	98	14	1.3	94.8
	10-Jul-07	120	8.48	735	226	261	7.3	<0.4	314	26	0.3	132	0.189	0.131	0.016	0.507	70.3	33.6	7.22	32.3	**0.74**	0.3010	13	0.486	0.314	439	210	14	1.6	97.6
	15-Aug-07	42	8.61	839	230	250	14.7	<0.4	345	31	0.2	183	0.195	0.099	0.016	0.517	72.6	39.8	10.1	48.7	0.29	0.0984	13	0.323	0.205	526	51	1.5	14	99.5
	21-Sep-07	27	8.59	877	252	283	11.7	<0.4	343	37	0.2	168	0.174	0.456	**0.044**	0.366	70.7	40.5	10.4	52.1	0.24	0.1340	9	0.289	0.210	532	41	1.5	10	97.8
	09-Oct-07	24	8.41	907	243	285	5.9	<0.4	344	57	0.4	165	0.249	0.933	**0.042**	0.589	71.3	40.3	11.2	66.4	0.14	0.1100	9	0.322	0.263	559	44	10	2.0	101
	29-Nov-07	200	8.33	1010	262	315	2.1	<0.4	466	68	0.4	189	0.206	1.130	**0.025**	0.470	97.8	54.0	8.09	73.9	**1.06**	0.3050	12	0.666	0.212	650	400	14	3.9	114
	20-Dec-07	14	8.15	1040	280	341	<0.6	<0.4	369	50	0.4	205	0.290	1.240	0.018	0.783	75.7	43.7	10.8	65.1	0.23	0.0356	10	0.315	0.290	621	<5	10	2.1	92.4
S-32	26-Jan-07	6.2	8.30	1020	297	363	<0.6	<0.4	387	57	0.2	183	0.215	1.750	**0.033**	1.110	80.2	45.3	10.5	67.5	0.24	0.0374	14	0.426	0.313	627	8	2.8	14	95.4
	22-Feb-07	6.3	8.56	1120	314	358	12.0	<0.4	399	56	0.4	194	0.454	2.130	**0.068**	1.350	82.7	46.8	11.0	65.3	0.07	0.0371	21	0.482	0.519	650	9	3.0	21	92.5
	20-Mar-07	16	8.03	1010	288	351	<0.6	<0.4	376	55	0.3	168	0.310	0.991	0.010	1.220	77.3	44.6	10.2	59.7	**0.48**	0.0503	11	0.356	0.304	593	20	1.9	10	95.2
	09-Apr-07	200	8.07	524	122	149	<0.6	<0.4	228	24	0.3	118	0.452	0.291	0.004	2.750	52.8	23.4	8.73	20.5	**0.94**	0.2780	16	0.495	0.289	333	220	2.0	16	98.1
	22-May-07	170	8.20	829	196	232	3.3	<0.4	368	39	0.3	213	0.131	0.311	0.016	0.847	77.5	42.3	9.09	44.2	**0.91**	0.2850	12	0.398	0.184	546	230	11	1.8	99.8
	08-Jun-07	170	8.14	679	197	223	8.4	<0.4	315	26	0.3	138	0.146	0.131	0.005	0.780	69.9	34.1	7.34	32.2	**1.16**	0.2720	12	0.325	0.138	429	280	13	1.1	104
	03-Jul-07	23	8.30	570	186	227	<0.6	<0.4	247	21	0.3	103	0.122	0.060	0.006	0.345	56.3	25.8	7.14	19.4	**0.42**	0.1620	14	0.326	0.310	346	110	14	1.3	91.7
	10-Jul-07	110	8.47	741	226	261	7.2	<0.4	319	27	0.3	138	0.163	0.124	0.015	0.521	70.7	34.5	7.72	33.3	**0.65**	0.2810	13	0.487	0.319	449	200	13	1.5	97.7
	15-Aug-07	41	8.61	838	229	250	14.1	<0.4	332	31	0.3	180	0.189	0.081	0.013	0.538	70.2	38.0	9.73	46.5	0.26	0.0848	12	0.317	0.206	515	49	1.3	13	96.3
	21-Sep-07	28	8.56	883	253	287	10.5	<0.4	354	38	0.2	167	0.204	0.484	**0.042**	0.463	71.8	42.4	10.7	53.0	0.23	0.1320	9	0.304	0.221	536	37	1.3	9.0	100
	09-Oct-07	25	8.41	907	243	285	5.6	<0.4	339	57	0.3	166	0.237	0.861	**0.039**	0.580	71.1	39.2	11.0	66.3	0.16	0.1110	9	0.317	0.254	558	54	11	1.7	99.6
	29-Nov-07	180	8.35	984	257	308	2.8	<0.4	418	67	0.3	182	0.197	1.190	**0.028**	0.432	85.0	49.9	8.02	73.6	**0.60**	0.1630	11	0.595	0.206	622	390	12	3.7	108
	20-Dec-07	11	8.12	1030	280	341	<0.6	<0.4	-	51	0.4	207	0.307	1.370	0.018	0.775	84.2	45.7	11.1	75.8	0.24	0.0368	10	0.341	0.303	-	6	11	2.1	101
S-33	26-Jan-07	6.2	8.35	1060	303	363	3.2	<0.4	394	60	0.2	186	0.237	1.720	**0.042**	1.140	80.5	46.8	10.4	68.0	0.14	0.0369	14	0.433	0.331	638	5	2.7	14	94.7
	22-Feb-07	6.6	8.53	1110	315	361	11.2	<0.4	413	59	0.4	195	0.432	2.030	**0.061**	1.340	85.0	48.8	10.9	65.4	0.04	0.0356	21	0.463	0.494	659	9	2.8	21	93.8
	20-Mar-07	12	7.98	1020	286	349	<0.6	<0.4	361	59	0.4	169	0.335	1.300	0.012	1.310	73.7	43.1	9.75	60.2	**0.45**	0.0452	11	0.385	0.335	592	8	2.2	12	91.6
	09-Apr-07	190	8.07	523	122	148	<0.6	<0.4	213	24	0.3	118	0.450	0.193	0.002	2.700	49.1	21.9	8.44	20.5	**1.01**	0.2230	14	0.494	0.272	327	210	1.9	15	92.9
	22-May-07	180	8.22	830	196	231	4.1	<0.4	347	42	0.3	215	0.129	0.271	0.015	0.861	73.9	39.6	8.43	40.2	**1.16**	0.3640	12	0.479	0.175	540	320	11	1.8	92.2
	08-Jun-07	200	8.16	691	193	217	9.0	<0.4	319	27	0.3	146	0.158	0.149	0.006	0.837	71.2	34.2	7.58	33.4	**1.35**	0.3270	11	0.410	0.148	438	360	12	1.1	104
	03-Jul-07	14	8.31	578	186	225	1.2	<0.4	252	21	0.3	92	0.121	0.060	0.007	0.374	57.1	26.6	7.31	19.9	**0.45**	0.1730	15	0.415	0.320	337	130	14	1.2	97
	10-Jul-07	82	8.48	742	226	260	7.5	<0.4	311	27	0.2	139	0.187	0.113	0.014	0.536	69.8	33.2	7.81	36.4	**0.51**	0.2230	13	0.474	0.331	450	150	13	1.4	97.4
	15-Aug-07	29	8.13	839	229	254	12.0	<0.4	322	31	0.3	186	0.202	0.105	0.006	0.555	68.1	36.8	9.65	45.9	0.27	0.0851	13	0.327	0.215	516	47	1.5	13	92.6
	21-Sep-07	27	8.54	876	252	286	10.1	<0.4	345	38	0.2	166	0.217	0.542	**0.044**	0.455	71.0	40.6	10.6	52.1	0.22	0.1300	10	0.312	0.232	531	29	1.5	10	98.2
	09-Oct-07	28	8.40	908	243	286	5.0	<0.4	344	56	0.3	163	0.244	0.853	**0.038**	0.616	71.9	39.9	11.3	65.2	0.24	0.1240	9	0.346	0.255	555	45	10	1.7	101
	29-Nov-07	50	8.35	1010	266	319	3.0	<0.4	403	67	0.3	176	0.186	1.150	**0.027**	0.488	81.2	48.6	7.84	71.3	**0.39**	0.1170	12	0.527	0.210	615	250	14	3.5	104
	20-Dec-07	12	8.08	1040	280	342	<0.6	<0.4	377	51	0.4	212	0.284	1.360	0.017	0.763	78.9	43.7	11.0	68.0	0.26	0.0370	10	0.358	0.289	637	6	10	2.2	93.4

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-34	26-Jan-07	8.2	8.30	1020	299	364	<0.6	<0.4	368	59	0.3	186	0.253	1.830	**0.033**	1.130	77.8	42.3	10.5	67.1	0.20	0.0395	15	0.428	0.352	627	11	2.8	15	91.0
	22-Feb-07	6.5	8.55	1110	313	357	12.2	<0.4	398	58	0.4	194	0.475	2.110	**0.065**	1.310	84.1	45.7	11.0	66.3	0.06	0.0385	21	0.513	0.546	652	7	3.3	20	92.3
	20-Mar-07	14	7.95	1020	288	352	<0.6	<0.4	385	59	0.3	169	0.301	1.090	0.010	1.290	80.6	44.7	10.7	65.2	0.29	0.0530	11	0.357	0.335	608	21	2.1	11	97.8
	09-Apr-07	190	8.08	548	124	151	<0.6	<0.4	248	24	0.3	125	0.486	0.274	0.003	2.860	57.4	25.5	9.08	21.4	**0.95**	0.3330	15	0.534	0.273	350	270	2.1	15	103
	22-May-07	150	8.30	822	193	230	3.0	<0.4	357	38	0.3	217	0.126	0.329	**0.020**	0.843	75.3	41.0	8.71	42.2	**0.94**	0.2910	13	0.408	0.181	541	250	11	1.5	96.4
	08-Jun-07	180	8.17	705	190	213	8.8	<0.4	317	27	0.3	152	0.165	0.143	0.006	0.920	70.1	34.4	7.61	36.1	**1.20**	0.2880	11	0.348	0.156	445	280	12	0.8	104
	03-Jul-07	12	8.32	596	188	226	1.4	<0.4	260	21	0.3	110	0.145	0.062	0.006	0.386	59.2	27.2	7.42	21.2	**0.42**	0.1700	14	0.412	0.327	361	130	14	1.2	94.4
	10-Jul-07	80	8.45	751	224	261	6.0	<0.4	309	27	0.2	143	0.202	0.113	0.013	0.512	69.9	32.8	8.04	37.0	**0.55**	0.2360	13	0.452	0.331	454	120	13	1.3	96.8
	15-Aug-07	100	8.60	845	230	250	15.4	<0.4	358	30	0.3	184	0.209	0.132	**0.024**	0.506	75.9	41.0	10.7	50.5	**0.39**	0.1280	13	0.334	0.215	533	34	1.5	13	103
	21-Sep-07	36	8.60	873	252	283	12.1	<0.4	349	37	0.2	168	0.180	0.525	**0.053**	0.313	73.3	40.2	10.8	54.5	**0.34**	0.1580	10	0.315	0.218	537	46	1.7	11	100
	09-Oct-07	25	8.41	910	243	287	5.0	<0.4	339	54	0.4	160	0.275	1.100	**0.049**	0.019	70.6	39.6	11.2	66.1	0.16	0.1120	9	0.350	0.288	547	21	10	2.1	102
	29-Nov-07	45	8.35	933	244	292	2.7	<0.4	384	66	0.2	180	0.204	1.190	**0.026**	0.504	78.5	45.7	7.58	66.8	**0.31**	0.1150	12	0.515	0.222	593	110	14	3.1	102
	20-Dec-07	12	8.17	1040	281	343	<0.6	<0.4	384	52	0.4	208	0.284	1.190	0.018	0.801	82.3	43.3	10.9	72.4	0.28	0.0408	10	0.322	0.283	641	10	11	2.0	96.5
S-35	09-Apr-07	80	7.46	177	57	70	<0.6	<0.4	68.3	15	0.2	29	0.341	0.108	0.000	1.400	14.8	7.62	9.51	4.79	**0.43**	0.0105	15	0.410	0.298	121	20	1.4	14	79.5
	22-May-07	22	7.76	1610	91	111	<0.6	<0.4	647	373	1.3	176	0.137	0.180	0.003	1.440	129	78.8	11.8	75.9	**0.48**	0.1090	12	0.193	0.141	906	29	1.2	12	102
	08-Jun-07	38	7.72	759	136	161	2.4	<0.4	278	121	0.3	63	0.298	0.224	0.002	2.130	57.4	32.8	8.40	39.3	**0.57**	0.0130	13	0.344	0.253	413	18	13	1.5	98.4
	03-Jul-07	42	8.13	546	149	181	<0.6	<0.4	198	62	0.3	23	0.465	0.547	**0.026**	0.051	41.6	22.8	10.9	21.0	**0.88**	0.1100	15	0.816	0.697	271	41	16	2.0	98.7
	10-Jul-07	300	7.89	278	75	91	<0.6	<0.4	119	34	0.2	99	0.268	0.147	0.004	1.560	25.4	13.5	8.52	10.8	**0.61**	0.0885	21	0.749	0.417	243	300	2.9	24	66.2
S-36	09-Apr-07	33	7.38	158	52	63	<0.6	<0.4	56.9	10	0.2	20	0.483	0.051	0.000	3.020	11.8	6.67	9.22	2.71	0.23	0.0067	16	0.569	0.494	105	20	1.3	14	76.2
	22-May-07	1200	7.53	108	41	50	<0.6	<0.4	83.6	71	0.3	179	1.010	1.420	0.012	1.780	19.2	8.66	7.99	2.36	**0.89**	0.0742	12	1.960	0.825	321	1100	17	3.8	29.6
	08-Jun-07	55	7.60	503	188	223	2.8	<0.4	219	34	0.3	27	0.513	0.054	0.000	0.055	47.0	24.8	10.4	18.2	**0.53**	0.0133	17	0.618	0.454	274	12	16	1.3	103
	03-Jul-07	41	8.01	246	108	132	<0.6	<0.4	101	14	0.3	23	0.468	0.325	0.012	0.021	21.9	11.1	10.0	4.34	**0.93**	0.0563	16	0.820	0.724	149	11	17	1.8	80.2
	10-Jul-07	72	8.26	372	149	182	<0.6	<0.4	166	19	0.2	27	0.287	0.041	0.002	0.291	35.4	18.8	11.1	10.9	**0.81**	0.0682	15	0.668	0.467	213	66	1.7	16	99
Level I																														
CON D/S	29-Mar-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61	-	-	-
	05-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-
	22-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-
	26-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-
	29-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	-
	07-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96	-	-	-
	13-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	-	-	-
	18-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85	-	-	-
	24-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	-	-
	25-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	-	-	-
	10-Jul-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	-
	26-Jul-07	-	8.35	-	-	-	-	-	-	-	-	-	0.148	0.047	0.004	0.242	-	-	-	-	-	-	-	0.211	0.158	-	19	1.0	-	-
	24-Sep-07	-	8.19	-	-	-	-	-	-	-	-	-	0.029	0.023	0.001	0.068	-	-	-	-	-	-	-	0.080	0.023	-	14	0.6	-	-
	09-Oct-07	-	8.40	-	-	-	-	-	-	-	-	-	0.057	0.106	0.003	0.117	-	-	-	-	-	-	-	0.091	0.060	-	15	7.0	-	-
	19-Oct-07	-	8.17	-	-	-	-	-	-	-	-	-	0.031	0.057	0.002	0.158	-	-	-	-	-	-	-	0.081	0.038	-	20	0.4	-	-
CON U/S	29-Mar-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-
	22-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-
	26-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
	29-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
	07-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
	13-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
	18-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-
	24-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
	25-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-

TABLE NM6-2
GENERAL WATER QUALITY
RED RIVER FLOODWAY - 2007 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]	-	-	-
S-31	29-Mar-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-
	05-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	230	-	-	-
	22-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-
	26-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	-
	29-May-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	140	-	-	-
	07-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-
	13-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250	-	-	-
	18-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	-	-	-
	24-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	-	-	-
	25-Jun-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	240	-	-	-
	10-Jul-07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-
	26-Jul-07	-	8.27	-	-	-	-	-	-	-	-	-	0.219	0.056	0.005	0.613	-	-	-	-	-	-	-	0.307	0.209	-	53	1.2	-	-
	24-Sep-07	-	8.44	-	-	-	-	-	-	-	-	-	0.249	1.000	**0.073**	0.416	-	-	-	-	-	-	-	0.366	0.254	-	26	2.3	-	-
	09-Oct-07	-	8.41	-	-	-	-	-	-	-	-	-	0.249	0.933	**0.042**	0.589	-	-	-	-	-	-	-	0.322	0.263	-	44	10	-	-
	19-Oct-07	-	8.45	-	-	-	-	-	-	-	-	-	0.205	0.540	**0.029**	0.523	-	-	-	-	-	-	-	0.263	0.214	-	20	1.2	-	-

Notes:

"-" = No Data

E.C. = Electrical Conductivity — T.K.N. = Total Kjeldahl Nitrogen

D.O.C. = Dissolved Organic Carbon — T.D.S. = Total Dissolved Solids

T.O.C. = Total Organic Carbon — T.S.S. = Total Suspended Solids

1. See Table NM6-1 for sample location descriptions
2. All values are expressed in milligrams per litre (mg/L) unless indicated otherwise.
3. Unionized Ammonia = (f) x (Ammonia), f = 1/(10(pKa - pH) + 1), pKa = 0.09018+2729.92/T, where T = Temperature in Kelvins
4. CCME 2005 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines
   Chapter 4 - Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update October 2005) - Fact Sheets
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 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:
   Should not increase more than 10% of background levels when background is >250 mg/L.

BOLD - Exceedance of Criteria

TABLE NM6-3
PETROLEUM HYDROCARBONS IN SURFACE WATER
RED RIVER FLOODWAY - 2007 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 $(C_{34}-C_{50})$
Detection Limit		*0.5*	*0.5*	*0.5*	*1.5*	*100*	*100*	*250*	*250*
CCME [3]									
Recreation and Aesthetics		-	-	-	-	[4]	[4]	[4]	[4]
Freshwater Aquatic Life		370 (MAC)	2 (MAC)	90 (MAC)	-	-	-	-	-
Spill									
SPILL U/S (Stn 27+385)	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
SPILL D/S (Stn 27+535)	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
S-12	26-Jan-07	<0.5	<0.5	<0.5	<1.5	<100	**39,000 [5]**		-
	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	**227,000**	**12,200,000**	**5,320,000**
S-23	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
S-28	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	**200**	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	**0.6**	<0.5	<1.5	<100	<100	<250	<250
S-31	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
S-34	13-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	**570**	<250
	16-Feb-07	<0.5	<0.5	<0.5	<1.5	**100**	<100	<250	<250
	19-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	05-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250

TABLE NM6-3
PETROLEUM HYDROCARBONS IN SURFACE WATER
RED RIVER FLOODWAY - 2007 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})
Detection Limit		*0.5*	*0.5*	*0.5*	*1.5*	*100*	*100*	*250*	*250*
CCME [3]									
Recreation and Aesthetics		-	-	-	-	[4]	[4]	[4]	[4]
Freshwater Aquatic Life		370 (MAC)	2 (MAC)	90 (MAC)	-	-	-	-	-
Monthly									
CON D/S (Stn 19+900)	26-Jan-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	-
	22-Feb-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	19-Mar-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	09-Apr-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	22-May-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	08-Jun-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
(Stn 40+850)	03-Jul-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	10-Jul-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	15-Aug-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
(Stn 50+500)	21-Sep-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	09-Oct-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	29-Nov-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	20-Dec-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
CON U/S (Stn 7+650)	09-Apr-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	22-May-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	08-Jun-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	03-Jul-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250
	10-Jul-07	<0.5	<0.5	<0.5	<1.5	<100	<100	<250	<250

Notes:
"-" = No Data

1. See Table NM6-1 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 - Candadian Water Quality Guidelines for Recreation and Aesthetics (Update October 2005) - Fact Sheets
   Chapter 4 - Candadian Water Quality Guidelines for the Protection of Aquatic Life (Update October 2005) - Fact Sheets
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 odour.
5. Analyzed as Total Extractable Hydrocarbons (C11 - C30) which matches Hydrocarbon Fractions F2 and F3.

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

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME (2)			
Freshwater Aquatic Life		-	-
Monthly			
CON D/S (Stn 19+900)	26-Jan-07	230	<10
	22-Feb-07	80	<10
	19-Mar-07	2930	520
	09-Apr-07	790	<10
	22-May-07	210	70
	08-Jun-07	OVERGROWN	650
(Stn 40+850)	03-Jul-07	2350	90
	10-Jul-07	OVERGROWN	170
	15-Aug-07	Overgrown	Overgrown
(Stn 50+500)	21-Sep-07	OVERGROWN	850
	09-Oct-07	OVERGROWN	910
	29-Nov-07	140	<10
	20-Dec-07	720	<10
CON U/S (Stn 7+650)	09-Apr-07	170	<10
	22-May-07	1920	170
	08-Jun-07	50	<10
	03-Jul-07	1190	10
	10-Jul-07	940	80
VEG D/S (Stn 20+500)	09-Apr-07	300	10
	22-May-07	620	200
	08-Jun-07	830	30
	03-Jul-07	1810	50
	10-Jul-07	1700	330
(Stn 34+500)	15-Aug-07	1930	410
(Stn 50+500)	21-Sep-07	OVERGROWN	850
	09-Oct-07	OVERGROWN	910
	29-Nov-07	140	<10
	20-Dec-07	720	<10
VEG U/S (Stn 7+650)	09-Apr-07	170	<10
	22-May-07	1920	170
	08-Jun-07	50	<10
	03-Jul-07	1190	10
	10-Jul-07	OVERGROWN	OVERGROWN
S-01	09-Apr-07	240	20
	03-Jul-07	1100	10
S-02	09-Apr-07	90	40
	03-Jul-07	950	20
S-03	09-Apr-07	120	40
	03-Jul-07	1090	20
S-04	09-Apr-07	250	<10
	03-Jul-07	900	30
S-05	09-Apr-07	470	<10
U/S	09-Apr-07	630	50
	08-Jun-07	1540	40
U/S	08-Jun-07	2080	40
	03-Jul-07	2170	260
U/S	03-Jul-07	900	120
	10-Jul-07	OVERGROWN	390
U/S	10-Jul-07	OVERGROWN	110

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. [1]	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME [2]			
Freshwater Aquatic Life		-	-
S-06	09-Apr-07	520	20
U/S	09-Apr-07	480	<10
	22-May-07	1770	170
U/S	22-May-07	2070	520
	08-Jun-07	OVERGROWN	70
U/S	08-Jun-07	460	10
	03-Jul-07	1470	10
U/S	03-Jul-07	1970	10
	10-Jul-07	OVERGROWN	530
U/S	10-Jul-07	OVERGROWN	550
S-07	09-Apr-07	720	10
U/S	09-Apr-07	640	<10
	22-May-07	950	<10
U/S	22-May-07	990	100
	08-Jun-07	OVERGROWN	150
U/S	08-Jun-07	2170	<10
	03-Jul-07	2940	30
U/S	03-Jul-07	2460	40
	10-Jul-07	OVERGROWN	70
U/S	10-Jul-07	OVERGROWN	30
	09-Oct-07	OVERGROWN	500
U/S	09-Oct-07	OVERGROWN	350
S-08	22-May-07	OVERGROWN	2050
S-09	09-Apr-07	860	<10
U/S	09-Apr-07	670	<10
	22-May-07	540	80
U/S	22-May-07	1450	50
	08-Jun-07	OVERGROWN	OVERGROWN
U/S	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	790	80
U/S	03-Jul-07	1550	200
	10-Jul-07	OVERGROWN	400
U/S	10-Jul-07	OVERGROWN	60
	21-Sep-07	OVERGROWN	60
U/S	21-Sep-07	OVERGROWN	100
	09-Oct-07	1610	30
U/S	09-Oct-07	OVERGROWN	370
S-10	09-Apr-07	440	<10
U/S	09-Apr-07	770	<10
	22-May-07	560	310
U/S	22-May-07	680	290
	08-Jun-07	OVERGROWN	130
U/S	08-Jun-07	OVERGROWN	170
	03-Jul-07	2570	<10
U/S	03-Jul-07	2160	20
	10-Jul-07	OVERGROWN	20
U/S	10-Jul-07	OVERGROWN	40
	09-Oct-07	OVERGROWN	460
U/S	09-Oct-07	OVERGROWN	OVERGROWN
S-11	22-May-07	900	20
	08-Jun-07	1400	<10

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME (2)			
Freshwater Aquatic Life		-	-
S-13	26-Jan-07	50	<10
	19-Mar-07	10	<10
	09-Apr-07	260	30
	22-May-07	160	90
	08-Jun-07	570	140
	03-Jul-07	1690	30
	10-Jul-07	OVERGROWN	770
	15-Aug-07	10	10
	21-Sep-07	1390	110
	09-Oct-07	1840	210
	29-Nov-07	30	<10
	21-Dec-07	250	<10
S-14	26-Jan-07	10	<10
	22-Feb-07	10	<10
	19-Mar-07	80	<10
	09-Apr-07	430	<10
	22-May-07	400	40
	08-Jun-07	1100	120
	03-Jul-07	1460	70
	10-Jul-07	OVERGROWN	280
	15-Aug-07	10	10
	21-Sep-07	1330	90
	09-Oct-07	OVERGROWN	450
	29-Nov-07	10	<10
	21-Dec-07	180	<10
S-21	26-Jan-07	210	<10
Field Dup.	26-Jan-07	330	<10
	22-Feb-07	570	110
	09-Apr-07	930	<10
	22-May-07	2210	1980
	08-Jun-07	1580	570
	03-Jul-07	1750	120
	10-Jul-07	OVERGROWN	OVERGROWN
	15-Aug-07	10	10
	21-Sep-07	OVERGROWN	OVERGROWN
Field Dup.	21-Sep-07	OVERGROWN	OVERGROWN
	09-Oct-07	OVERGROWN	OVERGROWN
	29-Nov-07	320	<10
	21-Dec-07	270	10
S-22	09-Apr-07	890	<10
U/S	09-Apr-07	480	<10
	22-May-07	1890	180
U/S	22-May-07	1270	260
	08-Jun-07	490	10
U/S	08-Jun-07	580	60
	03-Jul-07	2490	20
U/S	03-Jul-07	1800	50
	10-Jul-07	OVERGROWN	110
U/S	10-Jul-07	OVERGROWN	350
	21-Sep-07	OVERGROWN	460
	09-Oct-07	OVERGROWN	50

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME (2)			
Freshwater Aquatic Life		-	-
S-23	26-Jan-07	300	<10
	22-Feb-07	50	<10
	19-Mar-07	2400	430
	09-Apr-07	450	<10
	22-May-07	430	170
	08-Jun-07	OVERGROWN	700
	03-Jul-07	1940	70
	10-Jul-07	OVERGROWN	390
	15-Aug-07	1890	470
	21-Sep-07	1640	310
	09-Oct-07	OVERGROWN	OVERGROWN
	29-Nov-07	540	<10
	21-Dec-07	150	<10
S-25	26-Jan-07	<10	<10
	22-Feb-07	190	<10
	20-Mar-07	90	20
Field Dup.	20-Mar-07	100	20
	09-Apr-07	450	120
Field Dup.	09-Apr-07	310	20
	22-May-07	100	20
Field Dup.	22-May-07	90	<10
	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	1580	90
	10-Jul-07	OVERGROWN	240
	15-Aug-07	Overgrown	490
	21-Sep-07	OVERGROWN	OVERGROWN
	09-Oct-07	2360	660
	29-Nov-07	100	<10
	20-Dec-07	110	<10
S-26	09-Apr-07	70	10
	22-May-07	1010	290
	08-Jun-07	670	10
	03-Jul-07	2100	200
U/S	03-Jul-07	2230	30
	10-Jul-07	OVERGROWN	30
U/S	10-Jul-07	OVERGROWN	40
	15-Aug-07	Overgrown	2180
Field Dup.	15-Aug-07	Overgrown	1730
U/S	15-Aug-07	Overgrown	2240
	21-Sep-07	1570	60
U/S	21-Sep-07	820	100
	09-Oct-07	OVERGROWN	510
U/S	09-Oct-07	OVERGROWN	100
S-27	09-Apr-07	180	<10
	22-May-07	1720	<10
	08-Jun-07	760	20
	03-Jul-07	1080	<10
	10-Jul-07	OVERGROWN	30
	15-Aug-07	Overgrown	290
U/S	15-Aug-07	Overgrown	40
	09-Oct-07	OVERGROWN	190
U/S	09-Oct-07	OVERGROWN	130

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. (1)	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME (2)			
Freshwater Aquatic Life		-	-
S-28	26-Jan-07	110	<10
	22-Feb-07	30	<10
Field Dup.	22-Feb-07	50	<10
	20-Mar-07	120	60
	09-Apr-07	290	10
	22-May-07	1220	270
	08-Jun-07	OVERGROWN	OVERGROWN
Field Dup.	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	2190	50
Field Dup.	03-Jul-07	2790	40
	10-Jul-07	OVERGROWN	100
Field Dup.	10-Jul-07	OVERGROWN	120
	15-Aug-07	Overgrown	Overgrown
	21-Sep-07	1800	710
Field Dup.	21-Sep-07	1610	610
	09-Oct-07	OVERGROWN	620
Field Dup.	09-Oct-07	OVERGROWN	560
	29-Nov-07	60	<10
Field Dup.	29-Nov-07	140	<10
	20-Dec-07	200	<10
Field Dup.	20-Dec-07	180	<10
S-30	26-Jan-07	770	210
	22-Feb-07	1160	380
	20-Mar-07	1090	380
	09-Apr-07	260	20
	22-May-07	1750	1100
	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	1860	60
	10-Jul-07	OVERGROWN	1600
	15-Aug-07	1640	250
	21-Sep-07	OVERGROWN	200
	09-Oct-07	2460	140
	29-Nov-07	1850	<10
	20-Dec-07	860	30
S-31	26-Jan-07	610	140
	22-Feb-07	1050	340
	20-Mar-07	1050	400
	09-Apr-07	150	30
	22-May-07	1420	700
	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	550	60
	10-Jul-07	OVERGROWN	OVERGROWN
	15-Aug-07	1340	170
	21-Sep-07	OVERGROWN	60
	09-Oct-07	1930	100
	29-Nov-07	660	30
	20-Dec-07	460	50
S-32	26-Jan-07	520	60
	22-Feb-07	1040	420
	20-Mar-07	870	290
	09-Apr-07	190	50
	22-May-07	1340	710

TABLE NM6-4
BACTERIA IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Sample No. [(1)]	Date	Parameter	
		Total Coliform CFU/100mL	E.Coli CFU/100mL
Detection Limit		*10*	*10*
CCME [(2)]			
Freshwater Aquatic Life		-	-
S-32	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	900	20
	10-Jul-07	OVERGROWN	1240
	15-Aug-07	760	130
	21-Sep-07	OVERGROWN	110
	09-Oct-07	OVERGROWN	90
	29-Nov-07	830	30
	20-Dec-07	560	90
S-33	26-Jan-07	590	170
	22-Feb-07	900	310
	20-Mar-07	880	250
	09-Apr-07	210	110
	22-May-07	1010	480
	08-Jun-07	OVERGROWN	OVERGROWN
	03-Jul-07	390	70
	10-Jul-07	OVERGROWN	1340
	15-Aug-07	1710	120
	21-Sep-07	1480	50
	09-Oct-07	OVERGROWN	80
	29-Nov-07	350	60
	20-Dec-07	340	10
S-34	26-Jan-07	730	140
	22-Feb-07	1010	390
	20-Mar-07	1000	320
	09-Apr-07	230	140
	22-May-07	1770	820
	08-Jun-07	1110	390
	03-Jul-07	690	40
	10-Jul-07	OVERGROWN	1430
	15-Aug-07	Overgrown	170
	21-Sep-07	OVERGROWN	40
	09-Oct-07	2200	60
	29-Nov-07	280	10
	20-Dec-07	780	60
S-35	09-Apr-07	510	<10
	22-May-07	1710	150
	08-Jun-07	OVERGROWN	530
	03-Jul-07	1170	140
	10-Jul-07	OVERGROWN	790
S-36	09-Apr-07	640	<10
	22-May-07	430	290
	08-Jun-07	OVERGROWN	110
	03-Jul-07	2370	10
	10-Jul-07	OVERGROWN	650

Notes:
"-" = No Data
1. See Table NM6-1 for sample location descriptions
2. CCME 2005 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines
Chapter 4 - Candadian Water Quality Guidelines for the Protection of Aquatic Life (Update October 2005) - Fact Sheets

BOLD - Exceedance of Criteria

TABLE NM6-5
HERBICIDES IN SURFACE WATER
RED RIVER FLOODWAY - 2007 SURFACE WATER MONITORING

Location	Date	Parameter [1]						
		2,4-D	AMPA	Bromoxynil	Dicamba	Glyphosate	MCPA	Picloram
EQL		*<0.1*	*<1*	*<0.1*	*<0.1*	*<1*	*<0.1*	*<0.1*
CCME [2]								
Freshwater Aquatic Life		4	-	5	10	65	2.6	29
VEG D/S (20+500)	09-Apr-07	<0.1	<1	<0.1	<0.1	<1	<0.1	<0.1
VEG U/S (7+650)	09-Apr-07	<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. All values are expressed in micrograms per lite (µg/L).
2. CCME 2003 - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines
   Guidelines for Canadian Drinking Water Quality.
   Chapter 4 - Aquatic Life (1999, Updated 2003.)

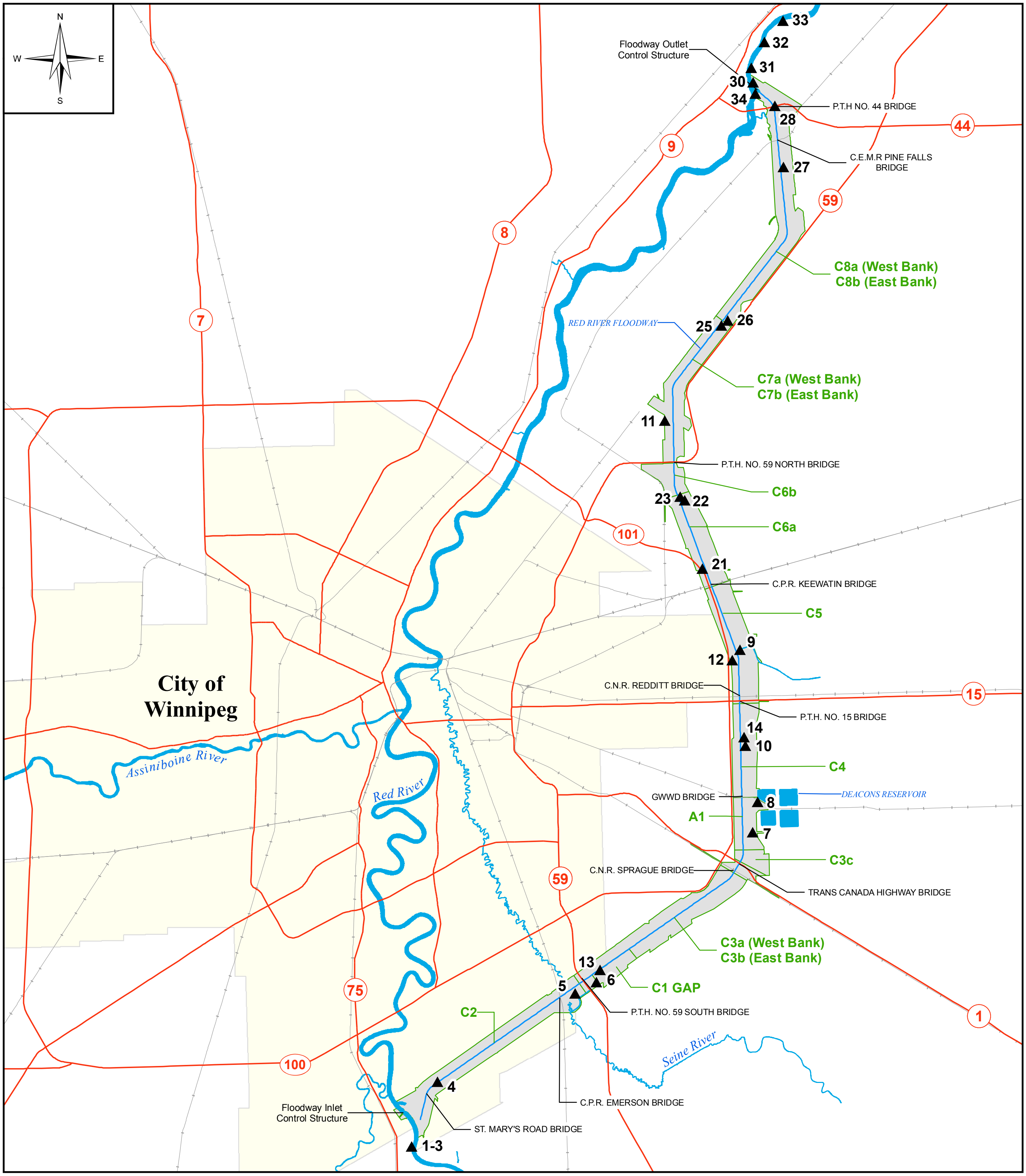
BOLD	- Parameter Detected
BOLD & Shaded	- Exceedance of Criteria

TABLE NM6-6
LEVEL I EVENT BASED TSS MONITORING REVIEW
RED RIVER FLOODWAY - 2007 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)	
29-Mar-07	13.2 - 20.0	4.00	<2	80.00	59.6	412.0	623	314.7	16,939	**-9.23%**	80.00	61	421.6	453	180	7,045	**-9.92%**
05-May-07	4.3 - 16.5	10.00	<2	0.10	15.4	0.1	540	243.5	11,361	**-0.02%**	0.10	16	0.1	540	230	10,731	**-0.02%**
22-May-07	15 - 31 / 12.2 - 29.5	4.00 / 3.50	<2 / <2	0.82	17.1	1.2	355	176.8	5,423	**-0.21%**	0.82	16	1.1	469	190	7,699	**-0.16%**
26-May-07	7.1 - 19.1	9.00	<2	8.00	29.6	20.5	420	75.1	2,725	**-1.13%**	8.00	21	14.5	514	36	1,599	**-0.64%**
29-May-07	6.4 - 21.3	3.00	<2	19.00	22.6	37.1	384	145.5	4,827	**-3.98%**	19.00	19	31.2	581	140	7,028	**-2.74%**
07-Jun-07	15.2 - 24.3	6.00	<2	2.94	55.8	14.2	609	189.8	9,987	**-0.34%**	2.94	96	24.4	609	180	9,471	**-0.22%**
13-Jun-07	9.0 - 23.1	10.00	<2	3.25	41.0	11.5	545	240.9	11,343	**-0.49%**	3.25	31	8.7	694	250	14,990	**-0.41%**
18-Jun-07	14.2 - 24.6	1.75	<2	3.00	74.3	19.3	850	229.5	16,854	**-0.24%**	3.00	85	22.0	789	71	4,840	**0.07%**
24-Jun-07	8.9 - 31.4	2.00	<2 - 2	2.00	39.2	6.8	1034	243.5	21,754	**-0.16%**	2.00	56	9.7	955	280	23,103	**-0.17%**
25-Jun-07	15.7 - 26.0	6.00	<2	3.11	64.5	17.3	1090	206.3	19,429	**-0.20%**	3.11	70	18.8	1060	240	21,980	**-0.21%**
10-Jul-07	11.4 - 32.0	9.00	<2	0.15	56.1	0.7	684	128.5	7,594	**-0.01%**	0.15	72	0.9	765	210	13,880	**-0.01%**
26-Jul-07	10.2 - 24.2	5.00	<2	1.37	19.9	2.4	374	62.9	2,033	**-0.25%**	1.37	19	2.2	326	53	1,493	**-0.27%**
24-Sep-07	11.7 - 29.2	3.00	<2	1.33	14.5	1.7	72.8	36.2	228	**-1.08%**	1.33	14	1.6	65.2	26	146	**-0.92%**
09-Oct-07	10.0 - 36.6	17.00	<2	1.75	18.5	2.8	61.9	33.9	181	**-1.25%**	1.75	15	2.3	66.9	44	254	**-1.68%**
19-Oct-07	18.8 - 24.4	25.00	<2	1.59	32.5	4.5	79.1	27.6	189	**0.35%**	1.59	20	2.7	82.5	20	143	**0.00%**

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

FIGURES



▲ 10 Surface Water Sampling Locations

C2 Contract Reference Locations

1:200,000

0 1 2 4 6 8 10

Kilometres

MEMO REFERENCE 05-1100-01.9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

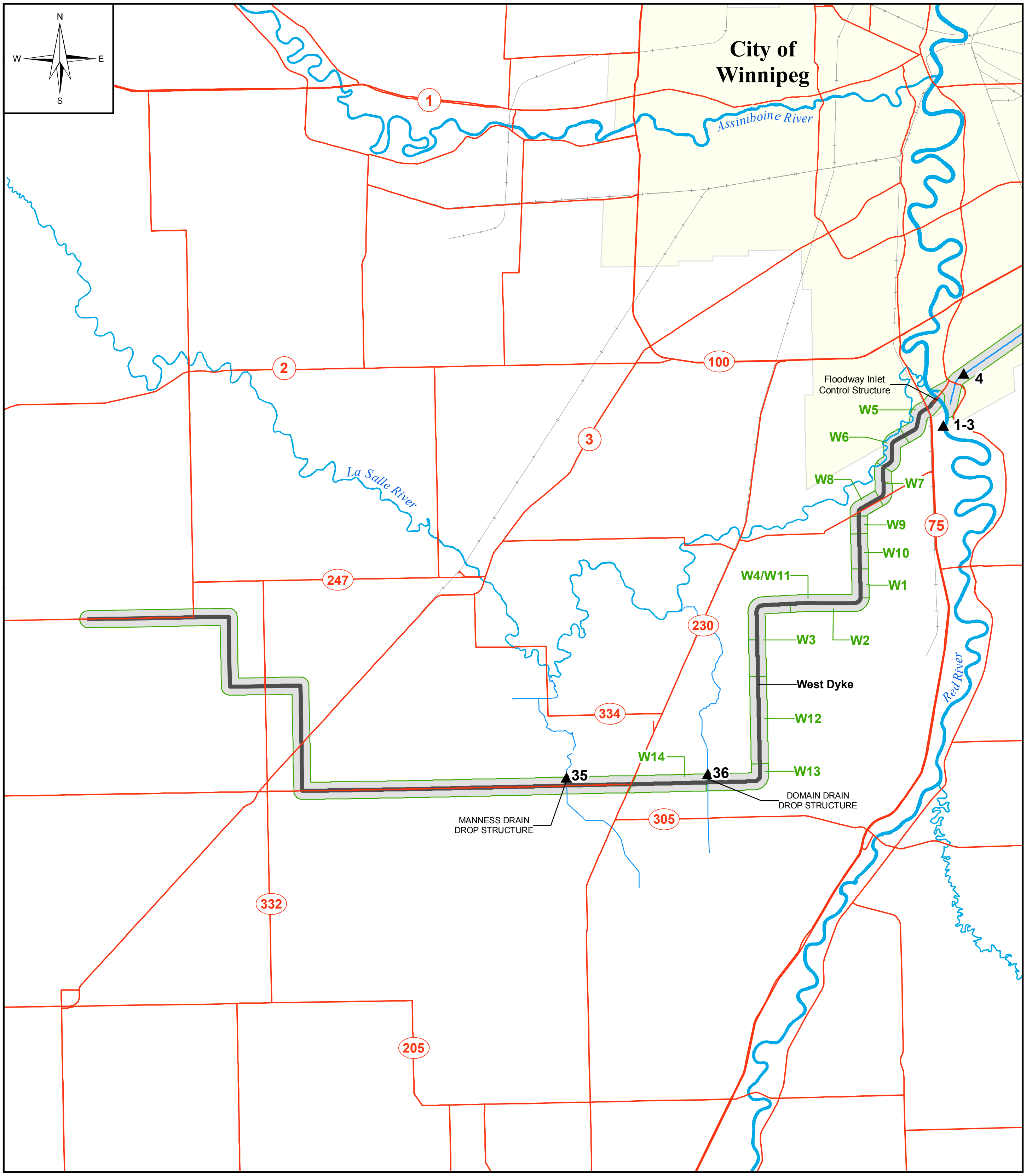
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

FLOODWAY CHANNEL SAMPLE LOCATIONS

JANUARY 2007	FIGURE NM6-1	REV 0

X:\projects\2003\03-1100-01\GIS\Archive\Contract_General\9905221\PDFs\NM6-1.pdf



▲ 35 Surface Water Sampling Locations

W2 Contract Reference Locations

1:250,000

0 1 2 4 6 8 10

Kilometres

MEMO REFERENCE 05-1100-01.9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

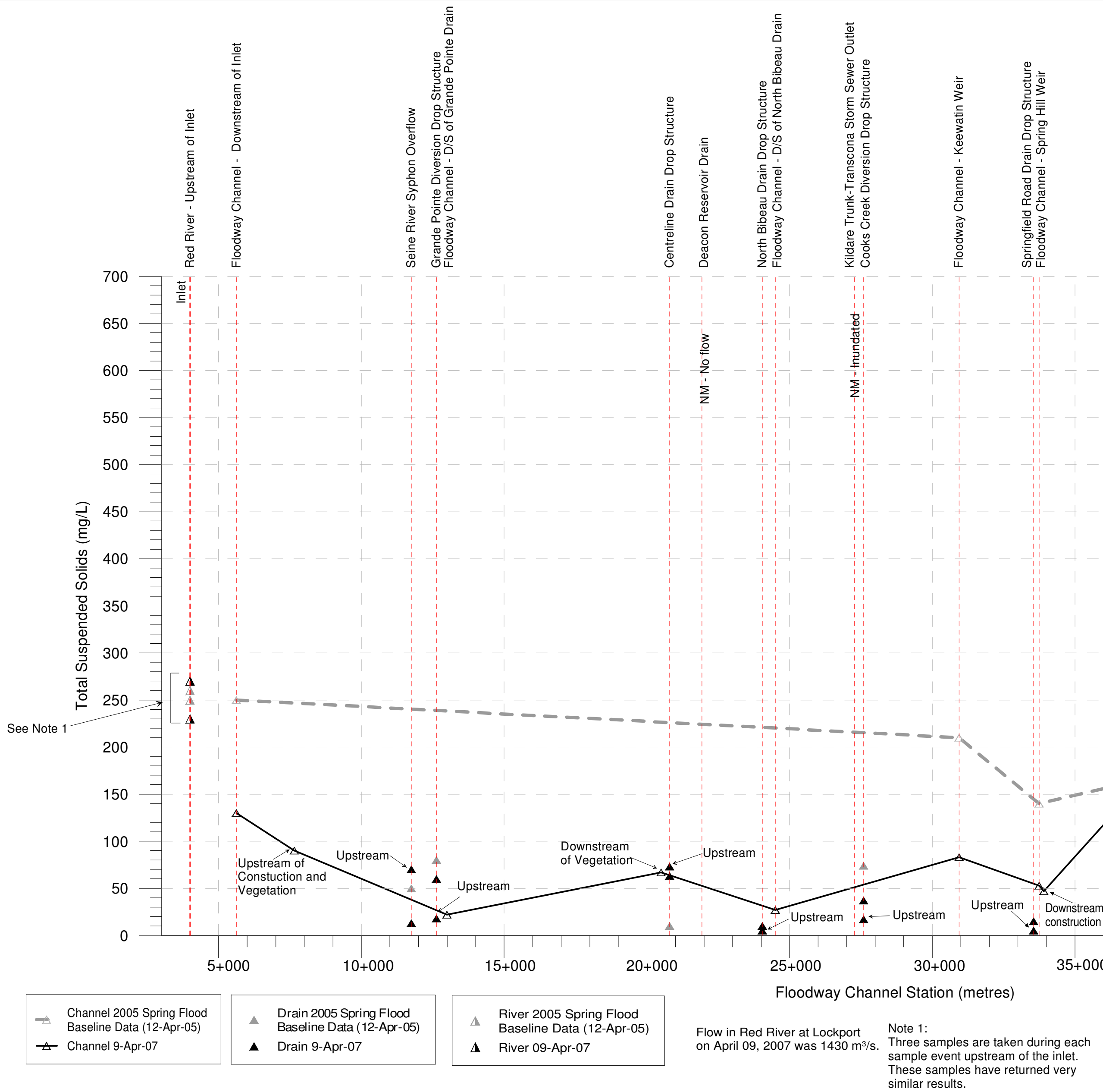
RED RIVER FLOODWAY EXPANSION

2007 CONSRTUCTION SURFACE WATER MONITORING

WEST DYKE SAMPLE LOCATIONS

JANUARY 2007	FIGURE NM6-2	REV 0

X:\projects\2003\03-1100-01\GIS\Archive\Contract_General\9905221\PDFs\NM6-2.pdf



MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

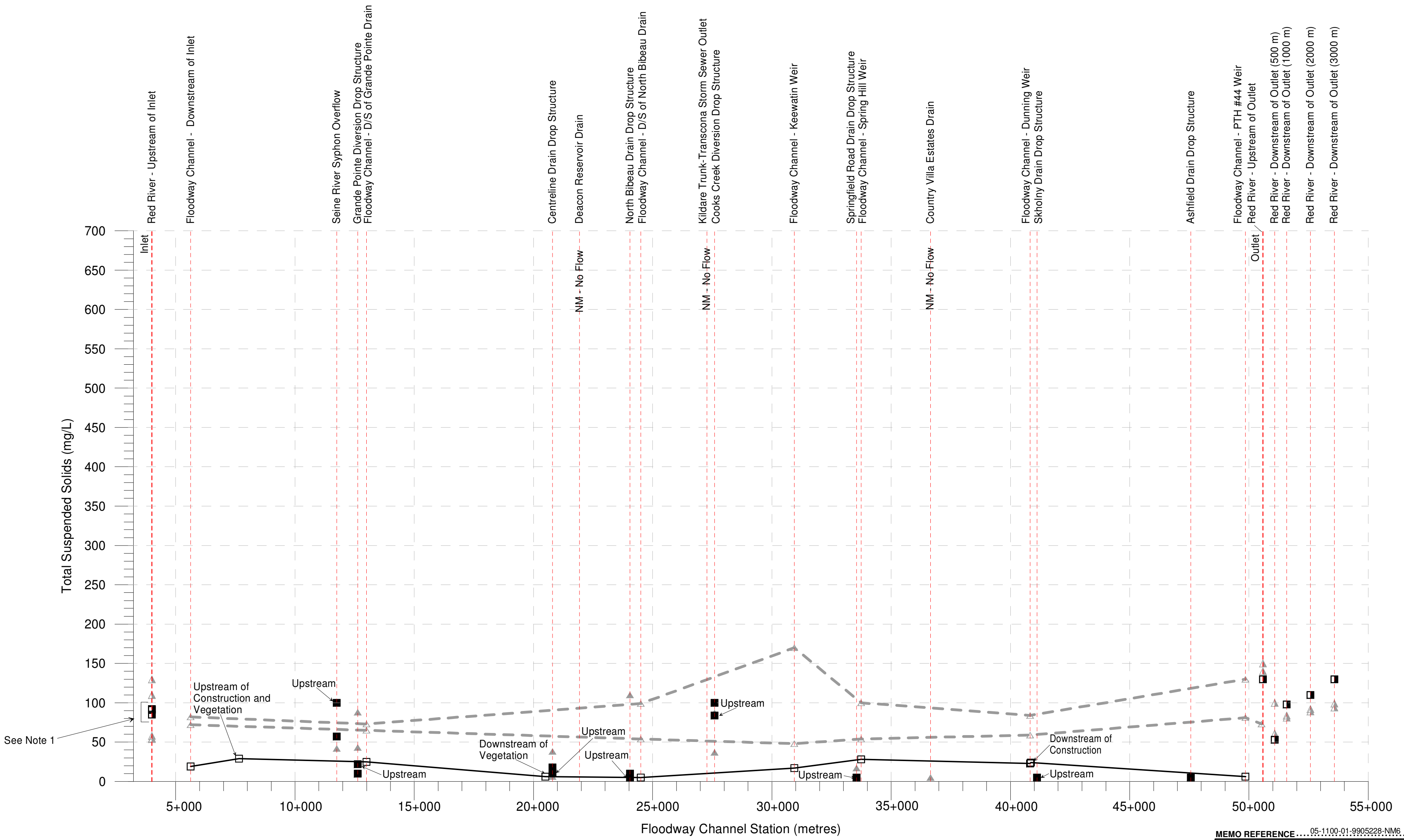
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL SUSPENDED SOLIDS
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-3	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\TSS\FigNM6-3_TSS construction_Spring flood.grf



Channel Summer Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)
Channel 3-July-05
Drain Summer Flood Baseline
Drain 3-July-07
River Summer Flood Baseline
River 3-July-07

Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905228-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

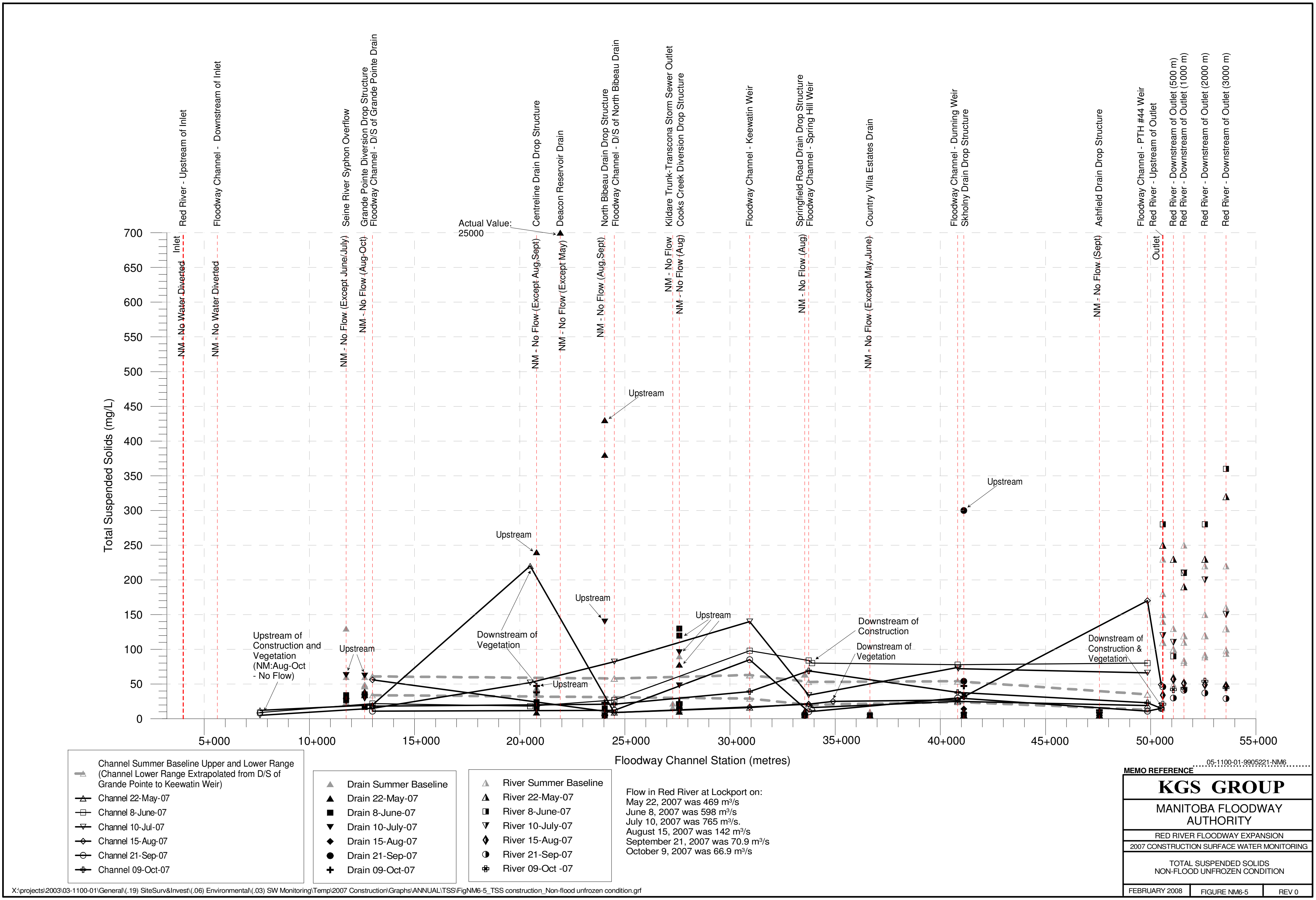
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

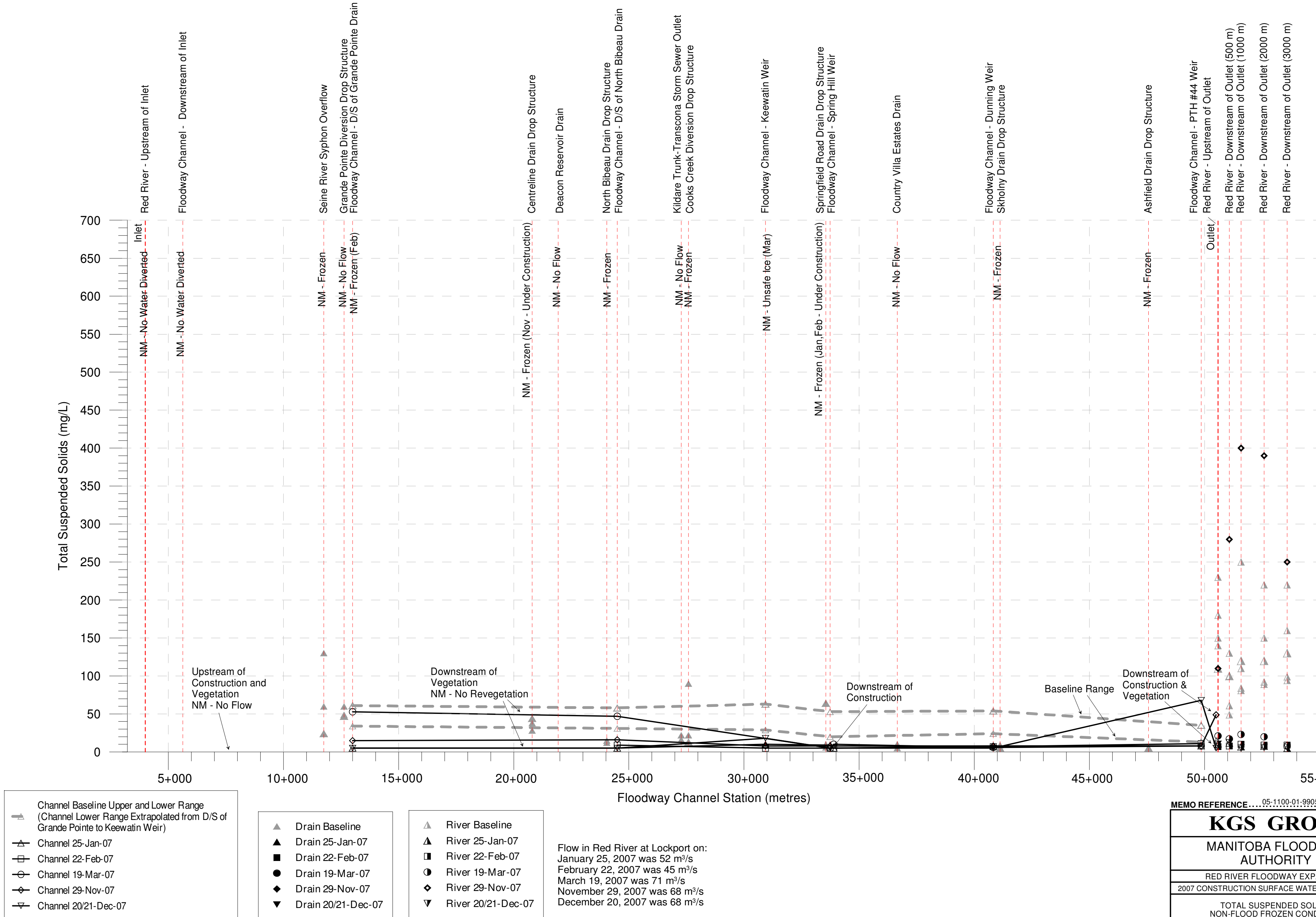
TOTAL SUSPENDED SOLIDS
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-4	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6.7_Summer Flood



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
NM - No Water Diverted
NM - No Water Diverted
NM - No Flow (Except June/July)
NM - No Flow (Aug-Oct)
NM - No Flow (Except Aug,Sept)
NM - No Flow (Except May)
NM - No Flow (Aug,Sept)
NM - No Flow
NM - No Flow (Aug)
NM - No Flow (Aug)
NM - No Flow (Except May,June)
NM - No Flow (Sept)
Outlet
Actual Value: 25000
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream of Construction and Vegetation (NM:Aug-Oct - No Flow)
Downstream of Vegetation
Downstream of Construction
Downstream of Vegetation
Downstream of Construction & Vegetation
Total Suspended Solids (mg/L)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
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 22-May-07
Channel 8-June-07
Channel 10-Jul-07
Channel 15-Aug-07
Channel 21-Sep-07
Channel 09-Oct-07
Drain Summer Baseline
Drain 22-May-07
Drain 8-June-07
Drain 10-July-07
Drain 15-Aug-07
Drain 21-Sep-07
Drain 09-Oct-07
River Summer Baseline
River 22-May-07
River 8-June-07
River 10-July-07
River 15-Aug-07
River 21-Sep-07
River 09-Oct -07
Flow in Red River at Lockport on:
May 22, 2007 was 469 m³/s
June 8, 2007 was 598 m³/s
July 10, 2007 was 765 m³/s.
August 15, 2007 was 142 m³/s
September 21, 2007 was 70.9 m³/s
October 9, 2007 was 66.9 m³/s
MEMO REFERENCE
05-1100-01-9905221-NM6
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2007 CONSTRUCTION SURFACE WATER MONITORING
TOTAL SUSPENDED SOLIDS NON-FLOOD UNFROZEN CONDITION
FEBRUARY 2008
FIGURE NM6-5
REV 0
X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\TSS\FigNM6-5_TSS construction_Non-flood unfrozen condition.grf



MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

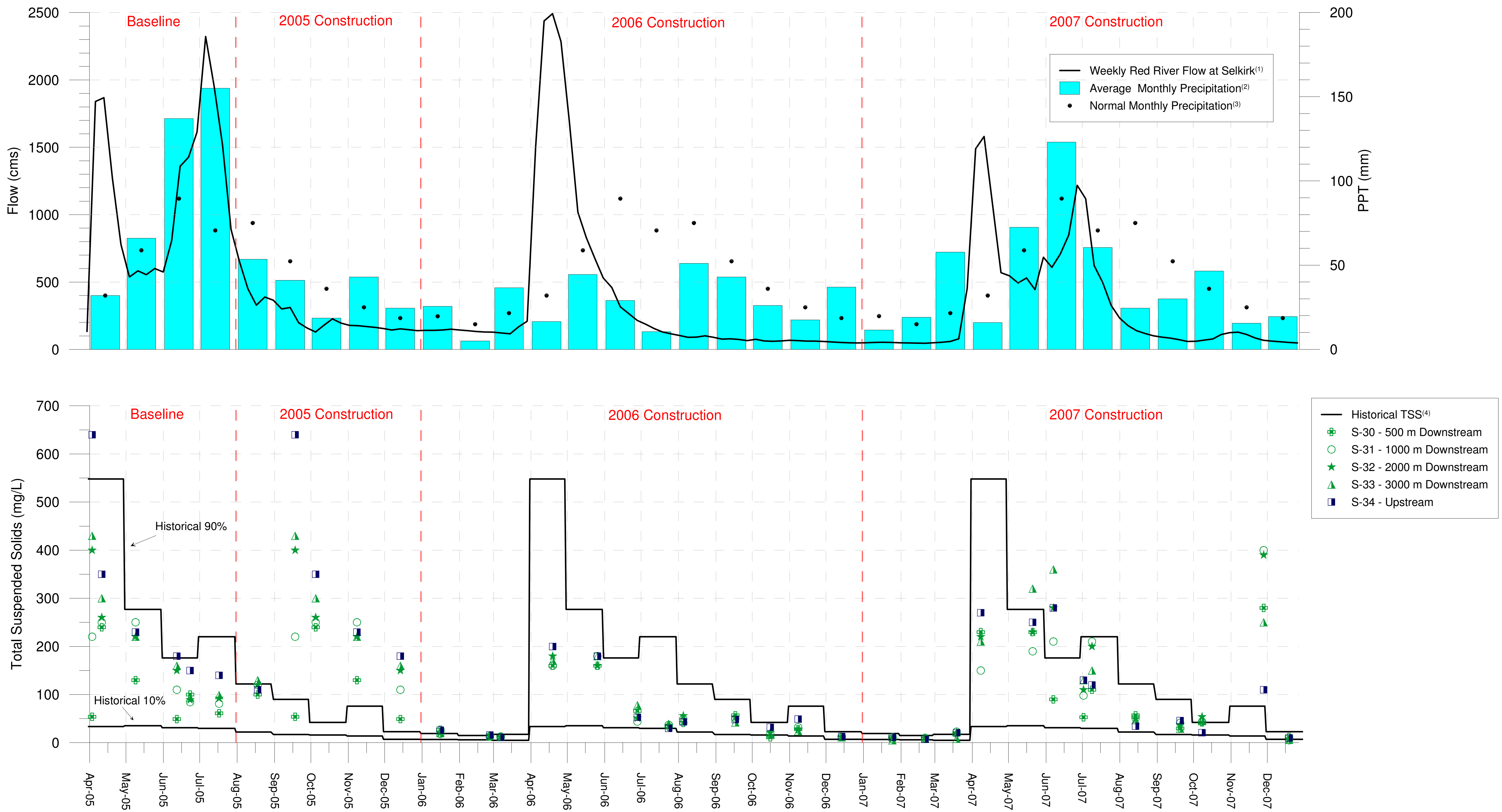
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL SUSPENDED SOLIDS
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-6	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\TSS\FigNM6-6_TSS construction_Non-flood frozen condition.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
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 05-1100-01-9905221-NM6

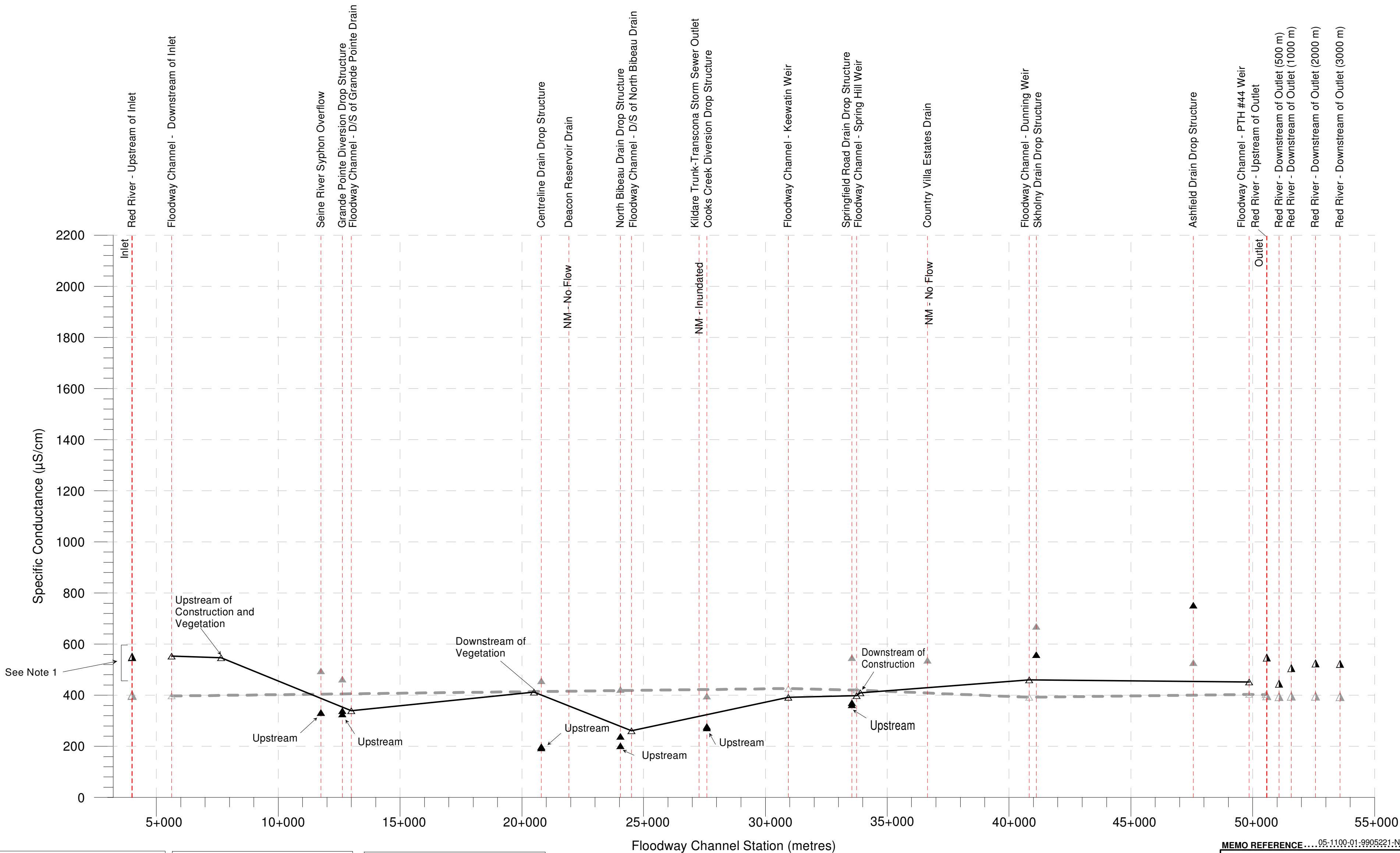
KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION
2007 CONSTRUCTION SURFACE WATER MONITORING

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

FEBRUARY 2008 | FIGURE NM6-7 | REV 0



Channel 2005 Spring Flood Baseline Data (12-Apr-05)
Channel 09-Apr-07

Drain 2005 Spring Flood Baseline Data (12-Apr-05)
Drain 09-Apr-07

River 2005 Spring Flood Baseline Data (12-Apr-05)
River 09-Apr-07

Flow in Red River at Lockport on April 09, 2007 was 1430 m^3/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

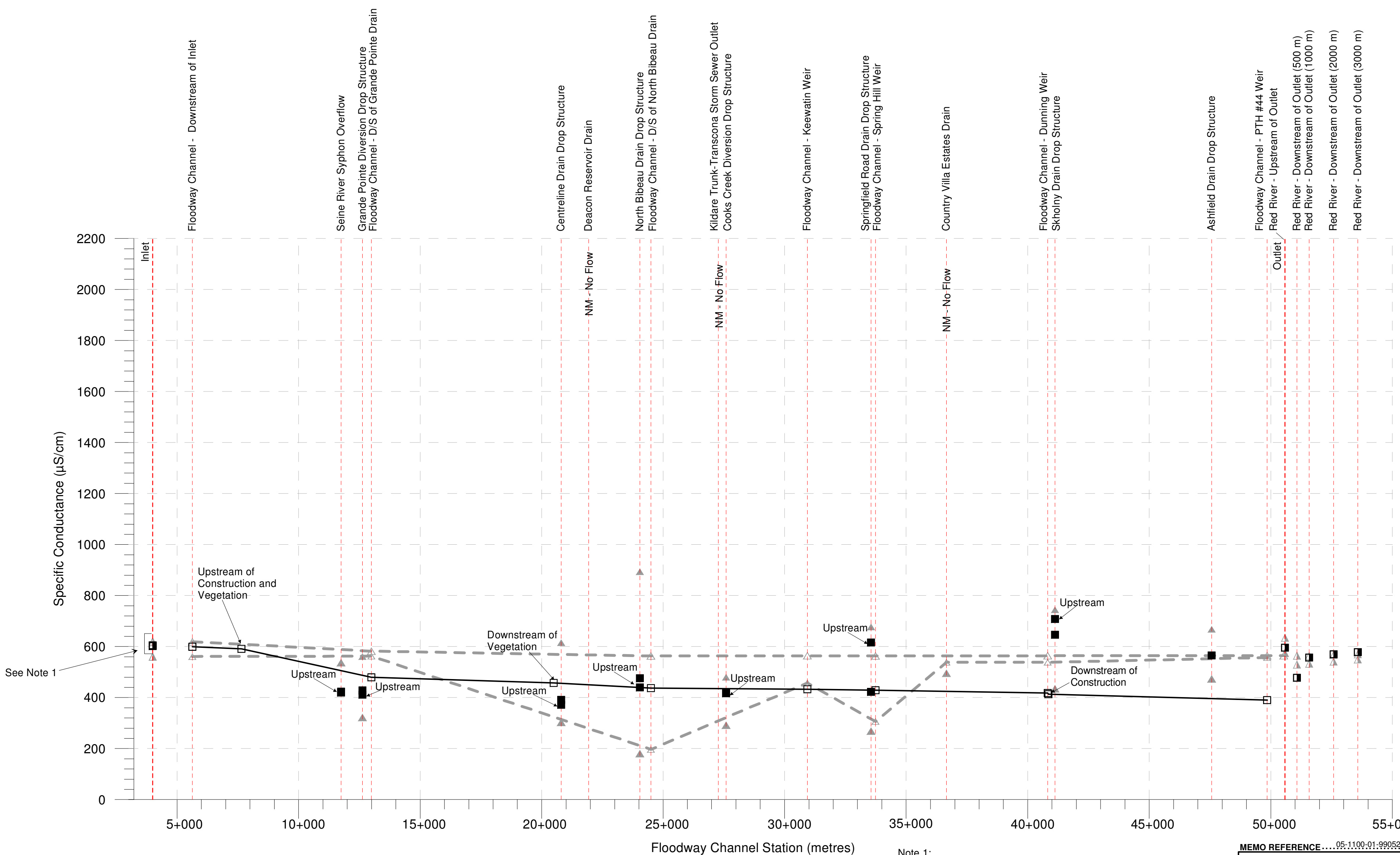
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SPECIFIC CONDUCTANCE
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-8	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\EC\FigNM6-8_EC construction_Spring Flood.grf



Channel Summer Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)
Channel 3-July-07

Drain Summer Flood Baseline
Drain 3-July-07

River Summer Flood Baseline
River 3-July-07

Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905228-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

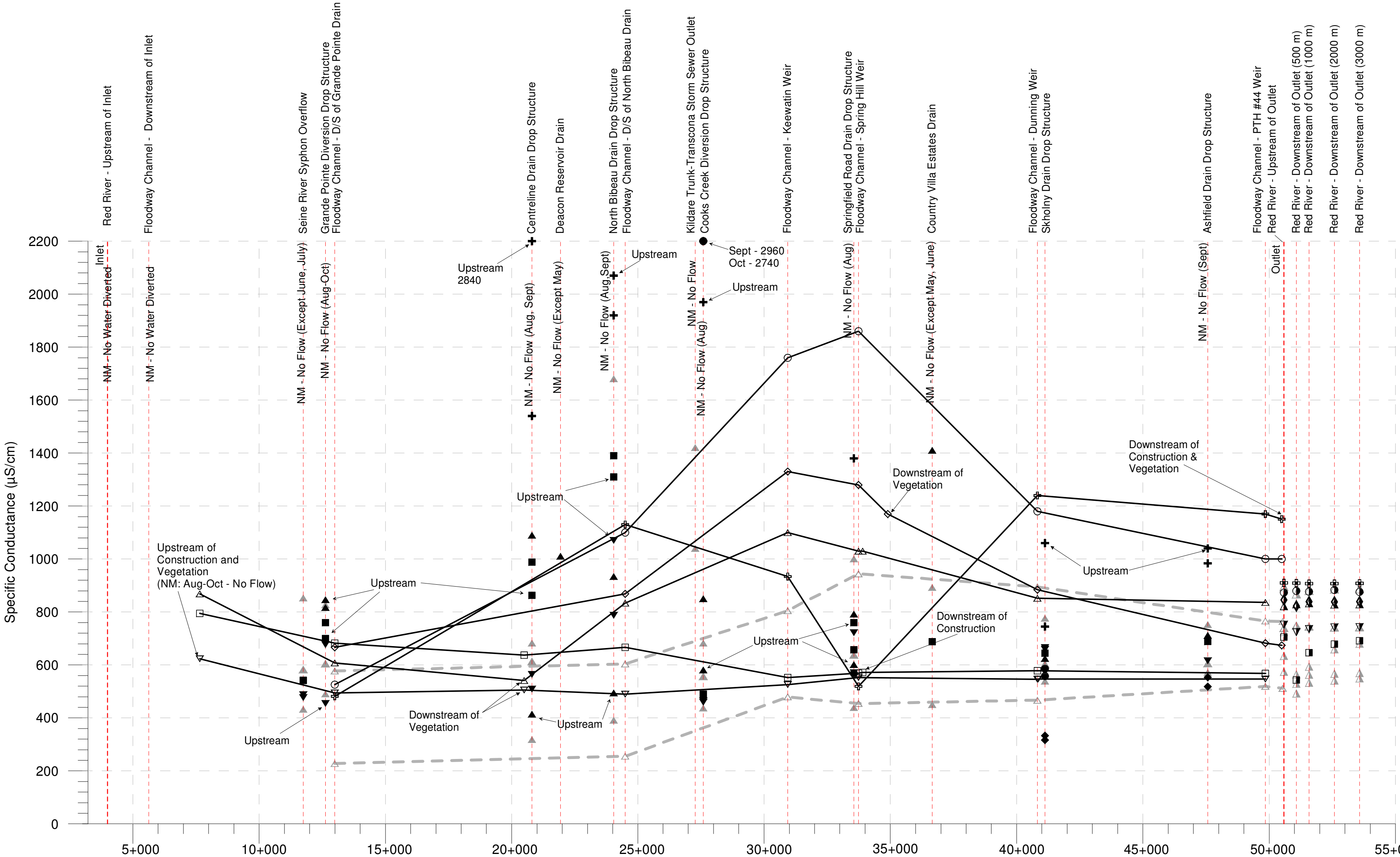
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SPECIFIC CONDUCTANCE
SUMMER FLOOD

FEBRUARY 2008 | FIGURE NM6-9 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6-9_Summer Flood



Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 22-May-07
Channel 8-June-07
Channel 10-July-07
Channel 15-Aug-07
Channel 21-Sep-07
Channel 09-Oct -07

Drain Summer Baseline
Drain 22-May-07
Drain 8-June-07
Drain 10-July-07
Drain 15-Aug-07
Drain 21-Sep-07
Drain 09-Oct -07

River Summer Baseline
River 22-May-07
River 8-June-07
River 10-July-07
River 15-Aug-07
River 21-Sep-07
River 09-Oct -07

Flow in Red River at Lockport on:
May 22, 2007 was 469 m³/s
June 8, 2007 was 598 m³/s
July 10, 2007 was 765 m³/s
August 15, 2007 was 142 m³/s
September 21, 2007 was 70.9 m³/s
October 9, 2007 was 66.9 m³/s

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

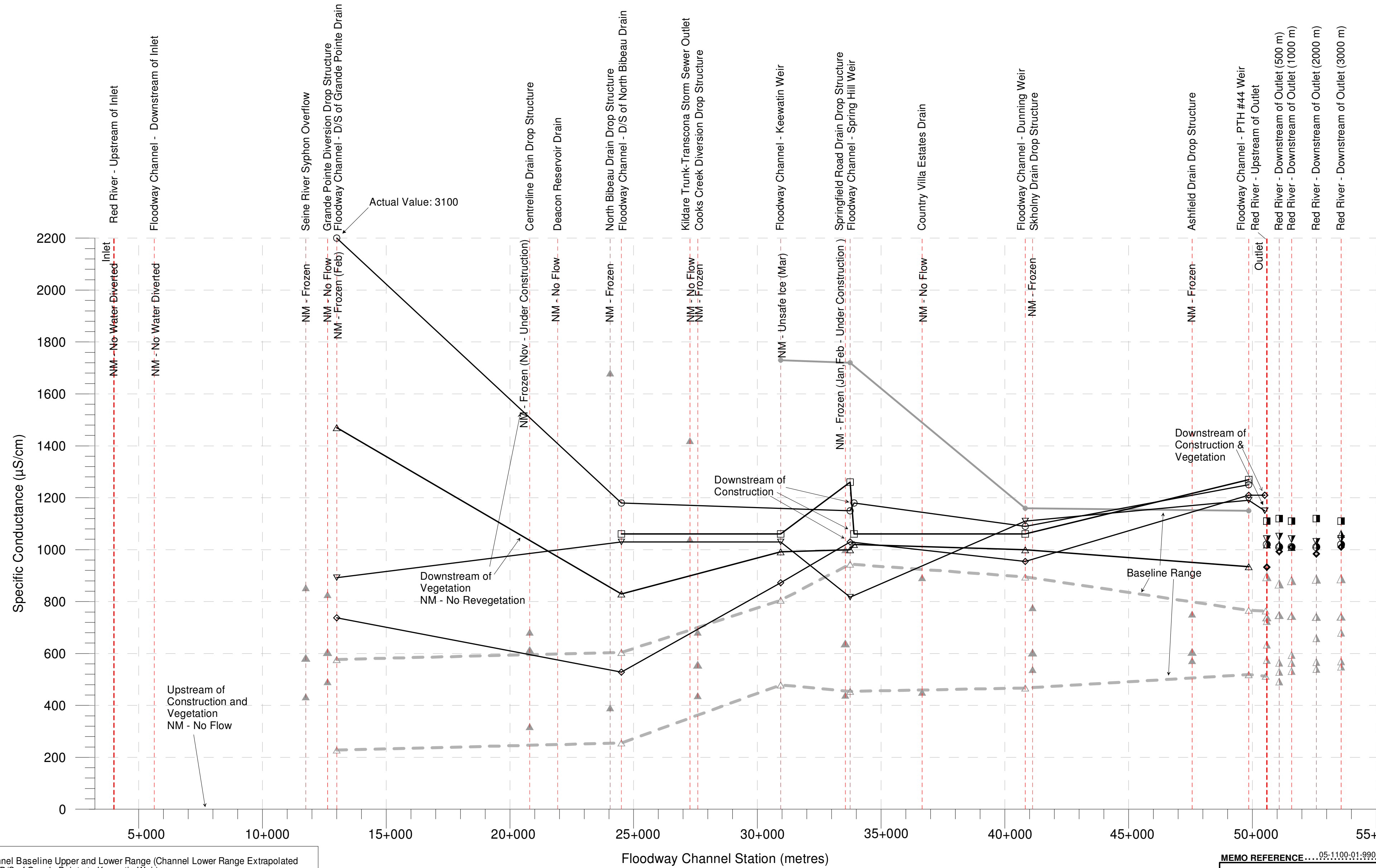
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SPECIFIC CONDUCTANCE
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008 | FIGURE NM6-10 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\EC\FigNM6-10_EC construction__Non-flood unfrozen condition.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 25-Jan-07
Channel 22-Feb-07
Channel 19-Mar-07
Channel 29-Nov-07
Channel 20/21-Dec-07

Drain Baseline
Drain 25-Jan-07
Drain 22-Feb-07
Drain 19-Mar-07
Drain 29-Nov-07
Drain 20/21-Dec-07

River Baseline
River 25-Jan-07
River 22-Feb-07
River 19-Mar-07
River 29-Nov-07
River 20/21-Dec-07

Flow in Red River at Lockport on:
January 25, 2007 was 52 m^3/s
February 22, 2007 was 45 m^3/s
March 19, 2007 was 71 m^3/s
November 29, 2007 was 68 m^3/s
December 20, 2007 was 68 m^3/s

MEMO REFERENCE 05-1100-01:9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

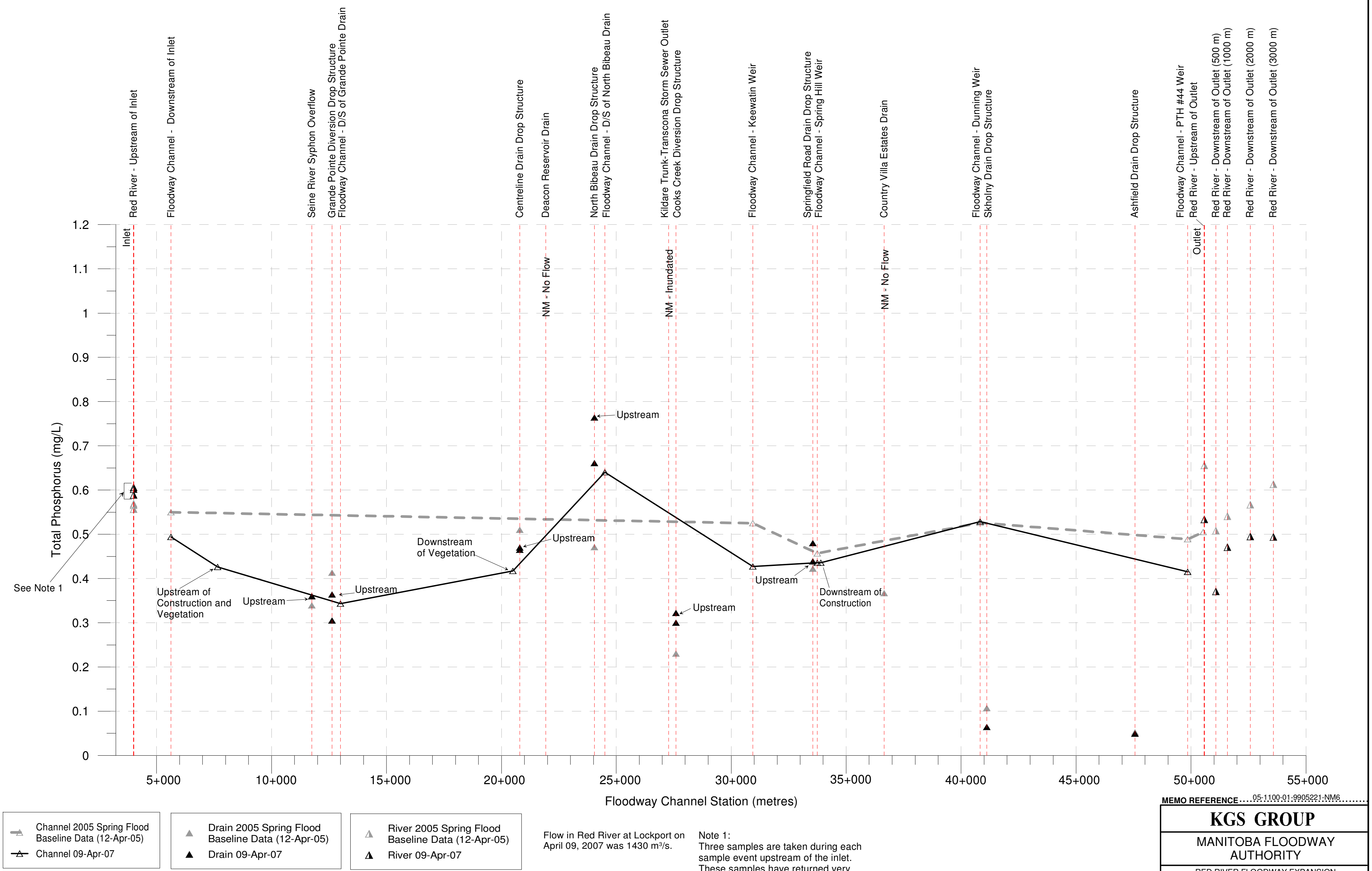
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SPECIFIC CONDUCTANCE
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008 | FIGURE NM6-11 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\EC\FigNM6-11_EC construction_Non-flood frozen conditions.grf



Flow in Red River at Lockport on April 09, 2007 was 1430 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

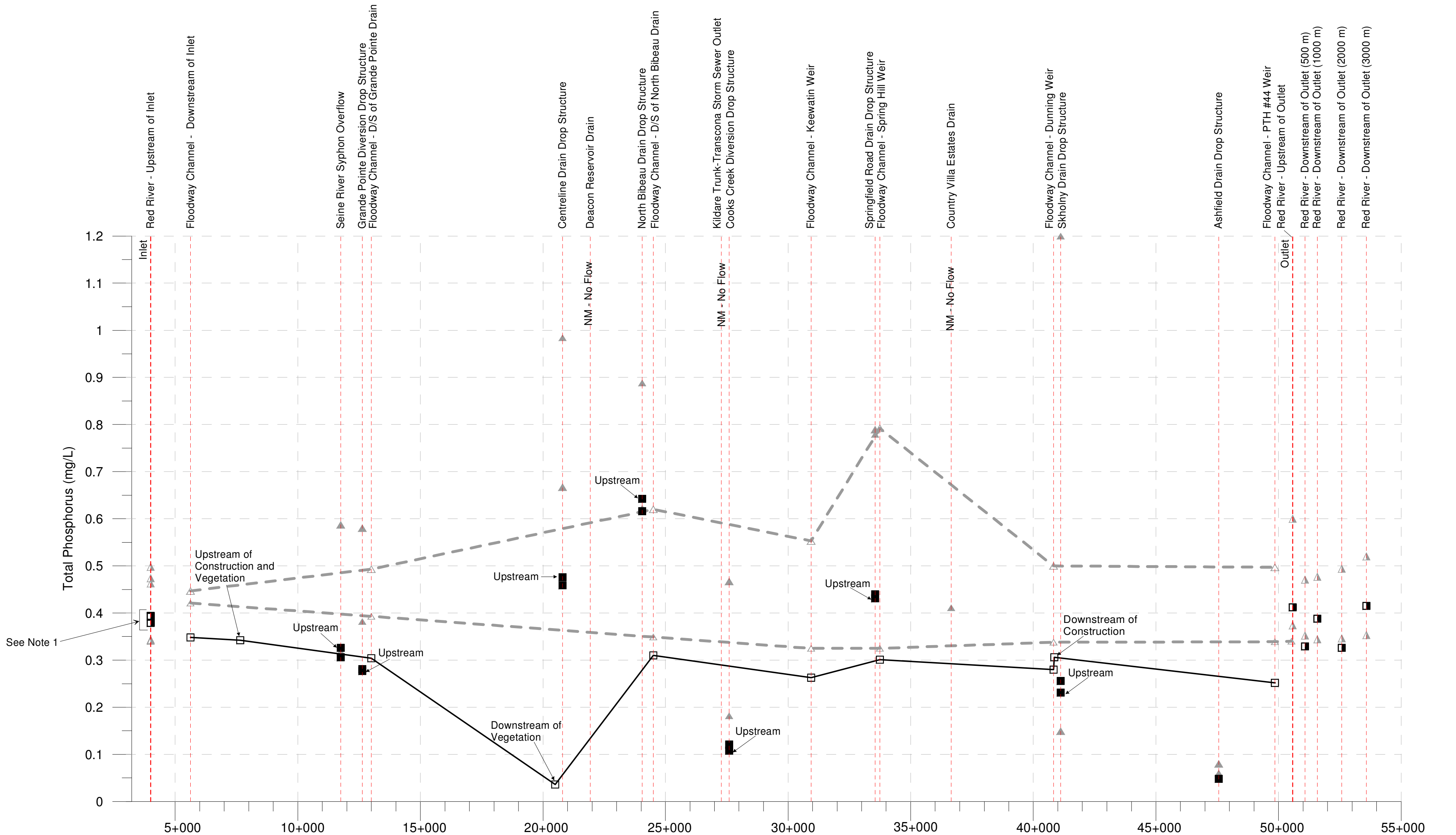
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL PHOSPHORUS
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-12	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6.4 April\FigNM6-12_Phosphorus construction_Spring flood.grf



Channel Summer Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)
Channel 3-July-07

Drain Summer Flood Baseline
Drain 3-July-07

River Summer Flood Baseline
River 3-July-07

Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905228-NM6-13

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

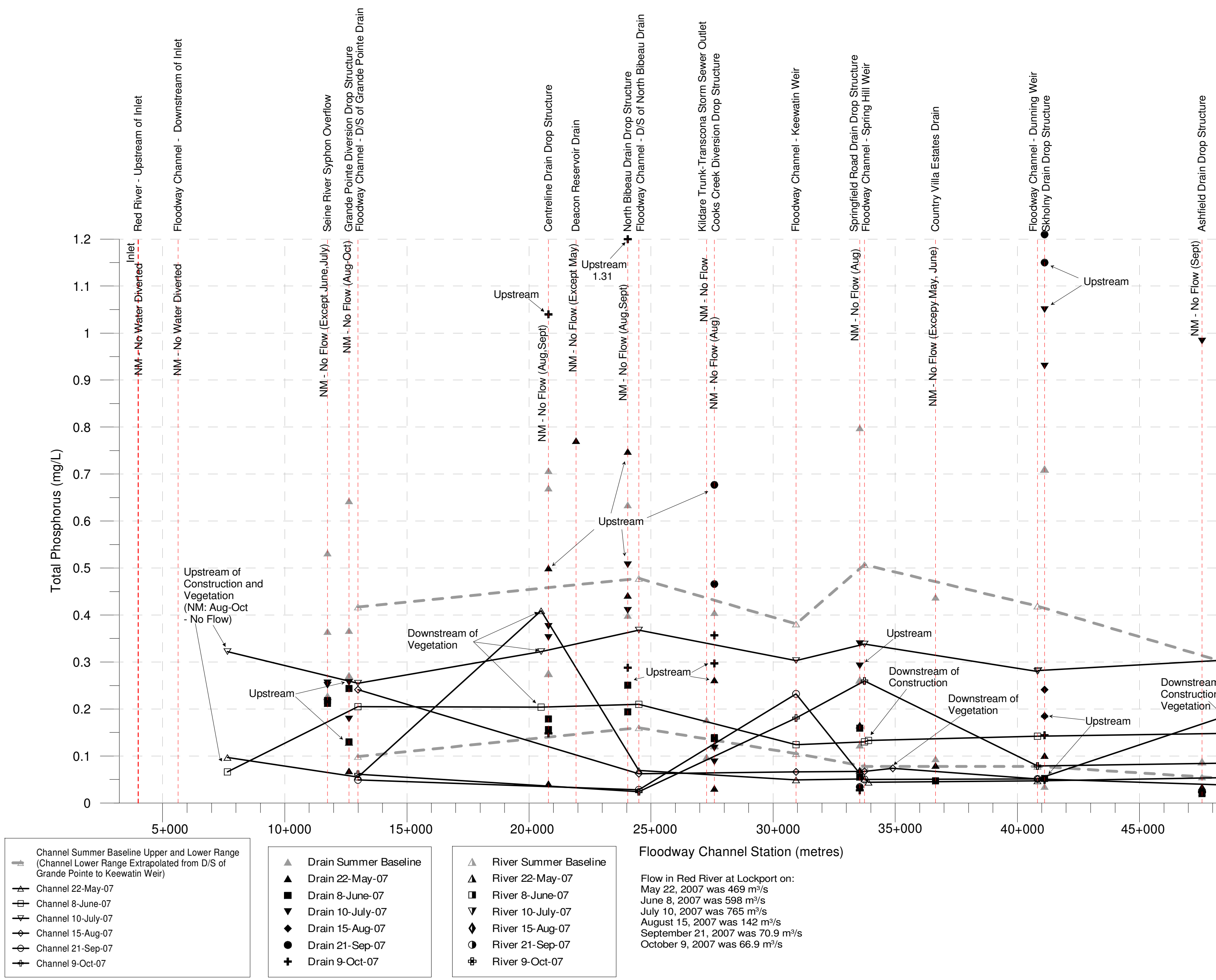
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL PHOSPHORUS
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-13	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6-13_Summer Flood



MEMO REFERENCE 05-1100-01:9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

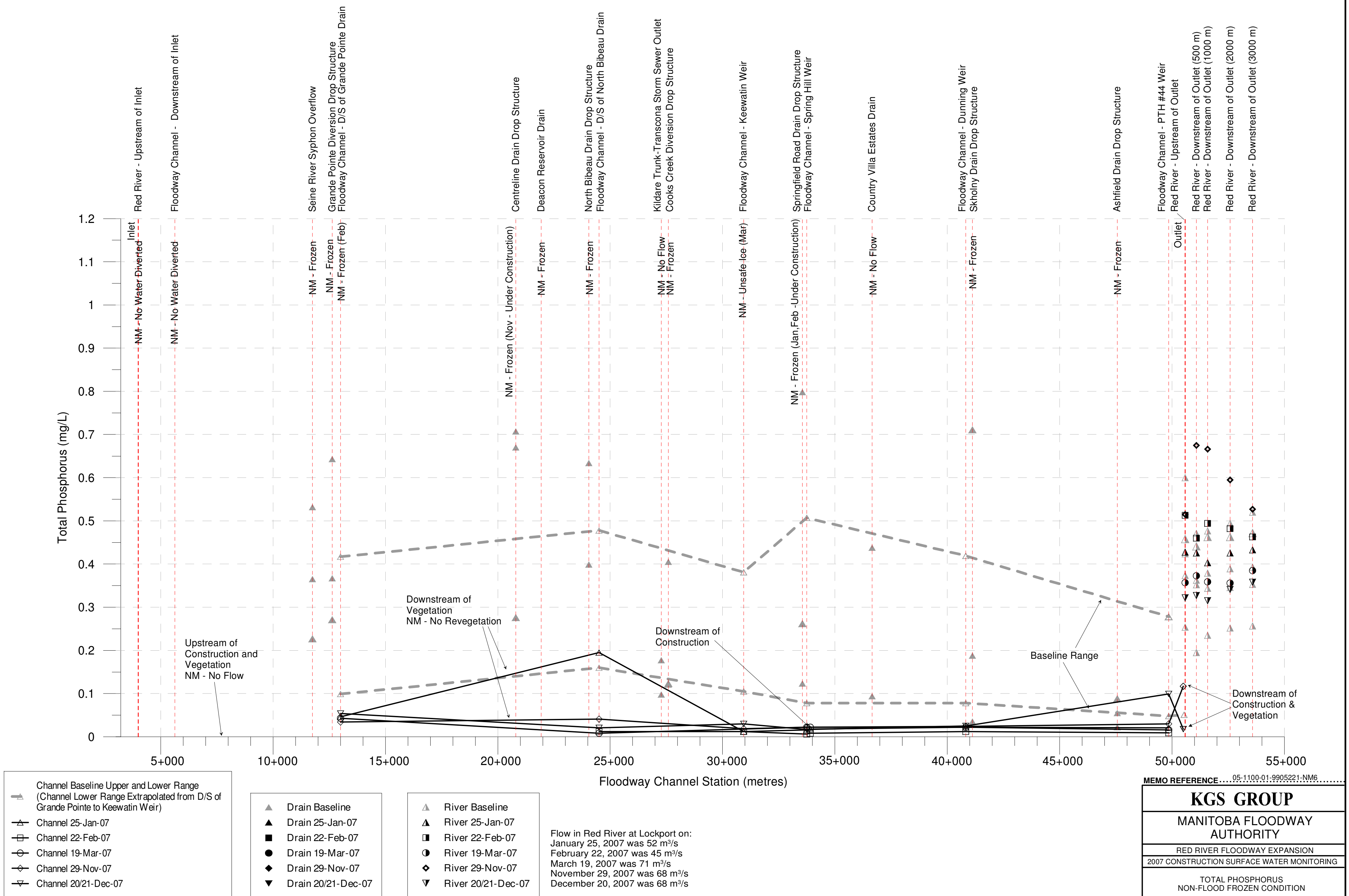
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL PHOSPHORUS
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-14	REV A

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Phosphorus\FigNM6-14_Phosphorus construction_Non-flood unfrozen condition.grf



MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

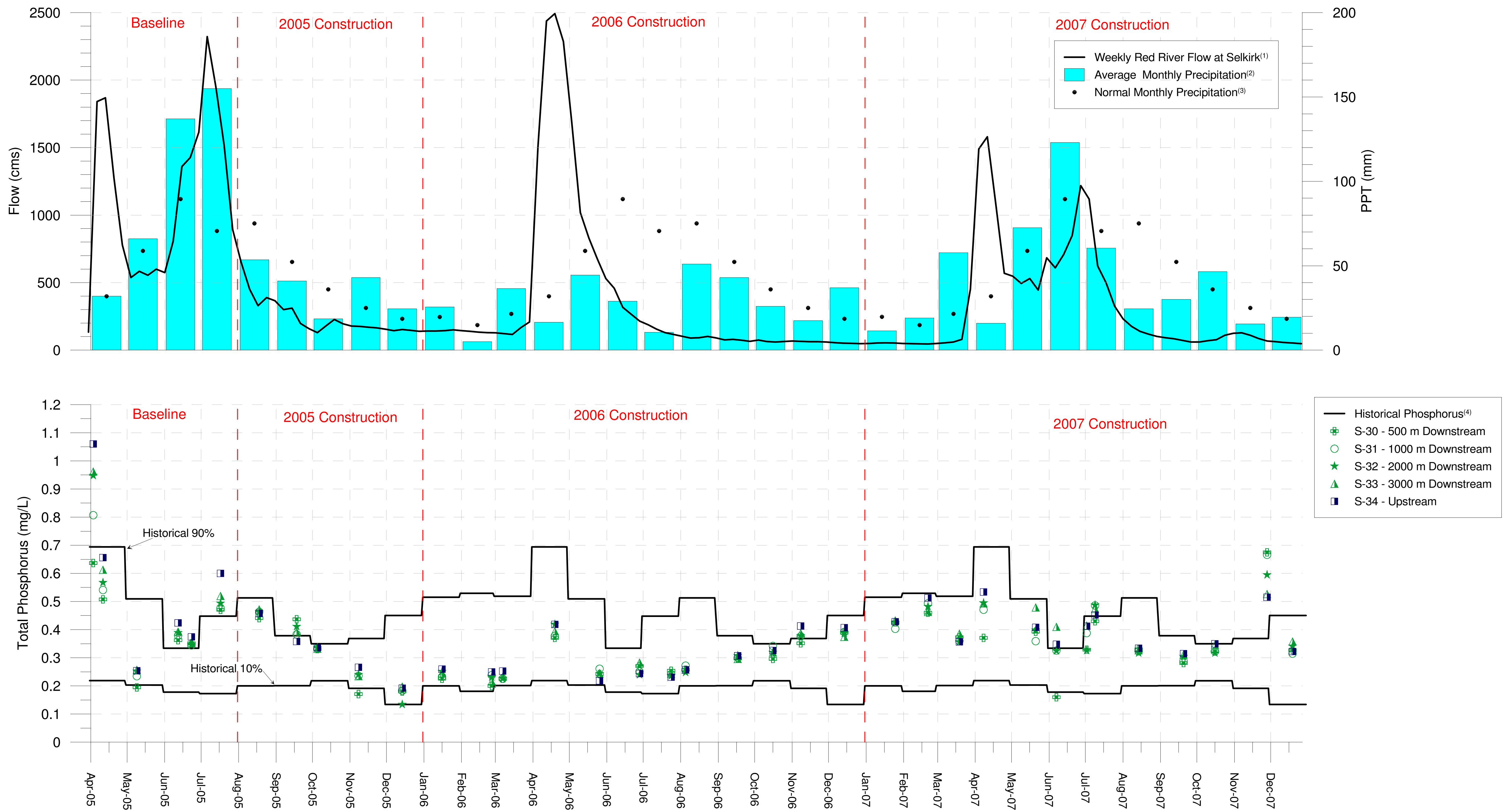
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

TOTAL PHOSPHORUS
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-15	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Phosphorus\FigNM6-15_Phosphorus construction_Non-flood frozen condition.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
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\2007 Construction\Graphs\Annual\Historical Data

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

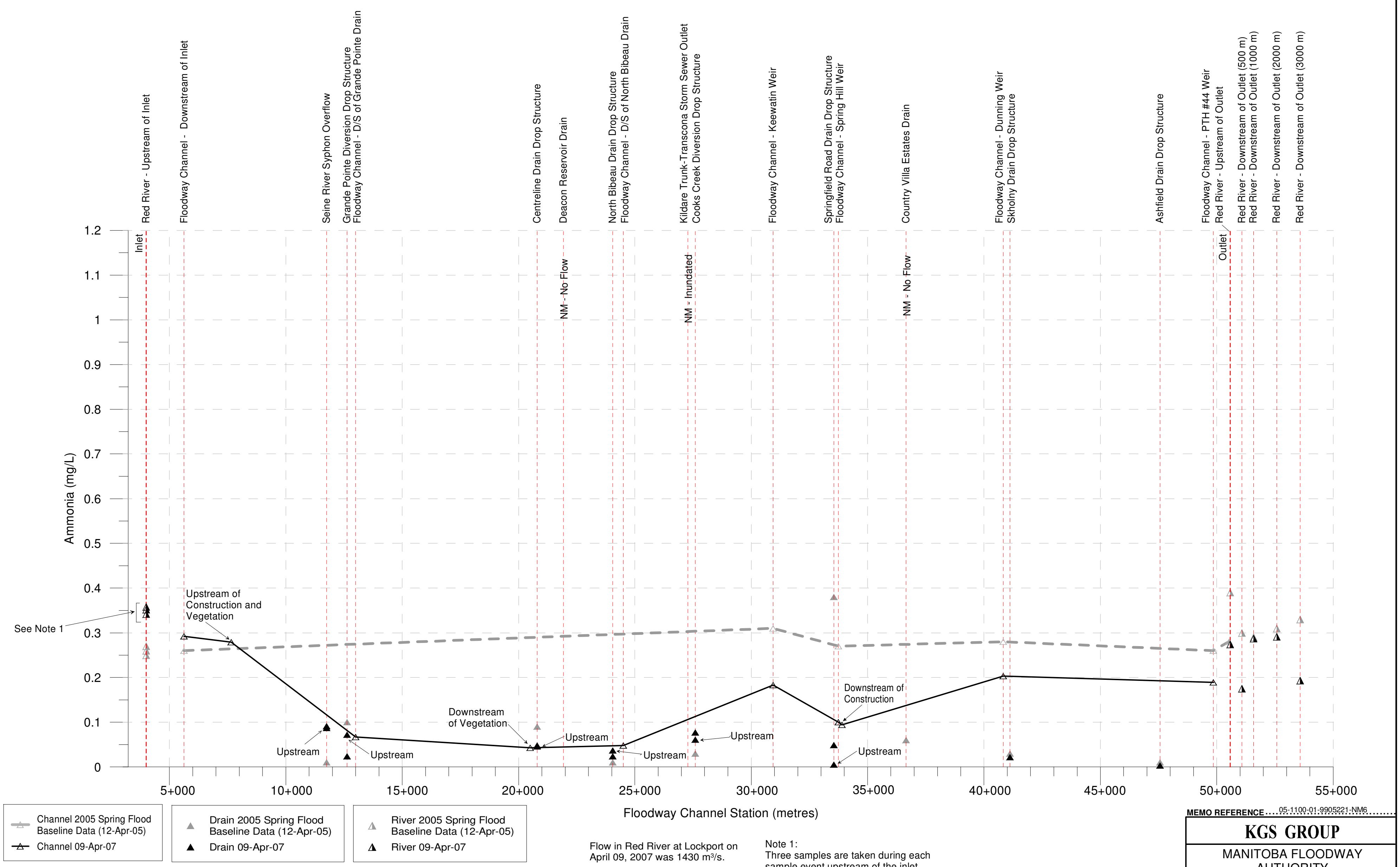
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
TOTAL PHOSPHORUS

FEBRUARY 2008	FIGURE NM6-16	REV 0



Flow in Red River at Lockport on April 09, 2007 was 1430 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

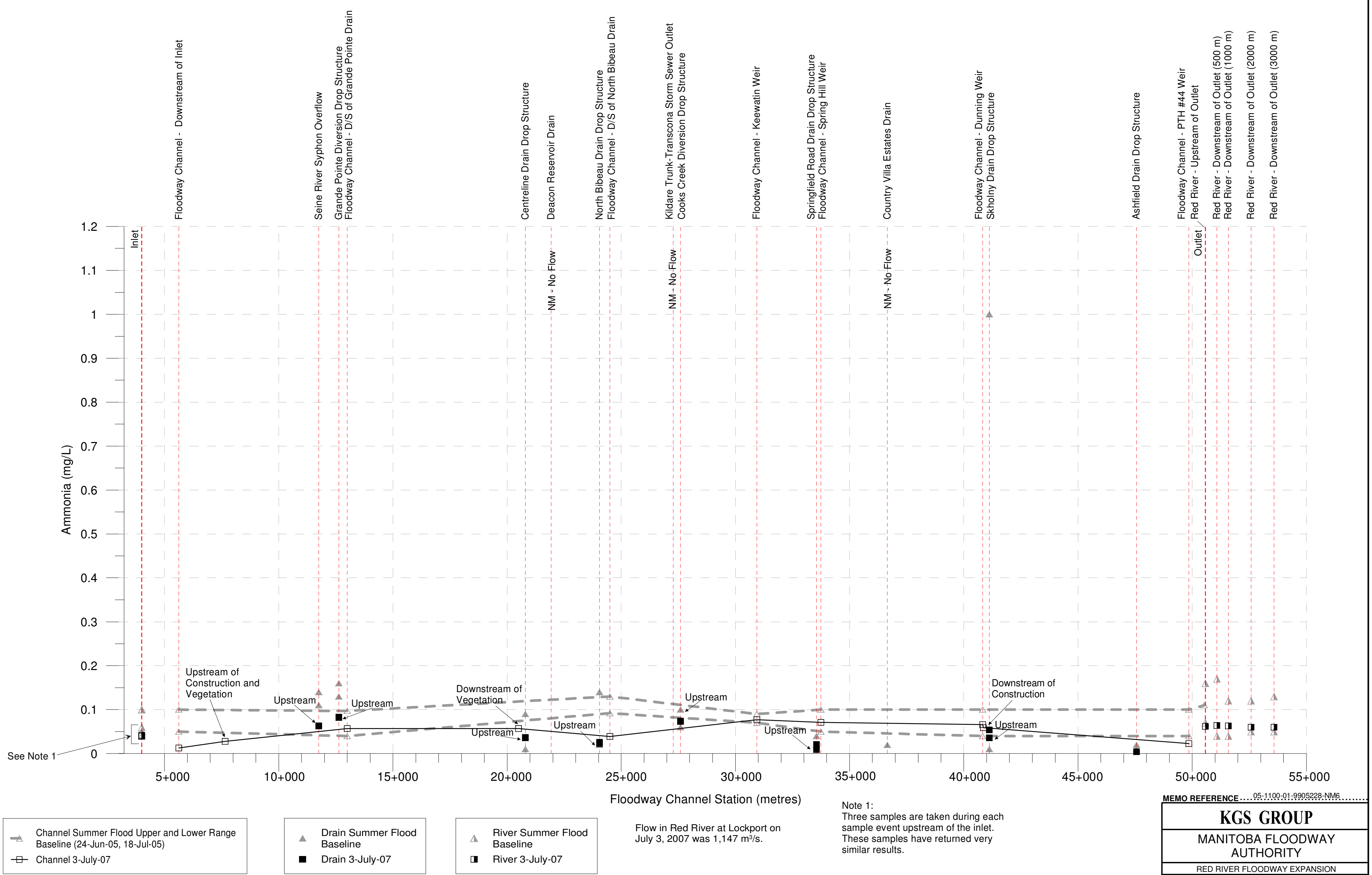
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-17	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Ammonia\FigNM6-17_Ammonia construction_Spring flood.grf



Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905228-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

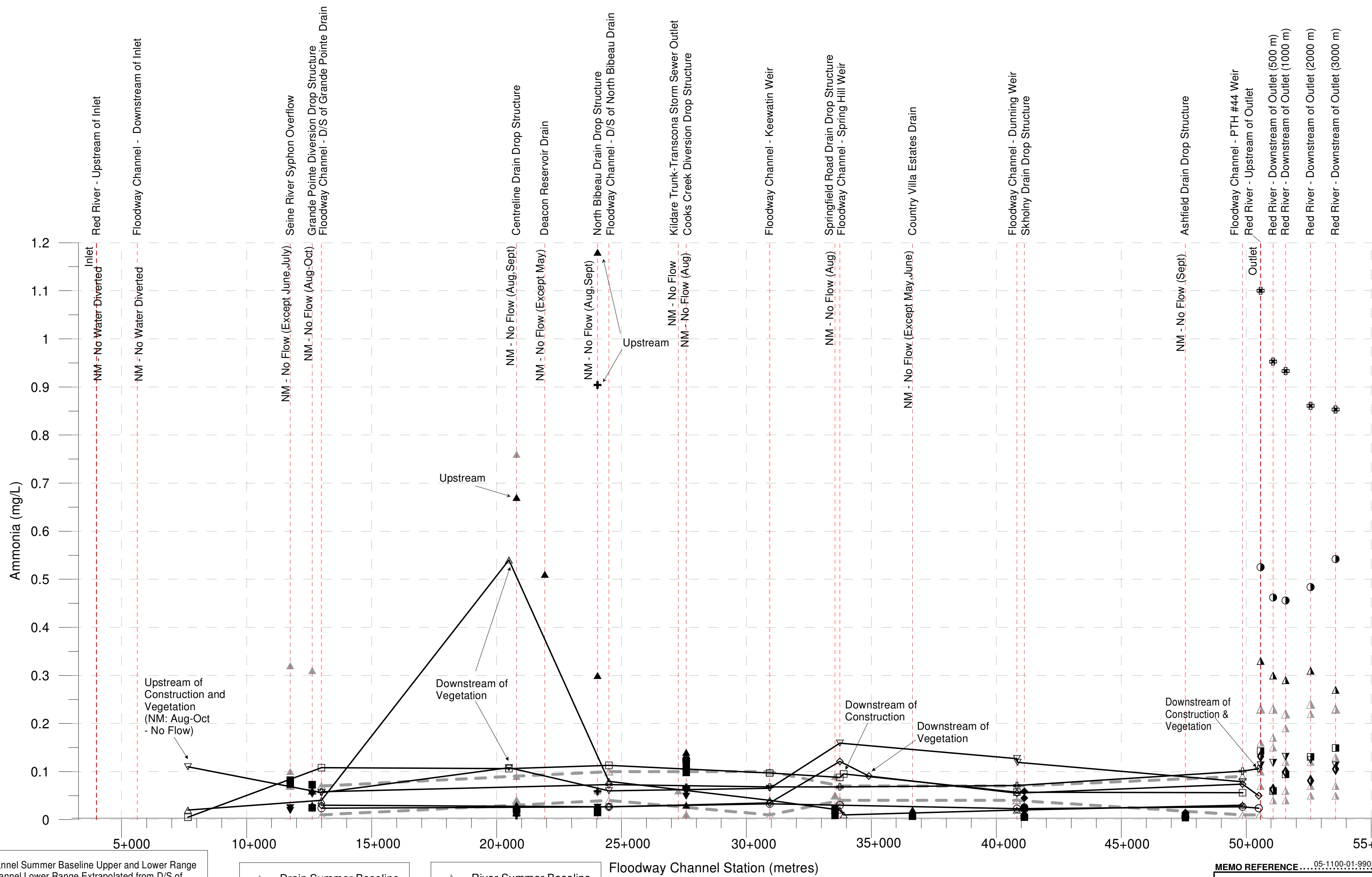
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-18	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6-18_Summer Flood



Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 22-May-07
Channel 8-June-07
Channel 10-July-07
Channel 15-Aug-07
Channel 21-Sep-07
Channel 9-Oct-07

Drain Summer Baseline
Drain 22-May-07
Drain 8-June-07
Drain 10-July-07
Drain 15-Aug-07
Drain 21-Sep-07
Drain 9-Oct-07

River Summer Baseline
River 22-May-07
River 8-June-07
River 10-July-07
River 15-Aug-07
River 21-Sep-07
River 9-Oct-07

Flow in Red River at Lockport on:
May 22, 2007 was 469 m^3/s
June 8, 2007 was 598 m^3/s
July 10, 2007 was 765 m^3/s
August 15, 2007 was 142 m^3/s
September 21, 2007 was 70.9 m^3/s
October 9, 2007 was 66.9 m^3/s

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

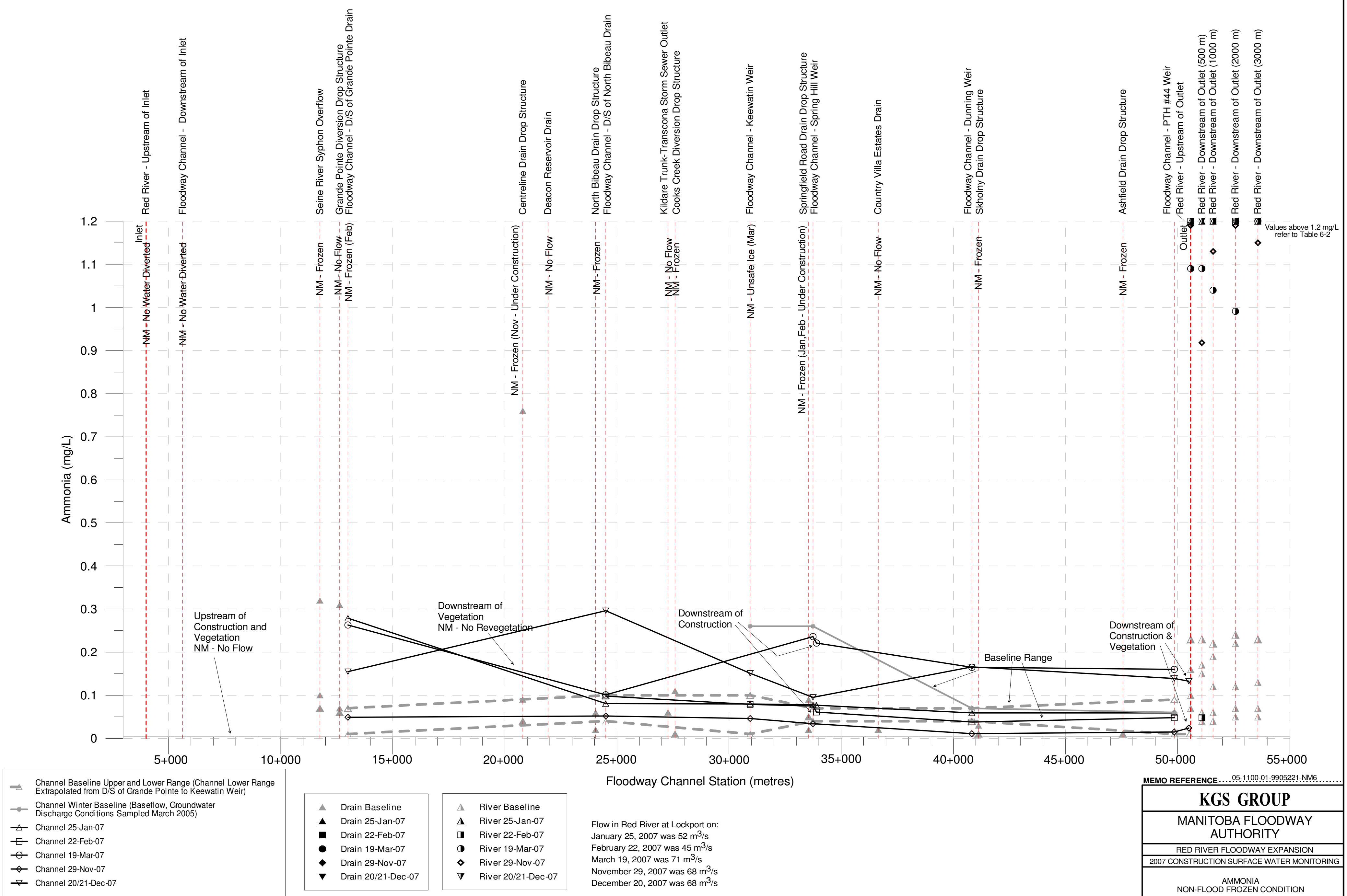
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-19	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Ammonia\FigNM6-18_Ammonia construction_Summer flood.grf\FigNM6-19_Ammonia construction_Non-flood unfrozen condition.grf



MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

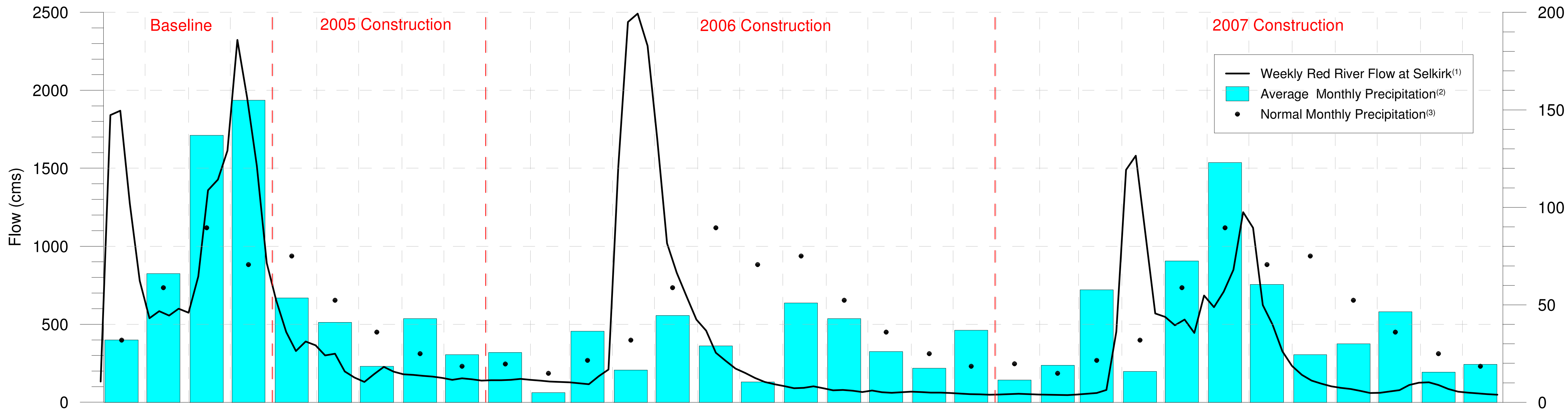
RED RIVER FLOODWAY EXPANSION

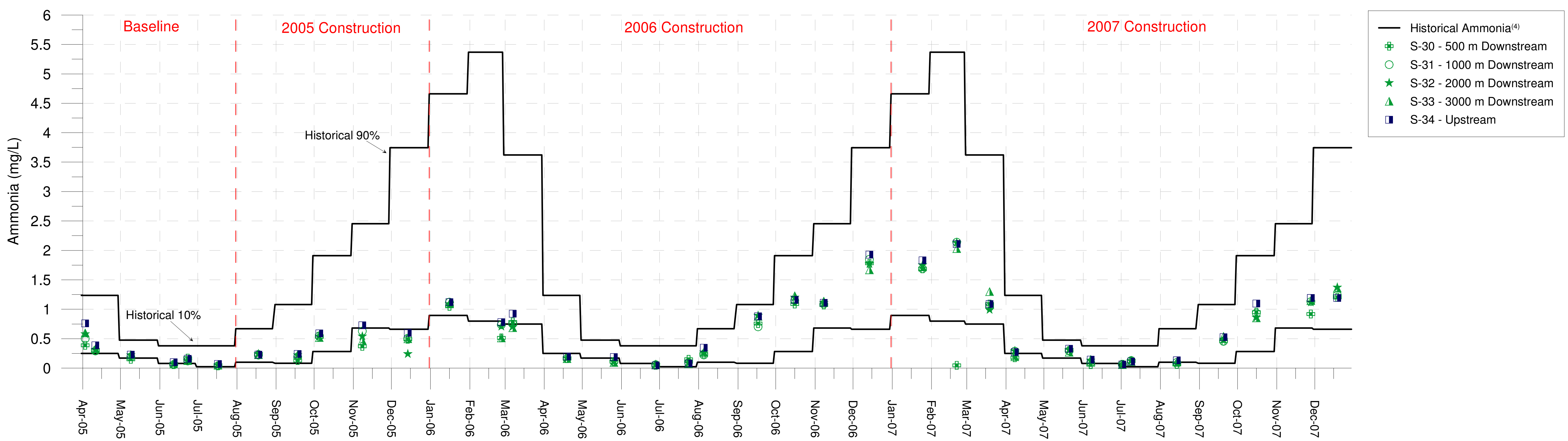
2007 CONSTRUCTION SURFACE WATER MONITORING

AMMONIA
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-20	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Ammonia\FigNM6-20_Ammonia 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

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\2007 Construction\Graphs\Annual\Historical Data

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

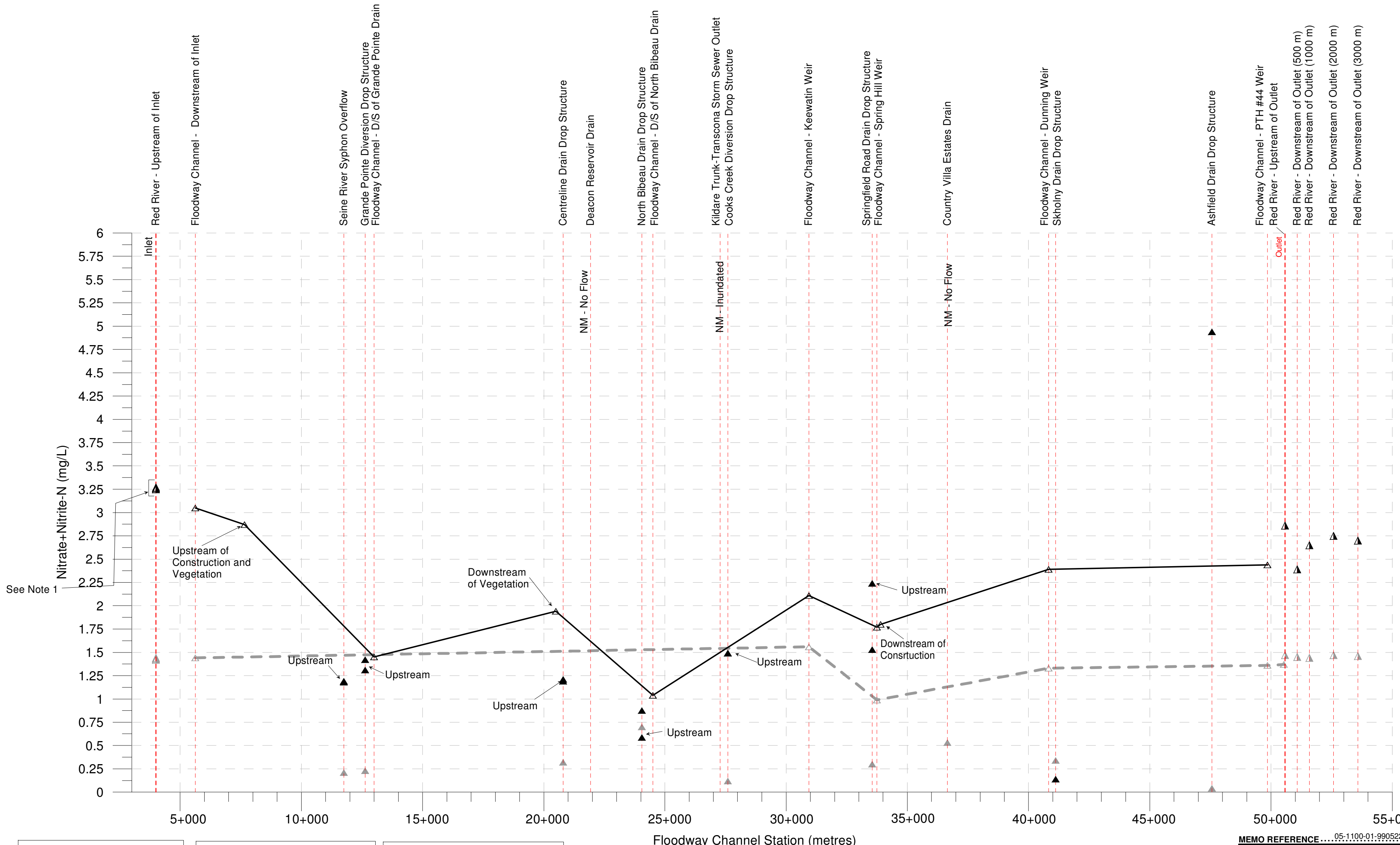
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
AMMONIA

FEBRUARY 2008 | FIGURE NM6-21 | REV 0



Channel 2005 Spring Flood Baseline Data (12-Apr-05)
Channel 09-Apr-07

Drain 2005 Spring Flood Baseline Data (12-Apr-05)
Drain 09-Apr-07

River 2005 Spring Flood Baseline Data (12-Apr-05)
River 09-Apr-07

Flow in Red River at Lockport on April 09, 2007 was 1430 m^3/s

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

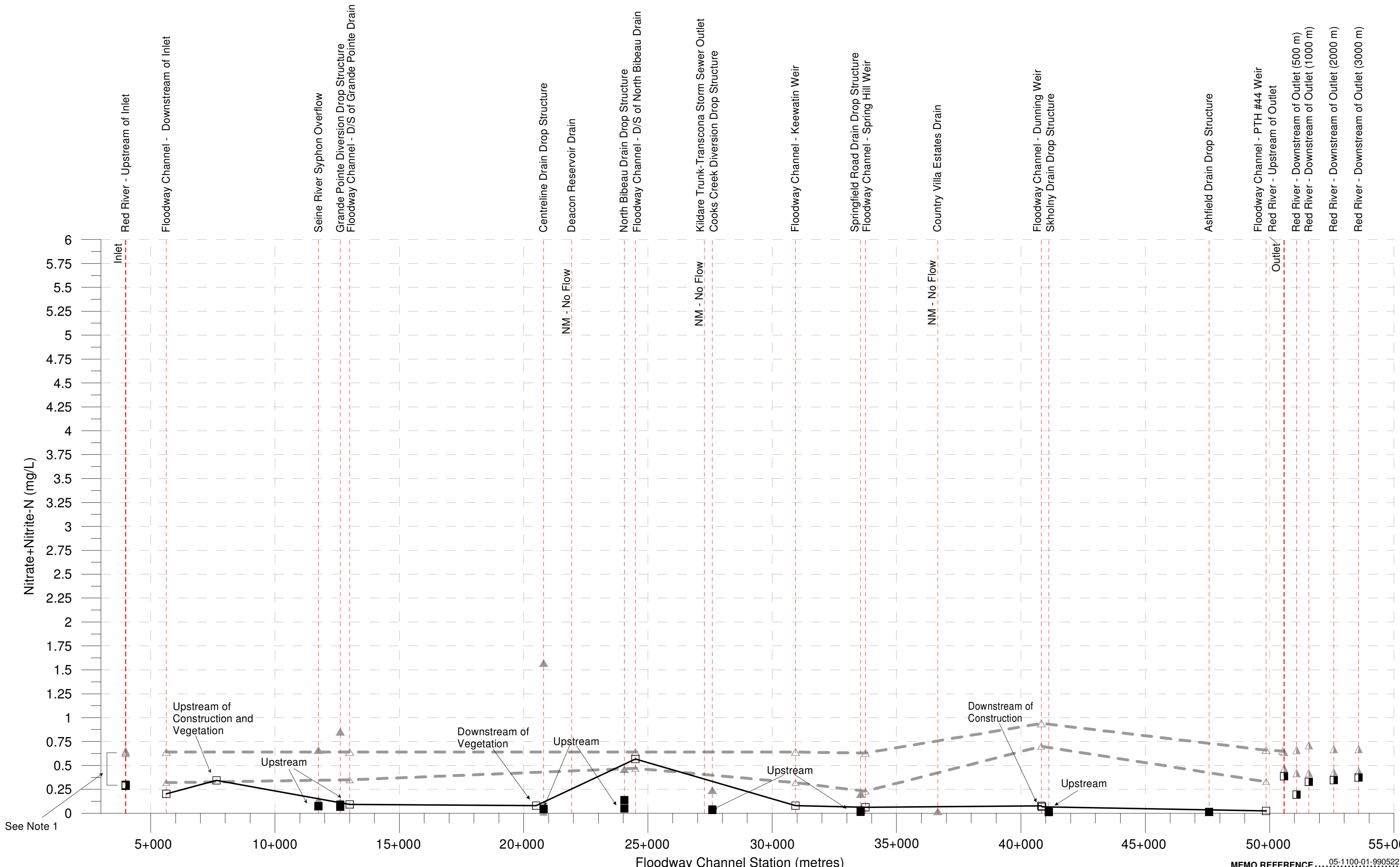
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-22	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\N&N\FigNM6-22_Nitrate+Nitrite construction_Spring Flood.grf



Channel Summer Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)
Channel 3-July-07

Drain Summer Flood Baseline
Drain 3-July-07

River Summer Flood Baseline
River 3-July-07

Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

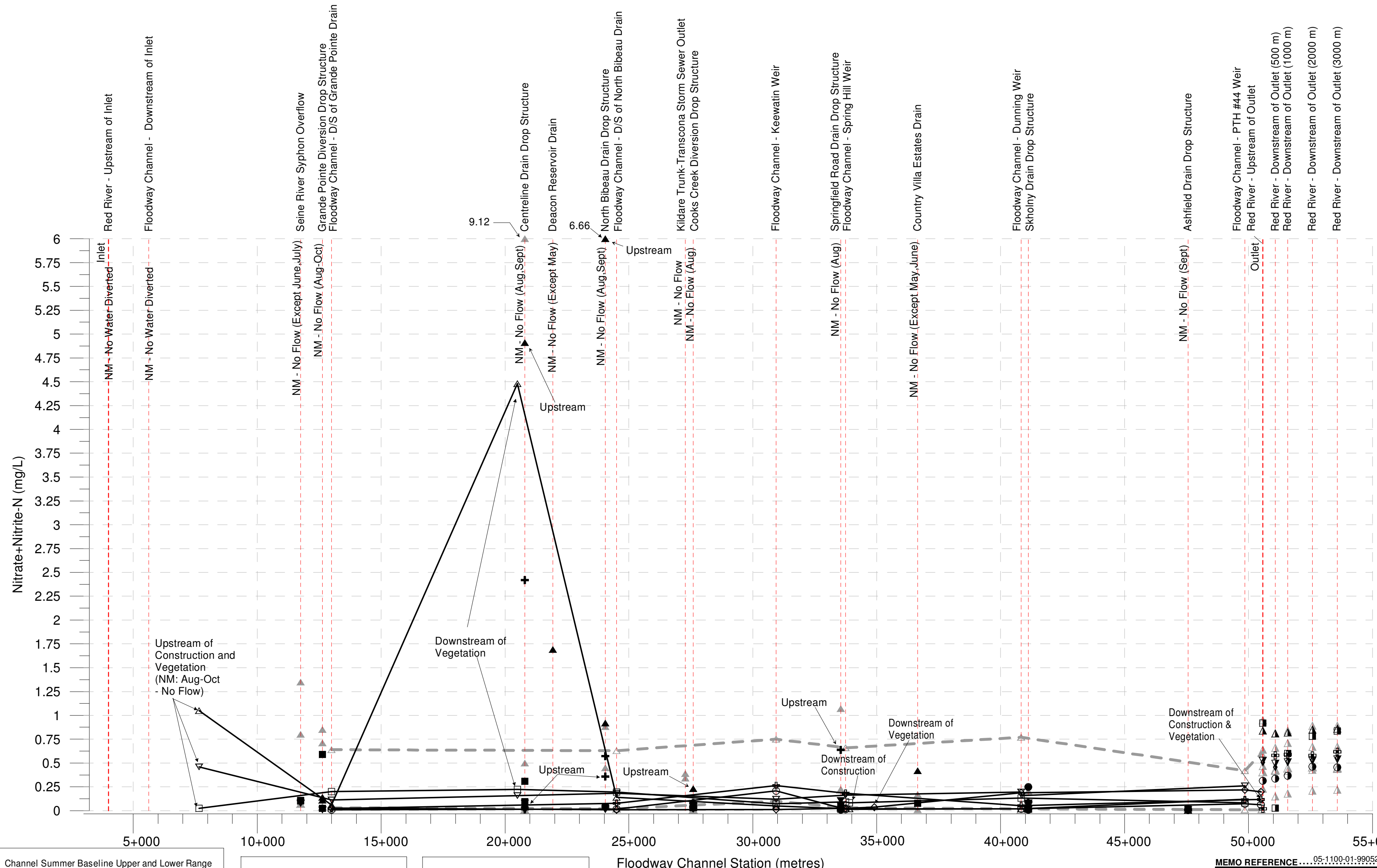
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-23	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\N&N\FigNM6-23_Nitrate+Nitrite construction_Summer Flood.grf



Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 22-May-07
Channel 8-June -07
Channel 10-July-07
Channel 15-Aug-07
Channel 21-Sep-07
Channel 9-Oct-07

Drain Summer Baseline
Drain 22-May-07
Drain 8-June-07
Drain 10-July-07
Drain 15-Aug-07
Drain 21-Sep -07
Drain 9-Oct -07

River Summer Baseline
River 22-May-07
River 8-June-07
River 10-July-07
River 15-Aug-07
River 21-Sep -07
River 9-Oct-07

Flow in Red River at Lockport on:
May 22, 2007 was 469 m^3/s
June 8, 2007 was 598 m^3/s
July 10, 2007 was 765 m^3/s
August 15, 2007 was 172 m^3/s
September 21, 2007 was 70.9 m^3/s
October 9, 2007 was 66.9 m^3/s

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

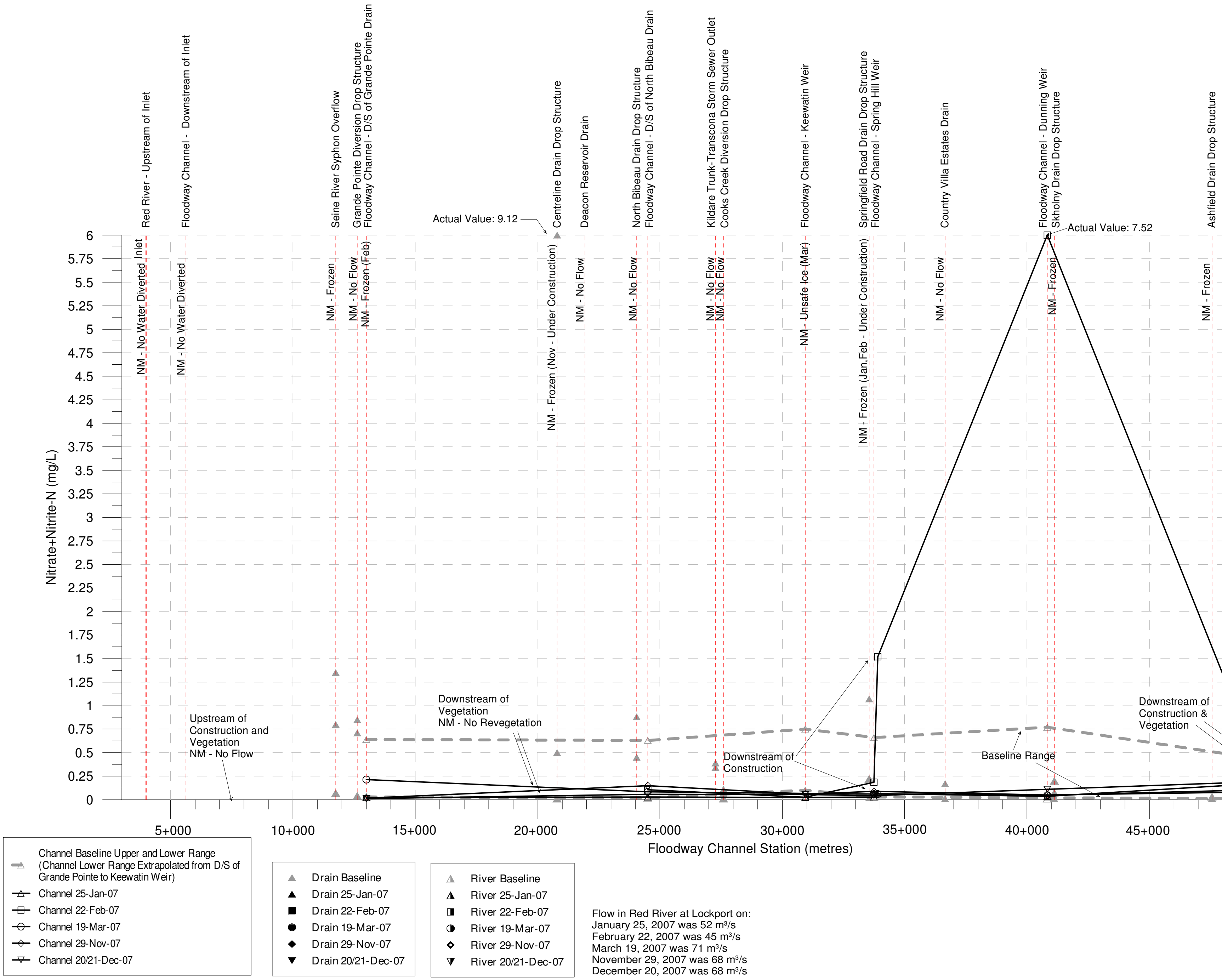
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION
2007 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-24	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\N&N\FigNM6-24_Nitrate+Nitrite construction_Non-flood unfrozen condition.grf



Flow in Red River at Lockport on:
January 25, 2007 was 52 m³/s
February 22, 2007 was 45 m³/s
March 19, 2007 was 71 m³/s
November 29, 2007 was 68 m³/s
December 20, 2007 was 68 m³/s

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\N&N\FigNM6-25_Nitrate+Nitrite construction_Non-flood frozen condition.grf

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

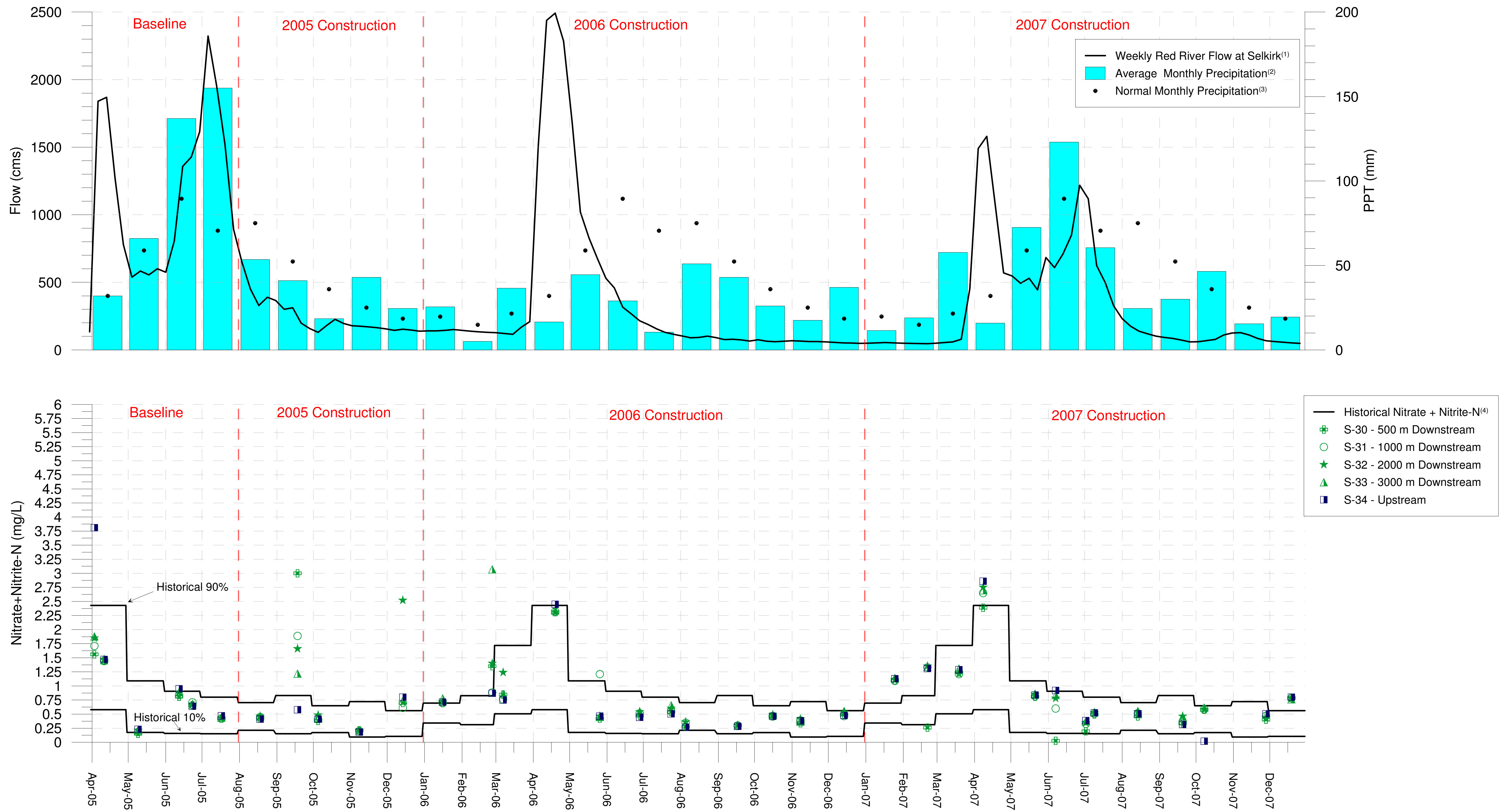
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

NITRATE+NITRITE-N
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-25	REV 0



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).

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\Annual\Historical Tables

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

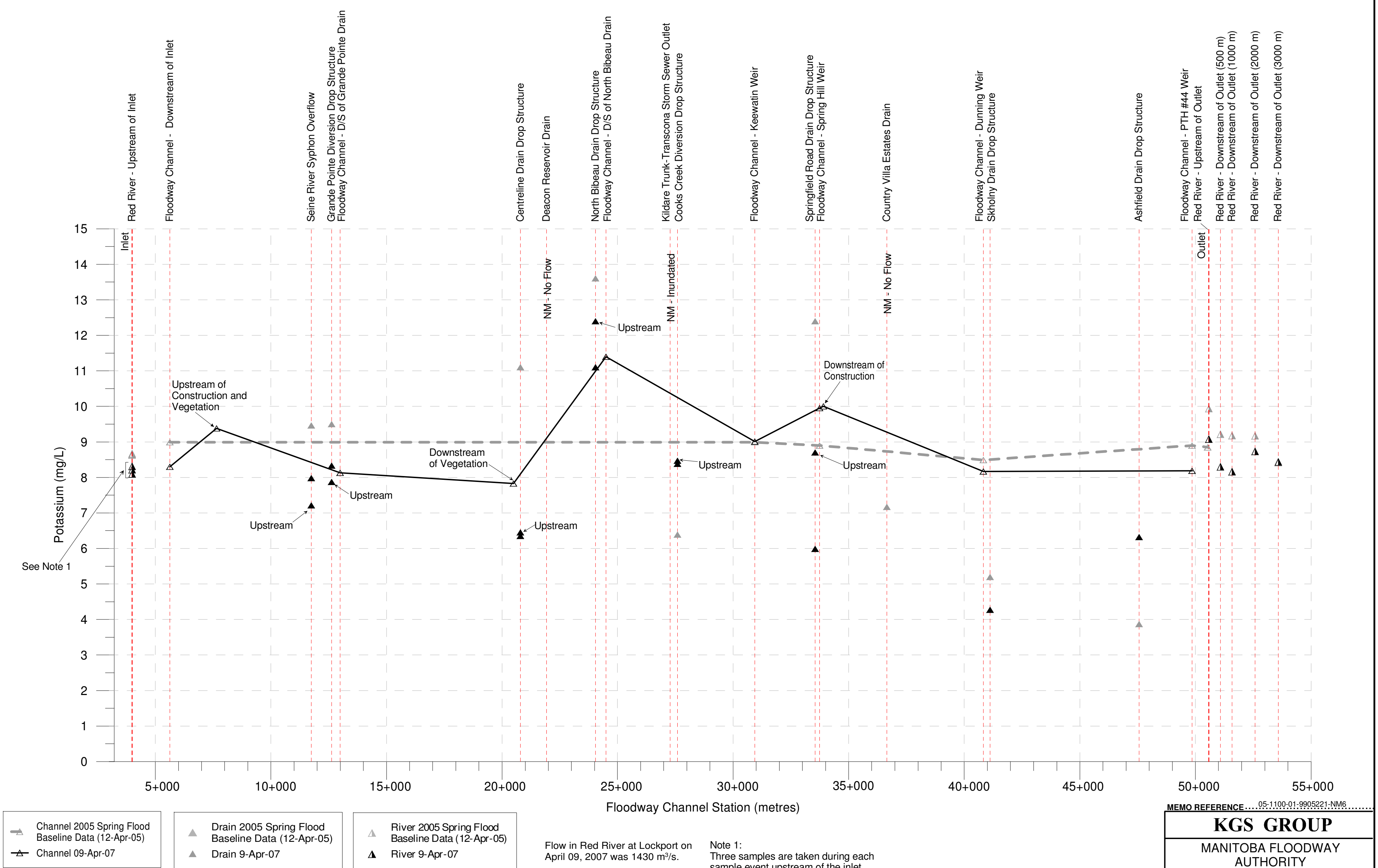
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

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

FEBRUARY 2008 | FIGURE NM6-26 | REV 0



Flow in Red River at Lockport on April 09, 2007 was 1430 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

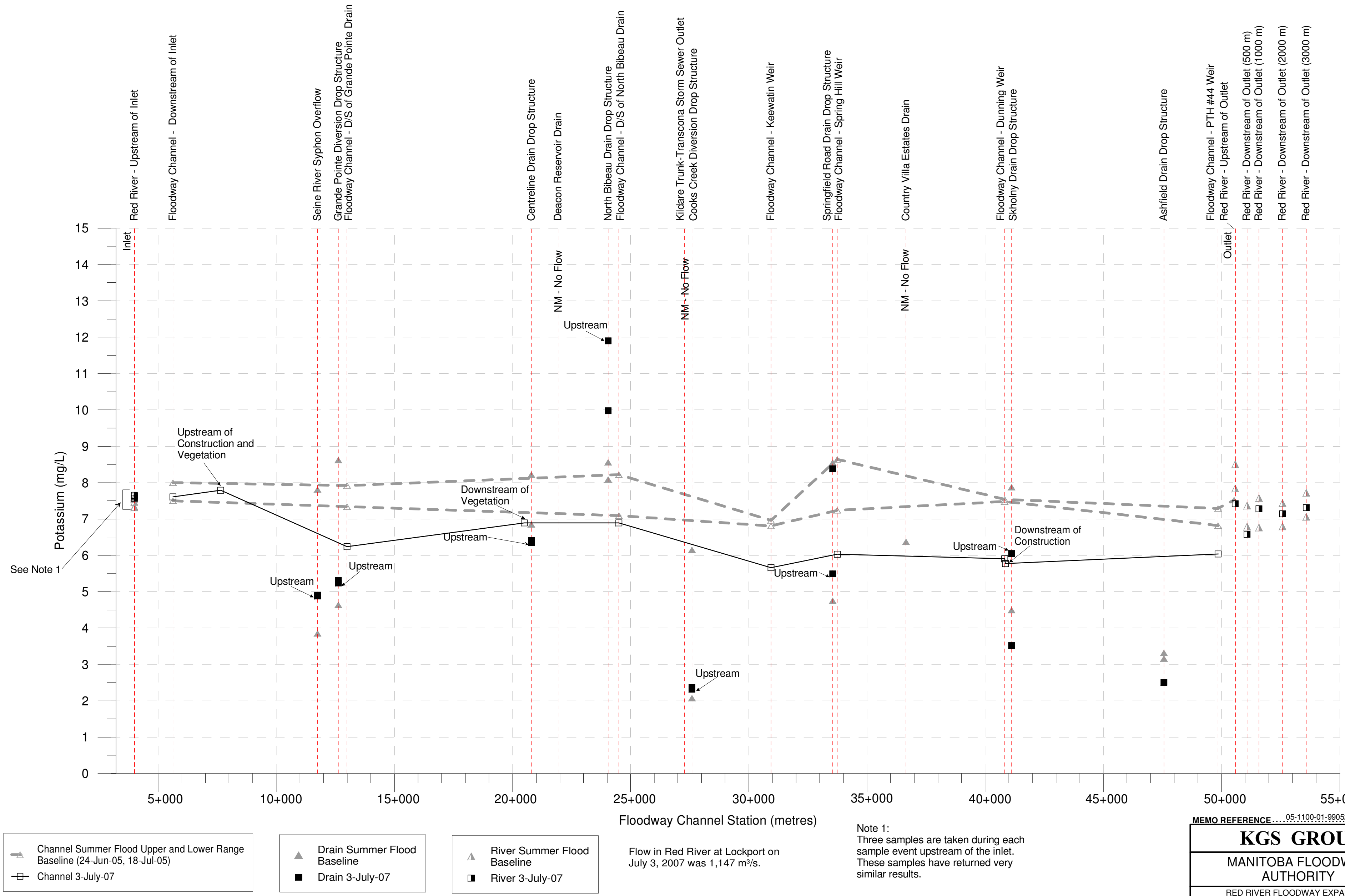
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

POTASSIUM
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-27	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2006 Construction\Graphs\FigNM6.4 April\FigNM6-27_Potassium construction_Spring flood.grf



MEMO REFERENCE 05-1100-01-9905228-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

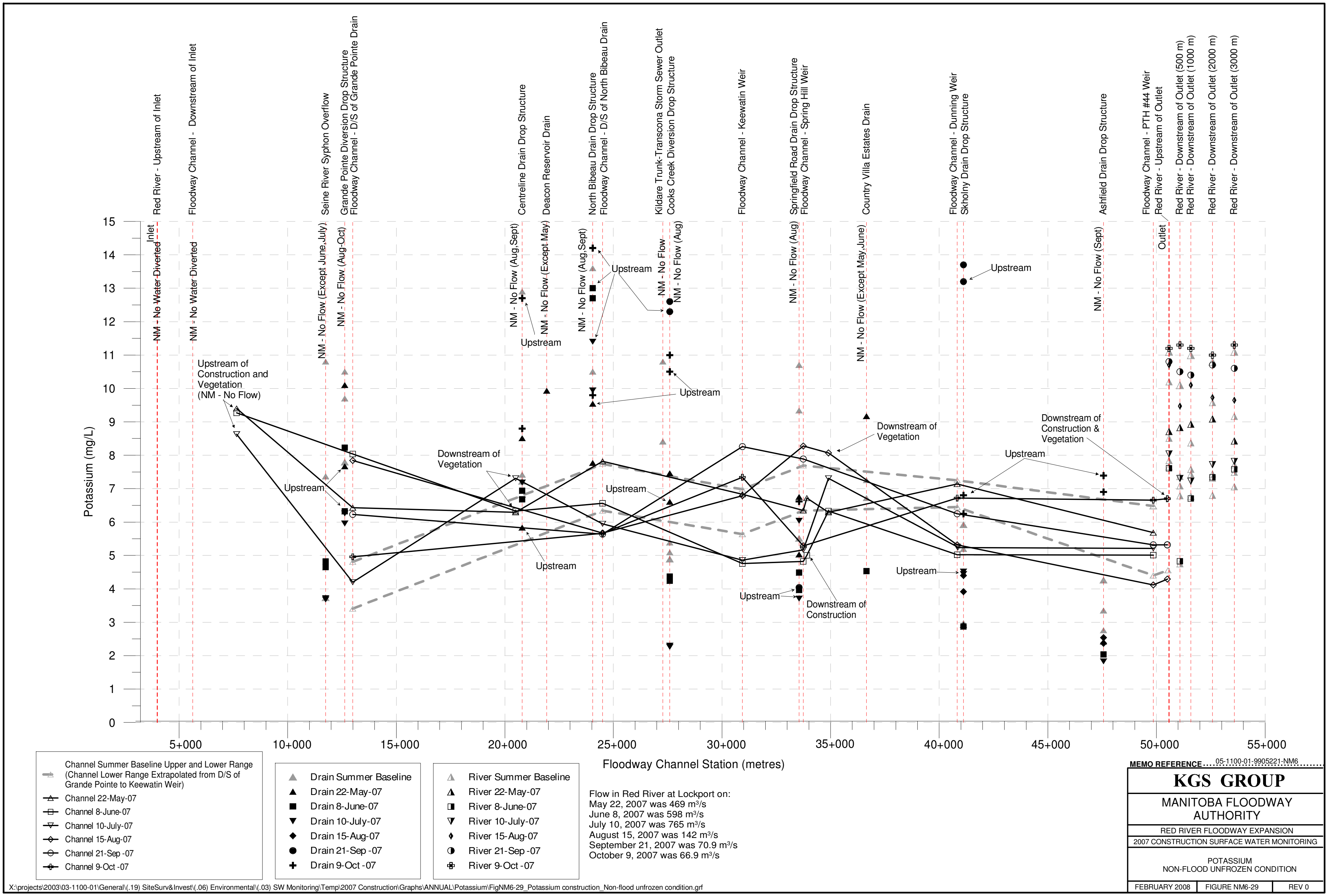
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

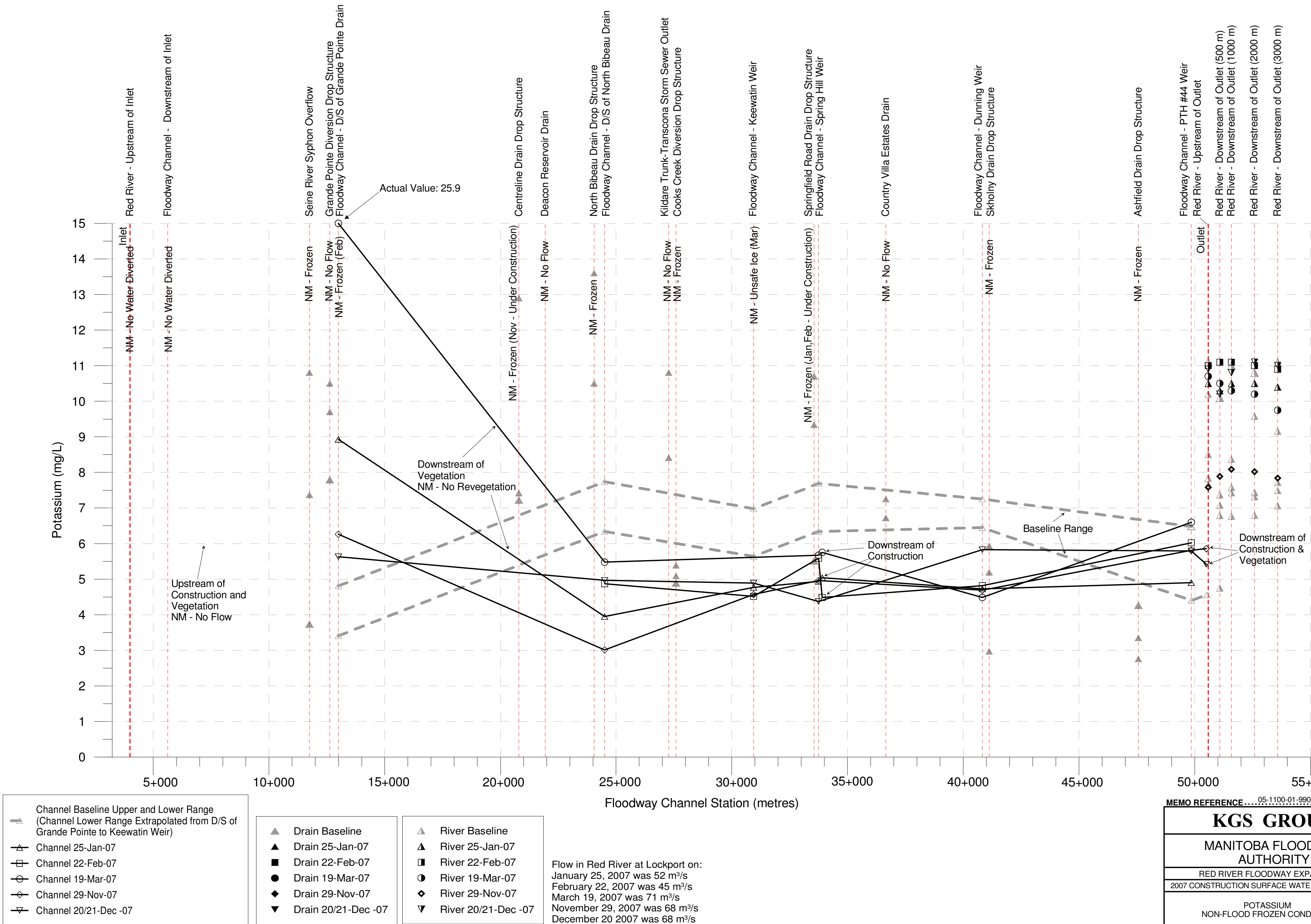
POTASSIUM
SUMMER FLOOD

FEBRUARY 2008 | FIGURE NM6-28 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6-28_Summer Flood



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
NM - No Water Diverted
NM - No Water Diverted
NM - No Flow (Except June,July)
NM - No Flow (Aug-Oct)
NM - No Flow (Aug,Sept)
NM - No Flow (Except May)
NM - No Flow (Aug,Sept)
NM - No Flow
NM - No Flow (Aug)
NM - No Flow (Aug)
NM - No Flow (Except May,June)
NM - No Flow (Sept)
Outlet
Upstream of Construction and Vegetation (NM - No Flow)
Upstream
Downstream of Vegetation
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Downstream of Construction
Downstream of Vegetation
Upstream
Upstream
Downstream of Construction & Vegetation
Upstream
Potassium (mg/L)
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 22-May-07
Channel 8-June-07
Channel 10-July-07
Channel 15-Aug-07
Channel 21-Sep -07
Channel 9-Oct -07
Drain Summer Baseline
Drain 22-May-07
Drain 8-June-07
Drain 10-July-07
Drain 15-Aug-07
Drain 21-Sep -07
Drain 9-Oct -07
River Summer Baseline
River 22-May-07
River 8-June-07
River 10-July-07
River 15-Aug-07
River 21-Sep -07
River 9-Oct -07
Flow in Red River at Lockport on:
May 22, 2007 was 469 m³/s
June 8, 2007 was 598 m³/s
July 10, 2007 was 765 m³/s
August 15, 2007 was 142 m³/s
September 21, 2007 was 70.9 m³/s
October 9, 2007 was 66.9 m³/s
MEMO REFERENCE 05-1100-01-9905221-NM6
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2007 CONSTRUCTION SURFACE WATER MONITORING
POTASSIUM
NON-FLOOD UNFROZEN CONDITION
FEBRUARY 2008
FIGURE NM6-29
REV 0
X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Potassium\FigNM6-29_Potassium construction_Non-flood unfrozen condition.grf



Flow in Red River at Lockport on:
January 25, 2007 was 52 m³/s
February 22, 2007 was 45 m³/s
March 19, 2007 was 71 m³/s
November 29, 2007 was 68 m³/s
December 20 2007 was 68 m³/s

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Potassium\FigNM6-30_Potassium construction_Non-flood frozen condition.grf

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

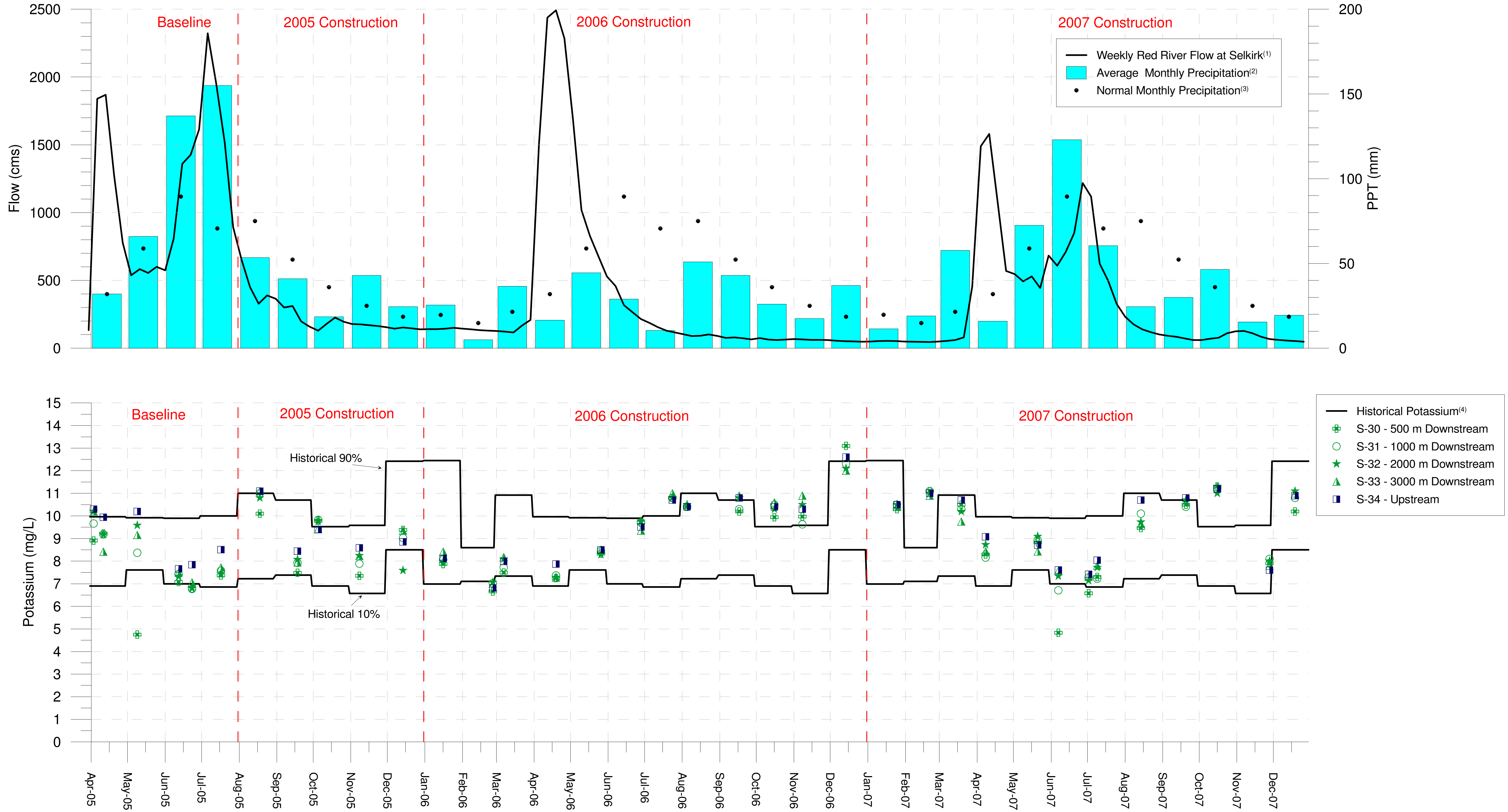
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

POTASSIUM
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-30	REV 0



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 10^{th} and 90^{th} 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\2007 Construction\Graphs\Annual\Historical Tables

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

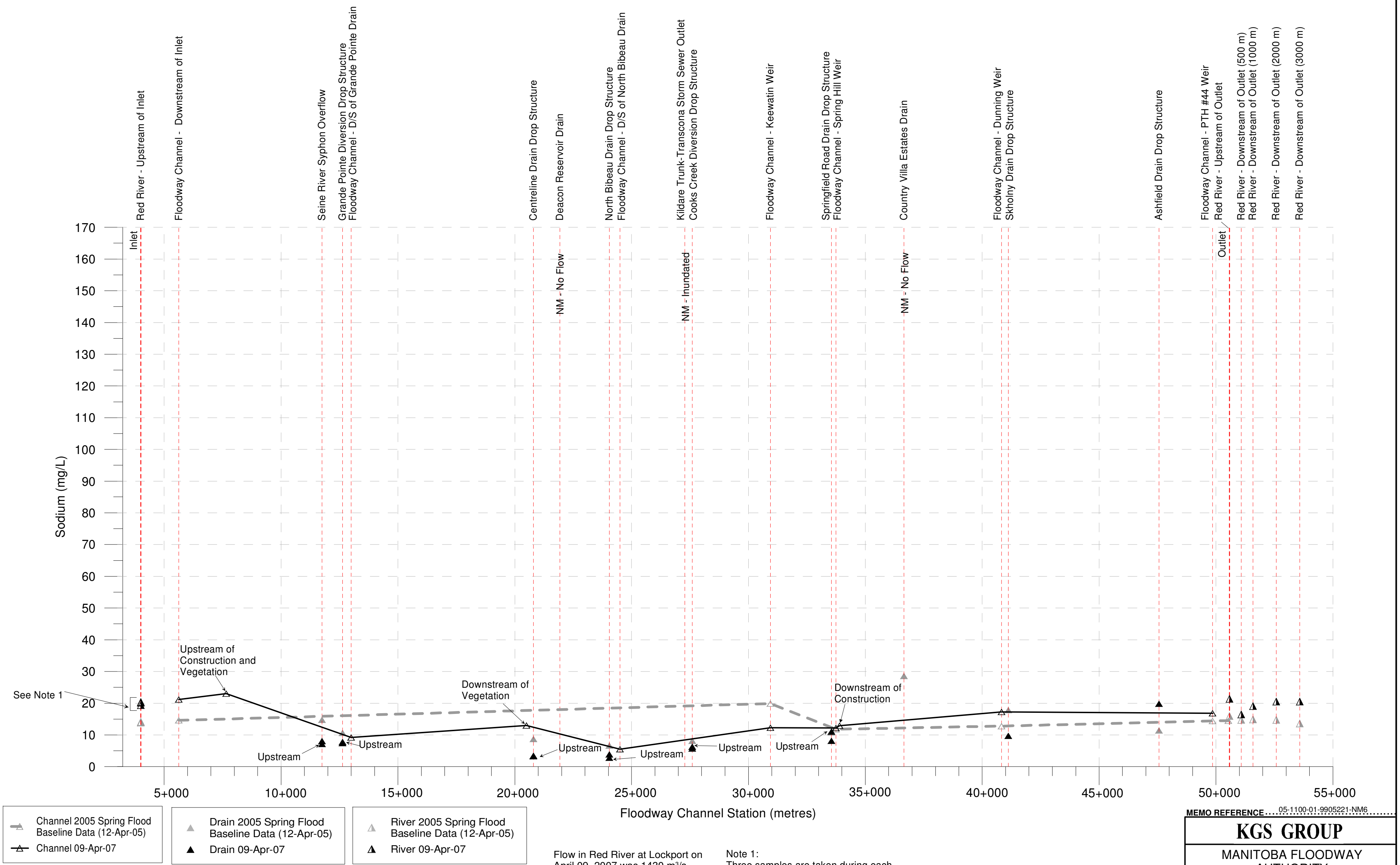
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

HISTORICAL WATER QUALITY COMPARISON
RED RIVER AT FLOODWAY OUTLET
POTASSIUM

FEBRUARY 2008	FIGURE NM6-31	REV 0



Flow in Red River at Lockport on April 09, 2007 was 1430 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

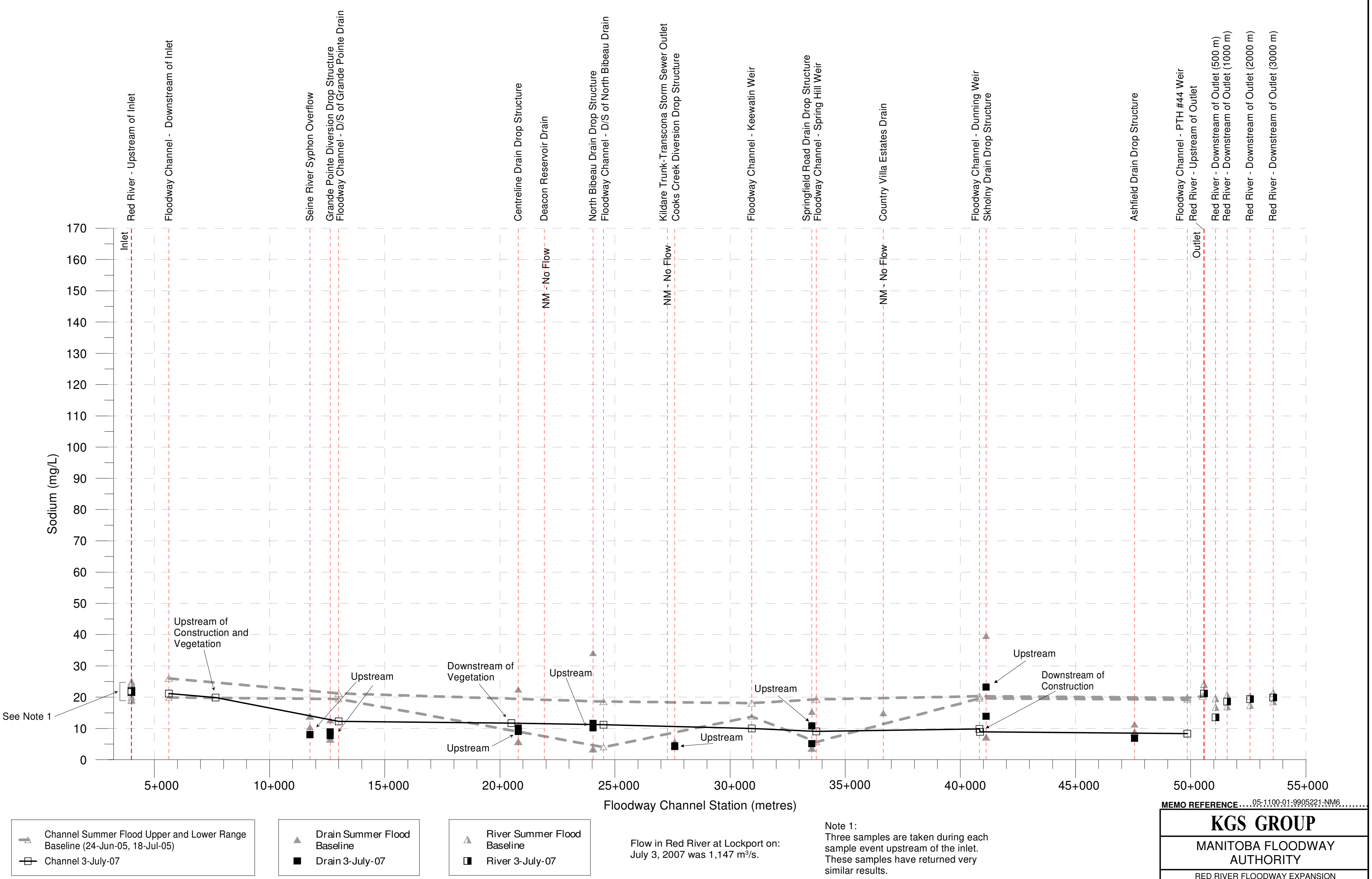
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-32	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Sodium\FigNM6-32_Sodium construction_Spring flood.grf



Flow in Red River at Lockport on: July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

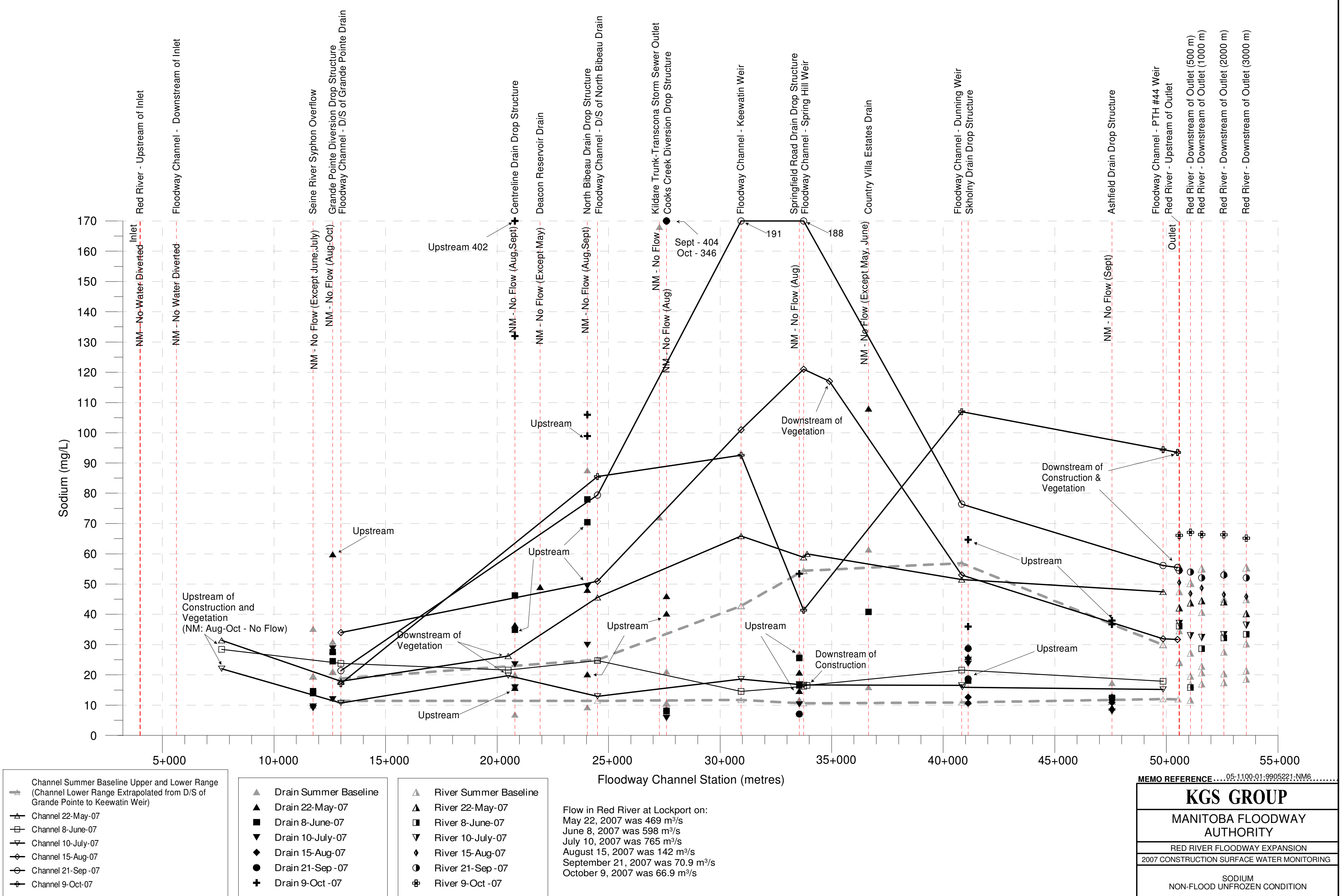
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-33	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Sodium\FigNM6-33_Sodium construction_summer flood.grf



Flow in Red River at Lockport on:
May 22, 2007 was 469 m³/s
June 8, 2007 was 598 m³/s
July 10, 2007 was 765 m³/s
August 15, 2007 was 142 m³/s
September 21, 2007 was 70.9 m³/s
October 9, 2007 was 66.9 m³/s

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

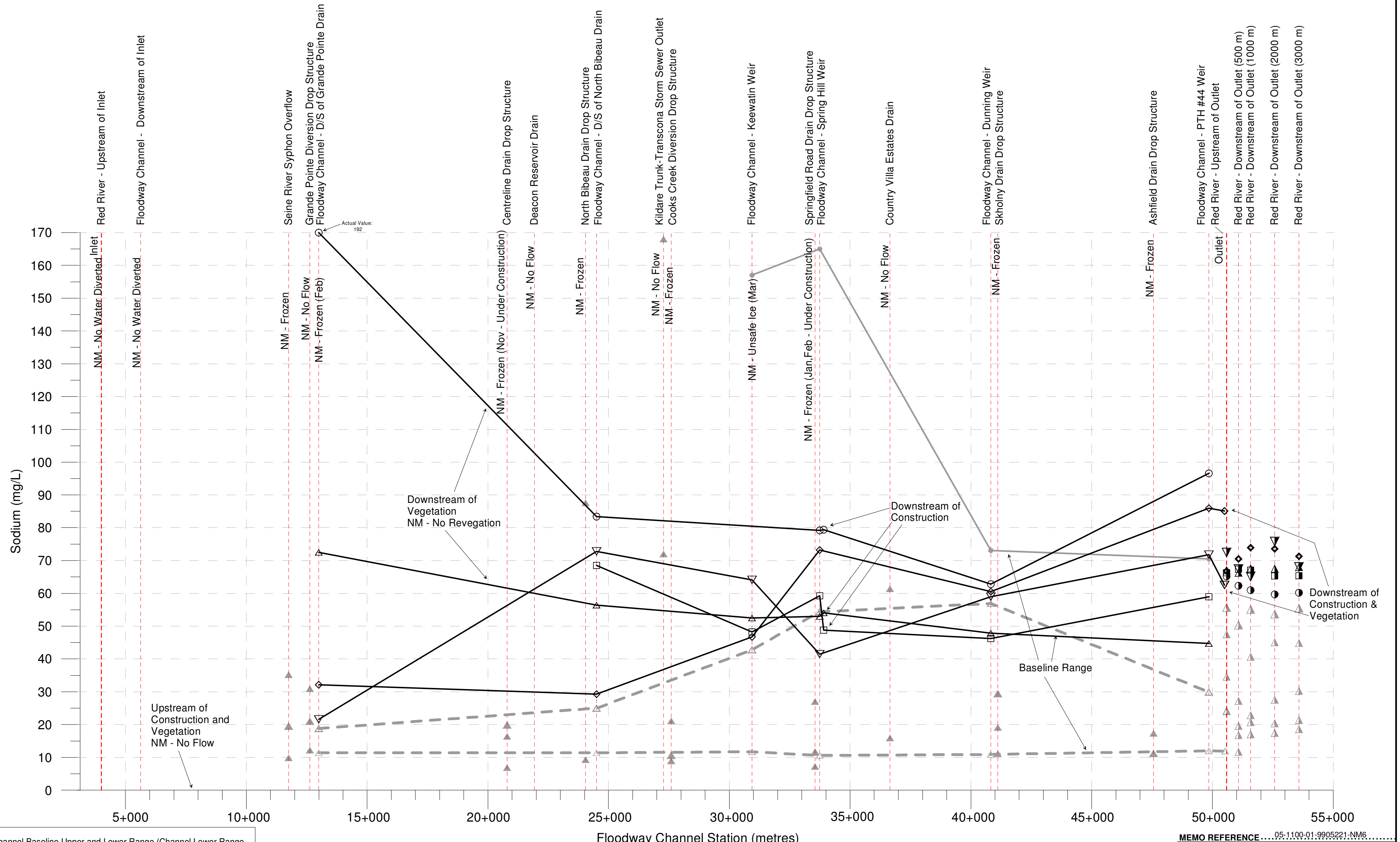
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008 | FIGURE NM6-34 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Sodium\FigNM6-34_Sodium construction_non-flood unfrozen condition.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 25-Jan-07
Channel 22-Feb-07
Channel 19-Mar-07
Channel 29-Nov-07
Channel 20/21-Dec-07

Drain Baseline
Drain 25-Jan-07
Drain 22-Feb-07
Drain 19-Mar-07
Drain 29-Nov-07
Drain 20/21-Dec-07

River Baseline
River 25-Jan-07
River 22-Feb-07
River 19-Mar-07
River 29-Nov-07
River 20/21-Dec-07

Flow in Red River at Lockport on:
January 25, 2007 was 52 m³/s
February 22, 2007 was 45 m³/s
March 19, 2007 was 71 m³/s
November 29, 2007 was 68 m³/s
December 20, 2007 was 68 m³/s

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\GraphsFigNM6-35_Sodium construction_Non-Flood Frozen.grf

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

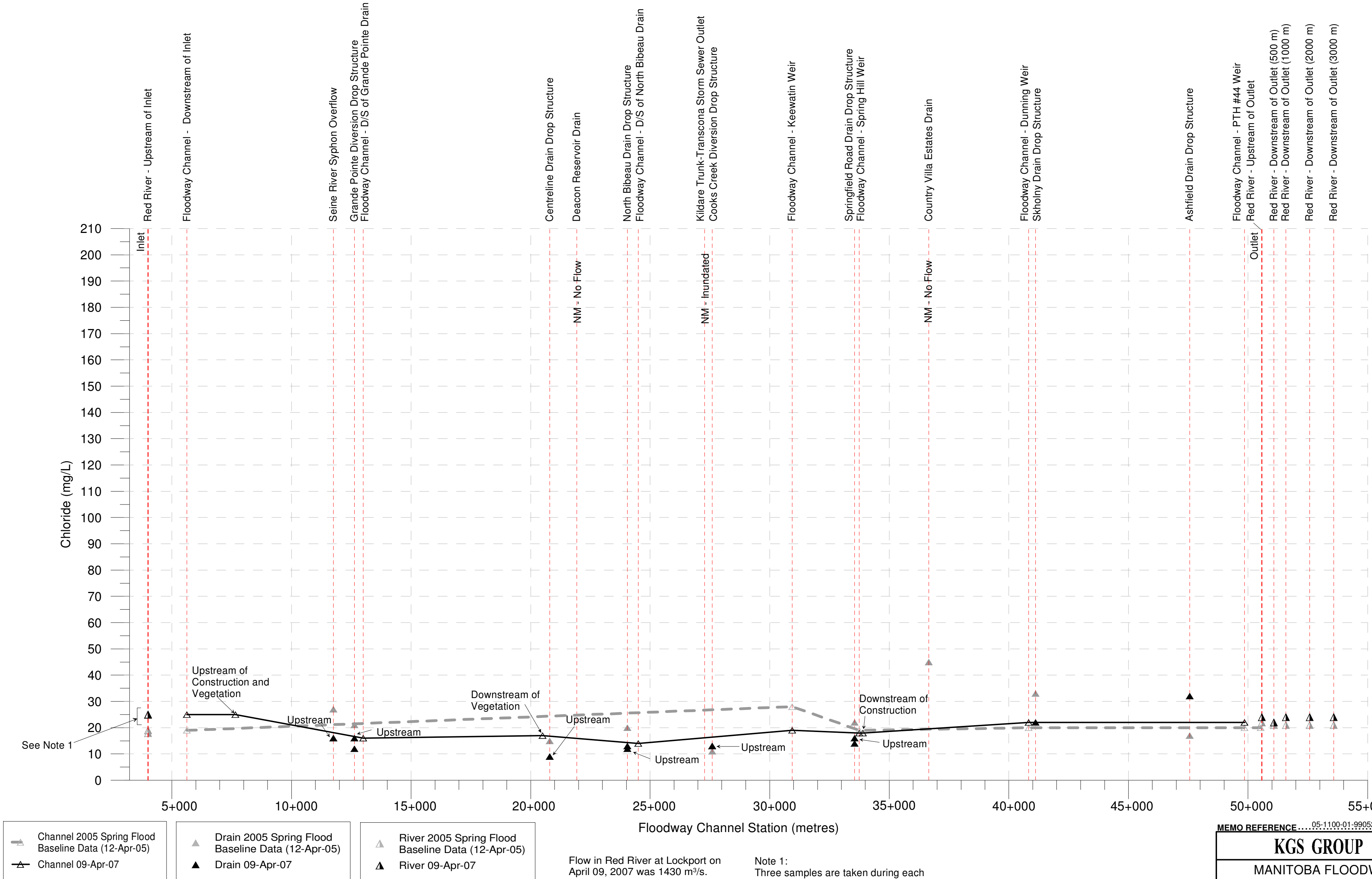
MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

SODIUM
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-35	REV 0



Flow in Red River at Lockport on April 09, 2007 was 1430 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

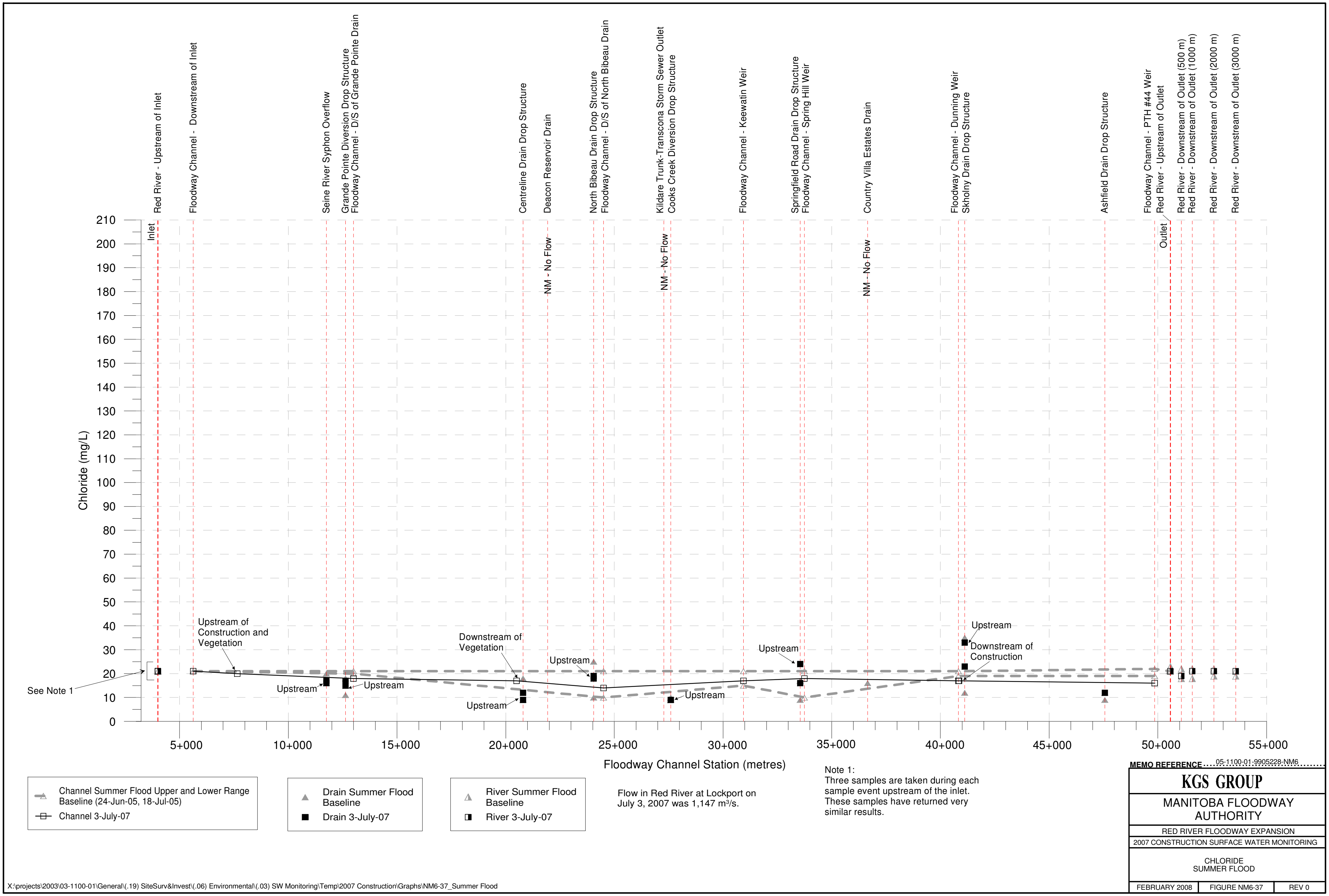
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

CHLORIDE
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-36	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Chloride\FigNM6-36_Chloride construction_Spring flood.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 Flow
NM - No Flow
NM - No Flow
Chloride (mg/L)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Upstream of Construction and Vegetation
Downstream of Vegetation
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Upstream
Downstream of Construction
See Note 1
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 Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)
Channel 3-July-07
Drain Summer Flood Baseline
Drain 3-July-07
River Summer Flood Baseline
River 3-July-07
Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.
Note 1:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.
MEMO REFERENCE 05-1100-01-9905228-NM6
KGS GROUP
MANITOBA FLOODWAY AUTHORITY
RED RIVER FLOODWAY EXPANSION
2007 CONSTRUCTION SURFACE WATER MONITORING
CHLORIDE
SUMMER FLOOD
FEBRUARY 2008
FIGURE NM6-37
REV 0
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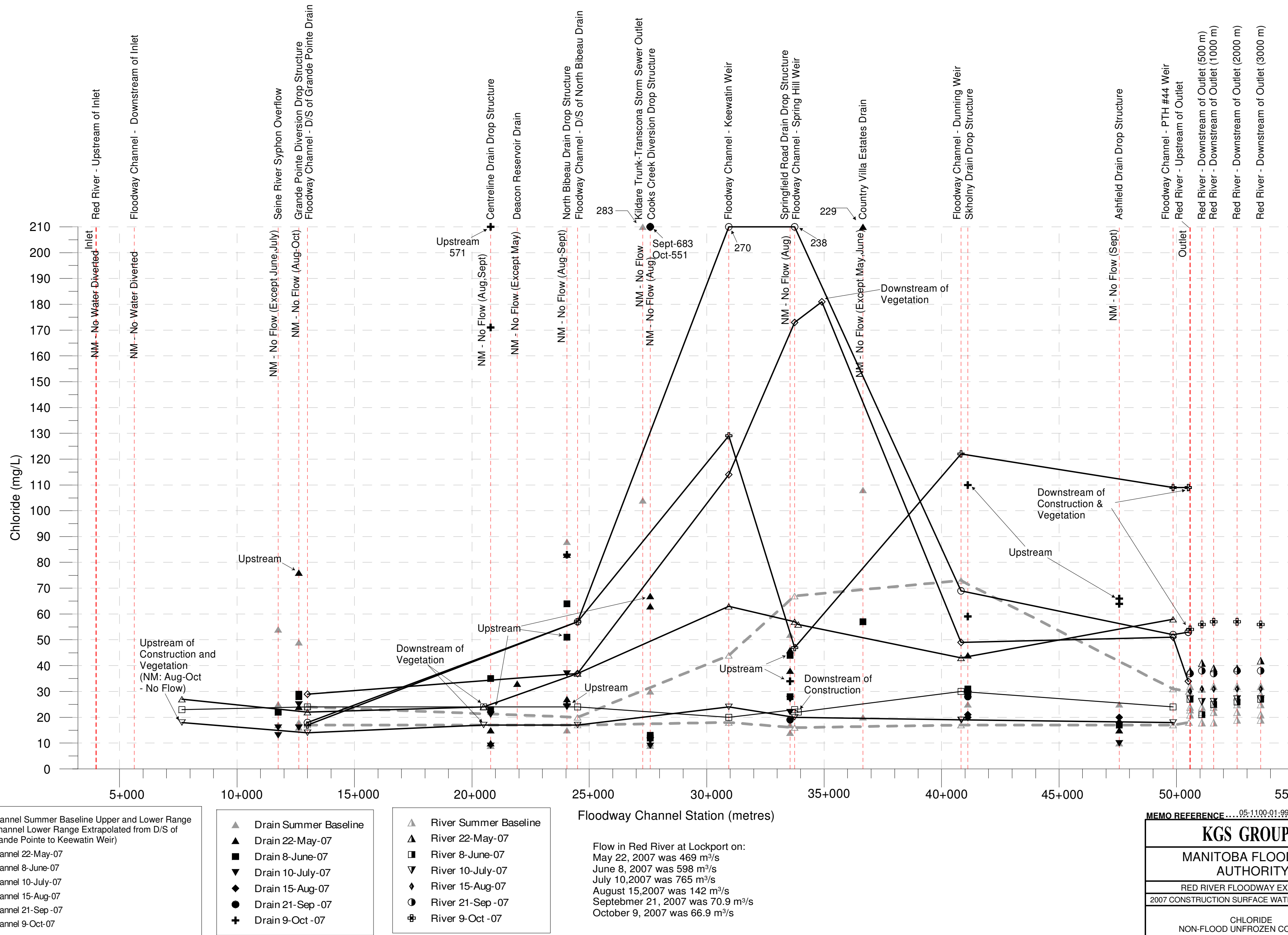


MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

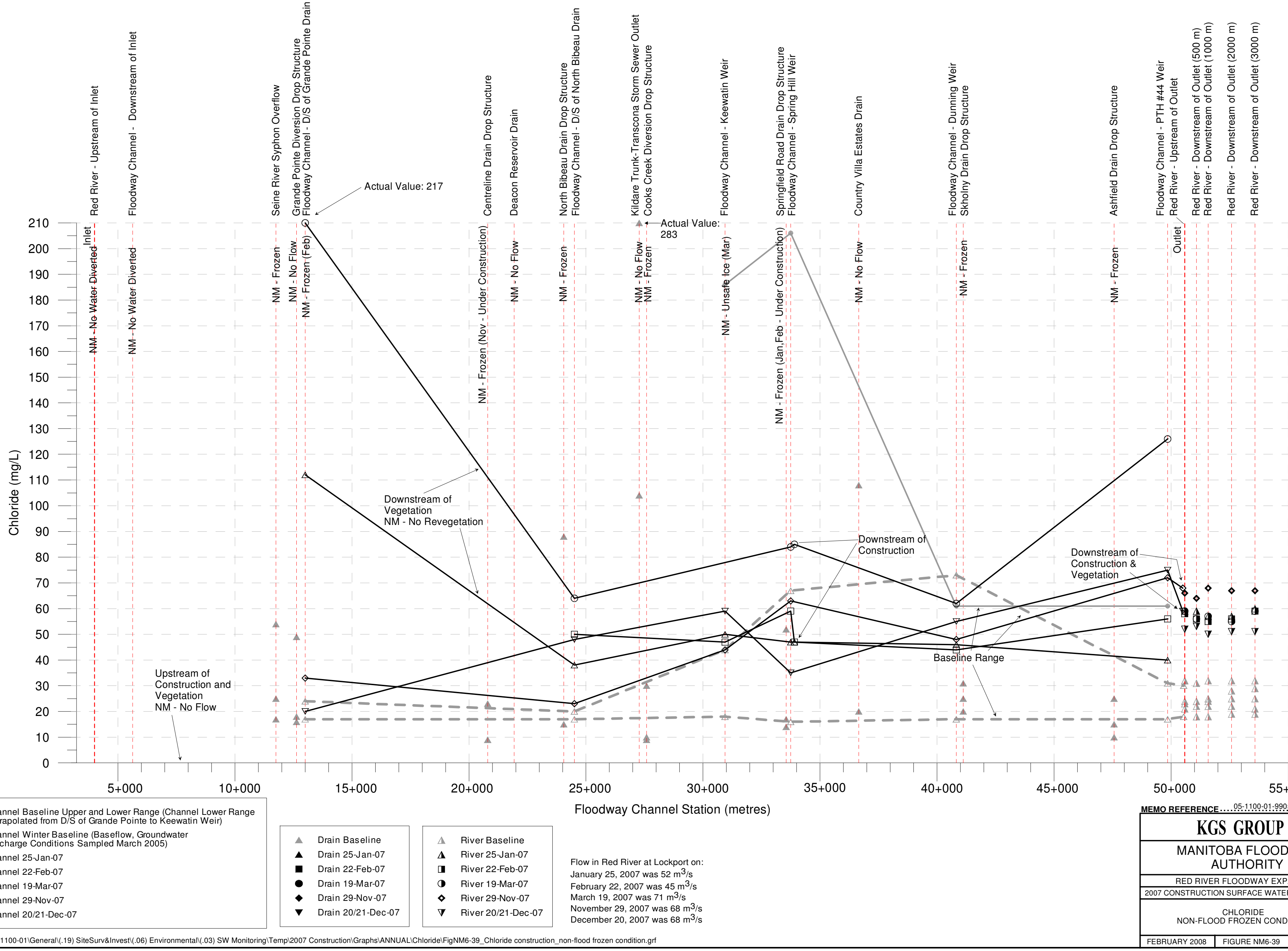
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

CHLORIDE
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-38	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Chloride\FigNM6-38_Chloride construction_non-flood unfrozen condition.grf



Flow in Red River at Lockport on:
January 25, 2007 was 52 m^3/s
February 22, 2007 was 45 m^3/s
March 19, 2007 was 71 m^3/s
November 29, 2007 was 68 m^3/s
December 20, 2007 was 68 m^3/s

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

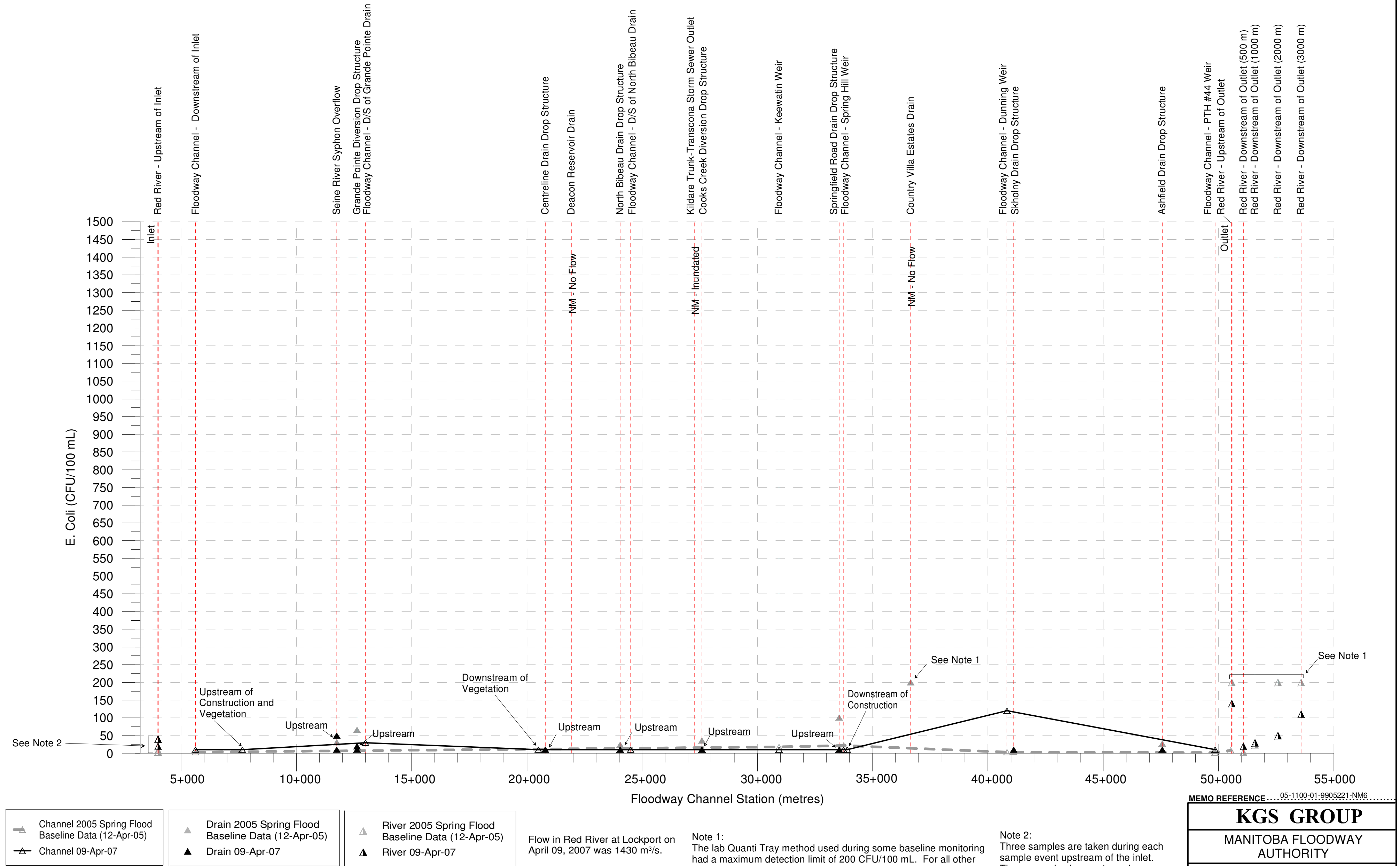
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

CHLORIDE
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008	FIGURE NM6-39	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\Chloride\FigNM6-39_Chloride construction_non-flood frozen condition.grf



Flow in Red River at Lockport on April 09, 2007 was 1430 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.

Note 2:
Three samples are taken during each sample event upstream of the inlet. These samples have returned very similar results.

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

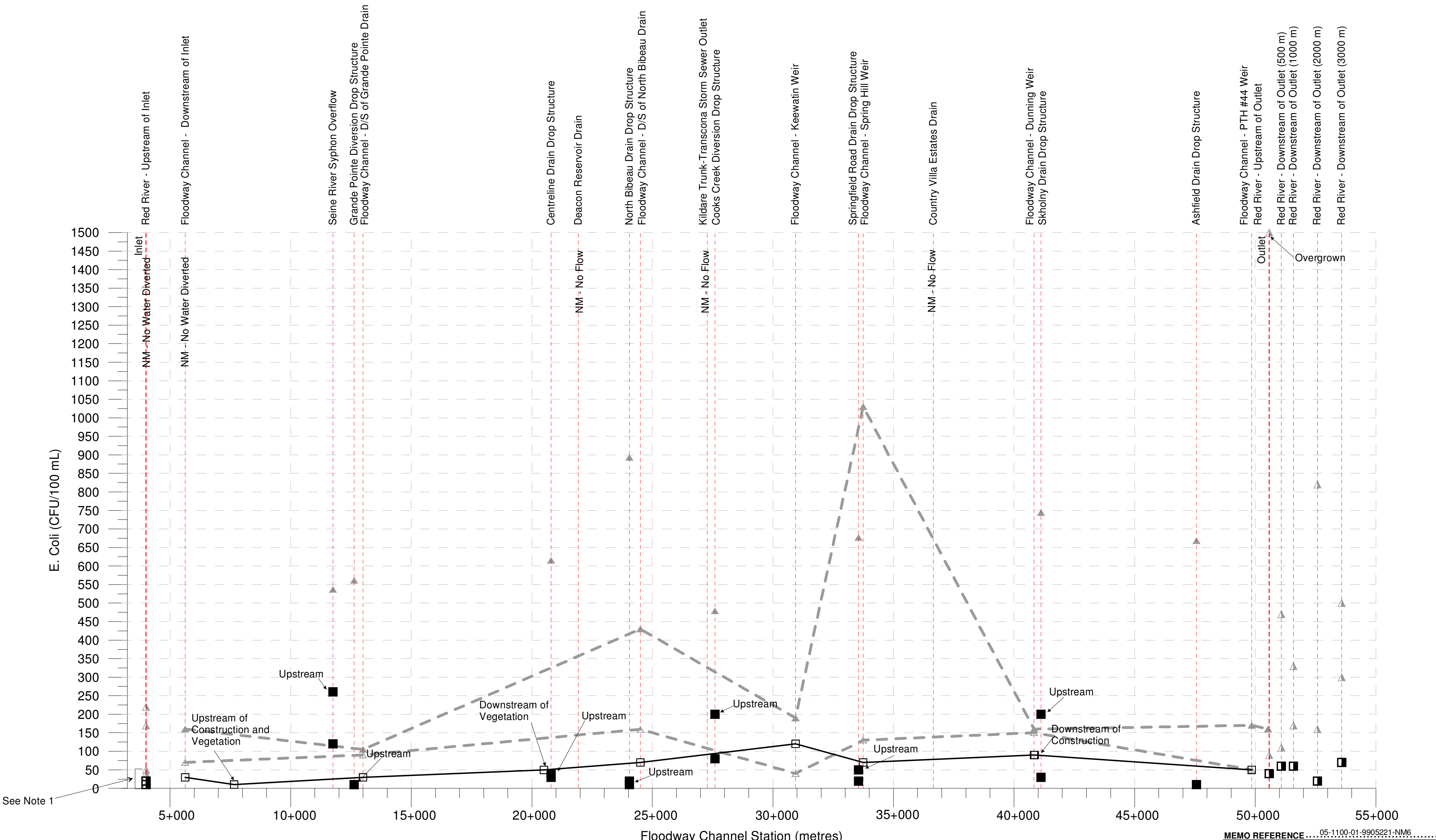
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
SPRING FLOOD

FEBRUARY 2008	FIGURE NM6-40	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\E-Coli\FigNM6-40_EColi construction_Spring Flood.grf



Channel Summer Flood Upper and Lower Range Baseline (24-Jun-05, 18-Jul-05)

Channel 3-Jul-07

Drain Summer Flood Baseline

Drain 3-Jul-07

River Summer Flood Baseline

River 3-Jul-07

Flow in Red River at Lockport on July 3, 2007 was 1,147 m³/s.

Note 1:
Three samples are taken during each sample event upstream of the inlet.These samples have returned very similar results.

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

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

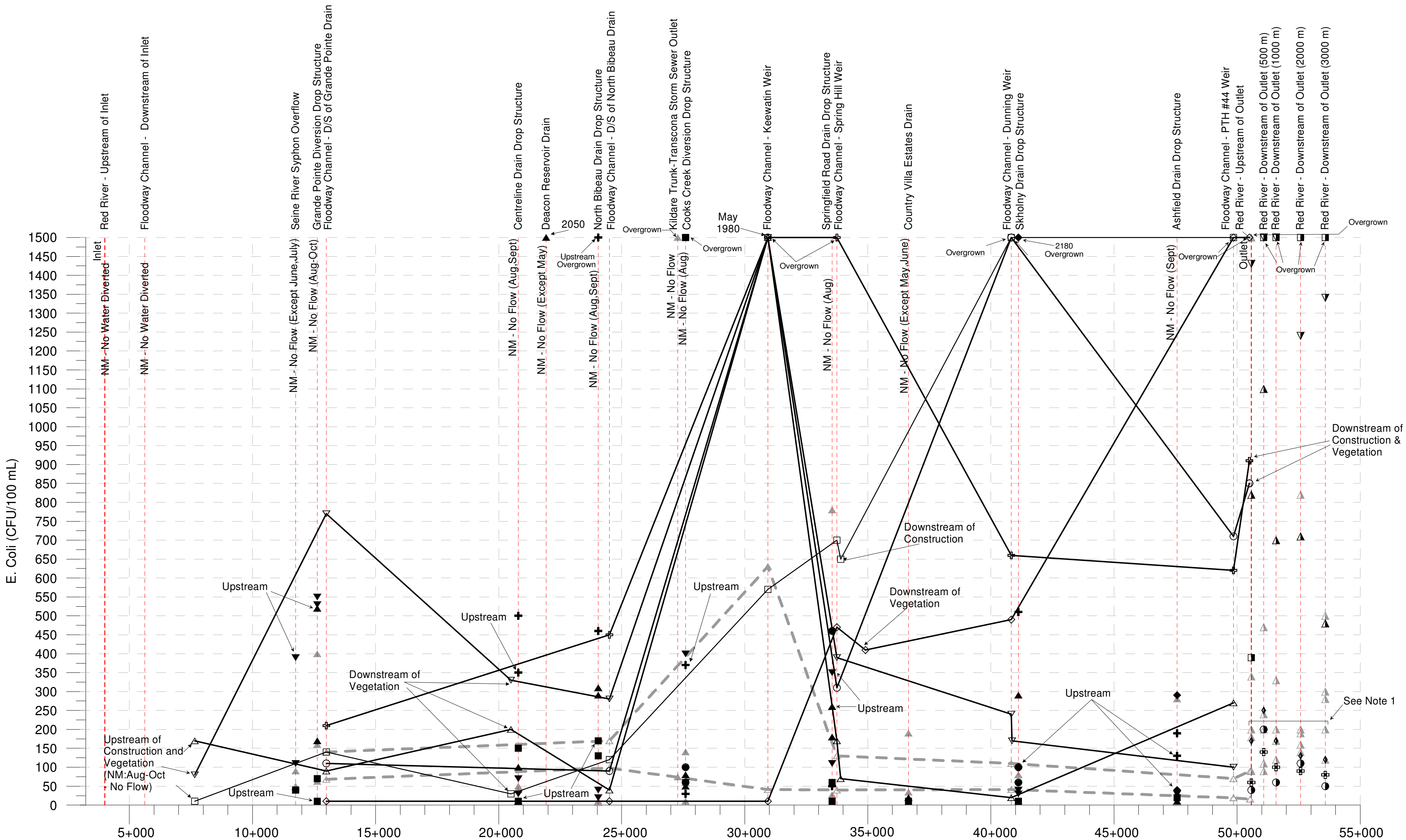
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
SUMMER FLOOD

FEBRUARY 2008	FIGURE NM6-41	REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\NM6-41 July summer flood



- Channel Summer Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
- Channel 22-May-07
- Channel 8-June-07
- Channel 10-Jul-07
- Channel 15-Aug-07
- Channel 21-Sep -07
- Channel 9-Oct -07

- Drain Summer Baseline
- Drain 22-May-07
- Drain 8-June-07
- Drain 10-Jul-07
- Drain 15-Aug-07
- Drain 21-Sep -07
- Drain 9-Oct -07

- River Summer Baseline
- River 22-May-07
- River 8-June-07
- River 10-Jul-07
- River 15-Aug-07
- River 21-Sep -07
- River 9-Oct -07

Flow in Red River at Lockport on:
May 22, 2007 was 469 m³/s
June 8, 2007 was 598 m³/s
July 10, 2007 was 765 m³/s
August 15, 2007 was 142 m³/s
September 21,2007 was 70.9 m³/s
October 9, 2007 was 66.9 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 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

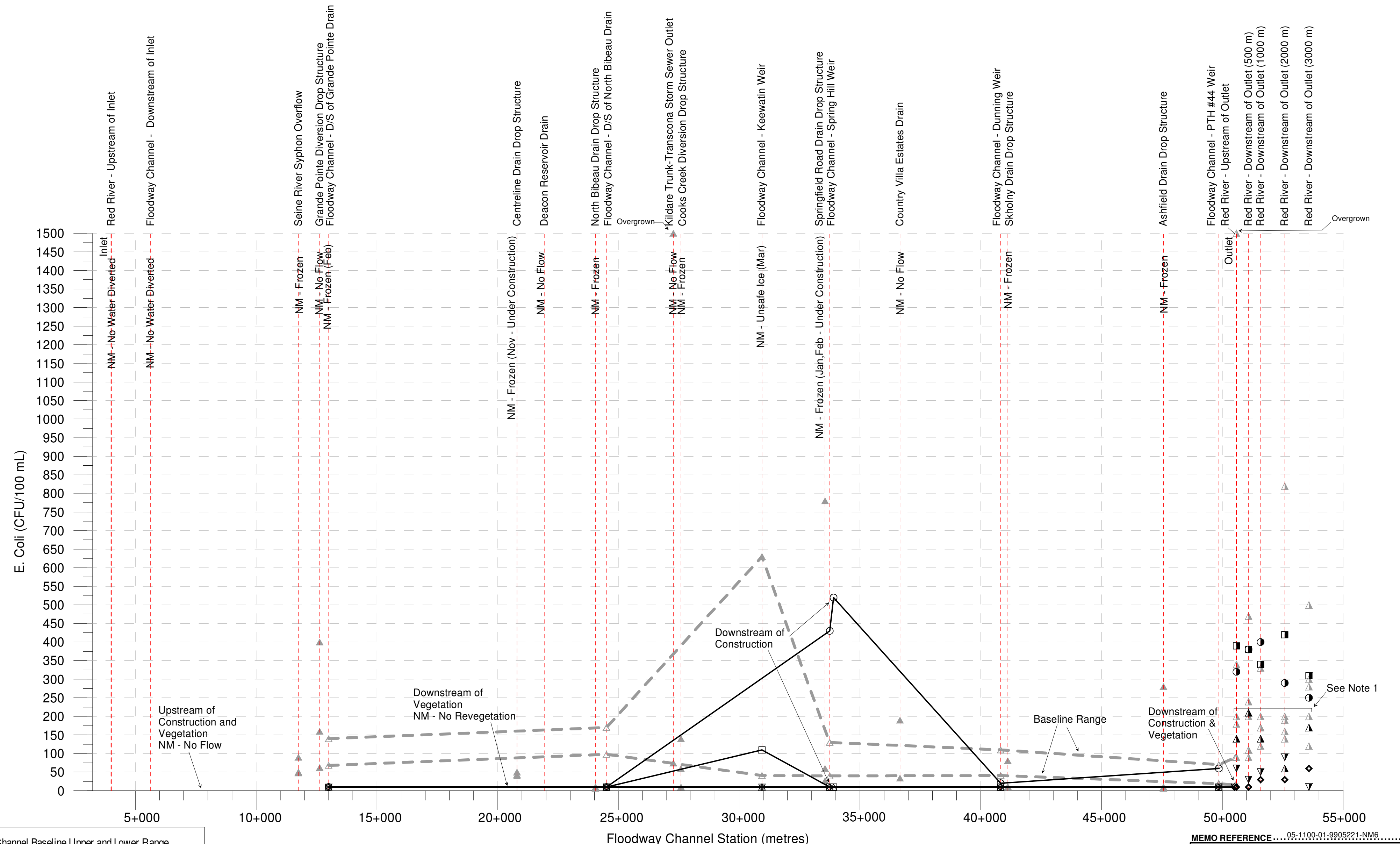
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
NON-FLOOD UNFROZEN CONDITION

FEBRUARY 2008 | FIGURE NM6-42 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\E-Coli\FigNM6-42_EColi construction_Non-flood unfrozen condition.grf



Channel Baseline Upper and Lower Range (Channel Lower Range Extrapolated from D/S of Grande Pointe to Keewatin Weir)
Channel 25-Jan-07
Channel 22-Feb-07
Channel 19-Mar-07
Channel 29-Nov-07
Channel 20/21-Dec -07

Drain Baseline
Drain 25-Jan-07
Drain 22-Feb-07
Drain 19-Mar-07
Drain 29-Nov-07
Drain 20/21-Dec -07

River Baseline
River 25-Jan-07
River 22-Feb-07
River 19-Mar-07
River 29-Nov-07
River 20/21-Dec -07

Flow in Red River at Lockport on:
January 25, 2007 was 52 m^3/s
February 22, 2007 was 45 m^3/s
March 19, 2007 was 71 m^3/s
November 29, 2007 was 68 m^3/s
December 20, 2007 was 68 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.

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

MEMO REFERENCE 05-1100-01-9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

E.COLI
NON-FLOOD FROZEN CONDITION

FEBRUARY 2008 | FIGURE NM6-43 | REV 0

X:\projects\2003\03-1100-01\General\(.19) SiteSurv&Invest\(.06) Environmental\(.03) SW Monitoring\Temp\2007 Construction\Graphs\ANNUAL\E-Coli\FigNM6-43_EColi construction_Non-flood frozen condition.grf

APPENDICES

APPENDIX A

SURFACE WATER MONITORING
2007 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 2006 Surface Water Sampling Program prepared by KGS Group.

The surface water quality monitoring program consists of Monthly monitoring during the 2006 construction year from January to December 2006 in conjunction with the on-going construction activities. It also consists of Event-based monitoring during 2006 in response to potential erosion causing precipitation and spill events.

The scope of work for the 2006 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 downstream of the Outlet and any additional required locations following precipitation events greater than 5 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 2006 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 outlined on Figure NM4-1 and Figure NM4-2 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 to provide additional baseline data prior to start of construction. During construction additional sample locations will be added upstream of the dyke in the Manness and Domain Drains and at previously identified critical fish habitat, upstream and downstream of the construction area. 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 (Con U/S and Con D/S) and upstream and downstream of the overall revegetation areas (Veg U/S and Veg D/S). Note these sample locations will change as work proceeds. 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 43, 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, until construction activities begin in the vicinity of the West Dyke drains, the sample locations upstream of the West Dyke at the Manness and Domain Drains and upstream and downstream of identified fish habitat are not required. 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, 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 2005 program, 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)
- Total extractable hydrocarbons (TEH) and total purgeable hydrocarbons (TPH)
- 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 2005 program and are detailed in Table 1. Additional other parameters can be added, if required and approved by MFA.

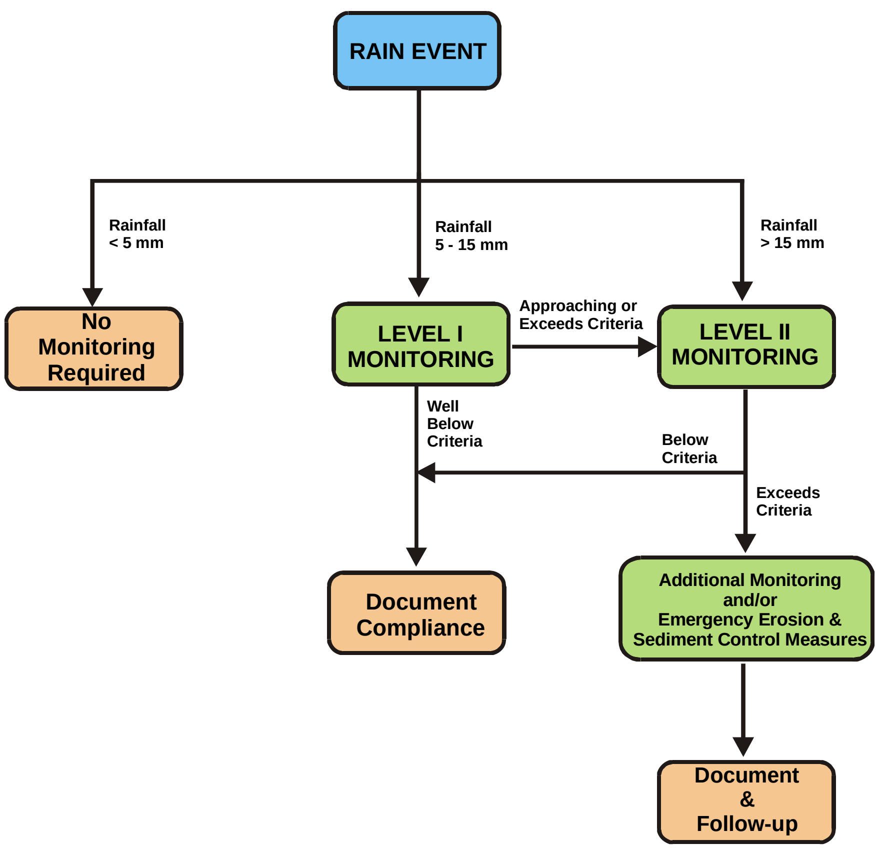
5.0 EVENT-BASED COMPLIANCE MONITORING

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, TEH and TPH

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. When a rainfall is less than 5 mm no monitoring is required. When rainfall is between 5 mm and 15 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. When rainfall exceeds 15 mm or 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 either the Level I or Level II monitoring programs. 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 number of rainfall gauges within the City of Winnipeg that could be used as a source of real-time rainfall data. This data will not be accessible directly by the monitoring team and will be provided by the owners of the rainfall gauge network on a minimum a 6 hour basis, but most likely a daily basis.

The rainfall/monitoring criteria have been formulated on a judgmental basis, 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 an 10 mm rain event, 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 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 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.

In addition to measuring field turbidity, samples will be collected at the three 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 2006 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 2007 CONSTRUCTION MONTHLY MONITORING (JANUARY 2007 - DECEMBER 2007)

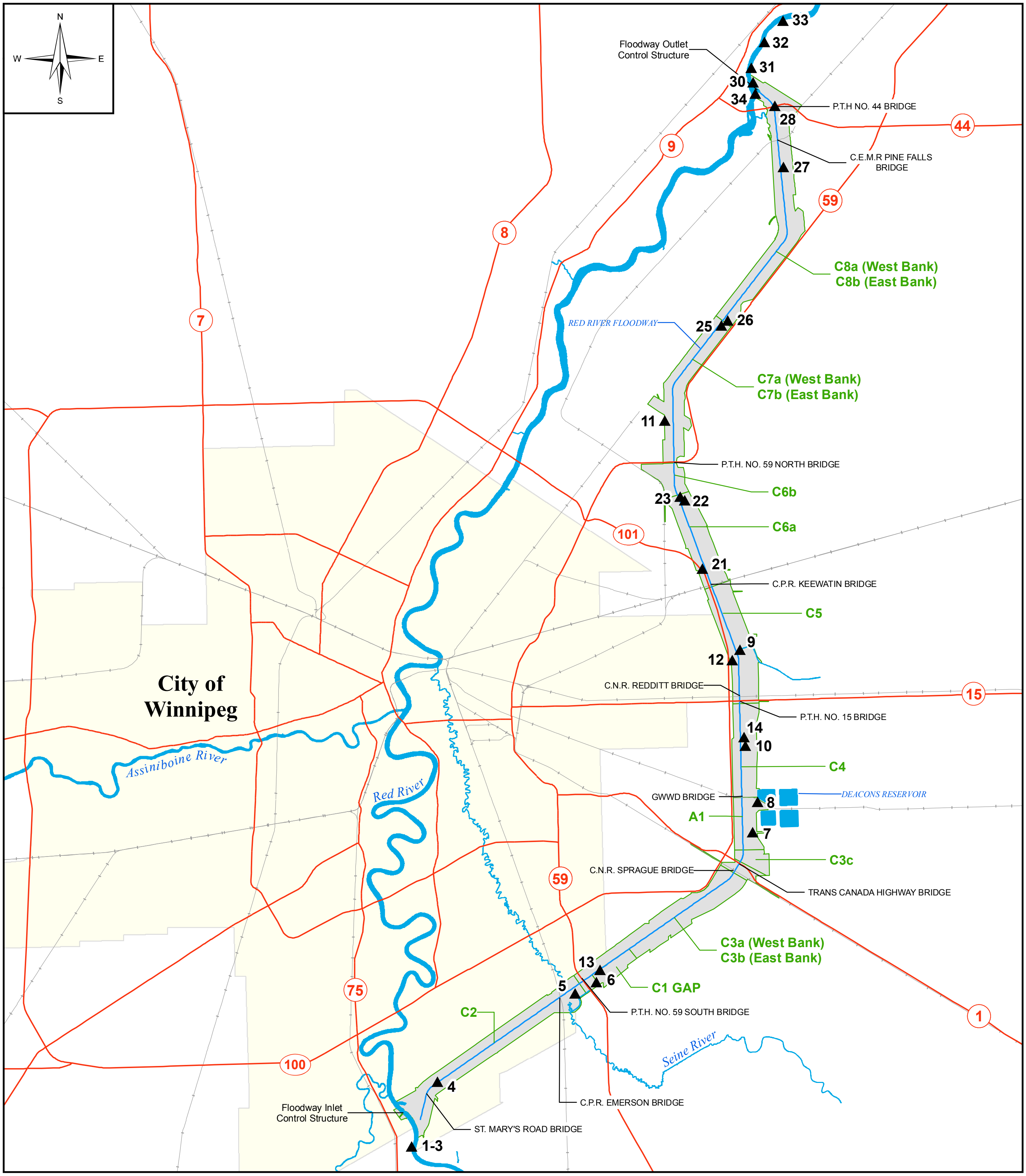
Sample Location	Sample Number	Parameters												
		Routine Extractable	TSS	Ammonia	Ortho - P	Total P	Total Dissolved P	DOC	TOC	TKN	Phenoxy Acid Herbicide Screen	Glyphosate	BTEX, F1 to F4	Total Coliform / E. Coli
Red River														
Upstream of Inlet (3 replicates) [1]	1 - 3	X	X	X	X	X	X	X	X	X				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 [2]														
Upstream of Manness Drain														
Upstream of Domain Drain		X	X	X	X	X	X	X	X	X				X
Upstream of Identified Fish Habitat														
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
Downstream of Identified Fish Habitat														
Estimated Average Number of Samples/Month [3]		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 - It is assumed that there will be limited construction along the West Dyke in 2007, samples will be obtained from the other West Dyke sample locations if construction occurs in those areas.

3 - Average based on experience obtained during previous years that realizes that not every sample location visited each month will have a sample collected.



▲ 10 Surface Water Sampling Locations

C2 Contract Reference Locations

1:200,000

0 1 2 4 6 8 10

Kilometres

MEMO REFERENCE 05-1100-01.9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

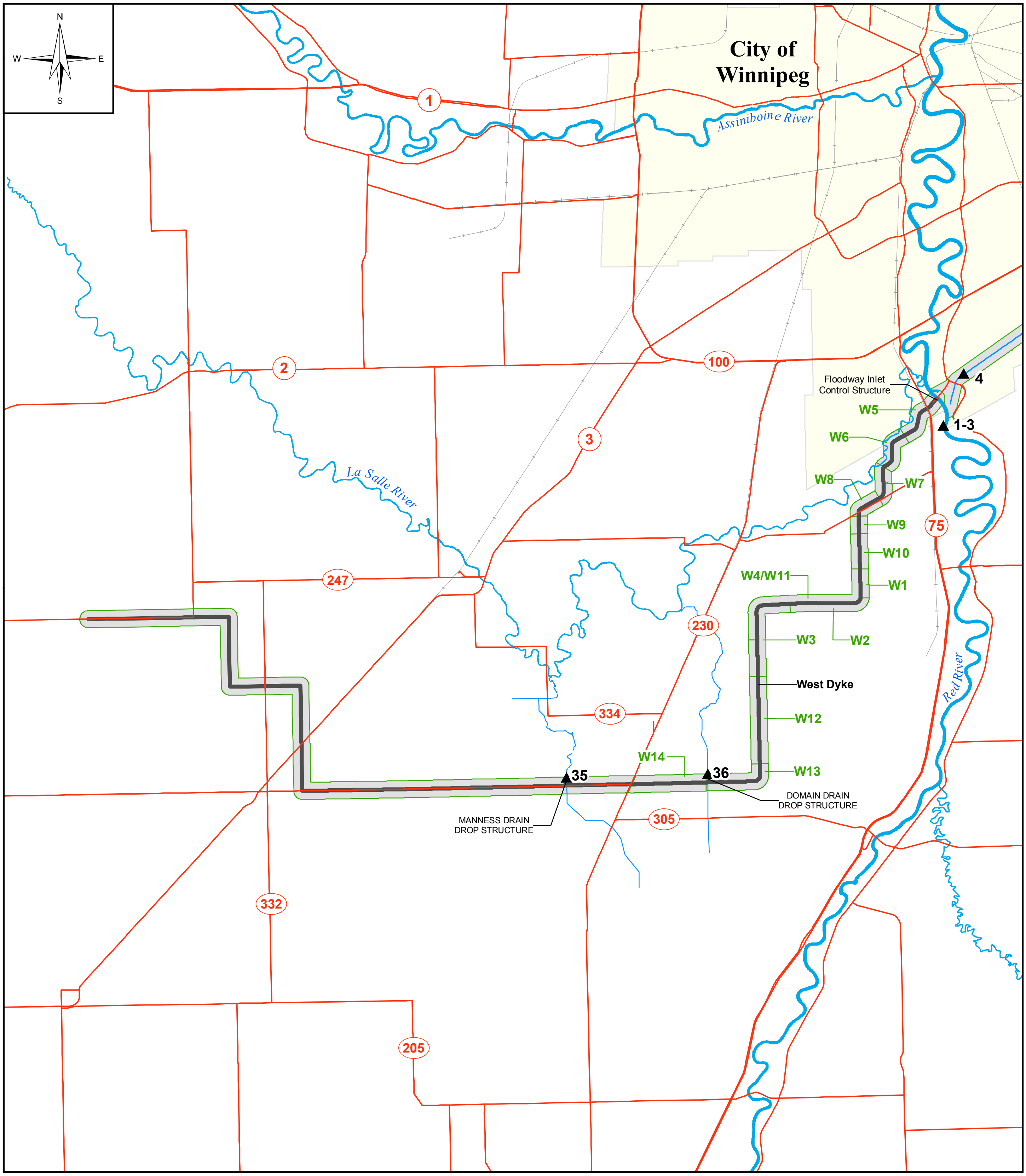
RED RIVER FLOODWAY EXPANSION

2007 CONSTRUCTION SURFACE WATER MONITORING

FLOODWAY CHANNEL SAMPLE LOCATIONS

JANUARY 2007	FIGURE NM6-1	REV A

X:\projects\2003\03-1100-01\GIS\Archive\Contract_General\9905221\PDFs\NM6-1.pdf



▲ 35 Surface Water Sampling Locations

W2 Contract Reference Locations

1:250,000

0 1 2 4 6 8 10

Kilometres

MEMO REFERENCE 05-1100-01.9905221-NM6

KGS GROUP

MANITOBA FLOODWAY AUTHORITY

RED RIVER FLOODWAY EXPANSION

2007 CONSRTUCTION SURFACE WATER MONITORING

WEST DYKE SAMPLE LOCATIONS

JANUARY 2007 | FIGURE NM6-2 | REV A

X:\projects\2003\03-1100-01\GIS\Archive\Contract_General\9905221\PDFs\NM6-2.pdf

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 – Downstream 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 – Downstream of Floodway Outlet	TSS =		mg/L	**Box 9**	**[Use Box 6 in Regression Equation]**

Regression Relationships

<u>Red River Water</u> (ie Red River, FW Operation)

TSS = 1.201 x Turbidity – 2.531

<u>Non – Red River Water</u> (ie. FW non-operation, Drains)

TSS = 0.533 x Turbidity + 7.071

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 – Downstream 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

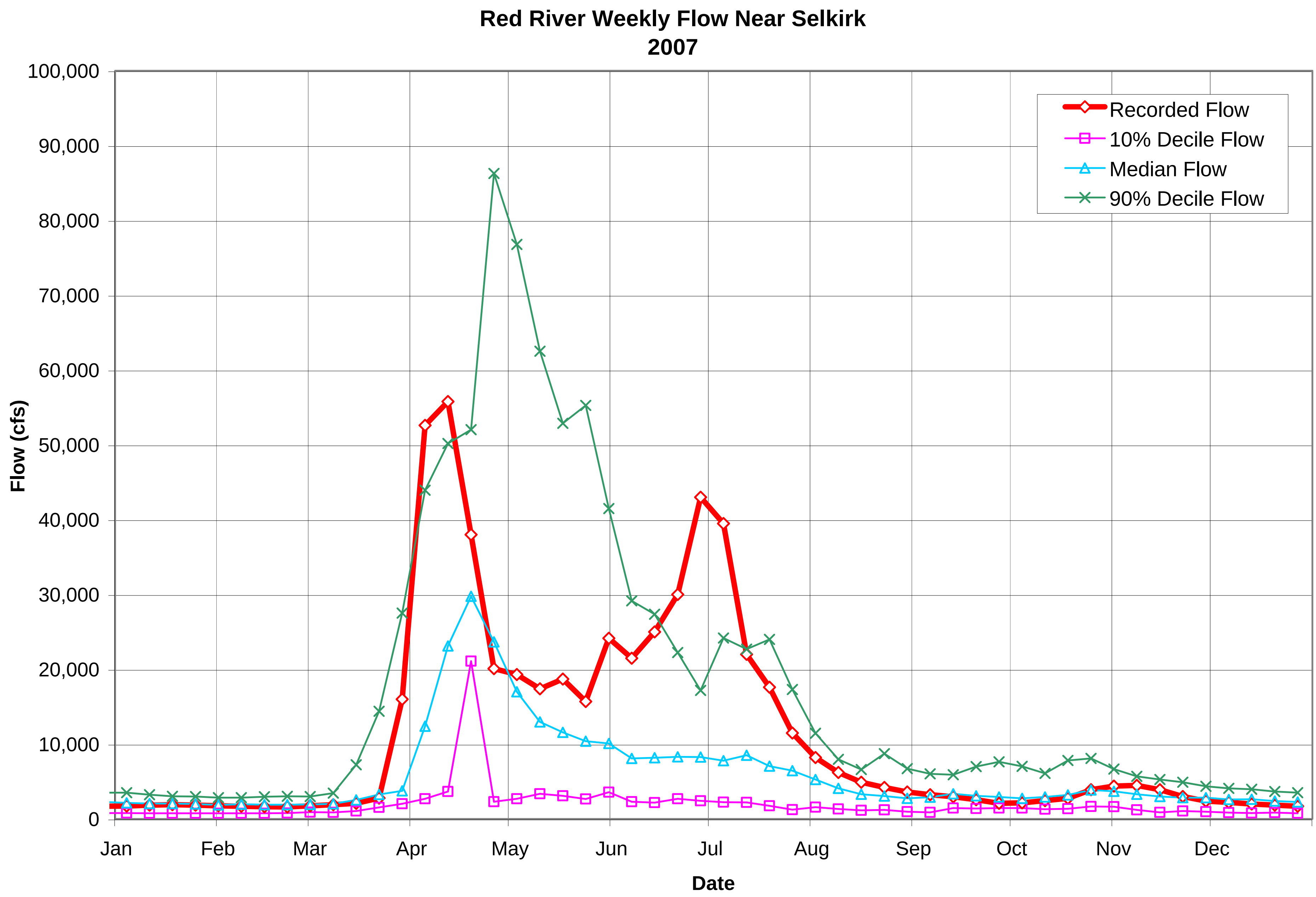
Note: Assumes no other inflows to channel except those at the downstream end of construction

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: ______________ **Date Prepared:** ______________

APPENDIX B

MANITOBA WATER STEWARDSHIP
WEEKLY RIVER FLOW REPORT
RED RIVER NEAR SELKIRK


Red River Weekly Flow Near Selkirk
2007
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 2007

Environment Canada Environnement Canada

Daily Data Report for January 2007

Notes on Data Quality.

WINNIPEG INT'L A
MANITOBA

Latitude: 49° 55' N **Longitude:** 97° 13' W **Elevation:** 238.70 m

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

Daily Data Report for January 2007

Day	Max Ter °C	Min Ter °C	Mean Ter °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	-9.4	-20.2	-14.8	32.8	0.0	0.0	M	M			
02	-3.1	-15.2	-9.2	27.2	0.0	0.0	5.0	5.0			
03	5.8	-6.9	-0.6	18.6	0.0	0.0	M	M			
04	2.6	-1.3	0.7	17.3	0.0	0.0	0.0	0.0			
05	0.0	-5.6	-2.8	20.8	0.0	0.0	0.0	0.0			
06	-3.8	-15.3	-9.6	27.6	0.0	0.0	0.5	0.5			
07	-3.5	-18.8	-11.2	29.2	0.0	0.0	0.0	0.0			
08	-11.8	-23.8	-17.8	35.8	0.0	0.0	0.0	0.0			
09	-15.0	-22.9	-19.0	37.0	0.0	0.0	0.0	0.0			
10	-7.7	-18.2	-13.0	31.0	0.0	0.0	1.5	1.5			
11	-10.3	-30.5	-20.4	38.4	0.0	0.0	0.0	0.0			
12	-27.6	-37.6	-32.6	50.6	0.0	0.0	0.0	0.0			
13	-15.4	-29.8	-22.6	40.6	0.0	0.0	0.0	0.0			
14	-25.2	-33.2	-29.2	47.2	0.0	0.0	0.0	0.0			
15	-22.0	-32.9	-27.5	45.5	0.0	0.0	0.0	0.0			
16	-11.2	-30.7	-21.0	39.0	0.0	0.0	0.0	0.0			
17	-7.4	-12.9	-10.2	28.2	0.0	0.0	0.0	0.0			
18	-7.5	-24.9	-16.2	34.2	0.0	0.0	0.0	0.0			
19	-15.7	-30.9	-23.3	41.3	0.0	0.0	0.0	0.0			
20	-5.2	-17.0	-11.1	29.1	0.0	0.0	1.5	1.5			
21	-5.7	-15.3	-10.5	28.5	0.0	0.0	0.0	0.0			
22	-4.8	-18.7	-11.8	29.8	0.0	0.0	0.0	0.0			
23	-11.1	-21.8	-16.5	34.5	0.0	0.0	0.0	0.0			
24	-8.5	-25.0	-16.8	34.8	0.0	0.0	0.0	0.0			
25	-3.3	-24.4	-13.9	31.9	0.0	0.0	0.5	0.5			
26	-1.9	-19.9	-10.9	28.9	0.0	0.0	0.5	0.5			
27	-16.7	-28.3	-22.5	40.5	0.0	0.0	0.0	0.0			
28	-14.5	-28.2	-21.4	39.4	0.0	0.0	1.5	1.5			
29	-14.5	-28.3	-21.4	39.4	0.0	0.0	0.5	0.5			
30	-14.4	-27.8	-21.1	39.1	0.0	0.0	0.0	0.0			
31	-14.5	-23.0	-18.8	36.8	0.0	0.0	0.0	0.0			
Sum				**1055.0**	**0.0**	**0.0**	**11.5***	**11.5***			
Avg	**-9.8**	**-22.2**	**-16.0**								
Xtrm	**5.8**	**-37.6**									

Legend

[empty] = No data available
M = Missing
E = Estimated

Navigation Options

Canada Map
Manitoba Map
Customized Search

Environment Canada Environnement Canada

Daily Data Report for February 2007

Notes on Data Quality.

WINNIPEG INT'L A
MANITOBA

Latitude: 49° 55' N **Longitude:** 97° 13' W **Elevation:** 238.70 m
Climate ID: 5023222 **WMO ID:** 71852 **TC ID:** YWG

Daily Data Report for February 2007

Day	Max Ter °C	Min Ter °C	Mean Ter °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	-13.8	-23.0	-18.4	36.4	0.0	0.0	1.5	1.5			
02	-20.7	-33.2	-27.0	45.0	0.0	0.0	0.0	0.0			
03	-26.1	-38.4	-32.3	50.3	0.0	0.0	0.0	0.0			
04	-27.0	-39.5	-33.3	51.3	0.0	0.0	0.0	0.0			
05	-24.8	-41.7	-33.3	51.3	0.0	0.0	0.0	0.0			
06	-23.8	-34.4	-29.1	47.1	0.0	0.0	0.0	0.0			
07	-18.9	-34.1	-26.5	44.5	0.0	0.0	0.0	0.0			
08	-19.7	-31.6	-25.7	43.7	0.0	0.0	0.0	0.0			
09	-20.4	-33.0	-26.7	44.7	0.0	0.0	0.0	0.0			
10	-16.7	-29.7	-23.2	41.2	0.0	0.0	0.0	0.0			
11	-19.3	-30.8	-25.1	43.1	0.0	0.0	0.0	0.0			
12	-22.3	-35.8	-29.1	47.1	0.0	0.0	0.0	0.0			
13	-20.5	-35.8	-28.2	46.2	0.0	0.0	0.0	0.0			
14	-19.0	-34.4	-26.7	44.7	0.0	0.0	0.0	0.0			
15	-11.0	-26.4	-18.7	36.7	0.0	0.0	0.0	0.0			
16	-5.5	-12.3	-8.9	26.9	0.0	0.0	0.0	0.0			
17	-11.8	-22.5	-17.2	35.2	0.0	0.0	0.0	0.0			
18	-5.5	-26.5	-16.0	34.0	0.0	0.0	0.0	0.0			
19	-5.4	-16.0	-10.7	28.7	0.0	0.0	0.0	0.0			
20	-7.1	-14.2	-10.7	28.7	0.0	0.0	3.5	3.5			
21	-7.7	-14.5	-11.1	29.1	0.0	0.0	2.5	2.5			
22	-8.7	-21.8	-15.3	33.3	0.0	0.0	0.0	0.0			
23	-3.7	-12.7	-8.2	26.2	0.0	0.0	1.0	1.0			
24	-3.8	-5.5	-4.7	22.7	0.0	0.0	1.5	1.5			
25	-3.8	-5.5	-4.7	22.7	0.0	0.0	6.5	6.5			
26	-4.3	-7.3	-5.8	23.8	0.0	0.0	0.5	0.5			
27	-3.9	-10.7	-7.3	25.3	0.0	0.0	2.0	2.0			
28	-0.8	-6.5	-3.7	21.7	0.0	0.0	0.0	0.0			
Sum				**1031.6**	**0.0**	**0.0**	**19.0**	**19.0**			
Avg	**-13.4**	**-24.2**	**-18.8**								
Xtrm	**-0.8**	**-41.7**									

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 March 2007

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 2007

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	-1.9	-10.4	-6.2	24.2	0.0	0.0	1.5	1.5			
02	-6.4	-14.2	-10.3	28.3	0.0	0.0	0.0	0.0			
03	-8.4	-23.0	-15.7	33.7	0.0	0.0	0.0	0.0			
04	-3.1	-24.0	-13.6	31.6	0.0	0.0	0.0	0.0			
05	-17.7	-30.8	-24.3	42.3	0.0	0.0	0.0	0.0			
06	-11.0	-17.8	-14.4	32.4	0.0	0.0	0.0	0.0			
07	-8.9	-21.7	-15.3	33.3	0.0	0.0	0.0	0.0			
08	-0.3	-9.2	-4.8	22.8	0.0	0.0	1.0	1.0			
09	1.5	-9.2	-3.9	21.9	0.0	0.0	0.0	0.0			
10	2.6	-14.9	-6.2	24.2	0.0	0.0	0.0	0.0			
11	3.4	-6.1	-1.4	19.4	0.0	0.0	0.0	0.0			
12	6.9	-2.1	2.4	15.6	0.0	0.0	0.0	0.0			
13	4.5	-3.7	0.4	17.6	0.0	0.0	0.0	0.0			
14	-2.0	-16.4	-9.2	27.2	0.0	0.0	0.0	0.0			
15	-9.0	-17.0	-13.0	31.0	0.0	0.0	0.0	0.0			
16	-5.6	-17.7	-11.7	29.7	0.0	0.0	0.0	0.0			
17	-1.9	-16.4	-9.2	27.2	0.0	0.0	0.0	0.0			
18	1.3	-2.8	-0.8	18.8	0.0	5.0E	5.0E	10.0E			
19	-1.9	-17.9	-9.9	27.9	0.0	0.0	0.0	0.0			
20	2.7	-17.8	-7.6	25.6	0.0	0.4	0.0	0.4			
21	4.7	-6.6	-1.0	19.0	0.0	0.0	0.0	0.0			
22	1.8	-7.2	-2.7	20.7	0.0	0.0	1.5	1.5			
23	5.4	-3.9	0.8	17.2	0.0	3.0	0.0	3.0			
24	5.2	-4.2	0.5	17.5	0.0	0.0	0.0	0.0			
25	8.2	2.6	5.4	12.6	0.0	0.0	0.0	0.0			
26	6.7	-2.4	2.2	15.8	0.0	3.4	0.0	3.4			
27	9.3	-3.6	2.9	15.1	0.0	0.0	0.0	0.0			
28	6.6	2.0	4.3	13.7	0.0	5.4E	0.0	5.4E			
29	3.9	-3.0	0.5	17.5	0.0	10.0E	10.0E	20.0E			
30	7.3	-5.1	1.1	16.9	0.0	6.0E	4.5E	10.5E			
31	3.9	0.5	2.2	15.8	0.0	1.0	0.0	1.0			
Sum				**716.5**	**0.0**	**34.2E**	**23.5E**	**57.7E**			
Avg	**0.3**	**-10.5**	**-5.1**								
Xtrm	**9.3**	**-30.8**									

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 April 2007

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 2007

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	3.0	-2.1	0.5	17.5	0.0	0.0	10.4E	10.4E			
02	-2.0	-8.5	-5.3	23.3	0.0	0.0	0.0	0.0			
03	-6.8	-12.2	-9.5	27.5	0.0	0.0	0.5	0.5			
04	-4.2	-13.1	-8.7	26.7	0.0	0.0	0.0	0.0			
05	-3.6	-13.6	-8.6	26.6	0.0	0.0	0.0	0.0			
06	-3.8	-13.5	-8.7	26.7	0.0	0.0	0.0	0.0			
07	-0.7	-11.6	-6.2	24.2	0.0	0.0	0.0	0.0			
08	0.6	-13.2	-6.3	24.3	0.0	0.0	0.0	0.0			
09	3.7	-11.1	-3.7	21.7	0.0	0.0	0.0	0.0			
10	7.6	-7.1	0.3	17.7	0.0	0.0	0.0	0.0			
11	7.5	-5.8	0.9	17.1	0.0	0.0	0.0	0.0			
12	8.6	-5.1	1.8	16.2	0.0	0.0	0.0	0.0			
13	13.2	-4.1	4.6	13.4	0.0	0.0	0.0	0.0			
14	12.1	-6.1	3.0	15.0	0.0	0.0	0.0	0.0			
15	18.8	0.5	9.7	8.3	0.0	0.0	0.0	0.0			
16	16.3	-0.4	8.0	10.0	0.0	1.0	0.0	1.0			
17	16.9	-5.1	5.9	12.1	0.0	0.0	0.0	0.0			
18	20.1	0.1	10.1	7.9	0.0	0.0	0.0	0.0			
19	18.8	1.6	10.2	7.8	0.0	0.0	0.0	0.0			
20	22.2	9.1	15.7	2.3	0.0	0.0	0.0	0.0			
21	20.6	3.5	12.1	5.9	0.0	0.5	0.0	0.5			
22	18.7	0.0	9.4	8.6	0.0	0.0	0.0	0.0			
23	15.3	-4.4	5.5	12.5	0.0	0.0	0.0	0.0			
24	15.4	0.2	7.8	10.2	0.0	0.0	0.0	0.0			
25	23.6	-1.5	11.1	6.9	0.0	0.0	0.0	0.0			
26	23.7	3.4	13.6	4.4	0.0	0.0	0.0	0.0			
27	19.4	5.1	12.3	5.7	0.0	0.0	0.0	0.0			
28	26.7	5.8	16.3	1.7	0.0	0.0	0.0	0.0			
29	20.0	4.4	12.2	5.8	0.0	0.0	0.0	0.0			
30	20.3	6.4	13.4	4.6	0.0	3.5	0.0	3.5			
Sum				**412.6**	**0.0**	**5.0**	**10.9E**	**15.9E**			
Avg	**11.7**	**-3.3**	**4.2**								
Xtrm	**26.7**	**-13.6**									

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

Navigation Options

Canada Map
Manitoba Map
Customized Search
Nearby Stations with Data
1971-2000 Climate Normals
Customizable Chart
Monthly Data (2007)

Environment Canada Environnement Canada

Daily Data Report for May 2007

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 2007

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	16.1	4.7	10.4	7.6	0.0	0.5	0.0	0.5	0		
02	17.7	2.0	9.9	8.1	0.0	0.0	0.0	0.0	0		
03	23.7	8.7	16.2	1.8	0.0	0.0	0.0	0.0	0		
04	14.8	10.5	12.7	5.3	0.0	14.0	0.0	14.0	0		
05	15.2	9.3	12.3	5.7	0.0	6.0	0.0	6.0	0		
06	17.7	9.7	13.7	4.3	0.0	2.0	0.0	2.0	0		
07	24.4	9.8	17.1	0.9	0.0	0.0	0.0	0.0	0		
08	29.4	10.4	19.9	0.0	1.9	0.0	0.0	0.0	0		
09	31.3	13.2	22.3	0.0	4.3	0.0	0.0	0.0	0		
10	20.8	4.9	12.9	5.1	0.0	0.0	0.0	0.0	0		
11	14.3	3.9	9.1	8.9	0.0	0.0	0.0	0.0	0		
12	20.8	0.4	10.6	7.4	0.0	0.0	0.0	0.0	0		
13	23.5	10.4	17.0	1.0	0.0	0.0	0.0	0.0	0		
14	12.6	7.5	10.1	7.9	0.0	3.5	0.0	3.5	0		
15	16.3	4.4	10.4	7.6	0.0	0.0	0.0	0.0	0		
16	16.3	-1.5	7.4	10.6	0.0	0.0	0.0	0.0	0		
17	25.1	5.0	15.1	2.9	0.0	0.0	0.0	0.0	0		
18	17.4	3.7	10.6	7.4	0.0	0.5	0.0	0.5	0		
19	12.7	2.7	7.7	10.3	0.0	0.0	0.0	0.0	0		
20	10.5	3.8	7.2	10.8	0.0	2.0	0.0	2.0	0		
21	22.4	8.5	15.5	2.5	0.0	3.0	0.0	3.0	0		
22	18.6	9.9	14.3	3.7	0.0	27.0	0.0	27.0	0		
23	18.1	9.1	13.6	4.4	0.0	3.5	0.0	3.5	0		
24	11.0	3.8	7.4	10.6	0.0	0.0	0.0	0.0	0		
25	10.3	2.1	6.2	11.8	0.0	0.0	0.0	0.0	0		
26	7.3	2.1	4.7	13.3	0.0	8.0	0.0	8.0	0		
27	17.9	-0.1	8.9	9.1	0.0	0.0	0.0	0.0	0		
28	20.4	6.7	13.6	4.4	0.0	0.0	0.0	0.0	0		
29	18.8	10.0	14.4	3.6	0.0	1.0	0.0	1.0	0		
30	14.3	9.3	11.8	6.2	0.0	0.5	0.0	0.5	0		
31	19.4	11.4	15.4	2.6	0.0	1.0	0.0	1.0	0		
Sum				**185.8**	**6.2**	**72.5**	**0.0**	**72.5**			
Avg	**18.0**	**6.3**	**12.2**								
Xtrm	**31.3**	**-1.5**									

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Environment Canada Environnement Canada

Daily Data Report for June 2007

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 2007

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	25.8	10.4	18.1	0.0	0.1	0.0	0.0	0.0	0		
02	24.0	10.7	17.4	0.6	0.0	0.0	0.0	0.0	0		
03	26.7	9.4	18.1	0.0	0.1	2.5	0.0	2.5	0		
04	18.7	2.7	10.7	7.3	0.0	0.5	0.0	0.5	0		
05	18.1	-1.0	8.6	9.4	0.0	0.0	0.0	0.0	0		
06	18.8	12.5	15.7	2.3	0.0	11.0	0.0	11.0	0		
07	14.0	5.7	9.9	8.1	0.0	4.5	0.0	4.5	0		
08	23.6	4.8	14.2	3.8	0.0	0.0	0.0	0.0	0		
09	23.3	12.8	18.1	0.0	0.1	0.0	0.0	0.0	0		
10	26.6	11.7	19.2	0.0	1.2	9.0	0.0	9.0	0		
11	29.1	16.5	22.8	0.0	4.8	0.0	0.0	0.0	0		
12	30.7	18.8	24.8	0.0	6.8	0.0	0.0	0.0	0		
13	24.1	17.5	20.8	0.0	2.8	9.0	0.0	9.0	0		
14	26.3	11.5	18.9	0.0	0.9	0.0	0.0	0.0	0		
15	23.9	13.9	18.9	0.0	0.9	0.5	0.0	0.5	0		
16	24.3	10.0	17.2	0.8	0.0	0.0	0.0	0.0	0		
17	21.5	14.1	17.8	0.2	0.0	10.0	0.0	10.0	0		
18	20.7	10.7	15.7	2.3	0.0	15.0	0.0	15.0	0		
19	20.7	10.9	15.8	2.2	0.0	11.0	0.0	11.0	0		
20	21.3	11.5	16.4	1.6	0.0	1.0	0.0	1.0	0		
21	25.1	13.2	19.2	0.0	1.2	0.0	0.0	0.0	0		
22	29.6	13.1	21.4	0.0	3.4	0.5	0.0	0.5	0		
23	28.3	13.7	21.0	0.0	3.0	16.0	0.0	16.0	0		
24	27.5	18.9	23.2	0.0	5.2	0.5	0.0	0.5	0		
25	23.2	15.5	19.4	0.0	1.4	26.0	0.0	26.0	0		
26	22.6	12.9	17.8	0.2	0.0	5.5	0.0	5.5	0		
27	15.6	9.0	12.3	5.7	0.0	0.5	0.0	0.5	0		
28	20.0	5.9	13.0	5.0	0.0	0.0	0.0	0.0	0		
29	23.2	6.9	15.1	2.9	0.0	0.0	0.0	0.0	0		
30	23.7	12.8	18.3	0.0	0.3	0.0	0.0	0.0	0		
Sum				**52.4**	**32.2**	**123.0**	**0.0**	**123.0**			
Avg	**23.4**	**11.2**	**17.3**								
Xtrm	**30.7**	**-1.0**									

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Environment Canada Environnement Canada

Daily Data Report for July 2007

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 July 2007

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	22.3	17.9	20.1	0.0	2.1	9.0	0.0	9.0	0		
02	27.9	13.7	20.8	0.0	2.8	0.0	0.0	0.0	0		
03	28.6	16.9	22.8	0.0	4.8	0.5	0.0	0.5	0		
04	26.4	14.9	20.7	0.0	2.7	0.0	0.0	0.0	0		
05	26.0	13.0	19.5	0.0	1.5	0.0	0.0	0.0	0		
06	29.3	14.6	22.0	0.0	4.0	0.0	0.0	0.0	0		
07	30.2	16.9	23.6	0.0	5.6	0.0	0.0	0.0	0		
08	25.8	12.0	18.9	0.0	0.9	0.0	0.0	0.0	0		
09	22.0	7.7	14.9	3.1	0.0	2.5	0.0	2.5	0		
10	21.9	11.3	16.6	1.4	0.0	9.0	0.0	9.0	0		
11	20.7	9.0	14.9	3.1	0.0	0.5	0.0	0.5	0		
12	23.3	10.1	16.7	1.3	0.0	0.0	0.0	0.0	0		
13	25.3	13.0	19.2	0.0	1.2	10.5	0.0	10.5	0		
14	24.5	11.0	17.8	0.2	0.0	13.0	0.0	13.0	0		
15	21.4	10.0	15.7	2.3	0.0	0.0	0.0	0.0	0		
16	25.2	7.6	16.4	1.6	0.0	0.0	0.0	0.0	0		
17	27.1	15.5	21.3	0.0	3.3	0.0	0.0	0.0	0		
18	28.5	14.2	21.4	0.0	3.4	0.0	0.0	0.0	0		
19	M	9.4	M	M	M	0.0	0.0	0.0	0		
20	27.4	M	M	M	M	0.0	0.0	0.0	0		
21	28.9	16.2	22.6	0.0	4.6	0.0	0.0	0.0	0		
22	32.1	17.9	25.0	0.0	7.0	0.0	0.0	0.0	0		
23	33.6	17.3	25.5	0.0	7.5	0.0	0.0	0.0	0		
24	34.8	22.8	28.8	0.0	10.8	0.0	0.0	0.0	0		
25	35.3	19.5	27.4	0.0	9.4	15.5	0.0	15.5	0		
26	28.9	15.2	22.1	0.0	4.1	0.0	0.0	0.0	0		
27	27.9	10.9	19.4	0.0	1.4	0.0	0.0	0.0	0		
28	29.4	14.5	22.0	0.0	4.0	0.0	0.0	0.0	0		
29	35.3	18.3	26.8	0.0	8.8	0.0	0.0	0.0	0		
30	33.8	20.1	27.0	0.0	9.0	0.0	0.0	0.0	0		
31	34.9	21.9	28.4	0.0	10.4	0.0	0.0	0.0	0		
Sum				**13.0***	**109.3***	**60.5**	**0.0**	**60.5**			
Avg	**28.0E**	**14.4E**	**21.3E**								
Xtrm	**35.3B**	**7.6E**									

Legend

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Daily Data Report for August 2007

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 August 2007

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	27.9	14.9	21.4	0.0	3.4	0.5	0.0	0.5	0		
02	27.0	11.1	19.1	0.0	1.1	0.0	0.0	0.0	0		
03	27.5	7.2	17.4	0.6	0.0	0.0	0.0	0.0	0		
04	29.2	18.4	23.8	0.0	5.8	0.0	0.0	0.0	0		
05	28.0	11.9	20.0	0.0	2.0	0.0	0.0	0.0	0		
06	19.3	9.4	14.4	3.6	0.0	0.0	0.0	0.0	0		
07	28.0	9.6	18.8	0.0	0.8	0.5	0.0	0.5	0		
08	23.6	18.0	20.8	0.0	2.8	2.5	0.0	2.5	0		
09	31.0	16.7	23.9	0.0	5.9	0.0	0.0	0.0	0		
10	25.4	16.1	20.8	0.0	2.8	7.5	0.0	7.5	0		
11	27.0	11.1	19.1	0.0	1.1	0.5	0.0	0.5	0		
12	23.9	7.3	15.6	2.4	0.0	0.0	0.0	0.0	0		
13	27.4	13.8	20.6	0.0	2.6	0.0	0.0	0.0	0		
14	23.2	11.3	17.3	0.7	0.0	0.0	0.0	0.0	0		
15	24.5	6.6	15.6	2.4	0.0	3.5	0.0	3.5	0		
16	21.3	5.5	13.4	4.6	0.0	0.0	0.0	0.0	0		
17	20.6	3.7	12.2	5.8	0.0	0.0	0.0	0.0	0		
18	24.2	9.2	16.7	1.3	0.0	0.0	0.0	0.0	0		
19	23.6	12.6	18.1	0.0	0.1	0.0	0.0	0.0	0		
20	17.5	13.5	15.5	2.5	0.0	2.5	0.0	2.5	0		
21	26.1	14.7	20.4	0.0	2.4	1.0	0.0	1.0	0		
22	25.5	13.3	19.4	0.0	1.4	0.0	0.0	0.0	0		
23	19.8	9.6	14.7	3.3	0.0	0.0	0.0	0.0	0		
24	18.1	6.6	12.4	5.6	0.0	0.0	0.0	0.0	0		
25	24.2	3.8	14.0	4.0	0.0	0.0	0.0	0.0	0		
26	29.3	13.2	21.3	0.0	3.3	0.0	0.0	0.0	0		
27	18.6	9.6	14.1	3.9	0.0	0.0	0.0	0.0	0		
28	21.3	8.4	14.9	3.1	0.0	5.0	0.0	5.0	0		
29	22.7	6.7	14.7	3.3	0.0	0.0	0.0	0.0	0		
30	30.0	9.6	19.8	0.0	1.8	1.0	0.0	1.0	0		
31	25.0	5.8	15.4	2.6	0.0	0.0	0.0	0.0	0		
Sum				**49.7**	**37.3**	**24.5**	**0.0**	**24.5**			
Avg	**24.5**	**10.6**	**17.6**								
Xtrm	**31.0**	**3.7**									

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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 September 2007

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	31.6	17.7	24.7	0.0	6.7	0.0	0.0	0.0	0		
02	22.8	10.2	16.5	1.5	0.0	0.0	0.0	0.0	0		
03	20.2	10.0	15.1	2.9	0.0	1.0	0.0	1.0	0		
04	26.5	7.2	16.9	1.1	0.0	0.0	0.0	0.0	0		
05	23.5	11.4	17.5	0.5	0.0	1.5	0.0	1.5	0		
06	22.1	6.4	14.3	3.7	0.0	0.0	0.0	0.0	0		
07	19.1	5.7	12.4	5.6	0.0	0.0	0.0	0.0	0		
08	14.6	3.7	9.2	8.8	0.0	0.0	0.0	0.0	0		
09	19.4	6.2	12.8	5.2	0.0	0.0	0.0	0.0	0		
10	16.7	4.1	10.4	7.6	0.0	1.5	0.0	1.5	0		
11	11.4	3.8	7.6	10.4	0.0	0.0	0.0	0.0	0		
12	18.5	4.9	11.7	6.3	0.0	0.0	0.0	0.0	0		
13	10.9	2.6	6.8	11.2	0.0	0.0	0.0	0.0	0		
14	12.0	-1.2	5.4	12.6	0.0	0.0	0.0	0.0	0		
15	22.3	3.0	12.7	5.3	0.0	0.0	0.0	0.0	0		
16	30.1	4.4	17.3	0.7	0.0	0.0	0.0	0.0	0		
17	26.6	11.1	18.9	0.0	0.9	0.0	0.0	0.0	0		
18	16.4	9.3	12.9	5.1	0.0	1.0	0.0	1.0	0		
19	18.5	5.8	12.2	5.8	0.0	0.0	0.0	0.0	0		
20	14.4	10.0	12.2	5.8	0.0	4.0	0.0	4.0	0		
21	18.0	6.7	12.4	5.6	0.0	0.5	0.0	0.5	0		
22	24.7	2.0	13.4	4.6	0.0	0.0	0.0	0.0	0		
23	27.2	12.7	20.0	0.0	2.0	0.0	0.0	0.0	0		
24	14.1	6.6	10.4	7.6	0.0	20.0	0.0	20.0	0		
25	12.7	4.7	8.7	9.3	0.0	0.5	0.0	0.5	0		
26	19.3	5.9	12.6	5.4	0.0	0.0	0.0	0.0	0		
27	14.5	2.4	8.5	9.5	0.0	0.0	0.0	0.0	0		
28	19.3	1.6	10.5	7.5	0.0	0.0	0.0	0.0	0		
29	27.5	14.1	20.8	0.0	2.8	0.0	0.0	0.0	0		
30	20.2	0.5	10.4	7.6	0.0	0.0	0.0	0.0	0		
Sum				**157.2**	**12.4**	**30.0**	**0.0**	**30.0**			
Avg	**19.8**	**6.5**	**13.2**								
Xtrm	**31.6**	**-1.2**									

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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 October 2007

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	20.5	-0.5	10.0	8.0	0.0	0.0	0.0	0.0	0		
02	17.5	2.0	9.8	8.2	0.0	0.0	0.0	0.0	0		
03	23.1	2.8	13.0	5.0	0.0	0.0	0.0	0.0	0		
04	17.9	3.0	10.5	7.5	0.0	0.0	0.0	0.0	0		
05	10.2	5.0	7.6	10.4	0.0	0.0	0.0	0.0	0		
06	9.6	5.5	7.6	10.4	0.0	0.0	0.0	0.0	0		
07	10.5	5.6	8.1	9.9	0.0	0.0	0.0	0.0	0		
08	8.1	1.3	4.7	13.3	0.0	19.5	0.0	19.5	0		
09	8.0	2.0	5.0	13.0	0.0	0.0	0.0	0.0	0		
10	6.7	2.8	4.8	13.2	0.0	0.0	0.0	0.0	0		
11	7.2	4.9	6.1	11.9	0.0	0.0	0.0	0.0	0		
12	9.6	5.4	7.5	10.5	0.0	0.0	0.0	0.0	0		
13	14.5	-0.8	6.9	11.1	0.0	0.0	0.0	0.0	0		
14	15.4	-1.3	7.1	10.9	0.0	0.0	0.0	0.0	0		
15	16.4	-2.4	7.0	11.0	0.0	0.0	0.0	0.0	0		
16	9.4	0.1	4.8	13.2	0.0	0.0	0.0	0.0	0		
17	12.5	7.2	9.9	8.1	0.0	1.5	0.0	1.5	0		
18	10.5	9.2	9.9	8.1	0.0	15.5	0.0	15.5	0		
19	11.4	4.9	8.2	9.8	0.0	7.5	0.0	7.5	0		
20	11.0	-0.4	5.3	12.7	0.0	0.0	0.0	0.0	0		
21	8.7	-1.5	3.6	14.4	0.0	0.0	0.0	0.0	0		
22	11.9	-0.7	5.6	12.4	0.0	0.0	0.0	0.0	0		
23	12.3	-2.4	5.0	13.0	0.0	0.0	0.0	0.0	0		
24	12.8	-4.3	4.3	13.7	0.0	0.0	0.0	0.0	0		
25	20.1	0.2	10.2	7.8	0.0	0.0	0.0	0.0	0		
26	9.9	-3.6	3.2	14.8	0.0	0.0	0.0	0.0	0		
27	5.0	-6.9	-1.0	19.0	0.0	0.0	0.0	0.0	0		
28	12.2	-4.0	4.1	13.9	0.0	0.0	0.0	0.0	0		
29	12.6	-2.8	4.9	13.1	0.0	0.0	0.0	0.0	0		
30	17.3	-0.2	8.6	9.4	0.0	0.5	0.0	0.5	0		
31	5.5	-5.7	-0.1	18.1	0.0	2.0	0.0	2.0	0		
Sum				**355.8**	**0.0**	**46.5**	**0.0**	**46.5**			
Avg	**12.2**	**0.8**	**6.5**								
Xtrm	**23.1**	**-6.9**									

Legend

[empty] = No data available

M = Missing

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Environment Canada Environnement Canada

Daily Data Report for November 2007

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 November 2007

Day	Max Ter °C	Min Ter °C	Mean Te °C	Heat Deg D °C	Cool Deg D °C	Total R mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max C 10's Deg	Spd of Max C km/h
01	7.4	-4.4	1.5	16.5	0.0	0.0	0.0	0.0			
02	7.6	-0.8	3.4	14.6	0.0	0.0	0.0	0.0			
03	6.6	-5.3	0.7	17.3	0.0	0.0	0.0	0.0			
04	3.7	-5.0	-0.7	18.7	0.0	0.5E	0.0	0.5E			
05	4.0	-3.7	0.2	17.8	0.0	0.0	0.0	0.0			
06	-2.0	-3.6	-2.8	20.8	0.0	0.0	0.0	0.0			
07	4.2	-3.4	0.4	17.6	0.0	0.0	0.0	0.0			
08	3.2	-2.0	0.6	17.4	0.0	0.5E	0.5E	1.0E			
09	2.7	-0.8	1.0	17.0	0.0	0.0	1.0	1.0			
10	6.5	-0.3	3.1	14.9	0.0	0.0	0.0	0.0			
11	10.7	1.6	6.2	11.8	0.0	0.0	0.0	0.0			
12	12.8	-5.2	3.8	14.2	0.0	0.0	0.0	0.0			
13	17.4	2.8	10.1	7.9	0.0	0.0	0.0	0.0			
14	2.9	-1.4	0.8	17.2	0.0	0.0	0.0	0.0			
15	1.8	-2.4	-0.3	18.3	0.0	0.0	0.0	0.0			
16	1.8	-6.3	-2.3	20.3	0.0	0.0	0.0	0.0			
17	-0.6	-7.8	-4.2	22.2	0.0	0.0	0.0	0.0			
18	4.5	-4.7	-0.1	18.1	0.0	1.0E	0.5E	1.5E			
19	4.7	-4.1	0.3	17.7	0.0	0.0	0.0	0.0			
20	-1.7	-9.6	-5.7	23.7	0.0	0.0	0.5	0.5			
21	-6.4	-16.7	-11.6	29.6	0.0	0.0	0.5	0.5			
22	-4.2	-18.0	-11.1	29.1	0.0	0.0	0.0	0.0			
23	-3.3	-14.1	-8.7	26.7	0.0	0.0	0.5	0.5			
24	-0.5	-9.3	-4.9	22.9	0.0	0.0	0.5	0.5			
25	-4.0	-12.1	-8.1	26.1	0.0	0.0	1.0	1.0			
26	-9.7	-22.9	-16.3	34.3	0.0	0.0	0.5	0.5			
27	-13.6	-26.5	-20.1	38.1	0.0	0.0	0.5	0.5			
28	-11.8	-18.0	-14.9	32.9	0.0	0.0	1.5	1.5			
29	-15.0	-23.9	-19.5	37.5	0.0	0.0	0.0	0.0			
30	-17.4	-24.4	-20.9	38.9	0.0	0.0	0.0	0.0			
Sum				**660.1**	**0.0**	**2.0E**	**7.5E**	**9.5E**			
Avg	**0.4**	**-8.4**	**-4.0**								
Xtrm	**17.4**	**-26.5**									

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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 December 2007

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†	-13.5	-22.9	-18.2	36.2	0.0	M	M	1.0		4	37
02†	-13.8	-23.8	-18.8	36.8	0.0	M	M	0.0		3	32
03†	-11.8	-21.8	-16.8	34.8	0.0	M	M	0.0			<31
04†	-10.3	-21.5	-15.9	33.9	0.0	M	M	1.5		5	44
05†	-18.3	-29.8	-24.1	42.1	0.0	M	M	0.0		2	35
06†	-12.4	-19.7	-16.1	34.1	0.0	M	M	0.5		3	44
07†	-17.7	-26.8	-22.3	40.3	0.0	M	M	0.0		32	46
08†	-21.1	-30.3	-25.7	43.7	0.0	M	M	0.5			<31
09†	-13.8	-26.2	-20.0	38.0	0.0	M	M	0.0		19	39
10†	-12.6	-19.8	-16.2	34.2	0.0	M	M	0.0		19	39
11†	-10.7	-20.0	-15.4	33.4	0.0	M	M	0.0			<31
12†	-5.3	-17.7	-11.5	29.5	0.0	M	M	3.0		18	54
13†	-4.4	-31.5	-18.0	36.0	0.0	M	M	2.0		35	61
14†	-16.6	-33.8	-25.2	43.2	0.0	M	M	0.5		18	44
15†	-11.6	-19.5	-15.6	33.6	0.0	M	M	0.0		19	39
16†	-9.0	-21.0	-15.0	33.0	0.0	M	M	1.0		17	54
17†	-6.1	-20.8	-13.5	31.5	0.0	M	M	0.0		19	32
18†	-5.4	-21.5	-13.5	31.5	0.0	M	M	0.0			<31
19†	-2.2	-14.6	-8.4	26.4	0.0	M	M	0.5			<31
20†	-2.2	-6.4	-4.3	22.3	0.0	M	M	0.0		18	57
21†	-4.2	-12.5	-8.4	26.4	0.0	M	M	3.0		32	32
22†	-6.3	-15.5	-10.9	28.9	0.0	M	M	2.5		29	44
23†	-13.1	-16.5	-14.8	32.8	0.0	M	M	0.0		34	48
24†	-6.1	-16.6	-11.4	29.4	0.0	M	M	1.5		18	59
25†	-7.1	-16.0	-11.6	29.6	0.0	M	M	0.0		3	32
26†	-12.6	-15.9	-14.3	32.3	0.0	M	M	0.0			<31
27†	-9.1	-18.8	-14.0	32.0	0.0	M	M	0.0			<31
28†	-7.5	-14.3	-10.9	28.9	0.0	M	M	1.0			<31
29†	-8.1	-14.1	-11.1	29.1	0.0	M	M	0.5		16	39
30†	-7.2	-15.6	-11.4	29.4	0.0	M	M	0.0		18	35
31†	-10.7	-21.0	-15.9	33.9	0.0	M	M	0.5		33	39
Sum				**1027.2**	**0.0**	**M**	**M**	**19.5**			
Avg	**-10**	**-20.2**	**-15.11**								
Xtrm	**-2.2**	**-33.8**								**35**	**61**

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