# Consent Decree Semiannual Report September 30, 2011

Consent Decree No. 2:11-cv-01011-EJM

Prepared for:

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,**

**UNITED STATES DEPARTMENT OF JUSTICE**

**AND**

**IOWA DEPARTMENT OF NATURAL RESOURCES**

Prepared by:

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September 12, 2011

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# 1.0 Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my directions and my inquiry of the person or person who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Michael C. Van Milligen
City Manager

# 2.0 Introduction

## 2.1 BACKGROUND

The City of Dubuque, Iowa is under a Consent Decree according to Case 2:11-cv-01001-EJM, United States of America and the State of Iowa v. the City of Dubuque, IA (N.D. Iowa), Civil Action Number 2008V00041, DOJ Case Number 90-5-1-1-09339.

The Consent Decree became effective on June 27, 2011 and requires the City to submit semiannual reports to the Department of Justice (DOJ), Environmental Protection Agency (EPA) and Iowa Department of Natural Resources (DNR).

## 2.2 PURPOSE

The purpose of this report is to satisfy Section VIII, Paragraph 25 of the Consent Decree. Paragraph 25 requires the City to submit semiannual reports on March 31 and September 30 after the Effective Date (June 27, 2011). The report includes summary information regarding events and activities performed in the prior six months, or in the case of this first semiannual report, activities performed since the Date of Lodging (April 25, 2011). Therefore, the "reporting period" shall refer to the time between April 25, 2011 and including August 31, 2011. Following this first semiannual report, the reporting periods shall be September 1 through February 28 (29) and March 1 through August 31.

## 2.3 REPORT SUMMARY

Paragraph 25 of the Consent Decree requires the semiannual reports to include specific information as well as a summary of the status and progress of all projects and programs required by Sections V and VI of the Consent Decree. Table Table 2-1 lists how the required information is organized in this report.

**Table 2-1. Organization of information required by the Consent Decree.**

| Consent Decree Paragraph | Summary of Requirement | Report Section |
|---|---|---|
| 25(a)i | Sanitary Sewer Overflow (SSO) locations | 3.1 |
| 25(a)ii | SSO duration of flows | 3.1 |
| 25(a)iii | SSO estimated flow volume | 3.1 |
| 25(a)iv | Waterbody downstream of SSO | 3.1 |
| 25(a)v | Suspected cause of SSO | 3.1 |
| 25(a)vi | SSO effect on public health and water quality | 3.2 |
| 25(a)vii | Measures to minimize SSO | 3.3 |
| 25(a)viii | Measures to stop SSO | 3.4 |
| 25(a)ix | Measures to prevent recurrence of SSO and milestones | 3.5 |
| 25(b)i | Construction upgrades | 4.0 |
| 25(b)ii | NPDES permit summary | 5.1 |
| 25(b)iii | NPDES permit violations during reporting period | 5.2 |
| 8 | Assessments and engineering analyses | 8.0 |
| 9 | Disposal of biosolids at WPCP | 4.1.2.3 |
| 10(a) | Capture of overflow from Key Way Drive manhole | 3.6 |
| 10(b) | Posting of warning signs at SSO locations | 3.7 |
| 11 | Construction upgrade to WPCP | 4.1.2 |
| 12(a) | North Fork Catfish Creek interceptor placed into service | 4.1.1 |
| 12(b) | I&I flow metering | 6.2.2 |
| 12(c) | Flow meters installed in first sewershed during 2010 | 6.2.1 |
| 12(d) | I&I source identification | 6.3 |
| 12(e) | I&I corrective action plan | 6.4 |
| 12(f) | Implement I&I corrective actions | 6.5 |
| 13(a) | Collection System Management, Operation, and Maintenance plan (CMOM) | 7.0 |
| 13(b) | Implement CMOM | 7.2 |
| 14 | Certify legal authority | Completed upon signing of Consent Decree |
| 15 | Certify that Section V of Consent Decree has been completed and placed into service | To be completed by June 30, 2016 |
| 16 | Demonstrate all SSO and by-passes have been eliminated | To be completed by June 30, 2017 |
| 17 | If SSO or by-pass occurs, submit Remedial Plan and Schedule | Only applicable after June 30, 2017 |
| 18 | If SSO or by-pass occurs due to O&M, submit Remedial Plan and Schedule | Only applicable after June 30, 2017 |

# 3.0 Sanitary Sewer Overflows

## 3.1 SANITARY SEWER OVERFLOW RECORD

Two sanitary sewer overflows (SSO, Table 3-1) occurred in the City of Dubuque during the reporting period. Both SSOs were caused by approximately 14 inches of rain that fell within 12 hours on July 27 and 28, 2011 (the Dubuque-area flood of record). (For simplicity, this rainfall event will be referred to the "July 28, 2011" rainfall throughout this report.) The City submitted a report dated August 4, 2011 to the DOJ, EPA, and DNR to document this event and resulting damage.

**Table 3-1. Sanitary sewer overflows during the reporting period.**

| SSO # | Sewer-shed | Street Address | Start Date | End Date | Start Time | End Time | Overflow Volume | Downstream Waterbody | Suspected Cause(s) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 1010 W Locust on Rosedale | 7/27/11 | 7/28/11 | 7:30 PM | 8:00 AM | Unknown due to extreme rain event | Mississippi River | I/I[1] due to extreme rain event |
| 2 | 8 | 2615 Kerper Blvd. | 7/28/11 | 7/29/11 | 8:30 PM | 1:00 AM | Unknown due to extreme rain event | Mississippi River | I/I due to extreme rain event |

[1] Inflow and Infiltration

Numerous basement backups also occurred as a result of the July 28, 2011 rainfall. Appendix A lists those backups that were reported to the City. Because these backups occurred on private property, City staff was not able to collect data on the start and end date, start and end time, and overflow volume. However, each backup reported in Appendix A are the result of the July 28, 2011 rainfall.

## 3.2 SSO'S EFFECT ON PUBLIC HEALTH AND WATER QUALITY

The two SSOs noted in Table 3-1 occurred during the Dubuque-area flood of record and drained into the street and storm sewer system. No effects on public health were reported, and visual inspection at the downstream waterbodies (prior to discharge to the Mississippi River) showed no sign of floating debris or offensive odors.

## 3.3 MEASURES ENACTED TO MINIMIZE DURATION AND IMPACT

The City minimized the duration and impact of the SSOs by capturing untreated wastewater and transporting it to areas with sufficient excess capacity. At SSO#1, an estimated 198,000 gallons of untreated wastewater was captured and transported by tankers to a sanitary sewer located at North Crescent Ridge. At SSO#2, approximately 18,000 gallons of untreated wastewater was

captured and transported to a sanitary sewer located at the Municipal Services Center 925 Kerper Court. The volumes were estimated based on the number of tanker trucks filled for each overflow.

## 3.4 MEASURES ENACTED TO STOP THE OVERFLOW EVENT

Similar to Section 3.3, the City was able to stop the overflow event by capturing and transporting wastewater to areas with sufficient excess capacity. When sufficient capacity returned to the area of each SSO, the City stopped capturing wastewater overflow, and the system returned to normal flow conditions.

## 3.5 MEASURES ENACTED TO PREVENT ANOTHER RECURRANCE

SSO#1 occurred within Sewershed 11, which is the priority sewershed to the City as documented in Paragraph 12 of the Consent Decree. As described in Section 6 of this report, the City is actively investigating potential sources of stormwater inflow and infiltration in this sewershed. Source identification will be complete by September 30, 2011 upon which a corrective action plan will be developed per the Consent Decree.

This is the first time the City has experienced an SSO at location #2. It is likely that this overflow occurred due solely to the extreme rainfall of July 28, 2011. City staff will observe this area during future rainfall events to determine if this is a recurring problem or isolated incident.

## 3.6 CAPTURING KEY WAY OVERFLOWS

Paragraph 10 of the Consent Decree requires the City to capture all overflows from the manhole located on Key Way Drive between 3500 Keymer Drive and 3507 Keystone Drive. An SSO did not occur at this location during the reporting period, so it was not necessary to capture any overflows.

## 3.7 WARNING SIGN POSTINGS

As documented in the August 4, 2011 report, SSO warning signs were not posted during the reporting period at the two SSO locations. DNR staff waived the required warning signs for SSO #1 and #2 due to the extreme rain event.

# 4.0 Construction Upgrades

## 4.1 CONSTRUCTION UPGRADES

The following paragraphs include a summary of the status and progress of all projects and programs required of the Consent Decree.

### 4.1.1 North Fork Catfish Creek Interceptor

The City of Dubuque completed the North Fork Catfish Creek Interceptor in the fall of 2010. This was a major sanitary sewer improvement project designed to eliminate bypass pumping of untreated wastewater into the North Fork of Catfish Creek during significant rain events.

The City upgraded the sanitary sewer to eliminate the need to pump untreated wastewater into the North Fork Catfish Creek during significant rains. Beginning in 1995, the City proactively investigated the inflow of rain and infiltration of groundwater into the sanitary sewer system including:

- Home/building inspections to check for illegal connections to the sewer system;
- Permanent and temporary flow monitoring;
- Smoke and dye testing to identify defects and cross-connections;
- Systematic inspection and rehabilitation/replacement of brick manholes;
- Routinely televising sewers to identify defects;
- Sewer flushing and cleaning as necessary; and
- Reconstruction and rehabilitation (lining) of deficient sewers.

While all of this work reduced extraneous (rain and groundwater) flow from getting into the sanitary sewer, reduced wastewater treatment costs, and reduced the instances of bypass pumping, it did not totally eliminate the need for bypass pumping.

In March of 2004, the City funded further evaluation of the North Fork Catfish Creek sanitary sewer. Completed in April of 2005, the study recommended a $2.9 million project to replace the existing 12-inch diameter clay sewer with a 24-inch diameter ductile iron sewer from University Avenue to Key Way, an 18-inch diameter sewer from Key Way to the NW Arterial, and a series of improvement projects were programmed into the City's next five-year capital improvement program budget adopted in March of 2005.

The project was constructed in three phases under three separate contracts. The DNR issued construction permits for the North Fork Catfish Creek Sanitary Sewer Improvements Project on May 11, 2009; July 26, 2009; and October 20, 2009 for Phase I, Phase II, and Phase III, respectively. Construction of the improvements started in started in August 2009 and was completed in September 2010. The $2.9 million combined construction project involved the replacement of an existing 12-inch diameter clay sanitary sewer with 8,100 feet of 24-inch

diameter ductile iron sewer and 2,900 feet of 18-inch diameter ductile iron sewer. The City Council accepted all three phases of the project on November 1, 2010.

### 4.1.2 Water & Resource Recovery Center

#### 4.1.2.1 Project Planning

During its Fiscal Year 2006 goal setting process, the City Council listed the Water Pollution Control Plant (WPCP) as one of its high priorities. City staff subsequently applied for a State Revolving Fund (SRF) planning and design loan during the summer of 2006, and plant upgrades were placed on the DNR Intended Use Plan schedule. Following public hearings and bidding requirements, the Facility Plan was developed and approved by DNR. The facility's name was also changed to the Water & Resource Recovery Center (WRRC).

In October 2008, the team of Strand Associates/IIW Engineers was approved by the City Council to proceed with the design of the WRRC upgrades. The NPDES permit was issued by DNR staff on April 1, 2010, and the plant construction permit was signed by DNR staff on April 5, 2010.

Following public bidding requirements, the City Council approved a contract, and the notice to proceed was issued August 19, 2010. Table Table 4-1 lists significant deadlines for the project outlined in the selected contractor's bid.

**Table 4-1. Significant deadlines for the Water & Resource Recovery Center.**

| Deadline | Target Date |
|---|---|
| Digester Startup | 4/2/2011 |
| Sludge Processing Startup | 8/12/2012 |
| Excess Flow Equalization | 6/20/2012 |
| Aeration Tank Completion | 2/19/2013 |
| Final Clarifiers | 4/8/2013 |
| Substantial Completion | 4/30/2013 |
| Final Completion | 10/1/2013 |

#### 4.1.2.2 Current Project Status

On July 11, 2011 at approximately 6:10 A.M., a thunderstorm with winds of approximately 74 mph caused damage to two of the four digesters under construction. On July 28, 2011, the City received more than 14 inches of rain in approximately twelve hours which caused considerable damage to the WRRC construction site. The damage caused by each event and the City's response were documented in separate reports to the EPA, DOJ, and DNR dated July 15, 2011 and August 4, 2011.

The City estimates a project delay of approximately three to four months beyond the final completion date of October 1, 2013. The City will provide more precise revised project deadlines by September 30, 2011, as requested by the DOJ letter to Ms. Jane McAllister dated August 31, 2011.

Through August 31, 2011, the project is in its 12$^{th}$ month of construction and work has been started on all aspects of the project. At this point, City staff estimates the project is 25% complete. The ultraviolet disinfection system was started in March 2011 and is operational.

Work continues on the digesters and sludge processing complex. The construction of the fourth primary clarifier has begun, and demolition of the primary clarifier domes is underway. In addition to the digester structures, work is progressing on the piping associated with the digester operation along with the installation of the many pumps and motors required for the process. A bio-solids handling contract is being negotiated with Nutri-Ject Systems of Hudson, Iowa.

The Administration/Laboratory Building is moving forward with a completion date for the laboratory projected for the end of December 2011. Upon completion of the laboratory addition, the existing building will be totally renovated and placed into service. The Administration/Laboratory Building will be a highly energy efficient building using plant effluent to meet heating and cooling needs. The entire structure is highly insulated and will use a minimum of energy for lighting, heating and cooling.

#### 4.1.2.3 Biosolid Accumulation Prevention at the WRRC

The City operates the North Incinerator and two centrifuges to maintain proper sludge blanket levels in the final clarifiers. In the event, the North Incinerator must be shut down for longer than one week, the City would continue to operate the centrifuges and dispose of the sludge at the Dubuque Area Metropolitan Sanitary Landfill. Based on past history, a worst-case complete shutdown, repair and startup of the incinerator can take place in four to six weeks.

The supplier of new centrifuges for the plant upgrade is the same firm that has performed major maintenance on the existing centrifuges. This firm has informed WRRC staff that they would be available to assist should the City have a major breakdown of one or both of the operating centrifuges.

Storage space for sludge will remain a challenge until portions of the new plant are brought online. When sections of the reconstructed plant are brought into service, the City will be able to use these areas to assist in WRRC sludge management.

# 5.0 National Pollutant Discharge Elimination System (NPDES)

## 5.1 SUMMARY OF ALL NPDES PERMIT REQUIREMENT INFORMATION

NPDES Monthly Operating Reports (MOR) for the City of Dubuque WRRC were submitted on the dates listed in Table 5-1:

**Table 5-1. Monthly operating reports submitted during 2011.**

| Report | Date Submitted |
|---|---|
| January 2011 | 2/11/2011 |
| February 2011 | 3/10/2011 |
| March 2011 | 4/15/2011 |
| April 2011 | 5/10/2011 |
| May 2011 | 6/14/2011 |
| June 2011 | 7/8/2011 |
| July 2011 | 8/7/2011 |

On July 28, 2011, WRRC staff called the DNR Region 1 office to report the effects of the major rain event. A follow-up email was sent July 29, 2011 to report the rain event as a possible Force Majeure event with a mailed request sent August 4, 2011.

## 5.2 NPDES VIOLATIONS AT THE WRRC DURING THE REPORTING PERIOD

### 5.2.1 NPDES Violation(s) Log

The City of Dubuque WRRC had permit violations in July 2011 caused by the July 28, 2011 rainfall event. The permit violations are listed in **Error! Reference source not found.**.

**Table 5-2. NPDES violations during the reporting period.**

| Date | Parameter | Permit Limit | Reported Amount |
|---|---|---|---|
| 7/27/11 | Daily Maximum Flow | 23.24 MGD | 26.58 MGD |
| 7/28/11 | Daily Maximum Flow | 23.24 MGD | 37.782 MGD |
| 7/29/11 | Daily Maximum Flow | 23.24 MGD | 26.268 MGD |
| Week of 7/22 – 7/28 | 7-Day TSS | 45 mg/L | 71 mg/L |
| Week of 7/22 – 7/28 | 7-Day TSS | 6,500 pounds | 14,270 pounds |
| July 2011 | 30-Day Average TSS | 30 mg/L | 40 mg/L |
| July 2011 | 30-Day Average TSS | 4,333 pounds | 5,346 pounds |

In addition to the permit violations caused by the rain event, one of the City's major pumping stations (the Catfish Creek station) was flooded at approximately 12:00 A.M. on July 28, 2011. The station was returned to service by 7:00 P.M. the same day.

### 5.2.2 Cause of NPDES Violations

On July 28, 2011, the City received more than 14 inches of rain in approximately twelve hours and is now considered the flood of record in the Dubuque area. The City has documented this as a Force Majeure event of which the consequences were beyond the control of the City. The county of Dubuque in which he City is located has been declared both a State of Iowa and Federal disaster area. DOJ has stated that this was a Force Majeure event.

# 6.0 Inflow & Infiltration Reduction Program

## 6.1 BACKGROUND

Prior to the reporting period, the City experienced several discharges of untreated or partially treated wastewater. These events were caused by sharp increases in flow within the sanitary sewer system during and immediately after a rainstorm. To better locate the sources of this issue, the City placed flow meters throughout the city. Depending on location, the meters measured the flow of water from each sewershed over a one to eleven month period of time. Five of the twelve sewersheds were identified as receiving elevated flows during and directly after a precipitation event. Under the Consent Decree, the City has agreed to investigate five sewersheds over the next five years. The section below describes the City's progress in identifying I&I sources in the five sewersheds (Figure 6-1). [Please note the numbered "Areas" in Figure 6-1 are numbered differently than in Paragraph 12(b) of the Consent Decree but represent the same areas (i.e. Area 1 = Sewershed 11).]

## 6.2 FLOW METERING

### 6.2.1 Sewershed 11

The City conducted flow metering within Sewershed 11 (Area 1 in Figure 6-1) during 2010. This requirement of the Consent Decree was satisfied upon signing of the Consent Decree.

### 6.2.2 Sewershed 12

The City conducted flow metering within Sewershed 12 (Area 2 in Figure 6-1) during 2011. Preliminary flow metering results are presented in Appendix B.

## 6.3 SOURCE INVESTIGATIONS

### 6.3.1 Private Property Inspections

As of August 31, 2011, 95% of all properties in Sewershed 11 and 67% of all properties in Sewershed 12 have been inspected. Private property inspections identify the roof drain discharge location, the presence of any stairwell or driveway drains, and the presence of a sump pit/pump on site. A passing inspection indicates no connections of clear water to the sanitary system. A failed inspection indicates a connection of clear water directly into the sanitary system, which may include roof drains connected to the sanitary sewer; a stairwell or driveway drain which is connected to the building floor drain; or a sump pump which is plumbed directly to the sanitary lateral or a floor drain within the building.

Each improper connection observed during a private property inspection results in a failure notice. The property owner then has 30 days to correct the improper connection, at which point a re-inspection of the property conducted to verify that the improper connection has been

eliminated. If the improper connection has not been corrected, the City will pursue legal action against the property owner to complete the necessary work.

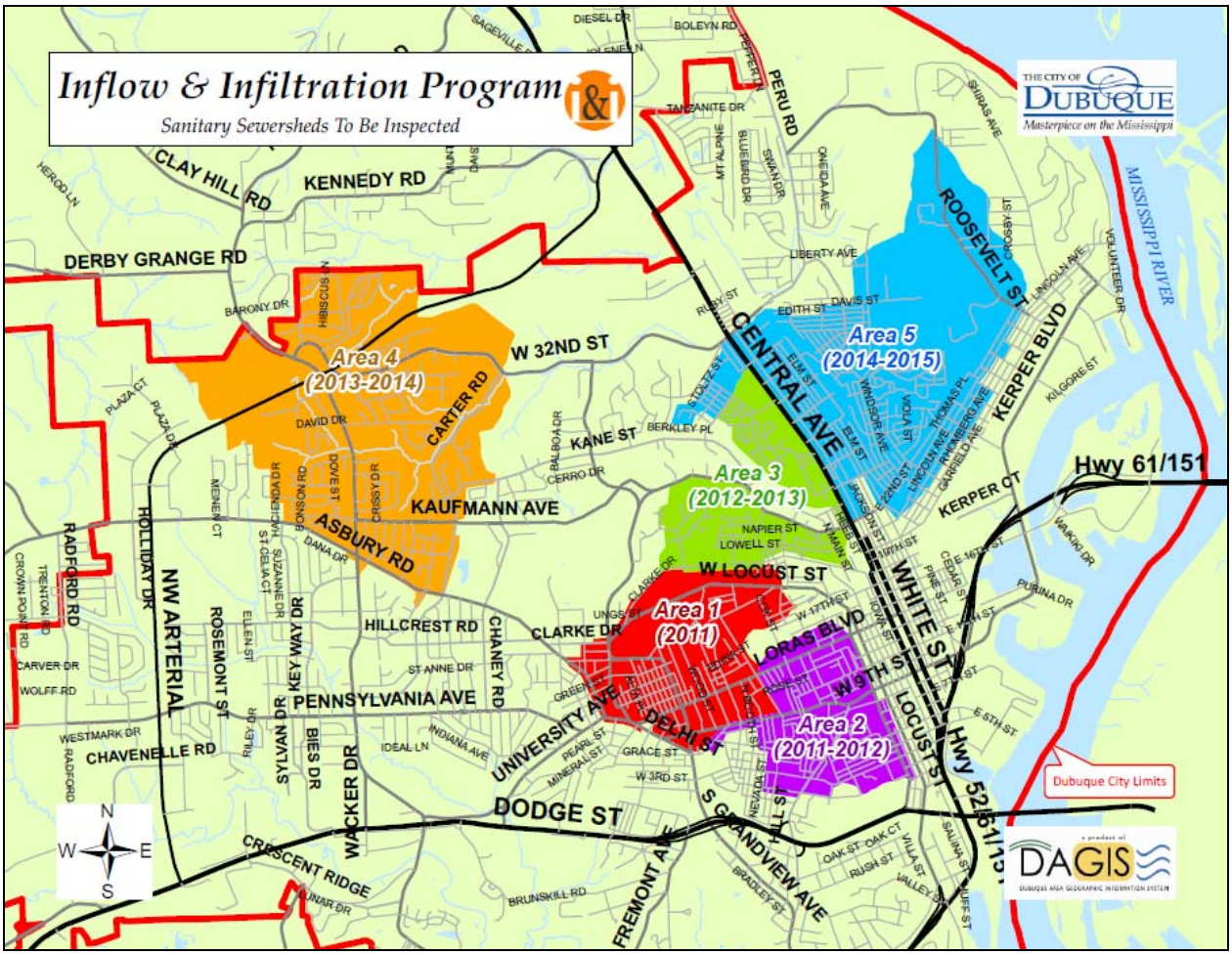


**Figure 6-1. Map of priority sewersheds for I&I investigation.**

### 6.3.2 Dye Testing

Dye testing has been performed in conjunction with private property inspections. The City uses dye to identify downspout and exterior stairwell or driveway connections to the sanitary system.

### 6.3.3 Smoke Testing

The City has conducted smoke testing in Sewershed 11 to identify improper clear water connections to the sanitary system and possible cracks, leaks or breaks in a property owner's sanitary lateral. Smoke testing has been used for large commercial or educational buildings where dye testing would not an efficient method of investigation. Smoke testing is scheduled for late September in Sewershed 12.

### 6.3.4 Manholes

Each sanitary manhole within Sewershed 11 has been opened and recorded as concrete or brick. Each brick manhole is rated based on its structural integrity and rate of infiltration (if observed). This rating system will be used to prioritize the replacement of brick manholes with concrete manholes. The location and type has been uploaded to the GIS database.

### 6.3.5 Sanitary Sewer

Approximately 85% of the public sanitary sewer within Sewershed 11 has been inspected using a closed circuit television system. Any cracks, leaky joints, illegal lateral connections, and damaged or broken pipes have been recorded. The severity of the structural degradation of each pipe section will be rated based on severity. This rating system will be used to prioritize which pipe sections are in need of immediate repair or replacement. The location of all infiltration locations has been uploaded to the GIS database.

## 6.4 CORRECTIVE ACTION PLAN

As stated in Paragraph 12 of the Consent Decree, the City will develop a corrective action plan for Sewershed 11. The City is evaluating the data collected from actions described in Section 6.3 and will submit a corrective action plan to EPA, DOJ, and DNR by December 31, 2011.

## 6.5 IMPLEMENTATION OF CORRECTIVE ACTION PLAN

As stated in Paragraph 12(f) of the Consent Decree, the City will implement the I&I corrective actions pursuant to EPA and DNR approval of the plan discussed in Section 6.4. Completed corrective actions will be detailed here in future semiannual reports.

# 7.0 CMOM Update

## 7.1 THE CMOM PROGRAM

The City of Dubuque's *Capacity, Management, Operation and Maintenance Plan* (CMOM) provides a summary of its policies, procedures, practices, and responsibilities associated with its sanitary sewer collection system. It is the blueprint for the City's managers and field workers to better manage, operate, and maintain Dubuque's sanitary sewer collection system, investigate capacity-constrained area, prevent SSOs, respond to SSOs that may occur, and plan for future system expansion.

In compliance with the Consent Decree, the City will submit the CMOM to EPA, DOJ, and DNR prior to September 23, 2011.

## 7.2 CMOM IMPLEMENTATION

The City developed the CMOM to serve as a "living" document. As required by Paragraph 13 of the Consent Decree, the City will fully implement the CMOM within two calendar months after receiving formal approval by EPA. However, as the City reviews its current procedures and codes, the CMOM will be updated and new procedures implemented as needed. Any revisions to the CMOM will be submitted to EPA, DOJ, and DNR for review and approval as required under the Consent Decree.

# 8.0 Assessments and Engineering Analyses

During the current reporting period, the City initiated two additional phases of the I&I Program beyond those required by the Consent Decree. Please refer to Section 6.0 of this report for a full description of the I&I Program.

## 8.1 SUNSET PARK

City staff was informed by residents that numerous homes in the Sunset Park subdivision had improper connections to the City's sanitary sewer system. As described in Section 6.2.1, private property inspections were initiated to identify the roof drain discharge location, the presence of any stairwell or driveway drains, and the presence of a sump pit/pump on site. A total of 152 additional inspections were conducted in this subdivision.

## 8.2 HISTORIC INSPECTIONS

Section 4.1.1 states that private property inspections were previously conducted in the areas that drain to the North Fork Catfish Creek interceptor. Of those inspected, a total of 466 properties failed the inspection. The City began a "historic inspection" phase during the reporting period to determine if any of these previous failures had "re-connected" to the sanitary sewer system.

Unlike the Sewershed 11, 12 and Sunset Park inspections, the historic inspections were conducted unannounced and without an appointment. This made it more difficult to conduct inspections because many residents were not home, but more importantly did not allow "repeat violators" from disconnecting from the sanitary system just for an inspection. Of the 466 previous failures, one hundred inspections were conducted and 15 of those 100 failed the inspection again. As described in Section 6.3.1, the home owners were given 30 days to correct the improper connection and schedule a reinspection.

# Appendix A

## Basement Backups Reported During the Reporting Period

Thirty basement backups were reported to the City as a result of the July 28, 2011 rainfall event. The thirty addresses are listed in Table A-1. Because these backups occurred on private property, City staff was not able to collect data on the start and end date, start and end time, and overflow volume.

**Table A-1. Basement backups reported as a result of the July 28, 2011 rainfall event.**

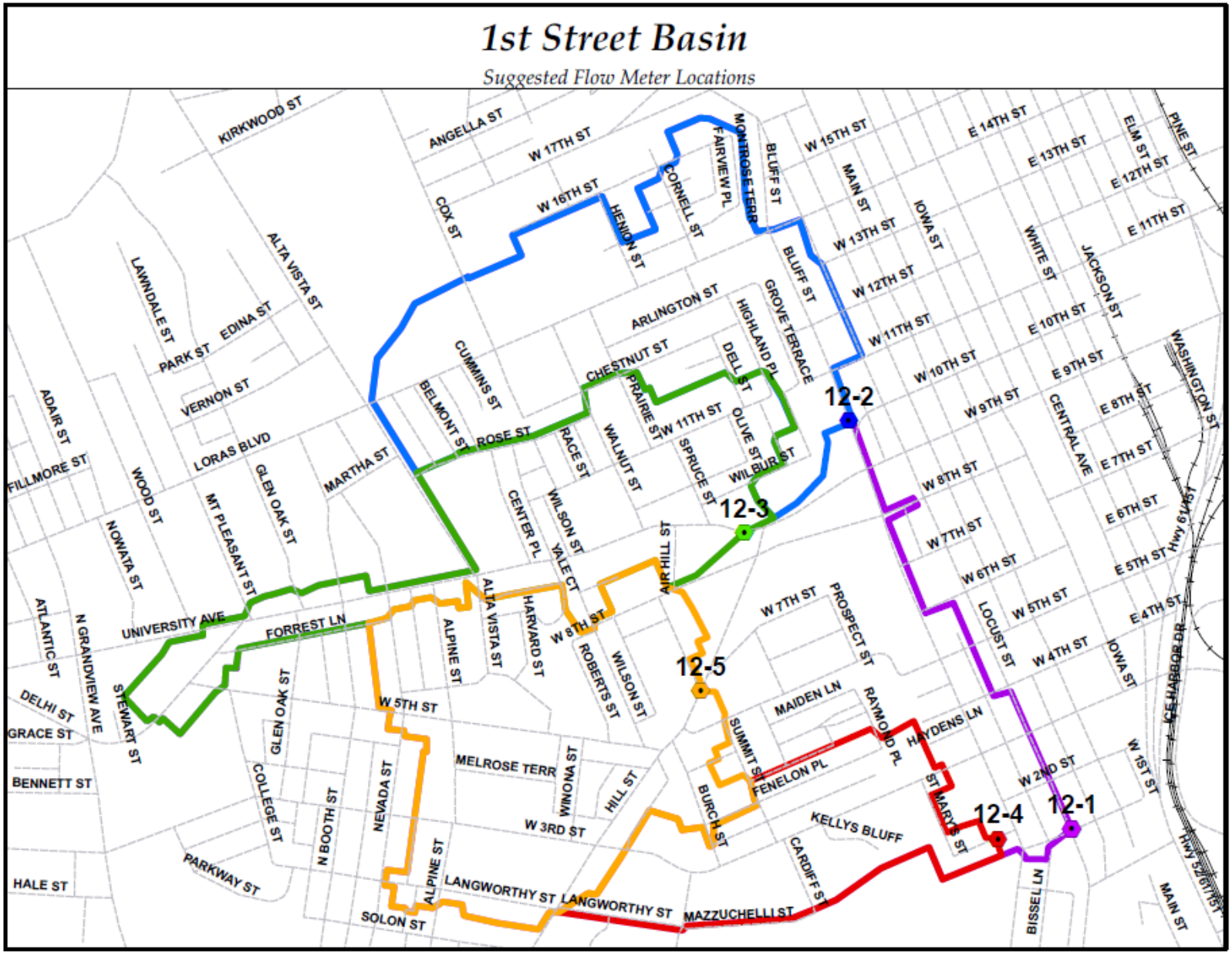
| SSO # | Sewer-shed | Street Address | Start Date | End Date | Start Time | End Time | Overflow Volume | Downstream Waterbody | Suspected Cause(s) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ND[1] | 1364 W 3rd St | Unknown due to extreme rain event | | | | | Mississippi River | I/I[2] due to extreme rain event |
| 2 | ND | 36 W 4th St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 3 | ND | 86 W 5th St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 4 | 10 | 511 E 22nd St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 5 | 10 | 102 E 28th St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 6 | 11 | 1723 N Algona St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 7 | ND | 1854 Bennett St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 8 | 11 | 1385 N Booth St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 9 | 10 | 2160 Elm St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 10 | 10 | 2440 Elm St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 11 | 10 | 2717 Elm St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 12 | 8 | 2345 Garfield Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 13 | 8 | 2365 Garfield Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 14 | ND | 1900 Hale St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 15 | ND | 1786 Jackson St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 16 | ND | 2025 Jackson St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 17 | 10 | 2529 Jackson St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 18 | 10 | 2606 Jackson St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 19 | 10 | 2610 Jackson St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 20 | 8 | 2615 Kerper St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 21 | 5 | 3387 Kimberly St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 22 | ND | 1414 Langworthy St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 23 | 8 | 2375 Rhomberg Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 24 | 8 | 2405 Rhomberg Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 25 | 11 | 2150 Rosedale Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 26 | 6 | 365 Saunders St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 27 | ND | 405 Southern Ave | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 28 | ND | 1689 Washington St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 29 | 10 | 2610 White St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |
| 30 | 10 | 2895 White St | Unknown due to extreme rain event | | | | | Mississippi River | I/I due to extreme rain event |

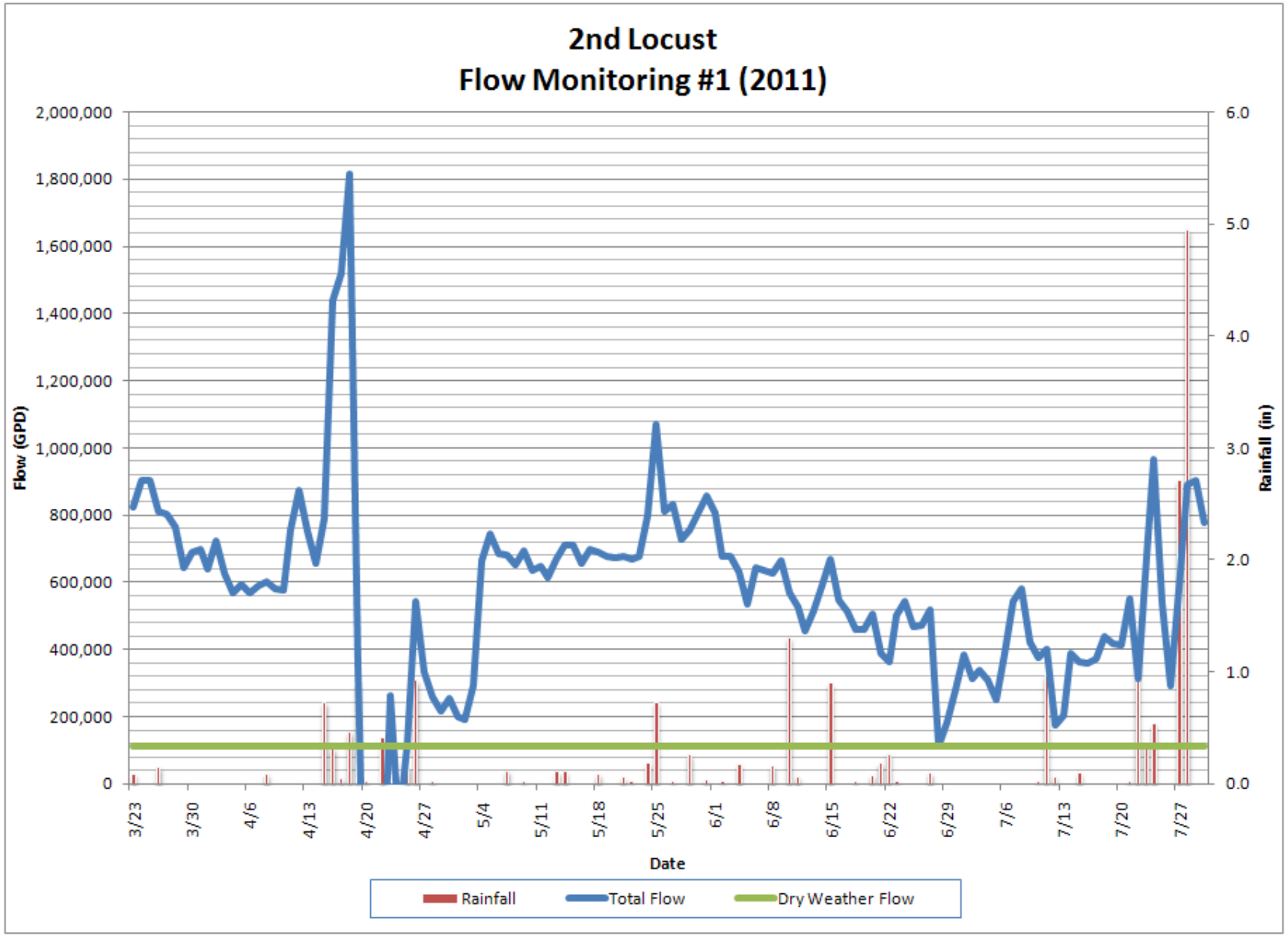
[1] ND = Sewershed not delineated in this area.

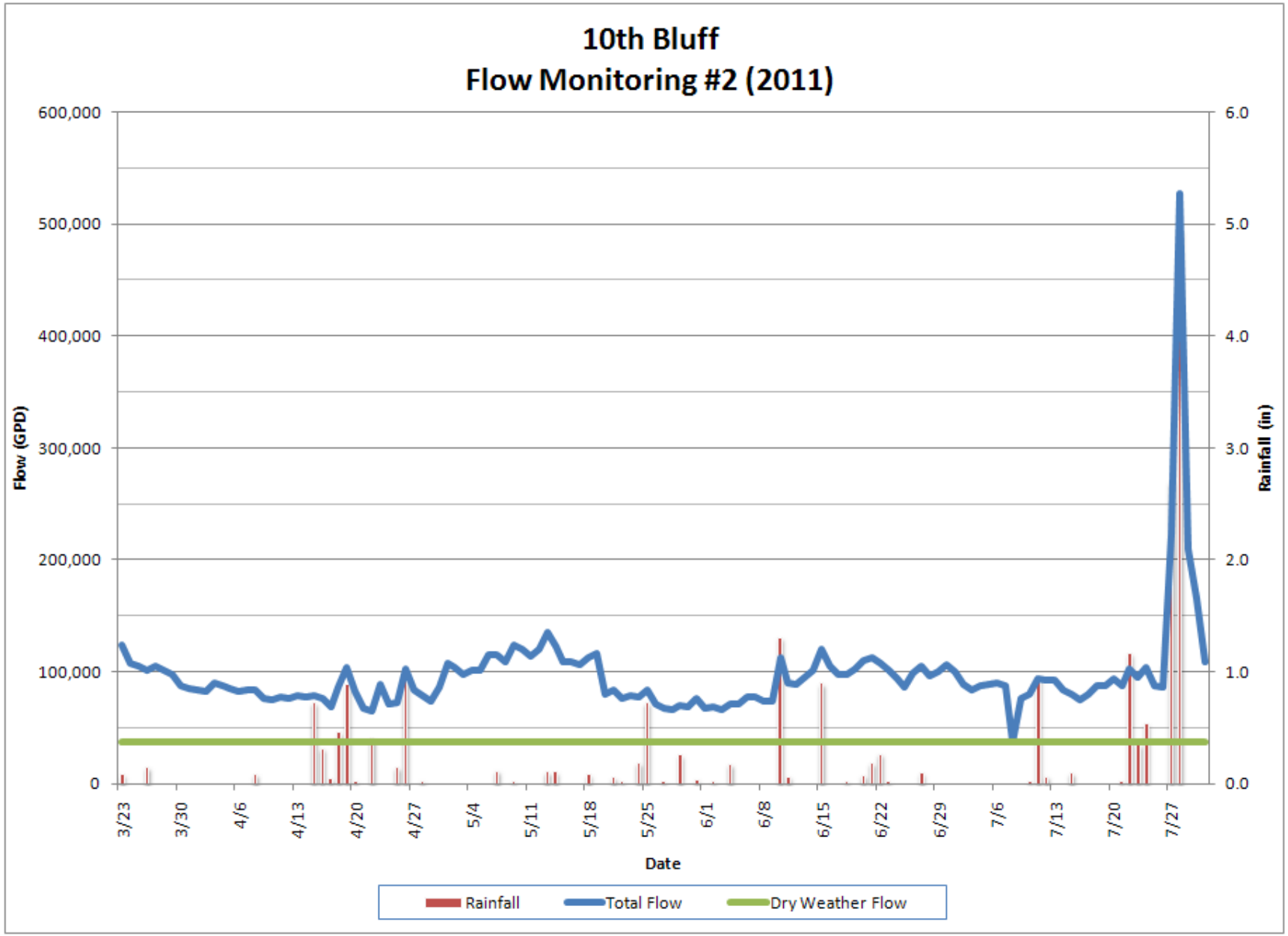
[2] Inflow & Infiltration

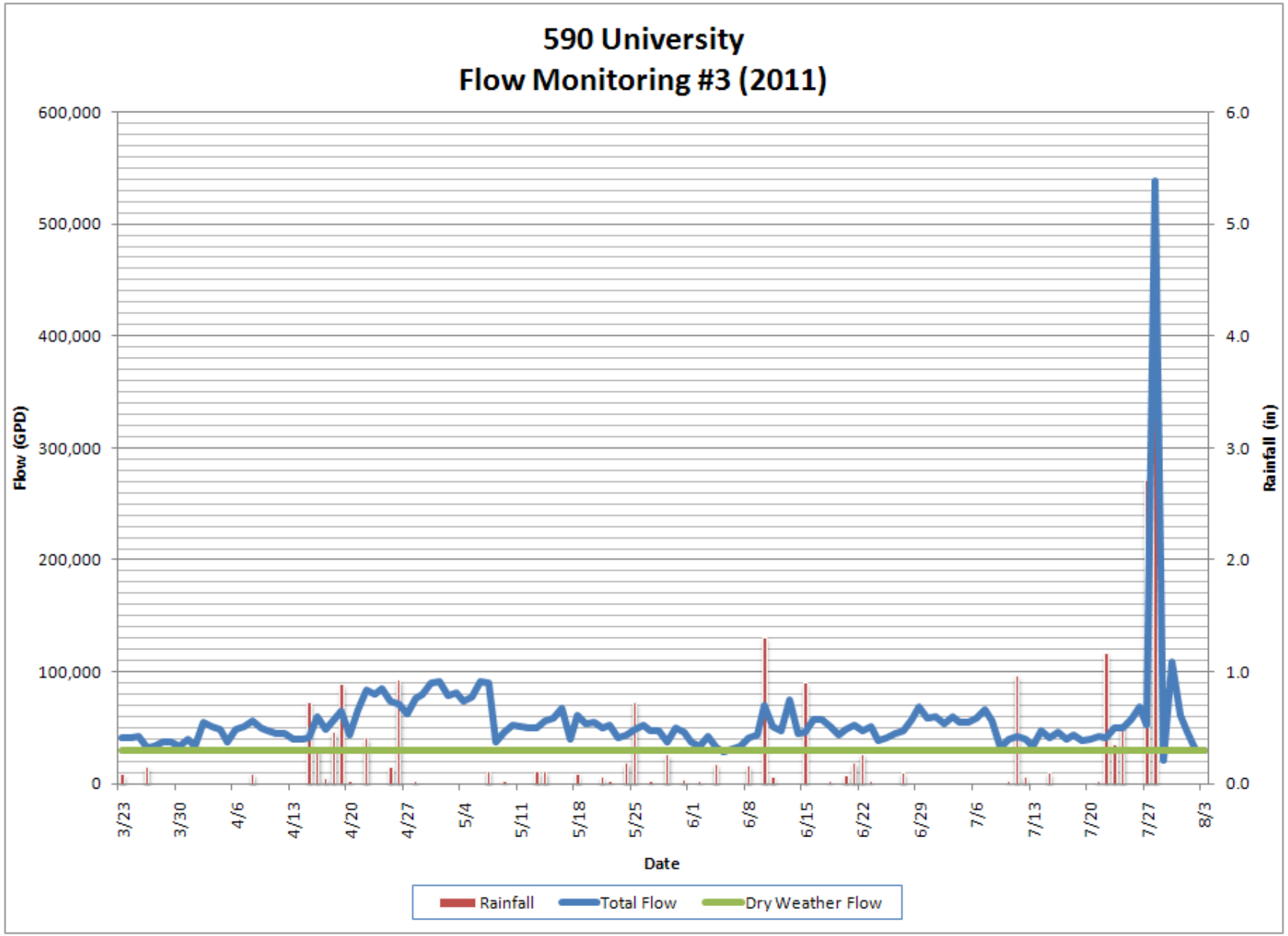
# Appendix B

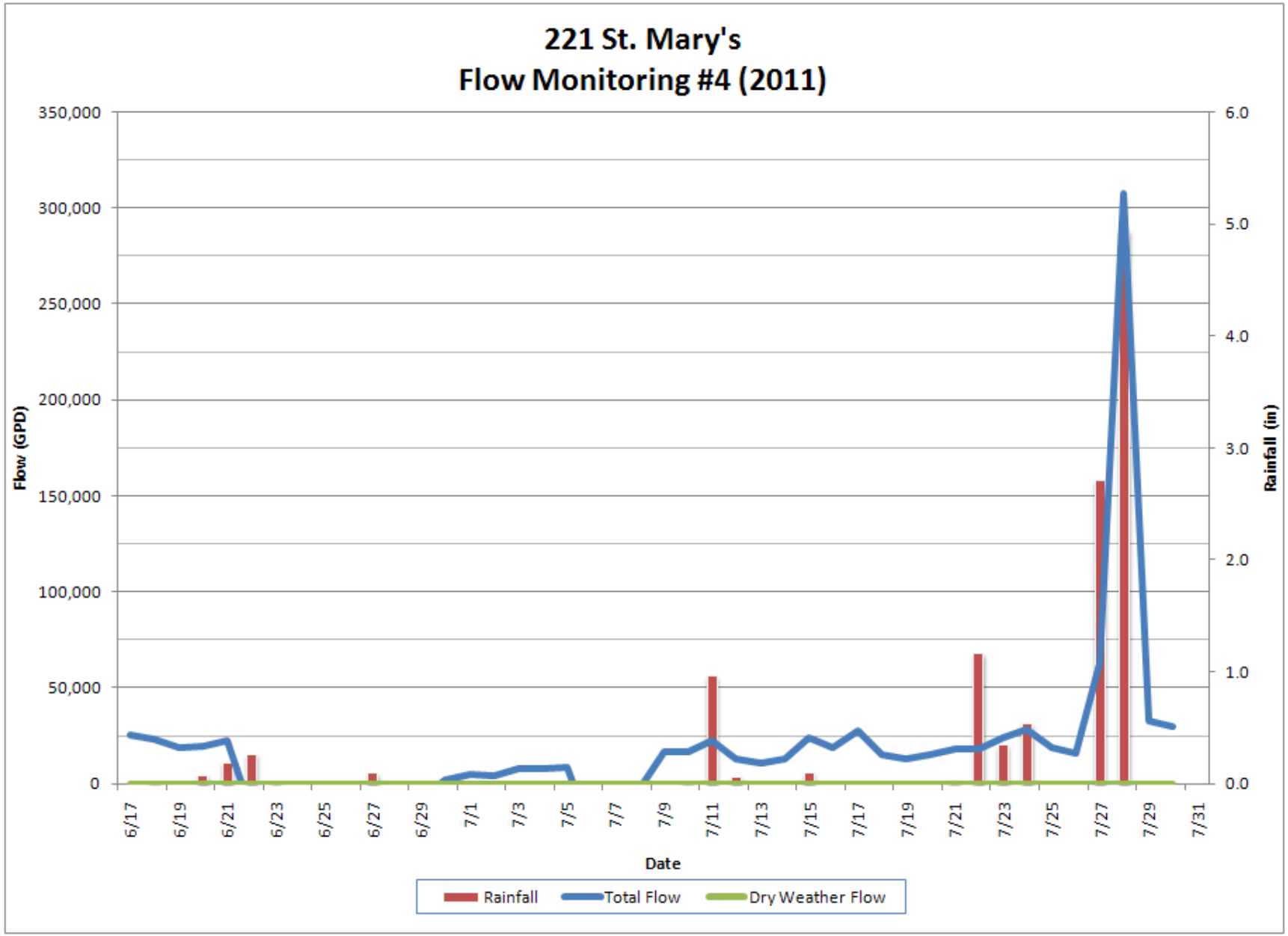
## Sewershed 12 Preliminary Flow Metering Results

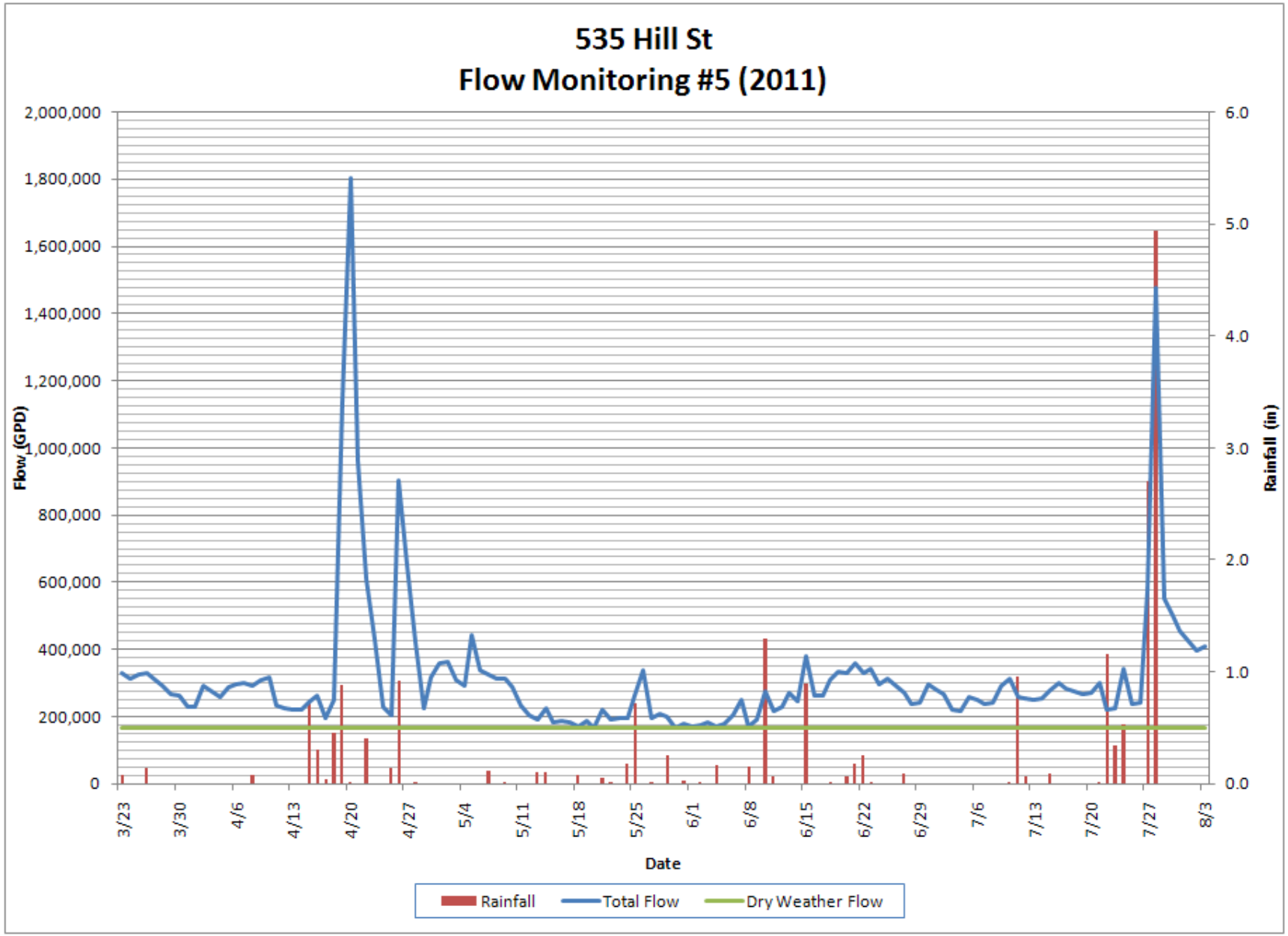

1st Street Basin
Suggested Flow Meter Locations
12-1
12-2
12-3
12-4
12-5
KIRKWOOD ST
ANGELLA ST
W 17TH ST
W 16TH ST
COX ST
HENION ST
CORNELL ST
FAIRVIEW PL
MONTROSE TERR
BLUFF ST
W 15TH ST
MAIN ST
E 14TH ST
E 13TH ST
ELM ST
E 12TH ST
PINE ST
W 13TH ST
IOWA ST
E 11TH ST
WHITE ST
JACKSON ST
W 12TH ST
W 11TH ST
E 10TH ST
W 10TH ST
E 9TH ST
W 9TH ST
CENTRAL AVE
E 8TH ST
WASHINGTON ST
E 7TH ST
W 8TH ST
E 6TH ST
W 7TH ST
W 6TH ST
E 5TH ST
Hwy 61/151
W 5TH ST
LOCUST ST
E 4TH ST
W 4TH ST
IOWA ST
ICE HARBOR DR
PROSPECT ST
MAIDEN LN
RAYMOND PL
HAYDENS LN
W 2ND ST
W 1ST ST
ST MARYS ST
FENELON PL
KELLYS BLUFF
CARDIFF ST
BISSELL LN
MAIN ST
Hwy 52/61/151
ARLINGTON ST
CHESTNUT ST
ROSE ST
CUMMINS ST
BELMONT ST
HIGHLAND PL
GROVE TERRACE
DELL ST
PRAIRIE ST
W 11TH ST
OLIVE ST
SPRUCE ST
WILBUR ST
WALNUT ST
RACE ST
CENTER PL
WILSON ST
YALE CT
ALTA VISTA ST
HARVARD ST
W 8TH ST
ROBERTS ST
WILSON ST
AIRHILL ST
SUMMIT ST
BURCH ST
LAWNDALE ST
PARK ST
EDINA ST
VERNON ST
ALTA VISTA ST
LORAS BLVD
ADAIR ST
FILLMORE ST
WOOD ST
NOWATA ST
MT PLEASANT ST
GLEN OAK ST
MARTHA ST
UNIVERSITY AVE
FORREST LN
STEWART ST
ATLANTIC ST
N GRANDVIEW AVE
DELHI ST
GRACE ST
BENNETT ST
GLEN OAK ST
COLLEGE ST
N BOOTH ST
NEVADA ST
ALPINE ST
ALPINE ST
MELROSE TERR
WINONA ST
HILL ST
W 3RD ST
PARKWAY ST
HALE ST
SOLON ST
LANGWORTHY ST
LANGWORTHY ST
MAZZUCHELLI ST


2nd Locust
Flow Monitoring #1 (2011)
Flow (GPD)
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Rainfall (in)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/23
3/30
4/6
4/13
4/20
4/27
5/4
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
Date
Rainfall
Total Flow
Dry Weather Flow


10th Bluff
Flow Monitoring #2 (2011)
600,000
500,000
400,000
300,000
200,000
100,000
0
Flow (GPD)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rainfall (in)
3/23
3/30
4/6
4/13
4/20
4/27
5/4
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
Date
Rainfall
Total Flow
Dry Weather Flow


590 University
Flow Monitoring #3 (2011)
600,000
500,000
400,000
300,000
200,000
100,000
0
Flow (GPD)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rainfall (in)
3/23
3/30
4/6
4/13
4/20
4/27
5/4
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
8/3
Date
Rainfall
Total Flow
Dry Weather Flow


221 St. Mary's
Flow Monitoring #4 (2011)
Flow (GPD)
Rainfall (in)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
6/17
6/19
6/21
6/23
6/25
6/27
6/29
7/1
7/3
7/5
7/7
7/9
7/11
7/13
7/15
7/17
7/19
7/21
7/23
7/25
7/27
7/29
7/31
Date
Rainfall
Total Flow
Dry Weather Flow


535 Hill St
Flow Monitoring #5 (2011)
Flow (GPD)
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Rainfall (in)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/23
3/30
4/6
4/13
4/20
4/27
5/4
5/11
5/18
5/25
6/1
6/8
6/15
6/22
6/29
7/6
7/13
7/20
7/27
8/3
Date
Rainfall
Total Flow
Dry Weather Flow