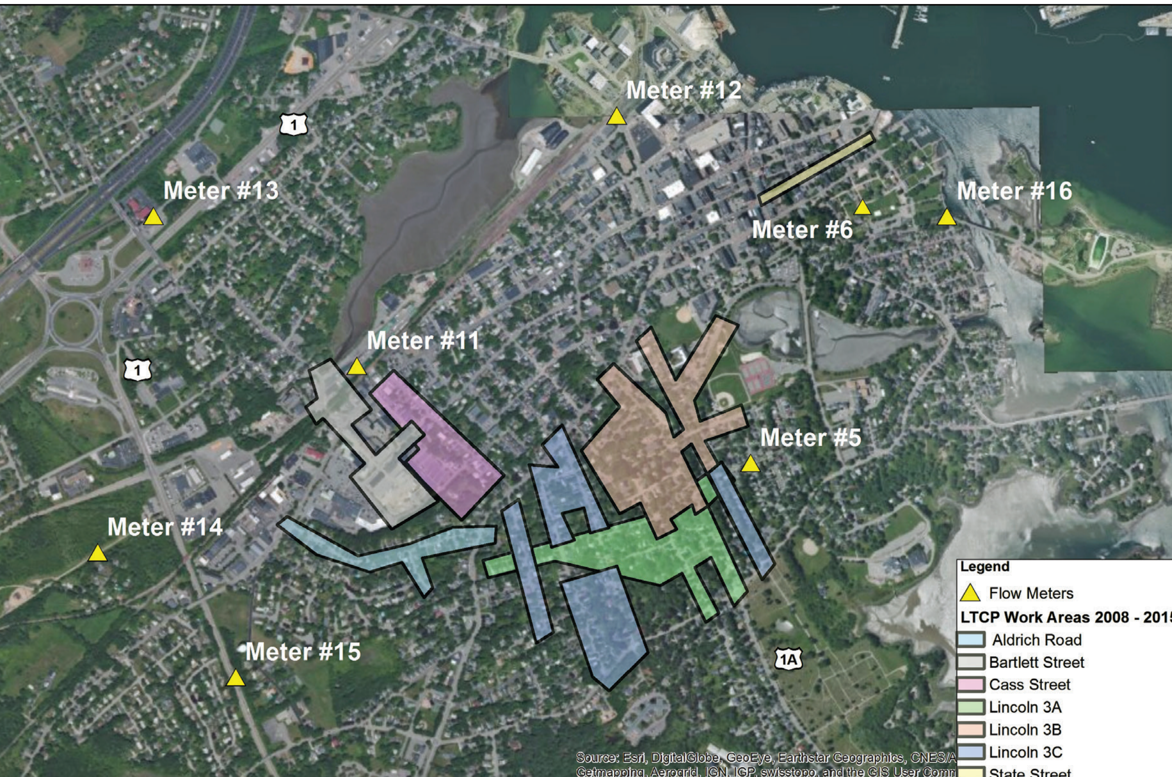
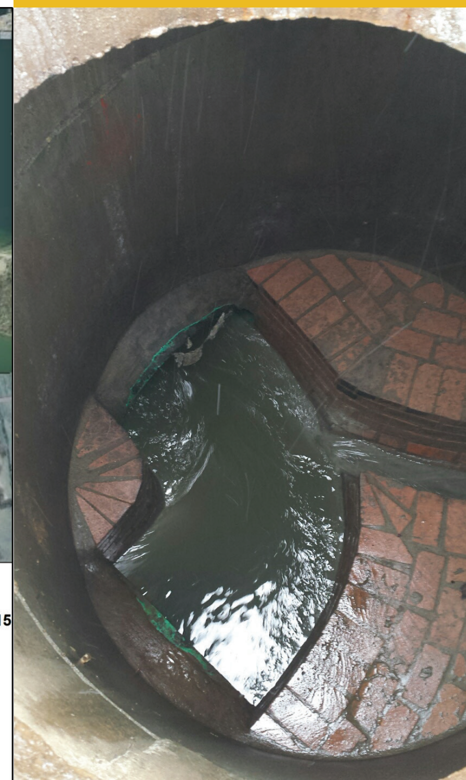
City of Portsmouth, NH





Revised Final

CSO Post-Construction Monitoring Plan/Report

Hazen

June 2017

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Executive Summary

The City of Portsmouth owns and operates a partially combined sewer system, and has invested over $50 million in overall CSO abatement activities through 2015. The improvements include extensive collection system work (e.g., sewer separation, pump station upgrades), long-term studies, and flow/water quality monitoring. The infrastructure improvements have followed the recommendations of the 2002 and 2005 Long-Term Control Plans (LTCP) and the 2010 Wastewater Master Plan (WMP) and LTCP Update.

As part of the Consent Decree and in accordance with EPA CSO Policy, the City of Portsmouth, NH is required to develop and submit for approval a Post-Construction Monitoring Plan (PCMP) to assess the performance of LTCP infrastructure upgrades. This document fulfills that requirement, and not only sets forth a framework for accurately assessing collection system performance now that all LTCP upgrades have been implemented, but also summarizes the results of that assessment.

The City has quantified the performance of LTCP implementation through hydraulic modeling, CSO discharge flow monitoring, and collection system flow monitoring. These efforts are an extension of previous modeling and monitoring work, and present a clear picture of post-construction system performance, consistent with the LTCP goals.

A flow and rainfall monitoring program was initiated on April 9, 2015 and lasted for 12 weeks. It focused on monitoring of rainfall (permanent gauges), CSO frequency and volume (permanent gauges), and collection system flows (temporary and permanent gauges). Dry and wet weather flow was monitored to provide an understanding of the system under a variety of expected conditions. The data collected from this monitoring program was used to empirically evaluate the performance of the improved collection system and recalibrate the PCSWMM model. Rainfall data was collected from the City's permanent rain gauge network.

In order to provide an integrated hydrologic/hydraulic collection system model that could be simulated in a single software environment (without the need for external or proprietary software), and georeferenced for spatial accuracy, the model framework was updated using City geographic information system (GIS) data and record drawings. The dry weather flow and wet weather hydrology were both updated as well, to reflect current conditions after the latest round of sewer separation work was completed (through 2015). Once the model updates were completed, the model was calibrated and verified to current system conditions based on the flow and rainfall monitoring conducted.

Using the updated/calibrated model, and consistent with the approach taken in the 2010 LTCP, the annual average CSO performance was simulated to determine if the quantitative LTCP targets were met. Table ES-1 summarizes the results. For CSO 013, there was only one single discharge (from a 3.7-inch storm in 1988, closely approximating a 5-year return frequency); thus, given the "atypical" nature of this particular storm event, and given that all other events in 1988, as well as for the other four years, produced zero discharge, the LTCP goals at this location are largely met. The AAOV was predicted at CSO 013 to be 0.1 MG. For CSO 10A and 10B, the AAOV was predicted to be 1.1 MG. This is less than the 2010 LTCP target volume for this location (2.1 MG), signifying LTCP success.

Table ES-1: Average Annual Overflow Volumes

		South Pond CSOs (10A/10B)	Deer St CSO (013)
Current Model (Post-Separation)	1968	0	0
	1988	4.03	0.53*
	1989	0	0
	1990	1.64	0
	1993	0	0
	Average	**1.1**	**0.1**
2010 LTCP Report Target		**2.1**	**0**

*Note: For CSO 013, there was only one single discharge (from a 3.7-inch storm in 1988, closely approximating a 5-year return frequency); additionally, all other events in 1988, as well as all events for the other four years, produced zero discharge.

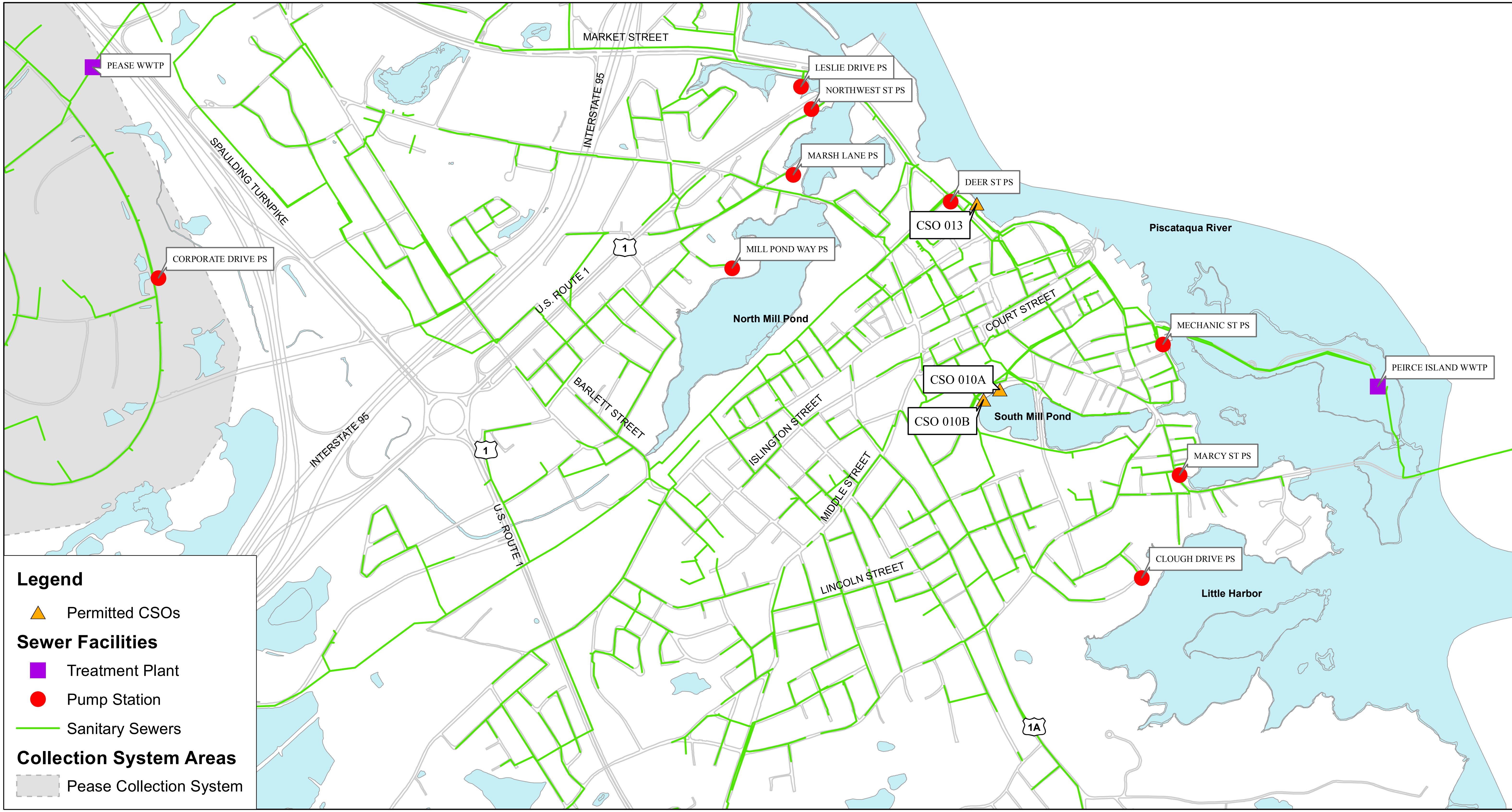
1 Introduction

The City of Portsmouth (NH) owns and operates approximately 120 miles of sewers (public gravity sewers and force mains, not including laterals) which convey wastewater to the Peirce Island Wastewater Treatment Facility (4.8 MGD design capacity) and Pease Wastewater Treatment Facility (1.2 MGD design capacity). Both Wastewater Treatment Facilities (WWTF) discharge to the Piscataqua River at separate locations. The City also has three (3) permitted Combined Sewer Overflows (CSOs) within the Peirce Island WWTF collection system discharging to South Mill Pond (CSO 010A, 010B) and the Piscataqua River near Deer Street (CSO 013). Figure 1 shows the locations of the CSO discharge points, the wastewater pumping stations, both WWTFs and the sewer system.

In 2009, the City of Portsmouth entered into a Consent Decree with the U.S. Environmental Protection Agency (EPA). Parts of the Consent Decree have required the City to reduce CSOs. An amendment to the Consent Decree was made in 2012, and stipulated the implementation of various wastewater infrastructure improvements. The City has invested over $50 million in overall CSO abatement activities through 2015. The improvements include extensive collection system work (e.g., sewer separation, pump station upgrades), long-term studies, and flow/water quality monitoring. The infrastructure improvements have followed the recommendations of the 2002 and 2005 Long-Term Control Plans (LTCP) and the 2010 Wastewater Master Plan (WMP) and LTCP Update.

As part of the Consent Decree and in accordance with EPA CSO Policy, the City is required to develop and submit for approval a Post-Construction Monitoring Plan (PCMP) to assess the performance of LTCP infrastructure upgrades. This document fulfills that requirement, and not only sets forth a framework for accurately assessing collection system performance now that all LTCP upgrades have been implemented, but also summarizes the results of that assessment. This Post-Construction Monitoring Plan/Report (PCMP/R) was developed consistent with the May 2012 EPA “CSO Post Construction Compliance Monitoring Guidance” document.

As described in greater detail within this document, the City has quantified the performance of LTCP implementation through hydraulic modeling, CSO discharge flow monitoring, and collection system flow monitoring. These efforts are an extension of previous modeling and monitoring work, and will present a clear picture of post-construction system performance, consistent with the LTCP goals.



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City of Portsmouth, NH
Figure 1: Sewer System Overview

0 0.275 0.55 1.1 Miles

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1.1 CSO Program Elements

The planned system improvements for controlling CSOs were outlined in the City's 2002 and 2005 LTCPs, and in the 2010 WMP and LTCP Update. The collection system modifications were designed to reduce CSOs and improve water quality in the Piscataqua River and South Mill Pond in accordance with the EPA Consent Decree. In addition, the City has continued its Nine Minimum Controls (NMC) program activities.

Table 2 and Figure 2 illustrate the collection system improvements made between 2008 and 2015 as part of the LTCP. The lengths of sewer interceptor installed, drain interceptor installed, combined sewer interceptor abandoned, and total area were derived from Geographic Information System (GIS) data and project record drawings (through January 2015). The City has focused mainly on sewer separation projects in the South Mill Pond (Lincoln Avenue area) and Deer Street areas. Reducing inflow/infiltration (I/I), localized flooding, and the elimination of illicit sewer connections have been secondary goals of these projects.

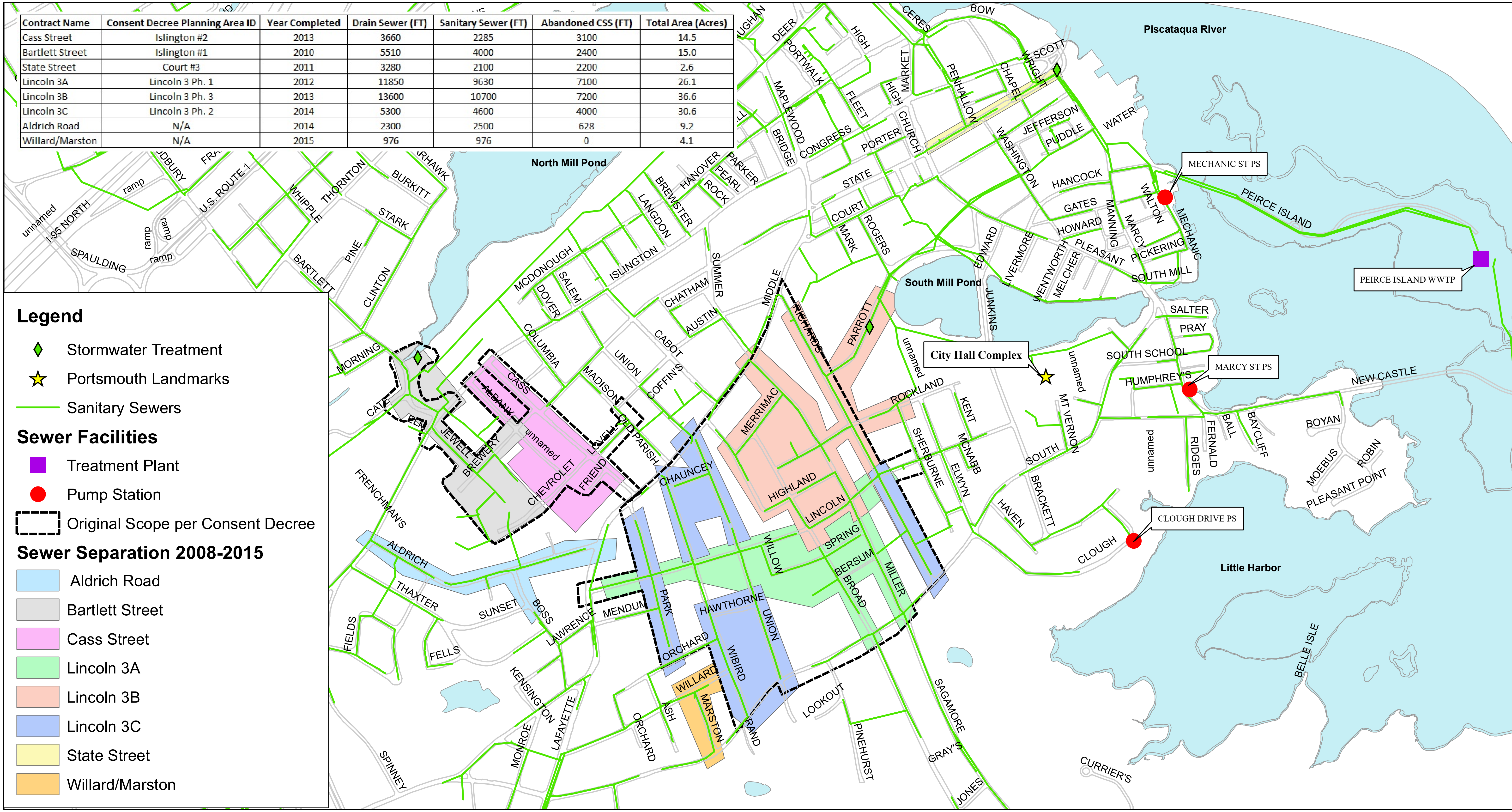
Table 2: Collection System Improvements from 2008 - 2015

Location	Project Type	Completion Date*
Bartlett Street Area	Sewer Separation	November 2010
State Street Area	Sewer Separation	June 2011
Lincoln Area 3A	Sewer Separation	June 2012
Lincoln Area 3B	Sewer Separation	August 2013
Lincoln Area 3C	Sewer Separation	October 2014
Willard/Marston**	Sewer Separation	October 2015
Cass Street Area	Sewer Separation	June 2013
Aldrich Area	Sewer Separation	June 2014

*Substantial completion of sewer and drain work.

**This project resulted from a change order to expand the area to be separated from the original scope of Lincoln 3C, to provide additional CSO benefits.

Contract Name	Consent Decree Planning Area ID	Year Completed	Drain Sewer (FT)	Sanitary Sewer (FT)	Abandoned CSS (FT)	Total Area (Acres)
Cass Street	Islington #2	2013	3660	2285	3100	14.5
Bartlett Street	Islington #1	2010	5510	4000	2400	15.0
State Street	Court #3	2011	3280	2100	2200	2.6
Lincoln 3A	Lincoln 3 Ph. 1	2012	11850	9630	7100	26.1
Lincoln 3B	Lincoln 3 Ph. 3	2013	13600	10700	7200	36.6
Lincoln 3C	Lincoln 3 Ph. 2	2014	5300	4600	4000	30.6
Aldrich Road	N/A	2014	2300	2500	628	9.2
Willard/Marston	N/A	2015	976	976	0	4.1



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City of Portsmouth, NH
Figure 2: Sewer Separation Areas

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1.1.0 Bartlett Street Area

The Bartlett Street Area collection system improvements were completed in 2010. The project area focused on Bartlett Street, between North Mill Pond and Chevrolet Avenue. The improvements included:

- Separation of sanitary and stormwater systems
- Installation of 5,500 feet of drain sewer
- Installation of 4,000 feet of sanitary sewer
- Decommissioning of 2,400 feet of combined sewer
- Approximately 15.0 acres separated (based on record drawings and GIS data)
- Installation of new catch basins
- Installation of a flow control structure and stormwater treatment unit
- Installation of a new headwall and outfall for treated stormwater flows to North Mill Pond
- Installation of new sanitary sewer manholes
- Installation of new drain sewer manholes

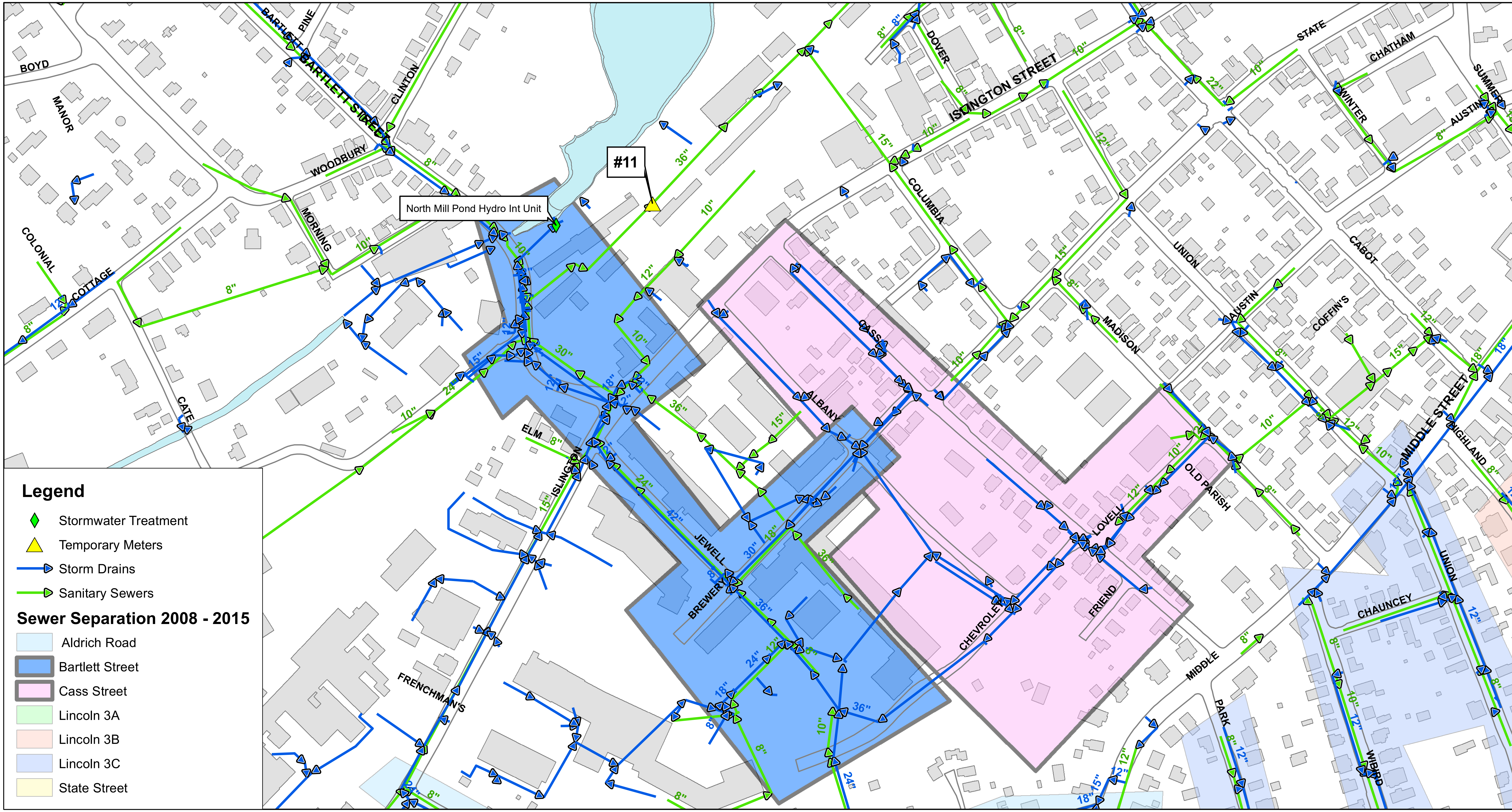
These improvements were implemented as part of the LTCP and had the benefits of reducing flooding in the area, increasing system capacity and reducing CSOs. Figure 3 illustrates the work area for the Bartlett Street and Cass Street Contracts.

1.1.1 Cass Street Area

The Cass Street Area improvements were completed in 2013. The project area covered Cass and Albany Streets from Islington to Middle Streets. The improvements included:

- Separation of sanitary and stormwater systems
- Installation of 3,600 feet of drain sewer
- Installation of 2,300 feet of sanitary sewer
- Decommissioning of 3,100 feet of combined sewer
- Approximately 14.5 acres separated (based on record drawings and GIS data)
- Installation of new catch basins
- Installation of new sanitary sewer manholes
- Installation of new drain sewer manholes

Sanitary sewer flow is conveyed between the Cass Street Area and Bartlett Area and through a 36-inch interceptor. Temporary flow meter #11 was installed within the 36-inch sewer, downstream of the combined sewer areas. The flow from the Bartlett/Cass Area is conveyed east through the State Street Area, eventually reaching the Peirce Island WWTF via the Mechanic Street Pump Station. Stormwater flows from the Bartlett and Cass Street Areas pass through a Downstream Defender stormwater treatment unit manufactured by Hydro International (Portland, ME). Effluent from the treatment unit discharges to North Mill Pond through the newly constructed headwall/outfall.



City of Portsmouth, NH

Figure 3: Bartlett and Cass Street Area Contracts

0 0.05 0.1 0.2 Miles

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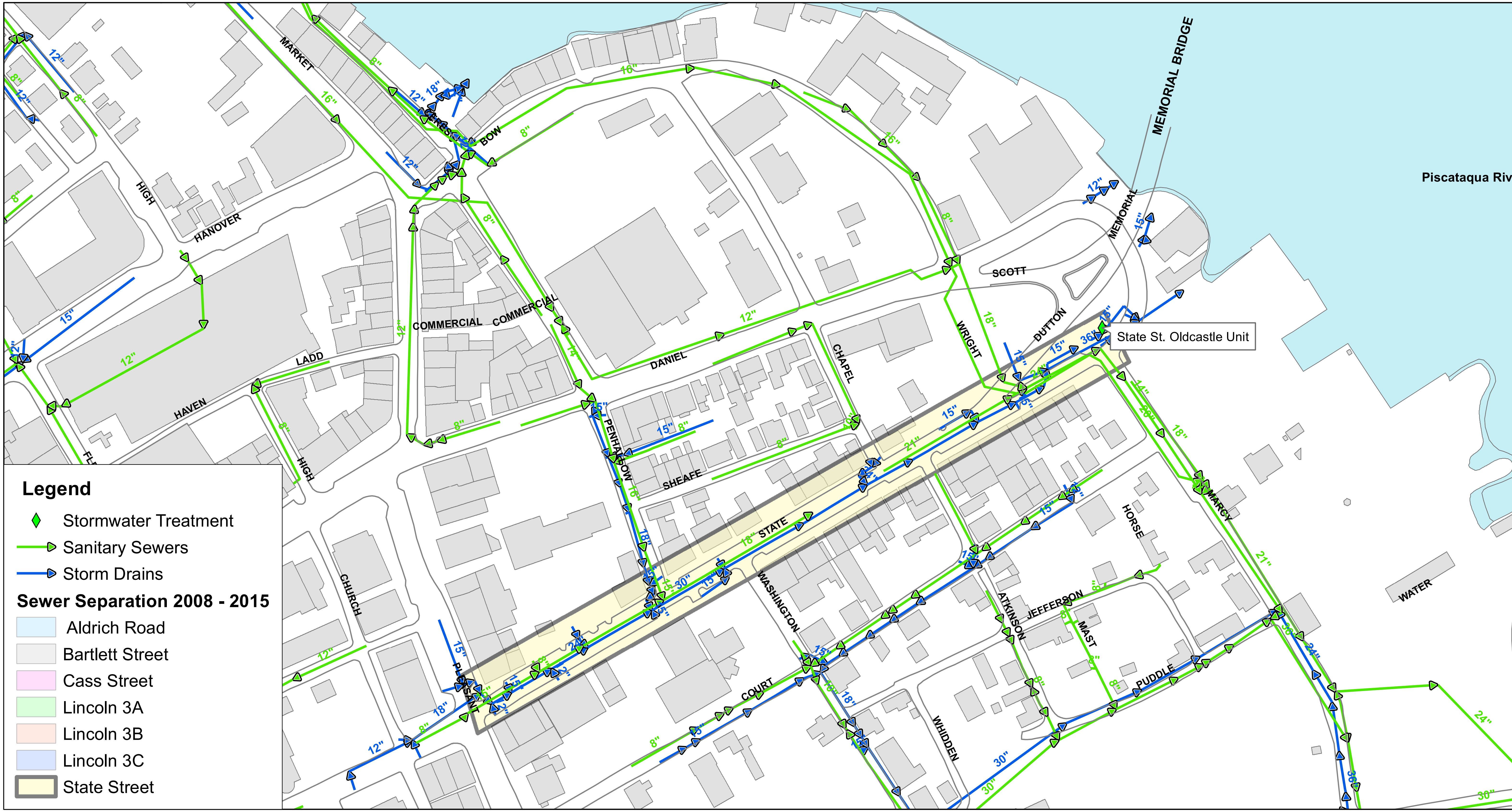
1.1.2 State Street Area

The State Street Area collection system improvements were completed in 2011. The project area focused on State Street between Pleasant and Marcy Streets. Figure 4 illustrates the work area for the State Street Contract. The collection system improvements completed under this contract included:

- Separation of sanitary and stormwater systems
- Installation of 3,300 feet of drain sewer
- Installation of 2,100 feet of sanitary sewer
- Decommissioning of 2,200 feet of combined sewer
- Approximately 2.6 acres separated (based on record drawings and GIS data)
- Installation of new catch basins
- Installation of a flow control structure and stormwater treatment unit
- Installation of a new headwall and outfall for treated stormwater flows to the Piscataqua River
- Installation of new sanitary sewer manholes
- Installation of new drain sewer manholes

The State Street Area collects sanitary and stormwater flows from the north and west sections of the City. The Deer Street Pumping Station, located north of State Street, also transfers sanitary sewer flow through the area. Sewer flows continue south from the State Street Area and are subsequently conveyed to the Peirce Island WWTF. The flow reaching State Street is mainly from separated areas; however, some combined areas still exist (e.g., the area east of Bartlett and Cass Streets). Temporary flow meter #16 measured flow leaving the State Street Area, prior to reaching the Peirce Island WWTF via the Mechanic Street Pump Station.

Stormwater flow entering the State Street Area is treated at a stormwater treatment unit prior to discharging into the Piscataqua River. The stormwater treatment unit consists of a Hancor (Findlay, OH) Stormwater Quality Unit and a sand filter manufactured by Oldcastle (Telford, PA).



City of Portsmouth, NH
Figure 4: State Street Area Contract

0 0.045 0.09 0.18 Miles

1.1.3 Lincoln Area 3A, 3B, and 3C

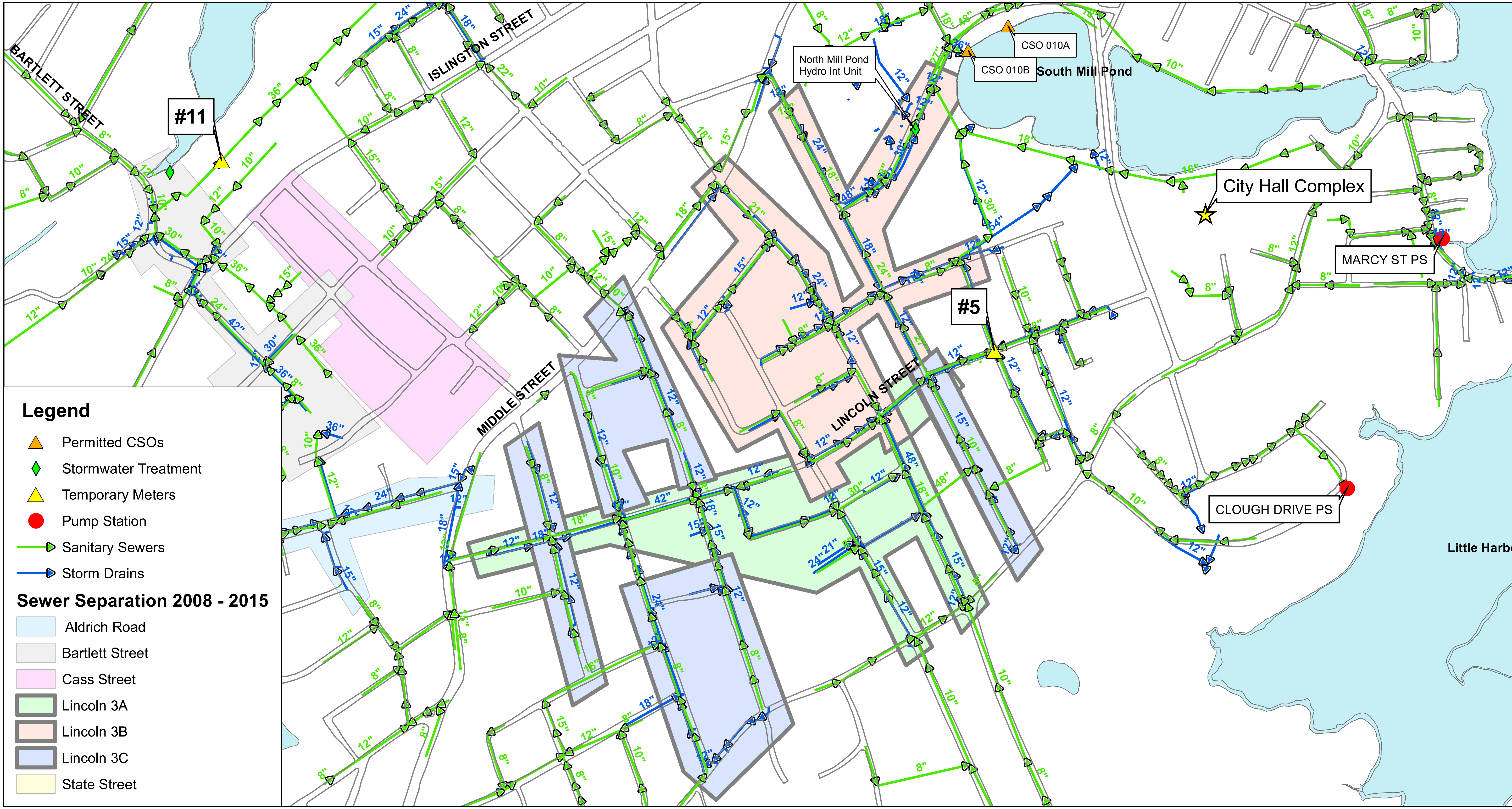
There were three phases of improvements in the Lincoln Avenue Area that were completed in 2012, 2013 and 2014, respectively. The Lincoln Area encompassed a large portion of the combined sewer system in the City and also represented a problem area for flooding during wet weather events. The Lincoln Area Contracts addressed improvements stipulated in the LTCP, as well as critical problems identified through closed-circuit television (CCTV) inspection and other studies. Figure 5 illustrates the work area for the Lincoln Area Contracts. The upgrades included:

- Separation of sanitary and stormwater systems
- Installation of 30,000 feet of drain sewer
- Installation of 25,000 feet of sanitary sewer
- Decommissioning of 15,000 feet of combined sewer
- Approximately 93.3 acres separated (based on record drawings and GIS data)
- Installation of new catch basins
- Installation of a flow control structure and stormwater treatment unit
- Installation of a new outfall for treated stormwater flows to South Mill Pond
- Installation of new sanitary sewer manholes
- Installation of new drain sewer manholes

The Lincoln Avenue Contract Areas receive sanitary sewer flows from the North, East, West, and South. Sanitary sewer flows from the Lincoln Avenue Areas travel east and then north past South Mill Pond, eventually combining with a sanitary sewer that flows south of the State Street Area, prior to reaching the Peirce Island WWTF via the Mechanic Street Pump Station. Separating the sanitary and stormwater systems in the Lincoln Avenue Areas was aimed at significantly reducing CSO volumes and frequency at the 010A and 010B outfalls which discharge to South Mill Pond. Temporary flow meter #5 measured flow in the 30-inch interceptor which collects most of the sanitary sewer flows in the Lincoln Avenue Area. Data from this flow meter, along with permanent monitoring at CSO 010A and 010B, were designed to support the assessment of the success of sewer separation work in the area.

Stormwater flows from the Lincoln Avenue Areas are conveyed to a Vortechs stormwater treatment unit manufactured by Contech Stormwater Solutions Incorporated (West Chester OH). The treatment unit is located prior to the headwall and outfall located at South Mill Pond. These improvements were implemented to reduce I/I, increase system capacity by replacing collapsed interceptors, reduce CSOs, reduce street flooding and basement backups.

A change order (#4) from the Lincoln 3C project resulted in an expansion of the area to be separated, including Willard and Marston Streets. This resulted in additional CSO reduction, beyond the scope of work previously identified in the Consent Decree.



City of Portsmouth, NH
Figure 5: Lincoln Area Contracts 3A, 3B, and 3C

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0 0.125 0.25 0.5 Miles

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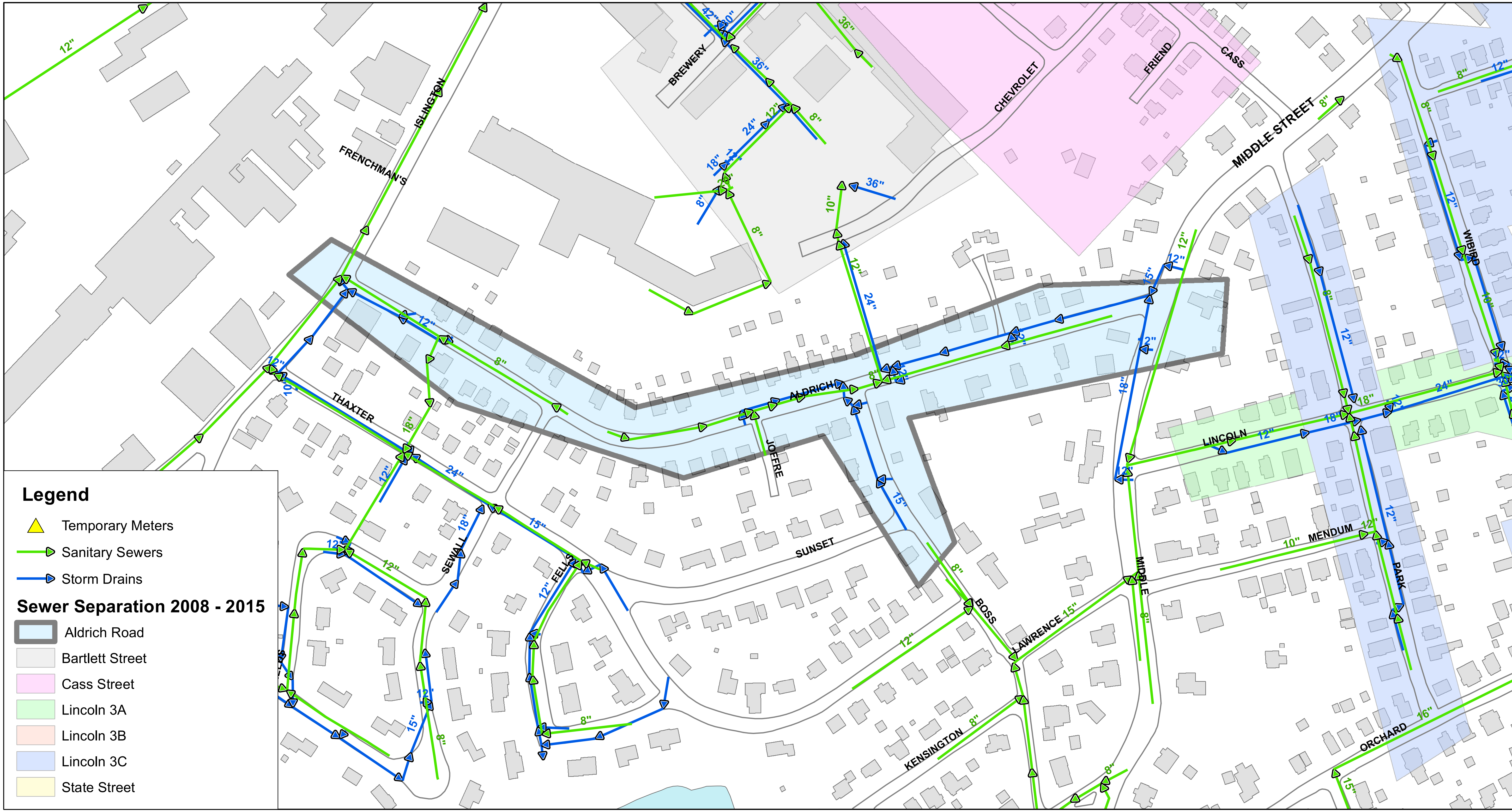
1.1.4 Aldrich Area

The Aldrich Area LTCP improvements were completed in 2014. The Aldrich Area is to the west of the Lincoln Avenue Areas and south of the Bartlett and Cass Street Areas. Figure 6 illustrates the work area for the Aldrich Area Contract. The upgrades included:

- Separation of sanitary and stormwater systems
- Installation of 2,300 feet of drain sewer
- Installation of 2,500 feet of sanitary sewer
- Decommissioning of 628 feet of combined sewer
- Approximately 9.2 acres separated (based on record drawings and GIS data)
- Installation of new catch basins
- Installation of new sanitary sewer manholes
- Installation of new drain sewer manholes

The sanitary sewer flows from the western portion of the Aldrich Area are conveyed to the 15-inch sewer on Islington Street and continue north to the Bartlett Area. The flows from the eastern portion of the Aldrich Area travel through a 12-inch sewer that connects to the Bartlett Area sanitary sewer system. The stormwater generated in the Aldrich Area flow to the west and east depending on location. These stormwater flows travel to the stormwater treatment unit constructed as part of the Bartlett Avenue Area improvements prior to discharging to South Mill Pond.



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City of Portsmouth, NH
Figure 6: Aldrich Area Contract

0 0.05 0.1 0.2 Miles

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1.2 Approach Summary

The overall goal of the PCMP/R is to provide a framework for assessing the performance of collection system infrastructure improvements implemented through 2015. In large part, the PCMP performance assessment was based on collection system flow monitoring and simulations using an updated hydrologic/hydraulic model. This PCMP has been developed consistent with the U.S. EPA May, 2012 document titled "CSO Post Construction Compliance Monitoring Guidance."

1.2.1 Collection System Monitoring

A comprehensive collection system flow monitoring program is part of this PCMP/R. The locations utilized for the flow monitoring program (Figure 7) overlap with the 2008 flow monitoring locations (installed during development of the 2010 LTCP Update) helping to ensure that accurate comparisons are made to assess the performance of infrastructure improvements. Permanent flow meters installed at the three (3) CSO discharge points are also utilized. The data from the flow monitoring program is utilized to re-calibrate the updated PCSWMM collection system model to provide a more complete understanding of collection system performance following LTCP improvements. Section 2.2 contains detailed information on the flow monitoring program.

1.2.2 Collection System Modeling

The PCMP focuses on the use of hydraulic modeling to assess the performance of collection system upgrades completed as part of the LTCP. Table 3 contains rainfall statistics for five (5) years of data obtained from the National Weather Service Durham, NH Station (NOAA 2001). This precipitation data was previously identified in the 2010 LTCP Update as representing average annual conditions in Portsmouth, NH and will continue to be used for the PCMP/R hydraulic modeling performance assessment work. The detailed rainfall data is included in the Appendix. The annual average rainfall and modeled CSO discharge volume over this five year period will be used as a benchmark for the assessment of collection system upgrades. The criteria used to assess simulated collection system performance are detailed in Sections 3 and 4.

Table 3: Rainfall Statistics for Five (5) Years of Data from Durham, NH Rain Gauge

Year	Annual Rainfall (Inches)
1968	42.5
1988	44.9
1989	40.5
1990	47.8
1993	35.4

Table 4 contains the expected "typical year" CSO discharge volumes based on hydraulic modeling conducted as part of the 2010 LTCP Update. The goal of the hydraulic modeling and flow monitoring work performed as part of this PCMP/R is to validate these projections for annual average CSO discharge volumes.

Table 4: Estimated Typical Year CSO Statistics After System Improvements Per 2010 LTCP Update

Location	Cumulative CSO Volume (MG)
South Mill Pond CSOs (010A/010B)	2.1
Deer Street CSO (013)	0

As described above, the City of Portsmouth's PCSWMM collection system model was updated to reflect the system improvements made between 2008 and 2015. The City's existing *Y2008* PCSWMM collection system model was then used as the basis for model updates. Record drawings and GIS data from the 2008 – 2015 improvements was used to update the collection system model to reflect current 2015 conditions (post-construction).

2 Monitoring Program

In order to understand the effects of CSO abatement activities, this PCMP/R includes monitoring activities to quantify collection system performance under a variety of flow conditions, and support calibration of the model. The monitoring plan includes provisions for rainfall, flow, and CSO discharge monitoring. The locations chosen for monitoring overlap with those utilized during the 2010 LTCP Update, so that flow and CSO discharge data can be accurately compared.

2.1 Rainfall

Rainfall data was collected using the two (2) permanent rain gauges that are maintained and operated by the City of Portsmouth. Rainfall data is used to assess the severity of each storm event and as an input to the updated and re-calibrated collection system model.

Table 5: City of Portsmouth Permanent Rain Gauges

Site	Location	Meter	Type
Rain1	Lafayette Road Pump Station	Electronic tipping bucket type rain collector	Permanent
Rain2	City Hall	Electronic tipping bucket type rain collector	Permanent

2.2 Flow Monitoring

The flow monitoring program in this PCMP/R focused on monitoring of rainfall, CSO frequency and volume, and collection system flows. Dry and wet weather flow was monitored to provide an understanding of the system under a variety of expected conditions. The monitoring program relied on a number of permanent and temporary flow monitoring instruments. The data collected from this monitoring program was used to empirically evaluate the performance of the improved collection system and recalibrate the PCSWMM model. As previously described, the locations used for data collection in this PCMP/R overlapped with the locations utilized in the 2010 LTCP Update.

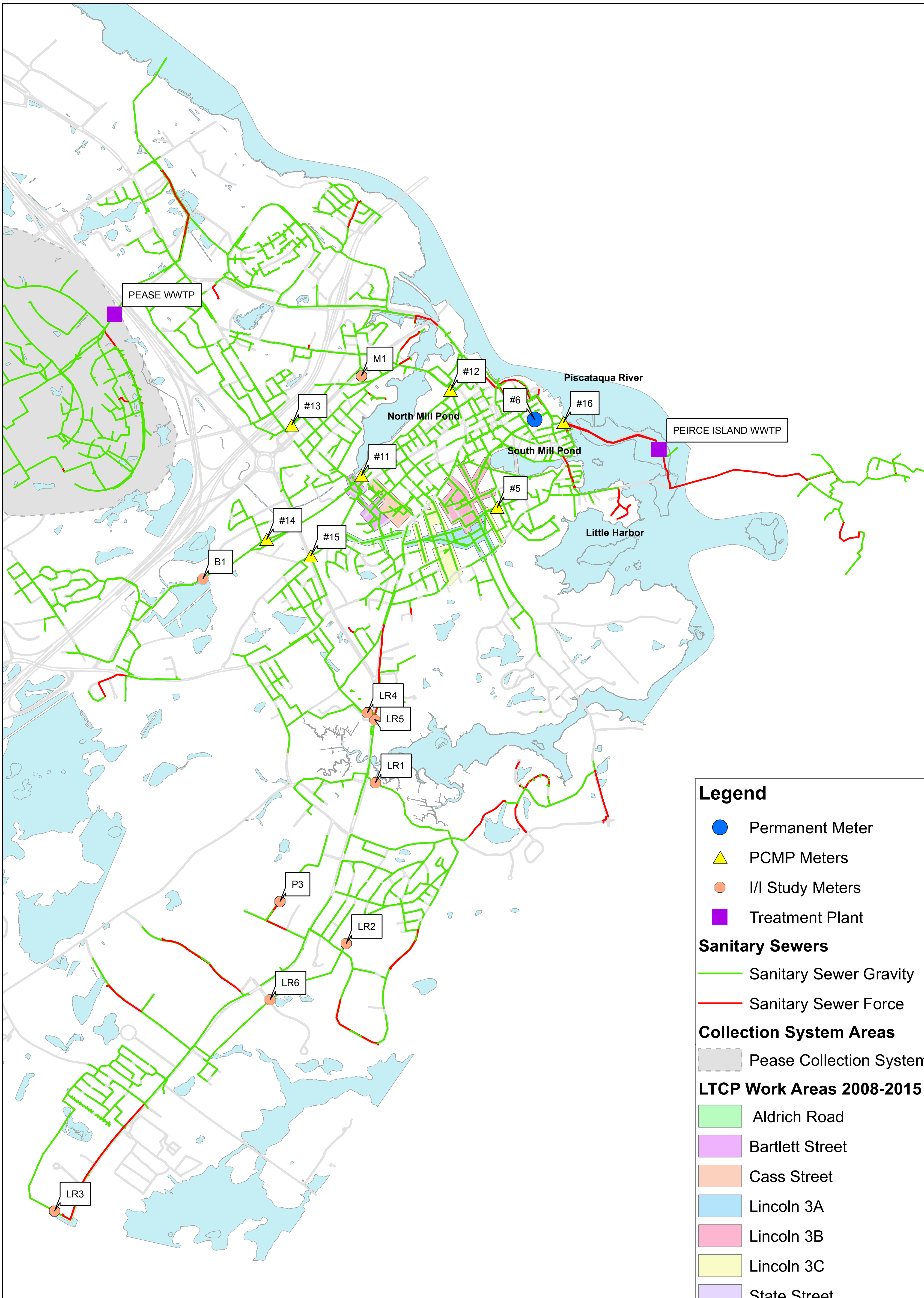
Table 5, Table 6 and Figure 7 describe/illustrate the locations of all permanent and temporary flow and rainfall monitoring devices. Flow monitoring data from the City's various CSO discharge points were also utilized to verify modeled system performance. Appendix A and B contain field data sheets detailing the locations of the permanent and temporary flow meters described in this section.

The temporary flow meters were installed for a 12-week period starting April 9, 2015. The metering data was quality-controlled through examination of time series data as well as scatter plots (depth versus velocity). Final meter data was found to be consistent and continuous (little or no downtime) throughout the monitoring period. The data represents a snapshot in time (12 weeks) but is of sufficient quantity and quality for model calibration and post-construction monitoring purposes.

Table 6: Temporary and Permanent Flow Monitoring Locations

Site	Location	Area(s) of Interest	Location Same as in 2008?	Comments
5	30-in Pipe in Lincoln Avenue at #167	Lincoln Avenue	Yes/No	Sanitary sewer flows in an area where extensive upgrades have been completed. Meter was relocated one manhole upstream to capture more viable data and avoid debris accumulation.
6	30-in Pipe in Puddle Lane at Strawberry Banke	Lincoln Avenue	Yes	Combined flows from CSOs 010A/010B, the Deer Street PS force main terminus, and the downstream Mechanic Street PS. Permanently installed meter.
11	36-in Pipe at Ricci Lumber	Bartlett and Cass	No	Flow from newly separated areas. Relocated slightly from its 2008 location.
12	24-in Pipe in Maplewood Avenue	Deer Street	Yes	Flow from the northern portion of the City where previous LTCP collection system improvements have been made.
13	20.6-in Pipe in Franklin Drive	Dennett Street	Yes	Flow from the northern portion of the City where previous LTCP collection system improvements have also been made.
14	17.5-in Pipe in Islington Street at Dirt Access Road	Borthwick	Yes	Sanitary sewer flows in the western regions of the City where previous LTCP improvements have been made.
15	10-in Pipe in Route 1 Bypass	Essex/Sheffield	No	Sanitary sewer flows in the western regions of the City where previous LTCP improvements have been made. Relocated slightly upstream along Route 1 from its 2008 location.
16	24-in Pipe in Peirce Island Road at Mechanic Street	Overall	Yes	Flows entering Mechanic Street PS which pumps to the Peirce Island WWTF

Note: Site ID numbers for the 2015 monitoring program were kept consistent with Site IDs used in previous monitoring programs (2010).



City of Portsmouth, NH
Figure 7: Collection System Flow Monitoring

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0 0.45 0.9 1.8 Miles

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2.3 CSO Activations

The monitoring of CSO activations provides empirical evidence related to the performance of collection system modifications. The collection and reporting of CSO discharge data to NHDES and EPA is required per the Consent Decree. Data continued to be collected during the execution of the PCMP/R, and utilized to evaluate system performance and update/re-calibrate the PCSWMM model.

2.3.1 Previous and Ongoing CSO Activation Monitoring

Currently, the three CSO regulators (010A, 010B, 013) are outfitted with permanent area velocity flow meters (AVFMs) that rely on ultrasonic level, pressure, and velocity sensors. These sensors provide redundant information in case of a single sensor failure, and facilitate accurate characterization of CSO events. These sensors are maintained by Flow Assessment Services LLC on a regular basis and data is downloaded during routine service visits. Appendix A contains data sheets for each of the three CSO monitoring locations.

Appendix F contains an event-by-event summary of observed CSO activations, starting at the beginning of the temporary monitoring period (April 2015).

3 Hydraulic Modeling Program

3.1 Hydraulic Model History

The City of Portsmouth began its hydraulic modeling work during the development of the 1991 CSO Abatement Program. That original model was updated during the development of the 2005 LTCP to accurately depict collection system upgrades at that point in time. The 2005 model utilized the EPA's Storm Water Management Model (SWMM) version 4.4GU. During the development of the 2010 LTCP Update, the City's collection system model was updated to PCSWMM 2009. The PCSWMM 2009 software package relies on the US EPA SWMM version 5 modeling engine. The updated model, referred to as the *Y2008* model, accounted for system infrastructure modifications made through 2008, and utilized collection system flow monitoring data obtained during the development of the 2010 LTCP Update.

3.2 PCMP/R Modeling

The objective of the City's hydraulic modeling work is to accurately predict the number of CSO events, and cumulative CSO discharge volume that may be expected to occur on an average annual basis. As described in Section 1.2.2, using standard precipitation data the model can be used to evaluate post-construction conditions to understand the effectiveness of LTCP controls, against the targets established in the 2010 LTCP Update. The general modeling approach is summarized in Figure 8. As the City's current infrastructure upgrades are nearly complete, the majority of the modeling and re-calibration work will occur in a single phase.

As part of the PCMP/R scope of work, the City's PCSWMM *Y2008* model was updated using GIS information and record drawings to reflect the collection system improvements made between 2008 and 2015. The updated model was then re-calibrated using the flow monitoring data collected as part of the PCMP/R. Recalibration allows the model parameters to be updated to reflect the work performed in removing wet weather flow from the combined sewer system (i.e., sewer separation). As previously described, a standard rainfall condition using the five (5) calendar years of data summarized in Table 3 was simulated to represent post-construction conditions. The modeled CSO discharge volumes for this condition was then compared to the target annual volume.

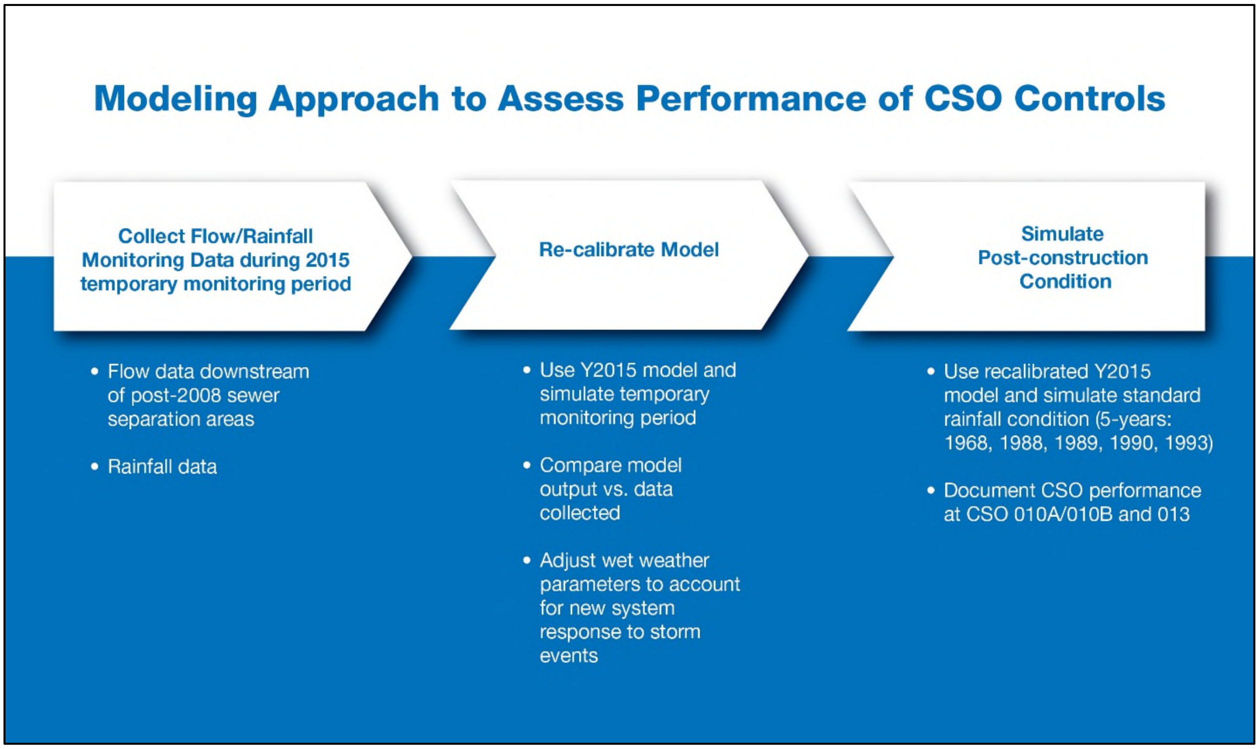


Figure 8: Overall Modeling Approach for Assessing Performance of CSO Controls

4 LTCP Performance Assessment

4.1 Assessment of CSO Performance

The data collected during the monitoring efforts of this PCMP/R was used to re-calibrate and validate the updated PCSWMM collection system model. Following model re-calibration, the standard rainfall condition spanning five (5) calendar years was then utilized to assess the performance of the collection system.

As outlined in this PCMP/R and the 2010 LTCP Update, the expected level of CSO control based on the hydraulic modeling conducted for the 2010 LTCP Update is shown in Table 4. Collection system simulation results will be analyzed to determine if the completed capital improvements are achieving these goals. If performance criteria are not being met, additional data collection and hydraulic modeling work will be conducted to better understand collection system performance. One of the advantages of using the PCSWMM hydraulic model is the ability to perform alternatives analysis and evaluate the impacts of any potential modifications to the collection system infrastructure and operation.

4.2 Flow and Rainfall Monitoring Results

Flow, rainfall and CSO discharge monitoring data was collected (as summarized in Table 5 and Figure 7) from April 9, 2015 through July 8, 2015. Additionally, temporary flow monitoring was performed (by others) for locations beyond the combined sewer area of the system, for purposes of inflow/infiltration analysis. This data was obtained and utilized in these model updates/calibration, to produce a more robust system analysis and model. Table 6 summarizes the storm events observed in the monitoring period at the City Hall rain gauge (only storms with depths greater than 0.2 inches are shown).

Table 7: Monitored Storm Event Summary (City Hall Gauge)

#	Rain Start	Rain End	Duration (hr)	Peak Intensity (in/hr)	Total Depth (in.)
1	3/14/2015 12:55	3/15/2015 3:25	14.5	0.24	0.56
2	3/26/2015 15:10	3/27/2015 9:15	18.1	0.48	0.74
3	4/9/2015 21:30	4/10/2015 8:15	10.7	0.24	0.30
4	4/20/2015 13:35	4/21/2015 6:15	16.7	0.84	2.13
5	5/28/2015 13:55	5/28/2015 14:15	0.3	1.44	0.24
6	5/31/2015 11:30	6/2/2015 12:45	49.3	0.72	3.11
7	6/21/2015 0:55	6/21/2015 13:00	12.1	0.96	1.43
8	6/23/2015 8:50	6/23/2015 12:45	3.9	2.40	0.47
9	6/27/2015 23:15	6/28/2015 15:35	16.3	0.72	1.60
10	7/1/2015 7:50	7/1/2015 20:20	12.5	0.60	0.56

Appendix C includes plots of the flow and rainfall data collected at each of the 7 temporary meter locations and 1 permanent meter location, along with model predictions.

4.3 Model Updates

The previous version of the Portsmouth LTCP collection system model was constructed in a format that required separate software packages for performing the hydrologic calculations (HSPF and CAPE) and hydraulic calculations (PCSWMM). This required a multi-step process for generating model predictions of CSO frequency and volume. An inflow and infiltration time series would have to be produced as an output by the hydrologic model, and then, in a separate step, used as an input into the hydraulic (pipe) model for final analysis of CSO performance. The PCSWMM software would not be able to generate both hydrologic and hydraulic model results without the use of external software. The previous model was also a schematic representation of the sewer system, and was not georeferenced to the actual spatial location of sewer infrastructure.

In order to provide an integrated hydrologic/hydraulic collection system model that could be simulated in a single software environment (without the need for external or proprietary software), and georeferenced for spatial accuracy, the model framework was updated using City geographic information system (GIS) data and record drawings.

Figures 9 and 10 illustrate the previous and updated collection system model networks, respectively. The previous model's pipe and manhole features were re-located to their actual location (per GIS). Pipe diameters and inverts were retained based on the previous model information, but were superseded with record drawing information as appropriate.

4.3.1 Boundary Condition

The boundary condition (i.e., terminus) of the model is the Peirce Island WWTP, and no changes were made to this condition in the updated model. The Mechanic Street Pump Station feeds the WWTP, and is the hydraulic boundary condition in the model, as described further below. Flows from Newcastle are conveyed directly to the WWTP (not through the Mechanic Street Pump Station) and the collection system from that Town is not included in this modeling scope.

4.3.2 Pump Stations

The Lafayette Road, Deer Street, and Mechanic Street Pump Stations are explicitly included in the model, are represented with SWMM type 4 pumps, and have peak capacities of 3.2 MGD, 10.5 MGD, and 21 MGD, respectively. These capacities are conservative, meaning they are modeled at less than their installed capacities. Thus, this PCMP/R demonstrates LTCP performance conservatively (meaning the system may actually be performing better than what is modeled).

4.3.3 Dry Weather Flows

Dry weather flow (sanitary flow and base groundwater flow) was updated in the model to reflect current conditions during the monitoring period, based on the flow monitoring data. The diurnal patterns and magnitudes of flow were both updated. The total dry weather flow predicted by the model was 5.0 MGD, through the Mechanic Street Pump Station.

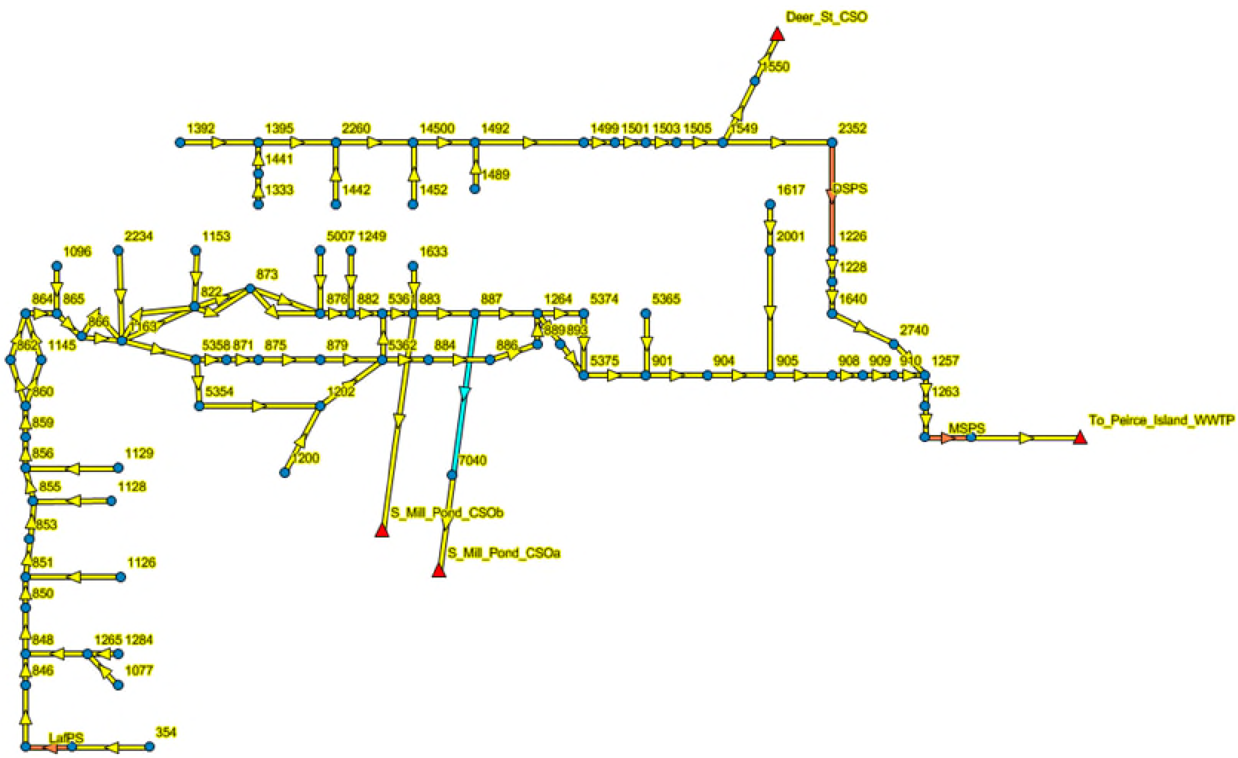
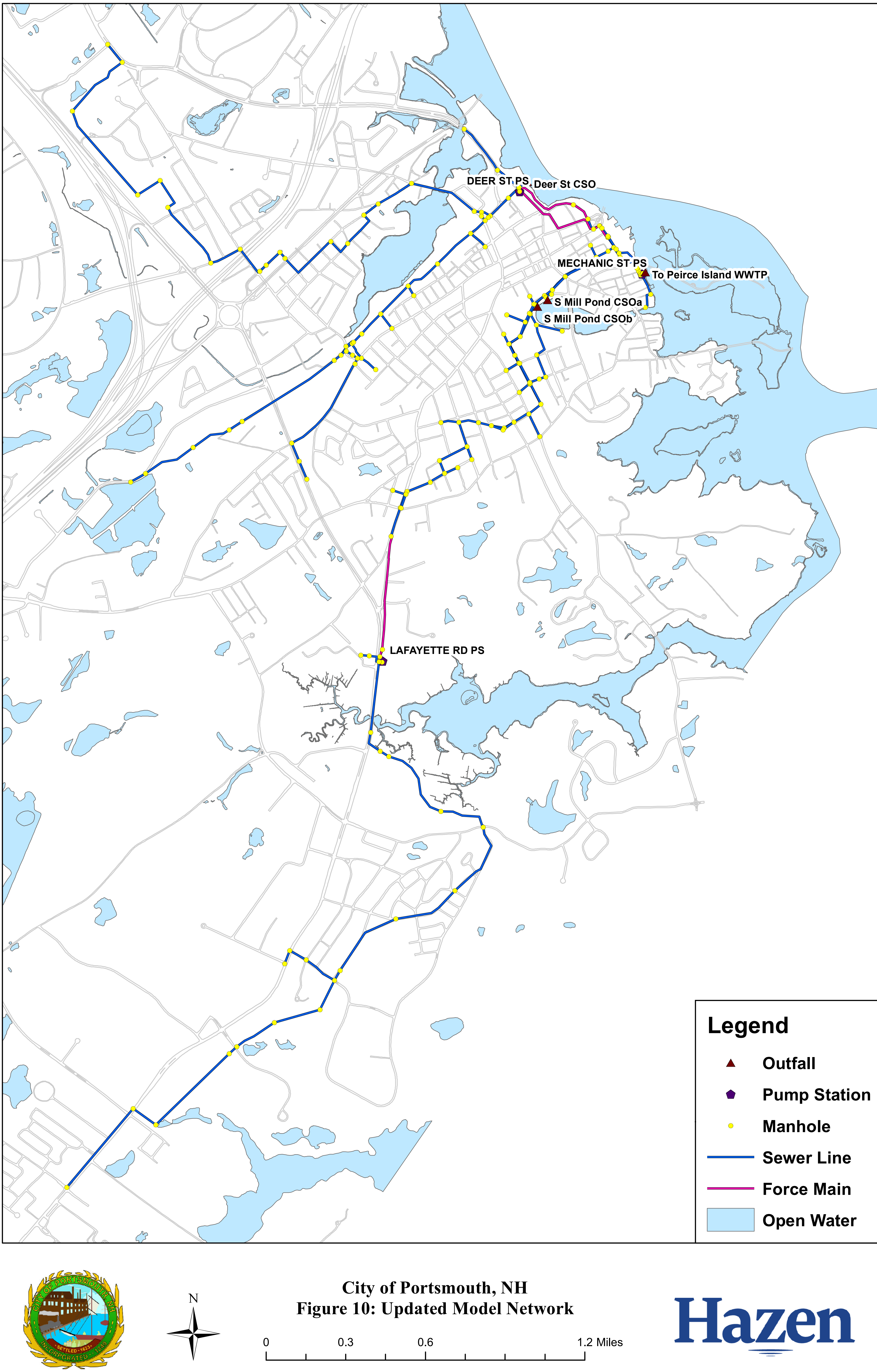


Figure 9: Previous Model



City of Portsmouth, NH
Figure 10: Updated Model Network

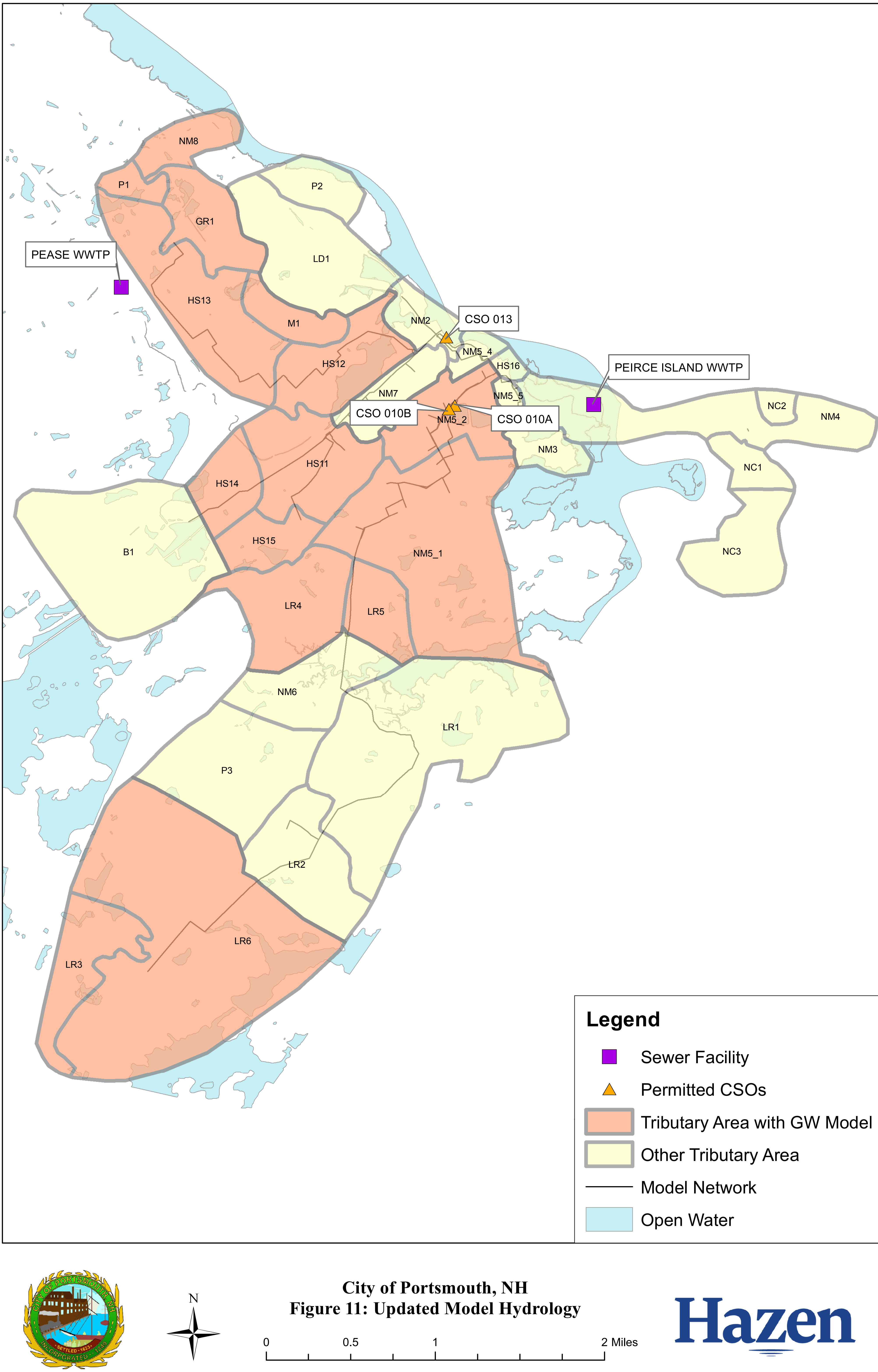
4.3.4 Wet Weather Flows

The hydrology of the collection system (the process of converting rainfall to inflow/infiltration and runoff into the sewer system) was updated using a combination of the "RTK" framework and the "groundwater infiltration" framework (included explicitly within the PCSWMM software). Figure 11 summarizes the locations in the model network where flow is loaded (i.e., delivered to the sewer system), and where one or both wet weather flow frameworks were utilized. In Figure 11, the red shaded areas represent model subcatchments where both the groundwater infiltration and RTK frameworks were employed, while the tan shaded areas represent subcatchments that utilized only the RTK approach. The flow monitoring data, representing the actual response of the sewer system to rainfall, was utilized to determine which areas of the system were most dominated by groundwater infiltration (versus inflow); this led to the decision as to which approach (RTK method, or both RTK coupled with groundwater infiltration) was applied at each location in the model.

Model subcatchments are the hydrologic units where rainfall dependent inflow/infiltration (RDI/I) is generated from rainfall, and is tributary to (and consequently introduced into) the piping network. Subcatchments were drawn based on temporary meter sub-basin boundaries - these GIS-based polygons from the I/I contract (by others), as well as the PCMP contract, were obtained, checked and used in the updated model.

Each of these wet weather hydrology approaches is appropriate when modeling a sewer system that has undergone significant sewer separation. Additionally, the flow monitoring data supported the use of these modeling approaches, given the type of wet weather response observed in the system. Generally, the City's system behaves according to a largely separated sewer system, with rainfall-induced peak flows receding gradually over time to dry weather conditions, and which is impacted heavily by groundwater infiltration.

The RTK unit hydrograph method was used as the hydrologic routine for representing the wet weather response in the sewer system model due to RDI/I. This method uses three triangular-shaped unit hydrographs to represent the RDI/I flow. Three parameters define each triangular unit hydrograph: R (ratio of RDI/I volume to rainfall volume), T (time to peak), and K (ratio of "time to recession" to "time to peak"). The first set of parameters (R1, T1, K1) represent the fast response of the sewer system to inflow, the second set (R2, T2, K2) represents the delayed response of the system to infiltration, while the third set (R3, T3, K3) represents the much longer and slower response of the sewer system to infiltration that could last days and weeks. Figure 12 illustrates this methodology as it relates to the wet weather RDI/I sewer system response.



City of Portsmouth, NH
Figure 11: Updated Model Hydrology

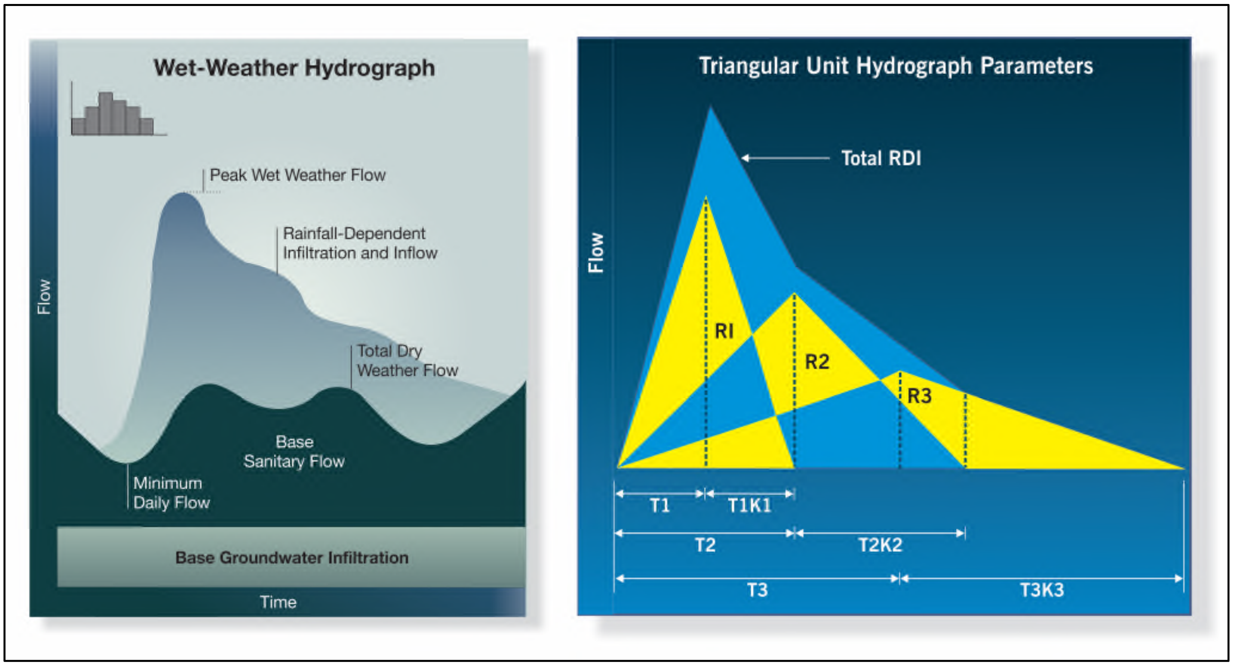


Figure 12: RTK Unit Hydrograph Methodology

The groundwater model framework allows for accurate representation of the sewer system's delayed response to flow entering the system through defects in pipes and manholes. In PCSWMM, this process was used to supplement the RTK framework described above, and enabled the model to better match the longer flow that lags days or weeks after rainfall.

In the model, groundwater parameters are stored in what are called "aquifers," which are represented by two zones: the unsaturated zone and the saturated zone (see Figure 13). The unsaturated zone (upper zone) has a variable moisture content and the lower zone is fully saturated and defined completely by the soil porosity. Fluxes contributing to the upper and lower zones are characterized by:

- Infiltration from the surface, f_i
- Evapotranspiration from the upper zone, f_{EU}
- Percolation from the upper zone to the lower zone, f_U
- Evapotranspiration from the lower zone, f_{EL}
- Percolation from the lower zone to the groundwater, f_L
- Lateral groundwater interflow to the drainage system, f_G

Upper to lower zone percolation is defined by the moisture content and the upper zone depth, d_U. Evapotranspiration from the lower zone fluxes depends also on the upper zone depth, d_U. Lateral groundwater interflow is dependent upon the lower zone depth d_L and the receiving node water depth.

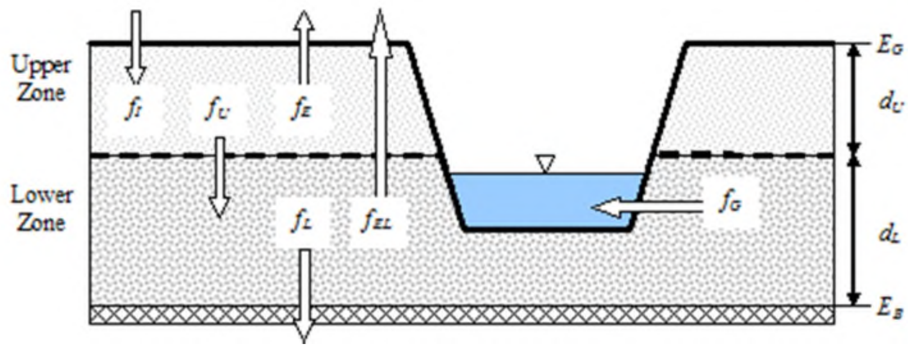


Figure 13: Two Zone Groundwater Model (SWMM)

The program performs a mass balance to calculate the water volume stored in each zone after computing the above water fluxes so that a new water table depth and unsaturated zone moisture content can be computed for each time step.

Important parameters defining the above flows are: soil porosity, wilting point, field capacity, saturated hydraulic conductivity, and soil tension; in addition of variables such as the fraction of total evaporation/evapotranspiration in the upper and lower zones, and the unsaturated zone moisture.

An evaporation time pattern for the Upper Zone was included to adjust the water table for different months of the year. This data was based on local National Weather Service sources.

4.4 Model Calibration

Once the model updates were completed, the model was calibrated and verified to current system conditions based on the flow and rainfall monitoring conducted (described in Section 2).

The overall calibration process involved identifying discrepancies between observed and simulated flows, investigating the discrepancies, and correcting model parameters. Calibration of parameters was performed for dry weather conditions (a week of dry weather was selected in May 2015) and for wet weather conditions, for several storms. Then the entire monitoring period was simulated to verify model performance, to ensure robust performance over a longer term. This supported the notion of ensuring the model was fit for the purpose of predicting system response to rainfall during typical, annual average conditions. Appendix C contains time series plots of model-predicted versus observed (measured) flow for a dry weather week, while Appendix D contains time series plots for flow and depth for the entire monitoring period.

Dry weather calibration was performed by adjusting the diurnal patterns and magnitude of flows upstream of each metering location. Dry weather flow volumes were all within the industry standard error range of +10/-10 percent.

For wet weather calibration, a number of parameters were evaluated and adjusted during the calibration process to improve estimates of flow, volume and depth. The three sets of R, T and K values, as well as the groundwater parameters (all described in Section 4.3.4), are hydrologic calibration parameters. They affect the prediction of the quantity and timing of rainfall that enters the sewer system as RDI/I. These parameters were established, starting with default PCSWMM values, and then adjusting them until reasonable agreement between modeled and measured flows were achieved. Sediment and pipe roughness are the primary hydraulic parameters that control depth of flow once it has entered the sewer system. Use of either of these two parameters to allow the model to better match meter data does not necessarily indicate the presence of sediment, for example; rather it indicates, in a lumped fashion, the presence of potential imperfections in the infrastructure that cause the water depth to vary. These imperfections can include pipe wall defects, pipe joint offsets, pipe-to-manhole connection defects or offsets, etc. The sediment and roughness parameters were held constant from the previous Y2008 model, with the exception of three locations. Downstream of temporary Meter #11 and Meter #12, the minor losses were increased and 0.4-0.5 feet of sediment was added in order to allow the modeled depth predictions to better match metered depth data. Downstream of Meter #16, minor losses were increased. These changes improved the agreement between modeled and measured depths.

The model predictions generally match the measured data reasonably well, by inspection of the plots for each monitoring location. The exception to this conclusion is for the April 20, 2015 storm event, which was preceded by snow in the weeks prior to it. Snow melt is not generally included in models developed for CSO LTCP studies. Thus, the model under-predicted this event at several monitoring locations during this event. Additionally, this storm was rather intense (2.1 inches total depth and 0.8 in/hr peak intensity) and not “typical,” in terms of annual average conditions. Thus, the discrepancy during this event does not impact the capability of the model to predict more typical, annual average conditions, as can be seen by inspection of the latter portions of the monitoring period performance in each of the plots in Appendix C.

Table 7 summarizes the comparison of modeled versus monitored CSO discharges during the temporary flow monitoring period. There is generally good agreement across the storms in this period, as to the presence or absence of CSO discharges. The only exception is the aforementioned April 20, 2015 event, which was influenced by snowmelt. This discharge occurred at CSOs 010A/B (1.97 MG at 010A, and 0.31 MG at 010B); no discharge was measured at CSO 013.

Table 8: Monitored vs Modeled CSO Discharges

#	Rain Start	Rain End	Monitored Volume (MG)	Modeled Volume (MG)
1	3/14/2015 12:55	3/15/2015 3:25	0	0
2	3/26/2015 15:10	3/27/2015 9:15	0	0
3	4/9/2015 21:30	4/10/2015 8:15	0	0
4	4/20/2015 13:35	4/21/2015 6:15	2.28	0
5	5/28/2015 13:55	5/28/2015 14:15	0	0
6	5/31/2015 11:30	6/2/2015 12:45	0	0
7	6/21/2015 0:55	6/21/2015 13:00	0	0
8	6/23/2015 8:50	6/23/2015 12:45	0	0
9	6/27/2015 23:15	6/28/2015 15:35	0	0
10	7/1/2015 7:50	7/1/2015 20:20	0	0

Table 8 summarizes the modeled and observed total volume through the monitoring period for each meter location. Industry standards suggest the volume be within an error range of +20% and -10%. Almost every meter's total volume falls within this range, except meters 14 and LR4. At both of these locations, the magnitudes of flow rates were relatively small, resulting in relatively high percent differences. The model is conservative for these two locations as it tends to over-predict flows.

Table 9: Modeled vs Observed Performance

Meter	Observed Volume (MG)	Modeled Volume (MG)	Difference
5	144.0	149.2	3.6%
6	275.4	273.5	-0.7%
11	92.6	91.3	-1.4%
12	66.7	61.5	-7.8%
13	31.4	32.1	2.3%
14	35	45.1	28.8%
15	9	8.2	-8.4%
16	192.7	176.8	-8.2%
B1	18	16.7	-7.3%
LR1	86.4	75.4	-12.7%
LR2	68.9	60.5	-12.2%
LR3	7	6.2	-11.3%
LR4	13.5	17.3	28.4%
LR5	8.6	7.8	-9.7%
LR6	55.4	49.5	-10.6%
M1	5.4	5.6	3.8%
P3	4.3	5.1	19.7%

4.5 Model Results

Using the calibrated model, and consistent with the approach taken in the 2010 LTCP, the annual average CSO performance was simulated to determine if the quantitative LTCP targets were met (described in Section 1.2.2).

Five (5) calendar years of rainfall were simulated using the model (1968, 1988, 1989, 1990, 1993), and then averaged to determine the annual average overflow volume (AAOV), against which the 2010 LTCP targets were compared for each CSO location.

Table 9 summarizes the AAOV results. For CSO 013, there was only one single discharge (from a 3.7-inch storm in 1988, closely approximating a 5-year return frequency); thus, given the "atypical" nature of this particular storm event, and given that all other events in 1988, as well as for the other four years, produced zero discharge, the LTCP goals at this location are largely met. The AAOV was predicted at CSO 013 to be 0.1 MG. For CSO 10A and 10B, the AAOV was predicted to be 1.1 MG. This is less than the 2010 LTCP target volume for this location (2.1 MG), signifying LTCP success.

Table 10: Average Annual Overflow Volumes

		South Pond CSOs (10A/10B)	Deer St CSO (013)
Current Model (Post-Separation)	1968	0	0
	1988	4.03	0.53*
	1989	0	0
	1990	1.64	0
	1993	0	0
	Average	**1.1**	**0.1**
2010 LTCP Report Target		**2.1**	**0**

*Note: For CSO 013, there was only one single discharge (from a 3.7-inch storm in 1988, closely approximating a 5-year return frequency); additionally, all other events in 1988, as well as all events for the other four years, produced zero discharge.

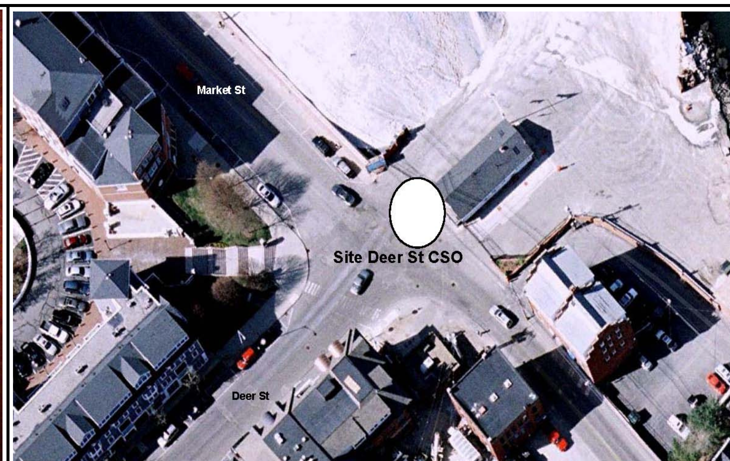
APPENDIX A – Permanent Flow Monitoring Site Sheets

FLOW Assessment SERVICES L.L.C.

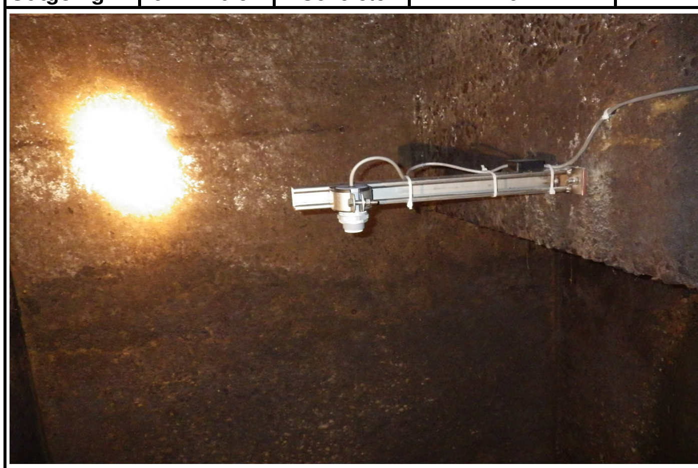
METER SITE INFORMATION FIELD LOG

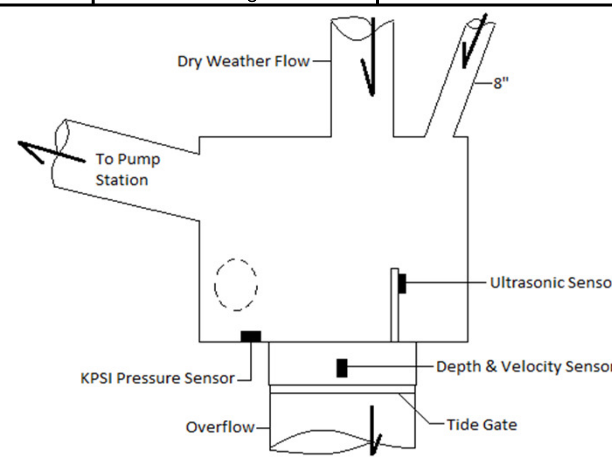
Hazen Note: Deer Street CSO #13

PROJECT: Portsmouth, NH	**DATE:** February 1, 2013	**TIME:**
LOCATION: Deer Street CSO	**MH#:**	**METER SITE:** Deer Street CSO
COMMENTS:		

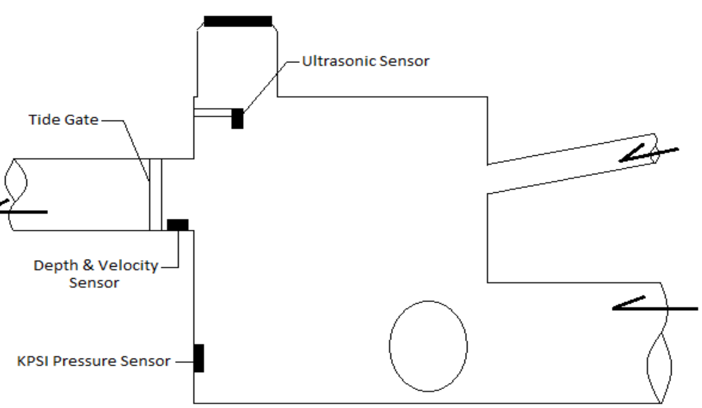


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming						
Incoming						
Incoming						
Outgoing	61W x 9.5H	Concrete	0	0	Rectangular	





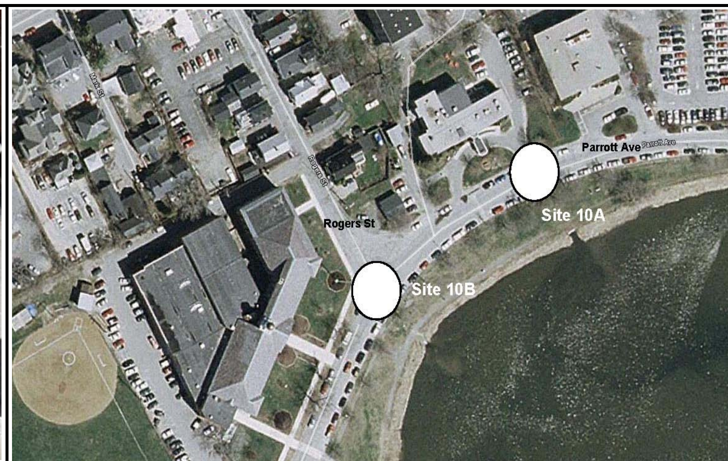
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:** 85.5"
SURCHARGE CURRENTLY TO:	**LEVEL:**	



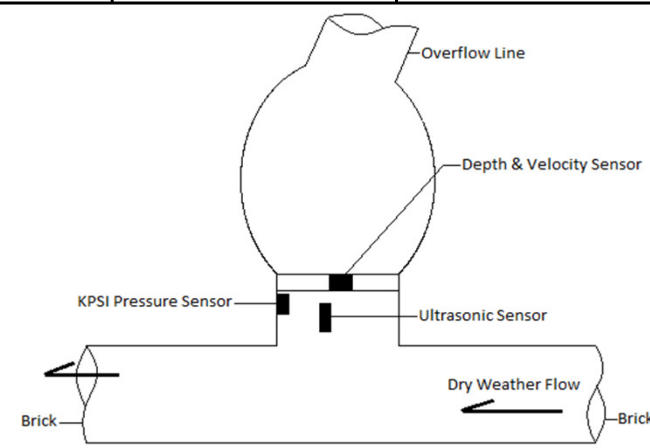
FLOW Assessment SERVICES L.L.C.

METER SITE INFORMATION FIELD LOG

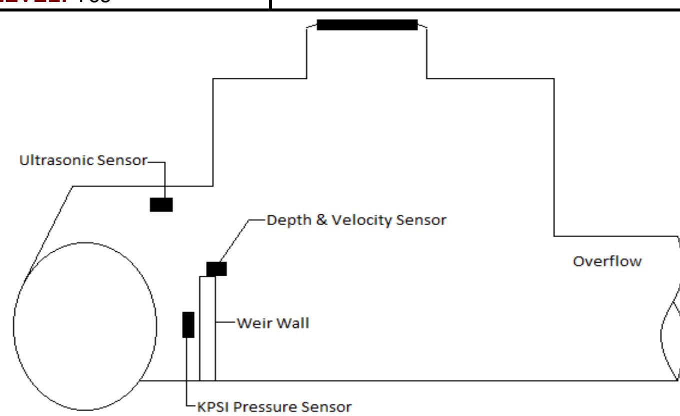
PROJECT: Portsmouth, NH	**DATE:** January 25, 2013	**TIME:**
LOCATION: 127 Parrot Avenue	**MH#:**	**METER SITE:** 10A
COMMENTS:		



	Size ('')	Material	Flow Depth ('')	Debris	Shape	MH Depth
Incoming						
Incoming						
Incoming						
Outgoing						



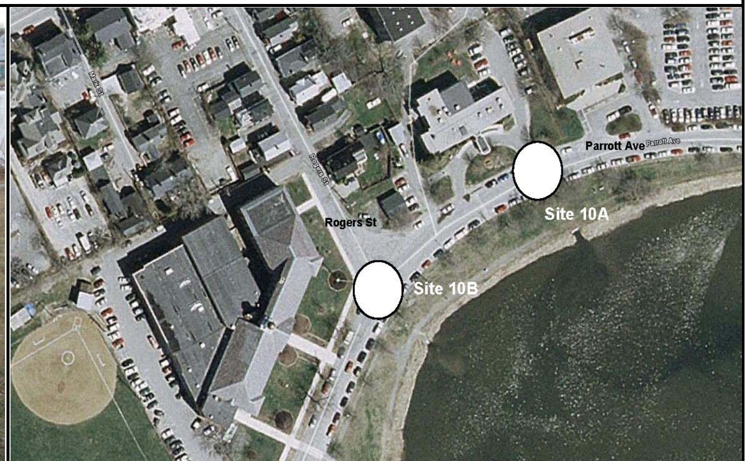
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:** 34.5"	**HEIGHT ABOVE WEIR:** 38"
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:** 13.1"
SURCHARGE CURRENTLY TO:	**LEVEL:** Yes	



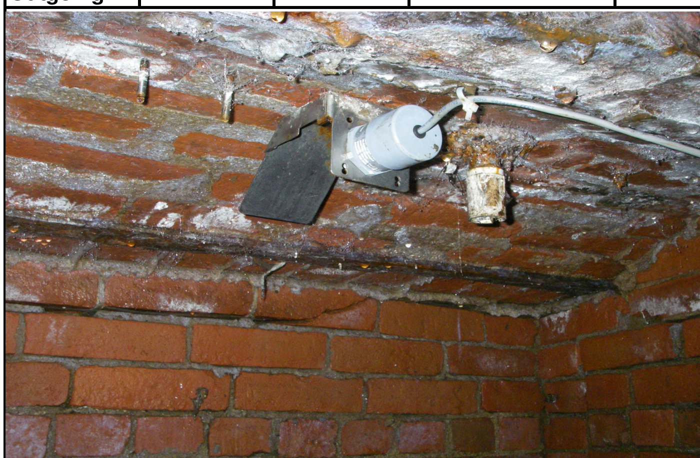
FLOW Assessment SERVICES L.L.C.

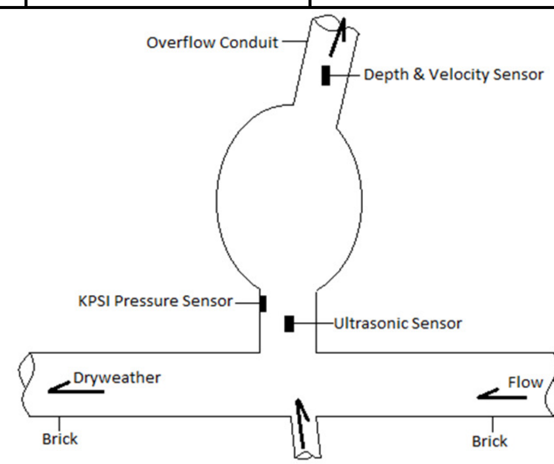
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** January 24, 2013	**TIME:**
LOCATION: Parrot Avenue at Rogers Street	**MH#:**	**METER SITE:** 10B
COMMENTS:		

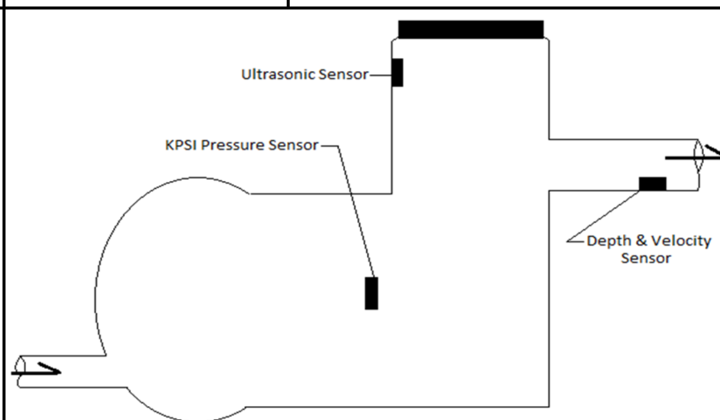


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming						
Incoming						
Overflow	24H x 36W	PIP Concrete	0	0	Rectangular	
Outgoing						





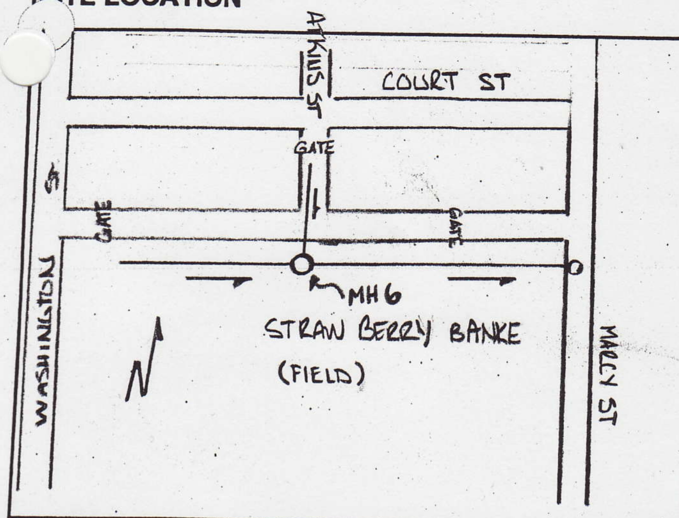
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:** 57.75"
SURCHARGE CURRENTLY TO:	**LEVEL:**	



SERVICES L.L.C.

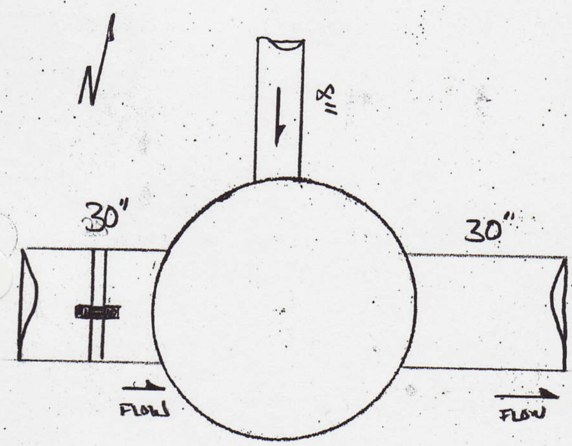
METER SITE INFORMATION FIELD LOG

SITE LOCATION



PROJECT:	PORTSMOUTH NH
LOCATION:	STRAW BERRY BANKE
MH #:	PORTSMOUTH NH 6
MAP #:	
DATE:	037808
TIME:	1050
COMMENTS:	IMMAGE # 0260 – VFT 0261 – VFT 0262 – VIEW FACING NORTH

PLAN VIEW



LINE DESCRIPTIONS

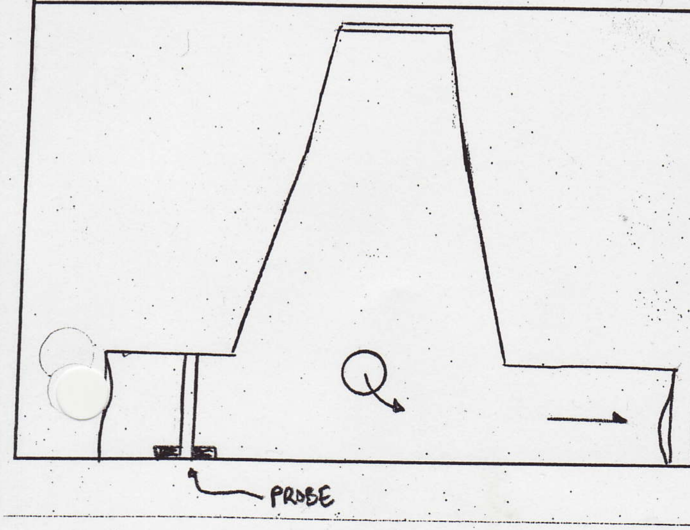
	INCOMING	INCOMING	INCOMING	OUTGOING	
SIZE	30"	8"		30"	
MATERIAL	RCP	PVC		RCP	
FLOW DEPTH	28"	.75		28"	
DEBRIS	Ø	Ø		Ø	
SHAPE	CIRC	CIRC		CIRC	
MH DEPTH	9'5"	8'5"		9'6"	

SURCHARGED MARKS TO: TO FRAME

SURCHARGED TO: —

NONE EVIDENT: —

PROFILE VIEW



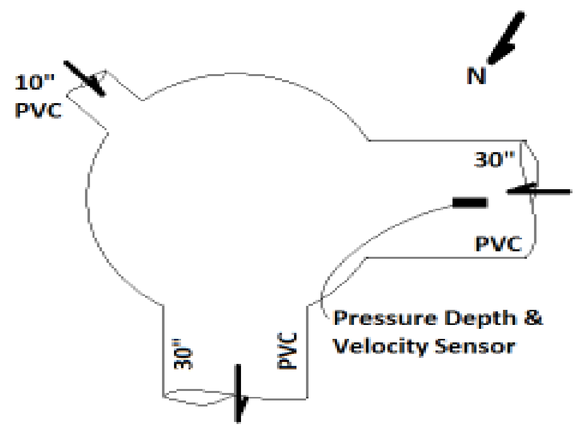
WEIR	N/A
LENGTH	N/A
BREADTH	N/A
LEVEL YES/NO	N/A
HEIGHT ABOVE WEIR	N/A
OVERFLOW OCCURS @	N/A

APPENDIX B – Temporary Flow Monitoring Sites Sheets for Monitoring

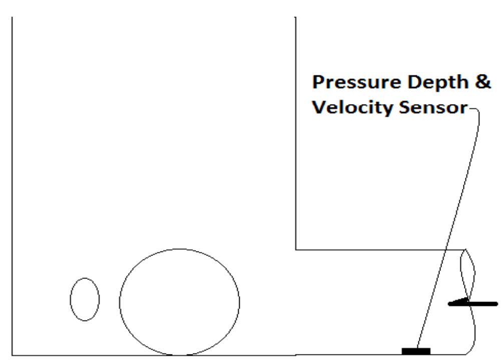
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** April 9, 2015	**JOB#:** 15036
LOCATION: Lincoln Avenue at Shelburne Avenue	**MH#:**	**METER SITE:** 5
GPS/COMMENTS: 43.069386, -70.757479		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30	PVC	13.8	0.75	Circular	11'1"
Incoming	10	PVC	1.5	0	Circular	9' 10"
Incoming						
Outgoing	30	PVC	14	0	Circular	11' 4"



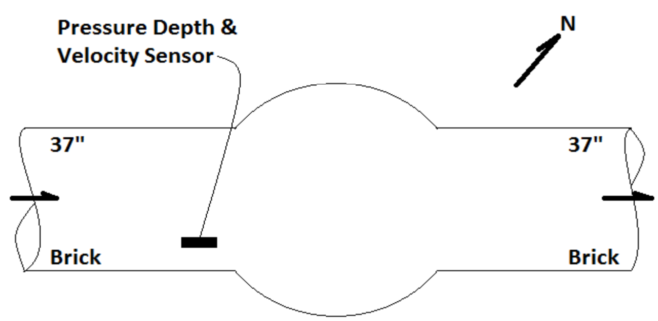
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	



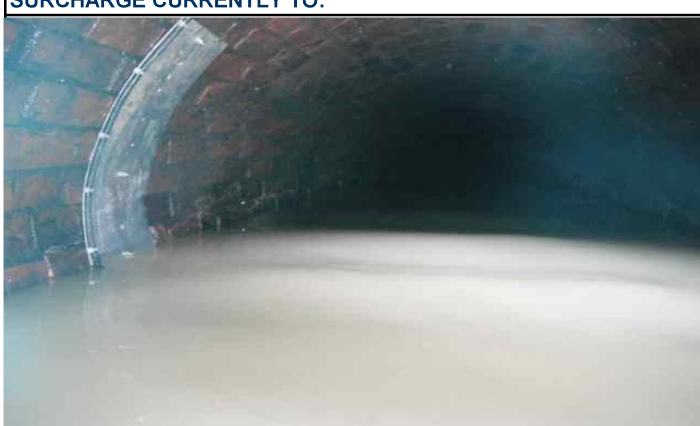
METER SITE INFORMATION FIELD LOG

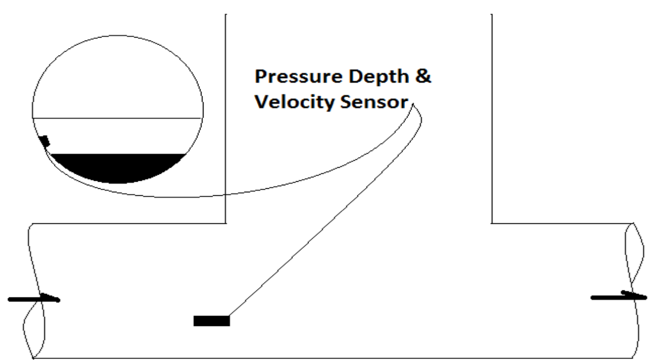
PROJECT: Portsmouth, NH	**DATE:** March 17, 2015	**JOB#:** 15021
LOCATION: Bartlett Street R.O.W.	**MH#:** 2247	**METER SITE:** 11
GPS/COMMENTS: 43.071824, -70.771102		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	37	Brick	15	6.75	Circular	8' 1"
Incoming						
Incoming						
Outgoing	37	Brick	15	6.75	Circular	8' 1"



SURCHARGE INFORMATION	**WEIR INFORMATION**	
SURCHARGE NONE EVIDENT:	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO: 7'	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	

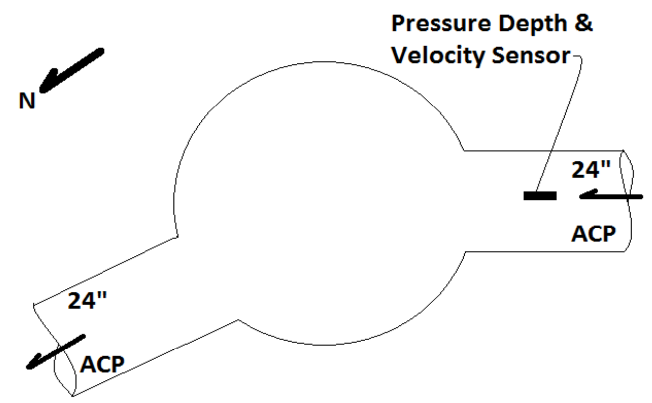




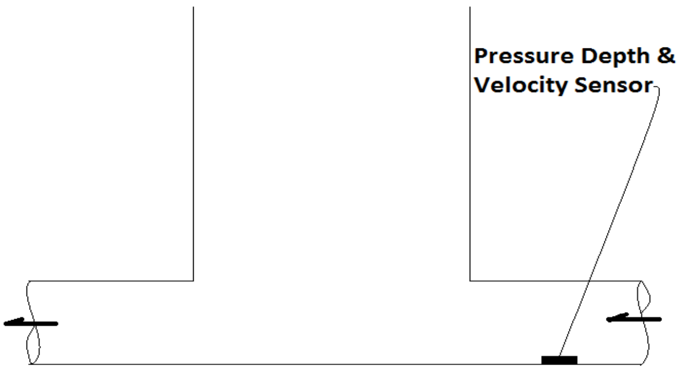
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** April 9, 2015	**JOB#:** 15036
LOCATION: Maplewood Avenue, North of Deer Street	**MH#:**	**METER SITE:** 12
GPS/COMMENTS: 43.078178, -70.762081		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	ACP	9.5	1.5	Circular	14' 2"
Incoming						
Incoming						
Outgoing	24	ACP	9.5	1	Circular	14' 2"



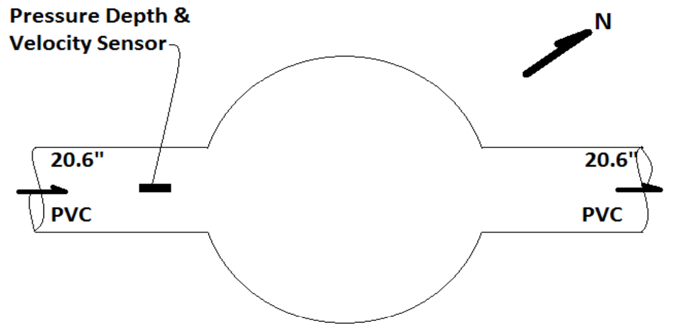
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO: 8'	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	



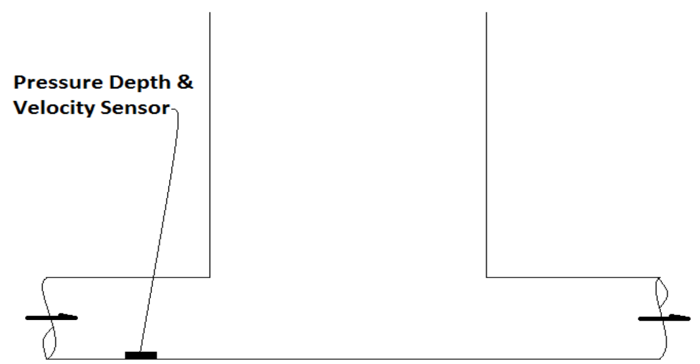
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** April 9, 2015	**JOB#:** 15036
LOCATION: Franklin Drive Near Woodbury Avenue	**MH#:**	**METER SITE:** 13
GPS/COMMENTS: 43.075683, -70.778137		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	20.6	PVC	5.2	0	Circular	13' 8"
Incoming						
Incoming						
Outgoing	20.6	PVC	5.2	0	Circular	13' 11"



SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	

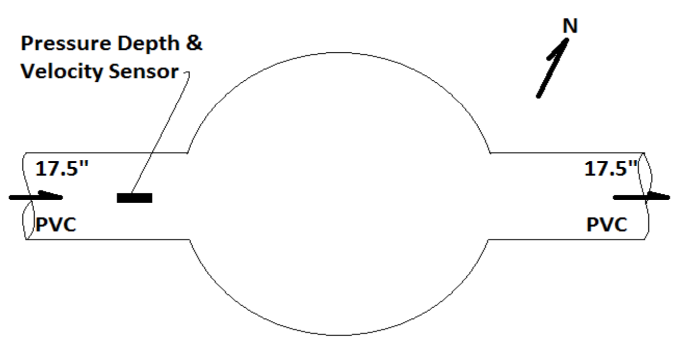


FLOW ASSESSMENT SERVICES

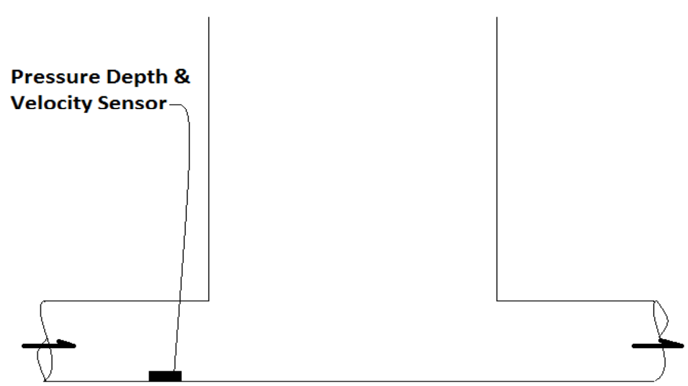
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** March 17, 2015	**JOB#:** 15021
LOCATION: Barberry Lane R.O.W.	**MH#:** 5856	**METER SITE:** 14
GPS/COMMENTS: 43.067068, -70.780258		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	17.5	PVC	10.7	0	Circular	12' 9"
Incoming						
Incoming						
Outgoing	17.5	PVC	10.7	0	Circular	12' 9"



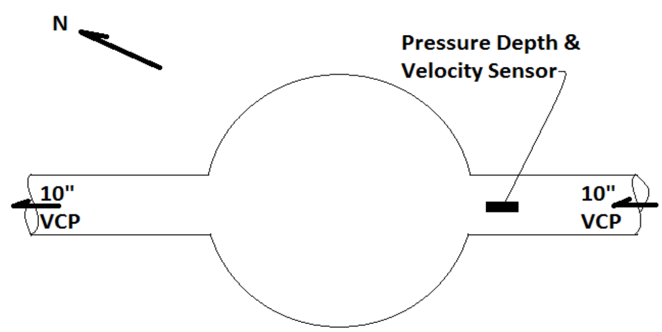
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO: 4'	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	



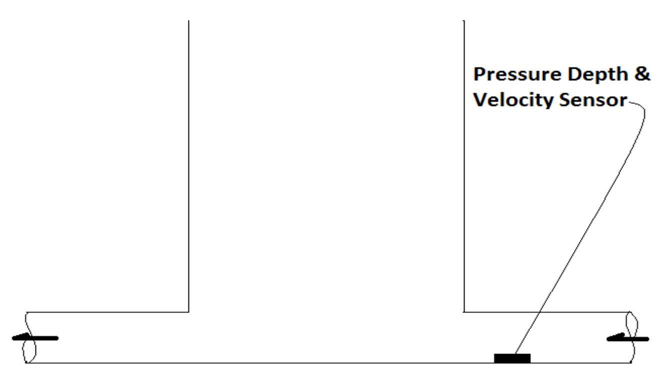
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** March 17, 2015	**JOB#:** 15021
LOCATION: Route 1 Bypass	**MH#:** 1384	**METER SITE:** 15
GPS/COMMENTS: 43.064873, -70.775838		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	10	VCP	2.9	0	Circular	12' 1"
Incoming						
Incoming						
Outgoing	10	VCP	2.9	0	Circular	12' 1"



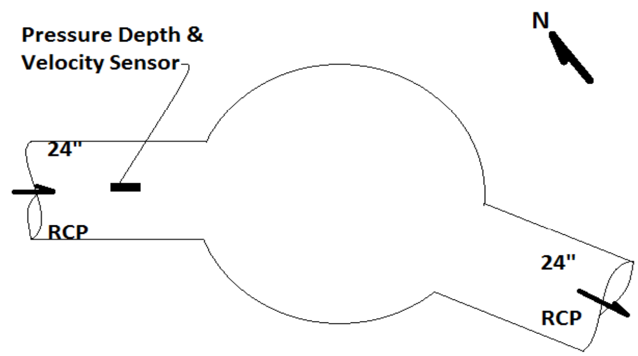
SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	



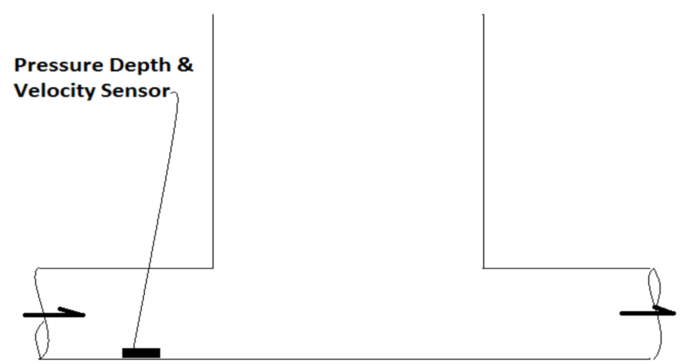
METER SITE INFORMATION FIELD LOG

PROJECT: Portsmouth, NH	**DATE:** April 9, 2015	**JOB#:** 15036
LOCATION: Pierce Island Road at Mechanic Street	**MH#:**	**METER SITE:** 16
GPS/COMMENTS: 43.075625, -70.750603		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	RCP	10.5	0	Circular	13' 10"
Incoming						
Incoming						
Outgoing	24	RCP	10.5	0	Circular	14' 1"

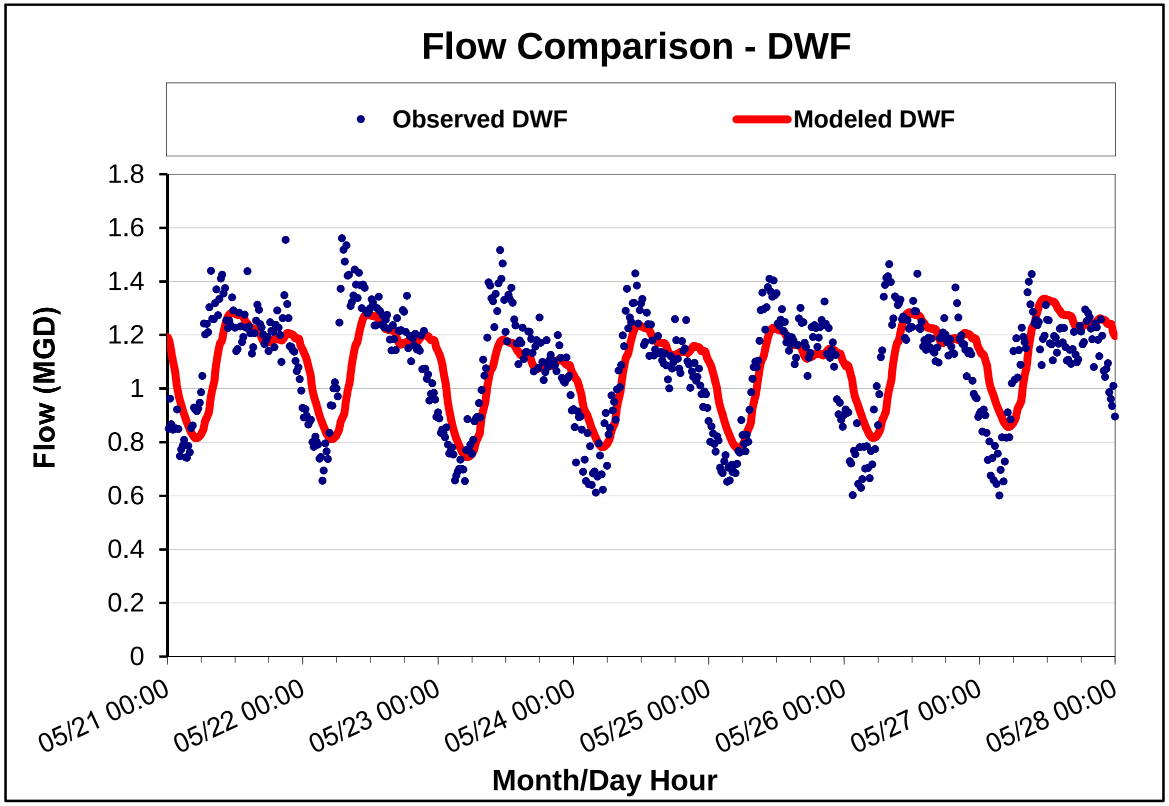


SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO:	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	

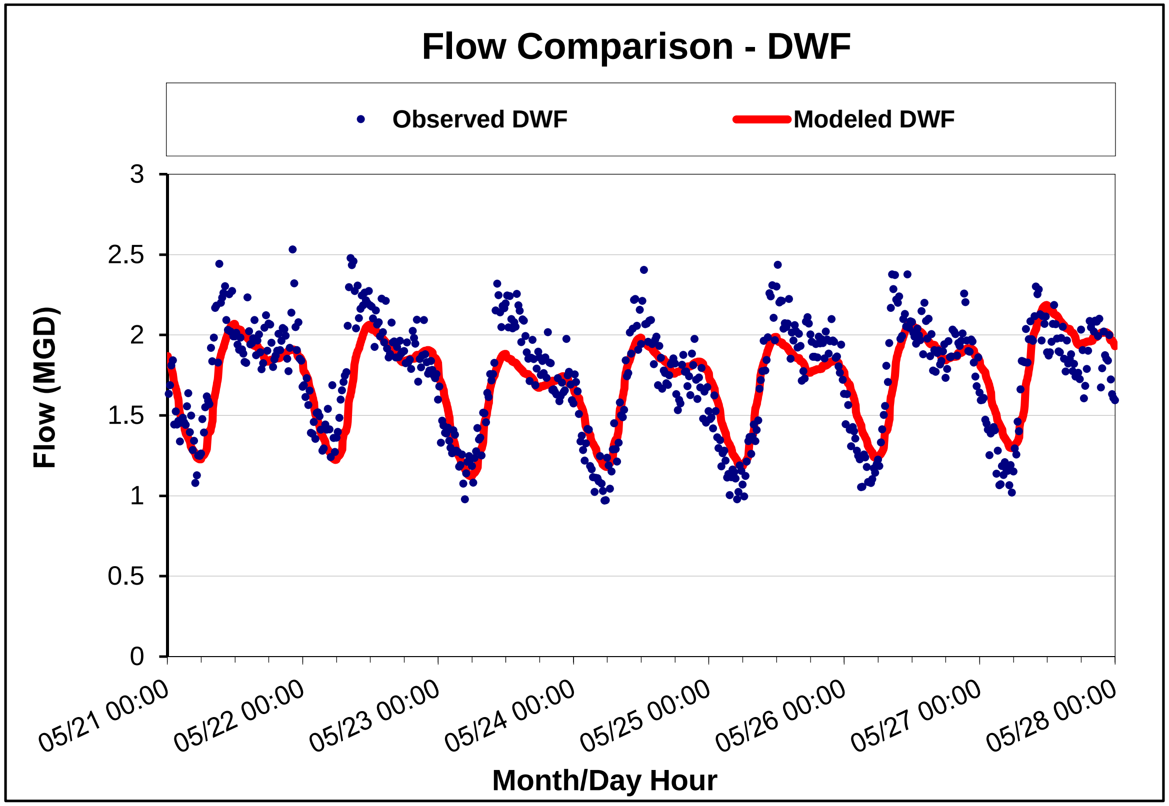


APPENDIX C – Dry Weather Model Calibration Comparison Plots

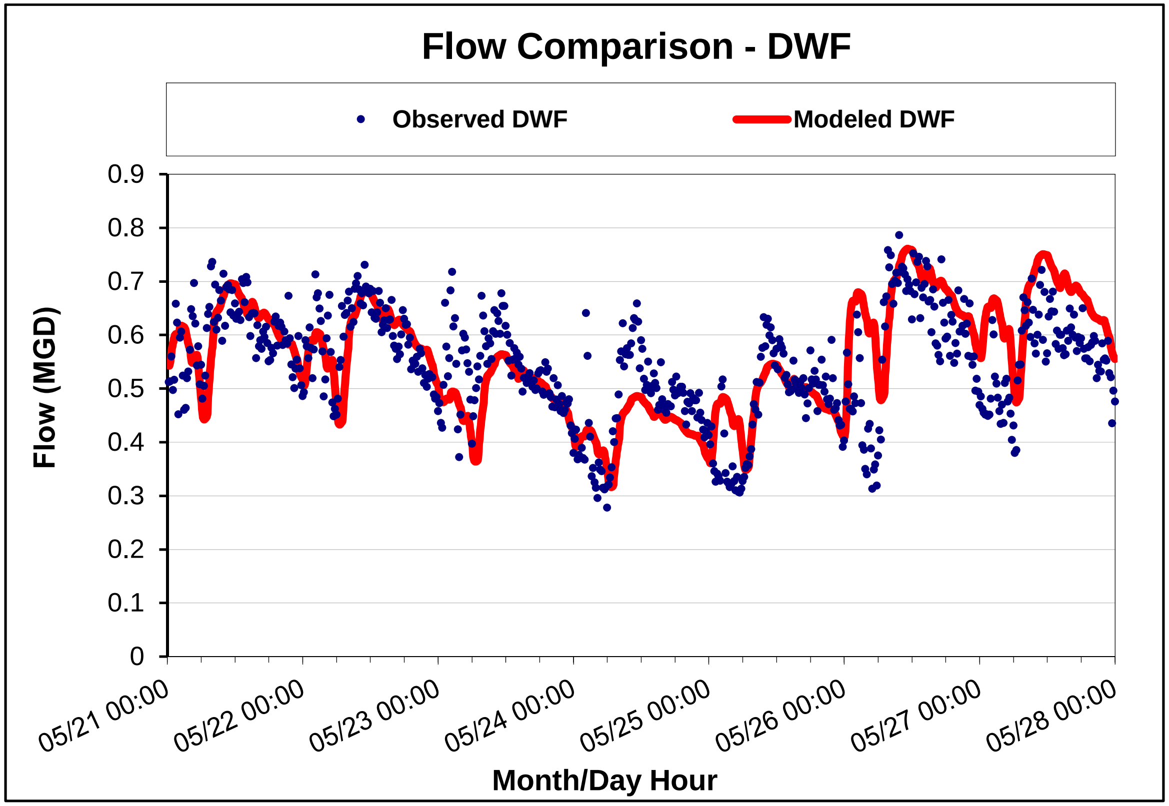
DWF Calibration Plots – Meter #5



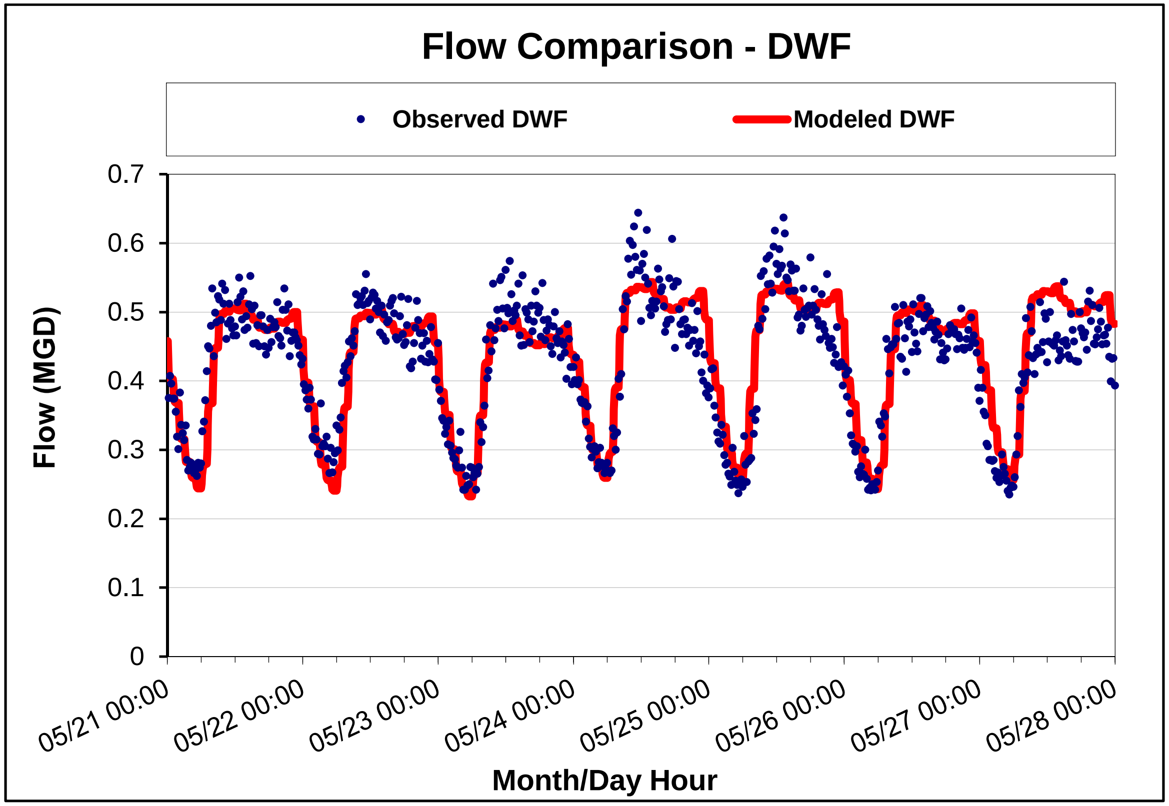
DWF Calibration Plots – Meter #6



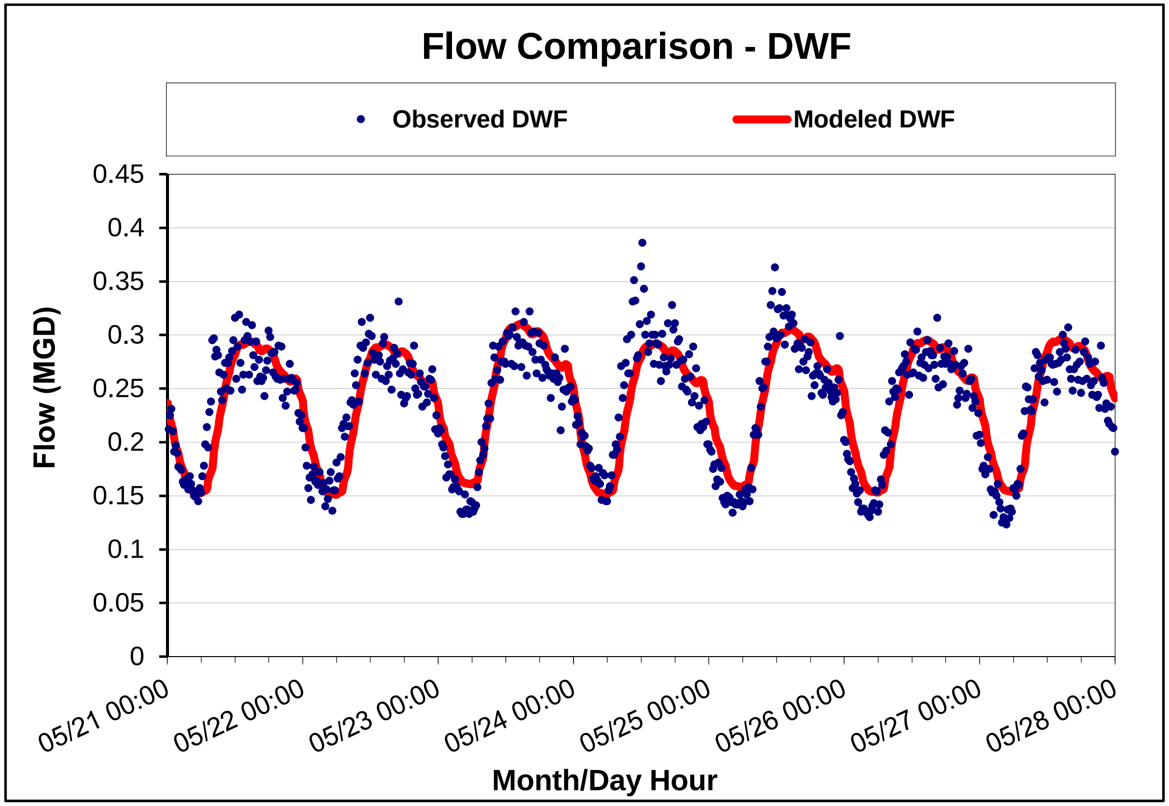
DWF Calibration Plots – Meter #11



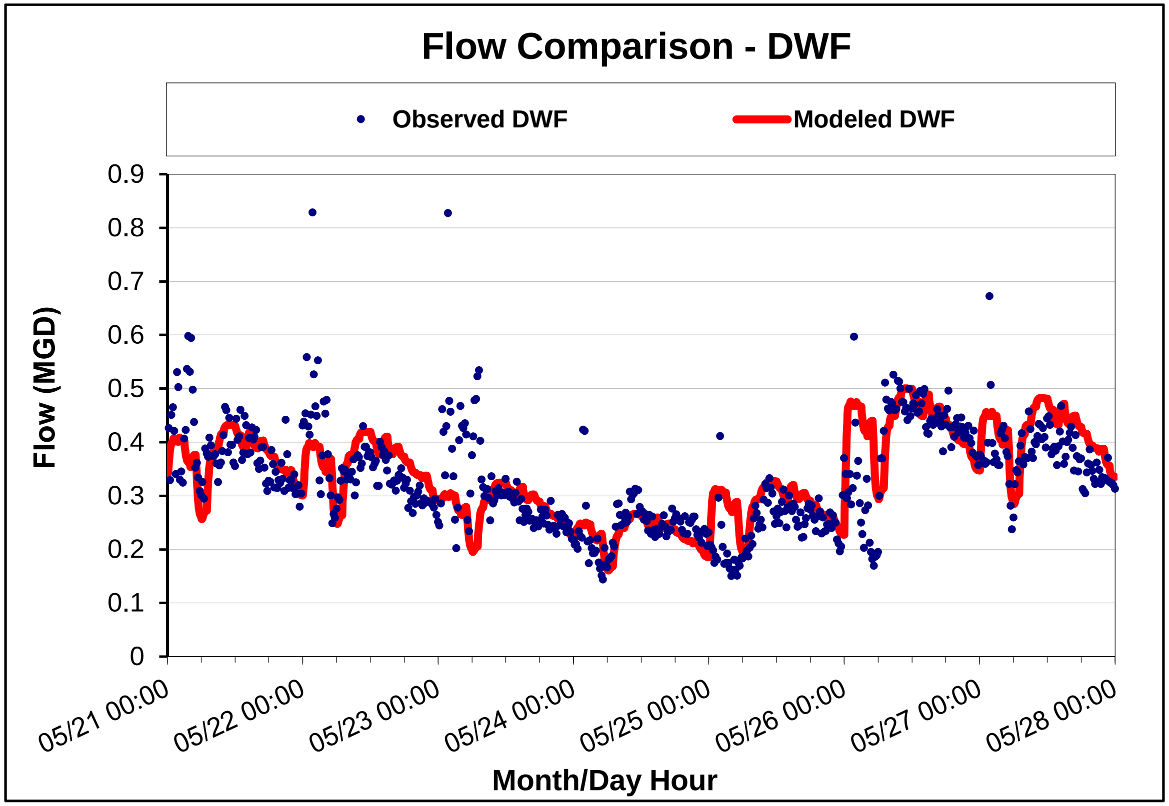
DWF Calibration Plots – Meter #12



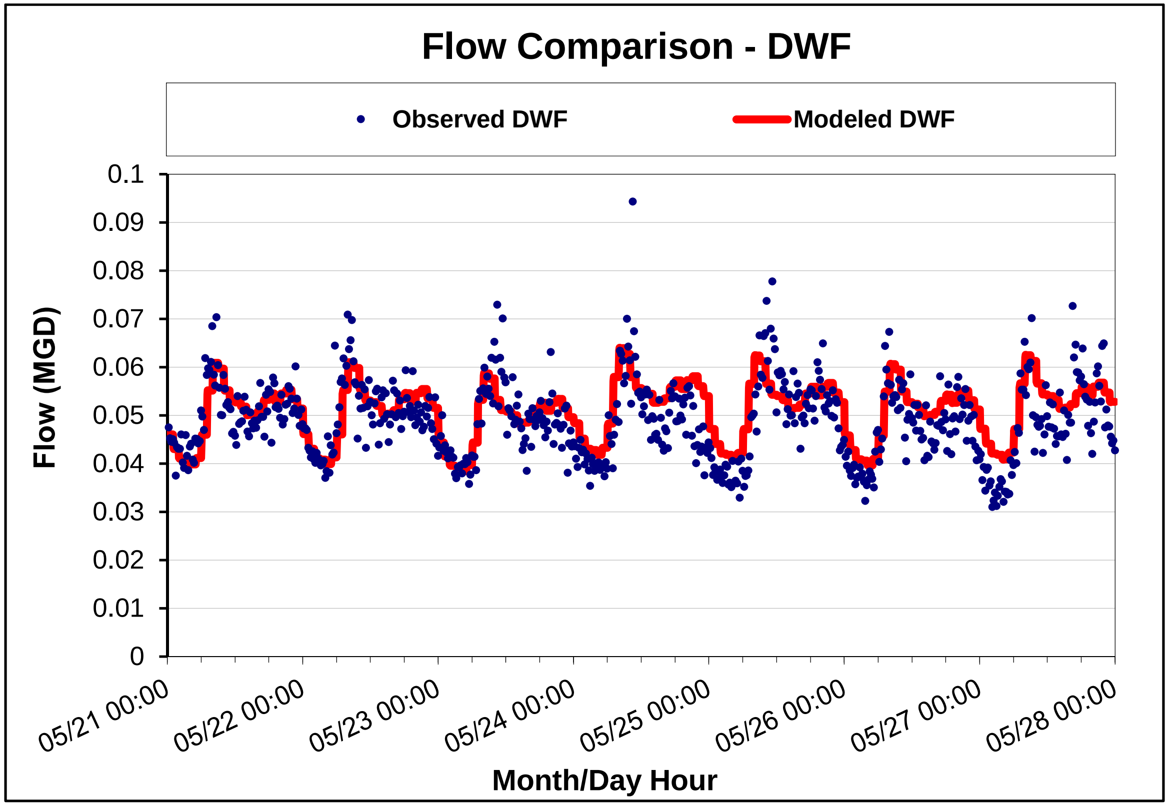
DWF Calibration Plots – Meter #13



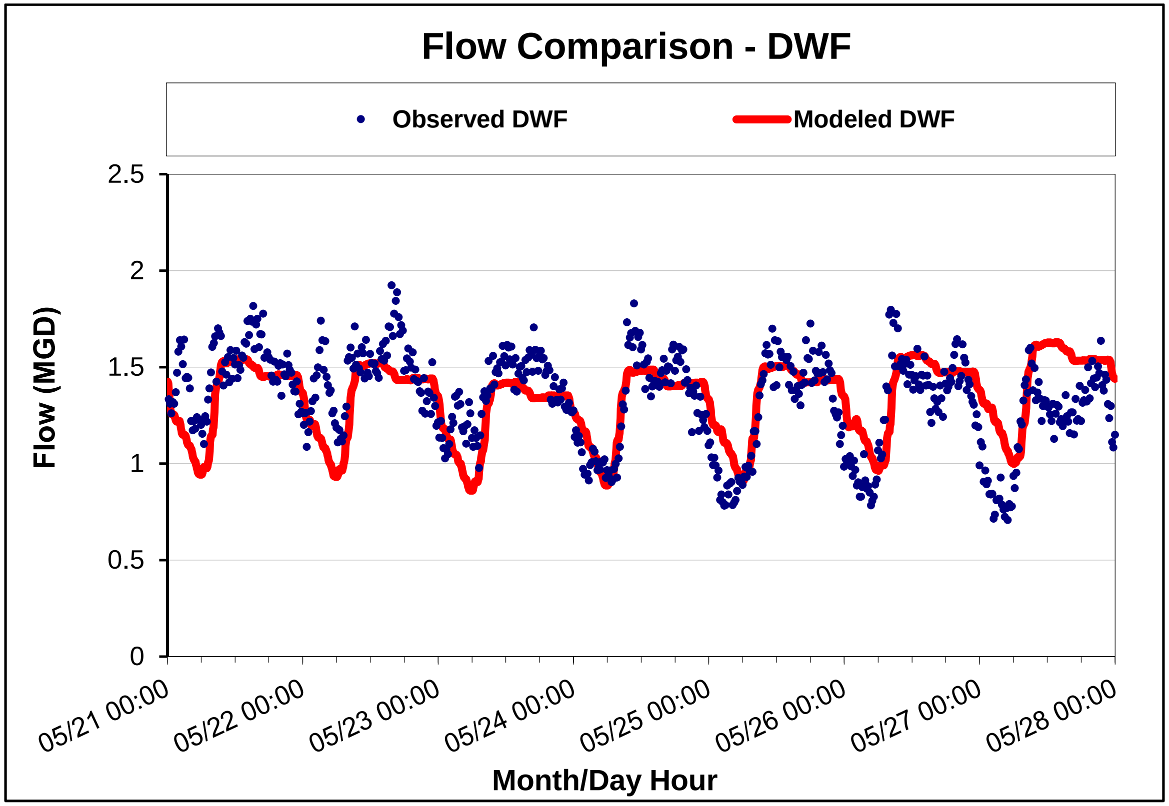
DWF Calibration Plots – Meter #14



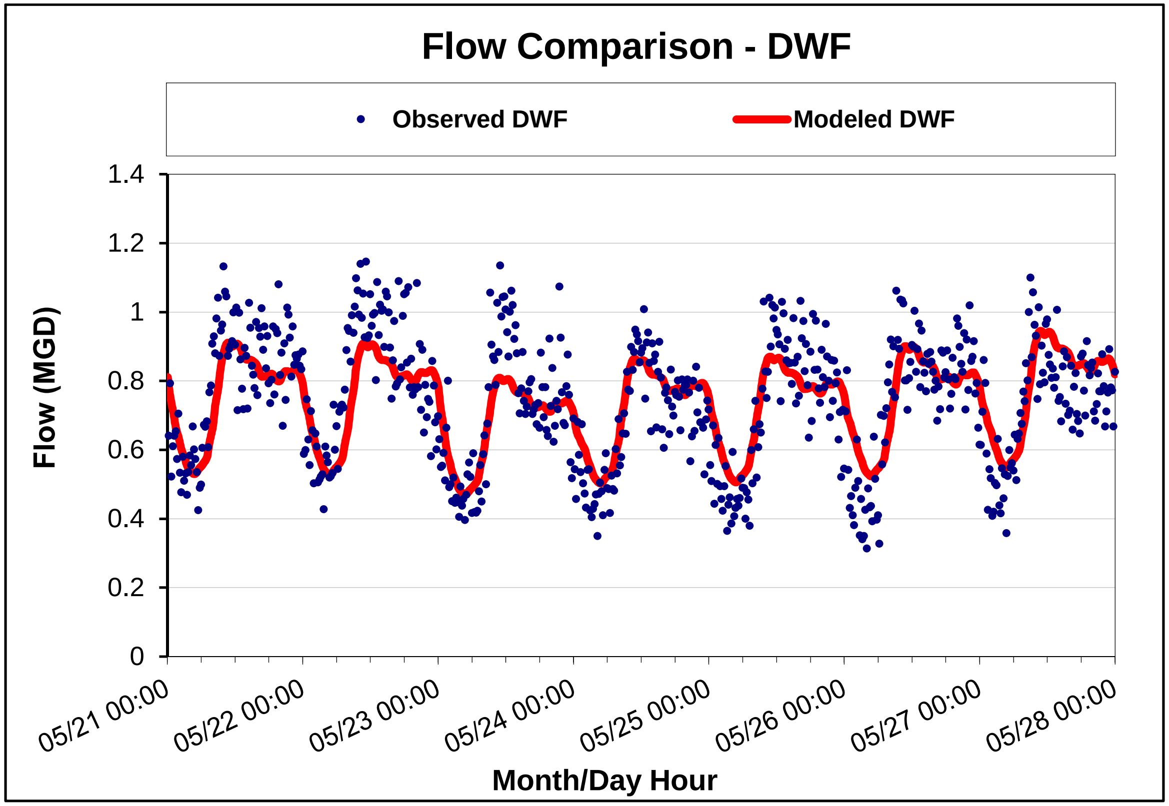
DWF Calibration Plots – Meter #15



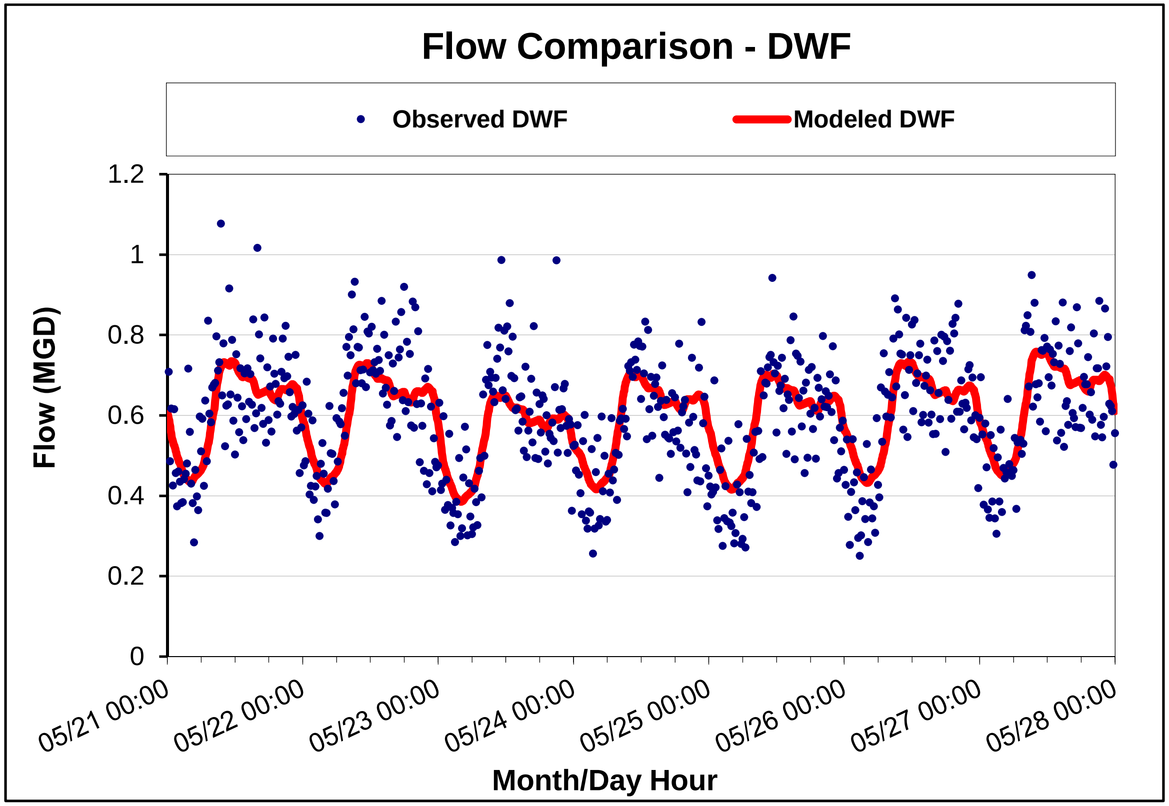
DWF Calibration Plots – Meter #16



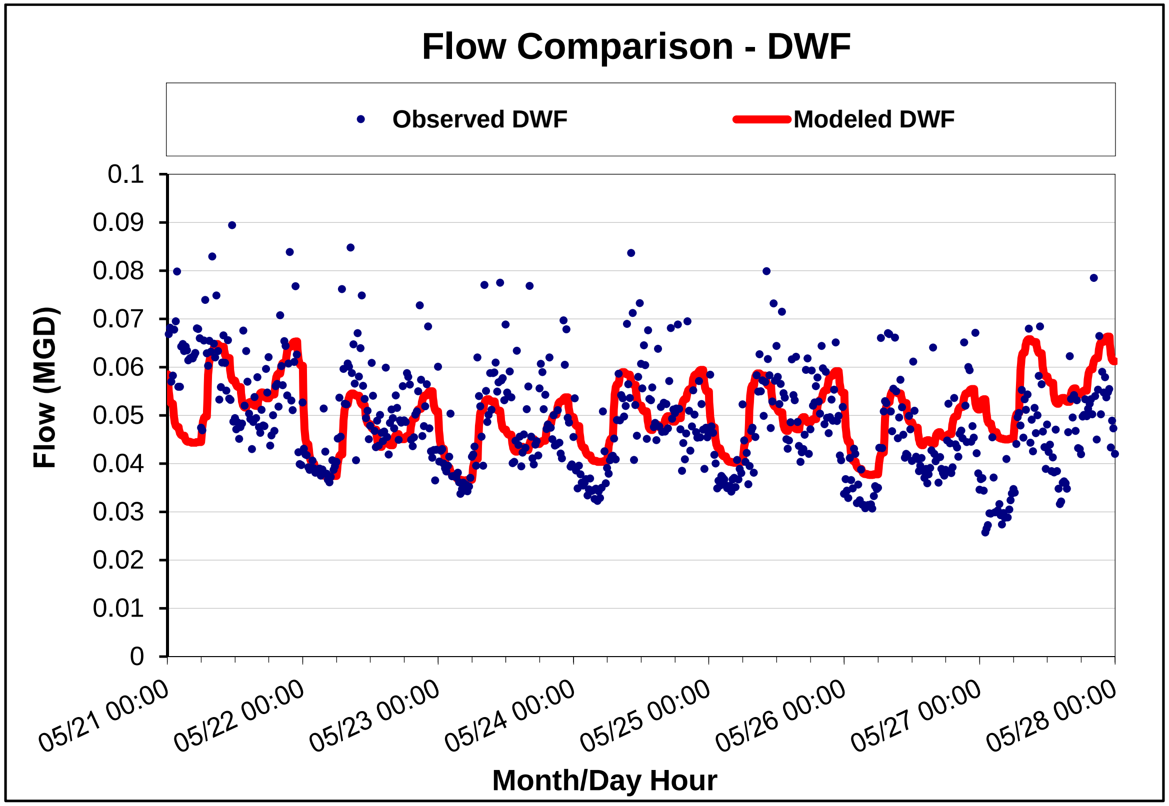
DWF Calibration Plots – Meter LR1



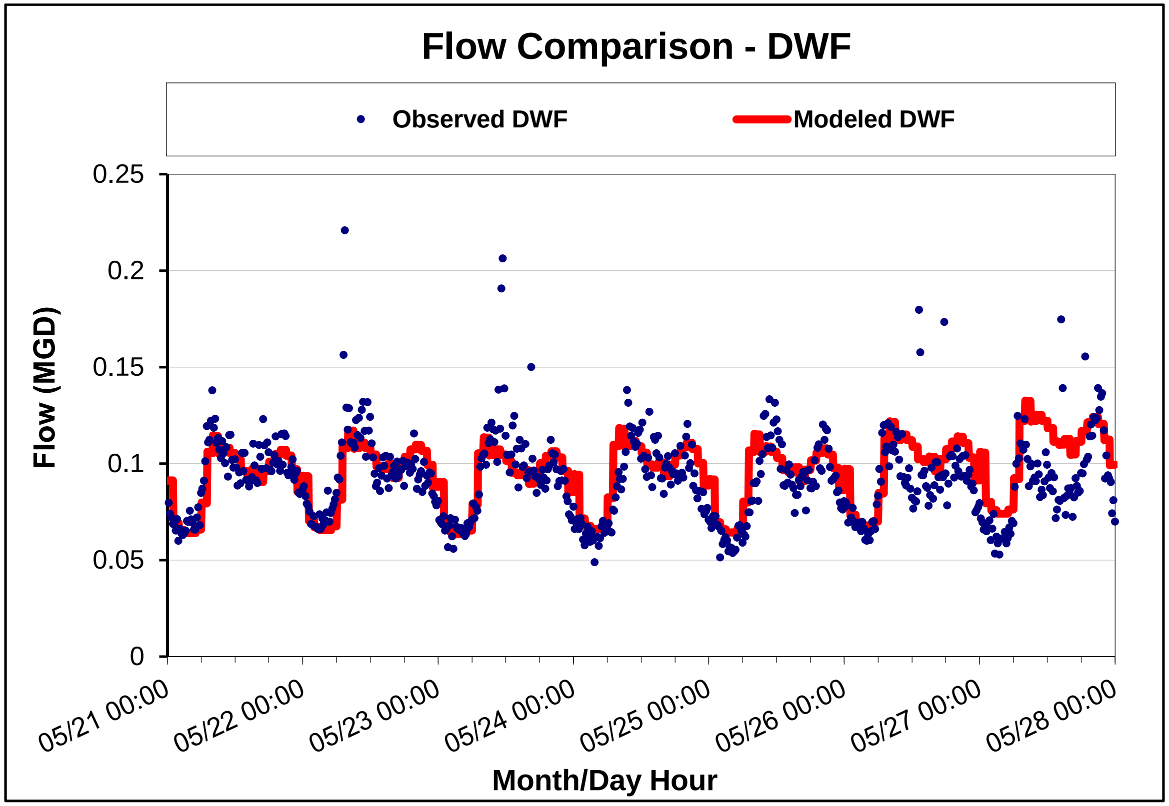
DWF Calibration Plots – Meter LR2



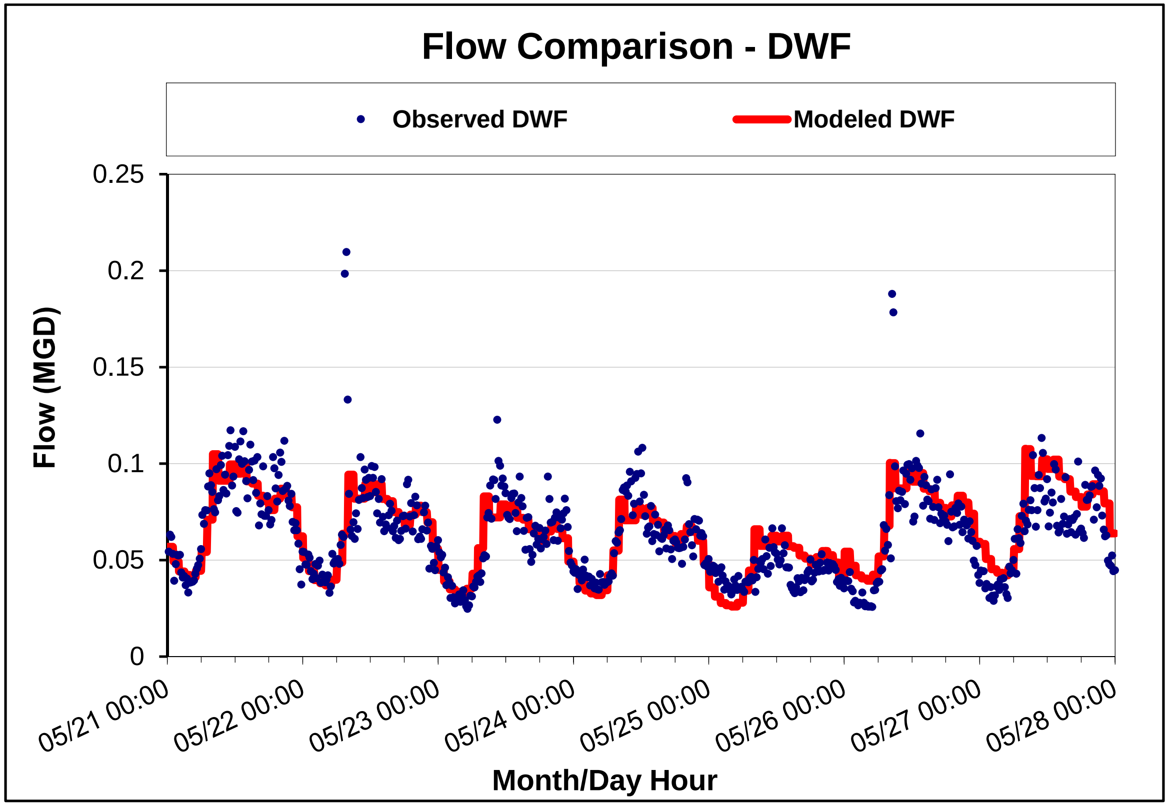
DWF Calibration Plots – Meter LR3



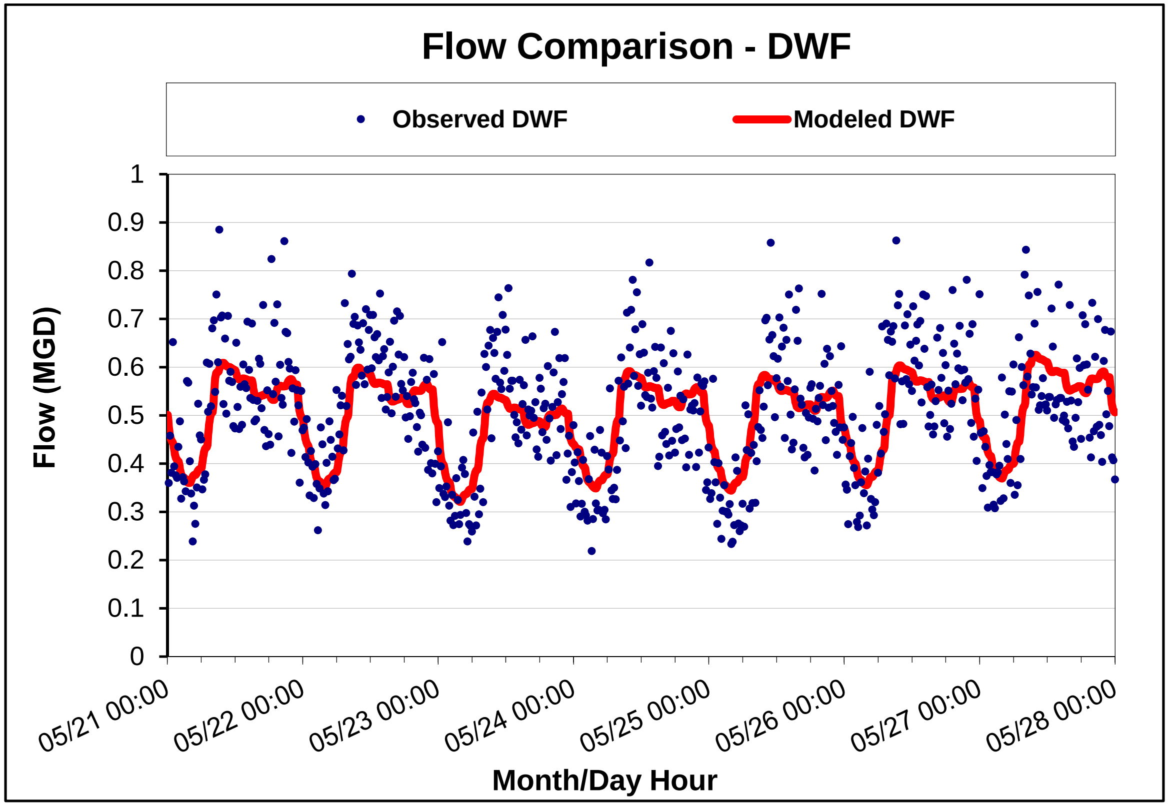
DWF Calibration Plots – Meter LR4



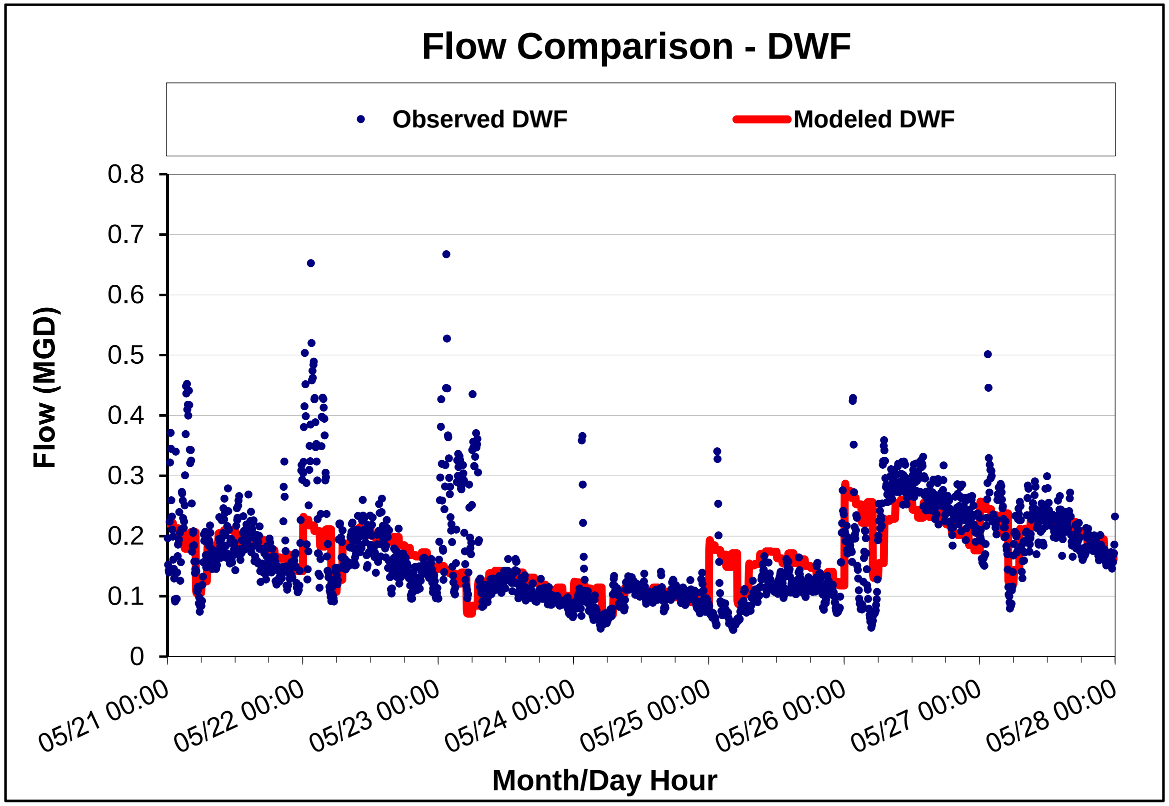
DWF Calibration Plots – Meter LR5



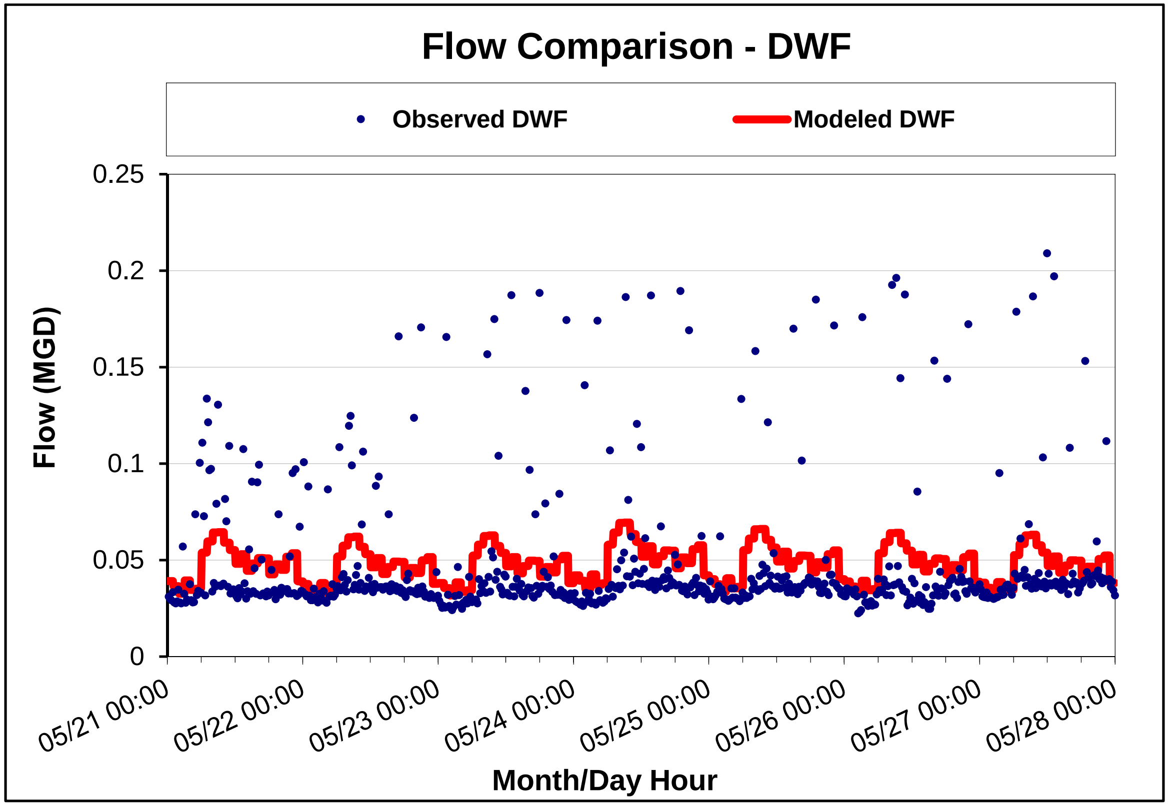
DWF Calibration Plots – Meter LR6



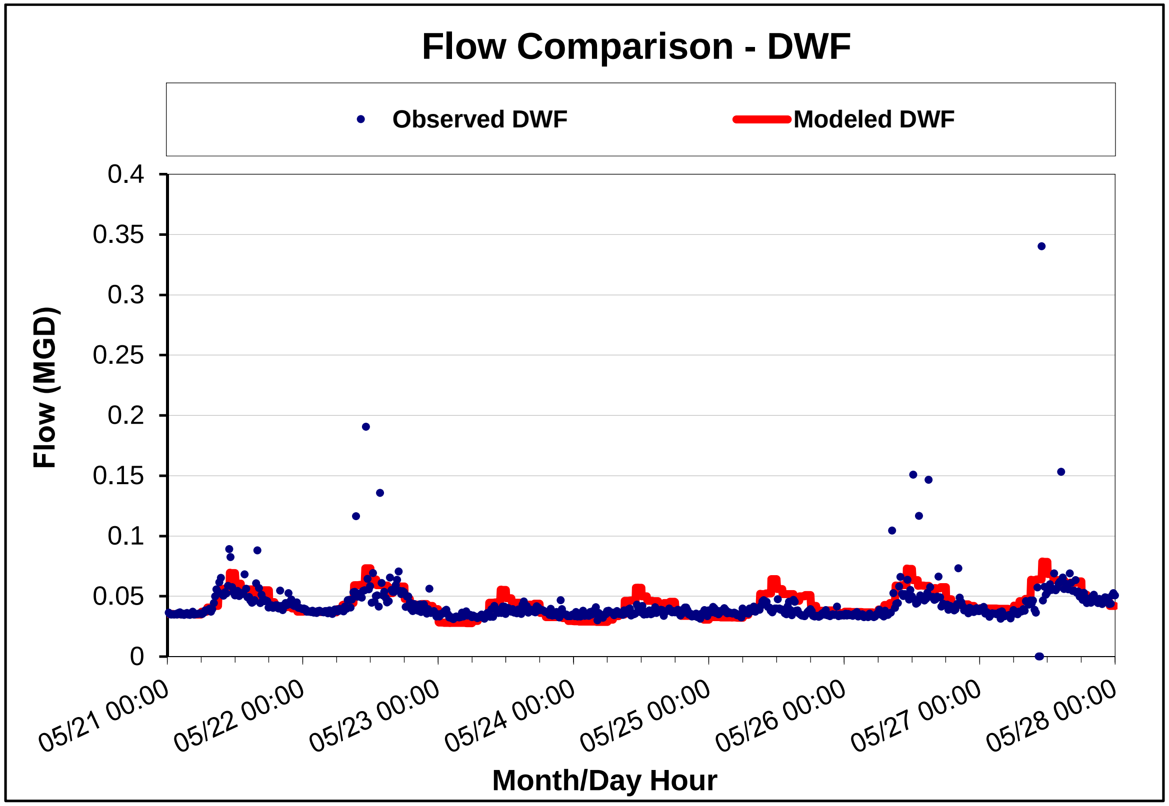
DWF Calibration Plots – Meter B1



DWF Calibration Plots – Meter M1

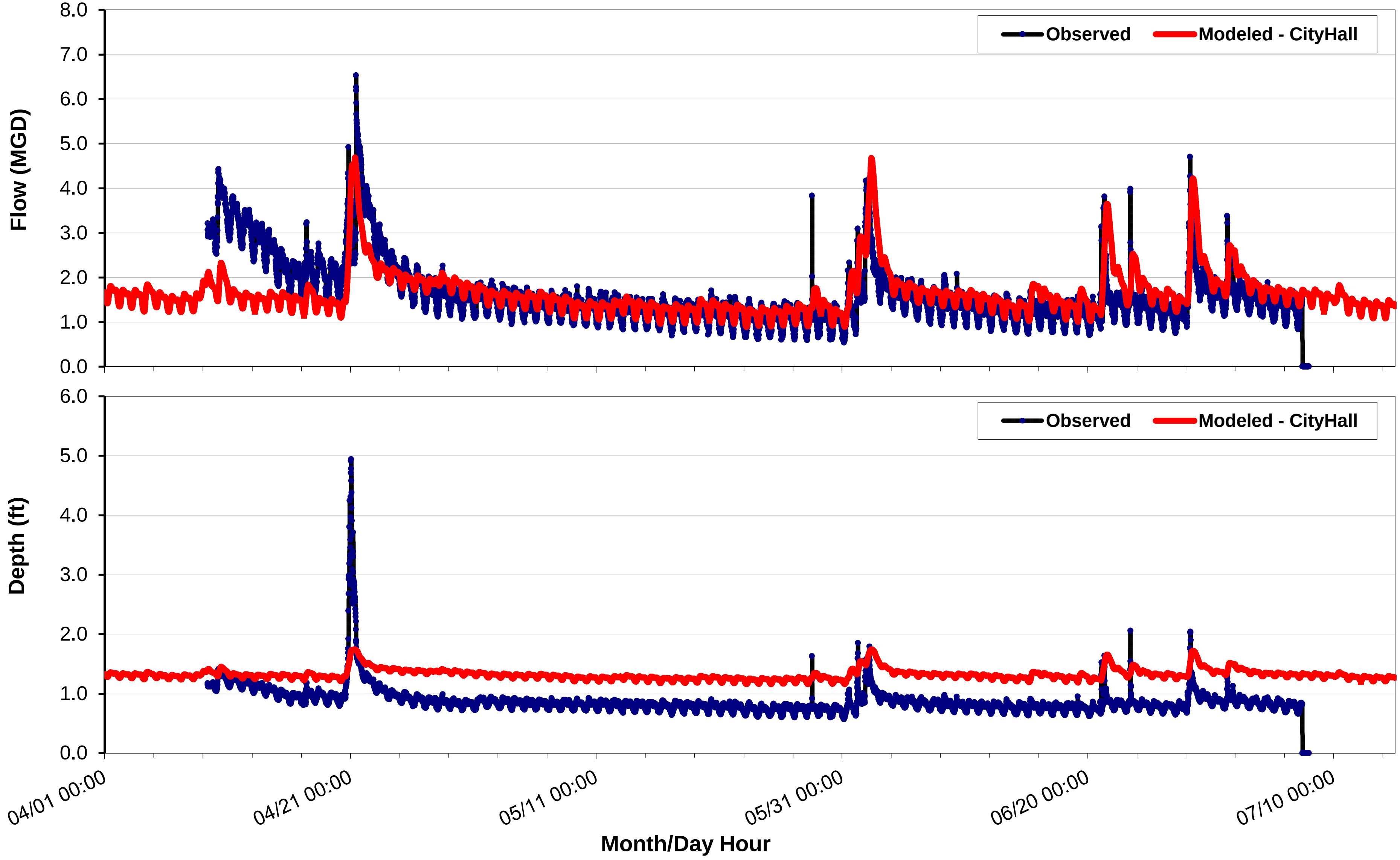


DWF Calibration Plots – Meter P3

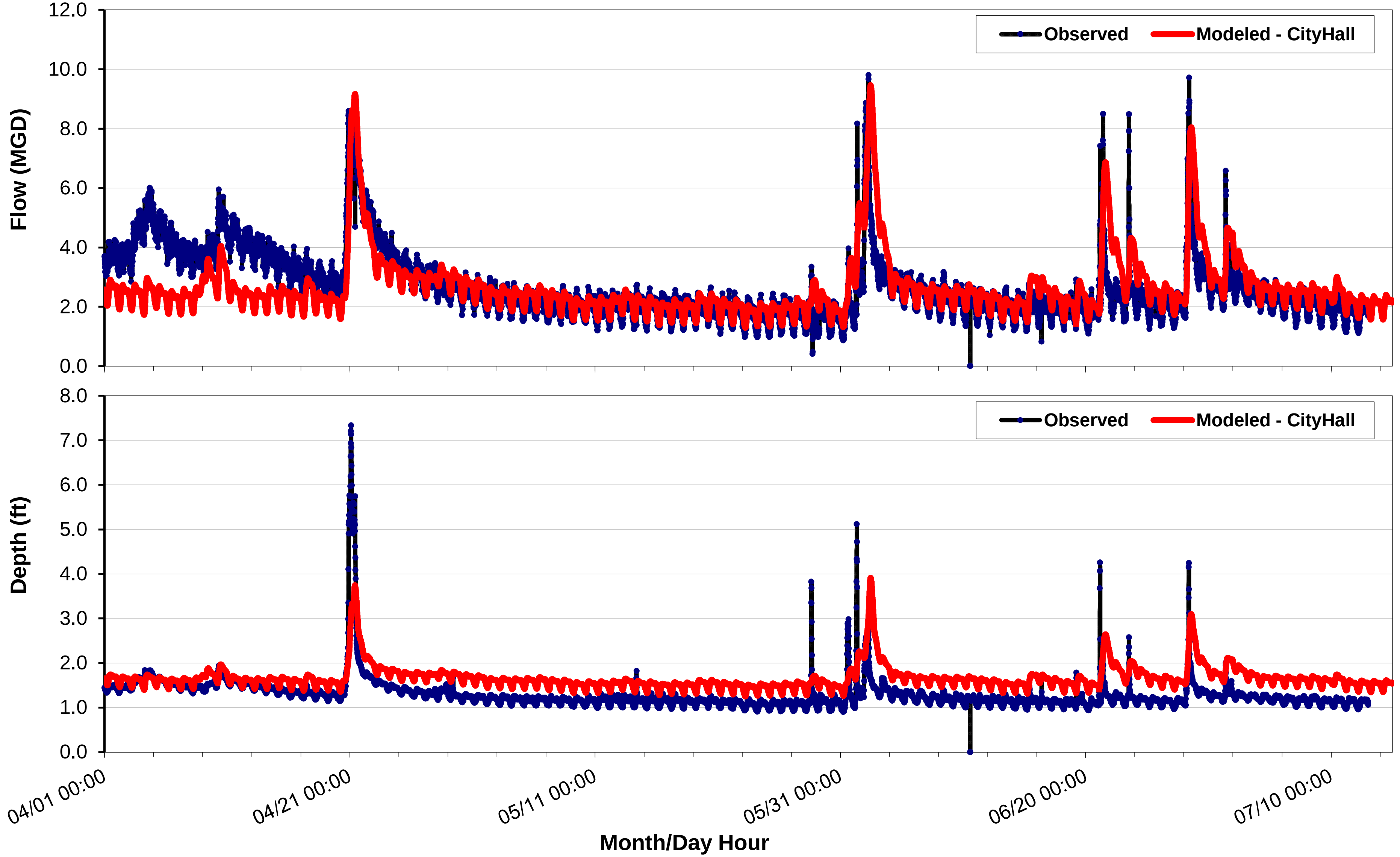


APPENDIX D – Wet Weather Model Calibration Comparison Plots

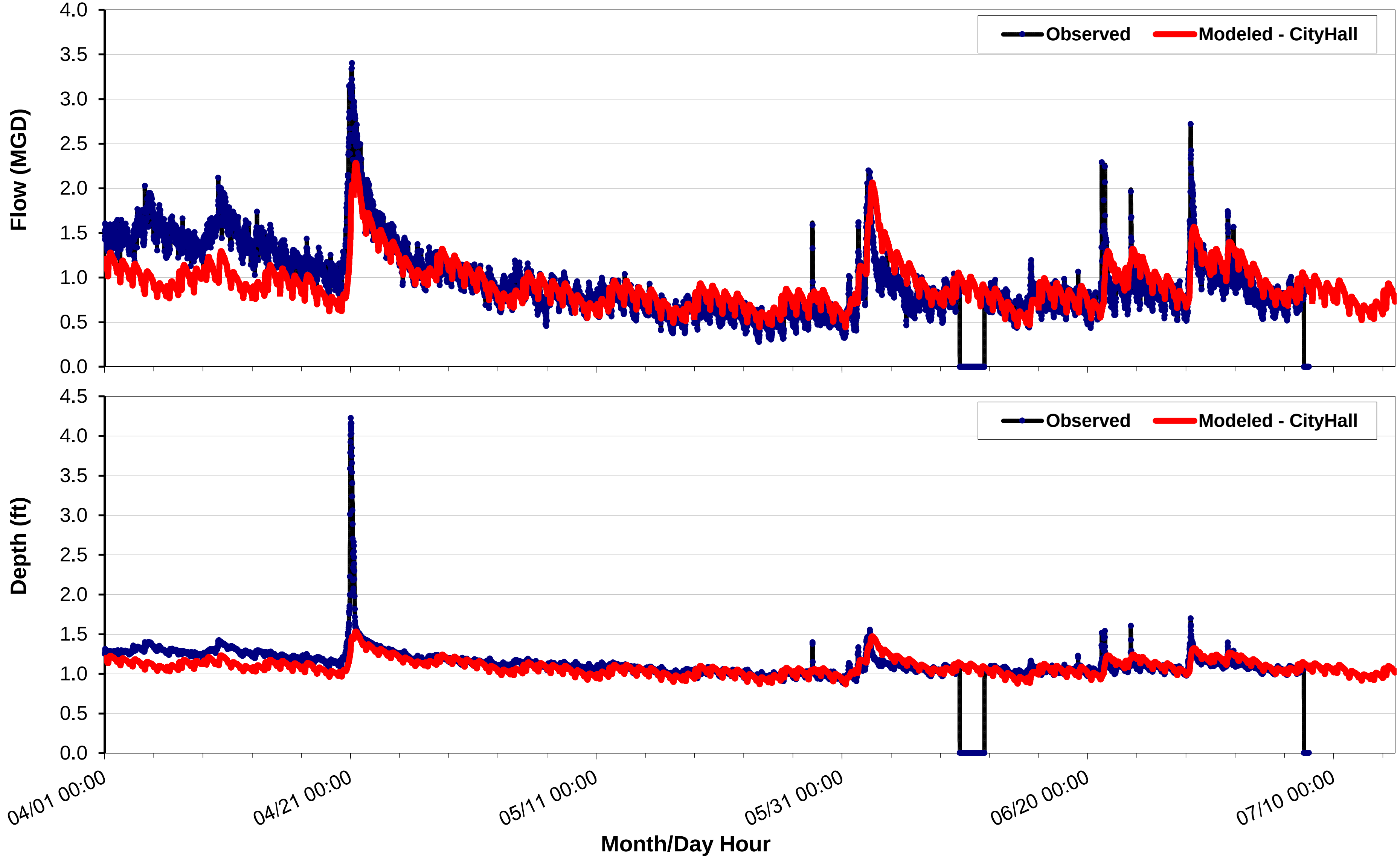
WWF Calibration Plots – Meter #5



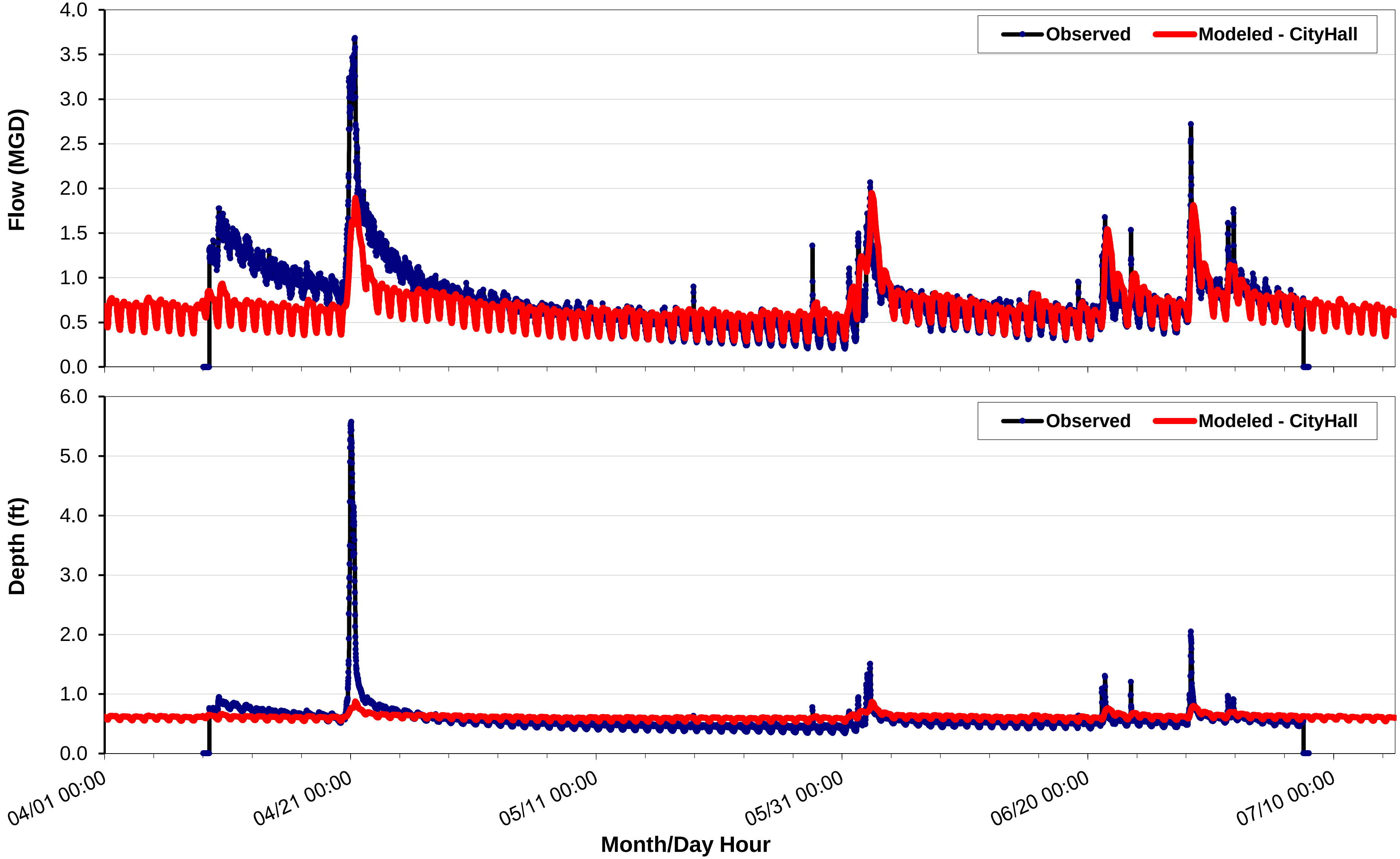
WWF Calibration Plots – Meter #6



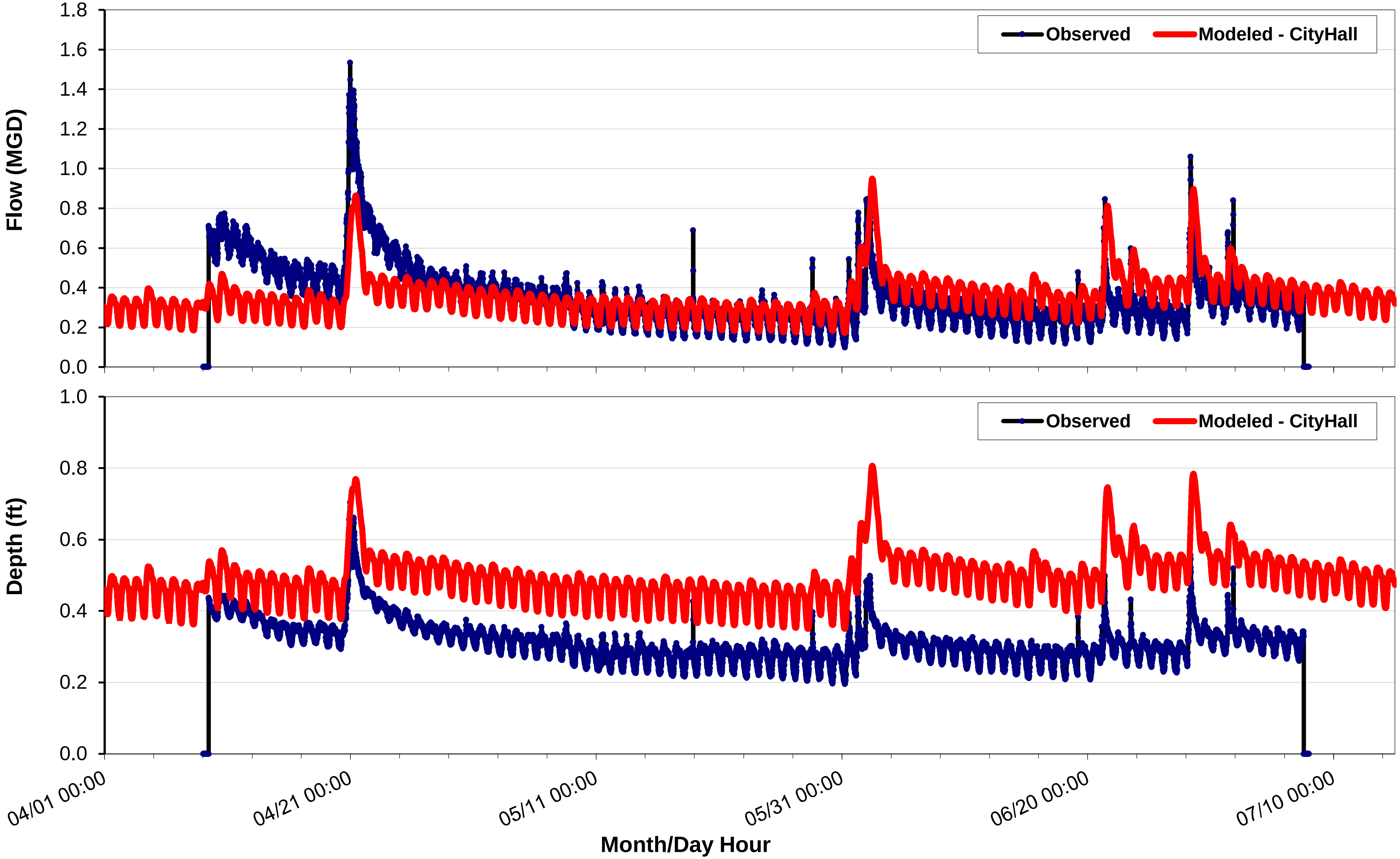
WWF Calibration Plots – Meter #11



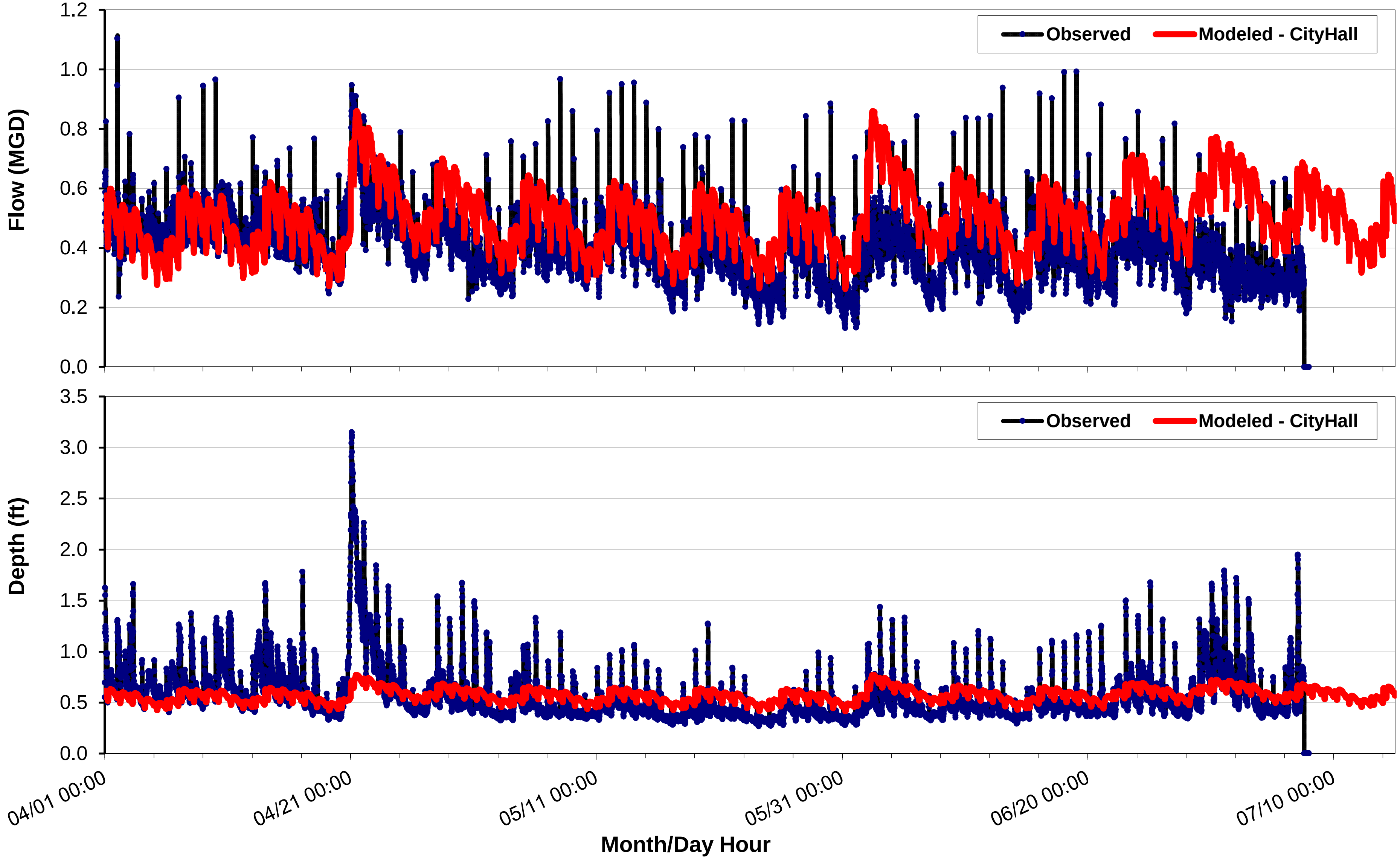
WWF Calibration Plots – Meter #12



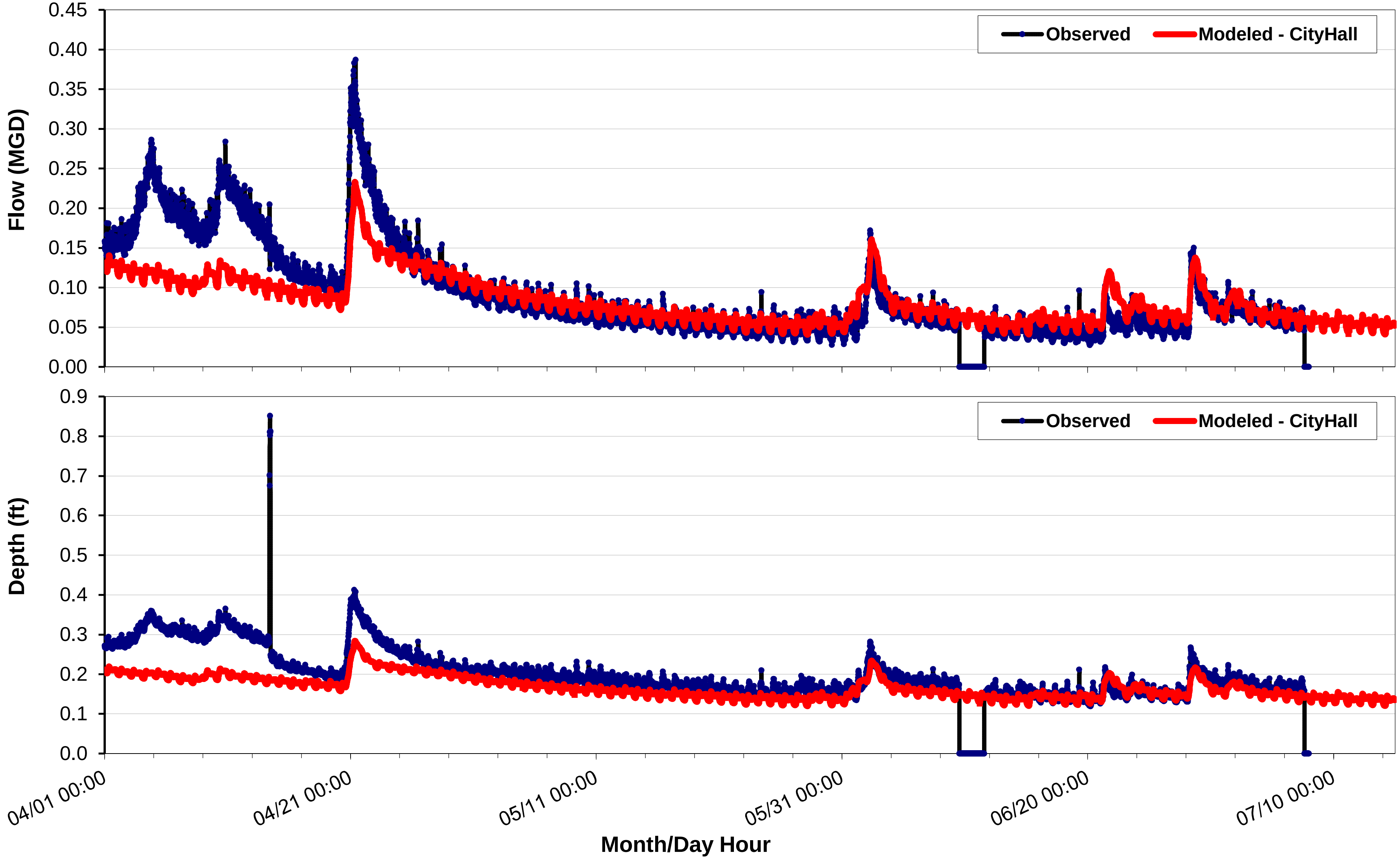
WWF Calibration Plots – Meter #13



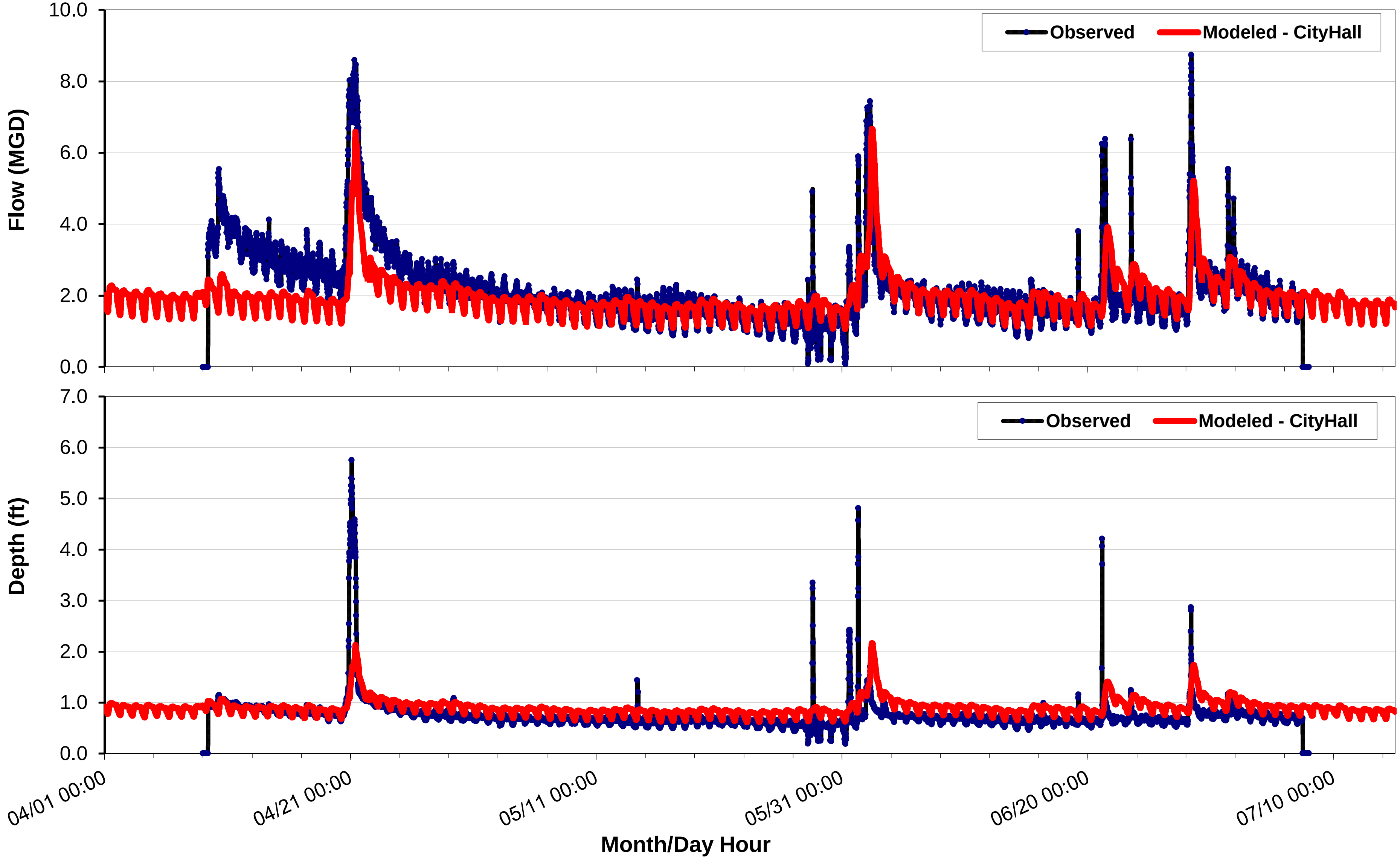
WWF Calibration Plots – Meter #14



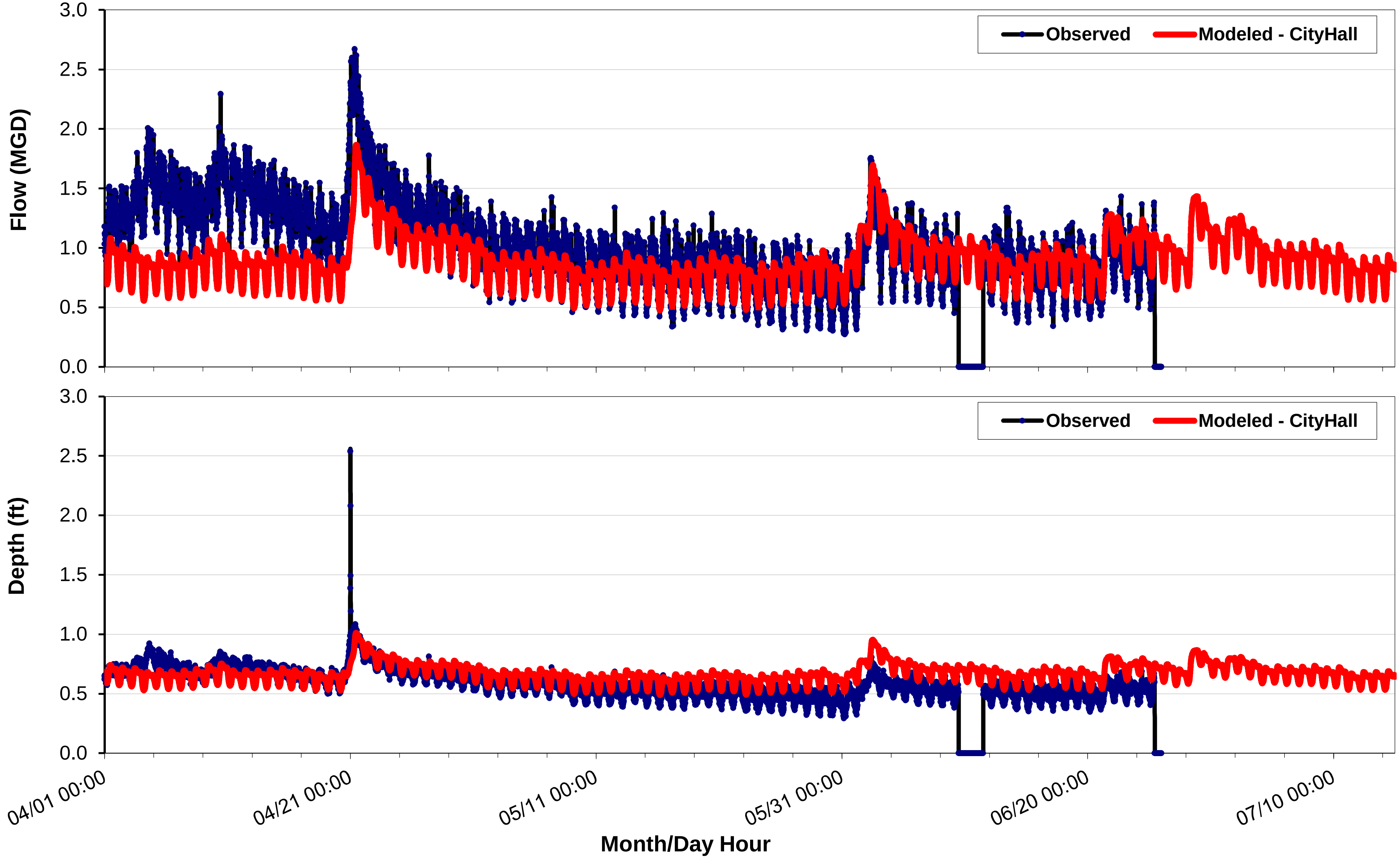
WWF Calibration Plots – Meter #15



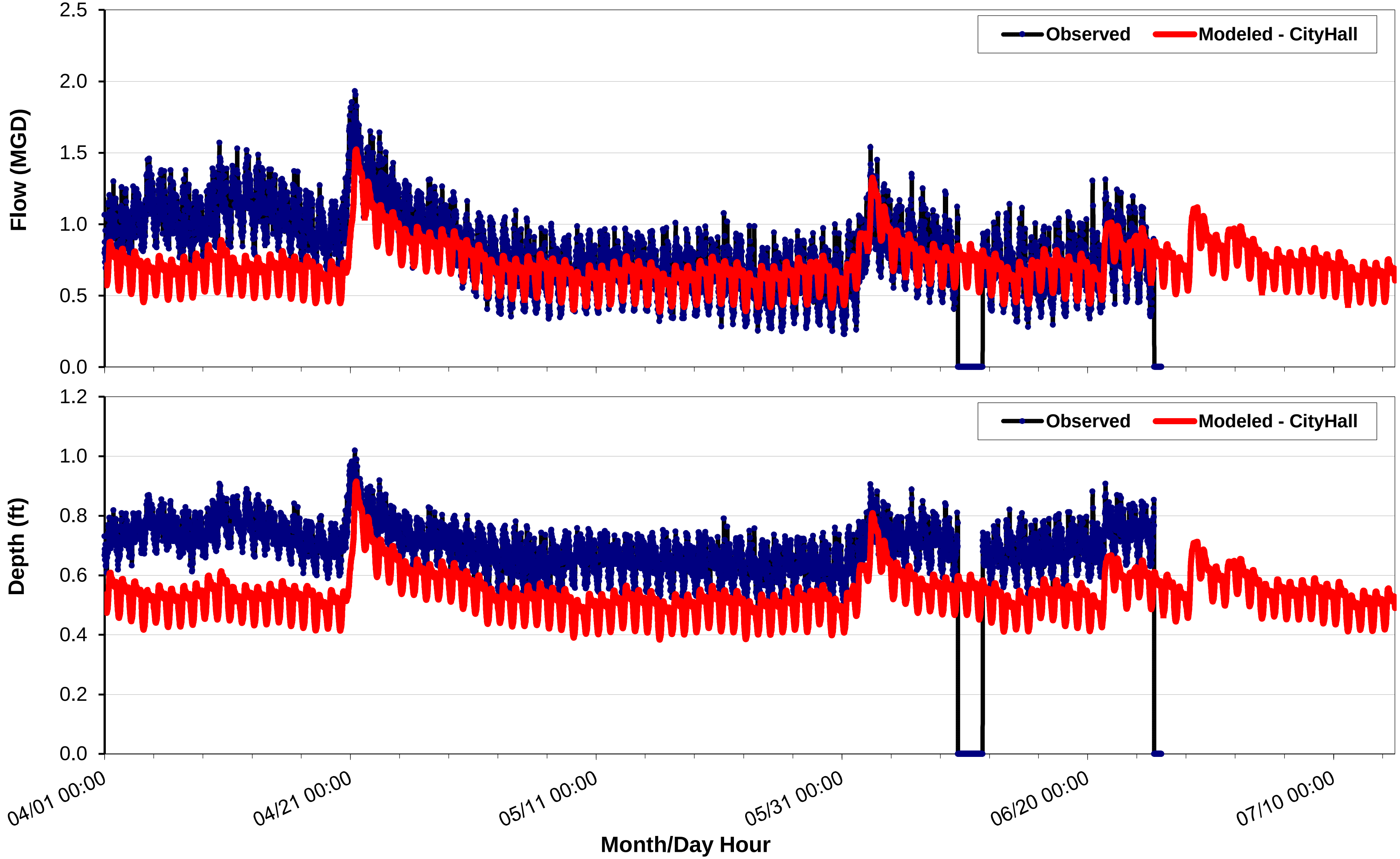
WWF Calibration Plots – Meter #16



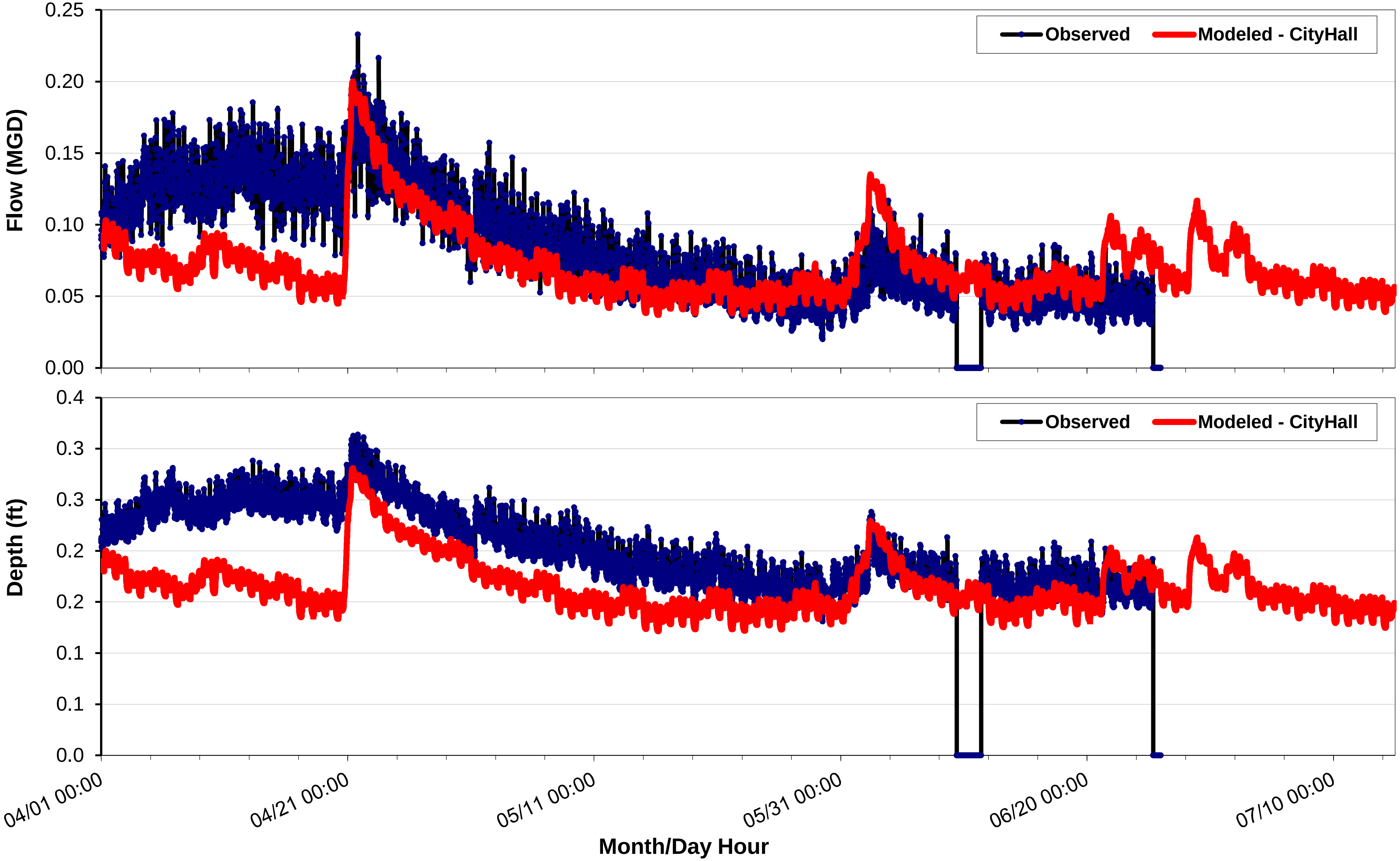
WWF Calibration Plots – Meter LR1



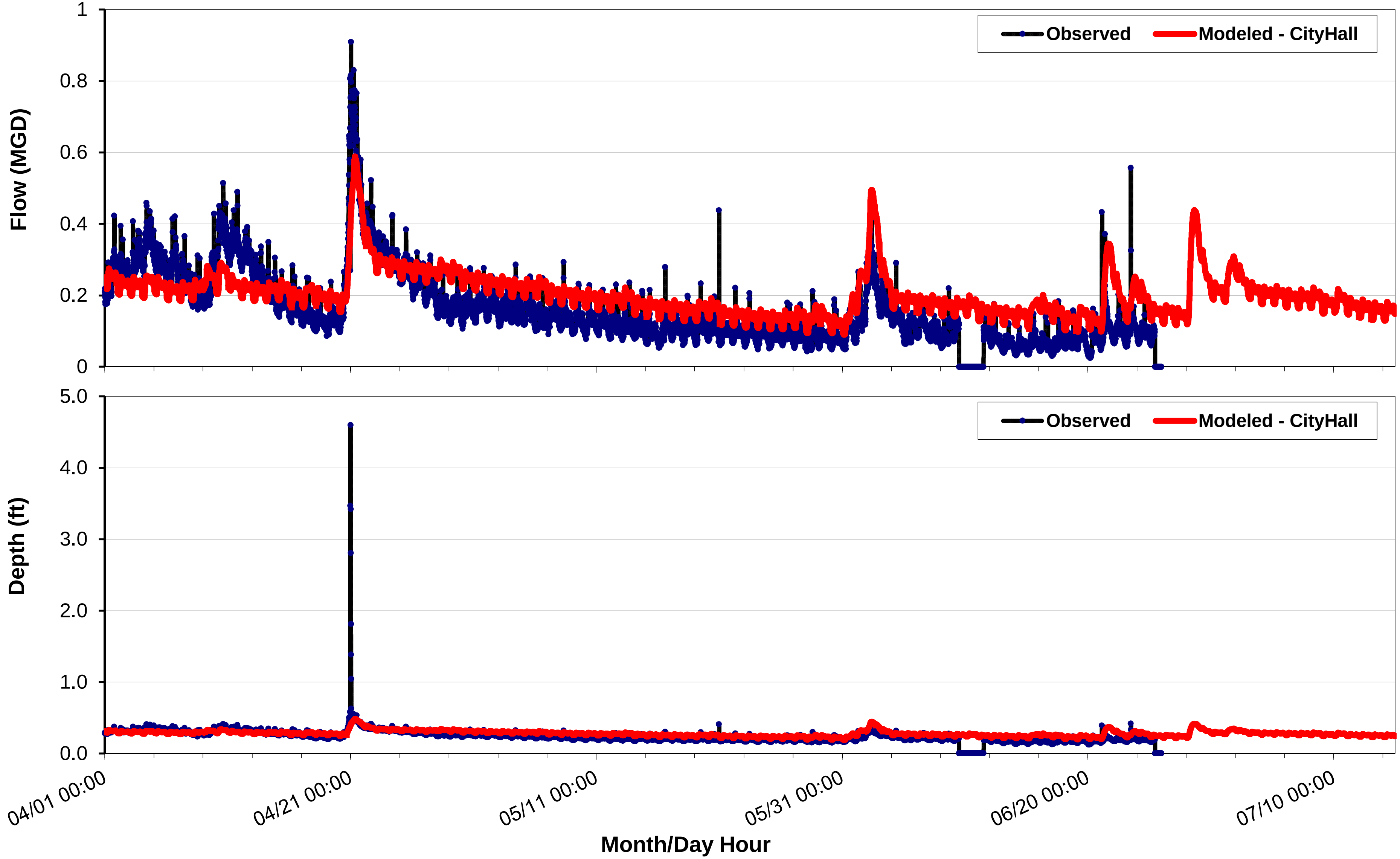
WWF Calibration Plots – Meter LR2



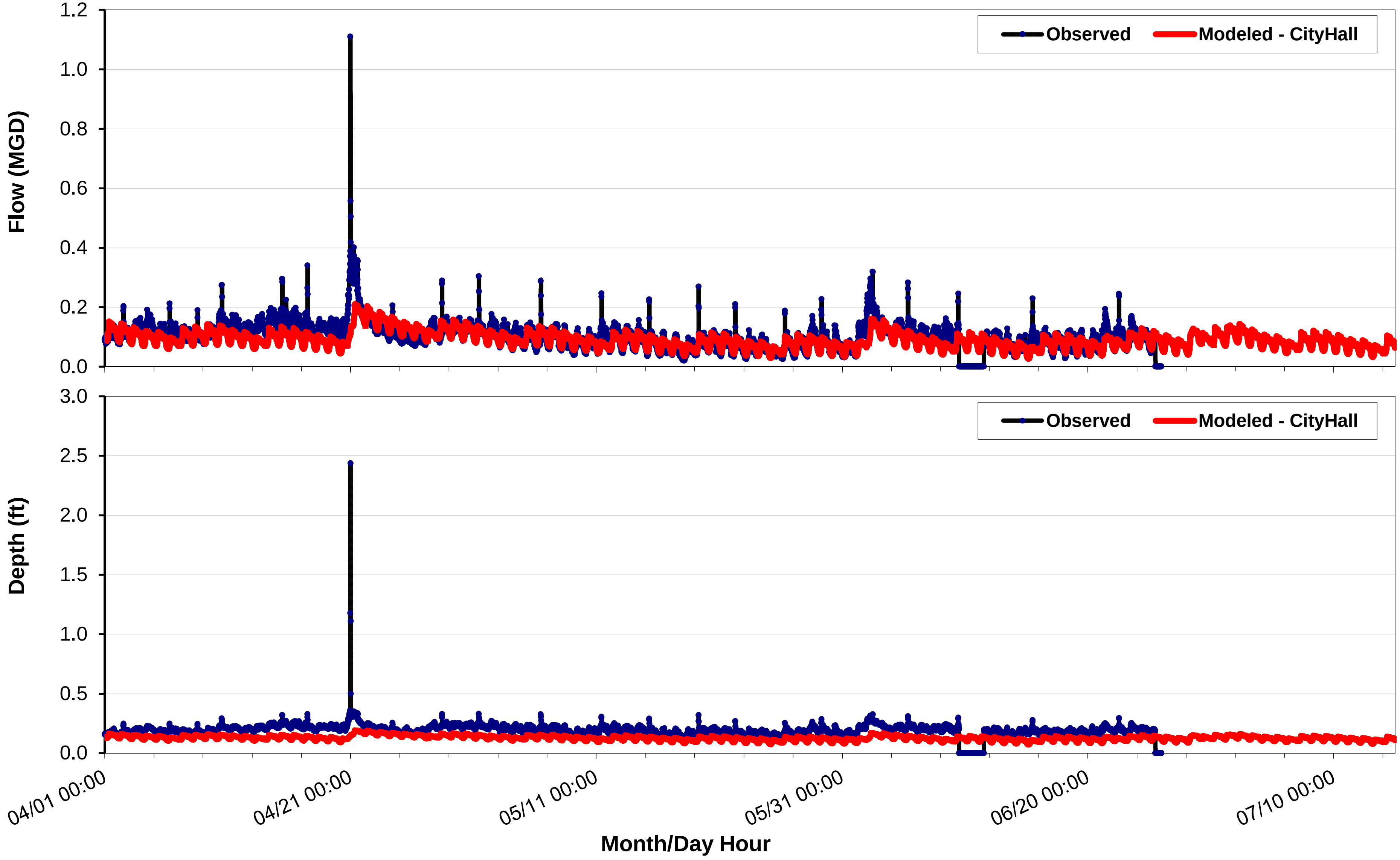
WWF Calibration Plots – Meter LR3



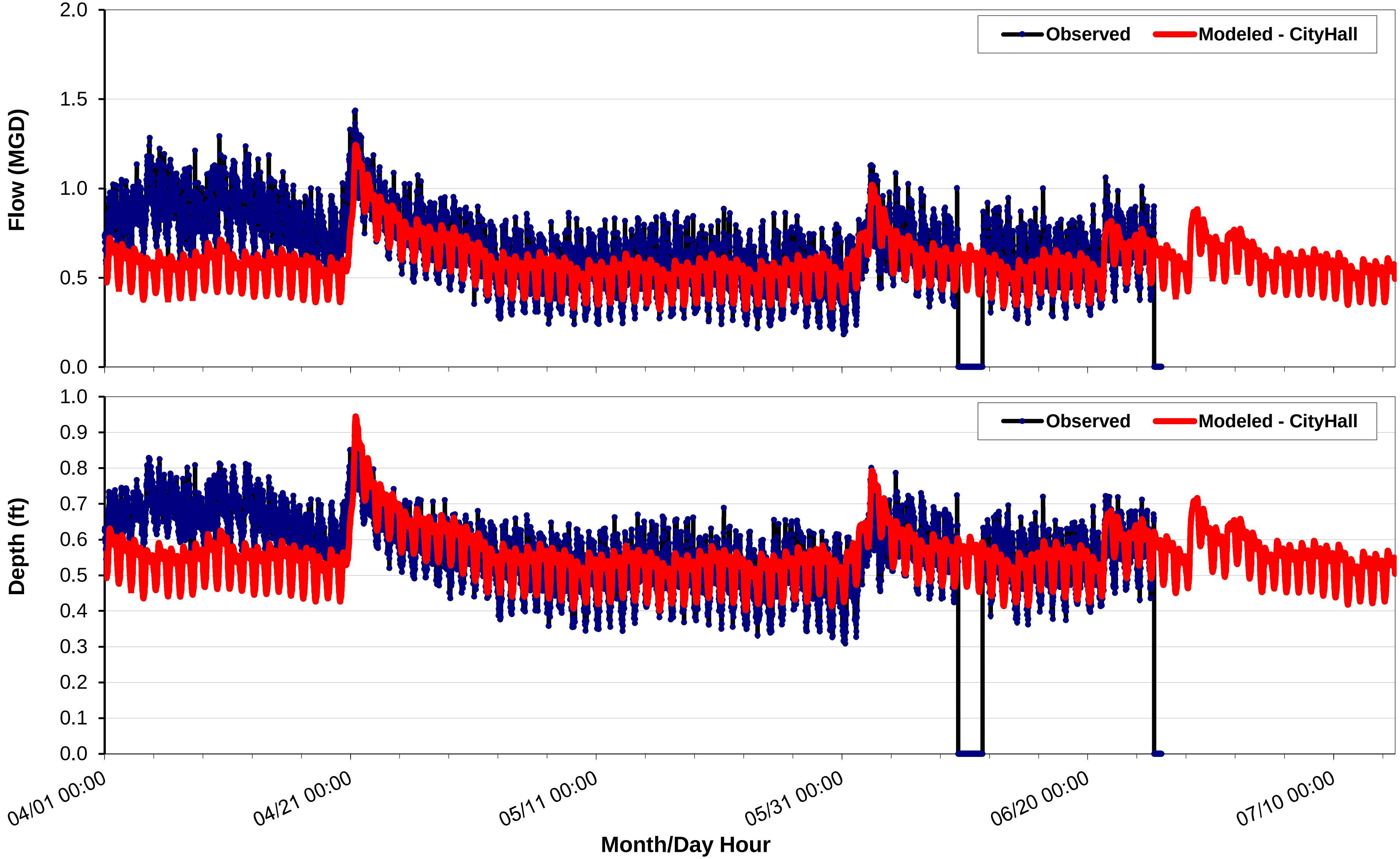
WWF Calibration Plots – Meter LR4



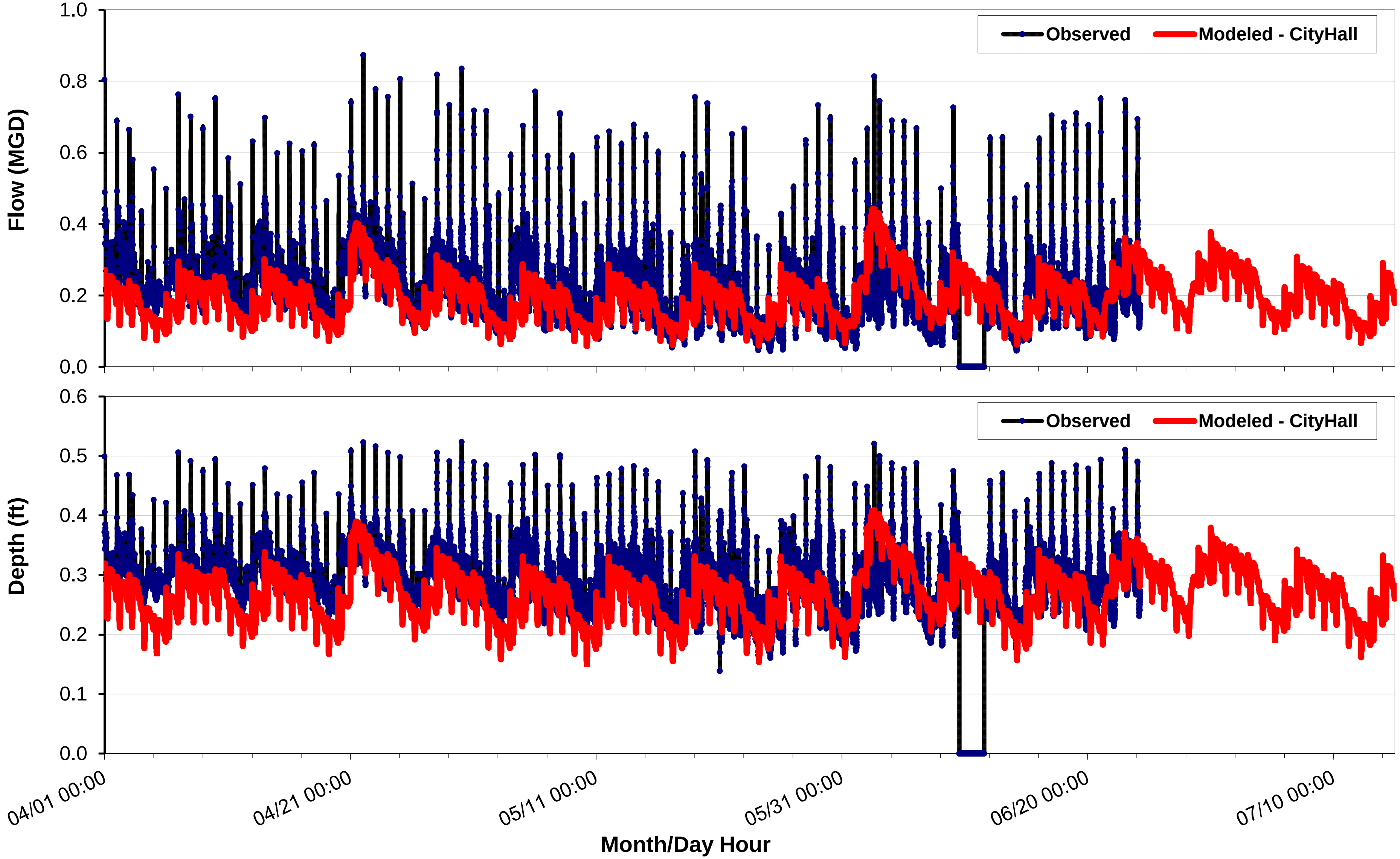
WWF Calibration Plots – Meter LR5



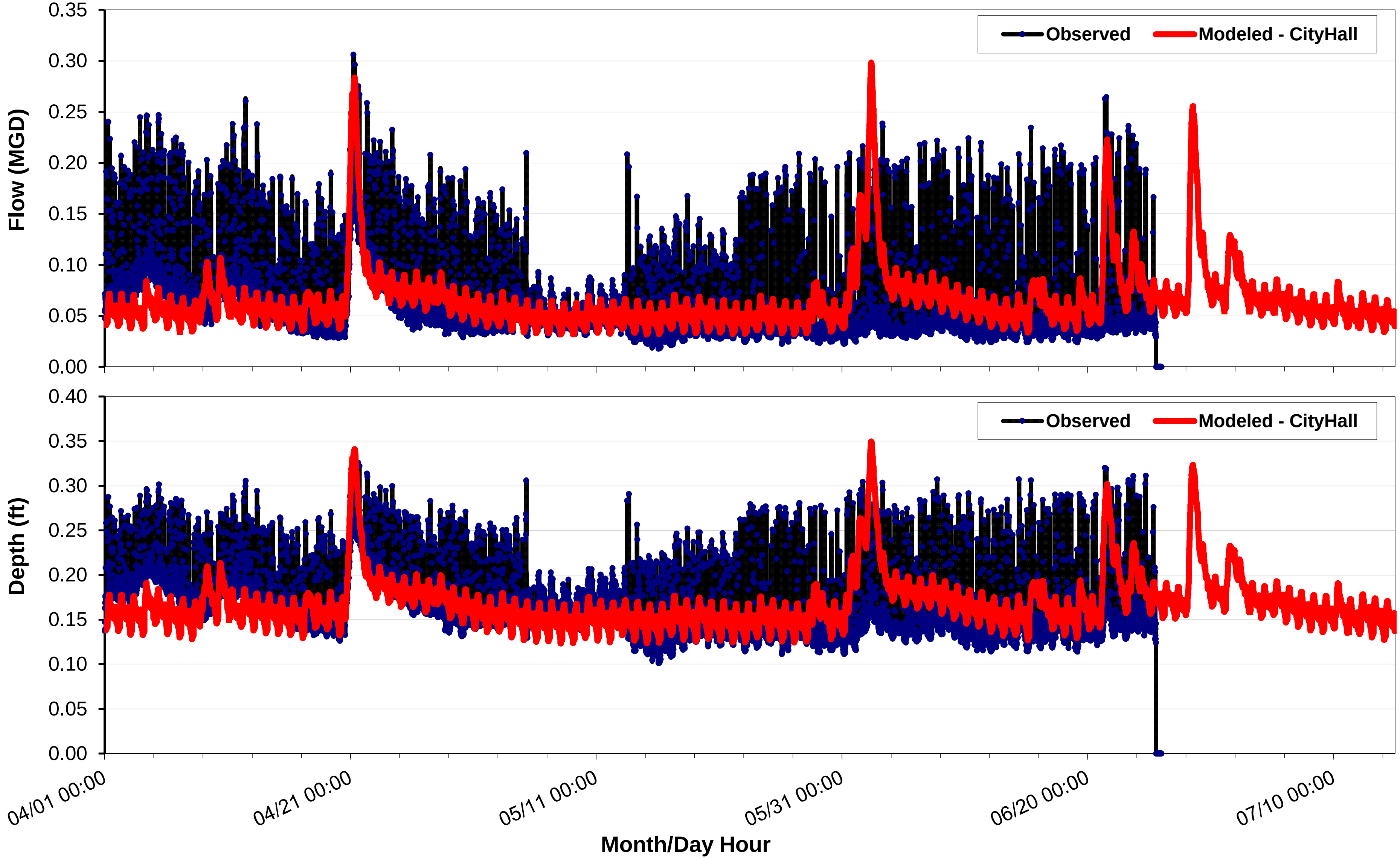
WWF Calibration Plots – Meter LR6



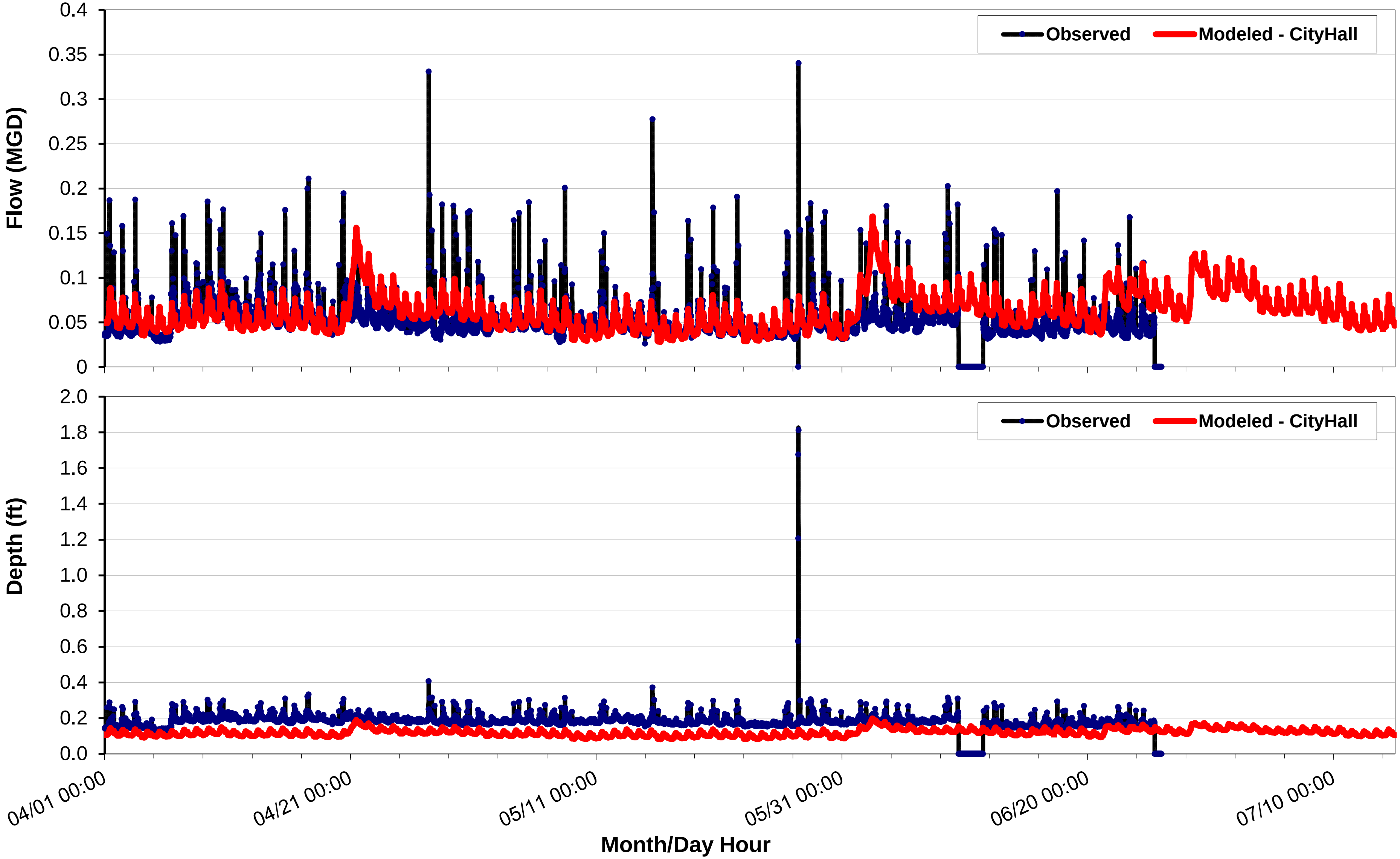
WWF Calibration Plots – Meter B1



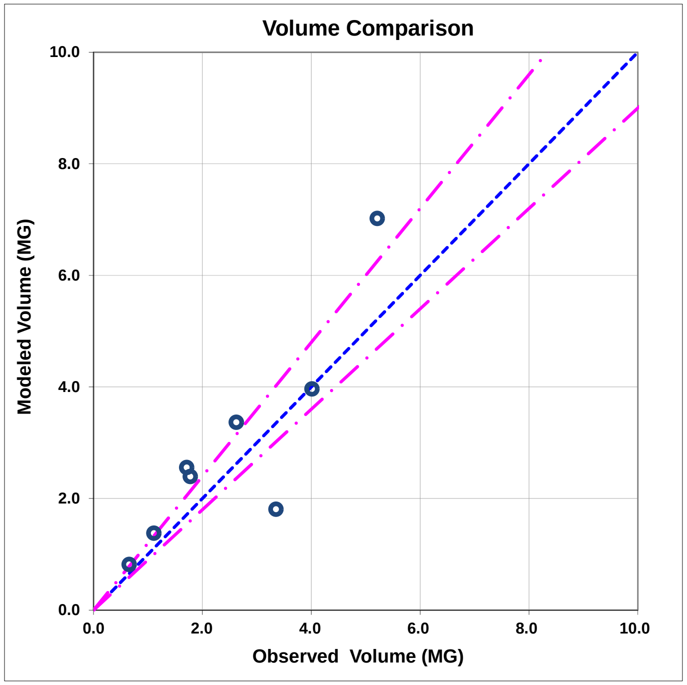
WWF Calibration Plots – Meter M1

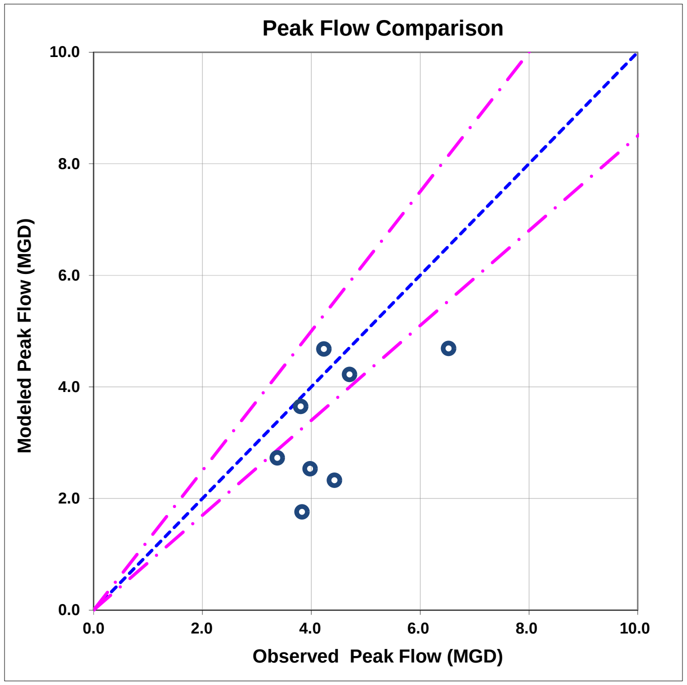


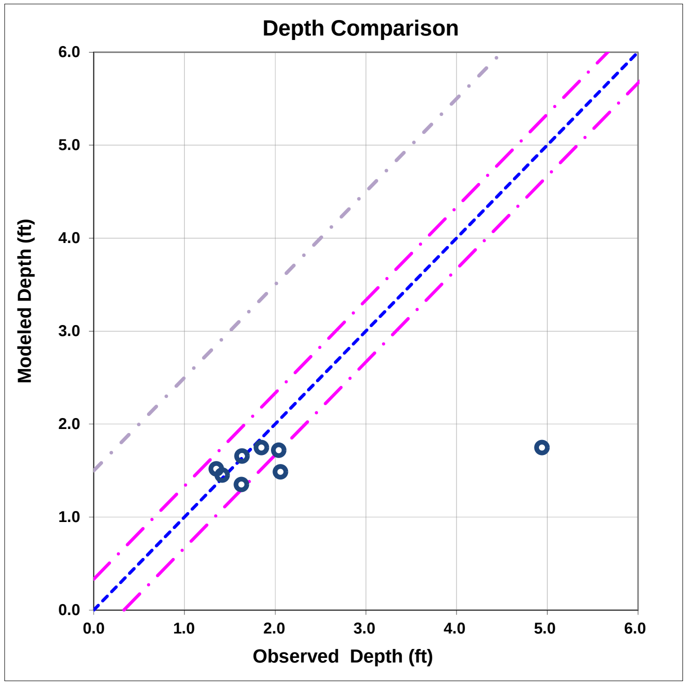
WWF Calibration Plots – Meter P3



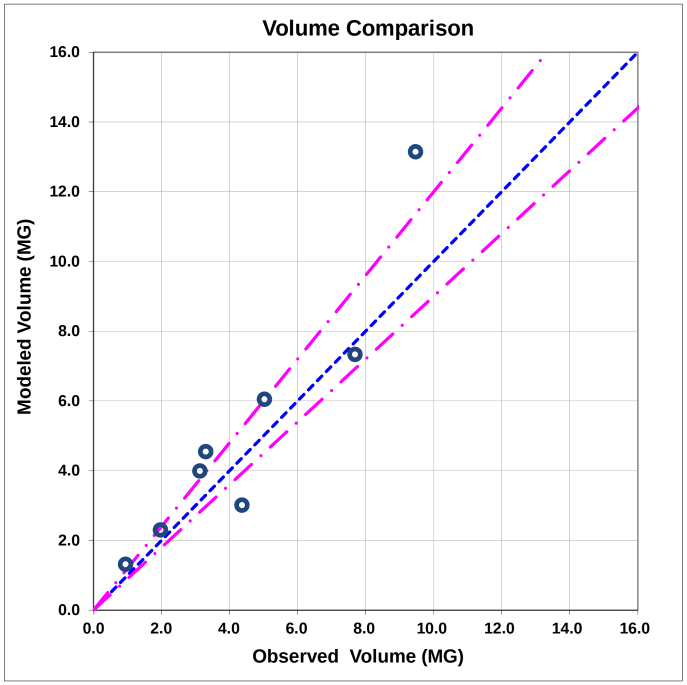
WWF Calibration Statistical Plots – Meter #5

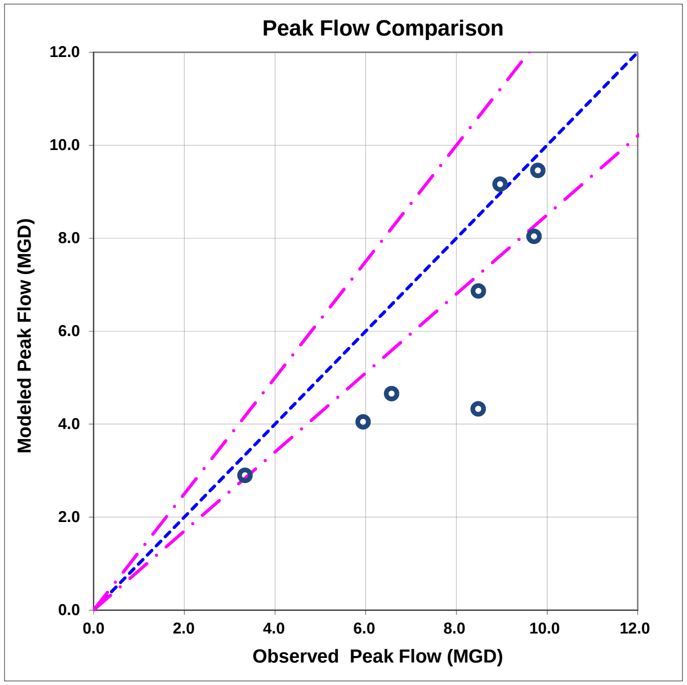


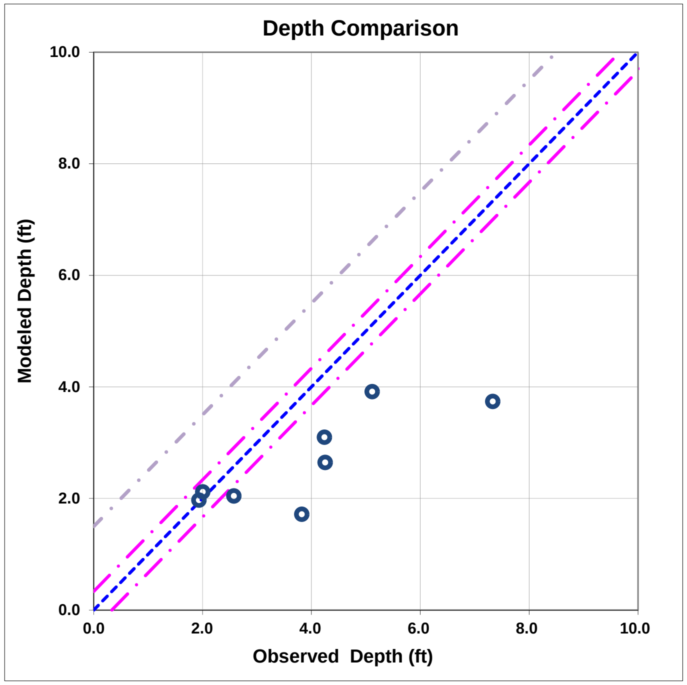




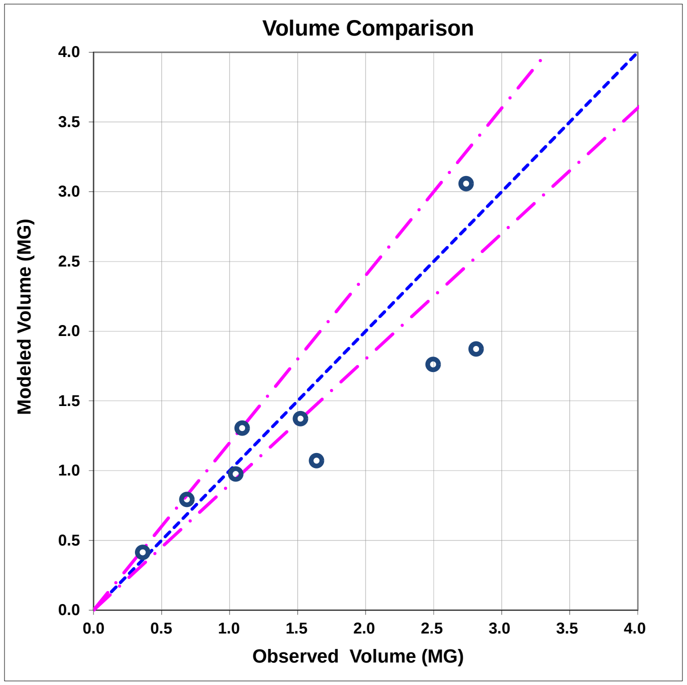
WWF Calibration Statistical Plots – Meter #6

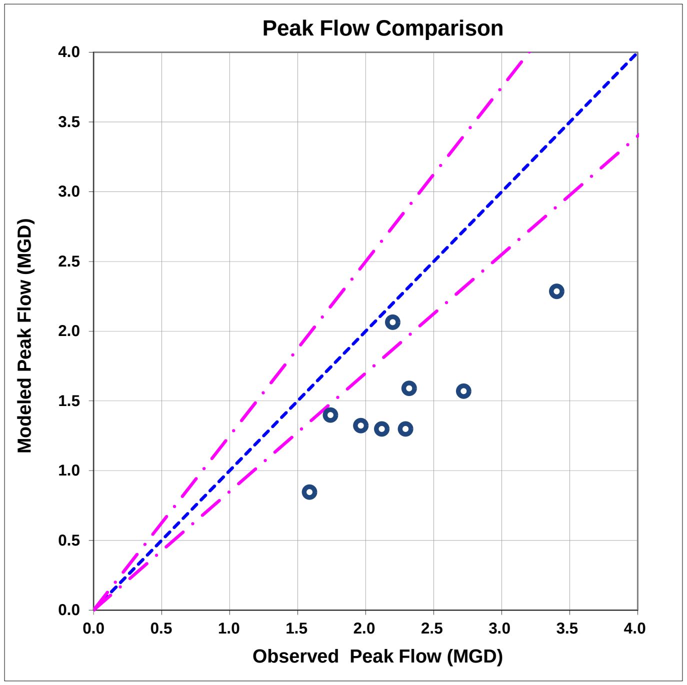


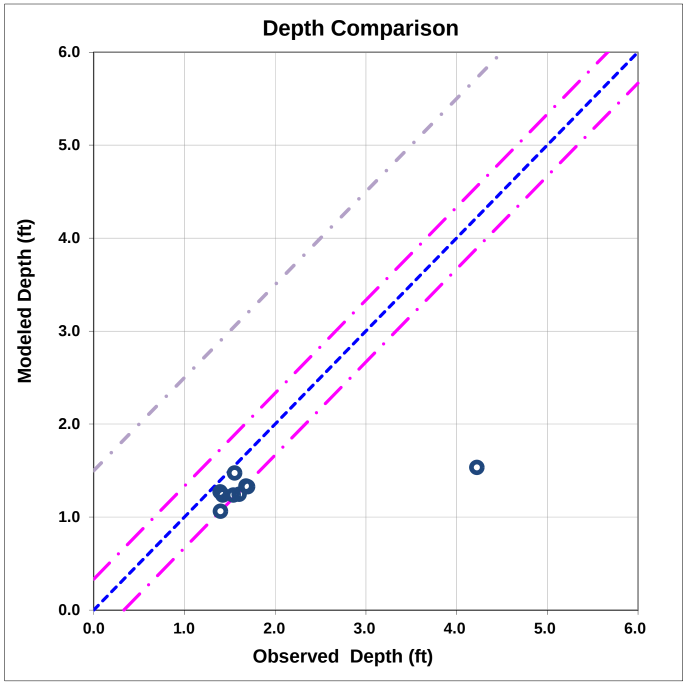




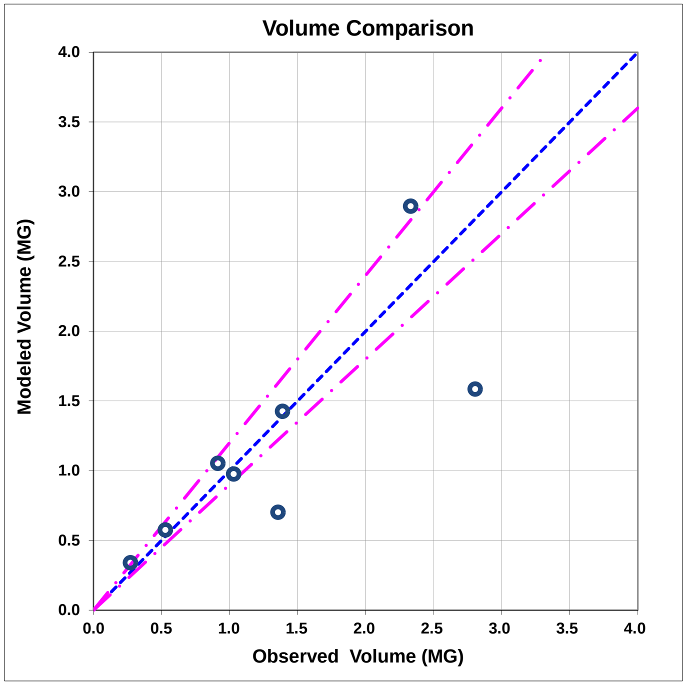
WWF Calibration Statistical Plots – Meter #11

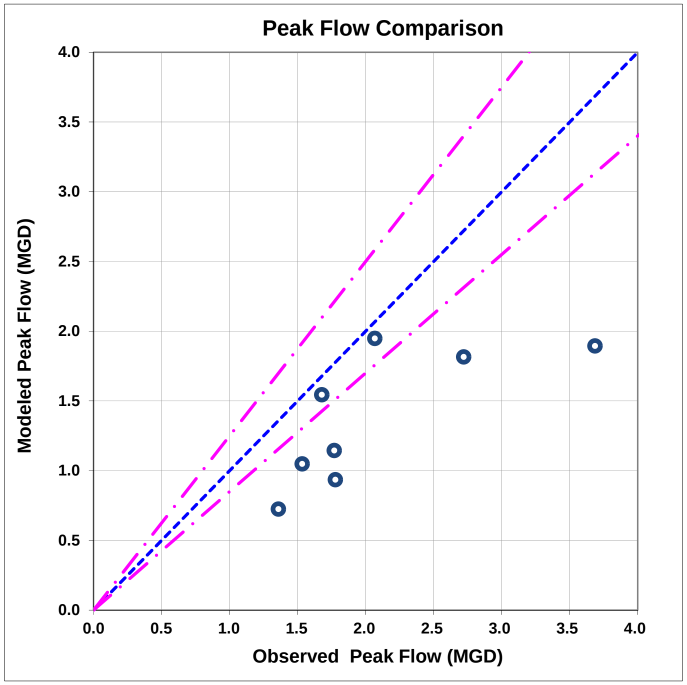


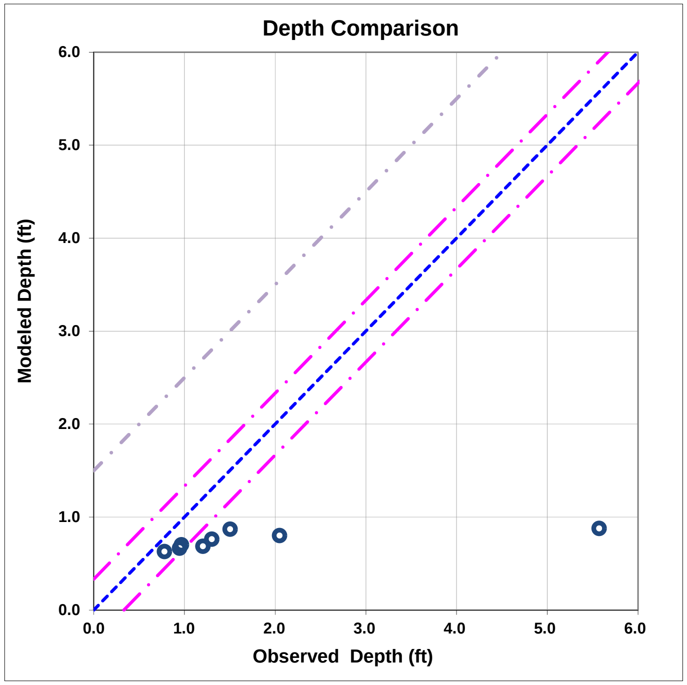




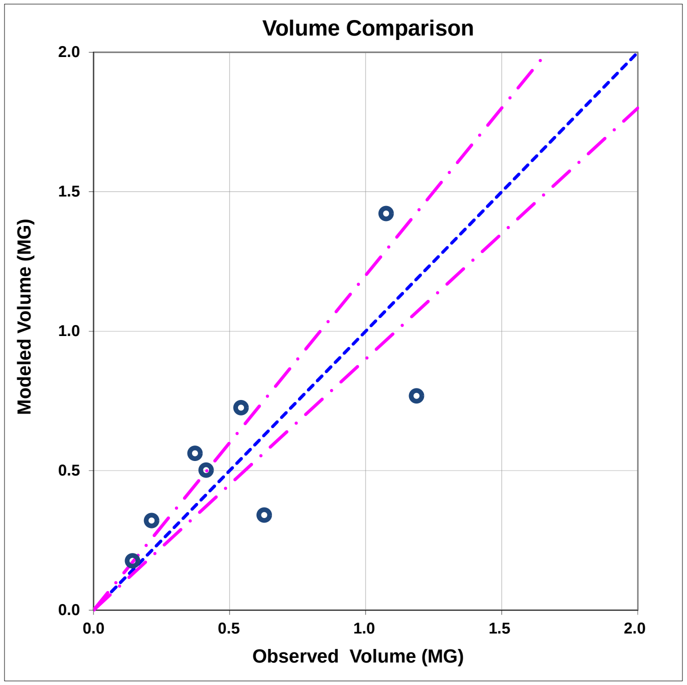
WWF Calibration Statistical Plots – Meter #12

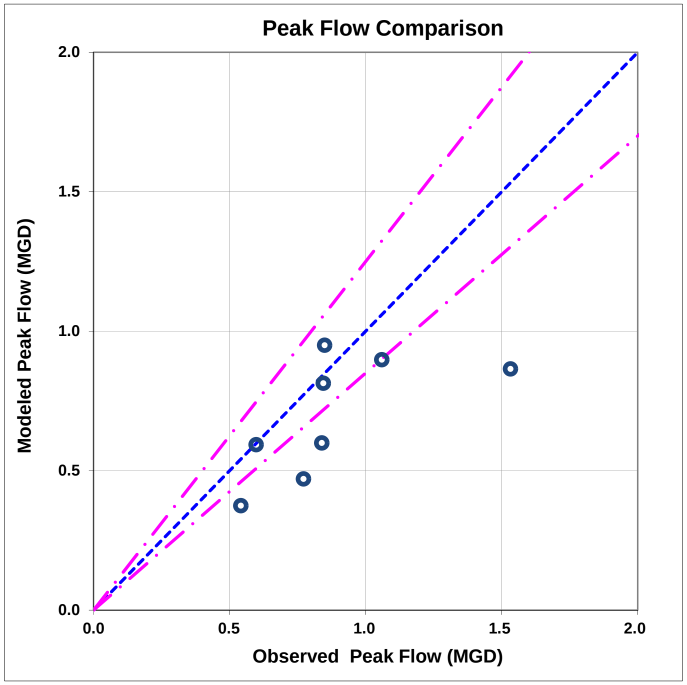


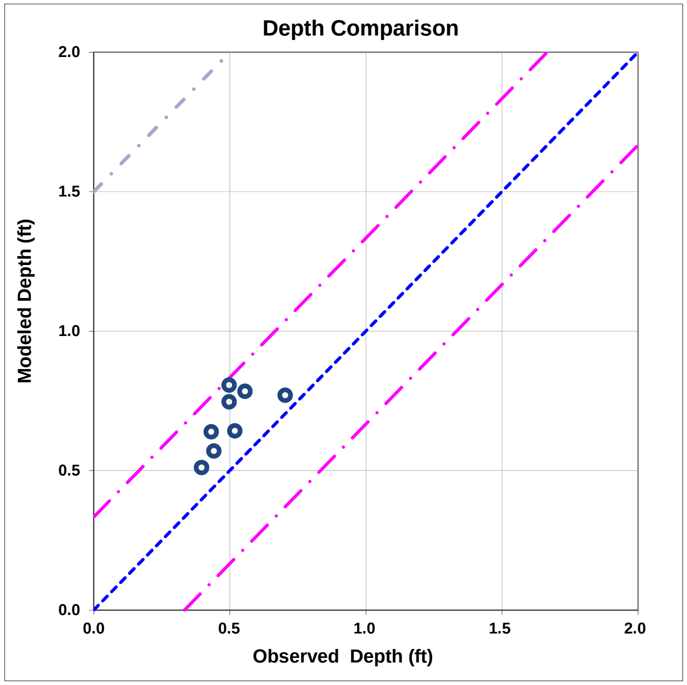




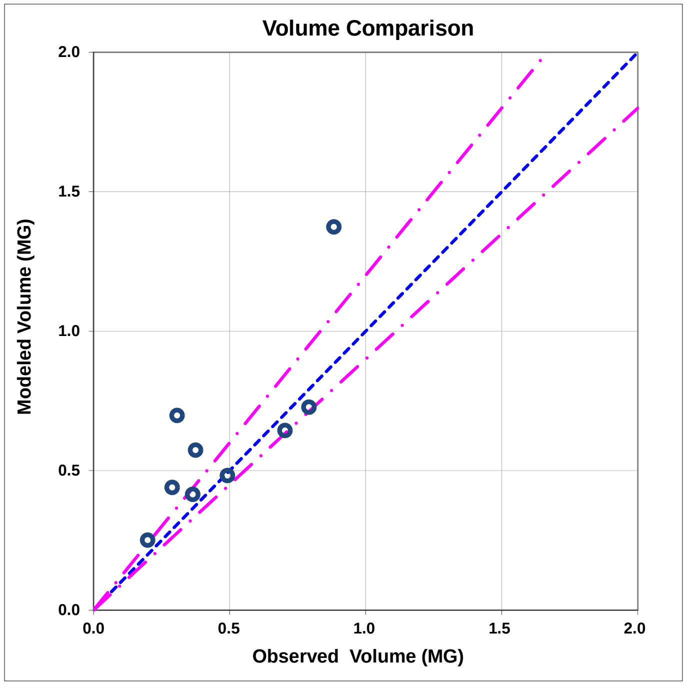
WWF Calibration Statistical Plots – Meter #13

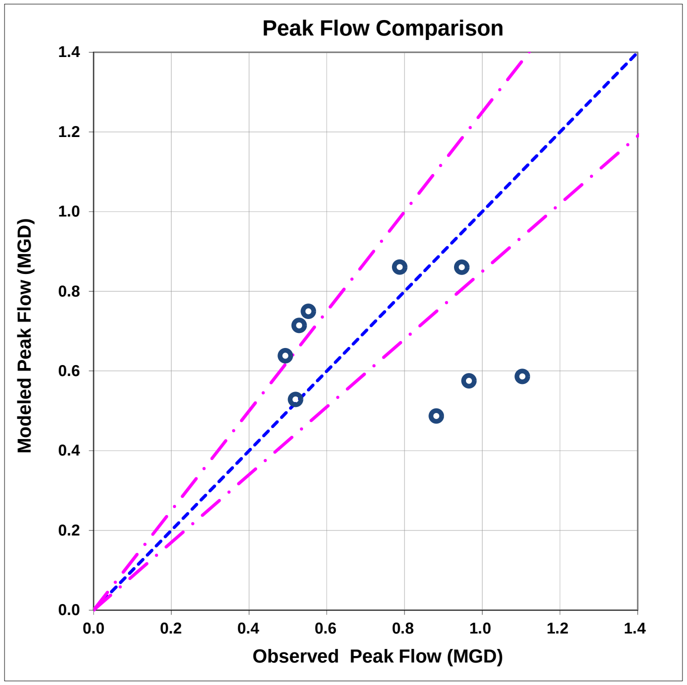


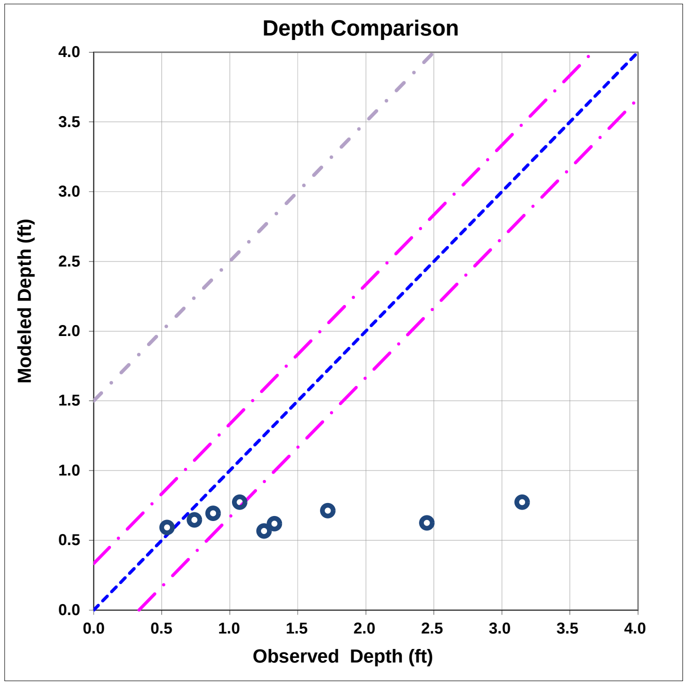




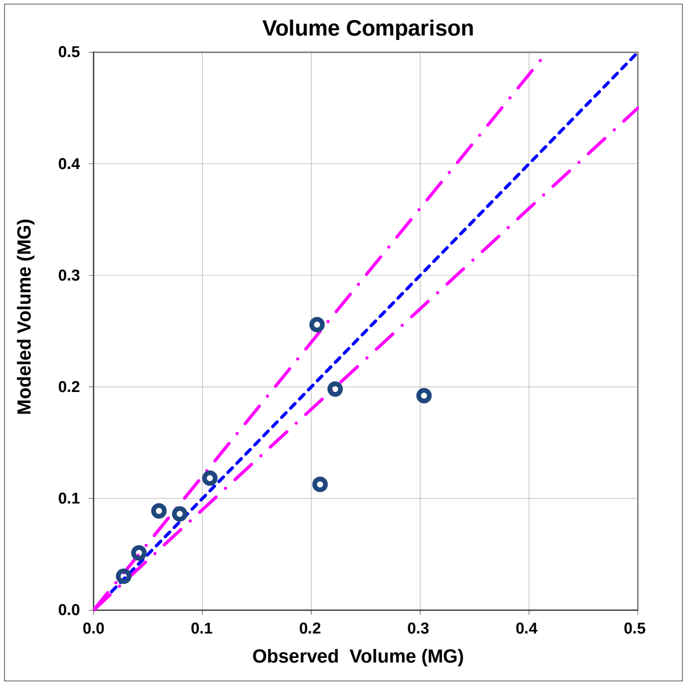
WWF Calibration Statistical Plots – Meter #14

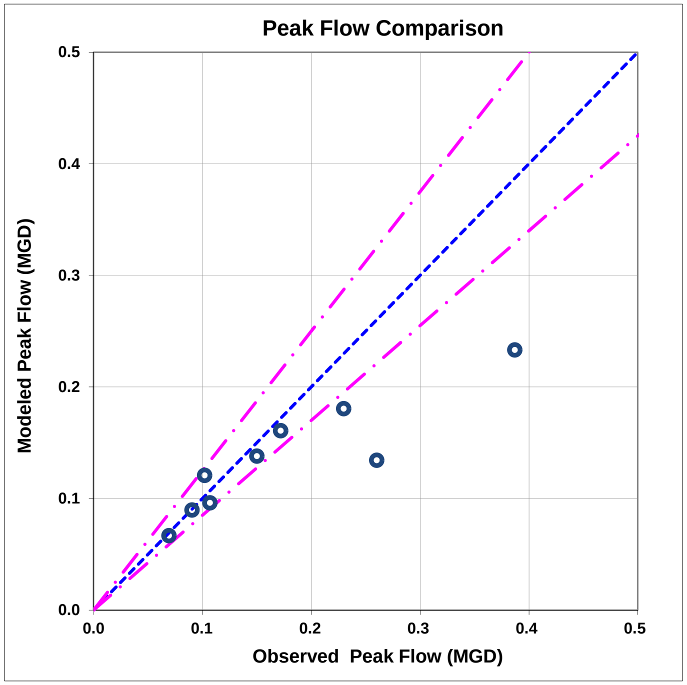


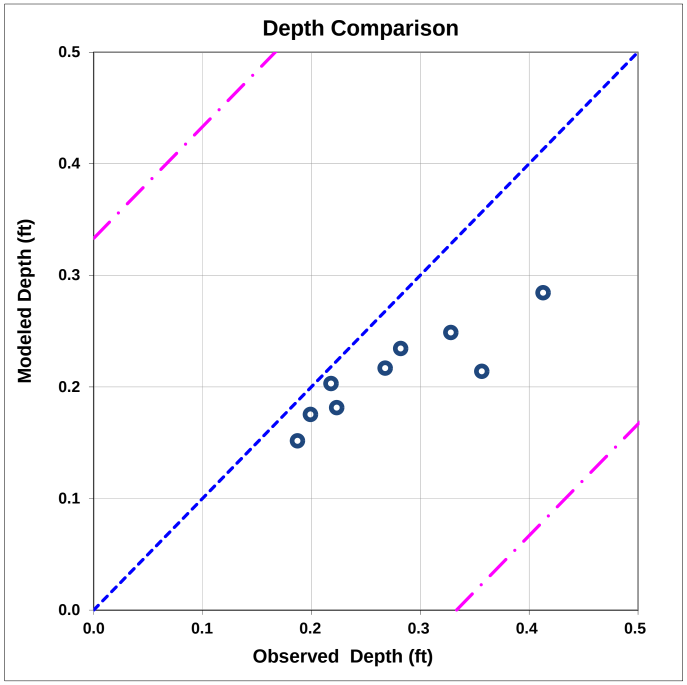




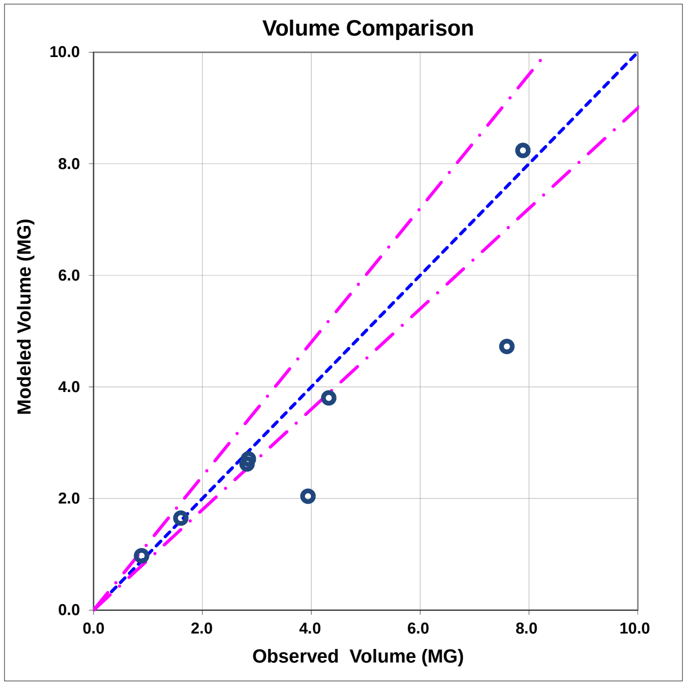
WWF Calibration Statistical Plots – Meter #15

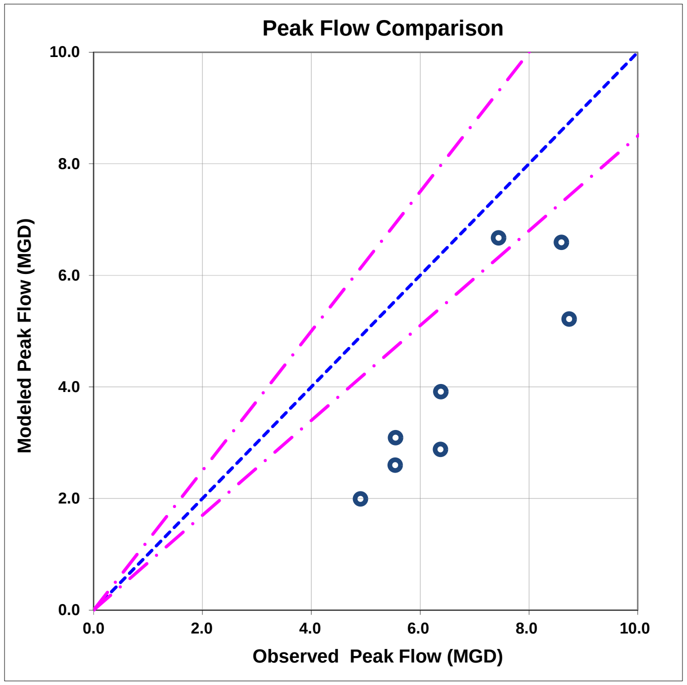


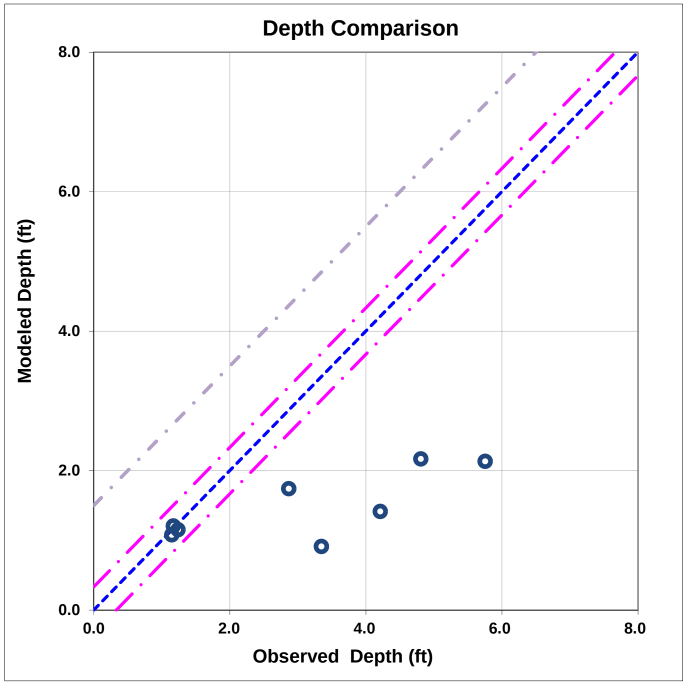




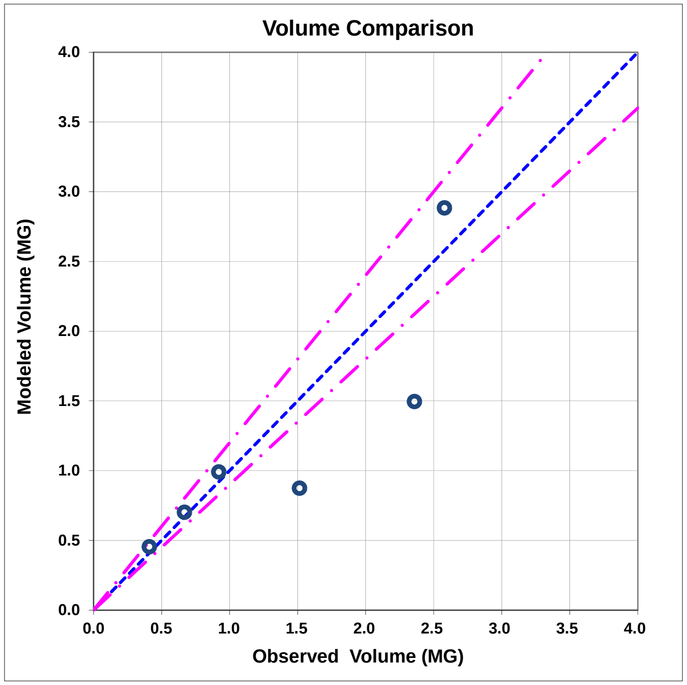
WWF Calibration Statistical Plots – Meter #16

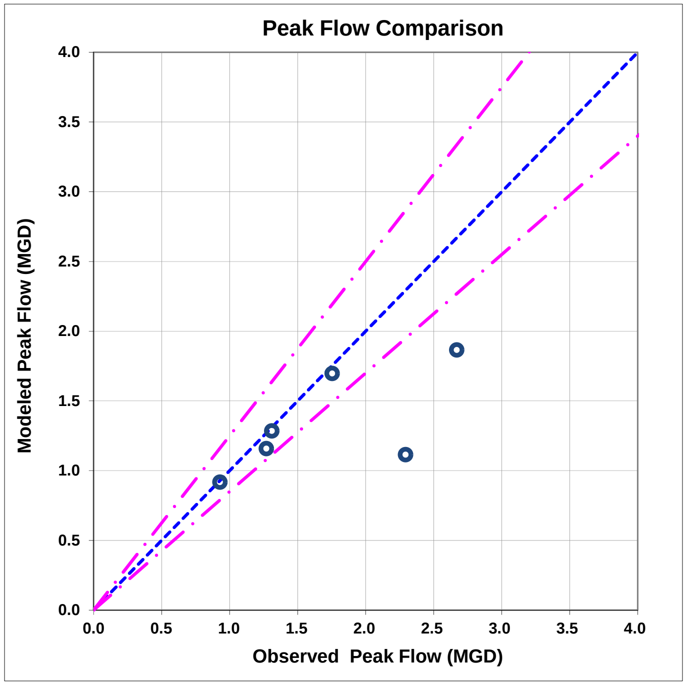


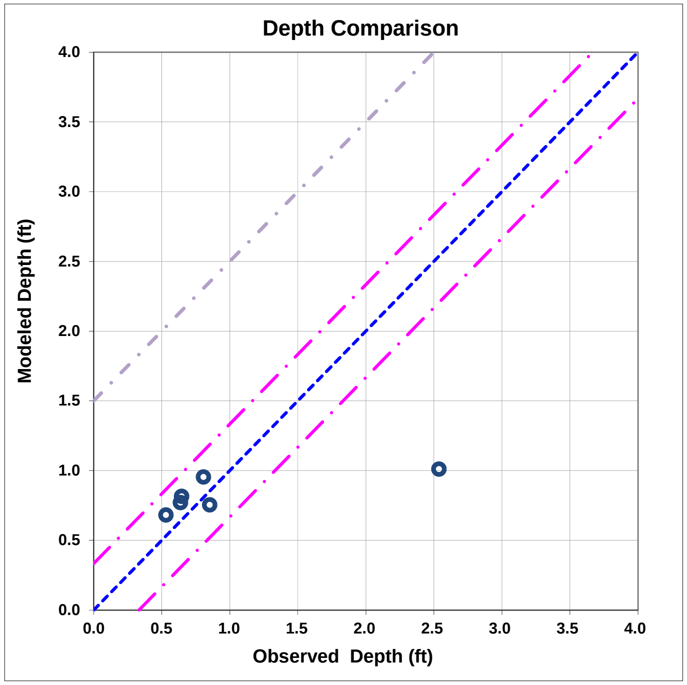




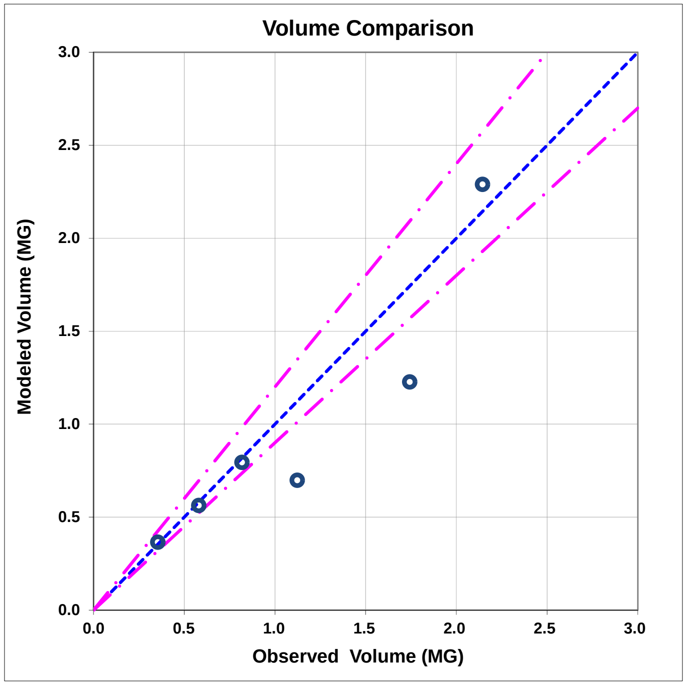
WWF Calibration Statistical Plots – Meter #LR1

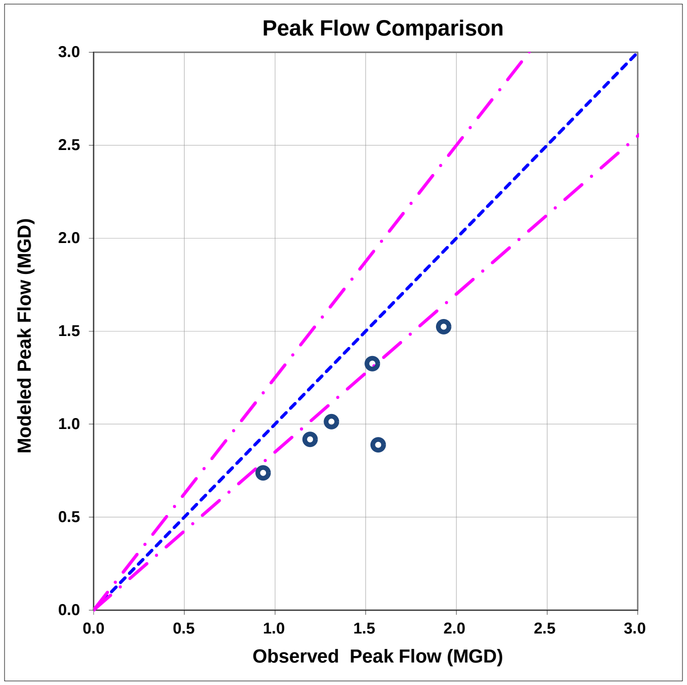


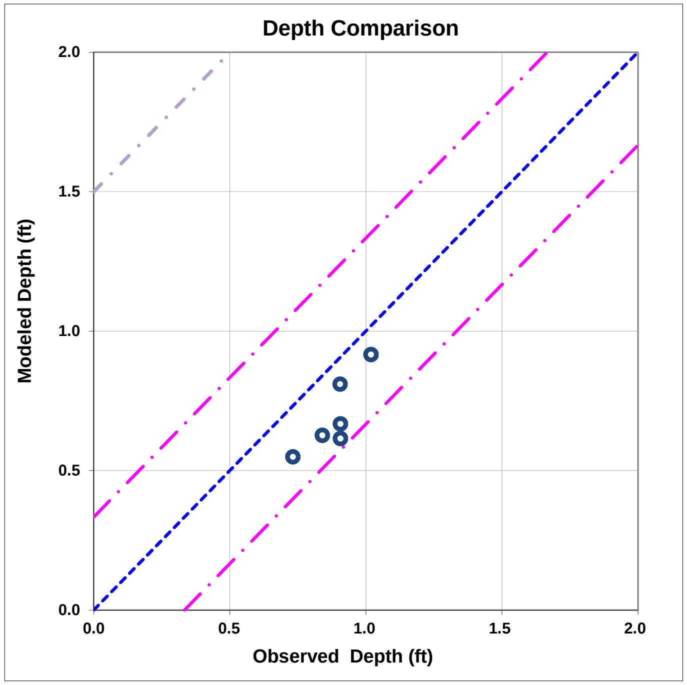




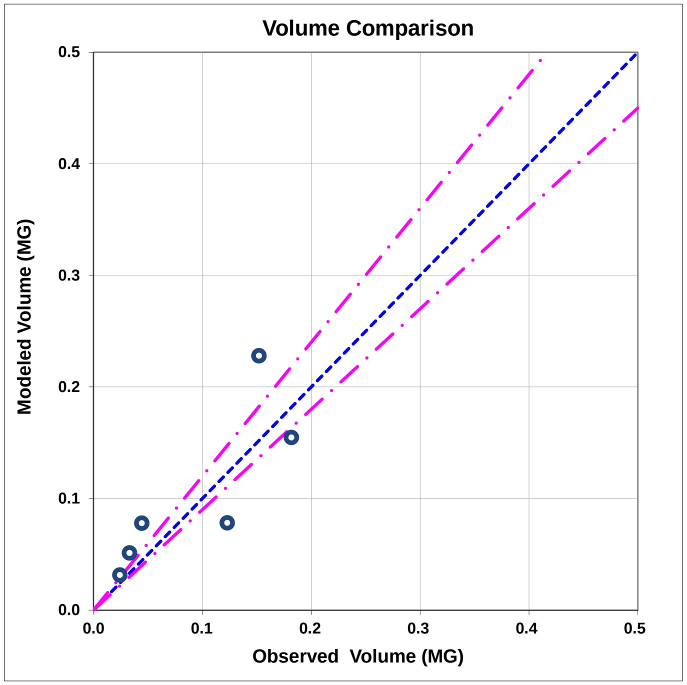
WWF Calibration Statistical Plots – Meter #LR2

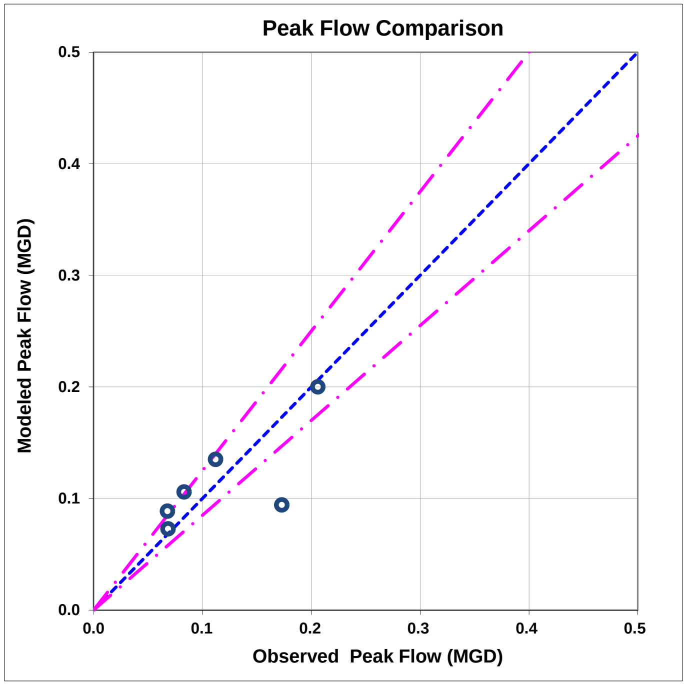


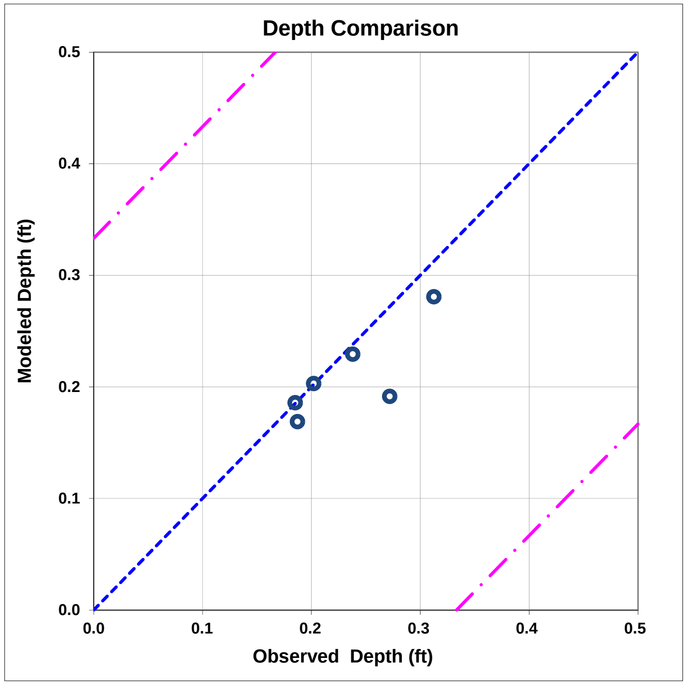




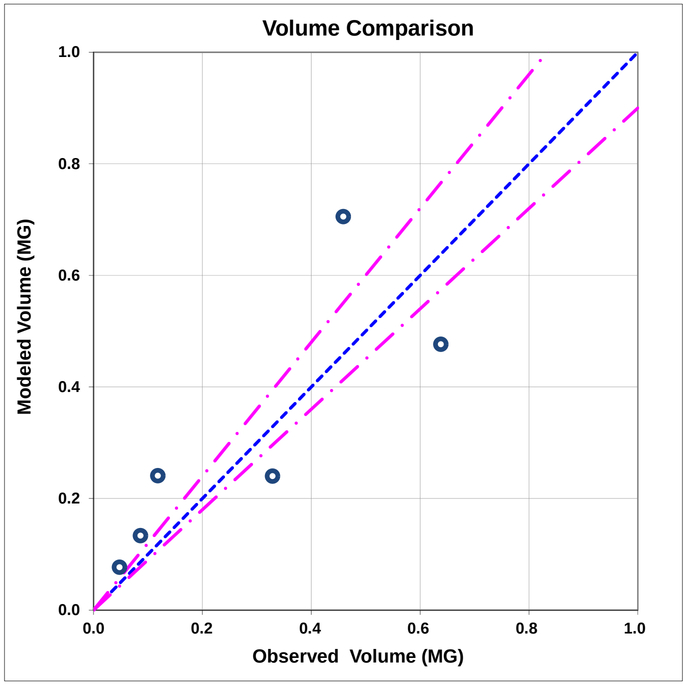
WWF Calibration Statistical Plots – Meter #LR3

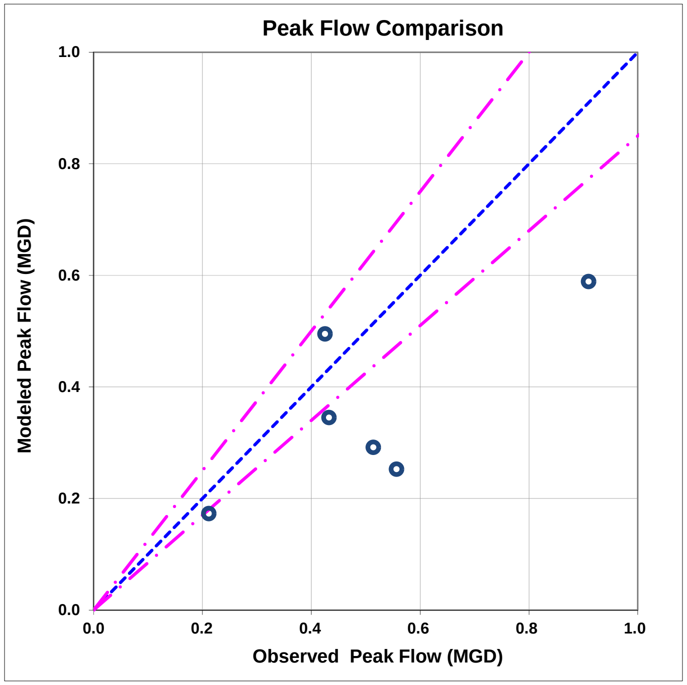


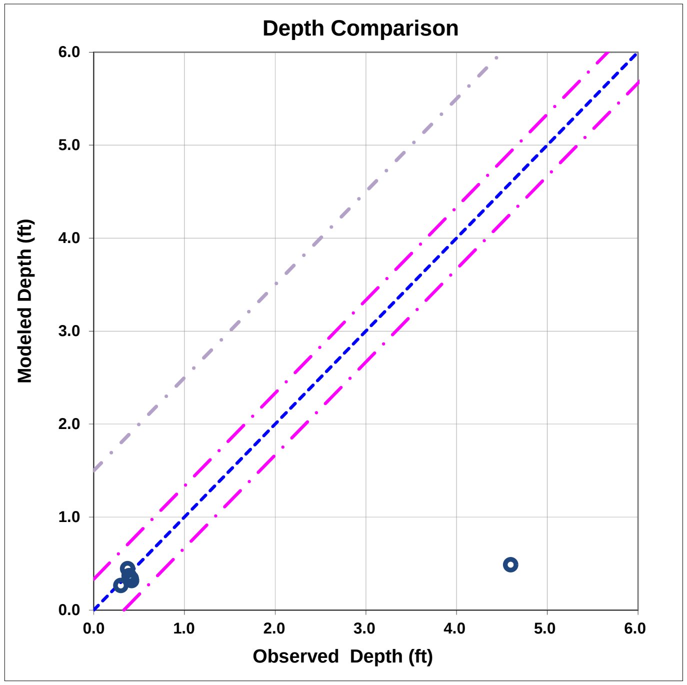




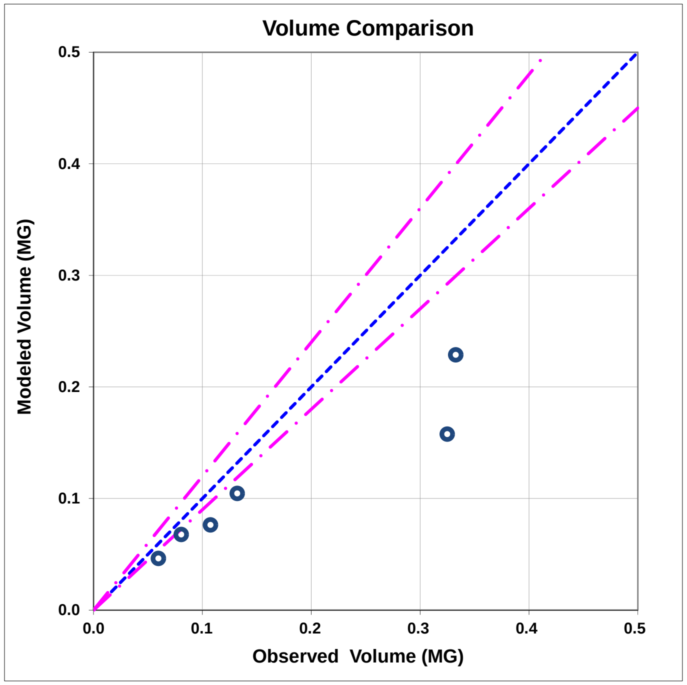
WWF Calibration Statistical Plots – Meter #LR4

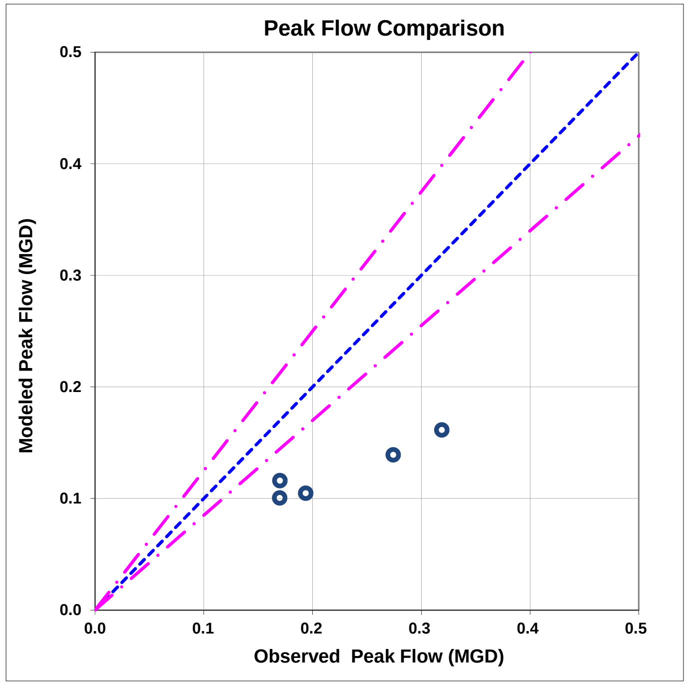


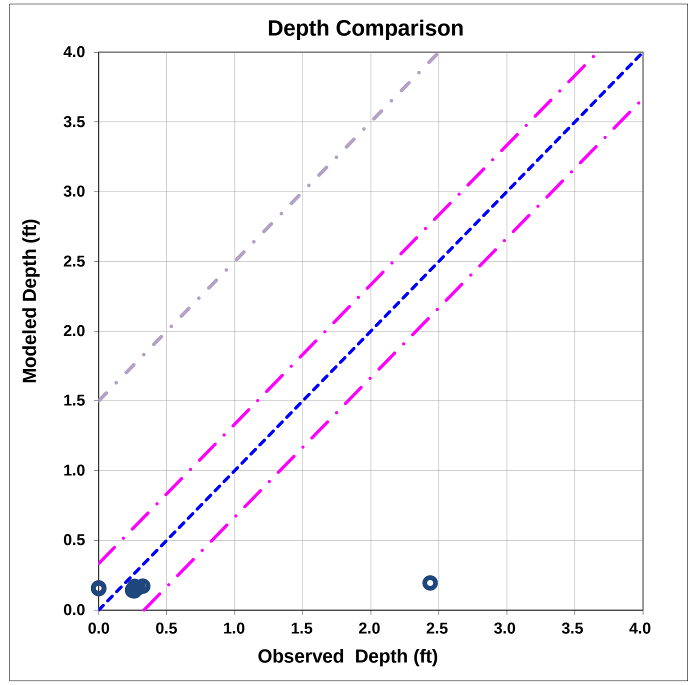




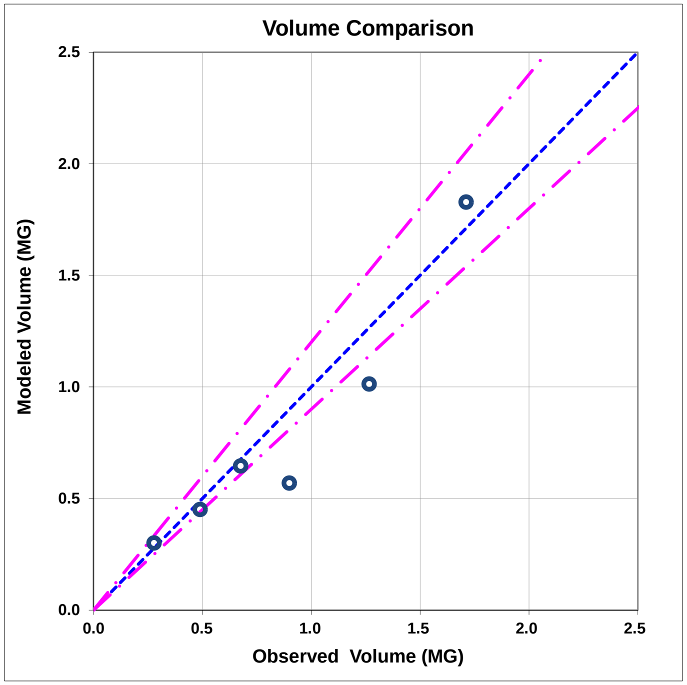
WWF Calibration Statistical Plots – Meter #LR5

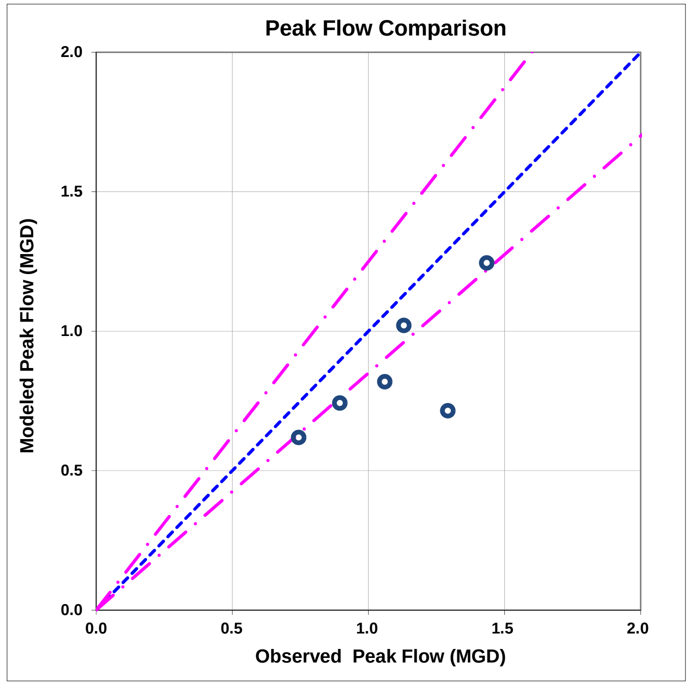


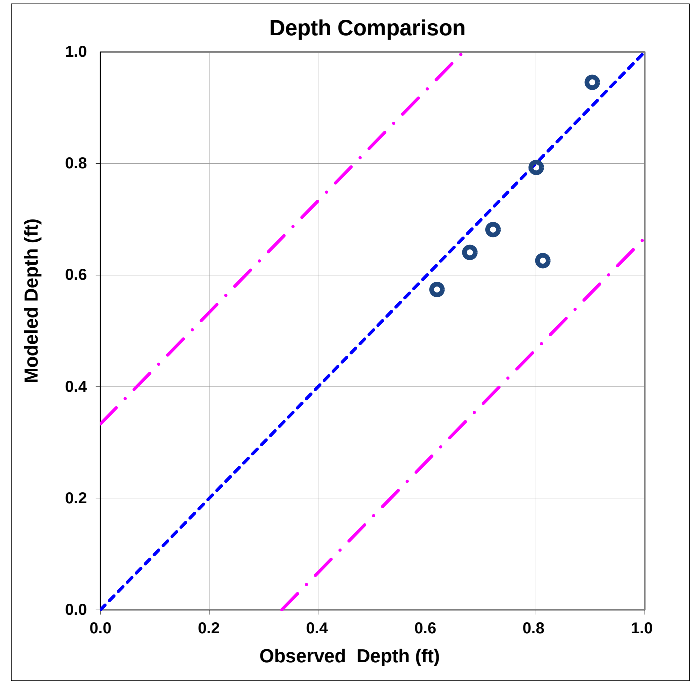




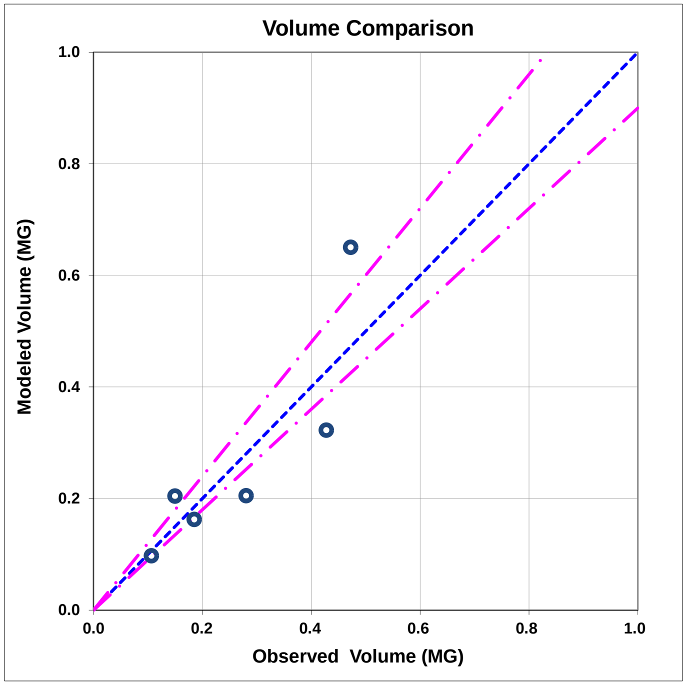
WWF Calibration Statistical Plots – Meter #LR6

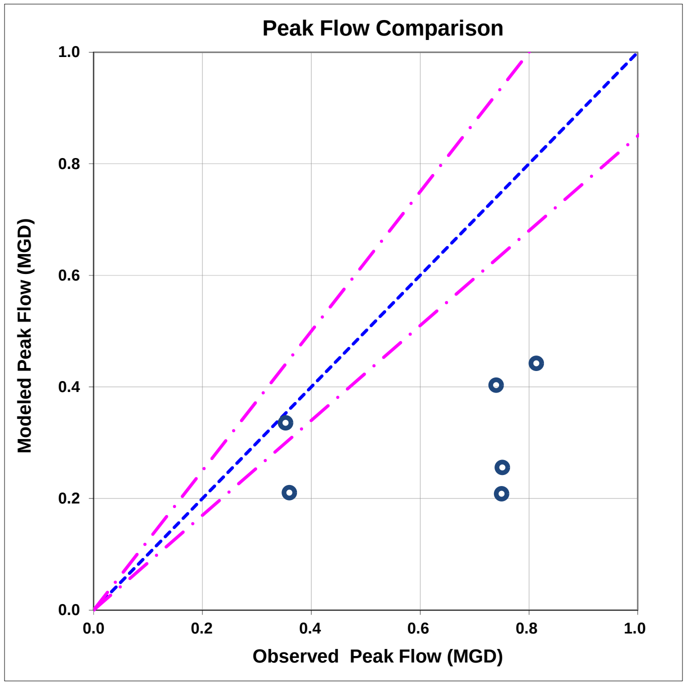


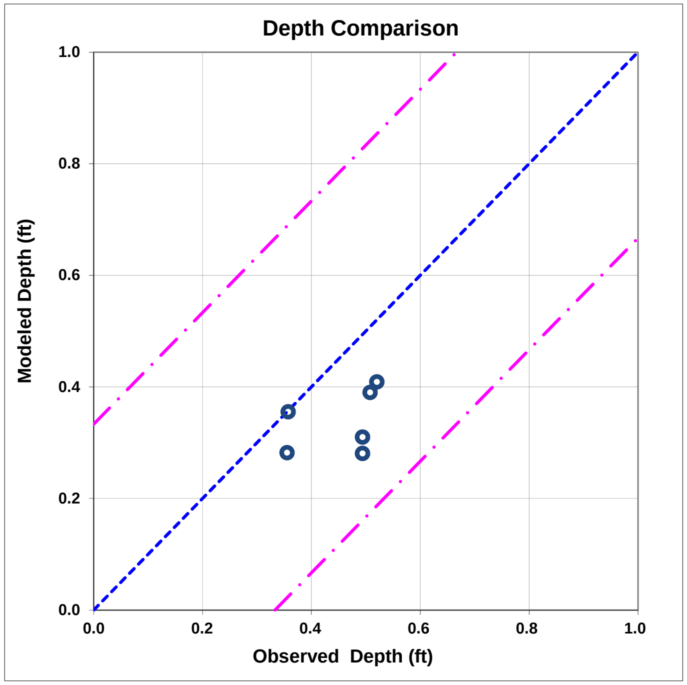




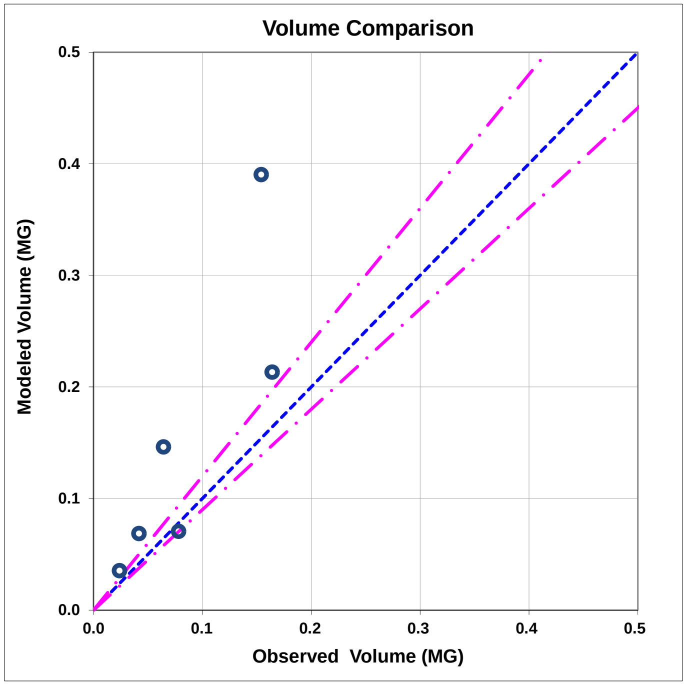
WWF Calibration Statistical Plots – Meter #B1

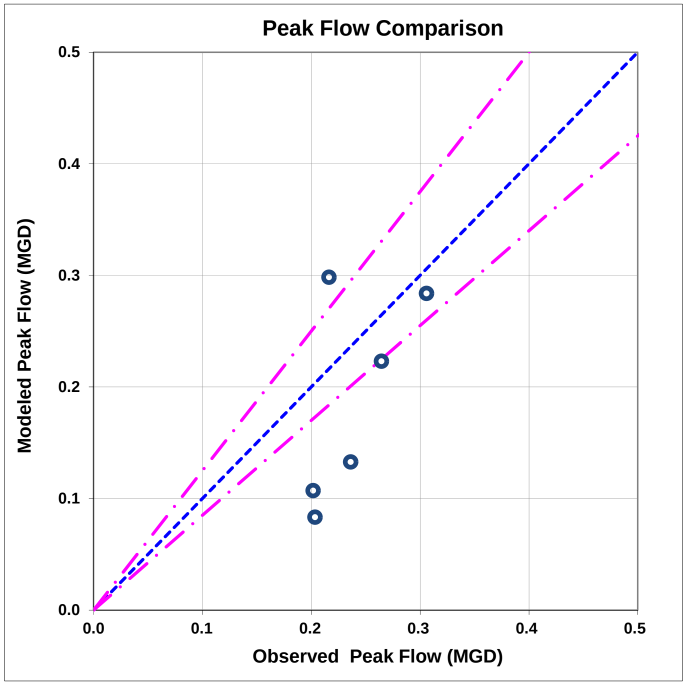


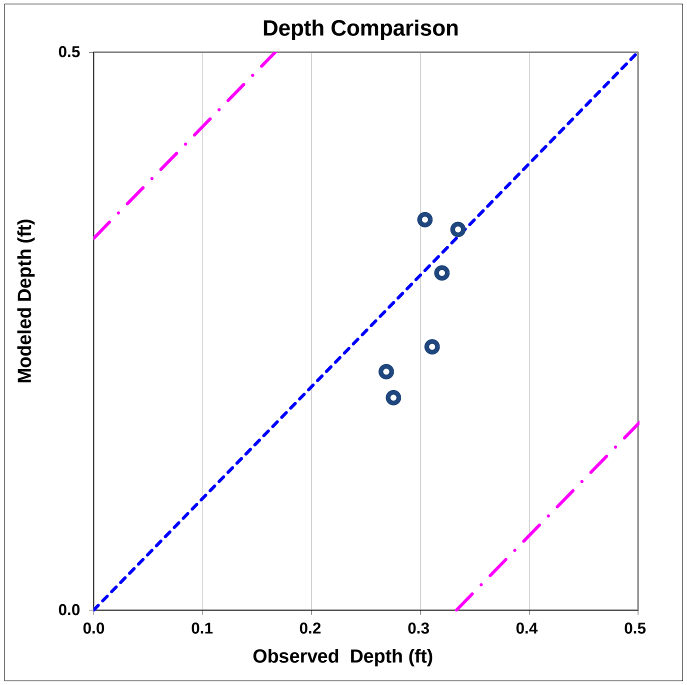




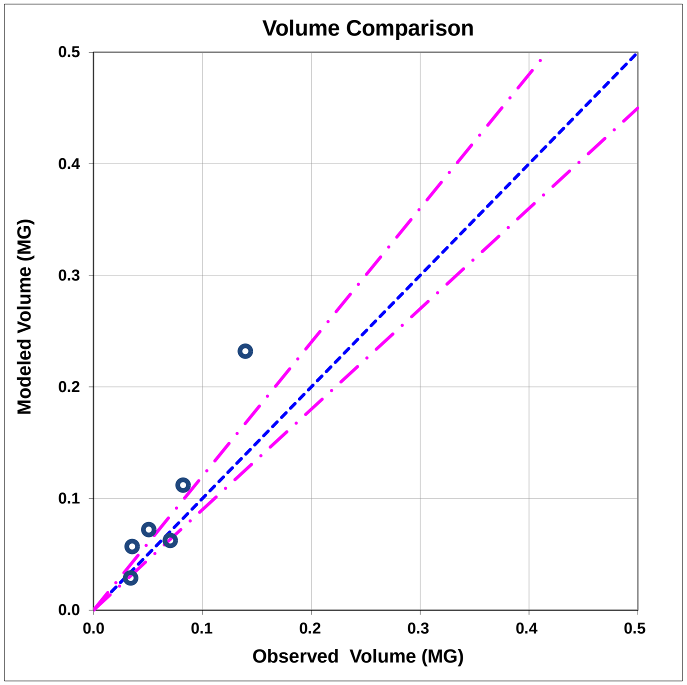
WWF Calibration Statistical Plots – Meter #M1

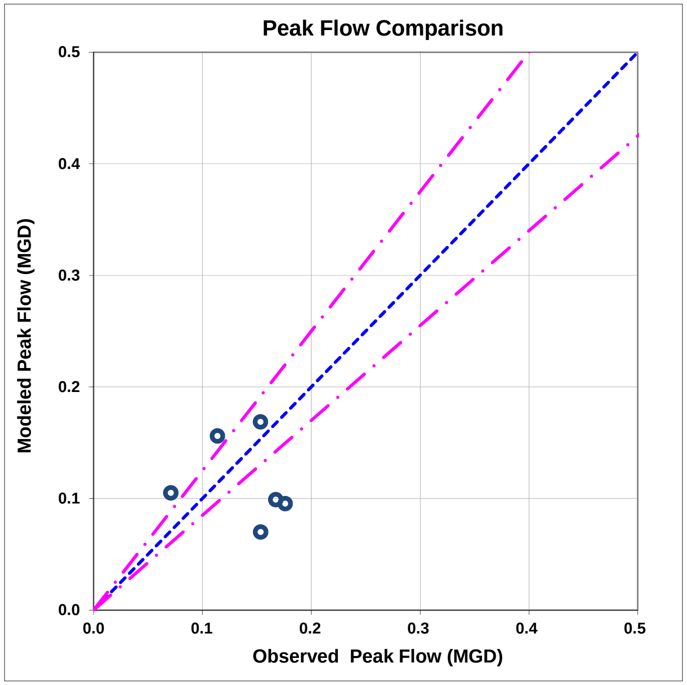


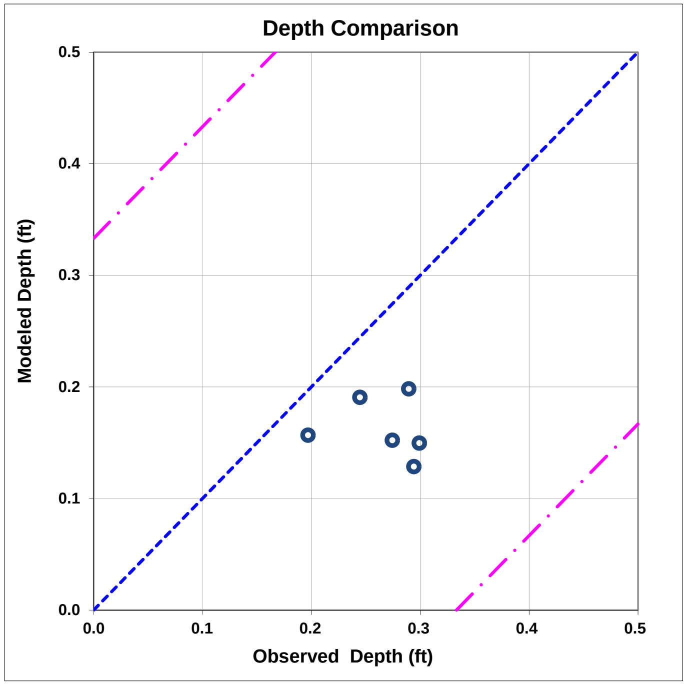




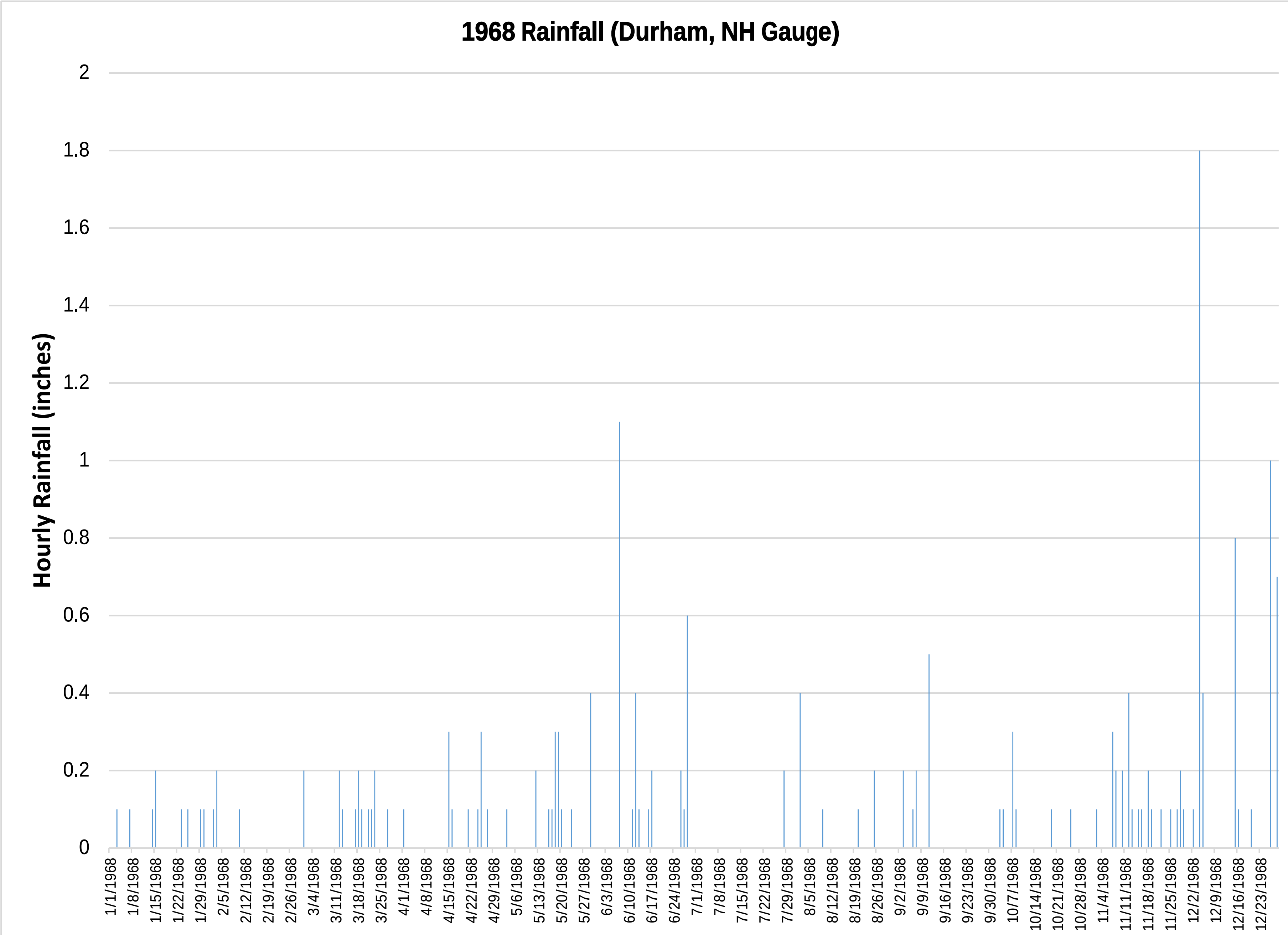
WWF Calibration Statistical Plots – Meter #P3

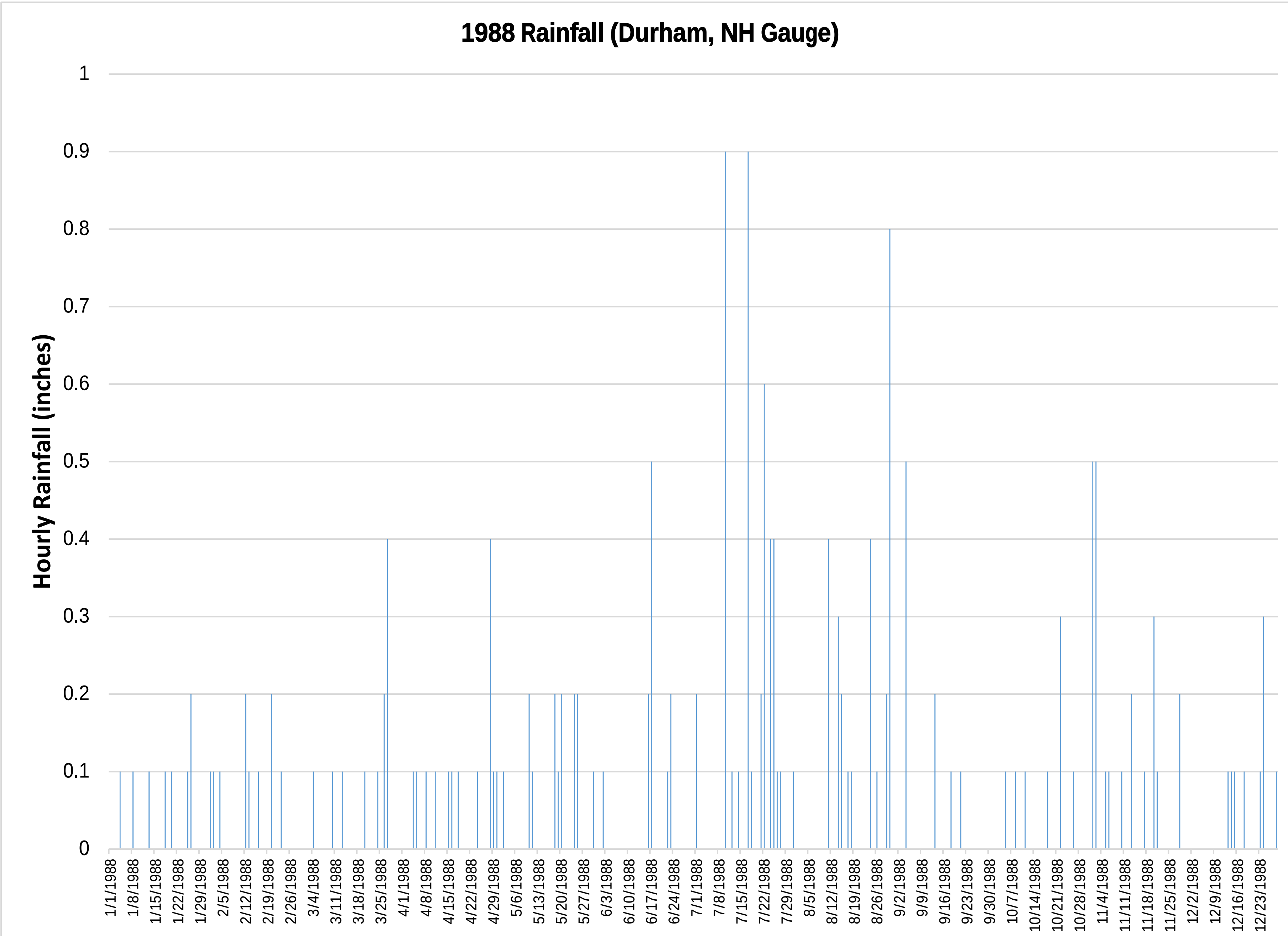


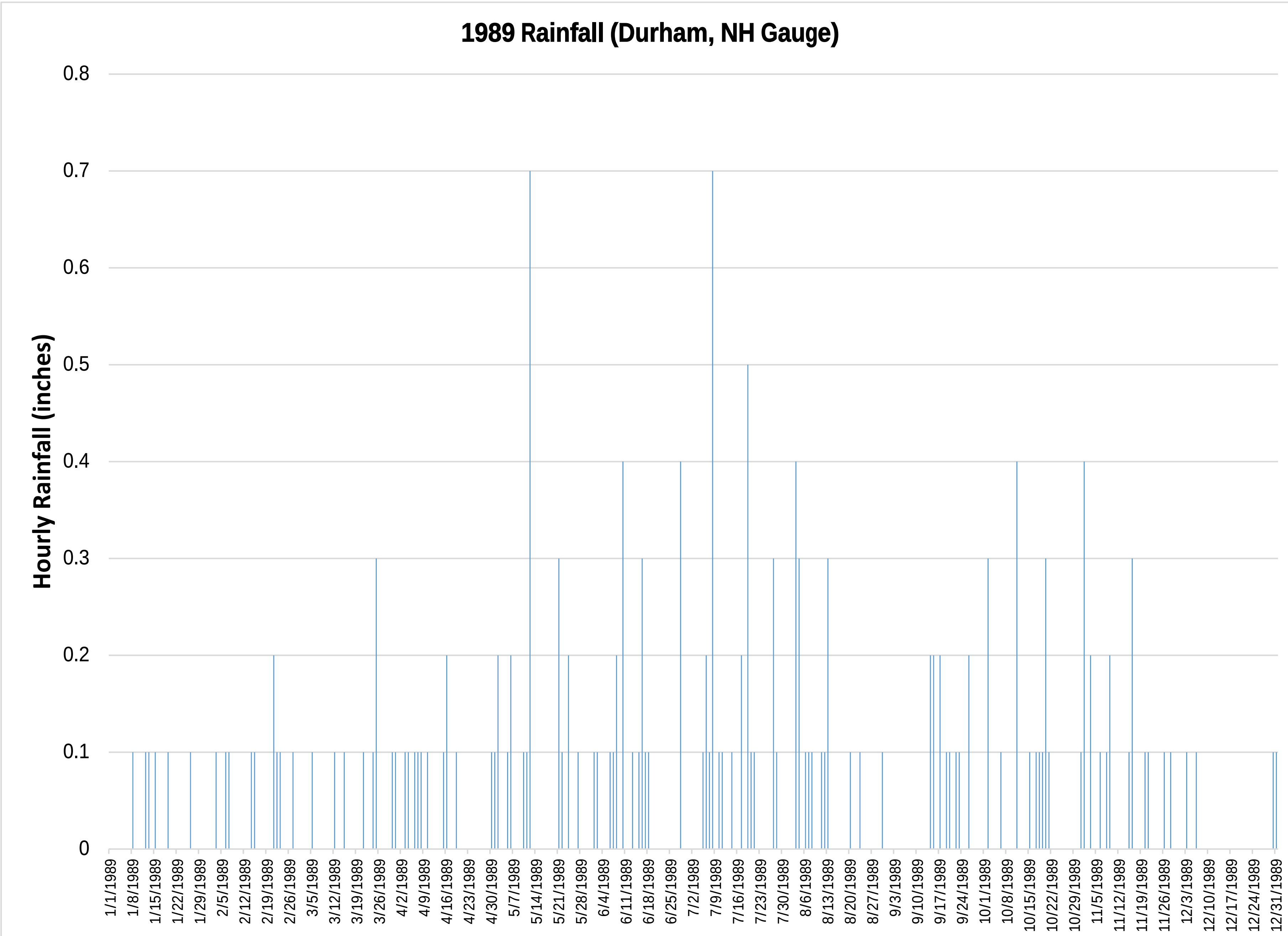


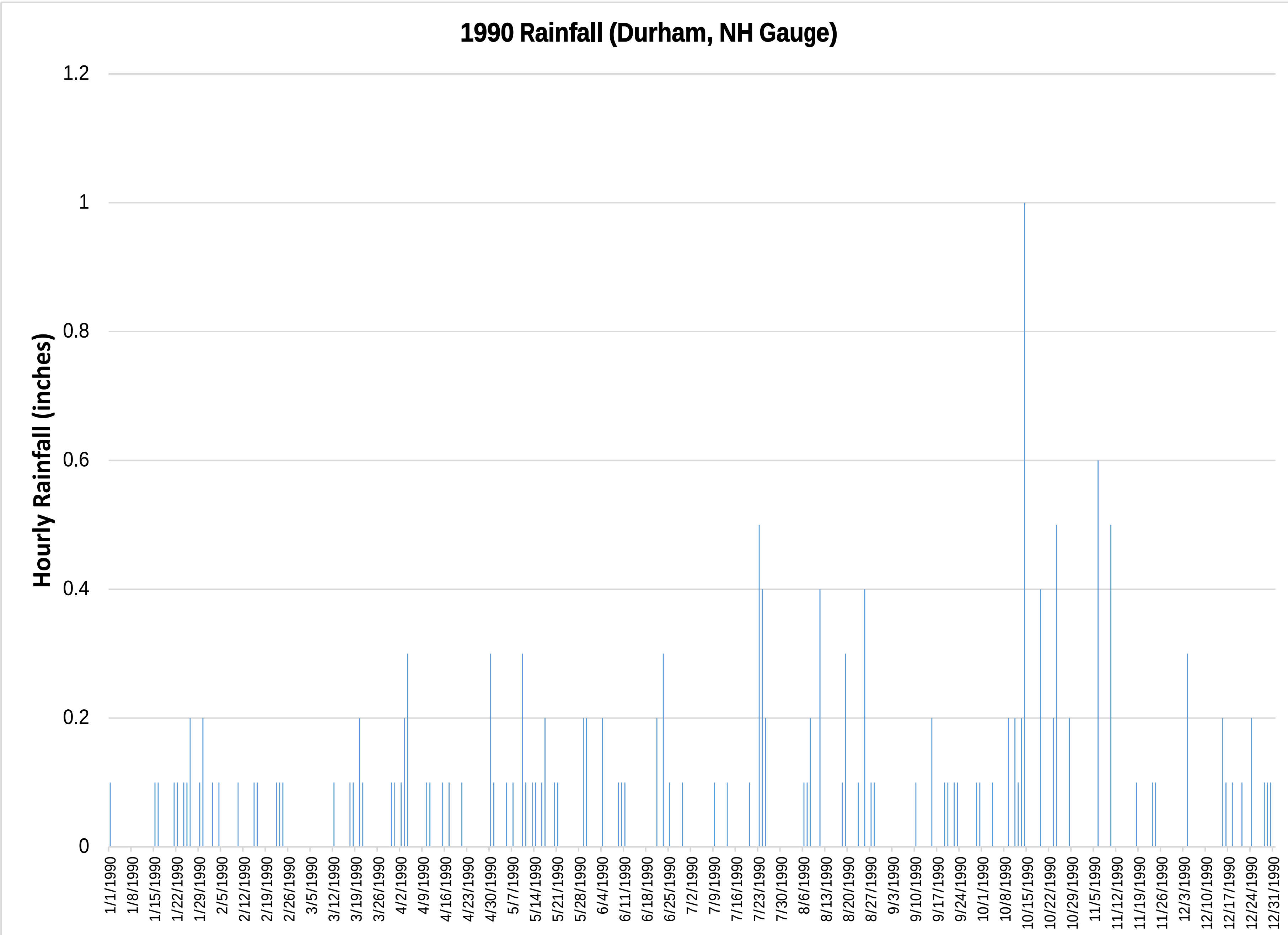


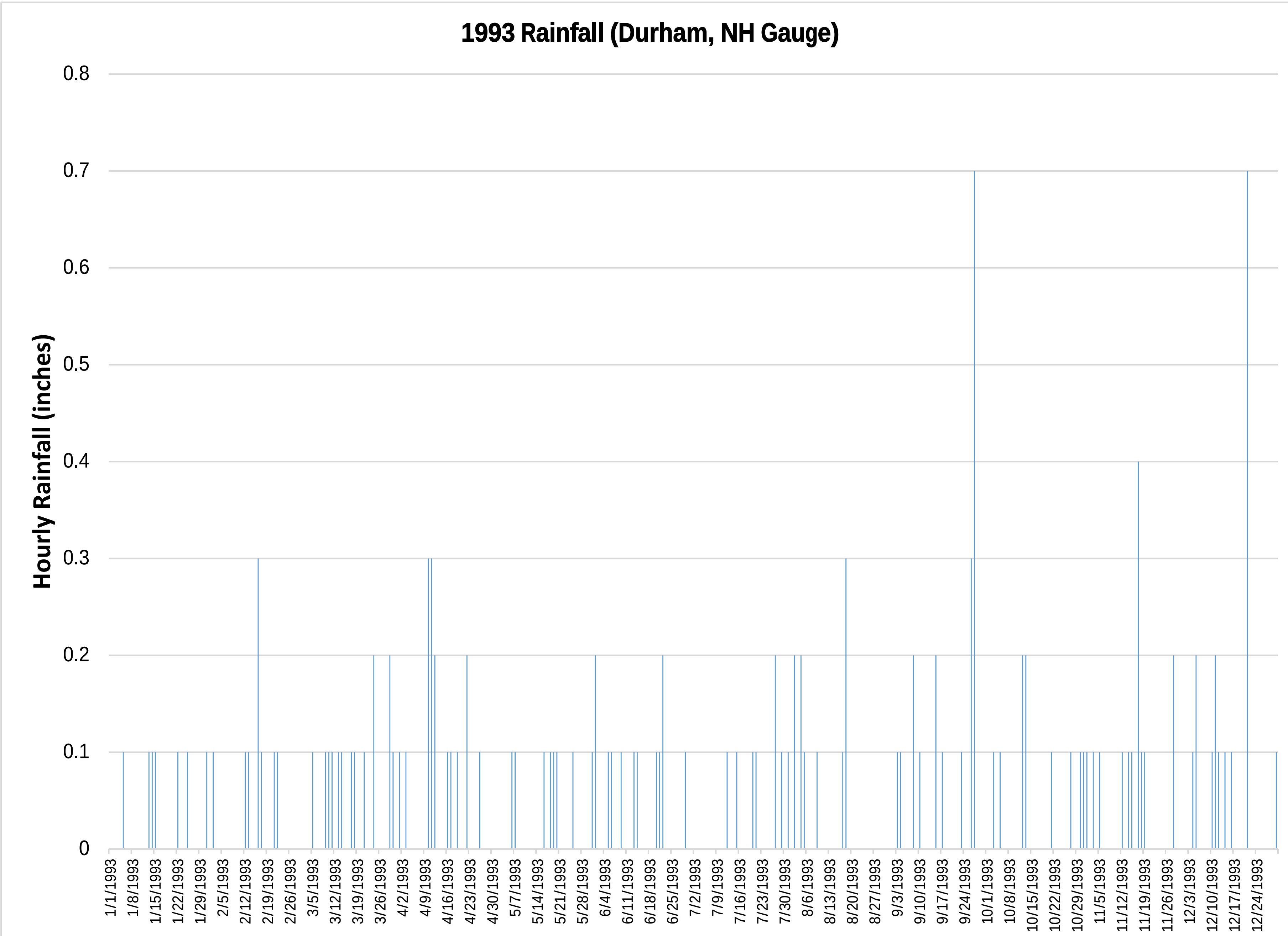
APPENDIX E – Average Annual Rainfall Data


1968 Rainfall (Durham, NH Gauge)
Hourly Rainfall (inches)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1/1/1968
1/8/1968
1/15/1968
1/22/1968
1/29/1968
2/5/1968
2/12/1968
2/19/1968
2/26/1968
3/4/1968
3/11/1968
3/18/1968
3/25/1968
4/1/1968
4/8/1968
4/15/1968
4/22/1968
4/29/1968
5/6/1968
5/13/1968
5/20/1968
5/27/1968
6/3/1968
6/10/1968
6/17/1968
6/24/1968
7/1/1968
7/8/1968
7/15/1968
7/22/1968
7/29/1968
8/5/1968
8/12/1968
8/19/1968
8/26/1968
9/2/1968
9/9/1968
9/16/1968
9/23/1968
9/30/1968
10/7/1968
10/14/1968
10/21/1968
10/28/1968
11/4/1968
11/11/1968
11/18/1968
11/25/1968
12/2/1968
12/9/1968
12/16/1968
12/23/1968


1988 Rainfall (Durham, NH Gauge)
Hourly Rainfall (inches)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/1/1988
1/8/1988
1/15/1988
1/22/1988
1/29/1988
2/5/1988
2/12/1988
2/19/1988
2/26/1988
3/4/1988
3/11/1988
3/18/1988
3/25/1988
4/1/1988
4/8/1988
4/15/1988
4/22/1988
4/29/1988
5/6/1988
5/13/1988
5/20/1988
5/27/1988
6/3/1988
6/10/1988
6/17/1988
6/24/1988
7/1/1988
7/8/1988
7/15/1988
7/22/1988
7/29/1988
8/5/1988
8/12/1988
8/19/1988
8/26/1988
9/2/1988
9/9/1988
9/16/1988
9/23/1988
9/30/1988
10/7/1988
10/14/1988
10/21/1988
10/28/1988
11/4/1988
11/11/1988
11/18/1988
11/25/1988
12/2/1988
12/9/1988
12/16/1988
12/23/1988


1989 Rainfall (Durham, NH Gauge)
Hourly Rainfall (inches)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/1/1989
1/8/1989
1/15/1989
1/22/1989
1/29/1989
2/5/1989
2/12/1989
2/19/1989
2/26/1989
3/5/1989
3/12/1989
3/19/1989
3/26/1989
4/2/1989
4/9/1989
4/16/1989
4/23/1989
4/30/1989
5/7/1989
5/14/1989
5/21/1989
5/28/1989
6/4/1989
6/11/1989
6/18/1989
6/25/1989
7/2/1989
7/9/1989
7/16/1989
7/23/1989
7/30/1989
8/6/1989
8/13/1989
8/20/1989
8/27/1989
9/3/1989
9/10/1989
9/17/1989
9/24/1989
10/1/1989
10/8/1989
10/15/1989
10/22/1989
10/29/1989
11/5/1989
11/12/1989
11/19/1989
11/26/1989
12/3/1989
12/10/1989
12/17/1989
12/24/1989
12/31/1989


1990 Rainfall (Durham, NH Gauge)
Hourly Rainfall (inches)
0
0.2
0.4
0.6
0.8
1
1.2
1/1/1990
1/8/1990
1/15/1990
1/22/1990
1/29/1990
2/5/1990
2/12/1990
2/19/1990
2/26/1990
3/5/1990
3/12/1990
3/19/1990
3/26/1990
4/2/1990
4/9/1990
4/16/1990
4/23/1990
4/30/1990
5/7/1990
5/14/1990
5/21/1990
5/28/1990
6/4/1990
6/11/1990
6/18/1990
6/25/1990
7/2/1990
7/9/1990
7/16/1990
7/23/1990
7/30/1990
8/6/1990
8/13/1990
8/20/1990
8/27/1990
9/3/1990
9/10/1990
9/17/1990
9/24/1990
10/1/1990
10/8/1990
10/15/1990
10/22/1990
10/29/1990
11/5/1990
11/12/1990
11/19/1990
11/26/1990
12/3/1990
12/10/1990
12/17/1990
12/24/1990
12/31/1990



1993 Rainfall (Durham, NH Gauge)
Hourly Rainfall (inches)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1/1/1993
1/8/1993
1/15/1993
1/22/1993
1/29/1993
2/5/1993
2/12/1993
2/19/1993
2/26/1993
3/5/1993
3/12/1993
3/19/1993
3/26/1993
4/2/1993
4/9/1993
4/16/1993
4/23/1993
4/30/1993
5/7/1993
5/14/1993
5/21/1993
5/28/1993
6/4/1993
6/11/1993
6/18/1993
6/25/1993
7/2/1993
7/9/1993
7/16/1993
7/23/1993
7/30/1993
8/6/1993
8/13/1993
8/20/1993
8/27/1993
9/3/1993
9/10/1993
9/17/1993
9/24/1993
10/1/1993
10/8/1993
10/15/1993
10/22/1993
10/29/1993
11/5/1993
11/12/1993
11/19/1993
11/26/1993
12/3/1993
12/10/1993
12/17/1993
12/24/1993

1968	
Date/Time	Rainfall (in.)
1/1/1968 0:00	0
1/1/1968 1:00	0
1/3/1968 13:00	0.1
1/3/1968 17:00	0.1
1/7/1968 1:00	0.1
1/7/1968 3:00	0.1
1/7/1968 4:00	0.1
1/7/1968 7:00	0.1
1/7/1968 10:00	0.1
1/14/1968 20:00	0.1
1/15/1968 0:00	0.1
1/15/1968 1:00	0.1
1/15/1968 2:00	0.2
1/15/1968 3:00	0.1
1/15/1968 4:00	0.1
1/15/1968 7:00	0.1
1/23/1968 17:00	0.1
1/25/1968 17:00	0.1
1/25/1968 18:00	0.1
1/25/1968 21:00	0.1
1/25/1968 23:00	0.1
1/29/1968 1:00	0.1
1/29/1968 11:00	0.1
1/30/1968 12:00	0.1
1/30/1968 13:00	0.1
1/30/1968 18:00	0.1
2/1/1968 1:00	0
2/2/1968 9:00	0.1
2/2/1968 15:00	0.1
2/3/1968 0:00	0.2
2/3/1968 1:00	0.1
2/3/1968 2:00	0.1
2/3/1968 3:00	0.1
2/3/1968 4:00	0.2
2/10/1968 13:00	0.1
2/10/1968 14:00	0.1
3/1/1968 1:00	0
3/1/1968 2:00	0.2
3/1/1968 3:00	0.2
3/12/1968 19:00	0.1
3/12/1968 21:00	0.1
3/12/1968 22:00	0.1
3/12/1968 23:00	0.2
3/13/1968 0:00	0.1
3/13/1968 4:00	0.1
3/13/1968 10:00	0.1
3/13/1968 14:00	0.1
3/13/1968 19:00	0.1
3/13/1968 22:00	0.1
3/17/1968 16:00	0.1
3/17/1968 17:00	0.1
3/17/1968 18:00	0.1
3/17/1968 19:00	0.1
3/17/1968 20:00	0.1
3/17/1968 21:00	0.1
3/17/1968 22:00	0.1
3/17/1968 23:00	0.1
3/18/1968 0:00	0.1
3/18/1968 1:00	0.2
3/18/1968 2:00	0.1
3/18/1968 3:00	0.1
3/18/1968 4:00	0.1
3/18/1968 10:00	0.1
3/18/1968 11:00	0.1
3/18/1968 12:00	0.1
3/18/1968 13:00	0.1
3/18/1968 14:00	0.2
3/18/1968 15:00	0.1
3/18/1968 16:00	0.1
3/18/1968 17:00	0.1
3/18/1968 18:00	0.1
3/18/1968 19:00	0.1
3/18/1968 20:00	0.1
3/19/1968 0:00	0.1
3/19/1968 1:00	0.1
3/19/1968 6:00	0.1
3/21/1968 16:00	0.1
3/22/1968 4:00	0.1
3/23/1968 14:00	0.1
3/23/1968 17:00	0.2
3/23/1968 19:00	0.1
3/27/1968 11:00	0.1
4/1/1968 1:00	0
4/1/1968 4:00	0.1
4/1/1968 5:00	0.1

1988	
Date/Time	Rainfall (in.)
1/1/1988 1:00	0
1/4/1988 6:00	0.1
1/4/1988 15:00	0.1
1/8/1988 22:00	0.1
1/13/1988 10:00	0.1
1/18/1988 9:00	0.1
1/18/1988 12:00	0.1
1/18/1988 14:00	0.1
1/18/1988 15:00	0.1
1/20/1988 16:00	0.1
1/20/1988 19:00	0.1
1/25/1988 19:00	0.1
1/25/1988 22:00	0.1
1/26/1988 0:00	0.2
1/26/1988 2:00	0.1
1/26/1988 5:00	0.1
1/26/1988 11:00	0.1
1/26/1988 12:00	0.1
2/1/1988 1:00	0
2/1/1988 21:00	0.1
2/2/1988 2:00	0.1
2/2/1988 10:00	0.1
2/2/1988 16:00	0.1
2/2/1988 18:00	0.1
2/4/1988 10:00	0.1
2/4/1988 12:00	0.1
2/4/1988 14:00	0.1
2/12/1988 9:00	0.1
2/12/1988 11:00	0.1
2/12/1988 12:00	0.1
2/12/1988 14:00	0.2
2/12/1988 15:00	0.1
2/12/1988 16:00	0.1
2/13/1988 3:00	0.1
2/16/1988 3:00	0.1
2/20/1988 0:00	0.1
2/20/1988 2:00	0.1
2/20/1988 3:00	0.2
2/20/1988 4:00	0.1
2/20/1988 5:00	0.2
2/20/1988 6:00	0.1
2/23/1988 16:00	0.1
3/1/1988 1:00	0
3/4/1988 6:00	0.1
3/4/1988 14:00	0.1
3/10/1988 0:00	0.1
3/13/1988 10:00	0.1
3/20/1988 10:00	0.1
3/24/1988 21:00	0.1
3/26/1988 13:00	0.2
3/26/1988 15:00	0.1
3/26/1988 17:00	0.1
3/26/1988 20:00	0.1
3/26/1988 23:00	0.1
3/27/1988 0:00	0.1
3/27/1988 1:00	0.3
3/27/1988 2:00	0.2
3/27/1988 3:00	0.4
3/27/1988 4:00	0.1
4/1/1988 1:00	0
4/4/1988 9:00	0.1
4/4/1988 21:00	0.1
4/5/1988 15:00	0.1
4/8/1988 8:00	0.1
4/11/1988 6:00	0.1
4/15/1988 12:00	0.1
4/15/1988 23:00	0.1
4/16/1988 1:00	0.1
4/16/1988 6:00	0.1
4/16/1988 8:00	0.1
4/18/1988 9:00	0.1
4/18/1988 16:00	0.1
4/24/1988 5:00	0.1
4/24/1988 6:00	0.1
4/24/1988 10:00	0.1
4/28/1988 13:00	0.1
4/28/1988 14:00	0.1
4/28/1988 15:00	0.3
4/28/1988 16:00	0.2
4/28/1988 17:00	0.4
4/28/1988 18:00	0.4
4/28/1988 19:00	0.2
4/28/1988 20:00	0.1
4/28/1988 21:00	0.4
4/28/1988 22:00	0.1

1989	
Date/Time	Rainfall (in.)
1/1/1989 1:00	0
1/8/1989 15:00	0.1
1/12/1989 19:00	0.1
1/13/1989 7:00	0.1
1/15/1989 5:00	0.1
1/15/1989 7:00	0.1
1/19/1989 12:00	0.1
1/26/1989 10:00	0.1
1/26/1989 11:00	0.1
1/26/1989 17:00	0.1
2/1/1989 1:00	0
2/3/1989 7:00	0.1
2/3/1989 10:00	0.1
2/3/1989 15:00	0.1
2/6/1989 13:00	0.1
2/7/1989 16:00	0.1
2/14/1989 7:00	0.1
2/14/1989 11:00	0.1
2/15/1989 12:00	0.1
2/15/1989 14:00	0.1
2/15/1989 17:00	0.1
2/21/1989 5:00	0.1
2/21/1989 6:00	0.1
2/21/1989 7:00	0.1
2/21/1989 9:00	0.1
2/21/1989 10:00	0.1
2/21/1989 11:00	0.1
2/21/1989 12:00	0.2
2/21/1989 14:00	0.1
2/21/1989 17:00	0.1
2/21/1989 19:00	0.1
2/22/1989 12:00	0.1
2/22/1989 15:00	0.1
2/23/1989 1:00	0.1
2/24/1989 18:00	0
2/25/1989 17:00	0
2/27/1989 2:00	0.1
3/1/1989 1:00	0
3/5/1989 17:00	0.1
3/12/1989 12:00	0.1
3/15/1989 6:00	0.1
3/21/1989 2:00	0.1
3/21/1989 3:00	0.1
3/21/1989 6:00	0.1
3/24/1989 22:00	0.1
3/25/1989 1:00	0.1
3/25/1989 4:00	0.1
3/25/1989 5:00	0.1
3/25/1989 6:00	0.1
3/25/1989 7:00	0.3
3/25/1989 8:00	0.1
3/25/1989 18:00	0.1
3/30/1989 10:00	0.1
3/30/1989 12:00	0.1
3/30/1989 13:00	0.1
3/30/1989 15:00	0.1
3/30/1989 16:00	0.1
3/30/1989 17:00	0.1
3/31/1989 12:00	0.1
3/31/1989 22:00	0.1
4/1/1989 1:00	0
4/3/1989 12:00	0.1
4/3/1989 15:00	0.1
4/4/1989 14:00	0.1
4/6/1989 1:00	0.1
4/6/1989 2:00	0.1
4/6/1989 8:00	0.1
4/6/1989 10:00	0.1
4/6/1989 11:00	0.1
4/6/1989 12:00	0.1
4/6/1989 14:00	0.1
4/7/1989 0:00	0.1
4/8/1989 4:00	0.1
4/8/1989 6:00	0.1
4/8/1989 9:00	0.1
4/10/1989 16:00	0.1
4/15/1989 18:00	0.1
4/15/1989 21:00	0.1
4/15/1989 22:00	0.1
4/15/1989 23:00	0.1
4/16/1989 0:00	0.1
4/16/1989 1:00	0.1
4/16/1989 2:00	0.1
4/16/1989 3:00	0.1
4/16/1989 5:00	0.2

1990	
Date/Time	Rainfall (in.)
1/1/1990 1:00	0
1/1/1990 7:00	0.1
1/15/1990 11:00	0.1
1/16/1990 11:00	0.1
1/21/1990 9:00	0.1
1/21/1990 12:00	0.1
1/22/1990 8:00	0.1
1/22/1990 12:00	0.1
1/24/1990 8:00	0.1
1/25/1990 15:00	0.1
1/25/1990 16:00	0.1
1/25/1990 17:00	0.1
1/25/1990 18:00	0.1
1/25/1990 19:00	0.1
1/26/1990 7:00	0.1
1/26/1990 9:00	0.1
1/26/1990 11:00	0.2
1/26/1990 12:00	0.1
1/26/1990 13:00	0.1
1/26/1990 16:00	0.1
1/29/1990 13:00	0.1
1/29/1990 14:00	0.1
1/29/1990 17:00	0.1
1/29/1990 21:00	0.1
1/29/1990 22:00	0.1
1/29/1990 23:00	0.1
1/30/1990 0:00	0.2
1/30/1990 1:00	0.2
1/30/1990 2:00	0.1
1/30/1990 3:00	0.2
1/30/1990 4:00	0.1
1/30/1990 5:00	0.1
1/30/1990 7:00	0.1
1/30/1990 10:00	0.1
2/1/1990 1:00	0
2/2/1990 11:00	0.1
2/2/1990 12:00	0.1
2/2/1990 13:00	0.1
2/2/1990 14:00	0.1
2/2/1990 15:00	0.1
2/2/1990 16:00	0.1
2/2/1990 19:00	0.1
2/4/1990 2:00	0.1
2/4/1990 5:00	0.1
2/4/1990 7:00	0.1
2/4/1990 10:00	0.1
2/4/1990 14:00	0.1
2/10/1990 8:00	0.1
2/15/1990 12:00	0.1
2/15/1990 16:00	0.1
2/15/1990 18:00	0.1
2/15/1990 22:00	0.1
2/16/1990 1:00	0.1
2/16/1990 3:00	0.1
2/22/1990 20:00	0.1
2/23/1990 2:00	0.1
2/23/1990 20:00	0.1
2/23/1990 23:00	0.1
2/24/1990 0:00	0.1
2/24/1990 1:00	0.1
2/24/1990 4:00	0.1
2/24/1990 14:00	0.1
3/1/1990 1:00	0
3/12/1990 12:00	0.1
3/17/1990 23:00	0.1
3/18/1990 5:00	0.1
3/18/1990 7:00	0.1
3/20/1990 4:00	0.2
3/20/1990 17:00	0.1
3/20/1990 18:00	0.1
3/20/1990 21:00	0.1
3/21/1990 7:00	0.1
3/21/1990 13:00	0.1
3/30/1990 19:00	0.1
3/30/1990 22:00	0.1
3/31/1990 1:00	0.1
4/1/1990 1:00	0
4/2/1990 3:00	0.1
4/2/1990 6:00	0.1
4/3/1990 15:00	0.1
4/3/1990 16:00	0.1
4/3/1990 17:00	0.1
4/3/1990 18:00	0.1
4/3/1990 19:00	0.2
4/3/1990 20:00	0.2

1990	
Date/Time	Rainfall (in.)
1/1/1993 1:00	0
1/5/1993 7:00	0.1
1/5/1993 8:00	0.1
1/5/1993 9:00	0.1
1/5/1993 12:00	0.1
1/13/1993 9:00	0.1
1/13/1993 21:00	0.1
1/14/1993 1:00	0.1
1/15/1993 11:00	0.1
1/22/1993 9:00	0.1
1/22/1993 10:00	0.1
1/22/1993 12:00	0.1
1/22/1993 13:00	0.1
1/22/1993 15:00	0.1
1/25/1993 0:00	0.1
1/25/1993 1:00	0.1
1/31/1993 8:00	0.1
1/31/1993 16:00	0.1
2/1/1993 1:00	0
2/1/1993 18:00	0
2/2/1993 17:00	0.1
2/12/1993 19:00	0.1
2/12/1993 22:00	0.1
2/13/1993 0:00	0.1
2/13/1993 3:00	0.1
2/13/1993 4:00	0.1
2/13/1993 12:00	0.1
2/13/1993 16:00	0.1
2/16/1993 14:00	0.1
2/16/1993 16:00	0.1
2/16/1993 17:00	0.1
2/16/1993 18:00	0.1
2/16/1993 20:00	0.1
2/16/1993 21:00	0.3
2/16/1993 22:00	0.3
2/16/1993 23:00	0.1
2/17/1993 6:00	0.1
2/21/1993 22:00	0.1
2/21/1993 23:00	0.1
2/22/1993 1:00	0.1
2/22/1993 4:00	0.1
2/22/1993 7:00	0.1
3/1/1993 1:00	0
3/5/1993 8:00	0.1
3/9/1993 1:00	0.1
3/9/1993 11:00	0.1
3/10/1993 9:00	0.1
3/11/1993 2:00	0.1
3/11/1993 13:00	0.1
3/13/1993 16:00	0.1
3/13/1993 17:00	0.1
3/13/1993 18:00	0.1
3/13/1993 19:00	0.1
3/13/1993 20:00	0.1
3/13/1993 21:00	0.1
3/13/1993 22:00	0.1
3/14/1993 6:00	0.1
3/17/1993 18:00	0.1
3/17/1993 19:00	0.1
3/17/1993 22:00	0.1
3/18/1993 1:00	0.1
3/21/1993 9:00	0.1
3/21/1993 12:00	0.1
3/24/1993 3:00	0.1
3/24/1993 4:00	0.1
3/24/1993 5:00	0.1
3/24/1993 6:00	0.1
3/24/1993 7:00	0.1
3/24/1993 9:00	0.2
3/24/1993 11:00	0.1
3/24/1993 12:00	0.1
3/24/1993 14:00	0.1
3/29/1993 12:00	0.1
3/29/1993 14:00	0.1
3/29/1993 15:00	0.1
3/29/1993 16:00	0.1
3/29/1993 17:00	0.2
3/29/1993 18:00	0.1
3/29/1993 19:00	0.2
3/29/1993 20:00	0.1
3/29/1993 22:00	0.1
3/30/1993 0:00	0.1
3/30/1993 2:00	0.1
3/30/1993 4:00	0.1
3/30/1993 7:00	0.1

1968	
Date/Time	Rainfall (in.)
4/15/1968 9:00	0.1
4/15/1968 11:00	0.1
4/15/1968 13:00	0.1
4/15/1968 17:00	0.1
4/15/1968 18:00	0.3
4/15/1968 19:00	0.1
4/15/1968 20:00	0.1
4/15/1968 23:00	0.1
4/16/1968 1:00	0.1
4/21/1968 19:00	0.1
4/24/1968 8:00	0.1
4/24/1968 15:00	0.1
4/24/1968 16:00	0.1
4/24/1968 22:00	0.1
4/24/1968 23:00	0.1
4/25/1968 0:00	0.2
4/25/1968 1:00	0.1
4/25/1968 2:00	0.3
4/25/1968 3:00	0.3
4/25/1968 4:00	0.1
4/27/1968 13:00	0.1
5/1/1968 1:00	0
5/3/1968 21:00	0.1
5/12/1968 2:00	0.1
5/12/1968 4:00	0.1
5/12/1968 5:00	0.1
5/12/1968 10:00	0.1
5/12/1968 14:00	0.2
5/16/1968 21:00	0.1
5/16/1968 23:00	0.1
5/17/1968 1:00	0.1
5/17/1968 2:00	0.1
5/18/1968 18:00	0.1
5/18/1968 20:00	0.1
5/18/1968 21:00	0.1
5/18/1968 22:00	0.1
5/18/1968 23:00	0.3
5/19/1968 0:00	0.3
5/19/1968 2:00	0.1
5/20/1968 3:00	0.1
5/20/1968 4:00	0.1
5/20/1968 8:00	0.1
5/20/1968 9:00	0.1
5/20/1968 10:00	0.1
5/20/1968 11:00	0.1
5/23/1968 9:00	0.1
5/29/1968 12:00	0.1
5/29/1968 13:00	0.1
5/29/1968 14:00	0.4
5/29/1968 15:00	0.1
5/29/1968 16:00	0.1
5/29/1968 17:00	0.1
5/29/1968 18:00	0.1
5/29/1968 19:00	0.3
5/29/1968 20:00	0.1
6/1/1968 1:00	0
6/7/1968 8:00	0
6/7/1968 20:00	1.1
6/11/1968 19:00	0.1
6/12/1968 13:00	0.4
6/12/1968 14:00	0.1
6/13/1968 2:00	0.1
6/13/1968 14:00	0.1
6/16/1968 22:00	0.1
6/16/1968 23:00	0.1
6/17/1968 0:00	0.1
6/17/1968 2:00	0.2
6/17/1968 3:00	0.1
6/17/1968 7:00	0.1
6/17/1968 15:00	0.1
6/26/1968 5:00	0.1
6/26/1968 6:00	0.2
6/26/1968 7:00	0.1
6/26/1968 8:00	0.1
6/26/1968 10:00	0.2
6/26/1968 13:00	0.1
6/26/1968 15:00	0.1
6/27/1968 14:00	0.1
6/28/1968 4:00	0.2
6/28/1968 5:00	0.1
6/28/1968 8:00	0.1
6/28/1968 13:00	0.1
6/28/1968 18:00	0.1
6/28/1968 19:00	0.6
6/28/1968 20:00	0.3

1988	
Date/Time	Rainfall (in.)
4/28/1988 23:00	0.1
4/29/1988 2:00	0.1
4/29/1988 3:00	0.1
4/30/1988 16:00	0.1
5/1/1988 1:00	0
5/2/1988 7:00	0.1
5/2/1988 22:00	0.1
5/10/1988 8:00	0.1
5/10/1988 19:00	0.2
5/10/1988 20:00	0.1
5/11/1988 11:00	0.1
5/11/1988 12:00	0.1
5/11/1988 14:00	0.1
5/11/1988 16:00	0.1
5/18/1988 7:00	0.1
5/18/1988 9:00	0.2
5/18/1988 13:00	0.1
5/19/1988 1:00	0.1
5/19/1988 9:00	0.1
5/19/1988 14:00	0.1
5/19/1988 22:00	0.1
5/20/1988 0:00	0.1
5/20/1988 2:00	0.2
5/20/1988 3:00	0.1
5/20/1988 5:00	0.1
5/20/1988 7:00	0.1
5/20/1988 8:00	0.1
5/20/1988 10:00	0.1
5/24/1988 14:00	0.2
5/24/1988 15:00	0.2
5/24/1988 16:00	0.1
5/24/1988 19:00	0.1
5/25/1988 11:00	0.2
5/25/1988 13:00	0.1
5/25/1988 22:00	0.1
5/30/1988 13:00	0.1
5/30/1988 22:00	0.1
5/30/1988 23:00	0.1
6/1/1988 1:00	0
6/2/1988 17:00	0.1
6/5/1988 18:00	0
6/6/1988 17:00	0
6/16/1988 15:00	0.2
6/17/1988 9:00	0.2
6/17/1988 10:00	0.5
6/17/1988 11:00	0.1
6/17/1988 12:00	0.1
6/17/1988 15:00	0.1
6/22/1988 23:00	0.1
6/23/1988 0:00	0.2
6/23/1988 1:00	0.2
6/23/1988 2:00	0.1
6/23/1988 7:00	0.1
7/1/1988 1:00	0
7/1/1988 22:00	0.2
7/10/1988 2:00	0.1
7/10/1988 18:00	0.9
7/12/1988 18:00	0.1
7/14/1988 23:00	0.1
7/17/1988 10:00	0.1
7/17/1988 18:00	0.6
7/17/1988 19:00	0.9
7/17/1988 20:00	0.3
7/17/1988 21:00	0.1
7/18/1988 1:00	0.1
7/21/1988 5:00	0.2
7/21/1988 6:00	0.1
7/21/1988 10:00	0.1
7/21/1988 13:00	0.1
7/21/1988 15:00	0.1
7/21/1988 16:00	0.2
7/21/1988 20:00	0.1
7/21/1988 21:00	0.1
7/21/1988 22:00	0.2
7/21/1988 23:00	0.1
7/22/1988 0:00	0.1
7/22/1988 1:00	0.6
7/22/1988 2:00	0.2
7/22/1988 4:00	0.1
7/22/1988 5:00	0.2
7/22/1988 6:00	0.1
7/22/1988 8:00	0.1
7/24/1988 5:00	0.1
7/24/1988 6:00	0.1
7/24/1988 7:00	0.3

1989	
Date/Time	Rainfall (in.)
4/16/1989 7:00	0.1
4/16/1989 10:00	0.1
4/16/1989 14:00	0.1
4/16/1989 20:00	0.1
4/19/1989 3:00	0.1
4/19/1989 7:00	0.1
4/30/1989 2:00	0.1
4/30/1989 3:00	0.1
4/30/1989 4:00	0.1
5/1/1989 1:00	0
5/1/1989 23:00	0.1
5/2/1989 1:00	0.1
5/2/1989 3:00	0.1
5/2/1989 4:00	0.1
5/2/1989 5:00	0.2
5/2/1989 6:00	0.1
5/2/1989 7:00	0.1
5/2/1989 8:00	0.1
5/2/1989 9:00	0.2
5/2/1989 10:00	0.2
5/2/1989 11:00	0.1
5/2/1989 12:00	0.2
5/2/1989 13:00	0.1
5/5/1989 20:00	0.1
5/6/1989 2:00	0.2
5/6/1989 3:00	0.2
5/6/1989 4:00	0.1
5/6/1989 6:00	0.1
5/10/1989 21:00	0.1
5/11/1989 4:00	0.1
5/11/1989 5:00	0.1
5/11/1989 7:00	0.1
5/11/1989 8:00	0.1
5/11/1989 10:00	0.1
5/11/1989 11:00	0.1
5/11/1989 12:00	0.1
5/11/1989 13:00	0.1
5/11/1989 21:00	0.1
5/11/1989 22:00	0.1
5/12/1989 0:00	0.1
5/12/1989 1:00	0.7
5/12/1989 2:00	0.1
5/12/1989 5:00	0.1
5/21/1989 17:00	0.3
5/22/1989 7:00	0.1
5/24/1989 9:00	0.2
5/24/1989 11:00	0.1
5/24/1989 22:00	0.1
5/27/1989 15:00	0.1
6/1/1989 1:00	0
6/1/1989 13:00	0.1
6/2/1989 16:00	0.1
6/6/1989 9:00	0.1
6/6/1989 10:00	0.1
6/6/1989 11:00	0.1
6/6/1989 12:00	0.1
6/6/1989 13:00	0.1
6/7/1989 22:00	0.1
6/8/1989 1:00	0.1
6/8/1989 7:00	0.1
6/8/1989 8:00	0.2
6/8/1989 9:00	0.1
6/8/1989 10:00	0.1
6/8/1989 14:00	0.1
6/10/1989 1:00	0.1
6/10/1989 3:00	0.1
6/10/1989 4:00	0.3
6/10/1989 5:00	0.4
6/10/1989 6:00	0.1
6/10/1989 7:00	0.2
6/10/1989 8:00	0.1
6/13/1989 14:00	0.1
6/15/1989 10:00	0.1
6/15/1989 11:00	0.1
6/15/1989 17:00	0.1
6/15/1989 19:00	0.1
6/15/1989 20:00	0.1
6/15/1989 21:00	0.1
6/15/1989 23:00	0.1
6/16/1989 1:00	0.3
6/17/1989 3:00	0.1
6/18/1989 4:00	0.1
6/28/1989 11:00	0.4
7/1/1989 1:00	0
7/5/1989 11:00	0.1

1990	
Date/Time	Rainfall (in.)
4/3/1990 21:00	0.1
4/3/1990 22:00	0.1
4/3/1990 23:00	0.1
4/4/1990 0:00	0.1
4/4/1990 1:00	0.1
4/4/1990 2:00	0.1
4/4/1990 3:00	0.3
4/4/1990 4:00	0.1
4/4/1990 5:00	0.1
4/4/1990 8:00	0.1
4/10/1990 15:00	0.1
4/10/1990 19:00	0.1
4/10/1990 22:00	0.1
4/11/1990 0:00	0.1
4/11/1990 2:00	0.1
4/11/1990 7:00	0.1
4/15/1990 7:00	0.1
4/15/1990 8:00	0.1
4/15/1990 9:00	0.1
4/15/1990 10:00	0.1
4/15/1990 11:00	0.1
4/15/1990 12:00	0.1
4/15/1990 13:00	0.1
4/15/1990 14:00	0.1
4/15/1990 16:00	0.1
4/17/1990 11:00	0.1
4/17/1990 18:00	0.1
4/21/1990 8:00	0.1
4/21/1990 10:00	0.1
4/21/1990 18:00	0.1
4/30/1990 13:00	0.3
4/30/1990 14:00	0.2
5/1/1990 0:00	0.1
5/1/1990 1:00	0
5/1/1990 2:00	0.1
5/1/1990 7:00	0.1
5/5/1990 2:00	0.1
5/5/1990 5:00	0.1
5/5/1990 8:00	0.1
5/5/1990 10:00	0.1
5/5/1990 11:00	0.1
5/7/1990 4:00	0.1
5/7/1990 9:00	0.1
5/7/1990 15:00	0.1
5/7/1990 23:00	0.1
5/10/1990 11:00	0.1
5/10/1990 21:00	0.2
5/10/1990 22:00	0.2
5/10/1990 23:00	0.3
5/11/1990 0:00	0.1
5/13/1990 3:00	0.1
5/13/1990 6:00	0.1
5/13/1990 7:00	0.1
5/13/1990 8:00	0.1
5/13/1990 9:00	0.1
5/13/1990 10:00	0.1
5/13/1990 11:00	0.1
5/13/1990 18:00	0.1
5/14/1990 9:00	0.1
5/16/1990 20:00	0.1
5/17/1990 1:00	0.1
5/17/1990 16:00	0.1
5/17/1990 17:00	0.2
5/17/1990 18:00	0.1
5/17/1990 19:00	0.2
5/17/1990 20:00	0.1
5/20/1990 19:00	0.1
5/20/1990 21:00	0.1
5/21/1990 6:00	0.1
5/21/1990 9:00	0.1
5/21/1990 10:00	0.1
5/21/1990 22:00	0.1
5/29/1990 15:00	0.1
5/29/1990 18:00	0.1
5/29/1990 20:00	0.1
5/29/1990 22:00	0.1
5/29/1990 23:00	0.2
5/30/1990 0:00	0.2
5/30/1990 1:00	0.2
5/30/1990 2:00	0.1
5/30/1990 3:00	0.1
5/30/1990 5:00	0.1
6/1/1990 1:00	0
6/4/1990 2:00	0.2
6/4/1990 12:00	0.1

1990	
Date/Time	Rainfall (in.)
4/1/1993 1:00	0
4/1/1993 10:00	0.1
4/1/1993 12:00	0.1
4/1/1993 14:00	0.1
4/1/1993 15:00	0.1
4/1/1993 17:00	0.1
4/1/1993 21:00	0.1
4/3/1993 22:00	0.1
4/10/1993 12:00	0.1
4/10/1993 15:00	0.1
4/10/1993 16:00	0.3
4/10/1993 19:00	0.1
4/10/1993 23:00	0.1
4/11/1993 9:00	0.2
4/11/1993 15:00	0.3
4/11/1993 17:00	0.1
4/12/1993 8:00	0.2
4/12/1993 10:00	0.1
4/12/1993 11:00	0.1
4/12/1993 13:00	0.1
4/12/1993 15:00	0.1
4/12/1993 16:00	0.1
4/12/1993 18:00	0.1
4/16/1993 13:00	0.1
4/17/1993 5:00	0.1
4/17/1993 6:00	0.1
4/17/1993 7:00	0.1
4/17/1993 9:00	0.1
4/19/1993 8:00	0.1
4/22/1993 17:00	0.1
4/22/1993 20:00	0.1
4/22/1993 21:00	0.2
4/22/1993 22:00	0
4/24/1993 17:00	0
4/26/1993 14:00	0.1
4/26/1993 16:00	0.1
4/26/1993 17:00	0.1
4/26/1993 18:00	0.1
4/26/1993 20:00	0.1
4/26/1993 21:00	0
4/28/1993 11:00	0
5/1/1993 1:00	0
5/6/1993 6:00	0.1
5/7/1993 16:00	0.1
5/16/1993 23:00	0.1
5/18/1993 22:00	0.1
5/18/1993 23:00	0.1
5/19/1993 4:00	0.1
5/20/1993 17:00	0.1
5/25/1993 9:00	0.1
5/31/1993 19:00	0.1
5/31/1993 22:00	0.1
5/31/1993 23:00	0.1
6/1/1993 0:00	0.2
6/1/1993 1:00	0.1
6/1/1993 2:00	0.1
6/1/1993 5:00	0
6/1/1993 16:00	0
6/5/1993 19:00	0.1
6/6/1993 1:00	0.1
6/6/1993 3:00	0.1
6/6/1993 8:00	0.1
6/6/1993 13:00	0.1
6/9/1993 3:00	0.1
6/9/1993 5:00	0.1
6/13/1993 17:00	0.1
6/14/1993 8:00	0.1
6/20/1993 16:00	0.1
6/21/1993 21:00	0.1
6/22/1993 13:00	0.1
6/22/1993 14:00	0.2
6/29/1993 1:00	0.1
7/1/1993 1:00	0
7/12/1993 14:00	0.1
7/15/1993 1:00	0.1
7/15/1993 13:00	0.1
7/20/1993 4:00	0.1
7/21/1993 11:00	0.1
7/27/1993 4:00	0.2
7/27/1993 5:00	0.1
7/27/1993 6:00	0.2
7/27/1993 8:00	0.1
7/29/1993 10:00	0.1
7/29/1993 22:00	0.1
7/29/1993 23:00	0.1

1968	
Date/Time	Rainfall (in.)
7/1/1968 1:00	0
7/6/1968 13:00	0
7/6/1968 20:00	0
7/28/1968 13:00	0.2
8/1/1968 1:00	0
8/2/1968 0:00	0.1
8/2/1968 1:00	0.3
8/2/1968 2:00	0.1
8/2/1968 3:00	0.2
8/2/1968 4:00	0.1
8/2/1968 5:00	0.2
8/2/1968 6:00	0.4
8/2/1968 7:00	0.2
8/9/1968 21:00	0.1
8/9/1968 22:00	0.1
8/20/1968 12:00	0.1
8/20/1968 13:00	0.1
8/25/1968 15:00	0.2
8/25/1968 19:00	0.1
9/1/1968 1:00	0
9/3/1968 15:00	0.2
9/3/1968 16:00	0.1
9/6/1968 16:00	0.1
9/6/1968 17:00	0.1
9/6/1968 22:00	0.1
9/7/1968 0:00	0.1
9/7/1968 1:00	0.2
9/7/1968 2:00	0.1
9/11/1968 7:00	0.1
9/11/1968 8:00	0.2
9/11/1968 9:00	0.5
9/11/1968 10:00	0.2
9/11/1968 11:00	0.1
10/1/1968 1:00	0
10/3/1968 22:00	0.1
10/3/1968 23:00	0.1
10/4/1968 0:00	0.1
10/7/1968 10:00	0.1
10/7/1968 12:00	0.3
10/7/1968 13:00	0.1
10/7/1968 14:00	0.1
10/7/1968 15:00	0.2
10/7/1968 16:00	0.3
10/7/1968 17:00	0.1
10/7/1968 18:00	0.1
10/7/1968 19:00	0.1
10/8/1968 0:00	0.1
10/19/1968 15:00	0.1
10/19/1968 17:00	0.1
10/19/1968 21:00	0.1
10/19/1968 23:00	0.1
10/25/1968 7:00	0.1
11/1/1968 1:00	0
11/2/1968 3:00	0.1
11/7/1968 17:00	0.1
11/7/1968 19:00	0.1
11/7/1968 20:00	0.1
11/7/1968 21:00	0.1
11/7/1968 22:00	0.1
11/7/1968 23:00	0.3
11/8/1968 0:00	0.2
11/8/1968 1:00	0.2
11/8/1968 2:00	0.1
11/8/1968 3:00	0.1
11/8/1968 8:00	0.1
11/10/1968 1:00	0.1
11/10/1968 4:00	0.1
11/10/1968 7:00	0.1
11/10/1968 10:00	0.1
11/10/1968 12:00	0.1
11/10/1968 13:00	0.1
11/10/1968 15:00	0.2
11/10/1968 16:00	0.1
11/10/1968 17:00	0.2
11/10/1968 18:00	0.2
11/10/1968 20:00	0.2
11/10/1968 21:00	0.1
11/12/1968 11:00	0.1
11/12/1968 13:00	0.1
11/12/1968 14:00	0.1
11/12/1968 15:00	0.1
11/12/1968 16:00	0.2
11/12/1968 17:00	0.2
11/12/1968 18:00	0.2
11/12/1968 19:00	0.4

1988	
Date/Time	Rainfall (in.)
7/24/1988 8:00	0.4
7/24/1988 9:00	0.1
7/24/1988 10:00	0.1
7/25/1988 17:00	0.4
7/26/1988 9:00	0.1
7/27/1988 8:00	0.1
7/31/1988 12:00	0.1
8/1/1988 1:00	0
8/11/1988 16:00	0.4
8/11/1988 19:00	0.1
8/14/1988 17:00	0.2
8/14/1988 18:00	0.2
8/14/1988 23:00	0.3
8/15/1988 0:00	0.1
8/15/1988 4:00	0.2
8/15/1988 5:00	0.1
8/15/1988 14:00	0.1
8/15/1988 15:00	0.1
8/17/1988 23:00	0.1
8/18/1988 0:00	0.1
8/18/1988 4:00	0.1
8/24/1988 11:00	0.1
8/24/1988 13:00	0.1
8/24/1988 14:00	0.1
8/24/1988 15:00	0.1
8/24/1988 16:00	0.1
8/24/1988 18:00	0.1
8/24/1988 19:00	0.4
8/24/1988 20:00	0.4
8/24/1988 21:00	0.1
8/24/1988 22:00	0.1
8/26/1988 15:00	0.1
8/29/1988 2:00	0.1
8/29/1988 4:00	0.1
8/29/1988 12:00	0.1
8/29/1988 16:00	0.2
8/29/1988 20:00	0.1
8/29/1988 21:00	0.2
8/29/1988 23:00	0.1
8/30/1988 0:00	0.8
8/30/1988 1:00	0.2
8/30/1988 2:00	0.1
9/1/1988 1:00	0
9/4/1988 17:00	0.1
9/4/1988 18:00	0.2
9/4/1988 19:00	0.2
9/4/1988 20:00	0.2
9/4/1988 21:00	0.5
9/4/1988 22:00	0.5
9/4/1988 23:00	0.1
9/13/1988 8:00	0.1
9/13/1988 9:00	0.1
9/13/1988 11:00	0.2
9/18/1988 5:00	0.1
9/21/1988 0:00	0.1
10/1/1988 1:00	0
10/5/1988 3:00	0.1
10/5/1988 6:00	0.1
10/5/1988 10:00	0.1
10/8/1988 9:00	0.1
10/8/1988 14:00	0.1
10/8/1988 19:00	0.1
10/11/1988 7:00	0.1
10/18/1988 18:00	0.1
10/22/1988 3:00	0.1
10/22/1988 5:00	0.2
10/22/1988 6:00	0.1
10/22/1988 7:00	0.1
10/22/1988 8:00	0.2
10/22/1988 9:00	0.3
10/22/1988 10:00	0.3
10/22/1988 11:00	0.2
10/22/1988 12:00	0.2
10/22/1988 13:00	0.3
10/22/1988 14:00	0.1
10/26/1988 20:00	0.1
11/1/1988 1:00	0
11/1/1988 13:00	0.1
11/1/1988 15:00	0.1
11/1/1988 16:00	0.1
11/1/1988 17:00	0.1
11/1/1988 18:00	0.1
11/1/1988 19:00	0.2
11/1/1988 20:00	0.2
11/1/1988 21:00	0.3

1989	
Date/Time	Rainfall (in.)
7/6/1989 1:00	0.1
7/6/1989 2:00	0.2
7/7/1989 18:00	0.1
7/8/1989 4:00	0.7
7/10/1989 10:00	0.1
7/10/1989 13:00	0.1
7/10/1989 16:00	0.1
7/10/1989 18:00	0.1
7/11/1989 17:00	0.1
7/14/1989 13:00	0.1
7/17/1989 4:00	0.1
7/17/1989 5:00	0.1
7/17/1989 6:00	0.1
7/17/1989 7:00	0.1
7/17/1989 8:00	0.1
7/17/1989 9:00	0.2
7/17/1989 10:00	0.1
7/17/1989 11:00	0.1
7/19/1989 19:00	0.5
7/20/1989 21:00	0.1
7/21/1989 1:00	0.1
7/27/1989 23:00	0.3
7/28/1989 0:00	0.1
7/28/1989 1:00	0.1
7/28/1989 5:00	0.1
7/28/1989 6:00	0.1
8/1/1989 1:00	0
8/3/1989 3:00	0.4
8/3/1989 4:00	0.2
8/4/1989 17:00	0.3
8/6/1989 10:00	0.1
8/7/1989 23:00	0.1
8/8/1989 0:00	0.1
8/8/1989 11:00	0.1
8/11/1989 14:00	0.1
8/11/1989 15:00	0.1
8/11/1989 19:00	0.1
8/11/1989 21:00	0.1
8/11/1989 22:00	0.1
8/12/1989 18:00	0.1
8/13/1989 5:00	0.2
8/13/1989 7:00	0.1
8/13/1989 13:00	0.3
8/13/1989 15:00	0.1
8/13/1989 20:00	0.1
8/13/1989 21:00	0.1
8/20/1989 5:00	0.1
8/20/1989 12:00	0.1
8/23/1989 15:00	0.1
8/30/1989 0:00	0.1
9/1/1989 1:00	0
9/14/1989 16:00	0.1
9/14/1989 18:00	0.1
9/14/1989 22:00	0.1
9/14/1989 23:00	0.2
9/15/1989 0:00	0.2
9/15/1989 1:00	0.1
9/15/1989 2:00	0.2
9/15/1989 3:00	0.2
9/15/1989 12:00	0.1
9/17/1989 2:00	0.1
9/17/1989 4:00	0.2
9/19/1989 11:00	0.1
9/19/1989 14:00	0.1
9/19/1989 17:00	0.1
9/19/1989 20:00	0.1
9/20/1989 5:00	0.1
9/20/1989 11:00	0.1
9/20/1989 14:00	0.1
9/22/1989 12:00	0.1
9/23/1989 17:00	0.1
9/26/1989 5:00	0.1
9/26/1989 6:00	0.1
9/26/1989 7:00	0.1
9/26/1989 8:00	0.2
9/26/1989 9:00	0.2
9/26/1989 10:00	0.2
9/26/1989 12:00	0.2
9/26/1989 14:00	0.1
10/1/1989 1:00	0
10/2/1989 1:00	0.1
10/2/1989 17:00	0.1
10/2/1989 18:00	0.1
10/2/1989 19:00	0.3
10/2/1989 20:00	0.2

1990	
Date/Time	Rainfall (in.)
6/9/1990 1:00	0.1
6/9/1990 2:00	0.1
6/10/1990 19:00	0.1
6/11/1990 7:00	0.1
6/11/1990 8:00	0.1
6/11/1990 12:00	0.1
6/11/1990 16:00	0.1
6/21/1990 20:00	0.1
6/21/1990 21:00	0.2
6/23/1990 10:00	0.1
6/23/1990 15:00	0.1
6/23/1990 16:00	0.3
6/25/1990 14:00	0.1
6/29/1990 19:00	0.1
7/1/1990 1:00	0
7/9/1990 4:00	0.1
7/13/1990 0:00	0.1
7/20/1990 17:00	0.1
7/20/1990 23:00	0.1
7/23/1990 1:00	0.2
7/23/1990 2:00	0.5
7/23/1990 12:00	0.1
7/23/1990 22:00	0.1
7/24/1990 0:00	0.4
7/24/1990 13:00	0.1
7/24/1990 16:00	0.4
7/25/1990 3:00	0.1
7/25/1990 4:00	0.1
7/25/1990 5:00	0.2
8/1/1990 1:00	0
8/6/1990 15:00	0.1
8/6/1990 19:00	0.1
8/6/1990 20:00	0.1
8/7/1990 3:00	0.1
8/8/1990 1:00	0.2
8/8/1990 2:00	0.1
8/8/1990 4:00	0.2
8/8/1990 5:00	0.1
8/8/1990 7:00	0.1
8/8/1990 9:00	0.1
8/11/1990 6:00	0.1
8/11/1990 9:00	0.2
8/11/1990 10:00	0.2
8/11/1990 11:00	0.3
8/11/1990 12:00	0.4
8/11/1990 16:00	0.1
8/18/1990 23:00	0.1
8/19/1990 5:00	0.2
8/19/1990 6:00	0.3
8/19/1990 8:00	0.3
8/23/1990 11:00	0.1
8/23/1990 15:00	0.1
8/25/1990 4:00	0.3
8/25/1990 6:00	0.2
8/25/1990 7:00	0.1
8/25/1990 8:00	0.3
8/25/1990 9:00	0.4
8/25/1990 10:00	0.1
8/25/1990 11:00	0.1
8/25/1990 13:00	0.1
8/25/1990 14:00	0.1
8/25/1990 16:00	0.1
8/25/1990 17:00	0.1
8/27/1990 19:00	0.1
8/28/1990 7:00	0.1
9/1/1990 1:00	0
9/10/1990 4:00	0.1
9/10/1990 5:00	0.1
9/10/1990 14:00	0.1
9/15/1990 10:00	0.1
9/15/1990 11:00	0.2
9/15/1990 16:00	0.1
9/19/1990 23:00	0.1
9/20/1990 0:00	0.1
9/20/1990 1:00	0.1
9/22/1990 22:00	0.1
9/23/1990 0:00	0.1
9/23/1990 1:00	0.1
9/29/1990 13:00	0.1
9/30/1990 23:00	0.1
10/1/1990 1:00	0
10/4/1990 20:00	0.1
10/4/1990 21:00	0.1
10/9/1990 7:00	0.1
10/9/1990 8:00	0.2

1990	
Date/Time	Rainfall (in.)
7/31/1993 10:00	0.1
8/1/1993 1:00	0
8/2/1993 17:00	0.1
8/2/1993 20:00	0.2
8/2/1993 21:00	0.1
8/2/1993 23:00	0.1
8/4/1993 3:00	0.2
8/5/1993 0:00	0.1
8/9/1993 15:00	0.1
8/9/1993 16:00	0.1
8/17/1993 20:00	0.1
8/18/1993 3:00	0.1
8/18/1993 4:00	0.3
8/18/1993 5:00	0.2
8/18/1993 6:00	0.1
8/18/1993 8:00	0.1
8/18/1993 9:00	0.1
9/1/1993 1:00	0
9/3/1993 17:00	0.1
9/4/1993 2:00	0.1
9/4/1993 10:00	0.1
9/8/1993 16:00	0.1
9/8/1993 17:00	0.1
9/8/1993 21:00	0.2
9/8/1993 22:00	0.2
9/10/1993 10:00	0.1
9/10/1993 11:00	0.1
9/15/1993 20:00	0.2
9/17/1993 17:00	0.1
9/23/1993 21:00	0.1
9/26/1993 8:00	0.1
9/26/1993 9:00	0.2
9/26/1993 10:00	0.3
9/26/1993 11:00	0.1
9/26/1993 12:00	0.1
9/26/1993 14:00	0.1
9/27/1993 15:00	0.1
9/27/1993 16:00	0.4
9/27/1993 17:00	0.7
9/27/1993 18:00	0.1
9/27/1993 19:00	0.2
9/27/1993 20:00	0.1
10/1/1993 1:00	0
10/3/1993 4:00	0.1
10/3/1993 7:00	0.1
10/3/1993 8:00	0.1
10/3/1993 9:00	0.1
10/5/1993 3:00	0.1
10/12/1993 16:00	0.1
10/12/1993 20:00	0.1
10/12/1993 22:00	0.2
10/12/1993 23:00	0.2
10/13/1993 0:00	0.2
10/13/1993 12:00	0.1
10/21/1993 8:00	0.1
10/21/1993 9:00	0.1
10/21/1993 10:00	0.1
10/21/1993 11:00	0.1
10/21/1993 14:00	0.1
10/21/1993 20:00	0.1
10/21/1993 22:00	0.1
10/27/1993 12:00	0.1
10/30/1993 16:00	0.1
10/30/1993 21:00	0.1
10/30/1993 22:00	0.1
10/30/1993 23:00	0.1
10/31/1993 0:00	0.1
10/31/1993 1:00	0.1
10/31/1993 5:00	0.1
11/1/1993 0:00	0.1
11/1/1993 1:00	0
11/1/1993 2:00	0.1
11/1/1993 3:00	0.1
11/1/1993 5:00	0.1
11/1/1993 15:00	0.1
11/3/1993 20:00	0.1
11/5/1993 19:00	0.1
11/12/1993 7:00	0.1
11/14/1993 18:00	0.1
11/15/1993 4:00	0.1
11/17/1993 15:00	0.1
11/17/1993 16:00	0.2
11/17/1993 17:00	0.1
11/17/1993 20:00	0.1
11/17/1993 21:00	0.4

1968	
Date/Time	Rainfall (in.)
11/12/1968 20:00	0.3
11/12/1968 21:00	0.1
11/13/1968 2:00	0.1
11/13/1968 7:00	0.1
11/13/1968 10:00	0.1
11/15/1968 19:00	0.1
11/15/1968 22:00	0.1
11/16/1968 2:00	0.1
11/18/1968 10:00	0.1
11/18/1968 13:00	0.1
11/18/1968 15:00	0.1
11/18/1968 16:00	0.1
11/18/1968 17:00	0.2
11/18/1968 18:00	0.2
11/18/1968 19:00	0.2
11/18/1968 21:00	0.1
11/19/1968 1:00	0.1
11/19/1968 4:00	0.1
11/22/1968 0:00	0.1
11/25/1968 0:00	0.1
11/27/1968 1:00	0.1
11/27/1968 2:00	0.1
11/28/1968 14:00	0.1
11/28/1968 15:00	0.1
11/28/1968 17:00	0.2
11/28/1968 18:00	0.1
11/28/1968 19:00	0.1
11/28/1968 21:00	0.1
11/28/1968 22:00	0.1
11/29/1968 3:00	0.1
11/29/1968 19:00	0.1
12/1/1968 1:00	0
12/2/1968 2:00	0.1
12/2/1968 13:00	0.1
12/4/1968 18:00	1.8
12/5/1968 2:00	0.1
12/5/1968 16:00	0.4
12/15/1968 6:00	0.5
12/15/1968 9:00	0.1
12/15/1968 10:00	0.8
12/16/1968 1:00	0.1
12/20/1968 1:00	0.1
12/26/1968 7:00	1
12/28/1968 5:00	0.7
12/28/1968 7:00	0.1
12/28/1968 11:00	0.1
12/28/1968 13:00	0.1

1988	
Date/Time	Rainfall (in.)
11/1/1988 22:00	0.3
11/1/1988 23:00	0.5
11/2/1988 0:00	0.5
11/2/1988 1:00	0.5
11/2/1988 2:00	0.5
11/2/1988 3:00	0.1
11/2/1988 4:00	0.1
11/2/1988 17:00	0.1
11/5/1988 6:00	0.1
11/5/1988 23:00	0.1
11/6/1988 0:00	0.1
11/6/1988 13:00	0.1
11/10/1988 20:00	0.1
11/13/1988 17:00	0.2
11/13/1988 18:00	0.2
11/13/1988 19:00	0.1
11/13/1988 20:00	0.1
11/17/1988 12:00	0.1
11/17/1988 14:00	0.1
11/20/1988 9:00	0.1
11/20/1988 11:00	0.1
11/20/1988 12:00	0.1
11/20/1988 14:00	0.2
11/20/1988 15:00	0.1
11/20/1988 17:00	0.1
11/20/1988 18:00	0.1
11/20/1988 20:00	0.2
11/20/1988 21:00	0.1
11/20/1988 23:00	0.3
11/21/1988 3:00	0.1
11/28/1988 3:00	0.1
11/28/1988 4:00	0.2
11/28/1988 9:00	0.1
11/28/1988 12:00	0.1
11/28/1988 13:00	0.1
11/28/1988 14:00	0.1
11/28/1988 16:00	0.1
11/28/1988 18:00	0.1
12/1/1988 1:00	0
12/13/1988 18:00	0.1
12/14/1988 10:00	0.1
12/15/1988 3:00	0.1
12/18/1988 10:00	0.1
12/23/1988 15:00	0.1
12/24/1988 15:00	0.1
12/24/1988 19:00	0.3
12/24/1988 21:00	0.2
12/28/1988 16:00	0.1
12/28/1988 18:00	0.1
12/28/1988 19:00	0.1

1989	
Date/Time	Rainfall (in.)
10/2/1989 22:00	0.1
10/6/1989 6:00	0.1
10/11/1989 5:00	0.1
10/11/1989 8:00	0.4
10/11/1989 9:00	0.1
10/15/1989 0:00	0.1
10/17/1989 9:00	0.1
10/17/1989 10:00	0.1
10/17/1989 11:00	0.1
10/17/1989 12:00	0.1
10/17/1989 14:00	0.1
10/17/1989 15:00	0.1
10/17/1989 17:00	0.1
10/17/1989 18:00	0.1
10/17/1989 19:00	0.1
10/17/1989 20:00	0.1
10/18/1989 5:00	0.1
10/19/1989 21:00	0.1
10/19/1989 22:00	0.1
10/20/1989 0:00	0.1
10/20/1989 8:00	0.1
10/20/1989 10:00	0.2
10/20/1989 12:00	0.1
10/20/1989 13:00	0.1
10/20/1989 14:00	0.2
10/20/1989 19:00	0.1
10/20/1989 21:00	0.3
10/20/1989 22:00	0.1
10/20/1989 23:00	0.2
10/21/1989 11:00	0.1
10/31/1989 11:00	0.1
10/31/1989 20:00	0.1
10/31/1989 22:00	0.1
10/31/1989 23:00	0.1
11/1/1989 0:00	0.4
11/1/1989 1:00	0.1
11/1/1989 16:00	0.1
11/3/1989 7:00	0.1
11/3/1989 8:00	0.2
11/3/1989 9:00	0.1
11/3/1989 10:00	0.1
11/3/1989 12:00	0.1
11/3/1989 14:00	0.1
11/3/1989 15:00	0.1
11/3/1989 16:00	0.1
11/3/1989 17:00	0.1
11/3/1989 18:00	0.1
11/6/1989 14:00	0.1
11/8/1989 23:00	0.1
11/9/1989 2:00	0.2
11/9/1989 9:00	0.1
11/9/1989 12:00	0.1
11/9/1989 14:00	0.1
11/9/1989 17:00	0.2
11/15/1989 8:00	0.1
11/15/1989 12:00	0.1
11/16/1989 6:00	0.1
11/16/1989 13:00	0.1
11/16/1989 15:00	0.1
11/16/1989 16:00	0.1
11/16/1989 18:00	0.3
11/20/1989 21:00	0.1
11/20/1989 22:00	0.1
11/21/1989 4:00	0.1
11/26/1989 9:00	0.1
11/26/1989 10:00	0.1
11/26/1989 11:00	0.1
11/26/1989 12:00	0.1
11/28/1989 5:00	0.1
11/28/1989 7:00	0.1
11/28/1989 17:00	0.1
12/1/1989 1:00	0
12/3/1989 12:00	0.1
12/6/1989 22:00	0.1
12/6/1989 23:00	0.1
12/15/1989 18:00	0
12/17/1989 0:00	0
12/30/1989 6:00	0.1
12/31/1989 12:00	0.1
12/31/1989 14:00	0.1
12/31/1989 17:00	0.1
12/31/1989 19:00	0.1
12/31/1989 21:00	0.1

1990	
Date/Time	Rainfall (in.)
10/11/1990 7:00	0.2
10/11/1990 9:00	0.1
10/12/1990 21:00	0.1
10/12/1990 23:00	0.1
10/13/1990 11:00	0.2
10/13/1990 14:00	0.2
10/13/1990 15:00	0.1
10/13/1990 18:00	0.2
10/13/1990 21:00	0.2
10/13/1990 23:00	0.1
10/14/1990 0:00	0.1
10/14/1990 1:00	0.2
10/14/1990 2:00	1
10/14/1990 3:00	0.5
10/14/1990 4:00	0.1
10/19/1990 0:00	0.4
10/19/1990 1:00	0.1
10/19/1990 2:00	0.3
10/19/1990 3:00	0.2
10/19/1990 4:00	0.1
10/23/1990 7:00	0.1
10/23/1990 8:00	0.1
10/23/1990 12:00	0.1
10/23/1990 14:00	0.1
10/23/1990 15:00	0.2
10/23/1990 17:00	0.2
10/23/1990 19:00	0.1
10/23/1990 20:00	0.2
10/23/1990 21:00	0.1
10/23/1990 22:00	0.1
10/24/1990 1:00	0.1
10/24/1990 2:00	0.3
10/24/1990 4:00	0.2
10/24/1990 5:00	0.2
10/24/1990 6:00	0.5
10/24/1990 8:00	0.1
10/28/1990 18:00	0.1
10/28/1990 19:00	0.2
10/28/1990 20:00	0.1
11/1/1990 1:00	0
11/6/1990 5:00	0.1
11/6/1990 7:00	0.2
11/6/1990 8:00	0.6
11/6/1990 9:00	0.3
11/10/1990 12:00	0.1
11/10/1990 14:00	0.1
11/10/1990 15:00	0.1
11/10/1990 16:00	0.3
11/10/1990 17:00	0.4
11/10/1990 18:00	0.5
11/10/1990 19:00	0.5
11/10/1990 20:00	0.5
11/10/1990 21:00	0.3
11/18/1990 1:00	0.1
11/23/1990 18:00	0.1
11/24/1990 7:00	0.1
12/1/1990 1:00	0
12/4/1990 2:00	0.1
12/4/1990 3:00	0.1
12/4/1990 4:00	0.1
12/4/1990 5:00	0.1
12/4/1990 6:00	0.3
12/4/1990 7:00	0.1
12/4/1990 8:00	0.1
12/4/1990 9:00	0.2
12/4/1990 10:00	0.2
12/4/1990 11:00	0.1
12/4/1990 12:00	0.2
12/4/1990 13:00	0.1
12/4/1990 14:00	0.1
12/4/1990 15:00	0.1
12/4/1990 16:00	0.2
12/15/1990 14:00	0.1
12/15/1990 16:00	0.1
12/15/1990 18:00	0.1
12/15/1990 19:00	0.1
12/15/1990 20:00	0.2
12/15/1990 21:00	0.1
12/16/1990 5:00	0.1
12/16/1990 8:00	0.1
12/16/1990 11:00	0.1
12/18/1990 9:00	0.1
12/18/1990 12:00	0.1
12/18/1990 17:00	0.1
12/21/1990 16:00	0.1

1990	
Date/Time	Rainfall (in.)
11/17/1993 22:00	0.1
11/18/1993 0:00	0.1
11/19/1993 15:00	0.1
11/19/1993 16:00	0.1
11/19/1993 17:00	0.1
11/19/1993 18:00	0.1
11/28/1993 10:00	0.1
11/28/1993 11:00	0.1
11/28/1993 13:00	0.1
11/28/1993 14:00	0.1
11/28/1993 15:00	0.2
11/28/1993 16:00	0.2
11/28/1993 17:00	0.2
11/28/1993 20:00	0.1
12/1/1993 1:00	0
12/4/1993 22:00	0.1
12/5/1993 0:00	0.1
12/5/1993 1:00	0.1
12/5/1993 2:00	0.1
12/5/1993 3:00	0.2
12/5/1993 4:00	0.1
12/5/1993 5:00	0.1
12/5/1993 7:00	0.1
12/5/1993 10:00	0.1
12/5/1993 11:00	0.1
12/5/1993 12:00	0.1
12/5/1993 13:00	0.1
12/5/1993 14:00	0.1
12/10/1993 18:00	0.1
12/10/1993 23:00	0.1
12/11/1993 1:00	0.1
12/11/1993 2:00	0.2
12/11/1993 3:00	0.1
12/11/1993 4:00	0.1
12/11/1993 9:00	0.1
12/11/1993 15:00	0.1
12/11/1993 18:00	0.1
12/11/1993 20:00	0.1
12/12/1993 9:00	0.1
12/14/1993 13:00	0.1
12/16/1993 0:00	0.1
12/21/1993 5:00	0.1
12/21/1993 7:00	0.1
12/21/1993 8:00	0.1
12/21/1993 9:00	0.1
12/21/1993 10:00	0.2
12/21/1993 11:00	0.3
12/21/1993 12:00	0.4
12/21/1993 13:00	0.3
12/21/1993 14:00	0
12/21/1993 16:00	0.7
12/30/1993 0:00	0.1
12/30/1993 5:00	0.1

1968	
Date/Time	Rainfall (in.)

1988	
Date/Time	Rainfall (in.)

1989	
Date/Time	Rainfall (in.)

1990	
Date/Time	Rainfall (in.)
12/21/1990 19:00	0.1
12/21/1990 21:00	0.1
12/24/1990 0:00	0.1
12/24/1990 2:00	0.1
12/24/1990 3:00	0.1
12/24/1990 4:00	0.1
12/24/1990 5:00	0.2
12/24/1990 6:00	0.1
12/24/1990 9:00	0.2
12/24/1990 11:00	0.1
12/24/1990 12:00	0.1
12/28/1990 8:00	0.1
12/28/1990 14:00	0.1
12/29/1990 17:00	0.1
12/30/1990 21:00	0.1
12/30/1990 23:00	0.1

1990	
Date/Time	Rainfall (in.)

APPENDIX F – Observed CSO Data

CSO Monitoring Summary

Event	Event Date	CSO Volume (MG)			CSO Duration (hrs)			Lafayette Rain Gauge		
		010A	010B	013	010A	010B	013	Peak Intensity (Inch/hr)	Total Rain (inches)	Duration (hrs)
1 [3]	3/30/2014	2.449	0.108		9.4	2.0		0.41	2.00	16.2
2 [3]	3/31/2014	0.968	0.009		4.3	0.8		0.11	0.71	18.3
3	6/13/2014	0.261			2.3			0.57	2.15	13.4
4	7/3/2014	0.054			0.8			0.87	1.19	8.2
5	7/15/2014	0.107			0.9			0.84	1.04	7.7
6	8/5/2014	0.005			0.3			0.62	0.62	0.5
7	8/13/2014	0.229			3.7			0.64	2.62	16.6
8	10/23/2014	0.934			4.3			0.82	3.02	66.0
9 [3]	12/9/2014	7.712	0.391	1.486	33.3	26.3	12.2	0.64	4.31	30.8
10 [3]	4/20/2015	1.970	0.308	0.239	13.3	2.3	3.7	0.35	2.59	20.1
11	9/13/2015	0.031			0.6			0.56	0.95	11.2
12	9/30/2015	0.773	0.165	0.009	6.0	0.9	3.8	0.96	3.35	11.3
13	10/29/2015	0.006			0.3			0.65	2.17	17.6
14	12/24/2015	0.013			0.7			0.33	1.05	14.7
15	1/10/2016	0.844	0.010	0.198	9.5	1.7	2.7	0.42	1.36	15.3
16	2/16/2016	0.004			0.6			0.58	1.03	9.7
17 [3]	2/25/2016	0.771	0.012		6.2	0.4		0.67	1.59	28.3
18	6/5/2016	0.035		0.052	0.7		0.9	0.56	1.86	16.4
19	7/18/2016	0.002			0.3			0.97	0.97	0.8
20	7/23/2016	0.519	0.021	0.035	1.4	0.4	0.7	1.05	1.06	1.2
21	10/21/2016	0.679	0.009	0.147	2.4	0.8	2.1	1.44	2.48	12.9
22	11/15/2016	0.150			2.3			0.58	1.91	12.7

Notes:

1) Post-construction monitoring began in April 2015

2) Blank cells mean no CSO

3) System influenced by snowmelt (source: NOAA snowfall data)

4) On or about 9/22/16, and 10/3/16, the Mechanic St Pump Station had limited capacity during construction of improvements