# Extreme Rain Event – July 17, 2005

As a result of heavy rainfall beginning in the early morning hours of July 17, 2005 just after midnight, there was significant basement flooding throughout Winnipeg. City crews responded in accordance with standard procedures.

The rainfall was significant throughout the City from 40 mm in the North West to 100 mm or more in the south area of Winnipeg. A complete report on the rainfall is included as Appendix A. Figure 1 below shows the rainfall pattern. As shown in Appendix A, at one gauge in Fort Richmond, in excess of 100 mm of rain measured, most falling within 45 minutes. This far exceeds the 100 year return frequency rainfall[1] for any point in Winnipeg. The combination of high river levels with extreme rain made for an exceptional event.

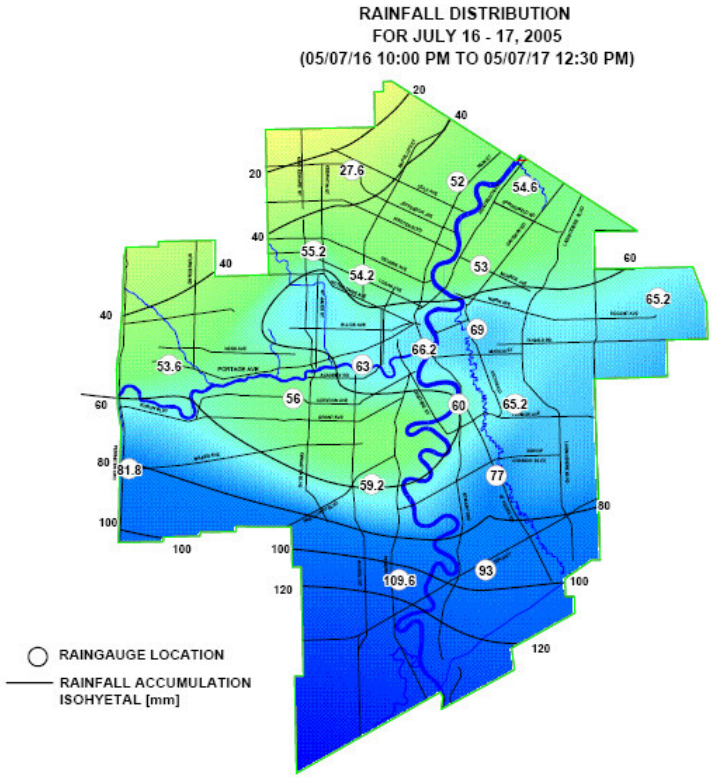


**Figure 1 Rainfall Event**

[1] Compared to long term records at Winnipeg Airport.

## System Overview

The systems that work together in order to deal with precipitation in Winnipeg are the wastewater, combined, and land drainage sewer systems together with the flood protection system. If these systems are overloaded, street flooding and sewer backup into basements[2] will occur.

The sewer system in Winnipeg consists of combined sewers, separate land drainage sewers, wastewater sewers, treatment plants, stormwater retention basins, major drains and ditches. Of these systems, the wastewater system relies on pump stations to convey wastewater to the treatment plants. All of the wastewater pumping systems rely on electric power. Backup power is provided at several locations. However, for many locations on the wastewater system, backup and redundancy is provided through overflows to the land drainage system or to the rivers.

While the wastewater system uses pumping, the land drainage systems, including combined sewers, normally rely on gravity to discharge to the rivers and streams. One exception is some underpasses and retention basins, where pumping is required. In addition, when river levels are high as was the case on July 17, 2005, pumping is required for land drainage and combined systems. This further complicates the operation of the system.

The flood protection system includes primary and secondary dikes, gates, permanent pumping stations, temporary pumping stations, and other infrastructure components. Components of this system are activated according to the river level. As the river level rises above normal summer level of 6.5 feet James Street datum, a few sewer gates are operated or pumping stations are put online. At the lower river levels the infrastructure is in place and automated. When the river rises above 18 feet James Street datum, significant effort is required to add temporary pumps and to construct temporary dikes.

These systems are very complicated. Most of the systems are buried underground and staff have to rely on maps and other data to operate the systems. The flood protection system is particularly complicated with numerous field procedures required. After 1997, a computerized flood manual was developed to provide crews with more direction in terms of what activities are required at varying conditions to protect the system from high river levels.

Land drainage systems on the streets are typically designed for a five-year or ten-year storm. When bigger storms happen, as they do, it is expected that there will be inconvenience associated with street flooding but little damage. This inconvenience is determined as “acceptable” versus the cost of increased spending on sewers. For major systems such as retention ponds, where the damages can be more than street flooding, the systems are designed for against a 25 year storm.[3]

When you experience a storm of the magnitude of the rain received July 17, 2005, the system will become overloaded.

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[2] Basements may be protected from backup and flooding through proactive measures recommended by the City such as backwater valve, sump pump, extended downspouts and grading away from foundations.

[3] For design of the floodway, where the damage can be significant, a 700-year design return period is used.

**Normal Staffing**

The system is, for the most part, an automated system that is expected to run without intervention from staff. Pumping stations and systems are unmanned. Pumping stations contain alarm monitoring systems to alert staff of problems. During regular working hours, maintenance staff carry out routine checks of pumping stations and perform maintenance and repair duties. Sewer crews maintain the pipe system.

During nights, staff are on duty to respond to issues. For on-street issues, there are two emergency services crews and an emergency services dispatcher. These staff members respond to issues in the water and sewer systems such as watermain breaks and blocked sewers. For water and wastewater pumping stations, an Operator is working who monitors system alarms. Response to these system alarms is provided by operators and technicians on standby.

During periods of high river level during the summer, additional staff resources are used as considered necessary for the circumstances.

**High River Level in the Summer**

The land drainage and combined sewer system is designed to function during high river levels during spring floods. It is recognized that there is a significant loss of capacity across the system when the rivers are high. However, in all but the most unusual circumstances, high river levels occur in the spring, when snowmelt and rainfall events are typically much less intense than summer rainfalls.

This year, Winnipeg experienced record high river levels in the summer when there is also an increased risk of intense rainfall events. The risk of the system being overwhelmed is increased significantly with high water levels in the summer. The City has issued several news releases this year indicating the risk of basement flooding is elevated and encouraging citizens to take steps to protect their properties.

Prior to the event on July 17th, the river level which had peaked at 20.1 feet James on July 3, 2005, had fallen to about 18 feet James. Normal summer level is 6.5 feet James. The flood manual is being used for operations for this summer's high river level. The flood manual lists procedures that must be carried out for any given river level scenario.

Under the scenario of a river level of 21 feet, 87 properties were listed where secondary dyking (sandbagging) was indicated. In addition, the manual indicated that 32 flood pumping stations would be needed and that another 32 temporary pumps would have to be located in the system. In addition over 100 manholes needed to be sealed and over 200 sewer system control activities were needed. This includes things like closing gates, checking flap gates and setting up temporary pumps.

## Preparation for Rainfall

As stated previously, the system is designed to run without intervention from staff. There is little time for reaction and activities during any rainfall event. The system is put in a state of readiness by carrying out the procedures in the flood manual and other normal operating procedures. Outside of regular working hours, in additional to the normal emergency staff, additional staff are placed on duty or on alert depending on the circumstances. This was the case during this event.

## Event Response

The following units had staff dealing with the event.

Wastewater Treatment
Collection System
Emergency Services Branch
Local Services Branch -Sewer Section
Electrical & Instrumentation Branch

In anticipation of the event, staff were placed at the two unmanned treatment plants to ensure that issues were dealt with immediately.

The Collection Branch standby crew and one additional staff member were called out on July 16 at 23:00 in preparation of the rain event. This is standard procedure during periods of high river levels. Their role is to inspect all active flood stations to ensure all equipment is operational and respond to alarms. For this event they were able to inspect 6 stations before the rain started. They continued to inspect the stations during the initial stages of the storm. All active flood stations had been checked before they were required. No problems were found during these inspections.

After the initial inspections were completed, the standby crew started to respond to alarm conditions. Additional staff were called in at 02:00 and 04:00 and assigned into two person crews. This allowed us to have 4 crews to respond to problem areas along with continued flood station inspections. Crews experienced longer than normal response times due to flooded underpasses, flooded streets, abandoned vehicles, downed trees and power lines.

Crews were notified of the RealFlex[4] alarms via radio by the McPhillips Control Center operator. The foremen generally decide which alarms are given priority response according to predetermined criteria. The Supervisor was also on site monitoring the alarms and directing the crews to problems received from other sources. The alarm system has backup power using batteries that are on a charging system. This is important in that if the power goes out at a station, the alarm system is still able to communicate that and any other alarm conditions.

[4] "RealFlex" is the trade name for the alarm monitoring and recording software used to monitor the wastewater system.

The following table summarizes the alarms received thru the RealFlex system for Sunday July 17.

| RealFlex Alarm Summary from July 17 at 00:00 to 23:59 | | | |
|---|---|---|---|
| ALARM Priority | Alarm Type | Total Received | Attended |
| 1 | Station Flood | 2 | 2 |
| 2 | Flood Station High Wet Well | 25 | 25 |
| 3 | Flood Station Loss of 600 Volt | 11 | 11 |
| 4 | Lift Station Power Failure | 17 | 17 |
| 5 | Low Instrument Air | 3 | 3 |
| 6 | Pump Fail | 14 | 14 |
| 7 | Lift Station Overflow/High Wet Well | 93 | 44 |
| 8 | PCU (Communication) Scan | 29 | 7 |
| 9 | Miscellaneous (Gen Run, Seal Water Loss, Etc.) | 63 | 12 |
| Total | | 257 | 135 |

The Collection crews also attended many land drainage issues after the rain. This included inspection of major drains, checking for blockages, inspecting SRB levels and checking pumps.

Typically there are five staff on duty at all times in Emergency Services - the dispatcher and two 2-man crews. Prior to the rain, the crews were occupied with normal duties, which included replacement of barricades that were reported down or missing, responding to reports of potential watermain leaks, and responding to reports of unsafe road conditions. Once the storm started, the crews initially responded to reports of manhole covers blown off. Due to the high volumes of customer calls, one of the crew members was reassigned to assist in answering telephones and dispatching crews leaving a 3-man crew. The crew responded to safety-related issues including numerous trees and debris on roadways, stop signs down, and manhole covers blown off. They also responded to a flood alarm at Deacon Pumping Station.

Two additional staff were called at approximately 01:00 to assist in answering the Emergency Services telephones due to the number of calls from citizens to advise of sewer backup, flooded streets and boulevards, and downed trees and debris.

On Saturday evening, four sewer crews and the foreman were on duty to operate and start temporary pumps. Two crews were monitoring and operating pumps at a sewer replacement project on Municipal Road - typically this is just one crew, but they were experiencing pumping problems (pump failure) so the Vactor[5] crew was being used in addition to intermittent pumping until a replacement pump was installed. The two other crews were monitoring and operating the

[5] Vactor is a trade name of truck mounted sewer cleaning and vacuum equipment.

pumps at Kildare and at Hawthorne, where pumping has continued since the storm event of June 30 due to high river levels.

At about 22:30 the foreman concluded that a potentially heavy thunderstorm was imminent. An additional two Local Services crews were called in to assist with flood operations, reporting at 23:00 and 24:00 (midnight) respectively. Crews were dispatched to start temporary pumps at the following locations:

Kilkenny and Rice
Churchill underpass
Kingston Row underpass
Lord and Lemay
Kildare and Perimeter
Hawthorne and Kildonan Dr
McLeod Creek (Whellams Lane)
Wildwood and Oakenwald
Wildwood and North Drive
Parkwood Pl

The crews experienced delays getting to the various sites because of driving conditions due to the torrential rain and flooded streets.

Throughout the night, crews monitored pump operations at all temporary pump locations to ensure uninterrupted pumping.

On Sunday, from 07:00 to 18:00, five crews were operating and monitoring pump operations. An additional six crews were investigating customer reports of sewage backups and liberating sewers where required. Three staff were answering the Emergency Services telephones until approximately 2:00 pm, when call volumes decreased. Late on Sunday, an additional pump was set up at Dugald and Borden to assist with overland flooding in South Transcona.

**Flooding**

As a result of the storm, significant flooding occurred. In terms of basement flooding, the department received only 134 reports of flooded basements as shown below. Of course, it is expected that the number of basements actually flooded would exceed the number reported by many multiples. The conclusion is that hundreds and perhaps thousands of basements were flooded.

In addition there was considerable street and road flooding. The underpasses were flooded. This is to be expected as sewer systems, ditches and drains were overloaded.

**SERVICE REQUEST CALL SUMMARY**

| | | | |
|---|---|---|---|
| | *TOTAL CALLS* | 180 | 43 |
| CODE | CALL DESC | 16-18 Jul COUNT | 19 Jul COUNT |
| BACKUP05 | {SEWER BACK UP - CLEAN WATER} | 33 | 7 |
| BACKUP10 | {SEWER BACK UP - RAW SEWAGE} | 81 | 14 |
| FLOOD05 | {BASEMENT FLOODING - FROM OVERLAND WATER} | 0 | 0 |
| ODOUR05 | {SEWER ODOUR OUTSIDE} | 0 | 0 |
| ODOUR10 | {SEWER ODOUR INSIDE BUILDING / HOUSE} | 0 | 0 |
| CATCHB05 | {CATCH BASIN PLUGGED - FRONT STREET} | 27 | 10 |
| CATCHB10 | {CATCH BASIN PLUGGED - BACK LANE} | 4 | 0 |
| CATCHB15 | {CATCH BASIN DAMAGED - FRONT STREET} | 4 | 5 |
| CATCHB20 | {CATCH BASIN DAMAGED - BACK LANE} | 0 | 0 |
| MANHOLE05 | {MANHOLE DAMAGED - FRONT STREET} | 4 | 0 |
| MANHOLE10 | {MANHOLE DAMAGED - BACK LANE} | 0 | 0 |
| MANHOLE15 | {MANHOLE COVER OFF} | 9 | 2 |
| MISC05 | {MISCELLANEOUS - SEWER SERVICES} | 7 | 3 |
| DITCH | {DITCH CLEAN / INVESTIGATE} | 11 | 2 |
| THANKS05 | {THANKS TO STAFF} | 0 | 0 |

**TOP STREET CALLS JUL 16-18**

| STREET | TOTAL CALLS |
|---|---|
| Dugald RD | 4 |
| Cherokee BAY | 3 |
| Thornhill BAY | 3 |
| Archibald ST | 2 |
| Baylor AVE | 2 |
| Elizabeth RD | 2 |
| Kilkenny DR | 2 |
| Kingston ROW | 2 |
| La Grave ST | 2 |
| Laval DR | 2 |
| Lemay AVE | 2 |
| Melrose AVE W | 2 |
| Ormiston RD | 2 |
| Valence AVE | 2 |

While power failures and/or basement flooding occurred at many locations in the City, the situation in St. Norbert seemed particularly bad with the extreme rainfall. Appendix B includes further information on St. Norbert.

## Assessment

The rainfall of July 17, 2005 clearly overwhelmed the system resulting in extensive street and basement flooding. This could be expected since the system is not designed for this kind of extreme rainfall. Basement flooding would have been expected during normal summer operation in the context of the extreme rainfall. However, in this instance, the capacity of the system was further reduced significantly because of unprecedented river levels for this time of year. Power

was also interrupted to pumping stations throughout the City. Crews were overtaxed due to the number of alarms.

Crews prepared and operated the system according to standard operating procedures. While the system experienced multiple power failures which no doubt contributed to the extent of basement flooding, the basement flooding would have resulted in any case with the combination of high river levels and extreme rainfall.

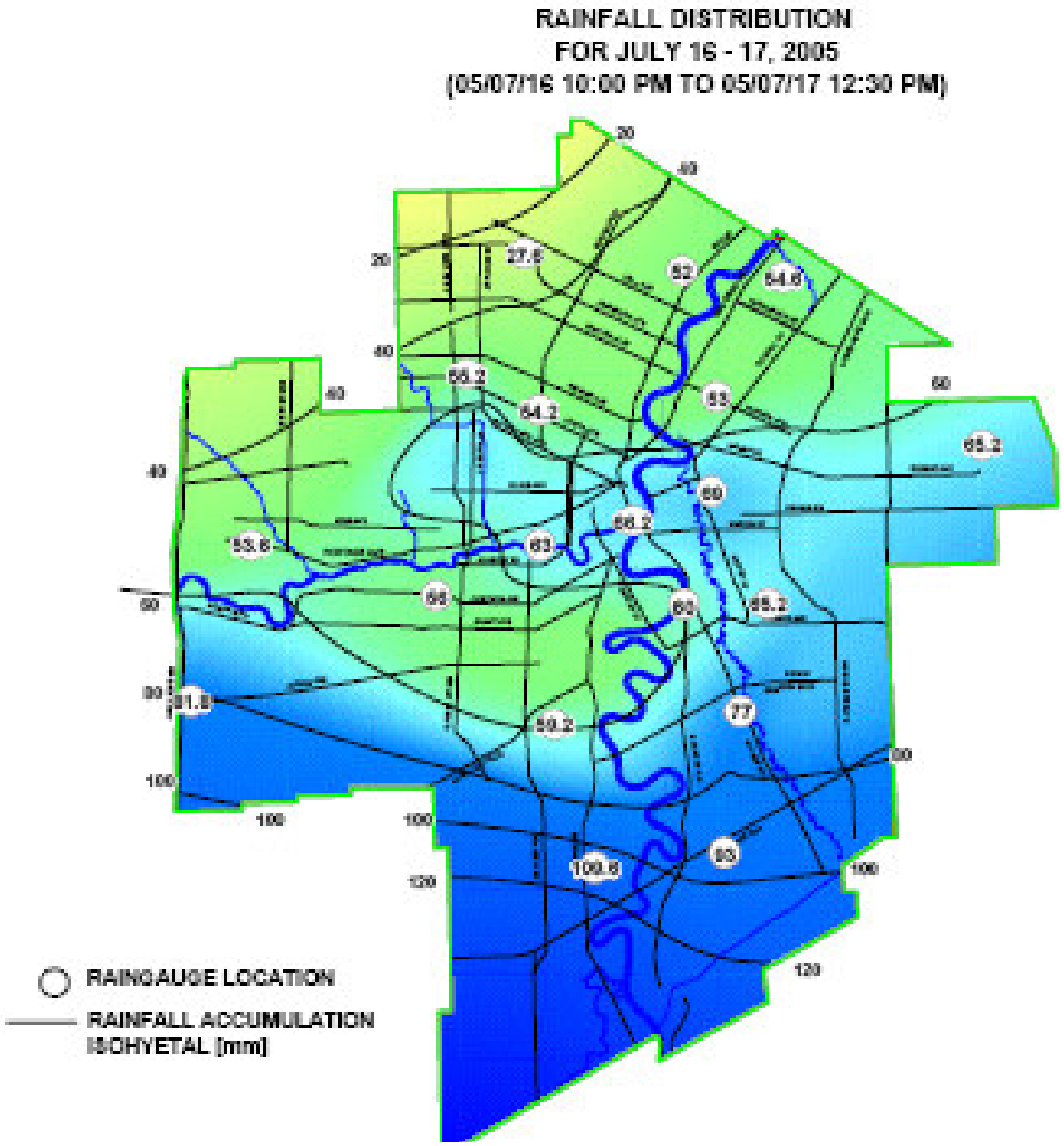
The event is further evidence that Winnipeg homeowners should take precautions and have backup valves, sump pumps and other measures to protect property for incidents like these or others that do result in basement flooding. Even if you have never been flooded in the past, circumstances can lead to basement flooding.

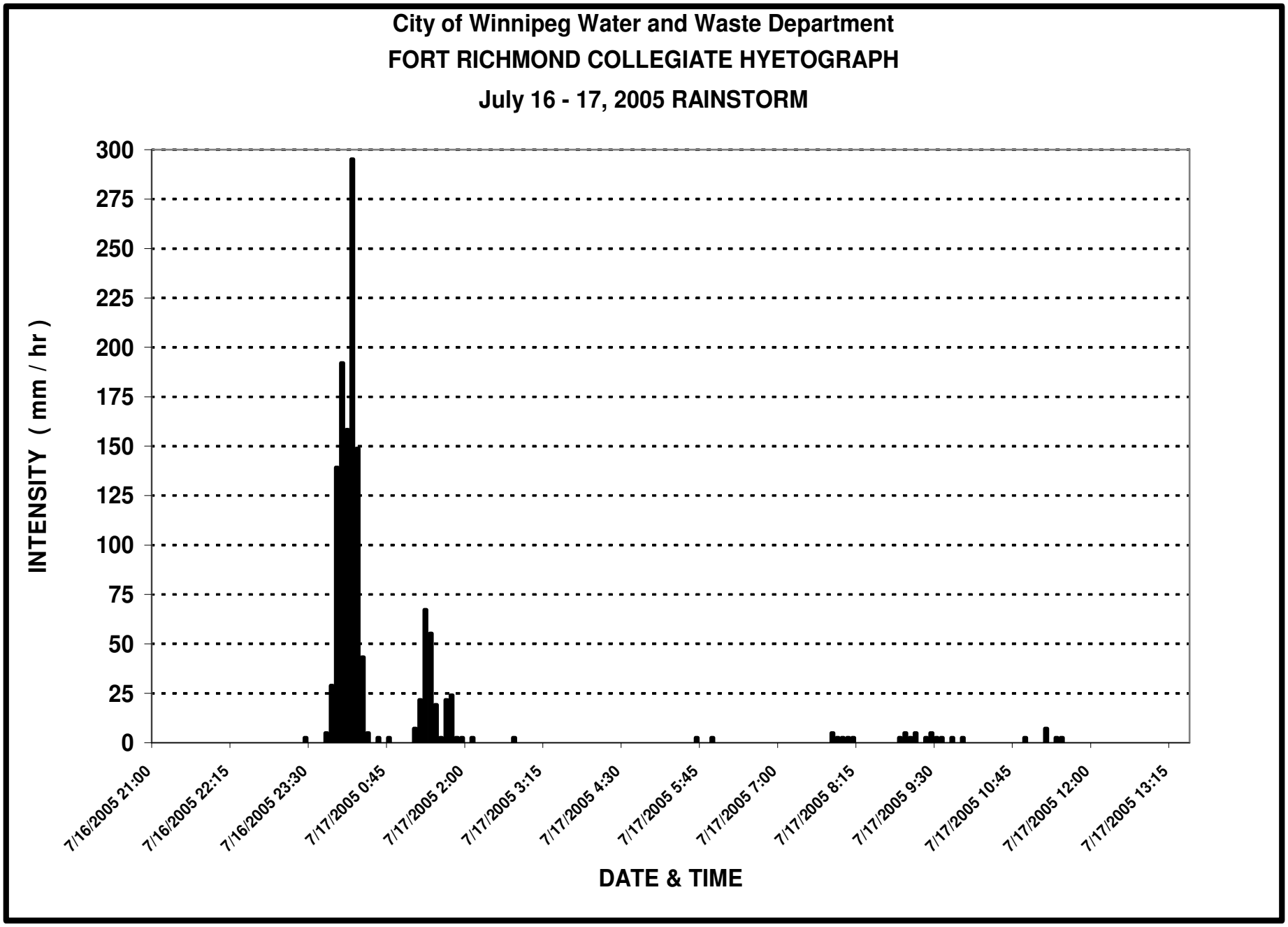
**Capital Improvement Plan**

For many years, the City has worked to improve the sewer system in Winnipeg. The 2005 capital budget plan and 2006 to 2010 five year forecast adopted by Council includes over $145 million in expenditures for Land Drainage and Flood Control. Details of the capital budget are available on the City of Winnipeg website at http://www.winnipeg.ca/finance/2005_adopted_capital_budget.pdf.

Prepared by: Water and Waste Department
July 21, 2005

## APPENDIX A – Rainfall Information



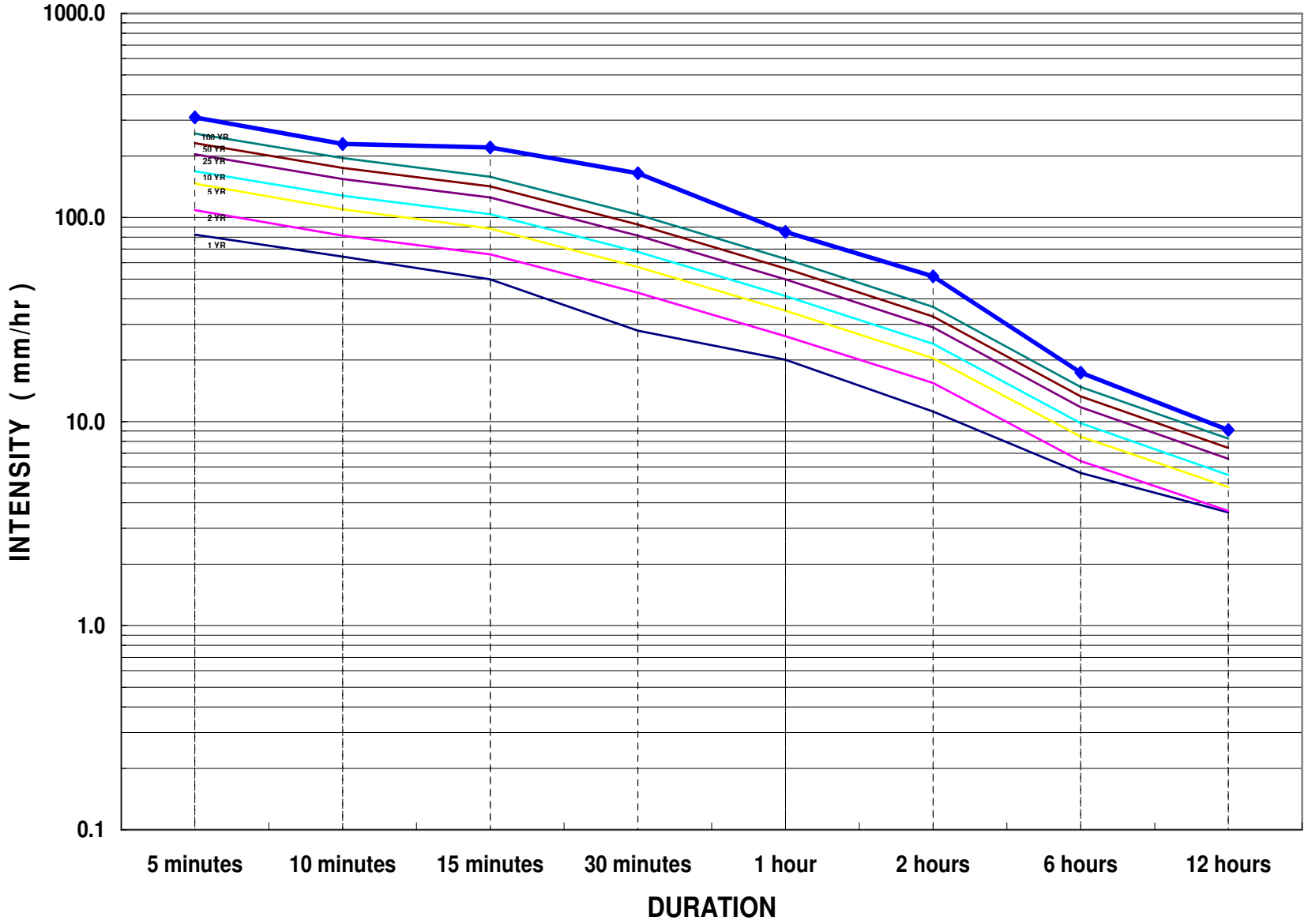

City of Winnipeg Water and Waste Department
FORT RICHMOND COLLEGIATE HYETOGRAPH
July 16 - 17, 2005 RAINSTORM
INTENSITY ( mm / hr )
300
275
250
225
200
175
150
125
100
75
50
25
0
7/16/2005 21:00
7/16/2005 22:15
7/16/2005 23:30
7/17/2005 0:45
7/17/2005 2:00
7/17/2005 3:15
7/17/2005 4:30
7/17/2005 5:45
7/17/2005 7:00
7/17/2005 8:15
7/17/2005 9:30
7/17/2005 10:45
7/17/2005 12:00
7/17/2005 13:15
DATE & TIME

**APPENDIX A – Rainfall Information**

**City of Winnipeg Water and Waste Department**

**FORT RICHMOND COLLEGIATE IDF CURVE**

**July 16 - 17, 2005 RAINSTORM**



# APPENDIX A – Rainfall Information

## THE CITY OF WINNIPEG
## WATER AND WASTE DEPARTMENT
### RAINFALL ACCUMULATION LOG - SUMMER 2005

Accumulations in millimeters

NA..... Not Available
NO..... Not Operational
+..... Incomplete raingauge data

PR - Parks and Rec Building
PL - Parklane Lift Station
AW - Arthur E. Wright School
NE - North End Treatment Plant
FS - Fire Station No. 24
WW - Westwood Lift Station
JW - Jameswood School
MC - McPhillips Pumping Station
SB - St. Boniface Shops
MN - Missions Gardens Lift Station
PM - Perimeter Lift Station
ET - Ecole Tuxedo Park
CL - Clarence Lift Station
MG - Mager Drive Lift Station
WN - Windsor Park Generator
FR - Fort Richmond Collegiate
D5 - District No. 5 Building
EN - Ecole Noel Ritchot
MY - Mayfair Pumping Station
LS - Laura Secord School
AD - Arthur Day School
SE - South End Pollution Control Center
AC - Archwood School
ML - MacLean Pumping Station

| RAINSTORM DATE | APPROXIMATE RAINSTORM START TIME | APPROXIMATE RAINSTORM STOP TIME | TELEMETRY RAINFALL MONITORING SITES | | | | | | | | | | | | | | | | | | | | PORTABLE R.M. SITES | | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PR | PL | AW | NE | FS | WW | JW | MC | SB | MN | PM | ET | CL | MG | WN | FR | D5 | EN | MY | LS | AD | SE | AC | ML | |
| April 26, 2005 | 11:30 AM | 7:00 PM | 2.2 | 0.0 | NA | 0.0 | 5.2 | NA | NA | NA | 0.0 | NA | 0.0 | 0.0 | 0.0 | NA | 0.0 | NA | 0.0 | NA | NA | 0.0 | 0.0 | NA | NA | NA | **0.6** |
| April 27 AM, 2005 | 12:00 AM | 12:00 AM | 0.0 | 0.0 | NA | 0.0 | 0.0 | NA | NA | NA | 0.0 | NA | 0.0 | 0.2 | 0.2 | NA | 0.2 | NA | 0.2 | NA | NA | 0.2 | 0.2 | NA | NA | NA | **0.1** |
| April 27, 2005 | 7:30 AM | 4:00 PM | 0.2 | 0.0 | NA | 1.2 | 1.6 | NA | NA | NA | 0.2 | NA | 0.0 | 0.4 | 0.2 | NA | 0.2 | NA | 0.2 | NA | NA | 0.2 | 0.2 | NA | NA | NA | **0.4** |
| April 28-29, 2005 | 04 28 05 11:30 PM | 04 29 05 12:30 AM | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.4 | NA | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.2 | 0.0 | NA | 0.0 | 0.0 | NA | NA | NA | **0.0** |
| April 29, 2005 | 7:30 AM | 9:00 AM | 0.2 | 0.0 | NA | 0.0 | 0.0 | 0.0 | NA | 0.2 | 0.4 | NA | 0.6 | 0.2 | 0.2 | NA | 0.4 | 0.2 | 0.2 | 0.2 | NA | 0.2 | 0.0 | NA | NA | NA | **0.2** |
| April 29 AM, 2005 | 7:30 AM | 3:00 PM | 1.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.4 | NA | 0.2 | 0.6 | NA | 0.8 | 0.6 | 0.6 | 0.6 | 0.8 | 0.4 | 0.8 | 0.2 | 0.2 | 1.0 | 0.4 | 0.6 | NA | NA | **0.5** |
| April 29-30, 2005 | 04 29 05 9:30 PM | 04 30 05 10:00 AM | 0.2 | 0.0 | 0.2 | 0.2 | 0.2 | 1.2 | NA | 0.2 | 0.4 | NA | 1.2 | 0.6 | 0.8 | 0.4 | 0.6 | 1.0 | 1.0 | 0.6 | 0.4 | 0.2 | 0.2 | 0.4 | NA | NA | **0.5** |
| May 1, 2005 | 8:00 AM | 6:30 PM | 0.4 | 0.0 | 0.4 | 0.2 | NA | 1.0 | NA | 0.0 | 0.4 | NA | 0.0 | 0.4 | 0.2 | 0.0 | 0.2 | 0.4 | 0.2 | 0.6 | 0.4 | 0.0 | 0.4 | 0.0 | NA | NA | **0.3** |
| May 2, 2005 | 12:30 PM | 3:00 PM | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | NA | NA | **0.1** |
| May 7-8, 2005 | 05 07 05 4:30 AM | 05 08 05 8:00 AM | 18.8 | 15.4 | 18.4 | 25.2 | 19.2 | 23.0 | NA | 21.0 | 21.0 | NA | 21.4 | 18.0 | 18.8 | 18.4 | 20.2 | 23.0 | 21.8 | 23.0 | 19.6 | 18.8 | 17.4 | 26.0 | NA | NA | **20.4** |
| May 9-10, 2005 | 05 09 05 1:30 AM | 05 10 05 2:00 AM | 7.6 | 7.2 | 12.6 | 8.2 | 9.2 | 9.4 | NA | 5.6 | 6.8 | NA | 5.2 | 8.6 | 6.8 | 6.0 | 8.0 | 10.4 | 9.4 | 11.6 | 6.6 | 8.0 | 9.6 | 10.2 | NA | NA | **8.4** |
| May 10, 2005 | 12:30 PM | 5:00 PM | 0.0 | 0.0 | 0.0 | 0.0 | 2.2 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | NA | NA | **0.1** |
| May 12-13, 2005 | 05 12 05 8:00 PM | 05 13 05 1:30 PM | 2.8 | 1.8 | 2.4 | 2.8 | 2.0 | 3.0 | NA | 3.2 | 3.2 | NA | 1.4 | 2.8 | 4.0 | 3.2 | 2.6 | 4.2 | 3.0 | 3.4 | 3.2 | 3.2 | 1.4 | 3.0 | NA | NA | **2.8** |
| May 13-14, 2005 | 05 13 05 11:30 PM | 05 14 05 6:00 PM | 0.4 | 0.2 | 0.6 | 0.4 | 2.8 | 1.6 | NA | 0.2 | 0.6 | NA | 0.6 | 0.8 | 0.4 | 0.4 | 0.6 | 0.6 | 0.6 | 0.6 | 0.4 | 0.4 | 0.4 | 0.6 | NA | NA | **0.7** |
| May 17-18, 2005 | 05 17 05 8:30 PM | 05 18 05 7:00 AM | 1.4 | 2.2 | 4.6 | 1.6 | 2.0 | 3.0 | NA | 3.6 | 1.8 | NA | 1.4 | 3.4 | 3.6 | 3.0 | 1.4 | 3.4 | 3.2 | 3.0 | 3.0 | 3.4 | 1.2 | 3.0 | NA | NA | **2.7** |
| May 18 PM, 2005 | 12:30 PM | 1:00 PM | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | NA | **0.1** |
| May 18, 2005 | 10:00 PM | 10:00 PM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| May 19, 2005 | 1:00 PM | 1:00 PM | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| May 20, 2005 | 11:30 AM | 11:30 AM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| May 21, 2005 | 6:30 AM | 7:00 PM | 29.8 | 31.2 | 28.2 | 30.0 | 32.0 | 36.6 | NA | 30.8 | 33.2 | 27.8 | 35.2 | 32.4 | 32.2 | 30.6 | 31.8 | 34.0 | 31.2 | 32.6 | 28.4 | 30.8 | 30.0 | 31.2 | 29.8 | NA | **31.4** |
| May 22 AM, 2005 | 6:00 AM | 8:00 AM | 0.8 | 0.2 | 0.2 | 1.0 | 1.4 | 0.6 | NA | 0.2 | 0.4 | 0.4 | 1.6 | 0.4 | 0.2 | 0.2 | 0.4 | 0.6 | 0.4 | 0.8 | 0.2 | 0.4 | 0.4 | 0.8 | 0.4 | NA | **0.5** |
| May 22, 2005 | 2:30 PM | 3:00 PM | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| May 23-24, 2005 | 05 24 05 12:00 AM | 05 24 05 6:30 AM | 0.6 | 0.2 | 0.4 | 0.6 | 0.4 | 0.0 | NA | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 1.0 | 1.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.8 | 0.6 | 0.6 | 0.0 | 0.6 | NA | **0.4** |
| May 26-28, 2005 | 05 26 05 5:30 AM | 05 28 05 10:30 PM | 13.4 | 6.4 | 12.0 | 15.4 | 15.0 | 7.6 | 8.6 | 9.6 | 12.8 | 8.8 | 3.2 | 9.2 | 8.8 | 10.4 | 11.4 | 8.8 | 10.6 | 11.0 | 11.4 | 14.6 | 11.0 | 10.2 | 11.2 | NA | **10.5** |
| May 29, 2005 | 12:00 PM | 6:00 PM | 0.2 | 0.0 | 0.0 | 1.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.2 | 0.6 | 0.2 | 0.8 | 0.6 | 0.2 | 0.2 | 0.0 | 0.0 | NA | **0.2** |
| May 31, 2005 | 7:00 AM | 10:30 AM | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| June 1, 2005 | 4:30 AM | 3:00 PM | 4.0 | 3.8 | 4.4 | 3.6 | 3.8 | 2.8 | 3.2 | 4.4 | 3.6 | 3.2 | 2.6 | 3.6 | 3.8 | 3.8 | 3.6 | 4.4 | 3.2 | 4.2 | 4.0 | 4.6 | 3.4 | NA | 3.2 | NA | **3.7** |
| June 2, 2005 | 10:00 AM | 2:00 PM | 0.0 | 0.0 | 0.6 | 0.0 | 0.2 | 1.6 | NA | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.1** |
| June 3, 2005 | 7:00 AM | 2:00 PM | 10.8 | 6.2 | 7.0 | 9.6 | 10.4 | 5.8 | NA | 8.8 | 11.8 | 12.4 | 5.2 | 7.4 | 12.2 | 12.8 | 14.8 | 16.2 | 15.4 | 17.2 | 11.2 | 9.2 | 16.2 | 15.4 | 13.4 | NA | **11.3** |
| June 3-4, 2005 | 06 04 05 12:00 AM | 06 04 05 5:00 AM | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | NA | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.2 | 0.4 | 0.0 | NA | **0.3** |
| June 4-5, 2005 | 06 04 05 11:30 PM | 06 05 05 4:30 PM | 3.4 | 2.8 | 3.6 | 3.0 | 3.2 | 3.0 | NA | 2.8 | 3.2 | 2.6 | 1.4 | 2.8 | 3.0 | 2.6 | 2.6 | 3.4 | 3.0 | 3.4 | 3.2 | 4.0 | 4.4 | 5.0 | 2.8 | NA | **3.1** |
| June 7, 2005 | 8:30 AM | 3:00 PM | 9.4 | 8.6 | 9.0 | 9.0 | 9.0 | 9.8 | 9.4 | 10.4 | 10.0 | 9.2 | NA | 10.2 | 9.8 | 9.8 | 10.6 | 12.6 | 11.2 | 13.0 | 10.6 | 10.2 | 8.6 | 12.4 | 10.4 | NA | **10.1** |
| June 8, 2005 | 9:30 AM | 10:30 PM | 7.2 | 8.8 | 12.6 | 7.2 | 8.6 | 4.8 | 4.8 | 13.6 | 7.6 | 7.4 | NA | 10.6 | 6.8 | 6.4 | 7.6 | 7.4 | 8.2 | 9.0 | 5.8 | 10.0 | 9.4 | 8.8 | 6.6 | NA | **8.1** |
| June 9 AM, 2005 | 3:00 AM | 1:30 PM | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | NA | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 24.2 | NA | **1.2** |
| June 9, 2005 | 8:30 PM | 8:30 PM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| June 10, 2005 | 2:00 PM | 2:30 PM | 0.0 | 0.2 | 0.2 | 0.2 | 0.0 | 0.4 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | NA | **0.1** |
| June 11-12, 2005 | 06 11 05 7:00 PM | 06 12 05 8:00 AM | 26.8 | 21.8 | 21.4 | 26.4 | 28.0 | 27.2 | 22.6 | 20.2 | 25.6 | 8.8 | 18.2 | 26.2 | 32.0 | 22.0 | 23.4 | 23.6 | 24.6 | 20.6 | 27.4 | 29.6 | 25.0 | 19.2 | 24.2 | 22.8 | **23.7** |
| June 12-13, 2005 | 06 12 05 2:30 PM | 06 13 05 12:00 AM | 1.6 | 0.2 | 0.4 | 0.4 | 0.8 | 0.0 | 0.4 | 0.8 | 0.6 | 0.2 | 0.2 | 1.2 | 1.0 | 0.4 | 0.6 | 0.0 | 0.4 | 0.4 | 0.4 | 1.0 | 0.0 | 0.2 | 0.6 | 1.6 | **0.6** |
| June 13 AM, 2005 | 11:30 AM | 6:00 PM | 1.4 | 0.2 | 0.2 | 0.6 | 1.8 | 0.6 | 0.0 | 0.4 | 1.2 | 1.8 | 0.2 | 0.6 | 1.4 | 1.2 | 1.0 | 1.2 | 1.8 | 1.0 | 1.0 | 0.6 | 1.2 | 1.2 | 1.4 | 1.4 | **1.0** |
| June 13-15, 2005 | 06 13 05 11:30 PM | 06 15 05 8:30 AM | 15.8 | 9.0 | 14.8 | 15.6 | 17.4 | 15.4 | 12.6 | 15.2 | 16.4 | NA | 11.4 | 16.8 | 18.4 | 16.4 | 16.6 | 22.4 | 20.0 | 25.4 | 16.6 | 16.8 | 14.4 | 19.8 | 16.4 | 15.6 | **16.5** |
| June 23, 2005 | 4:00 PM | 8:00 PM | 2.0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.4 | 0.6 | 1.4 | 3.4 | 4.0 | NA | 0.6 | 3.4 | 1.4 | 2.0 | 6.4 | 8.2 | 5.8 | 2.0 | 1.2 | 5.6 | 5.6 | 2.2 | 3.8 | **2.7** |
| June 26, 2005 | 5:00 AM | 12:00 PM | 5.4 | 7.8 | 5.6 | 5.8 | 5.0 | 3.4 | 4.8 | 5.0 | 6.0 | 7.4 | 3.6 | 6.6 | 6.2 | 5.0 | 9.2 | 5.6 | 8.0 | 7.6 | 6.0 | 7.0 | 6.6 | 8.4 | 7.0 | NA | **6.2** |
| | | | 168.0 | 135.2 | 161.0 | 169.8 | 183.4 | 163.2 | 67.4 | 158.6 | 171.8 | 99.2 | 115.8 | 165.0 | 176.8 | 156.2 | 172.0 | 191.2 | 187.4 | 196.8 | 165.4 | 177.0 | 168.6 | 182.4 | 154.4 | 45.2 | **169.6** |

# APPENDIX A – Rainfall Information

**THE CITY OF WINNIPEG**
**WATER AND WASTE DEPARTMENT**

**RAINFALL ACCUMULATION LOG - SUMMER 2005**

Accumulations in millimeters

NA..... Not Available
NO..... Not Operational
+..... Incomplete raingauge data

PR - Parks and Rec Building
PL - Parklane Lift Station
AW - Arthur E. Wright School
NE - North End Treatment Plant
FS - Fire Station No. 24
WW - Westwood Lift Station
JW - Jameswood School
MC - McPhillips Pumping Station
SB - St. Boniface Shops
MN - Missions Gardens Lift Station
PM - Perimeter Lift Station
ET - Ecole Tuxedo Park
CL - Clarence Lift Station
MG - Mager Drive Lift Station
WN - Windsor Park Generator
FR - Fort Richmond Collegiate
D5 - District No. 5 Building
EN - Ecole Noel Ritchot
MY - Mayfair Pumping Station
LS - Laura Secord School
AD - Arthur Day School
SE - South End Pollution Control Center
AC - Archwood School
ML - MacLean Pumping Station

| RAINSTORM DATE | APPROXIMATE RAINSTORM START TIME | APPROXIMATE RAINSTORM STOP TIME | TELEMETRY RAINFALL MONITORING SITES | | | | | | | | | | | | | | | | | | | | | PORTABLE R.M. SITES | | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PR | PL | AW | NE | FS | WW | JW | MC | SB | MN | PM | ET | CL | MG | WN | FR | D5 | EN | MY | LS | AD | SE | AC | ML | |
| June 27, 2005 | 1:00 AM | 8:30 AM | 11.8 | 14.6 | 14.2 | 13.2 | 14.2 | 20.2 | 15.8 | 13.6 | 13.4 | 10.6 | 17.8 | 15.8 | 12.2 | 11.2 | 11.4 | 11.8 | 12.4 | 12.6 | 12.8 | 14.4 | 11.6 | 12.4 | 11.8 | NA | **13.5** |
| June 27-28, 2005 | 06 27 05 6:30 PM | 06 28 05 2:00 AM | NA | 0.0 | 0.2 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.2 | 0.4 | 0.2 | 0.0 | 0.8 | 0.4 | 0.2 | 0.4 | NA | **0.3** |
| June 28, 2005 | 1:00 AM | 11:00 AM | NA | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| June 29-30, 2005 | 06 29 05 6:00 AM | 06 30 05 5:00 PM | NA | 69.4 | 82.6 | 83.0 | 100.0 | 74.0 | 71.4 | 75.6 | 85.4 | 77.8 | 77.0 | 78.8 | 73.4 | 75.2 | 81.8 | 83.6 | 84.4 | 91.8 | 80.6 | 81.2 | 87.2 | 86.8 | 79.2 | NA | **80.9** |
| July 1, 2005 | 5:00 AM | 6:00 PM | 0.0 | 0.0 | 0.0 | 0.2 | 0.8 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 4.6 | 0.2 | 0.2 | 0.2 | 0.0 | 0.2 | 0.8 | 0.2 | 0.4 | NA | **0.4** |
| July 2, 2005 | 2:30 AM | 8:00 AM | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.8 | 0.6 | 0.0 | 0.2 | 0.2 | 0.4 | 0.4 | 0.6 | 0.6 | 0.4 | 1.2 | 0.8 | 1.2 | 0.2 | 0.2 | 0.0 | 1.2 | 0.4 | NA | **0.4** |
| July 2-3, 2005 | 07 02 05 9:30 PM | 07 03 05 12:30 AM | NA | 13.2 | 13.4 | 15.8 | 16.4 | 9.2 | 10.8 | 16.4 | 17.2 | 12.4 | 12.8 | 10.4 | 27.8 | 16.6 | 17.4 | 26.6 | 25.6 | 12.0 | 16.4 | 16.2 | 10.6 | NA | 15.8 | NA | **15.9** |
| July 3, 2005 | 11:30 AM | 11:00 PM | 11.2 | 5.4 | 3.4 | 2.2 | 2.2 | 4.0 | 4.6 | 6.0 | 3.2 | 2.4 | 7.4 | 1.8 | 1.8 | 3.8 | 6.4 | 4.6 | 2.2 | 16.0 | 1.8 | 2.2 | 5.0 | 5.4 | 4.6 | NA | **4.7** |
| July 4 AM, 2005 | 7:30 AM | 9:30 AM | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 0.0 | 0.2 | NA | **0.1** |
| July 4, 2005 | 4:30 PM | 6:00 PM | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | NA | **0.0** |
| July 7-8, 2005 | 07 07 05 10:30 PM | 07 08 05 3:30 AM | 25.2 | 26.0 | NA | 27.0 | 28.0 | 27.6 | 22.0 | 21.4 | 27.6 | 31.8 | 35.8 | 20.6 | 21.6 | 26.6 | 38.4 | 34.0 | 39.0 | 31.4 | 24.4 | 25.8 | 39.8 | 44.0 | 30.4 | NA | **29.5** |
| July 10 12, 2005 | 07 10 05 9:30 PM | 07 12 05 5:30 AM | 24.2 | 33.0 | 30.4 | 30.8 | 27.4 | 45.0 | 40.0 | 26.2 | 29.2 | 18.6 | 38.2 | 27.8 | 32.4 | 25.4 | 21.6 | 13.8 | 11.2 | 9.0 | 29.6 | 30.0 | 18.0 | 12.8 | 21.4 | NA | **25.9** |
| July 14, 2005 | 4:00 PM | 4:30 PM | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.2 | NA | 0.0 | 0.0 | 0.0 | 0.2 | NA | NA | **0.2** |
| July 16-17, 2005 | 07 16 05 10:00 PM | 07 17 05 12:30 PM | 53.0 | 55.2 | 27.6 | 52.0 | 54.6 | 53.6 | NA | 54.2 | 69.0 | NA | 81.8 | 56.0 | 59.2 | 60.0 | 65.2 | 109.6 | 77.0 | NA | 66.2 | 63.0 | 65.2 | 93.0 | NA | NA | **64.0** |
| | | | 293.4 | 352.0 | 333.4 | 394.6 | 427.4 | 398.2 | 233.0 | 372.4 | 417.6 | 253.2 | 387.2 | 376.8 | 406.2 | 376.8 | 419.6 | 478.6 | 441.8 | 371.6 | 397.6 | 411.0 | 407.4 | 438.6 | 319.0 | 45.2 | 405.3 |

# Appendix B - St. Norbert Flooding – July 17, 2005

As a result of heavy rainfall beginning on July 17, 2005 after midnight, there was significant basement flooding throughout Winnipeg. City crews responded in accordance with standard procedures. The rainfall in the south area of Winnipeg was particularly high with in excess of 100 mm of rain measured, most falling within 45 minutes. While power failures and basement flooding have occurred throughout the City, the public in St. Norbert have been particularly concerned.

**System Description**

St. Norbert has a separate sewer system. Wastewater is conveyed to the St. Norbert / X-Kalay Wastewater Pumping Station near the river directly north of Lemay at the projection of LaBarriere Street as shown on the attached figure. This wastewater lift station serves St. Norbert both east and west of Pembina Highway south of Houde Avenue. The St. Norbert Lift Station is equipped with two sanitary sewage lift pumps which discharge to the interceptor on Pembina Hwy. The station is also equipped with a gravity overflow to the Red River through a flap and sluice gate. The gate chamber also has an electric pump to handle any overflow during times of elevated river elevations (9 foot James activation level).

There are several land drainage outfalls serving the area. In particular concern was raised with the 900 mm diameter outfall on Lord Avenue at the river.

**Preparation**

Prior to the event, the river level which had been close to 20 feet James had fallen to about 18 feet James. At this elevation the flood manual calls for the positive gate to be closed and temporary pumps to be set up as follows:

> *The system includes a 900 mm LDS* [land drainage sewer] *with positive gate and 900 mm CSP* [corrugated steel pipe] *outfall to the Red River. When the positive gate is closed to prevent river backup in the LDS, temporary pumping is required to accommodate storage for rainfall runoff. Pumping is setup with suction in the LDS MH* [manhole] *or adjacent CB* [catch basin] *with discharge to the LDS MH downstream.*

This was the situation with the gate closed and two temporary gas engine driven pumps on site.

As discussed in the main report, on the night of July 16-17, crews were on duty as the possibility of significant rainfall was predicted.

**St. Norbert Wastewater Pumping Station**

During the rain event of July 17 the RealFlex alarm system indicated a “PCU Scan" alarm from the station at 01:13. A PCU Scan alarm is an indication of a communication problem with the station. Communication problems with stations are common during conditions of thunderstorms. It does not indicate a power failure or a mechanical or electrical problem.

These alarms are usually temporary in nature and usually do not require a response from our crews. Of the **235** alarms received during the event, 29 were PCU Scan. They are a relatively low priority alarm compared to the many power failure alarms that staff were dealing with at the time. During the early morning hours of July 17 we had 29 PCU SCAN alarms from our network. In addition, staff had no recent history of problems at the station and observed that there were no alarms from nearby stations, and concluded that the area was not having a general power failure.

Since the alarm at St Norbert had not "reset" after several hours and when the required manpower was available, an Instrumentation Technician attended the station at approximately 06:00. The technician reset the alarm unit. At this time it was determined that there was that there was 110 Volt power at the station (the lights were on), but the 600 Volt power required to operate the pumps was not working. Manitoba Hydro was contacted and respond by 07:00. They determined that a transformer required replacement which was estimated to take approximately 3 hours.

As an additional measure, crews started to obtain and install a 6-inch temporary pump which would have pumped from the sanitary system into the overflow pipe. The new transformer was installed before we completed the installation of the temporary pumping, power was restored at 10:15, both the sanitary and storm pumps pumped at full capacity.

It is not possible to know when the 600 volt power at the station was interrupted due to a loss of communication. It could have been any time between 01:13 and 06:00. It is also not known what caused the PCU Scan problem as the system worked again when it was reset by the technician upon entering the station.

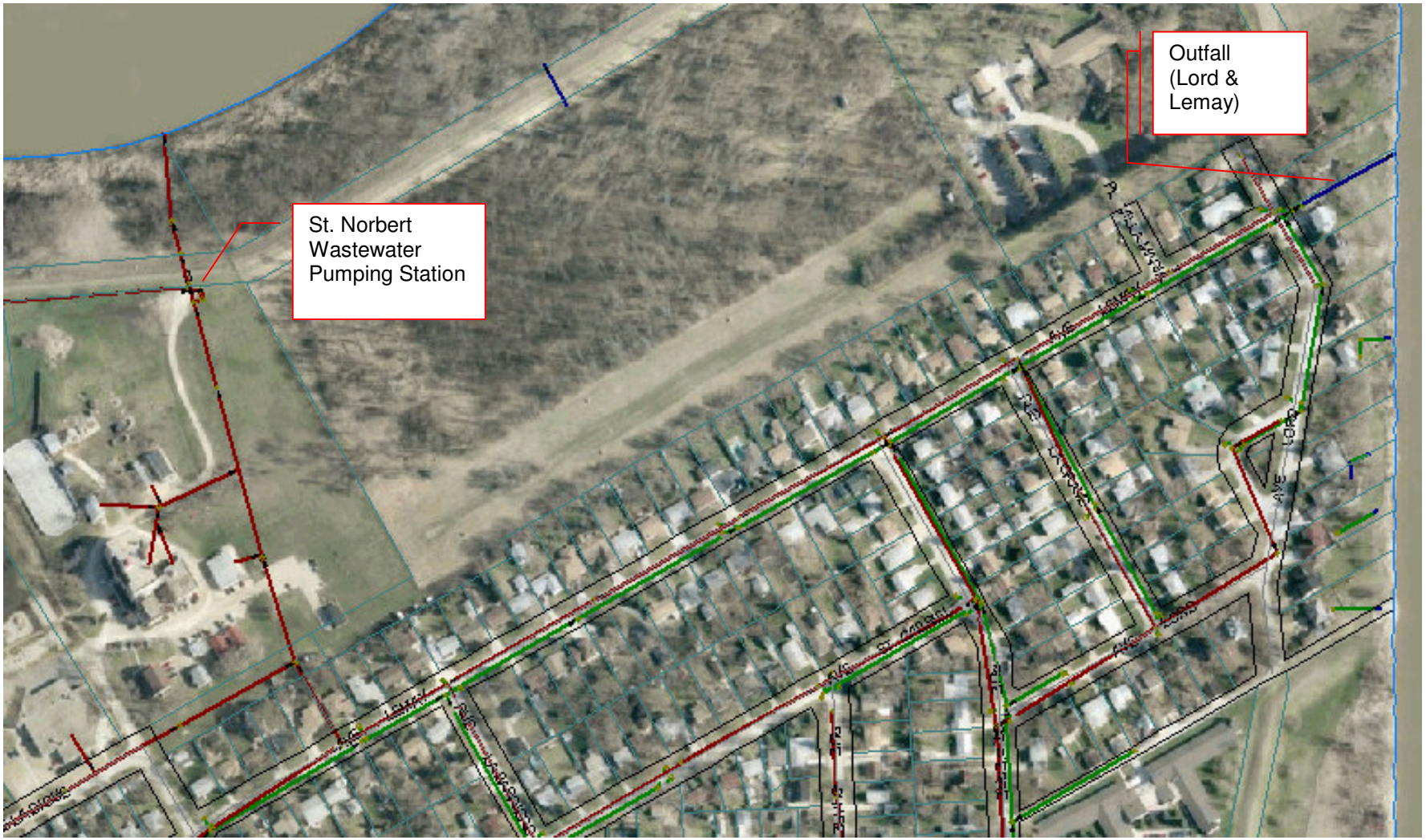
**Lord and Lemay Outfall - Temporary Pumping and Gate**

About 23:00, with the impending rain, crews were dispatched to start temporary pumps at 10 locations in Winnipeg. On route to a St. Vital location, a crew was informed that rain was beginning in South Winnipeg and that the Lord and Lemay would be a priority. The crew was detoured at the Pembina/Jubilee underpass and as the crew got closer to St Norbert, the torrential rains slowed traffic significantly. Once in St Norbert, approximately 2 feet of water was on the roads, and their 1/2 ton truck stalled causing further delays. The foreman indicated that they arrived on site and were able to start the pumps at approximately 01:00.

The pumps then ran continuously throughout the night, although it is apparent that they were unable to keep up with the water. This would be expected since the pumps would not be large enough to deal with the amount of rainfall and runoff. Around 08:00 Sunday morning, a Supervisor asked that the levels on either side of the gate be checked. Given the difference in height of water on either side of the gate, it made sense to open the gate, even though the flood manual would have dictated that the gate be closed at that river level. Once the gate was opened, temporary pumping was suspended and the water level went down. In many locations a flap gate is installed so that this relief happens automatically. Given this event, the department will investigate installing a flap gate in addition to the positive gate.

**Assessment**

Crews operated the system according to standard operating procedures. While the wastewater system experienced a power failure which no doubt contributed to the extent of basement flooding, basement flooding would have likely resulted in any case with the combination of high river levels and extreme rainfall.


Outfall
(Lord &
Lemay)
St. Norbert
Wastewater
Pumping Station