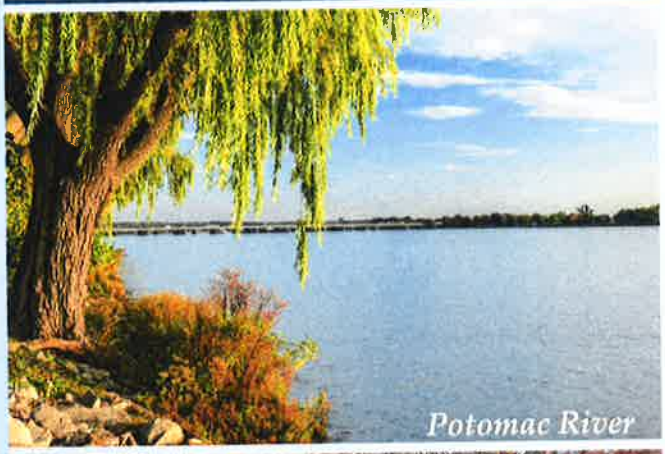
Combined Sewer System
Phase I: Post-Construction Monitoring Report

August 2016

Anacostia River


Potomac River

Rock Creek

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Water and Sewer Authority
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FINAL

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Executive Summary

ES.1 Purpose

The District of Columbia Water and Sewer Authority's (DC Water's) National Pollutant Discharge Elimination System Permit (NPDES Permit) requires conducting post construction monitoring (PCM) in three phases after various elements of the CSO control program are implemented. The first phase of PCM is required after rehabilitation of the sewage pumping stations and replacement of the inflatable dams is completed. These system improvements, which are referred to as Phase I CSO controls, have been completed and DC Water has therefore conducted the first phase of monitoring. This report summarizes the Phase I monitoring data, presents observations and findings relevant to the monitoring work and provides an assessment of the Phase I CSO controls.

In accordance with the CSO Policy, CSO planning is based on "average year" conditions. For the development of DC Water's Long Term Control Plan (LTCP), rainfall in the period 1988-1990 was established as the average year condition. Data on CSO overflows and the quality of receiving water was collected in 2015 for the rainfall conditions that occurred at that time. This data was used to evaluate and update the calibration of the computer models for the sewer system and receiving waters developed for the LTCP. These models were then used to make predictions for an average year climate condition so that a comparison to the LTCP could be made as required by the NPDES Permit.

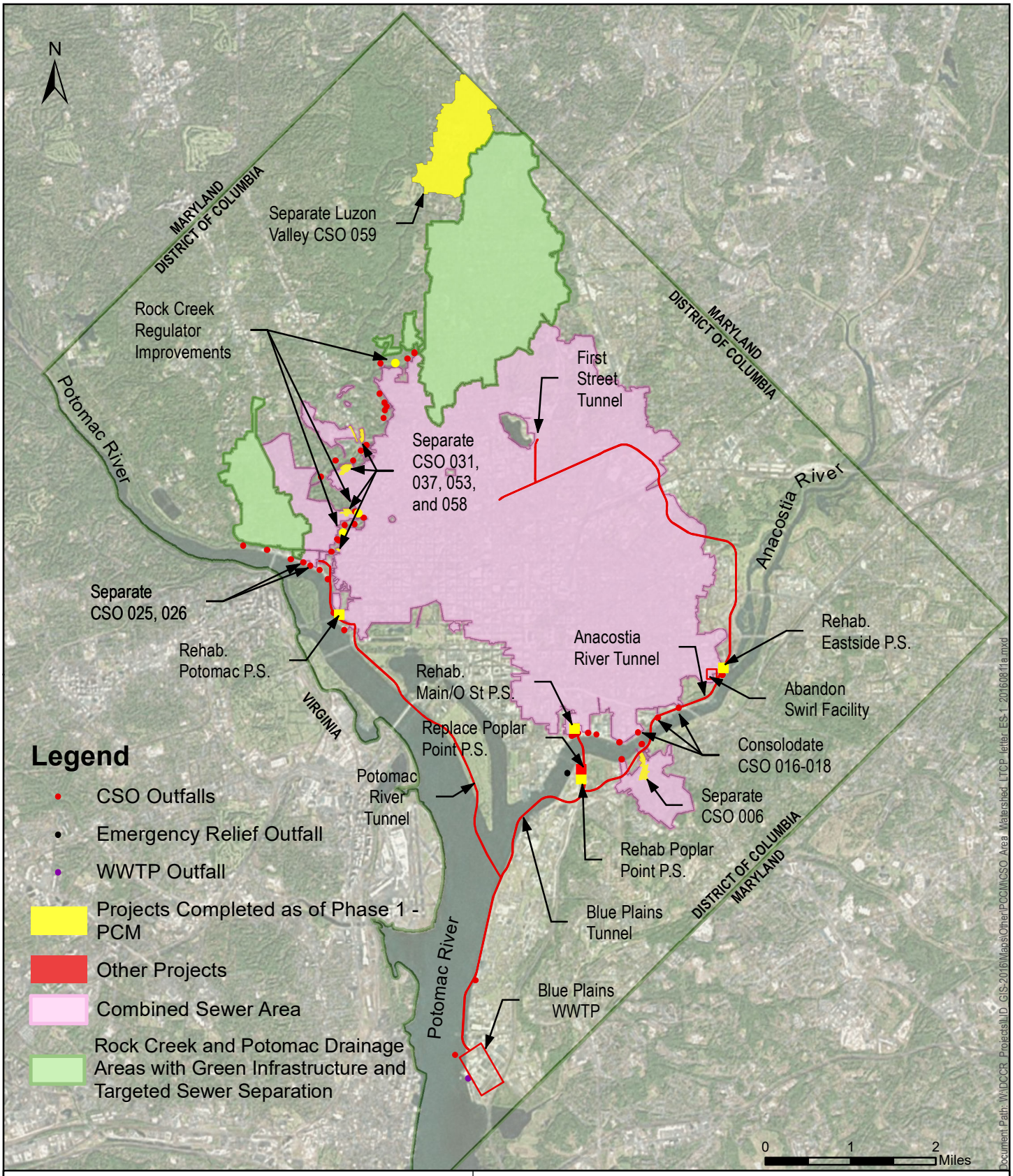
ES. 1.1 Background

DC Water is implementing a LTCP, also referred to as the DC Clean Rivers Project (DCCR), to control combined sewer overflows (CSOs) to the District of Columbia's (District) waterways. DCCR is comprised of a variety of projects to control CSOs, including pumping station rehabilitations, green infrastructure (GI), and a system of underground storage/conveyance tunnels. DCCR is being implemented in accordance with a first amendment to the Consent Decree (Amended Consent Decree), entered on January 14, 2016, which amends and supersedes the 2005 Consent Decree (Consent Decree) and incorporates GI in a hybrid green-gray solution to control CSOs while improving the quality of life in the District.

The major elements of the LTCP are shown on Figure ES-1. The projects that have been completed and placed in operation as of Phase I PCM are summarized in Table ES-1.

Table ES-1. LTCP Projects Placed in Operation
As of Phase I Post Construction Monitoring

Receiving Water	Anacostia River
Anacostia River	• Rehabilitation of Main, O Street, East Side and Poplar Point Pumping Stations • Replacement of inflatable dams at Structures 14, 15, 15a, 16 and 24 • Separation of CSO 006
Potomac River	• Rehabilitation of Potomac Pumping Station • Replacement of inflatable dams at Structures 34 and 35
Rock Creek	• Separation of CSO 031, 037, 053, 057, 058 and 059 • Diversion structure improvement at CSO 033, 036 and 047
System Wide	• Constructing Low Impact Development-Retrofit also known as GI at the following DC Water facilities: Anacostia Water Pumping Station, East Side Pumping Station, and Fort Reno Reservoir



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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Long Term Control Plan

Date: August 2016

Figure ES-1

ES. 1.2 Permit Requirements

Part III, Section D of the permit specifies the required post construction monitoring phases as follows:

- **Phase 1 Monitoring** – Following the placement in operation of the inflatable dams and pumping stations rehabilitation. This program will be conducted for a period of one year in each receiving water (Anacostia and Potomac Rivers).

Replacement of the inflatable dams was completed in 2004 and rehabilitation of the last pumping station (Potomac Pumping Station) was completed in October 2013. As a result, Phase 1 monitoring was implemented. The permit required the monitoring to consist of at least the elements in Table ES-2.

Table ES-2. NPDES Permit Requirements- Phase I

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	• 1 gauge in Northeast Boundary • 1 gauge in Tiber Creek	• 1 gauge in Slash Run	• Continuous
CSO Overflow (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary	n/a	• 4 storms minimum approximately 1 hr sample interval for each storm
Receiving Water Monitoring- Dissolved Oxygen (4)	• Continuous DO Monitors	• Continuous DO Monitors	• Approximately 30 minute intervals
Receiving Water Monitoring- Bacteria, Field Parameters (2) (4)	• Bacteria Samples	• Bacteria Samples	• 4 storms minimum

(1) Temporary gauges, meters and samplers to be installed.

(2) Samples shall be analyzed for Fecal Coliform, Escherichia Coli (*E.coli)*, CBOD5 and Total Suspended Solid (TSS).

(3) Monitoring shall be conducted for a continuous period of 12 months.

(4) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

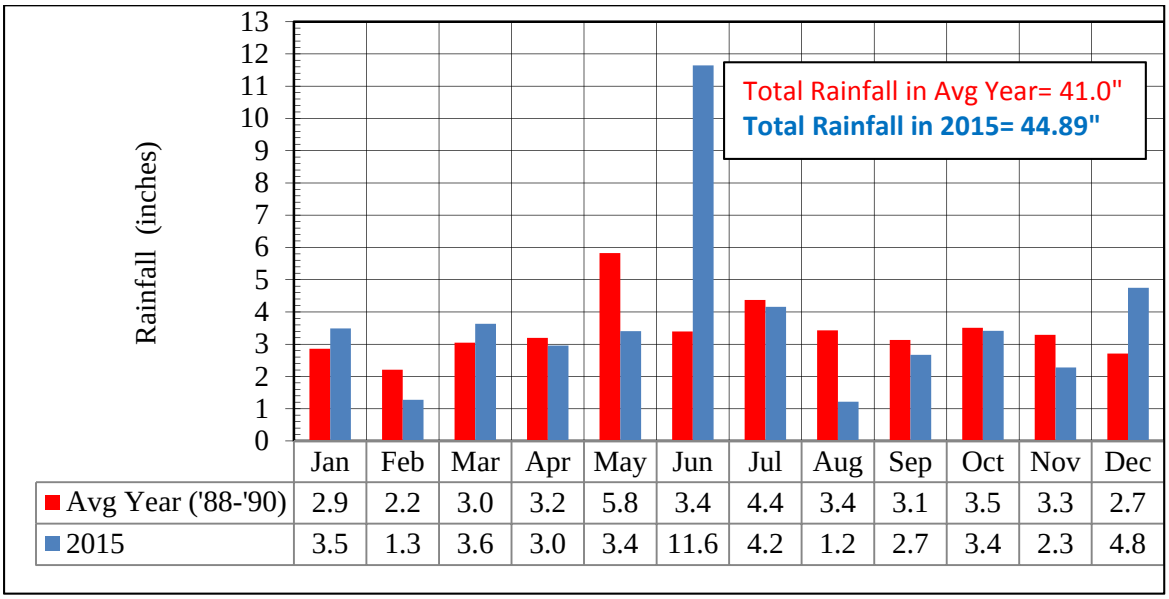
ES.2 Phase I PCM- Data Collection

DC Water submitted its PCM plan to EPA and the District Department of Energy and Environment (DOEE) for review and comment on May 28, 2014. Flow meters and monitoring equipment were installed in the autumn of 2014. The Phase I monitoring effort started in December 2014 and extended until February 2016 to collect adequate data required by the permit. For model calibration, a twelve month period from January 1, 2015 to December 31, 2015 (referred in this report as PCM period) was selected.

ES. 2.1 Rainfall Monitoring

Collection of rainfall data is critical for developing and modeling the correlation between rain events, CSO overflows and water quality impacts. As rainfall can vary widely over even a small geographic area, radar rainfall data at a 1 kilometer by 1 kilometer square grid was used for modeling purposes in addition to data from rain gages.

Average monthly rainfall recorded during the PCM period is presented in Figure ES-2 and is compared to the average year. Year 2015 was a wetter year than normal and included the extremely wet month of June 2015 with a total rainfall of 11.6 inches.

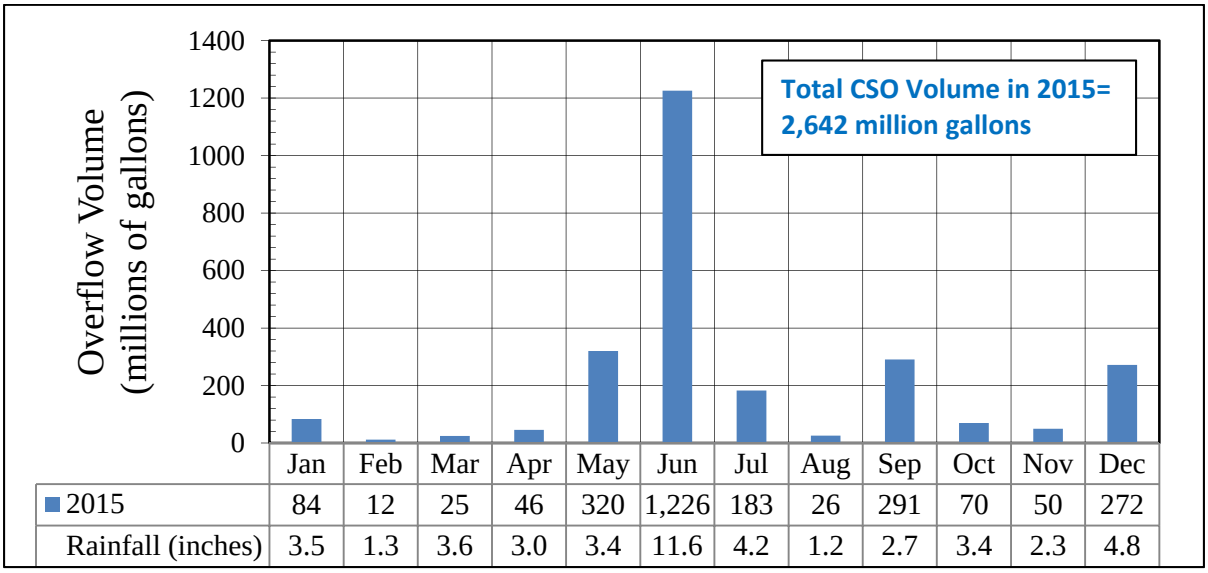


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg Year ('88-'90)	2.9	2.2	3.0	3.2	5.8	3.4	4.4	3.4	3.1	3.5	3.3	2.7
2015	3.5	1.3	3.6	3.0	3.4	11.6	4.2	1.2	2.7	3.4	2.3	4.8

Figure ES-2. Average Monthly Rainfall Summary
January 1, 2015 – December 31, 2015

ES. 2.2 Combined Sewer System (CSS) Monitoring

Flow monitoring was conducted by installing about 50 meters in the combined sewer system. Thirty three of these meters are for CSO outfalls and the remainder were for internal system points and dry weather diversions in the CSS. Monitored CSOs comprised approximately 83% of eth combined sewer area. Figure ES-3 graphically depicts the amount of CSO volume discharged from the outfalls during the PCM period.

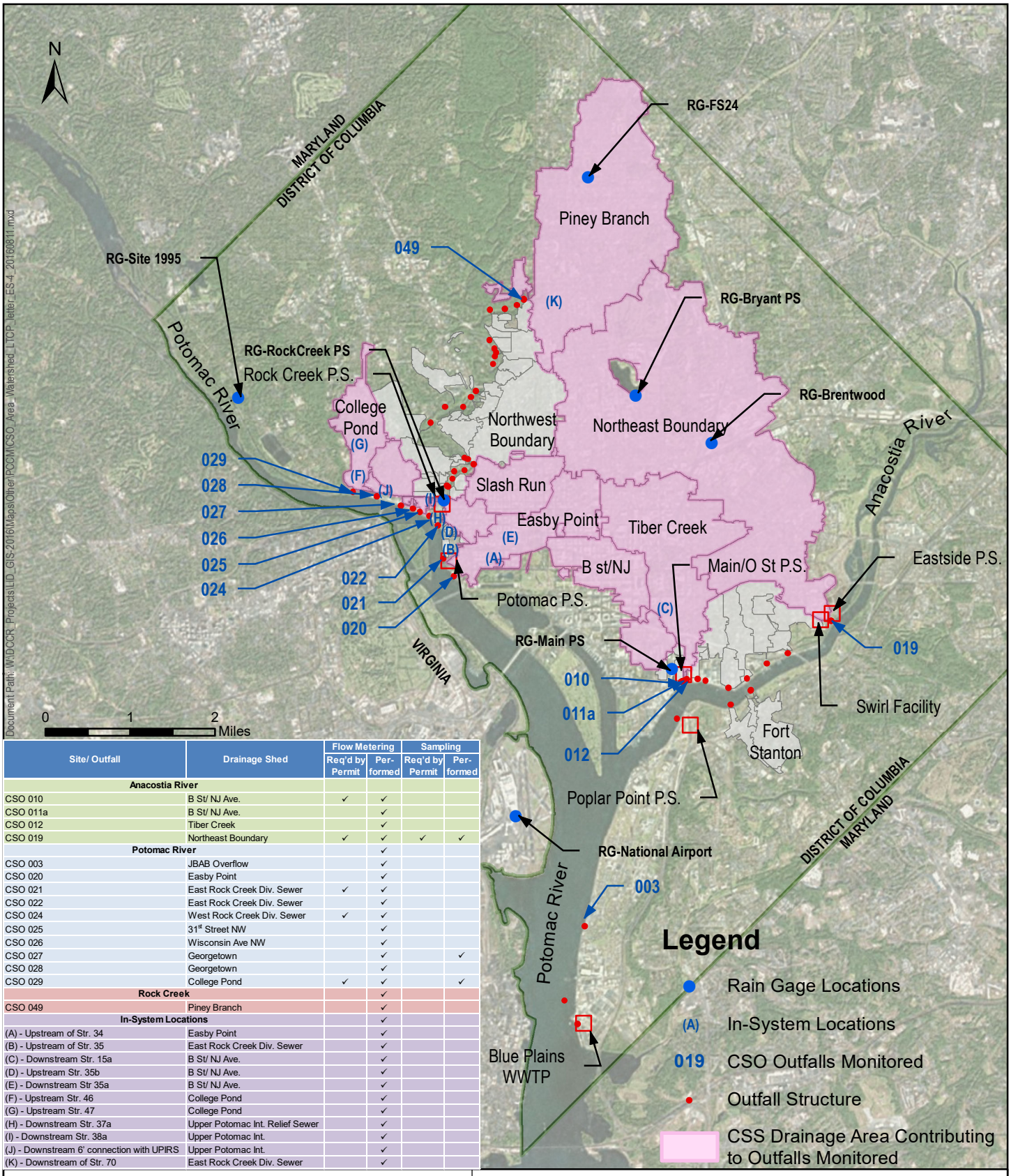


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	84	12	25	46	320	1,226	183	26	291	70	50	272
Rainfall (inches)	3.5	1.3	3.6	3.0	3.4	11.6	4.2	1.2	2.7	3.4	2.3	4.8

Figure ES-3. Total Monitored CSO Outfalls- Overflow Volume (MG)
January 1, 2015 – December 31, 2015

In addition, grab sampling was performed at the following three CSO outfalls: CSO 019, CSO 027 and CSO 029 to characterize the nature of combined sewer overflows. Based on the flow meter data, samples were mathematically composited to calculate event mean concentrations.

Figure ES-4 shows the rainfall and flow monitoring locations.



Site/ Outfall	Drainage Shed	Flow Metering		Sampling	
		Req'd by Permit	Per-formed	Req'd by Permit	Per-formed
Anacostia River					
CSO 010	B St/ NJ Ave.	✓	✓		
CSO 011a	B St/ NJ Ave.		✓		
CSO 012	Tiber Creek		✓		
CSO 019	Northeast Boundary	✓	✓	✓	✓
Potomac River			✓		
CSO 003	JBAB Overflow		✓		
CSO 020	Easby Point		✓		
CSO 021	East Rock Creek Div. Sewer	✓	✓		
CSO 022	East Rock Creek Div. Sewer		✓		
CSO 024	West Rock Creek Div. Sewer	✓	✓		
CSO 025	31st Street NW		✓		
CSO 026	Wisconsin Ave NW		✓		
CSO 027	Georgetown		✓		✓
CSO 028	Georgetown		✓		
CSO 029	College Pond	✓	✓		✓
Rock Creek			✓		
CSO 049	Piney Branch		✓		
In-System Locations			✓		
(A) - Upstream of Str. 34	Easby Point		✓		
(B) - Upstream of Str. 35	East Rock Creek Div. Sewer		✓		
(C) - Downstream Str. 15a	B St/ NJ Ave.		✓		
(D) - Upstream Str. 35b	B St/ NJ Ave.		✓		
(E) - Downstream Str 35a	B St/ NJ Ave.		✓		
(F) - Upstream Str. 46	College Pond		✓		
(G) - Upstream Str. 47	College Pond		✓		
(H) - Downstream Str. 37a	Upper Potomac Int. Relief Sewer		✓		
(I) - Downstream Str. 38a	Upper Potomac Int.		✓		
(J) - Downstream 6' connection with UPIRS	Upper Potomac Int.		✓		
(K) - Downstream of Str. 70	East Rock Creek Div. Sewer		✓		

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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Rainfall and Flow Monitoring Locations

Date: August 2016

Figure ES-4

ES.2.2.1 CSS Model Calibration and Validation

Extensive monitoring effort was conducted during Phase PCM. Hence, the collection system model used for LTCP predictions was calibrated in order to include the PCM monitored areas. The model calibration is required at the Phase I stage of LTCP implementation to evaluate if the original assumptions implementation to evaluate if the original assumptions and predictions made during LTCP development are still valid.

Using the calibrated model, CSO overflow volumes and frequencies predicted for the PCM period and the PCM data is shown in the Figures ES-5 and ES-6. The calibrated model predictions for the system wide CSOs came within 5% of the monitored CSO volume.

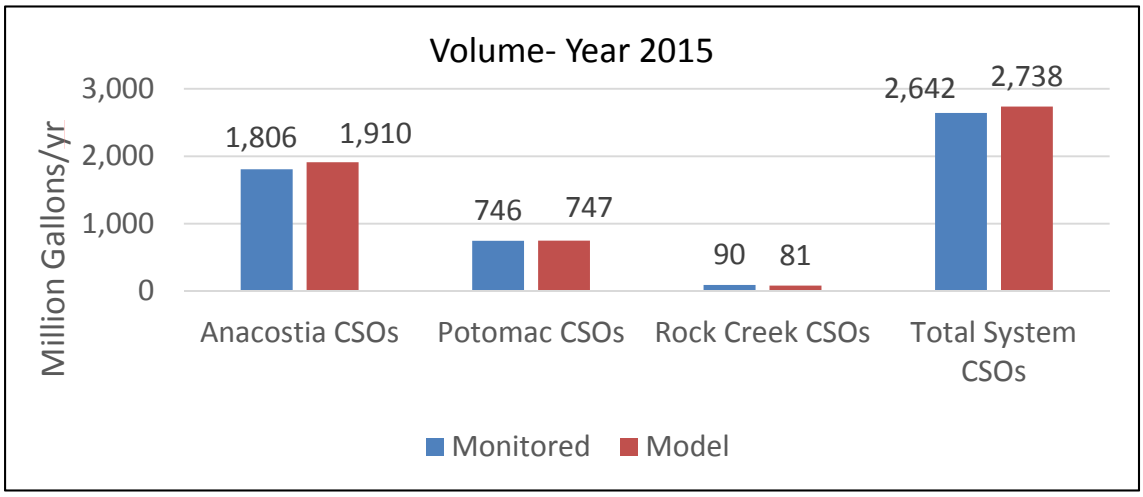


Figure ES-5. CSO Volume Summary for Year 2015

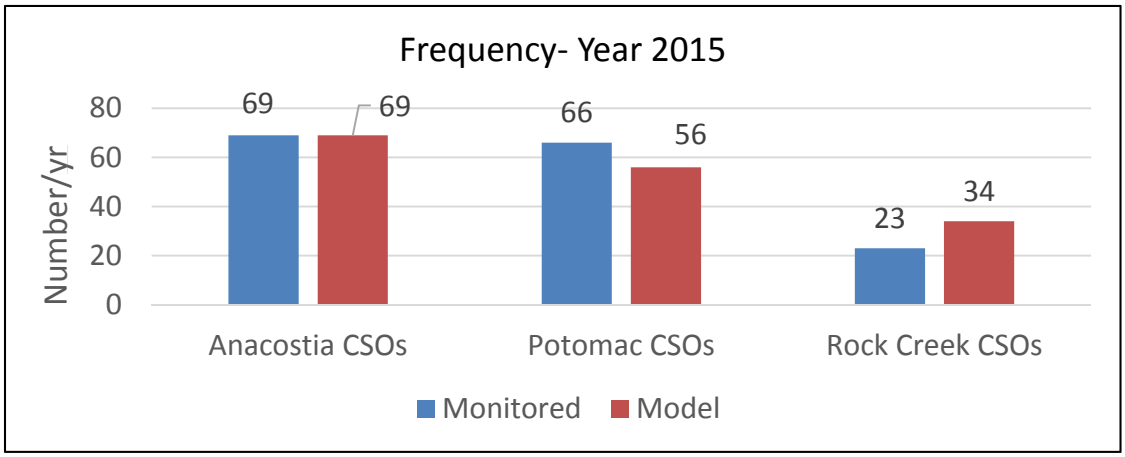


Figure ES-6. CSO Frequency Summary for Year 2015

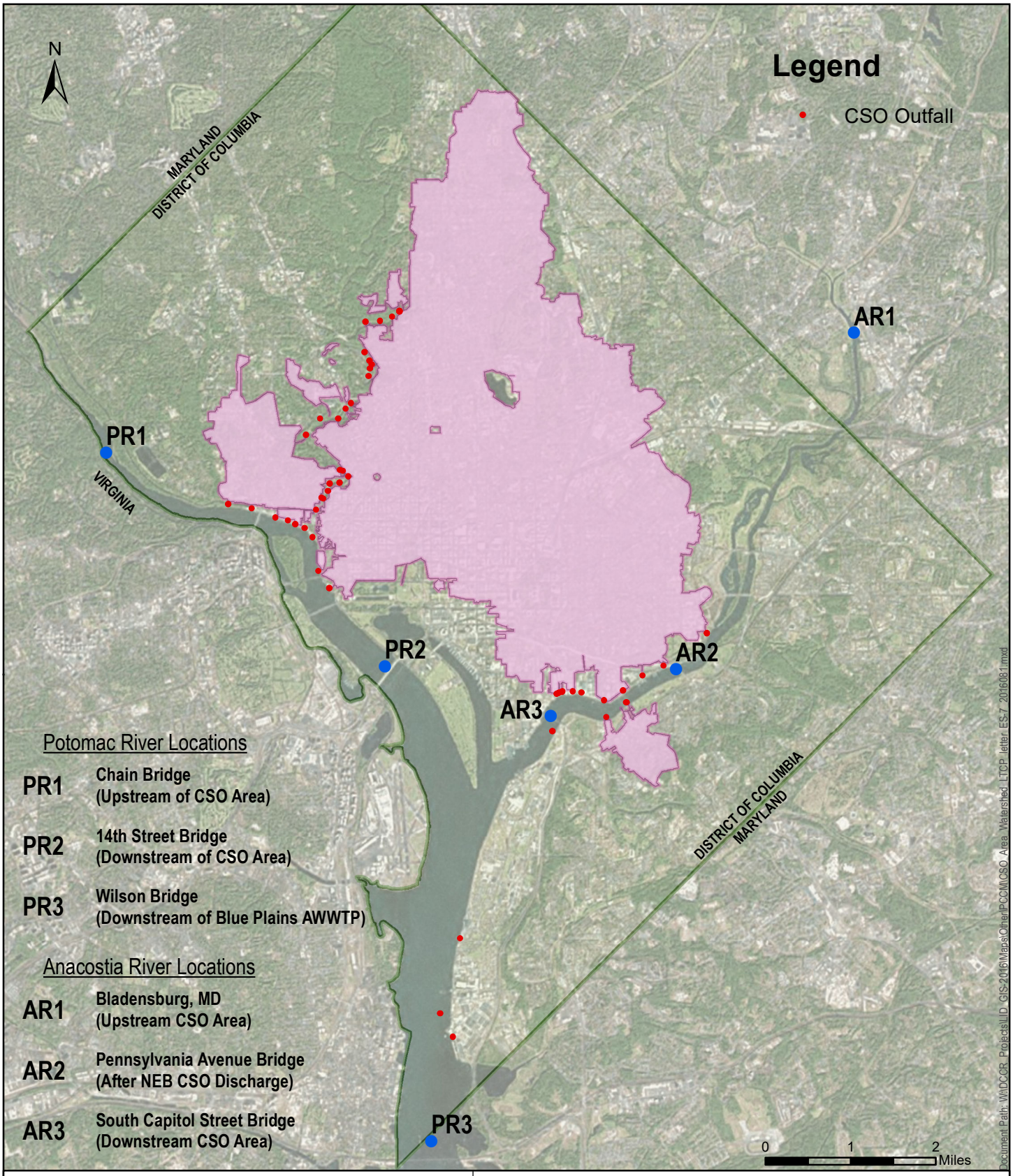
ES. 2.3 Receiving Water Monitoring

DC Water has retained Metropolitan Washington Council of Governments (MWCOG or COG) to perform receiving water monitoring. Receiving water monitoring comprised the following:

- Dissolved Oxygen (D.O.)
  D.O. monitoring was performed on the Anacostia and Potomac Rivers at the location shown in Figure ES-7. D.O. monitoring was not conducted for Rock Creek since it was not required by the permit because the creek is naturally aerated due to turbulence caused by irregular bottom of the creek bed. Dissolved oxygen problems have not historically been reported for Rock Creek.

- Regular Sampling
  Regular water quality sampling was conducted at the locations shown in Figure ES-8. A total of seventy one (71) samples were collected at each site during the monitoring period. The sampling was typically conducted twice on one week and once the following week. Since the sampling was at regular intervals, the data collected represents both wet and dry weather conditions. Samples were typically analyzed for field parameters, fecal coliform, E. coli, CBOD5 (total), TSS and chlorophyll a. Sampling was conducted while flow monitors are installed on the CSOs and the D.O. meters are operating on the receiving water.

- Wet Weather Sampling
  A total of four (4) 40 hour- wet weather sampling events were performed in the receiving waters. Wet weather sampling was performed to determine impacts of CSO and stormwater on water quality during and after a storm. Analyses included field parameters and bacteriological parameters.



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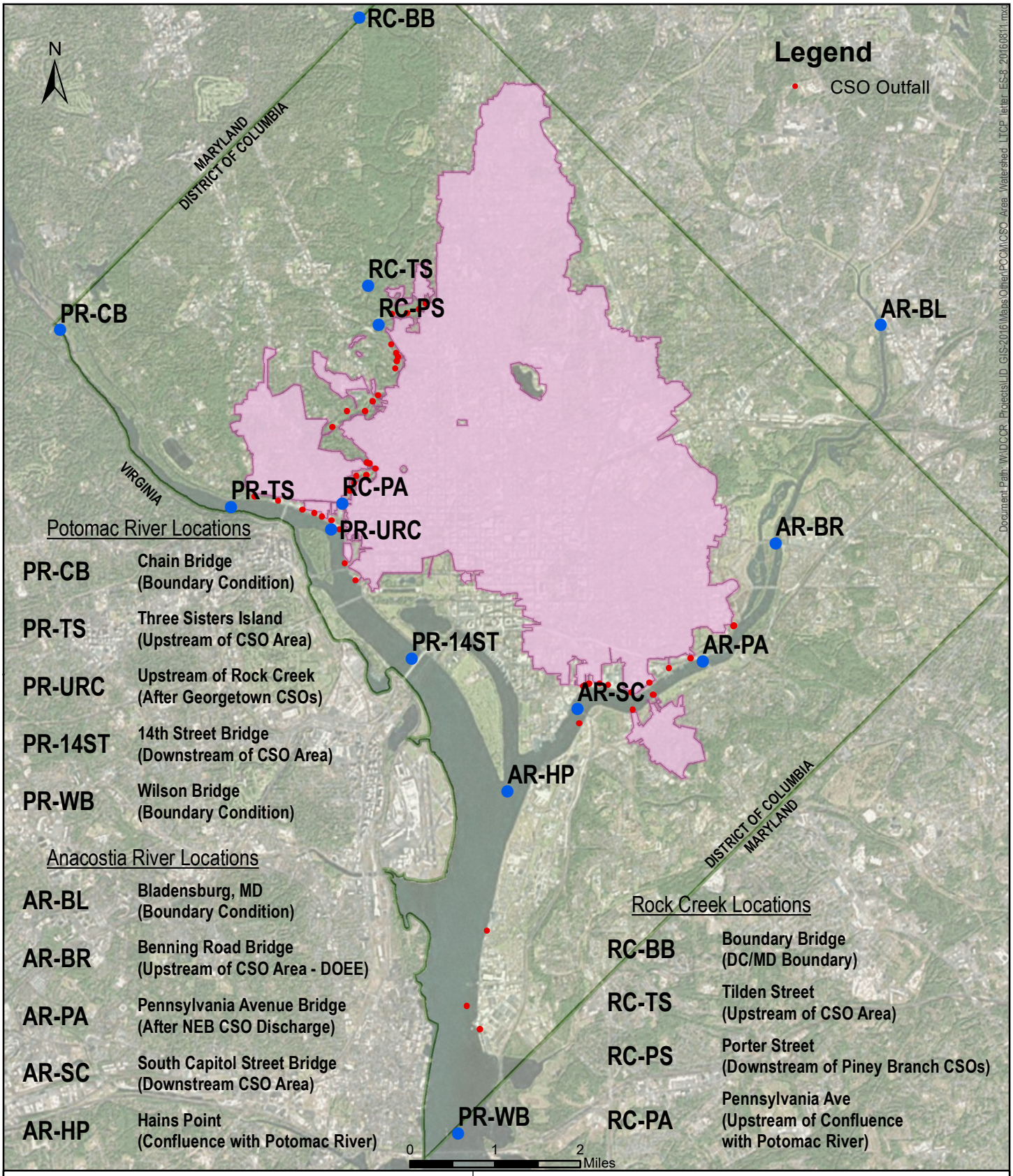
Receiving Water Monitoring - D.O. for Potomac and Anacostia Rivers

Date: August 2016 | Figure ES-7



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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Receiving Water Monitoring Locations

Date: August 2016 | Figure ES-8

ES.3 Assessment of Phase I CSO Controls

ES. 3.1 CSO Overflows

Using the calibrated computer models, CSO overflow volumes and frequencies predicted for the average year conditions are shown in the Figure ES-9 and ES-10. The figures show the predictions in the LTCP with and without Phase I Controls and the prediction with Phase I Controls based on the PCM data.

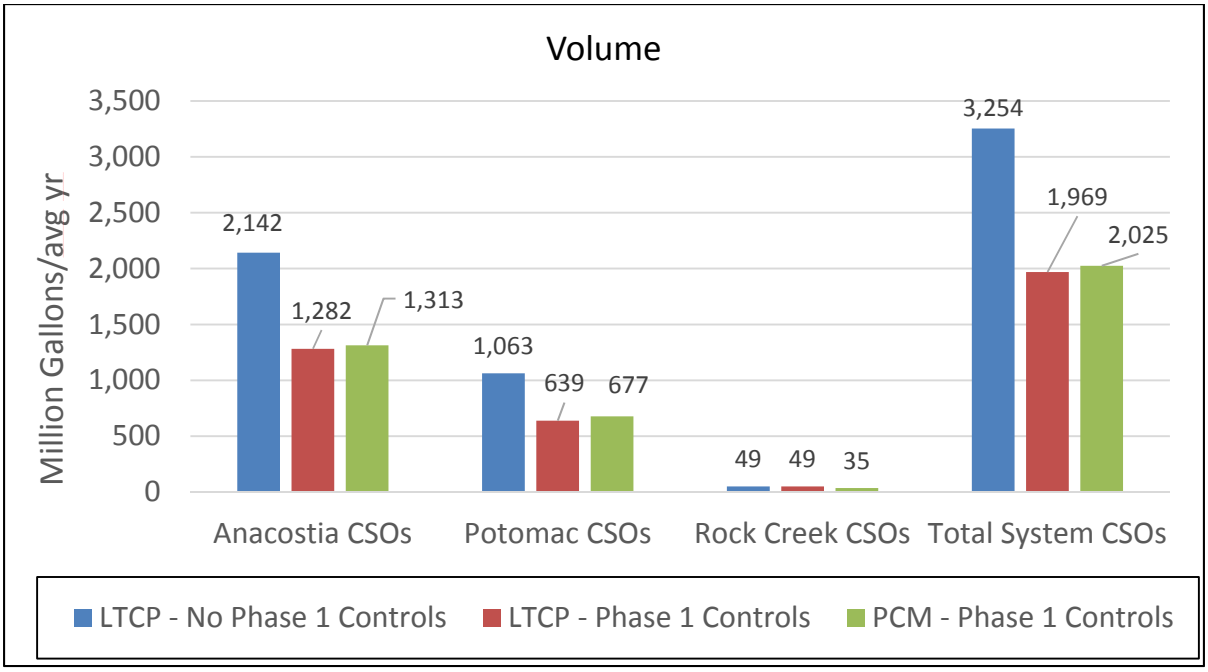


Figure ES-9. Predicted CSO Volume (Average Year)

The following observations are made:

- Compared to no CSO controls, Phase I controls have achieved significant overflow volume reductions for each receiving water: Anacostia River- 39% reduction; Potomac River- 36% reduction, Rock Creek- 29% reduction.
- An overall system wide CSO volume reduction of 38% (compared to a predicted 39% reduction) is achieved by Phase I controls compared to no CSO controls.

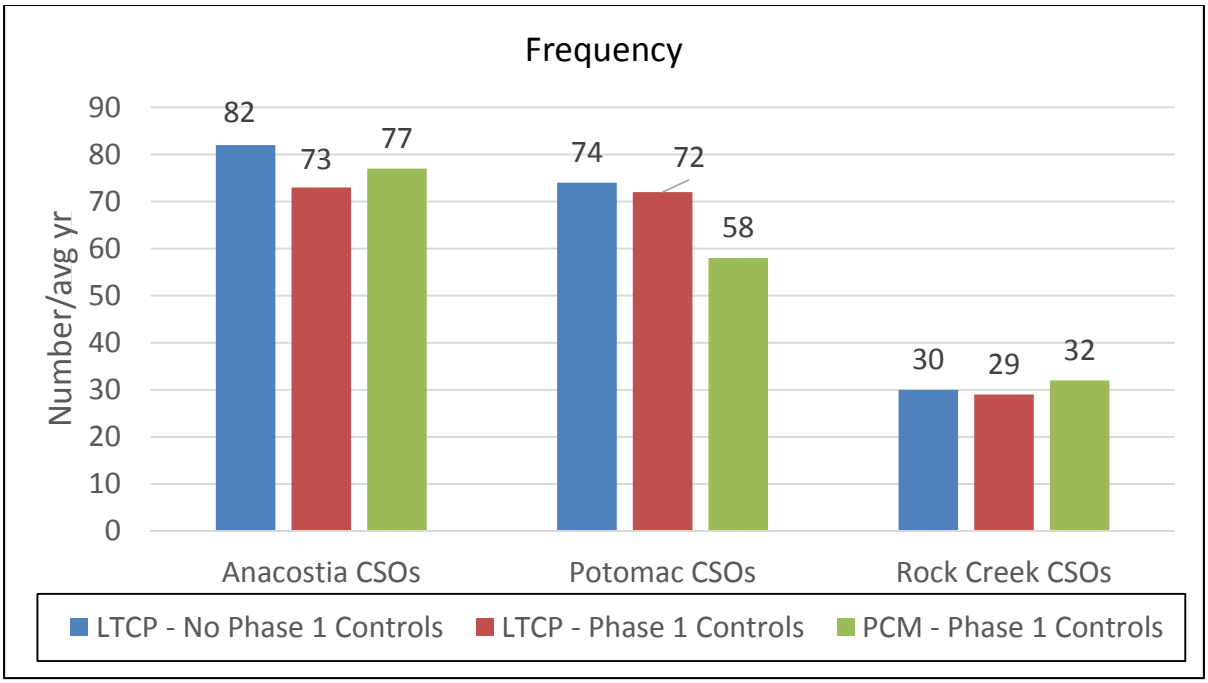


Figure ES-10. Predicted CSO Frequency (Average Year)

The following observations are made:

- Compared to no CSO controls, Phase I controls have reduced the overflow occurrences for Anacostia and Potomac Rivers. An overflow frequency reduction of 22% is observed for Potomac River.
- The overflow frequency observed at Rock Creek with Phase I controls which is slightly above the frequency observed during no CSO controls is within the range of accuracy acceptable for model predictions.

ES. 3.2 Receiving Water Quality

The report includes detailed analyses of receiving water quality in each receiving water. A summary of the results is provided below.

ES.3.2.1 Anacostia River

- Bacteria: Summary of the bacteria water quality results for Anacostia River is provided in Table ES-3.

Table ES-3. Predicted Anacostia River Water Quality – Bacteria in Average Year

Parameter	Location	No. Phase I Controls in LTCP	Phase I Controls based on PCM	% Improvement
# of Months E. Coli Exceeds Class A WQS (Geometric mean of 126 MPN/100ml)	Bladensburg	12	12	0%
	CSO 019	12	9	25%
	Hains Point	1	1	0%

1) Upstream flow entering the District has high concentrations of *E.coli* and does not typically meet water quality standards. However, the Phase I controls have reduced the exceedance frequency of the *E.coli* water quality standard (geometric mean of 126 MPN/ 100 ml) by 1-3 months at most of the locations within the District.
2) Noticeable reductions are observed in the bacteria concentrations for the months of May through September.
3) The monthly geometric mean concentrations are strongly affected by the upstream *E.coli* concentrations, evidenced by modeling which concludes that 50-100% fewer months would exceed the geometric mean water quality criteria if CSOs were the only loading source.

- Dissolved Oxygen: Summary of the dissolved oxygen water quality results are provided in Table ES-4.

Table ES-4. Predicted Anacostia River Water Quality – Dissolved Oxygen in Avg. Year

Parameter	Location	No. Phase I Controls in LTCP	Phase I Controls based on PCM	% Improvement
# of Days Dissolved Oxygen < 5.0 mg/l	Bladensburg	7	8	-14%
	CSO 019	88	81	8%
	Hains Point	13	8	38%
Minimum Day Dissolved Oxygen (mg/l)	Bladensburg	4.3	4.3	0%
	CSO 019	1.6	1.9	16%
	Hains Point	4.3	4.5	4%

Except at Bladensburg, Phase I controls have improved the dissolved oxygen levels in the Anacostia River. However, CSO control alone will not allow the dissolved oxygen standard to be met. Control of storm water and upstream sources are required to achieve this standard.

ES.3.2.2 Potomac River

- Bacteria: Summary of the bacteria water quality results for Potomac River is provided in Table ES-5.

Table ES-5. Predicted Potomac River Water Quality – Bacteria in Average Year

Parameter	Location	No. Phase I Controls in LTCP	Phase I Controls based on PCM	% Improvements
# of Months E. Coli Exceeds Class A WQS (Geometric mean of 126 MPN/100ml)	Boundary	1	1	0%
	Memorial Bridge	2	2	0%
	Wilson Bridge	0	0	

1) The concentration by which the Potomac River is exceeding the *E.coli* water quality standard (geometric mean of 126 MPN/ 100 ml) is small.
2) As indicated in LTCP Report (Section 9.7.3.1), CSOs mostly cause transient elevations of bacteria levels in river reaches immediately downstream of outfalls in the Potomac River.
3) The monthly *E.coli* geomeans is most affected by the boundary conditions and least affected by transient wet weather sources like CSOs and storm water. If CSOs were the only source, modeling indicated that the Potomac River will have zero monthly geometric mean exceedances.

- Dissolved Oxygen: Summary of the dissolved oxygen water quality results for Potomac River is provided in Table ES-6.

Table ES-6. Predicted Potomac River Water Quality – Dissolved Oxygen in Avg. Year

Parameter	Location	No. Phase I Controls in LTCP	Phase I Controls based on PCM	% Improvement
# of Days Dissolved Oxygen < 5.0 mg/l	Chain Bridge	0	0	
	Memorial Bridge	0	0	
	Wilson Bridge	35	36	-3%
Minimum Day Dissolved Oxygen (mg/l)	Boundary	4.3	7.4	42%
	Memorial Bridge	1.6	5.9	73%
	Wilson Bridge	4.3	4.2	-2%

1) Low dissolved oxygen is not a significant problem in the Potomac River. The model predicts that the water quality standard for dissolved oxygen is always met at Memorial Bridge and upstream. Slight depressions from the standard are predicted from the confluence with the Anacostia to the south of the Wilson Bridge. When the dissolved oxygen standard is not met, the concentration typically drops only slightly below the standard.
2) Except at Wilson Bridge, noticeable improvements are observed in the minimum day dissolved oxygen due to Phase I controls. Under CSO Loads only scenario, modeling indicated that total CSO removal will allow Potomac River to have zero days of dissolved oxygen below 5 mg/l.

ES.3.2.3 Rock Creek

- Bacteria: Summary of the bacteria water quality results for Rock Creek is provided in Table ES-7.

Table ES-7. Predicted Rock Creek Water Quality – Bacteria in Average Year

Parameter	Location	No. Phase I Controls in LTCP	Phase I Controls based on PCM	% Improvement
# of Months E. Coli Exceeds Class A WQS (Geometric mean of 126 MPN/100ml)	Boundary Bridge	12	12	0%
	Porter Street	12	12	0%
	Penn Ave	12	12	0%

As expected, Phase I controls did not have any effect in the monthly geometric mean concentrations due to low frequency of CSO discharges to Rock Creek and high background concentration of bacteria from upstream sources. Mainly due to loading sources other than CSOs, Rock Creek exceeds the Class A standard every month of the year.

ES. 3.3 Overall Evaluation

The NPDES Permit indicates that the results from the monitoring phases are be used to assess the performance of CSO controls against predictions established as part of LTCP development and its supplements. The evaluation is to consist of the following:

- Comparison of monitored overflow magnitude and duration with the LTCP predictions
- Comparison of monitored water quality in receiving waters with LTCP predictions
- Comparison of monitored CSO reductions with LTCP reductions
- Comparison of performance to TMDLs and allocations established for CSOs and approved bypasses in the receiving waters; and
- Overall evaluation as to whether or not CSO controls are providing degree of control predicted for LTCP conditions and whether or not modifications or additions to the LTCP are required.

An overall evaluation of phase I controls as required by the NPDES permit is provided below.

- The Post Construction Monitoring results for the total system show the reduction in CSO volume, with Phase I controls in place, to be 38%, which is 1% percent less than predicted. This is within the range of accuracy of modeling used to make LTCP predictions.
- The NPDES permit identifies the required minimum flows to receive complete treatment at Blue Plains. DC Water operated the plant conservatively and provided complete treatment to an estimated 266 million gallons of combined sewage beyond that required by its NPDES permit in 2015.
- At times, temporary rehabilitation and repair work on the sewer system including the Potomac Pumping Station, Potomac Force Mains and Structure 24 inflatable dams and other components affected the ability to capture combined sewage. Notices of temporary measures to take equipment out of service for repair were provided to EPA as required. It is predicted that this repair work may improve CSO capture by approximately 8%. Such situations are unusual and do not reflect a need to consider modifications to the LTCP. The tunnel system is designed to capture flow not intercepted by the existing sewer system. When the LTCP is in place, flow not handled by the existing sewer systems is designed to be captured by the tunnel, up to the capacity of the tunnel system.
- The predicted water quality in the receiving waters is consistent with LTCP predictions, within the range of accuracy used to make the modeling predictions.

- TMDLs for the receiving waters have established wasteload allocations (WLAs) for CSOs. The WLAs for CSOs are typically based on complete implementation of the LTCP. The Phase I CSO controls have made progress toward meeting TMDL allocations in proportion to the volume of CSO reduced at this stage of the program. Detailed calculations for each TMDL are included in the report.

In conclusion, the post construction monitoring shows that the CSO program is tracking LTCP predictions and that modifications or additions to LTCP do not need to be considered.

1 Introduction

1.1 Purpose

The District of Columbia Water and Sewer Authority's (DC Water's) National Pollutant Discharge Elimination System Permit (NPDES Permit) requires conducting post construction monitoring (PCM) in three phases after various elements of the CSO control program are implemented. The first phase of PCM is required after rehabilitation of the sewage pumping stations and replacement of the inflatable dams is completed. These system improvements, which are referred to as Phase I CSO controls, have been completed and DC Water has therefore conducted the first phase of monitoring. This report summarizes the Phase I monitoring data, presents observations and findings relevant to the monitoring work and provides an assessment of the Phase I CSO controls.

In accordance with the CSO Policy, CSO planning is based on "average year" conditions. For the development of DC Water's Long Term Control Plan (LTCP), rainfall in the period 1988-1990 was established as the average year condition. Data on CSO overflows and the quality of receiving water was collected in 2015 for the rainfall conditions that occurred at that time. This data was used to evaluate and update the calibration of the computer models for the sewer system and receiving waters developed for the LTCP. These models were then used to make predictions for an average year climate condition so that a comparison to the LTCP could be made as required by the NPDES Permit.

1.2 Background

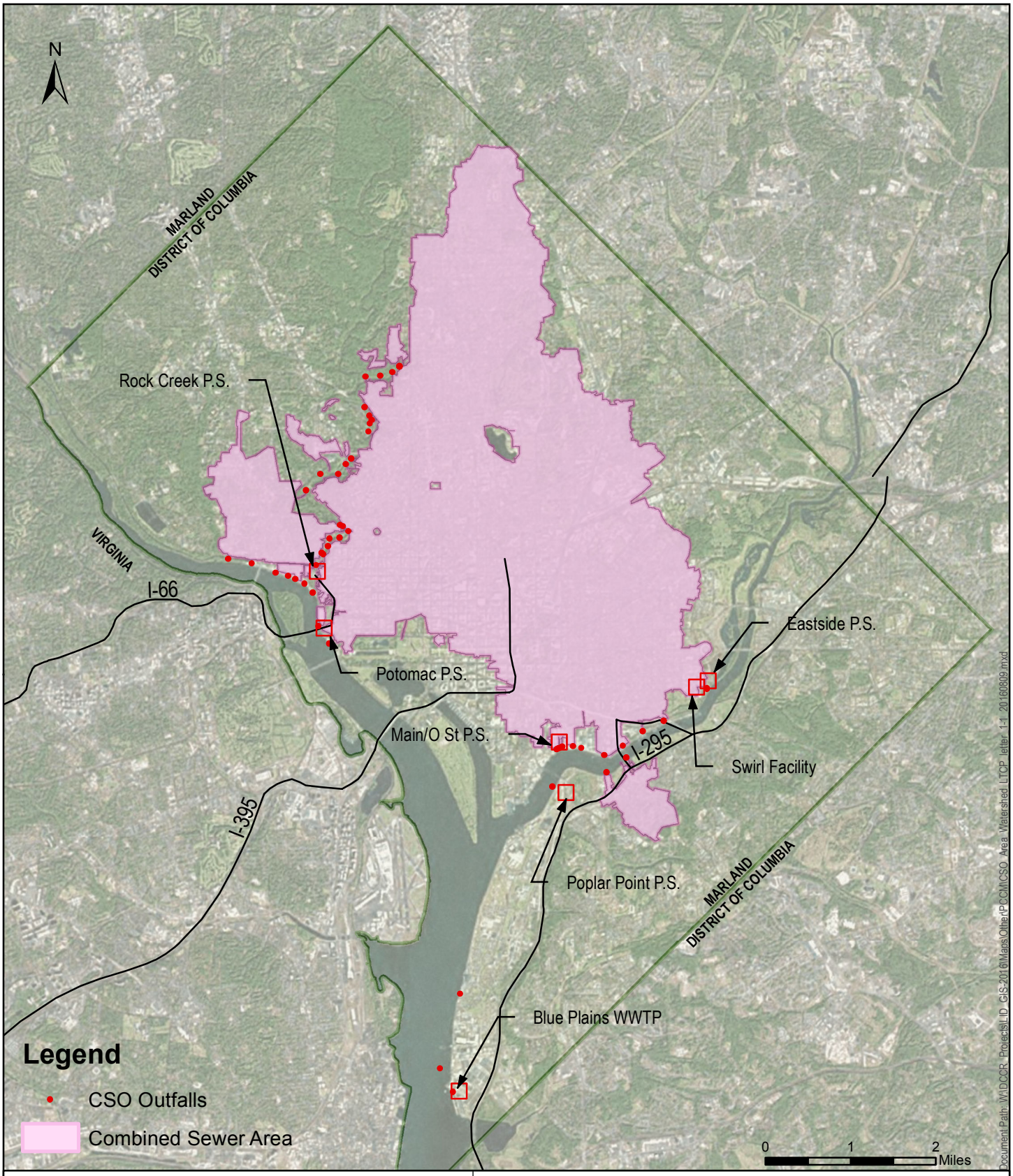
1.2.1 Long Term Control Plan

The District of Columbia Water and Sewer Authority (DC Water or Authority) operates a wastewater collection system comprised of separate and combined sewers. Parts of the District are served by separate storm and sanitary sewers. In the combined sewer system (CSS), there is a single sewer to convey storm water and sanitary wastes. The area served by combined sewers comprises about 12,436 acres (about 33 percent) of the District, and is shown on Figure 1-1.

During dry weather, sanitary wastes collected in the CSS are conveyed to the District's advanced wastewater treatment plant at Blue Plains (BPAWWTP or the Blue Plains AWWTP). During periods of rainfall, the capacity of a combined sewer may be exceeded and the excess flow, which is a mixture of storm water and sanitary wastes, is discharged directly through outfalls to the Anacostia River, Rock Creek or the Potomac River or tributary waters. There are a total of 47 active combined sewer overflow (CSO) outfalls listed in DC Water's existing National Pollutant Discharge Elimination System (NPDES) Permit issued by the United States Environmental Protection Agency (EPA).

In accordance with the CSO Policy and its NPDES permit requirements, DC Water submitted a Draft Long Term Control Plan (LTCP), to EPA in 2001. After an extensive public participation program which generated over 2,300 comments, DC Water submitted a Final LTCP to the EPA in 2002. The DC Department of Energy and Environment (formerly DC Department of the Environment and

Department of Health) (DOEE) and the EPA approved the Final LTCP and determined that CSOs remaining after implementation of the plan would not cause or contribute to the exceedance of water quality standards, subject to post construction monitoring. It was also determined that the CSOs remaining after implementation of the plan would comply with total maximum daily loads (TMDLs) established for the receiving waters.



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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Combined Sewer Area

Date: August 2016	Figure 1-1

1.2.2 Total Nitrogen Removal/ Wet Weather Plan

On April 5, 2007, EPA issued a modification to DC Water's NPDES permit. The permit modification included a total nitrogen effluent limit for Blue Plains of 4.689 million pounds per year. The total nitrogen limit was developed by EPA to achieve the goals of the Chesapeake Bay Program for nutrient reductions. In addition to meeting the new effluent limit for total nitrogen, DC Water had existing NPDES Permit requirements for treating wet weather flows at Blue Plains. The latter requirement is part of DC Water's LTCP for the combined sewer system.

When the LTCP was finalized in 2002, there was no effluent limit for total nitrogen in DC Water's NPDES permit for Blue Plains and the LTCP. The imposition of the new total nitrogen limit could require a modification to the LTCP and its implementation schedule. DC Water conducted evaluations to assess the impact of adding the new total nitrogen effluent limit on top of the LTCP and existing NPDES permit requirements for treating wet weather flows. On October 12, 2007, DC Water submitted its Final Total Nitrogen Removal/Wet Weather Plan (TN/WW Plan) to EPA. The TN/WW Plan is provided as a companion document to the Consent Decree Modification.

Under the LTCP and the NPDES permit existing at the time, Blue Plains was rated for an annual average flow of 370 million gallons per day (MGD). During wet weather events, flows up to 740 MGD receive complete treatment for up to 4 hours. After the first 4 hours, the complete treatment capacity is reduced to 511 MGD to protect the biological process. Additional flows of up to 336 MGD that exceed the complete treatment capacity of the plant receive excess flow treatment, which consists of screening, grit removal, primary treatment and disinfection before being discharged to the Potomac River. This provides a total treatment capacity of 1076 MGD for the first four hours and 847 MGD thereafter.

The TN/WW Plan modified the plant treatment capacities and the handling of flows during wet weather. The major components of the TN/WW Plan are as follows:

- Complete treatment capacity – Blue Plains will provide complete treatment up to 555 MGD for the first four hours and 511 MGD thereafter. In accordance with the existing NPDES permit, combined sewer system flow (CSSF) conditions (i.e., wet weather events) exist and start when plant influent flow is greater than 511 MGD. CSSF conditions stop four hours after plant influent flow drops below 511 MGD or 4 hours has elapsed since the start of CSSF conditions, whichever occurs last.

- Enhanced nitrogen removal (ENR) – ENR facilities will be constructed with capacity to provide complete treatment for the flow rates identified above and to meet the new total nitrogen effluent limit.

- Enhanced Clarification Facility (ECF) – A 225 MGD ECF facility will be constructed at Blue Plains.

- Tunnel to Blue Plains and System Storage Volume – A new tunnel is being constructed from Poplar Point to Blue Plains. The total tunnels system storage volume will be increased from 126 MG to 157 MG. This new tunnel segment will not only serve as a flow equalization facility but will also allow a reduction in the required capacity of the ECF and the peak flow rates that receive complete treatment at the Plant.

- Outfall Sewer Overflow to Blue Plains Tunnel – Connections between the existing Outfall sewers on the influent side of Blue Plains and the tunnel to Blue Plains will be constructed. These facilities will allow flow from the collection system that exceeds the complete treatment capacity of the plant to overflow into the tunnel.

- Tunnel Dewatering Pumping Station – Under the Final LTCP, a tunnel dewatering pumping station was proposed to be constructed at the tunnel terminus at Poplar Point. As part of the TN/WW plan, the same tunnel dewatering pumping station is relocated to the new terminus of the tunnel at Blue Plains. The pumping station will be sized to have a minimum firm capacity of 225 MGD, equal to the capacity of the ECF. In addition, the facility will have the ability to dewater the tunnel system up to the new ECF and be able to discharge ECF effluent to complete treatment and discharge at Outfall 002 or at Outfall 001. Figure 1-2 shows the TN/WW plan.

1.2.3 Amended Consent Decree Requirements

On January 14, 2016, the Court entered the First Amendment to the CD (Amended CD) in Consolidated Civil Action No. 1:CV00183TFH. The Amended CD incorporates changes to the Selected CSO Controls and related schedules to incorporate substitution of Green/Gray CSO Controls in the Potomac sewershed and Green CSO Controls in the Rock Creek sewersheds as summarized below.

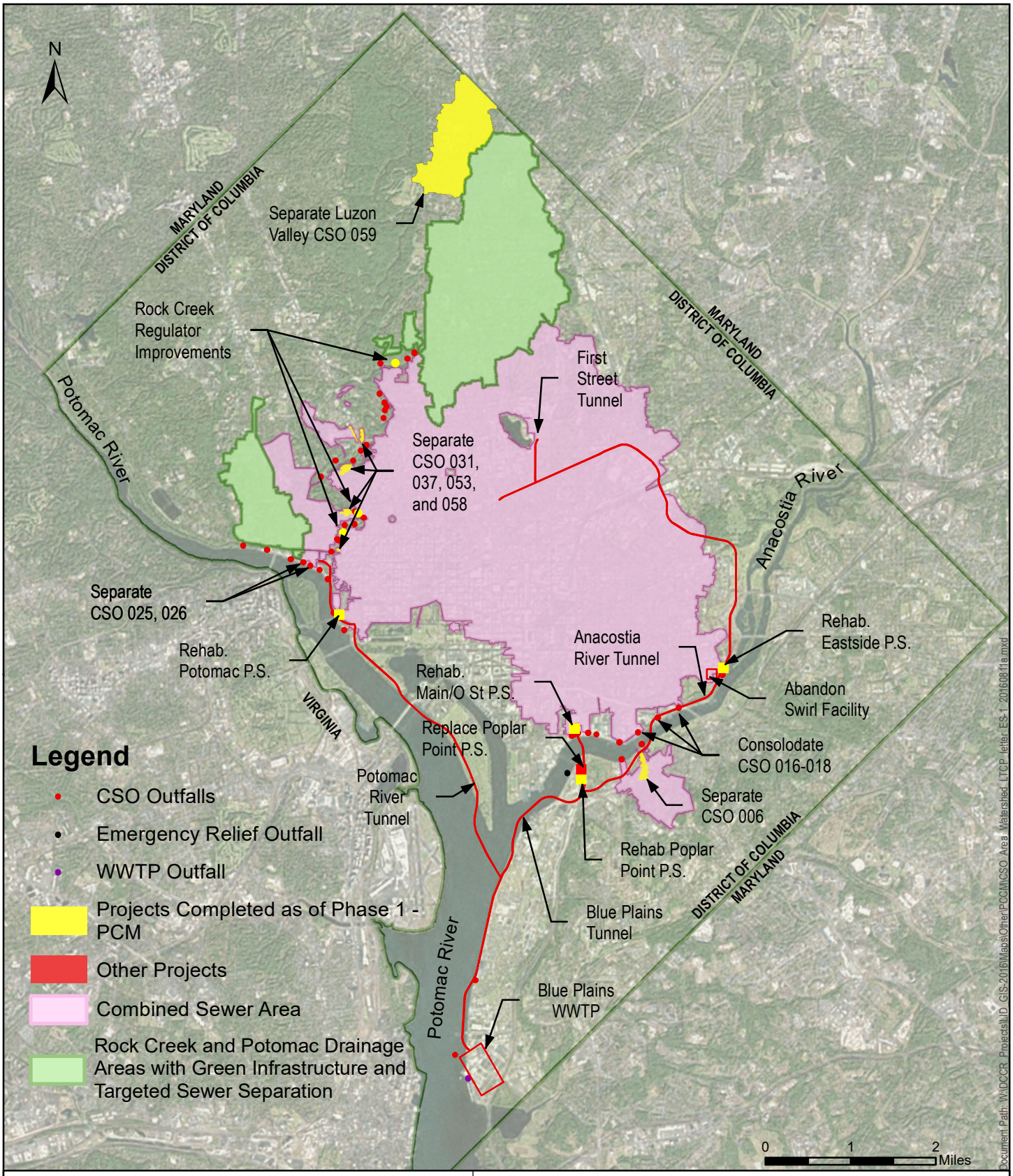
- Green/Gray CSO Controls for the Potomac Sewershed – The Green/Gray CSO Controls in the Potomac sewershed are designed to build upon the additional conveyance and treatment capacity provided by the Blue Plains Tunnel, the Blue Plains Tunnel Dewatering Pumping Station, and the ECF. Outfall 025 and 026 will be controlled by separation. Outfalls 027, 028 and 029 will be controlled using Green Infrastructure and targeted sewer separation. For Outfalls 020, 021, 022 and 024, a smaller Potomac storage (30 million gallons) tunnel and targeted Sewer Separation will be implemented. Because the Potomac and Anacostia Tunnel Systems will be interconnected, the total system storage available will not be less than 187 million gallons.

- Green/Gray CSO Controls for the Rock Creek Sewershed – DC Water will substitute Green Infrastructure for the Piney Branch Storage Tunnel.

The major elements of the LTCP are shown on Figure 1-2. The projects that have been completed and placed in operation as of Phase I post construction monitoring are summarized in Table 1-1:

Table 1-1. LTCP Projects Placed in Operation As of Phase I Post Construction Monitoring

Receiving Water	Anacostia River
Anacostia River	• Rehabilitation of Main, O Street, Eastside and Poplar Point Pumping Stations • Replacement of inflatable dams at Structures 14, 15, 15a, 16 and 24 • Separation of CSO 006
Potomac River	• Rehabilitation of Potomac Pumping Station • Replacement of inflatable dams at Structures 34 and 35
Rock Creek	• Separation of CSO 031, 037, 053, 057, 058 and 059 • Diversion structure improvement at CSO 033, 036 and 047
System Wide	• Constructing Low Impact Development-Retrofit or Green Infrastructure at the following DC Water facilities: Anacostia Water Pumping Station, East Side Pumping Station, and Fort Reno Reservoir



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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Long Term Control Plan

Date: August 2016

Figure 1-2

1.2.4 LTCP Implementation Status

The District of Columbia Water and Sewer Authority (DC Water or Authority) entered into a Consent Decree (CD) with the U.S. Government to establish a schedule for implementation of DC Water's Long Term Control Plan (LTCP). The CD was entered by the Court on March 23, 2005 in Consolidated Civil Action No. 1:CV00183TFH by the United States District Court for the District of Columbia. On January 14, 2016, the Court entered the First Amendment to the CD (Amended CD) in Consolidated Civil Action No. 1:CV00183TFH.

1.2.4.1 Anacostia River Projects

The Anacostia River Project components included in the Amended CD are summarized in Table 1-2.

Table 1-2. Anacostia River Projects in LTCP Decree

Component	Description	Status
Anacostia River		
Rehabilitation of Main, O Street and East Side Pumping Stations	Rehab Main, O Street and East Side pumping stations.	Completed
Separate Fort Stanton Drainage Area (Outfall 006)	Separate this CSO in the Fort Stanton Drainage Area	Completed
Storage/Conveyance Tunnel from Blue Plains to CSO 019	105 million gallon storage/conveyance tunnel from Blue Plains to CSO 019 to store and convey combined sewer flows from CSOs along Anacostia River as well as Main and O Street pumping stations. Abandon/ demolish Northeast Boundary Facility upon completion.	Place in Operation: March 23, 2018
Poplar Point Pumping Station	Provide certain interim improvements to the existing pumping station. Design, construct and place in operation a new 45 MGD pumping station.	Place in Operation: March 23, 2018
Northeast Boundary Storage/Conveyance Tunnels	Storage/conveyance tunnel in Northeast Boundary area and a branch tunnel from storage/ conveyance tunnel in the area of First Street NW and Rhode Island Avenue. These tunnels relieve street and basement flooding in the Northeast Boundary area.	Place in Operation: March 23, 2025

Component	Description	Status
M Street (CSO 016 and CSO 017) and 018 Diversion Sewers	Consolidate and direct all combined sewer flow from Outfalls 016, 017 and 018 to storage/ conveyance tunnel from Blue Plains to CSO 019.	Place in Operation: March 23, 2018

Based on the current level of planning, the Anacostia River Projects have been divided into various contract divisions to facilitate implementation. There is one contract division proposed for each of the three major tunnel segments and their associated shafts. The other contract divisions are comprised of near-surface diversion structures, associated diversions, junction sewers and the tunnel overflow structures. The planned contract divisions are listed in Table 1-3. Figure 1-3 shows the contract divisions and the current status of implementation.

Table 1-3. Planned Contract Divisions for Anacostia River Projects

Contract Division	Description
A	Blue Plains Tunnel
B	Tingey Street Diversion Sewer for CSOs 013 and 014
C	CSO 019 Overflow and Diversion Structures
D	Joint Base Anacostia-Bolling Overflow and Diversion Structures
E	M Street Diversion Sewer (CSOs 015, 016, and 017)
G	CSO 007 Diversion Sewer
H	Anacostia River Tunnel
I	Main Pumping Station Diversions
P	First Street Tunnel
J	Northeast Boundary Tunnel
Y	Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility
Z	Poplar Point Pumping Station Replacement

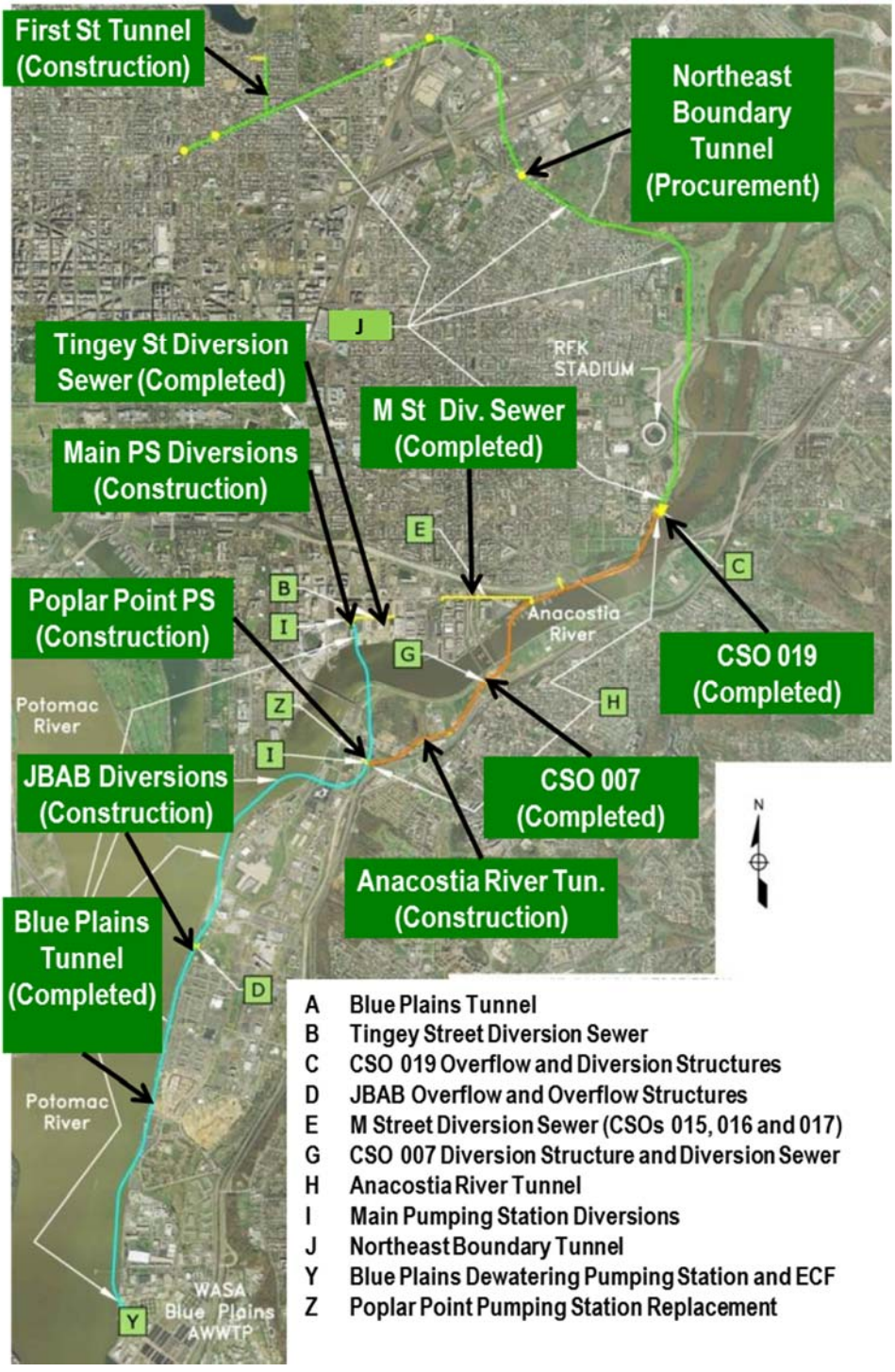


Figure 1-3. Anacostia River Project Status (as of July 2016)

1.2.4.2 Potomac River Projects

The control measures selected for the Potomac River are predicted to limit overflows to four events per average year. The principal control measures include rehabilitation of the Potomac Pumping Station, construction of a gravity Potomac Tunnel to intercept the CSOs from outfalls 020, 021, 022 and 024, separation of CSOs 025 and 026, and implementation of Green Infrastructure.

The Potomac River Project components included in the Amended CD are summarized in Table 1-4 and are shown on Figure 1-4.

Table 1-4. Potomac River Projects

Component	Description	Status
Potomac River		
Rehabilitation of the Existing Potomac Pumping Station	Rehabilitate station to firm 460 MGD pumping capacity	Completed
Potomac Storage Tunnel	At least 30 million gallon storage tunnel to store combined sewer flow from CSOs 020, 021, 022 and 024	Place in Operation: March 23, 2030
CSO Outfall Separation	Separate the CSS tributary to CSOs 025 and 026 and eliminate the outfalls	Place in Operation: March 23, 2025
Green Infrastructure Program	Implement Green Infrastructure Program for Potomac River sewershed	Project No.1: June 23, 2019 Project No.2: June 23, 2024 Project No.3: June 23, 2027

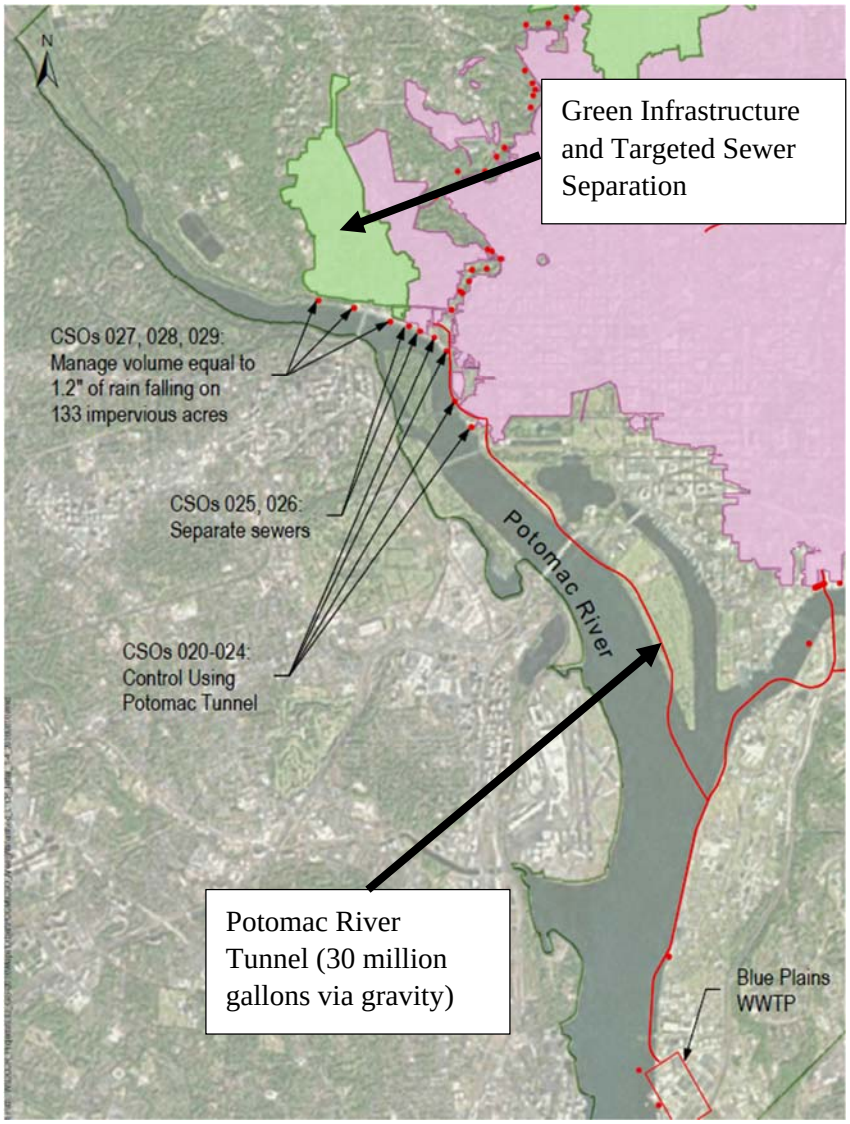


Figure 1-4. Potomac River Projects

1.2.4.3 Rock Creek Projects

The control measures in the LTCP for Rock Creek are predicted to limit Piney Branch overflows to one per average year. The remaining overflows in Rock Creek will be controlled to 4 events per average year. The Rock Creek Project components included in the Amended CD are summarized in Table 1-5 and are shown on Figure 1-5.

Table 1-5. Rock Creek Projects

Component	Description	Status
Green Infrastructure Program	Implement Green Infrastructure Program for Rock Creek sewershed	Project No.1: March 30, 2019 Project No.2: January 23, 2023 Project No.3: March 23, 2027 Project No.4: September 30, 2029 Project No.5: March 23, 2030
CSO Outfall Separation	Separate CSS tributary areas for CSOs 031, 037, 053, 058, and 059 and eliminate these outfalls	Completed
Monitoring of CSO Outfalls 033, 036, 047 and 057	Plan, design, construct and place in operation the measures to control CSOs from 033, 036, 047 and 057	Completed
Piney Branch Diversion Structure Improvements	Modify diversion structure no. 70 at Piney Branch to improve diversions to interceptor system	Place in Operation: March 23, 2020

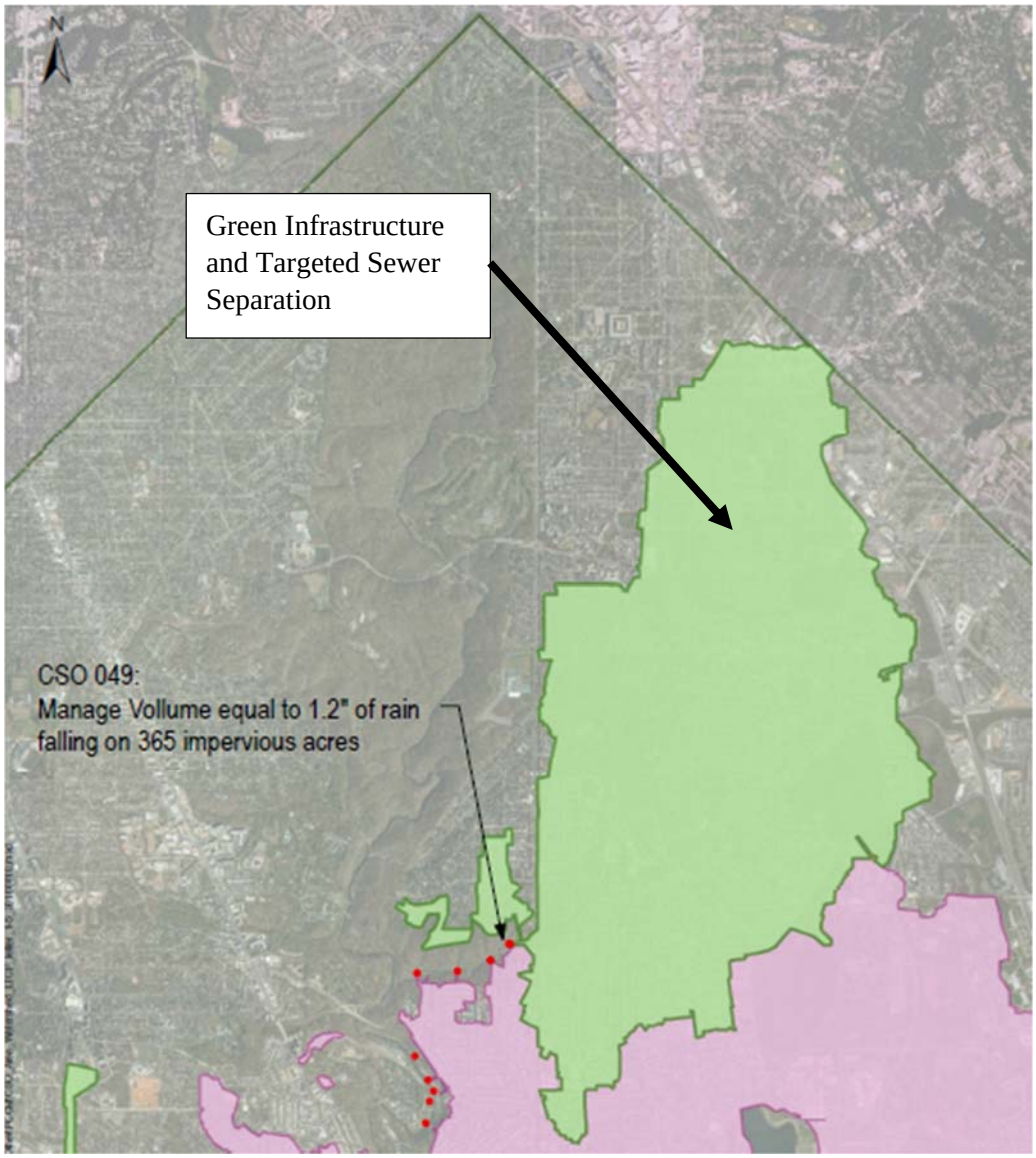


Figure 1-5. Rock Creek Projects

1.2.4.4 System-Wide Improvements

The Amended CD includes the following system-wide improvements:

- Low Impact Development Retrofit – the Decree requires DC Water to construct $3 M of LID at DC Water facilities and to evaluate the effectiveness of these measures. These projects have been completed as described as follows.

- **Anacostia Water Pumping Station (AWPS)**

  AWPS is located at the intersection of Ridge Place SE and 19th Street in Washington, DC's southeast quadrant. AWPS is one of DC Water's pump stations for its drinking water conveyance system. The LIDR facilities at AWPS include a bioretention cell and permeable

pavement in the parking spaces (LIDR shown on Figure 1-6). At the site, the LIDR manages stormwater runoff volume generated from the driveways, parking spaces, and building's roof. The bioretention cell was designed with sloped sides to collect runoff from adjacent pervious lawn and a portion of the parking lot. The cell also collects runoff from a portion of the roof. The pervious pavement manages the runoff that falls directly onto the parking spaces.

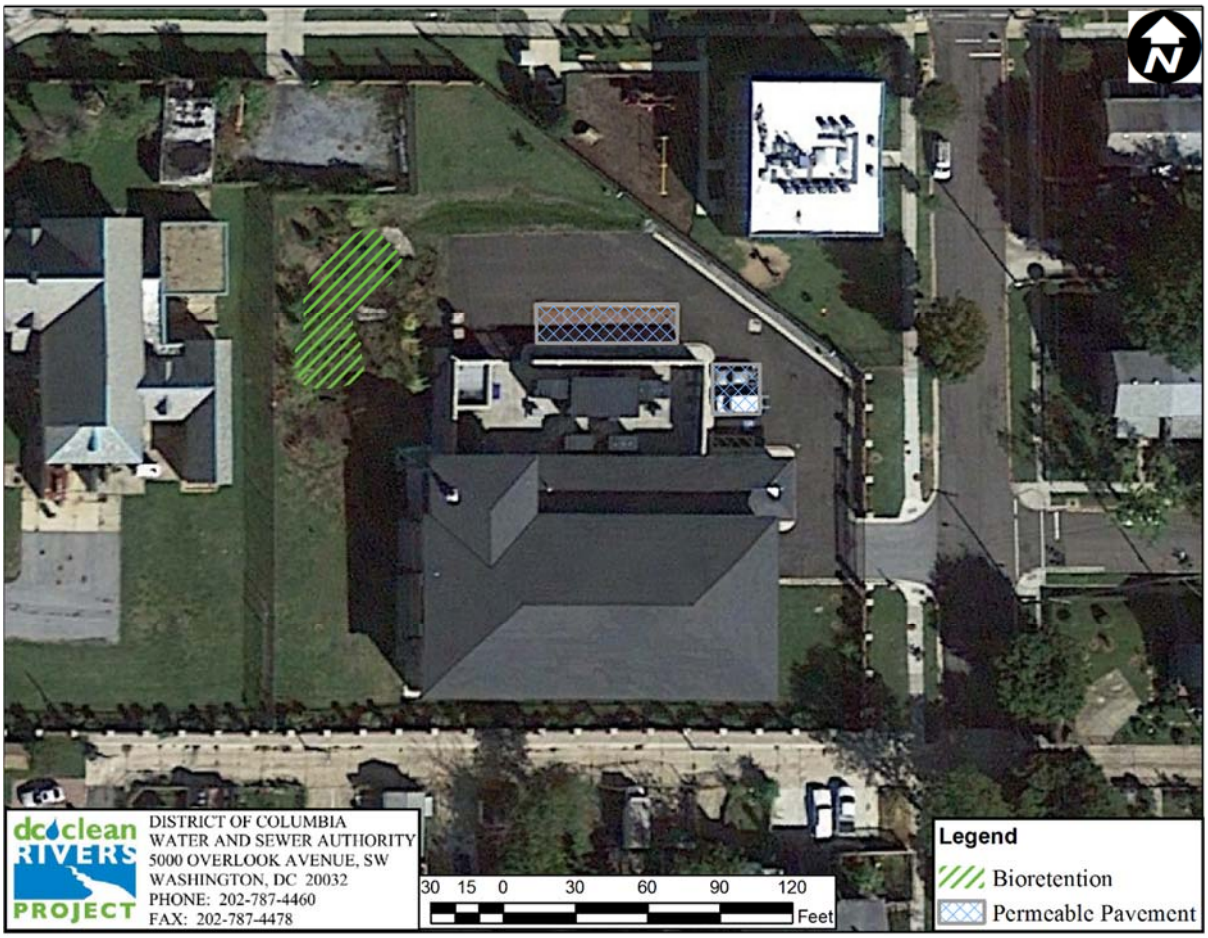


Figure 1-6. Aerial view of the AWPS and locations of LIDR facilities

- **East Side Pumping Station (ESPS)**

  ESPS is located on the west bank of the Anacostia River, approximately 450 yards south of the Robert F. Kennedy Memorial Stadium. Access to ESPS is provided through paved roads, which together with the impervious parking areas and the building's roof contribute to increased stormwater runoff. At the site, a green roof was constructed on the entire roof of the ESPS to manage stormwater that falls directly on the roof (Figure 1-7).

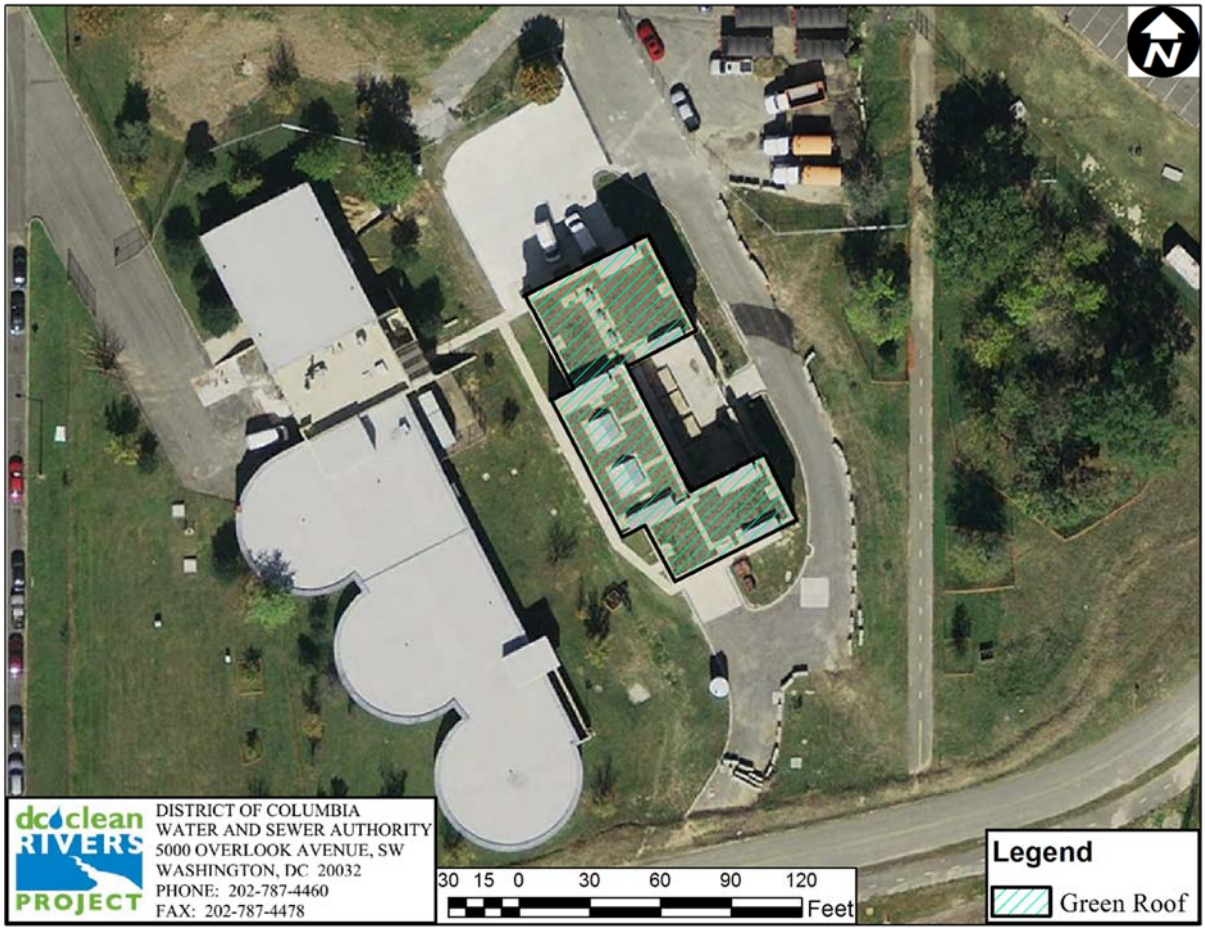


Figure 1-7. Aerial view of the ESPS and location of LIDR facility

- **Fort Reno Reservoir**

  FRR is a covered 5.8 million gallon reservoir system for drinking water located at Fort Reno Park. Prior to LIDR construction, the site's landscape was a mix of impervious (roads, parking lots, buildings) and pervious (lawns of managed turf) areas. LIDR constructed at the site includes a green roof and permeable pavers in the parking spaces (Figure 1-9). The green roof was constructed on top of the 42,500 square foot reservoir.

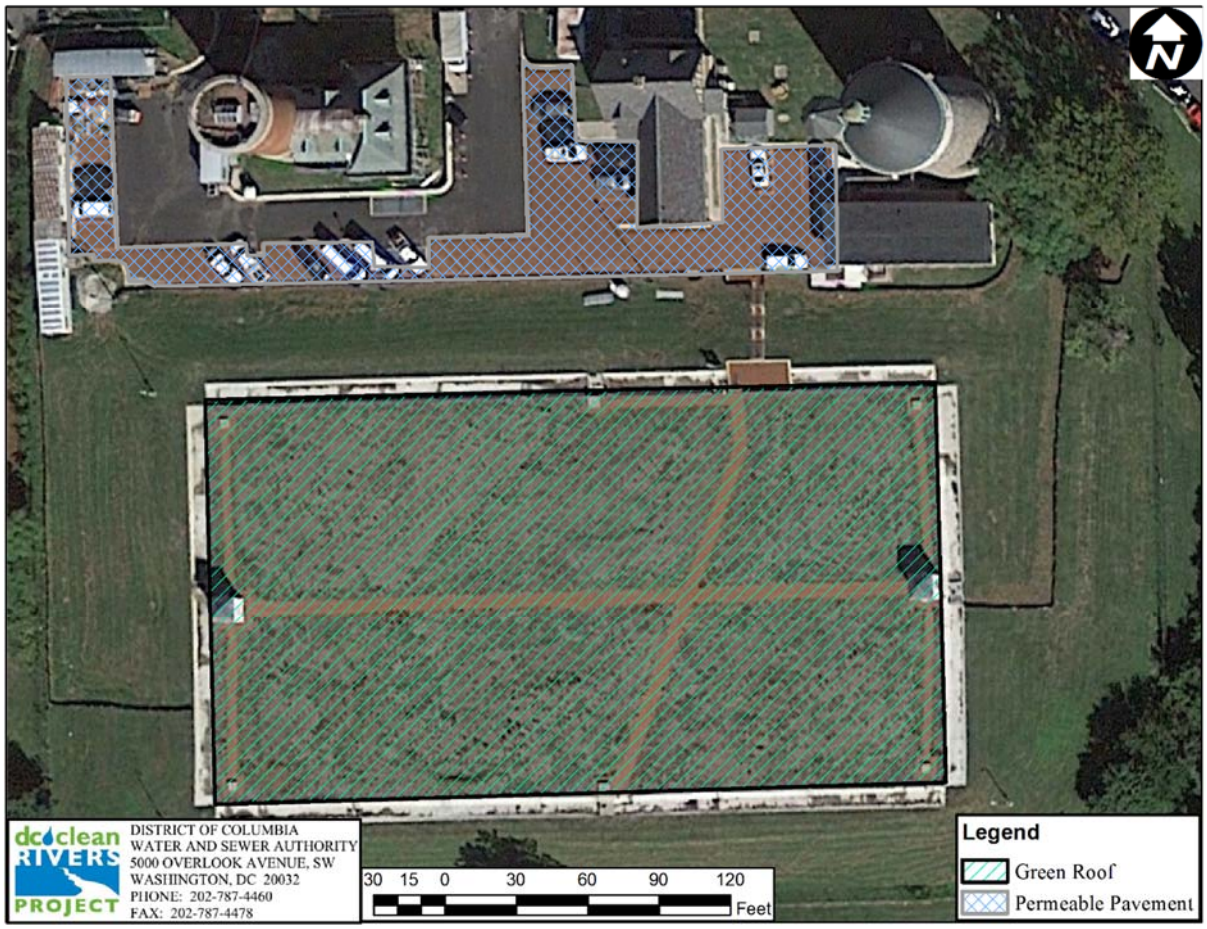


Figure 1-8. Aerial view of the FRR and locations of LIDR facilities

- Excess Flow Treatment Improvements at Blue Plains – the Decree requires the addition of four new primary clarifiers and improvement to the excess flow treatment control and operations. Because of the TN/WW plan, these improvements have been deleted and will be replaced by a new 225 MGD enhanced clarification facility (ECF).

1.3 NPDES Permit Requirements

Part III, Section D of the permit specifies the required post construction monitoring phases as follows:

- **Phase 1 Monitoring** – Following the placement in operation of the inflatable dams and pumping stations rehabilitation. This program will be conducted for a period of one year in each receiving waters (Anacostia and Potomac Rivers).

- **Phase 2 Monitoring** – Following the placement in operation of the Anacostia, Rock Creek and Potomac storage tunnels, respectively, as each tunnel is placed in operation. This program will be conducted for a period of one year in each receiving waters (Anacostia, and Potomac Rivers and Rock Creek).

- **Phase 3 Monitoring** – Following the placement in operation of the complete CSO tunnels storage system. This program will be conducted once every 5 years for each receiving waters (Anacostia and Potomac Rivers and Rock Creek).

Replacement of the inflatable dams was completed in 2004 and rehabilitation of the last pumping station (Potomac Pumping Station) was completed in October 2013. As a result, Phase 1 monitoring was implemented. The permit required the monitoring to consist of at least the elements in Table 1-6.

Table 1-6. NPDES Permit Requirements- Phase I

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	• 1 gauge in Northeast Boundary • 1 gauge in Tiber Creek	• 1 gauge in Slash Run	• Continuous
CSO Overflow (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary	n/a	• 4 storms minimum approximately 1 hr sample interval for each storm
Receiving Water Monitoring- Dissolved Oxygen (4)	• Continuous DO Monitors	• Continuous DO Monitors	• Approximately 30 minute intervals
Receiving Water Monitoring- Bacteria, Field Parameters (2) (4)	• Bacteria Samples	• Bacteria Samples	• 4 storms minimum

(5) Temporary gauges, meters and samplers to be installed.
(6) Samples shall be analyzed for Fecal Coliform, *E.coli*, CBOD5 and TSS.
(7) Monitoring shall be conducted for a continuous period of 12 months.
(8) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

1.4 Post Construction Monitoring Plan

A Post Construction Monitoring plan (PMP) was submitted to EPA and DC Department of Energy and Environment (formerly DC Department of the Environment) on May 28, 2014 for informational purposes. A copy of the PMP is provided in Appendix H. Later, the scope of the monitoring program was expanded to collect more data on precipitation, CSO overflow (flow and volume) and receiving

water monitoring. The scope expanded to include data collection for Rock Creek as well. More details on the specific monitoring locations is discussed in Section 2, 3 and 4 of this Report. The data collected from this intensive monitoring program has facilitated to better assess the effectiveness of the Phase I CSO controls on a system wide basis.

1.5 Monitoring Schedule

The monitoring effort started in December 2014 and was initially anticipated for completion in December 2015 (12 months of monitoring). However, due to the reasons specified below, monitoring was extended until February 2016. A detailed discussion of these monitoring efforts is included in the later sections of this Report.

Table 1-7. Post Construction Monitoring- Duration

Monitoring Type	Start	End
Rainfall Monitoring (1)	12/1/2014	2/29/2016
CSO Overflow (Flow and Volume) (2)	12/1/2014	2/29/2016
CSO Overflow Sampling (3)	12/1/2014	2/16/2016
Receiving Water Monitoring- Dissolved Oxygen (4)	12/10/2014	2/3/2016
Receiving Water Monitoring- Bacteria, Field Parameters (5)	12/18/2014	1/7/2016

(1) Rainfall monitoring was conducted for the duration of the monitoring program.

(2) Flow monitoring at the permit specified outfalls was conducted for at least 12 months. Flow monitoring at CSO 019 was extended until 2/29/2016 to facilitate additional CSO overflow sampling at Northeast Boundary. In addition, extensive flow monitoring (50 flow meters) was conducted at several outfalls and for major sewers for modeling purposes.

(3) Due to the natural variability in bacteria results, more CSO overflow sampling (6 storms) was conducted at CSO 019 than required by the permit. In order to check the characteristics of CSOs at other outfalls, sampling was conducted at CSO 027 and CSO 029 for one storm event.

(4) Dissolved oxygen monitoring was conducted at a total of six (6) monitoring locations along Anacostia and Potomac Rivers. Due to frozen river conditions during winter months, several Dissolved Oxygen sensors encountered maintenance issues resulting in data gaps. Hence, Dissolved Oxygen monitoring was extended until 2/3/2016 to ensure at least 12 months of data collection at each monitoring location.

(5) Receiving water monitoring was conducted at thirteen (13) monitoring locations. Samples were collected in a pattern of twice in one week followed by once in the next week for a total of seventy one (71) sampling events which resulted data collection during both dry and wet weather. In addition, four (4) wet weather sampling events were conducted each lasting for forty-eight (48) hours.

1.6 Modeling Period

The EPA's CSO Control Policy (1994) requires the effectiveness of CSO controls to be evaluated on a "system-wide, annual average basis." For model calibration, a twelve month period from January 1, 2015 to December 31, 2015 (referred in this report as PCM period) was selected.

1.7 Organizations Involved in Phase I Monitoring Program

The following organizations are involved in this monitoring phase:

- DC Water - Operates the combined and separate sanitary sewer systems in the District.
- DCCR Firms- Engineering firms providing professional engineering services to DC Water in support of the LTCP effort via a program management contract known as Program Consultants Organization (PCO).
  - CSL Services – firm retained to install, maintain and operate the flow meters and rain gages in the combined sewer system.
  - Martel Laboratories – laboratory retained to perform analytical work on samples collected under CSO Overflow Monitoring.
- Metropolitan Washington Council of Governments (MWCOG) - supports a Regional Monitoring Subcommittee (RMS) that coordinates the local monitoring efforts of federal, state, and local government agencies in Maryland, Virginia, and the District of Columbia. MWCOG maintains a centralized database and performs processing, analysis, and disbursement of ambient monitoring data.
  - Versar – environmental services firm retained by MWCOG to install, operate and maintain continuous DO monitors in the receiving waters (Anacostia River, Potomac River) in addition to water quality sampling (regular sampling and wet weather sampling) in the receiving waters (Anacostia River and Potomac River).
  - Martel Laboratories – laboratory retained to perform analytical work on samples collected under Receiving Water Monitoring.

1.8 Quality Assurance Project Plan

All of the monitoring activities were conducted in accordance with the Quality Assurance Project Plan (QAPP) provided in Appendix G. The purpose of the QAPP is to document the type and quality of data needed, and the procedures required to assure that the data was collected and managed in a manner consistent with applicable requirements and generally accepted and approved quality assurance objectives.

2 Rainfall Monitoring

2.1 Introduction

Data on rainfall is necessary to analyze the response of the CSS to rainfall, to calibrate the CSS model, and to assist in predicting the impact of Phase I controls on CSOs and receiving waters under the average year rainfall condition.

2.2 Permit Requirements

The rainfall monitoring required by the permit is shown in Table 2-1.

Table 2-1. Rainfall Monitoring – Permit Requirements

Receiving Water	Frequency
Anacostia River	
1 gage in Northeast Boundary	Continuous
1 gage in Tiber Creek	Continuous
Potomac River	
1 gage in Slash Run	Continuous

(1) Temporary gauges, meters and samplers to be installed.

(2) Monitoring shall be conducted for a continuous period of 12 months.

2.3 Summary of Monitoring

DC Water operates four rain gages in the CSS to collect data on rainfall. These gages are in the drainage areas required to be monitored and are used for post construction monitoring. Two additional rain gages were installed in the drainage areas that correspond with the major CSO outfalls which will be monitored. Collection of rainfall data allowed developing and modeling the correlation between rain events, CSO overflows and water quality impacts.

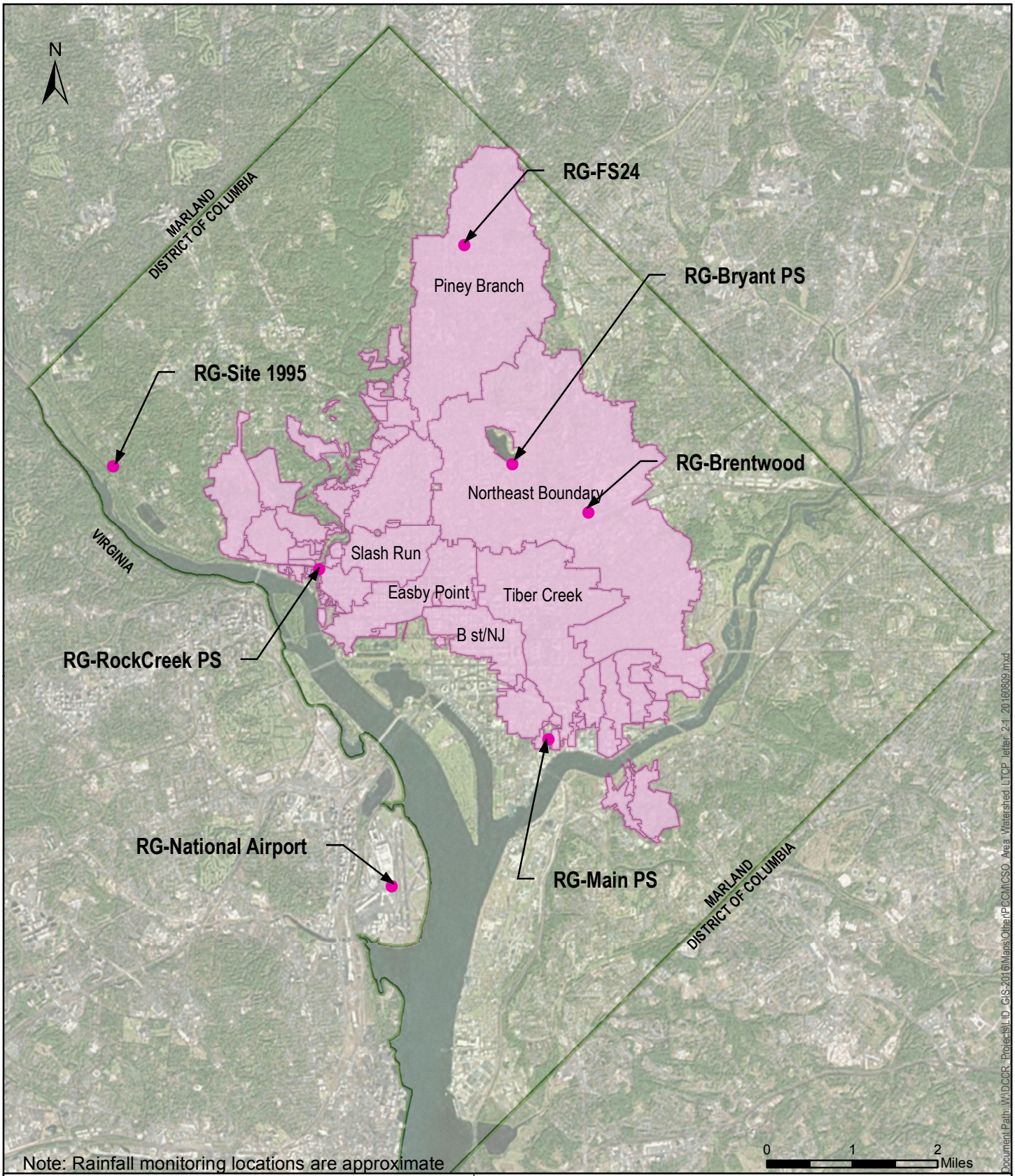
The rain gages are of the tipping bucket design, capable of recording rain in 0.01-inch increments. The data from the rain gages listed in Table 2-2 was acquired for the duration of the monitoring program. Table 2-2 provides the drainage areas and rainfall monitoring locations.

Table 2-2. Rainfall Monitoring Locations

Drainage Area	Gage		Site
	Req'd by Permit	Additional	
Anacostia River			
1 gage in Northeast Boundary	X		1. Bryant St PS- 2nd & 4th St NW (RG-BRYANT PS) 2. Brentwood Reservoir - Brentwood Parkway & New York Ave NE (RG-BRENTWOOD)
1 gage in Tiber Creek	X		3. Main Pumping St – First St & O St SE (RG-MAIN PS)
Potomac River			
1 gage in Slash Run	X		4. Rock Creek PS - Rock Creek Parkway N & K St NW (RG-ROCK CREEK PS)
1 gage in Georgetown		X	5. Fletcher's Boat House- Site 1995 4940 Canal Road NW (RG- SITE 1995)
Rock Creek			
1 gage in Piney Branch		X	6. Company 24 Fire St - Gallatin St & Georgia Ave NW (RG- FS24)
Other			
1 gage at National Airport		X	7. National Weather Service gage at Ronald Reagan National Airport (RG-NATIONAL AIRPORT)
Total	**7**		

2.3.1 Radar Data

Rainfall can vary widely over even a small geographic area. Therefore, radar rainfall data at a 1 km x 1 km grid resolution was used to provide rainfall in each drainage area during each rain event. This radar rainfall data was then corrected and adjusted using the measurements recorded at the rain gages. Rain gage locations are shown on Figure 2-1.



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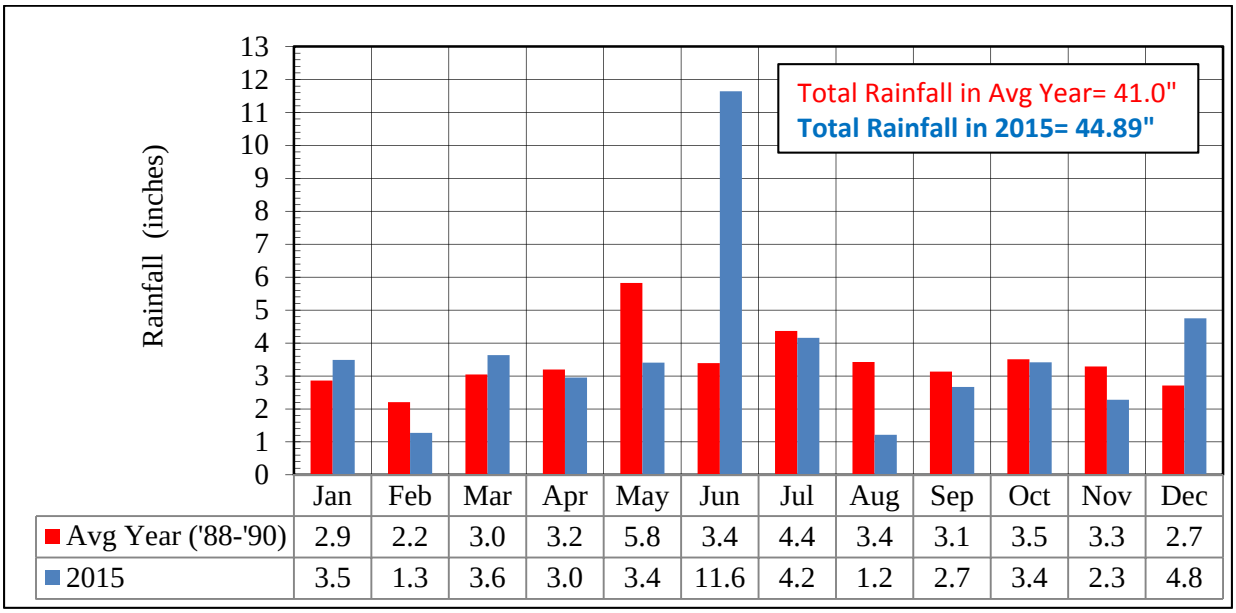
DC Clean Rivers Project
Post Construction Monitoring Phase-1

Rainfall Monitoring Location Map

Date: August 2016	Figure 2-1

2.4 Rainfall Conditions Summary

Average monthly rainfall recorded during the PCM period is presented in Figure 2-2 and is compared to the average year. Year 2015 was a wetter year than normal and included the extremely wet month of June 2015 with a total rainfall of 11.6 inches.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg Year ('88-'90)	2.9	2.2	3.0	3.2	5.8	3.4	4.4	3.4	3.1	3.5	3.3	2.7
2015	3.5	1.3	3.6	3.0	3.4	11.6	4.2	1.2	2.7	3.4	2.3	4.8

Figure 2-2. Average Monthly Rainfall Summary
January 1, 2015 – December 31, 2015

Comparison of the annual rainfall conditions between 2015 and the average year is presented below. It can be observed that the year 2015 was a wetter year with more long duration storms and higher intensity storms resulting in more CSO volume.

Table 2-3. Annual Average Rainfall Conditions

Statistics	Average of 1988-1990[1]	2015[2]
Annual Rainfall (inches)	41.0	44.9
No. of Events > 0.05 inches	71	86.0
No. of Events >=0.5 inches	32	31
No. of Events >=1.0 inches	13	10
No. of Events Max Intensity >=0.5 in/hr	8	28
No. of Events Max Intensity >=1.0 in/hr	2	15
Average Storm Duration (Hours)[2]	10.1	17.6
Average Max Intensity (in/hr)	0.16	0.19
Max Intensity (in/hr)	1.29	1.44

Notes:

1. Rainfall at Ronal Reagan National Airport.
2. Using Radar rainfall data
3. Individual events separated by a minimum of 12 hours with no rain. A threshold of 0.05" was selected since rainfall less than this produces minimal runoff.

3 Combined Sewer System (CSS) Monitoring

3.1 Introduction

Monitoring of the Combined Sewer System (CSS) is required to characterize the frequency, duration, flow rate, volume and pollutant concentrations of CSO discharges. The information collected will assist with the assessing the impact of the implemented Phase I controls on CSO volume and water quality. Monitoring consisted of:

- Flow and volume measurement of selected CSO overflows
- Sampling and analysis of the water quality of selected CSO outfalls

3.2 Permit Requirements

The CSO monitoring required by the permit is tabulated below.

Table 3-1. CSO Monitoring – Permit Requirements

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
CSO Overflow Monitoring (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary		• 4 storms per year • Approx 1 hour sample interval for each storm

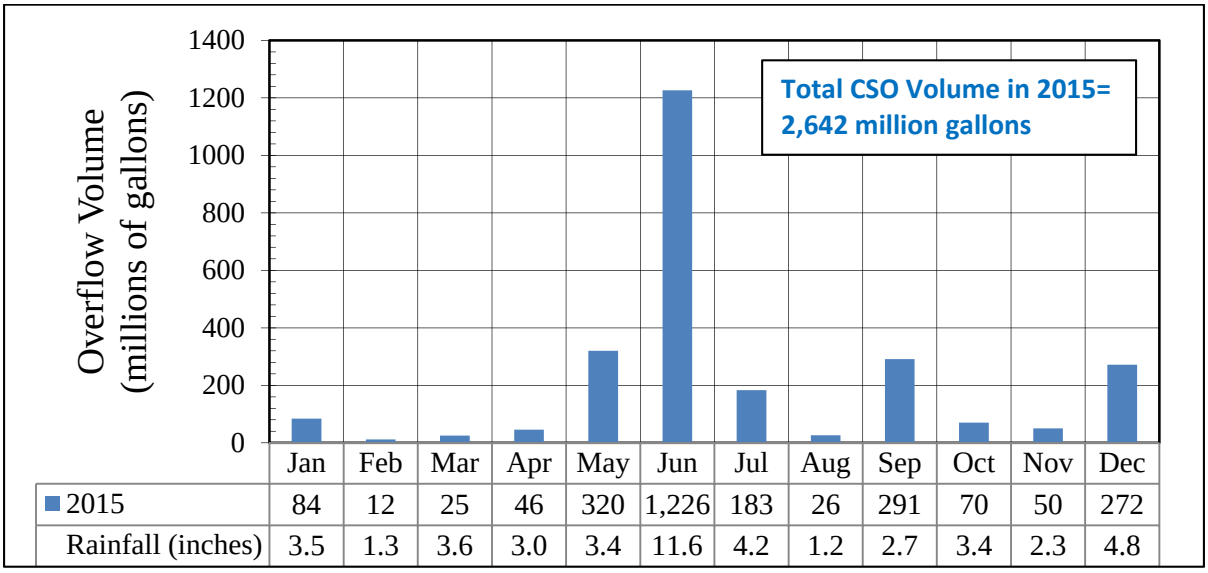
(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for Fecal Coliform, *E.coli*, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.

3.3 Summary of Monitoring

3.3.1 CSO Overflow Monitoring (Flow and Volume)

Flow monitoring was conducted by installing 50 meters in the combined sewer system. Thirty three of these meters are for CSO outfalls, while the remainder are internal system points and dry weather diversions in the CSS. Note that at some locations, more than one flow monitor was required due to the configuration of the sewers. For outfalls such as CSO 011a, 012, 020 that are influenced by the tides, dual meters were installed on the upstream and downstream side of the inflatable dams. Overall, approximately 83% of the CSS drainage area was monitored during PCM.

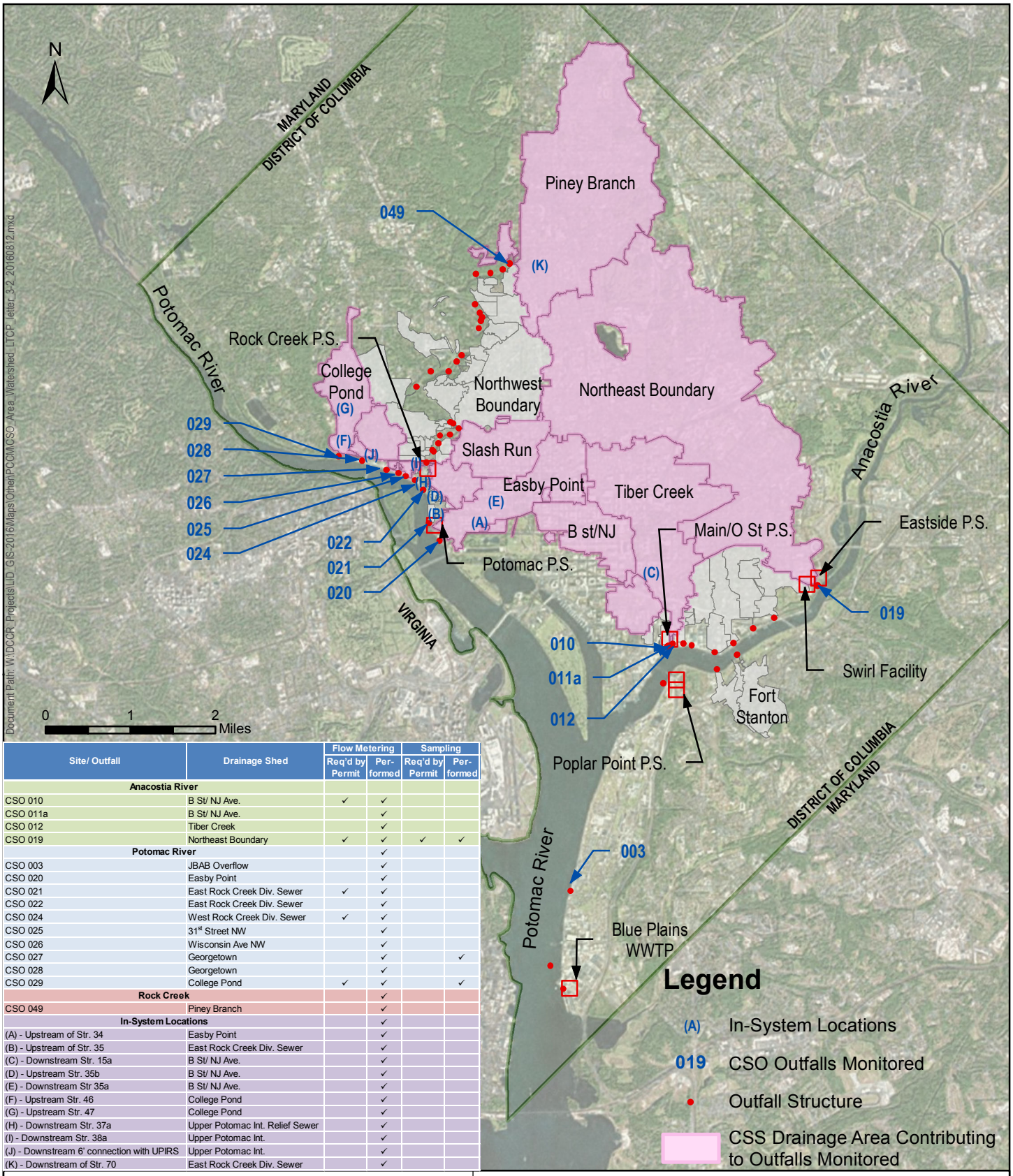
Flow monitors operated continuously and collected data at five minute intervals. Flow monitoring was conducted during PCM duration. Figure 3-1 graphically depicts the relative amounts of CSO volume discharged from the outfalls during the monitoring period.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	84	12	25	46	320	1,226	183	26	291	70	50	272
Rainfall (inches)	3.5	1.3	3.6	3.0	3.4	11.6	4.2	1.2	2.7	3.4	2.3	4.8

Figure 3-1. Total Monitored CSO Outfalls- Overflow Volume (MG)
January 1, 2015 – December 31, 2015

Figure 3-2 and Table 3-2 shows the drainage areas and flow monitoring locations. Detailed location maps and data collected during monitoring period for each monitoring site is included in Appendix E.



Site/ Outfall	Drainage Shed	Flow Metering		Sampling	
		Req'd by Permit	Per-formed	Req'd by Permit	Per-formed
Anacostia River					
CSO 010	B St/ NJ Ave.	✓	✓		
CSO 011a	B St/ NJ Ave.		✓		
CSO 012	Tiber Creek		✓		
CSO 019	Northeast Boundary	✓	✓	✓	✓
Potomac River			✓		
CSO 003	JBAB Overflow		✓		
CSO 020	Easby Point		✓		
CSO 021	East Rock Creek Div. Sewer	✓	✓		
CSO 022	East Rock Creek Div. Sewer		✓		
CSO 024	West Rock Creek Div. Sewer	✓	✓		
CSO 025	31st Street NW		✓		
CSO 026	Wisconsin Ave NW		✓		
CSO 027	Georgetown		✓		✓
CSO 028	Georgetown		✓		
CSO 029	College Pond	✓	✓		✓
Rock Creek			✓		
CSO 049	Piney Branch		✓		
In-System Locations			✓		
(A) - Upstream of Str. 34	Easby Point		✓		
(B) - Upstream of Str. 35	East Rock Creek Div. Sewer		✓		
(C) - Downstream Str. 15a	B St/ NJ Ave.		✓		
(D) - Upstream Str. 35b	B St/ NJ Ave.		✓		
(E) - Downstream Str 35a	B St/ NJ Ave.		✓		
(F) - Upstream Str. 46	College Pond		✓		
(G) - Upstream Str. 47	College Pond		✓		
(H) - Downstream Str. 37a	Upper Potomac Int. Relief Sewer		✓		
(I) - Downstream Str. 38a	Upper Potomac Int.		✓		
(J) - Downstream 6' connection with UPIRS	Upper Potomac Int.		✓		
(K) - Downstream of Str. 70	East Rock Creek Div. Sewer		✓		

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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Rainfall and Flow Monitoring Locations

Date: August 2016 | Figure 3-2

Table 3-2. CSO Monitoring Sites and Meter Designations

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
Anacostia River					
B St/ New Jersey Ave	CSO 010 - B ST/ NJ Ave Pumped Overflow	10-15-1	Structure 15, downstream of inflatable dam	In-system hydraulics	X
		10-15a-1L	Structure 15A, between weir and inflatable dam	In-system hydraulics	X
		10-15a-2L	10' sewer, next to weir at Structure 15A	In-system hydraulics	
	CSO- 011A	11a-11-1U	West conduit of B ST/ NJ Ave Sewer, upstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-1D	West conduit of B ST/ NJ Ave Sewer, downstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-2U	East conduit of B ST/ NJ Ave Sewer, upstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-2D	East conduit of B ST/ NJ Ave Sewer, downstream of Structure 11 & inflatable dams	CSO overflow	
	B St/ NJ Avenue Sewer	00-35A-1	Upstream of Structure 35A on B ST/ NJ Ave Sewer	Internal System Flow	
	B St/ NJ Avenue Sewer	00-35b-1	Downstream of Structure 35A on B ST/ NJ Ave Sewer	Internal System Flow	
Tiber Creek	CSO 012	12-16-1U	West conduit of Tiber Creek Sewer, upstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-1D	West conduit of Tiber Creek Sewer, downstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-2U	East conduit of Tiber Creek Sewer, upstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-2D	East conduit of Tiber Creek Sewer, downstream of Structure 16 & inflatable dams	CSO overflow	
Northeast Boundary	CSO 019	19-24-1	West conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-2	Middle conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-3	East conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-4L	Top of weir in mixing tank at Swirl Facility	CSO overflow	X

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
Potomac River					
	CSO 003	03-02-1L	Downstream of Structure 2	CSO Overflow	
	CSO 020	20-34-1U	Upstream of Structure 34	CSO Overflow	
		20-34-1D	Between Outfall and Structure 34	CSO Overflow	
Slash Run	CSO 021	21-35-1	Slash Run Trunk Sewer Overflow	CSO overflow	X
		00-35-1	Slash Run Trunk Sewer Dry Weather Flow, upstream of Structure 35	Diverted flow	
	CSO 022	22-36-1	Downstream of Structure 36	CSO Overflow	
		22-36-2	27" Storm	Storm	
West Rock Creek Diversion Sewer	CSO 024	24-38a-1L	On the weir, downstream of Structure 38a	CSO overflow	X
		24-38a-2V	On the weir, downstream of Structure 38a	CSO overflow	X
		24-38a-3	30" CS connected to CSO 024 Outfall sewer	CSO overflow	X
		24-39b-1L	21", overflows from STR 39b to meter location 24-38a-3	CSO overflow	
		24-39a-1L	12", overflows from STR 39a to meter location 24-38a-3	CSO overflow	
	CSO 025	25-41-1	Downstream of Structure 41	CSO overflow	
		25-41c-1	Downstream of Structure 41c	CSO overflow	
		25-41b-1	Downstream of Structure 41b	CSO overflow	
	CSO 026	26-42-1	Downstream of Structure 42A	CSO overflow	
	CSO 027	27-43a-1	Downstream of Structure 43A	CSO overflow	
		27-44-1L	Level sensor on UPI at Structure 44	CSO overflow	
	CSO 028	28-45-1	Downstream of Structure 45	CSO overflow	
College Pond	CSO 029	29-46-1	21" SS, upstream, of Structure 46	Diverted flow	
		29-47-1	6' CS, upstream of Structure 47	Diverted flow	
		29-47-2	6' CS, downstream of Structure 47	CSO overflow	X
		29-47-3	12" Storm, at Structure 47	Storm	
		29-47-4	18" Storm, at Structure 47	Storm	
	UPIRS	00-UPIRS-1	downstream of Rock Creek Siphon and Structure 37A	Internal System Flow	
		00-UPIRS-2	Downstream of flow diversion from UPIRS to UPI via 6' connection	Internal System Flow	
	UPI	00-UPI-1	Between Structure 38A and Rock Creek PS	Internal System Flow	
		00-UPI-2	UPI, downstream of 6' flow connection from UPIRS	Internal System Flow	
		00-UPI-3	UPI flows to Rock Creek PS	Internal System Flow	

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
Rock Creek					
Piney Branch	CSO 049	49-70-1L	On the weir, west conduit at Structure 70	CSO overflow	
		49-70-2L	On the weir, middle conduit at Structure 70	CSO overflow	
		49-70-3	East conduit, near Outfall 049 at Structure 70	CSO overflow	
		49-70-4	ERCDS, downstream of Structure 70	Diverted flow	

In addition to the data available from the installed flow monitors, flow data at various locations was also obtained from DC Water's SCADA system. SCADA points measure flows into DC Water's sewer system from surrounding jurisdictions as well as flows from DC Water's pump stations to BP AWWTP.

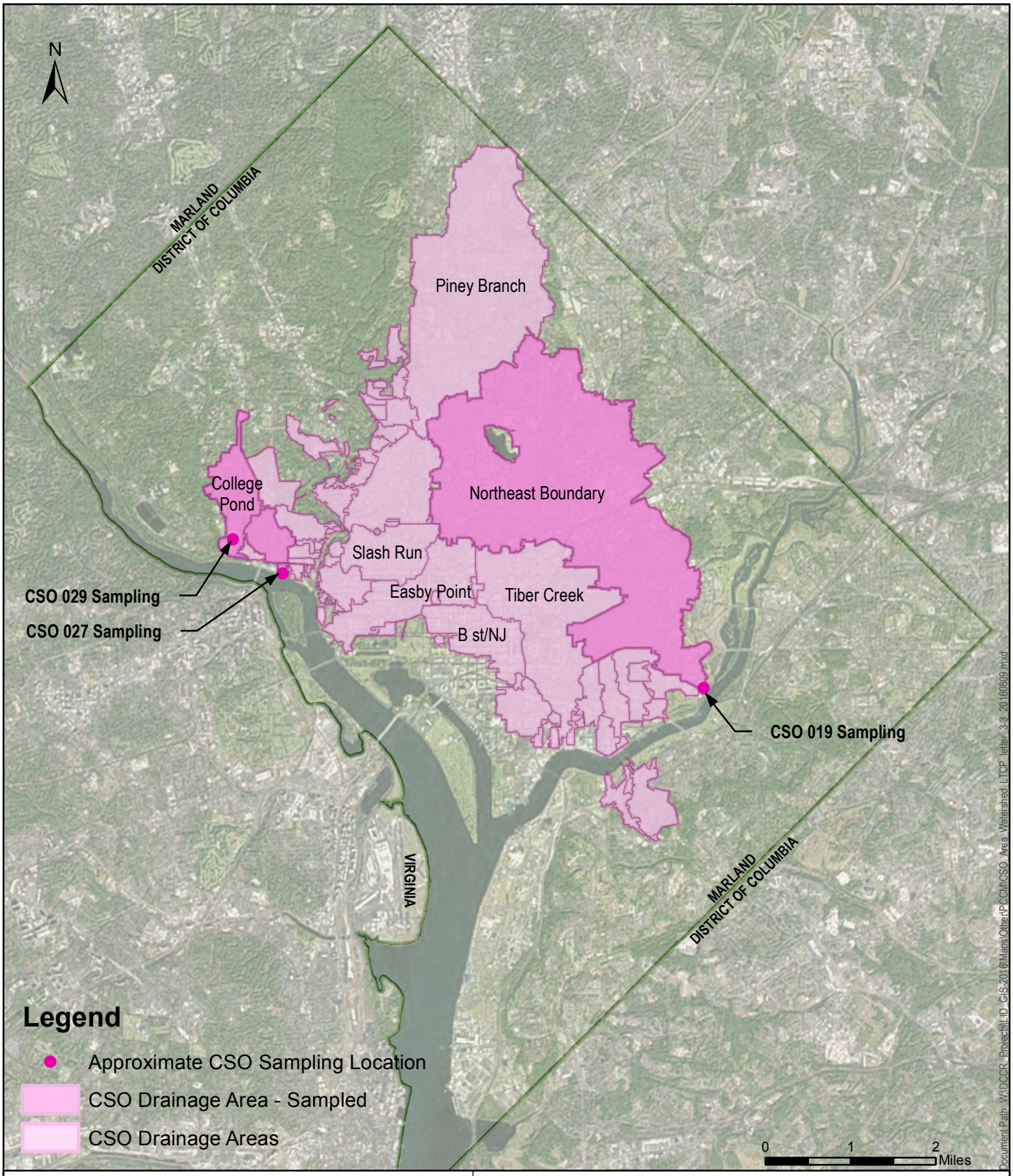
3.3.2 CSO Overflow Sampling

Sampling of CSO overflows was conducted at three (3) locations to characterize the nature of combined sewer overflows. The drainage areas sampled are shown in Table 3-3 and Figure 3-3.

The sampling location for Northeast Boundary (NEB) drainage area was at the influent to the NEB Swirl (CSO 019) which represents CSO before treatment by the Swirl facility. The sampling location for College Pond (CSO 029) drainage area was at the downstream of the weir at Structure 47. The sampling location for Georgetown (CSO 027) was at the overflow manhole downstream of Structure 43a. Detailed sampling location maps were included in Appendix F.

Table 3-3. CSO Overflow Sampling Locations

Monitoring Type	Anacostia River	Potomac River	Frequency
CSO Overflow Sampling	• 1 sampling station at Northeast Boundary		• 4 storms per year • Approx 1 hour sample interval for each storm
		1 sampling station in College Pond	• 1 storm • Approx 1 hour sample interval
		1 sampling station in Georgetown	• 1 storm • Approx 1 hour sample interval



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Post Construction Monitoring Phase-1

CSO Sampling Location Map

Date: August 2016

Figure 3-3

3.3.2.1 Sample Collection Frequency and Analytical Work

Manual grab sampling was performed during four storms at a frequency of 1 sample per hour for first 8 hours and then 1 sample every 8 hours for up to a total 40 hours per storm event and for a maximum of 12 samples per storm. Based on flow meter data, samples were mathematically composited to determine event mean concentrations. Samples were analyzed for the parameters shown in Table 3- 4. Samples were collected to characterize the nature of CSO overflows.

To check the characteristics of CSOs at other outfalls, sampling was performed at Potomac River CSOs (CS0 027 and CSO 029) for a storm event and the samples were analyzed for the parameters shown in Table 3-4.

Table 3-4. CSO Overflow Sampling Analysis

Parameter	Analysis Method (1)
Field Parameters	PH – SM 4500 H-B Temperature – EPA 170.1 Dissolved Oxygen – SM 4500 – G
Fecal Coliform	SM 9221 – E (A1-Medium)
	SM 9221 – E (EC-Medium)
E.coli	SM 9223 B-94 (Quantitray)
	SM 9221 –F (EC-MUG)
CBOD5 (total)	SM 5210 B -01
TSS	SM 2540 D -97
Chlorophyll a	SM 10200 - H

Notes:

(1) SM= Standard Methods

3.3.2.2 CSO Overflow Sampling- Summary

The Table 3-5 summarizes the rain events during which samples were taken at the monitoring locations for Anacostia and Potomac Rivers. The sampling location maps and data collected during monitoring period is included in Appendix F.

3.4 Event Mean Concentration

Event mean concentrations (EMCs) were used to calculate conventional pollutant loads from the CSS. EMCs are defined as the total mass of pollutants discharged divided by the total flow volume. EMCs for each monitored storm were calculated by computing a flow weighted average concentration of all the samples that were taken during the storm. In addition, overall EMCs were calculated by computing flow weighted averages over all the monitored storm events.

Table 3-5. Event Mean Concentrations Summary for CSO Overflow Sampling

Anacostia CSO (CSO 019)							
Sampling Date		**4/20/2015**	**6/1/2015**	**9/29/2015**	**11/19/2015**	**2/3/2016**	**2/16/2016**
		Storm #1	**Storm #2**	**Storm #3**	**Storm #4**	**Storm #5**	**Storm #6**
Analysis	**Units**						
$CBOD_5$ total	mg/L	37	18	17	42	59	28
TSS	mg/L	152	203	115	204	684	234
Chlorophyll-a	mg/m3	17	7	7	12	18	14
Fecal Coliforms (A1-Med)	MPN/100ml	12,421	DQL	Not Measured	Not Measured	61,932	156,742
Fecal Coliforms (EC-Med)	MPN/100ml	16,000	25,662	66,285	39,400	78,837	108,412
E.coli (EC-Med)	MPN/100ml	16,000	14,047	27,925	10,074	176,126	80,698
*E.coli (*Quantitray)	MPN/100ml	168,674	61,877	Not Measured	Not Measured	1,407,564	170,523
Dissolved Oxygen	mg/L	9		7	5	13	13
Total Overflow Volume	MG	21.66	82.01	117.53	10.08	12.72	34.30

Potomac CSOs (027 & 029)			
Sampling Date		**5/6/2016**	**5/6/2016**
		CSO 027	**CSO 029**
Analysis	**Units**		
$CBOD_5$ total	mg/L	24.5	18
TSS	mg/L	32.5	106
Chlorophyll-a	mg/m3	DQL	DQL
Fecal Coliforms (A1-Med)	MPN/100ml	73,500	104,500
Fecal Coliforms (EC-Med)	MPN/100ml	180,000	89,500
E.coli (EC-Med)	MPN/100ml	180,000	89,500
*E.coli (*Quantitray)	MPN/100ml	155,950	139,750
Dissolved Oxygen	mg/L	10.53	11.17
Total Overflow Volume	MG	0.16	0.16

Notes:

(1) DQL= Data Quality Error

Table 3-6. Comparison of EMCs with LTCP

Analysis	Units	LTCP (1)	PCM (2)
$CBOD_5$ total	mg/L	34 - 74	21.2 - 23
TSS	mg/L	118 - 186	69.2 - 187
Fecal Coliforms	MPN/100ml	191,309 - 939,270	55,191 - 134,750
E.coli	MPN/100ml	122,011 - 686,429	35,536 - 215,533
Dissolved Oxygen	mg/L	6	6 - 10.8

(1) Range of EMCs for system wide CSOs are presented here from LTCP Report (Table 4-4).

(2) Range of EMCs for CSO sampling conducted for outfalls 019, 027 & 029 are presented. For both Fecal Coliform and *E.coli,* the range provided includes the data collected by dual analytical methods listed in Table 3-4.

As required by the permit for Phase I monitoring, most of the CSO sampling was conducted at CSO 019 only (6 storms). Based on the sampling conducted as part of Phase I and comparison of the EMCs with LTCP EMCs, it was determined that there is no need to change the EMCs in the Water Quality models.

3.5 CSS Model Calibration and Validation

Compared to the flow monitoring during the LTCP model development back in 2000, extensive monitoring effort was conducted during Phase I monitoring as tabulated in Table 3-7. Overall, 83% of the CSS drainage area was monitored during PCM. Hence, the model was further refined in order to include the monitored areas. The model was recalibrated with the monitoring data in order to evaluate if the original assumptions and predictions are still valid.

Table 3-7. Drainage Areas Monitored During LTCP and Phase I PCM

NPDES No.	Drainage Area (acres)	Metered During LTCP	Metered during PCM
Anacostia River			
005 - Ft Stanton	66		
006 - Ft Stanton	Separated		
007 - Ft Stanton	188	Y	
009 - Canal St.	41		
010 - B St/NJ Ave	733	Y	Y
011 - B St/NJ Ave		Y	Y
011a - B St/NJ Ave		Y	Y
012 - Tiber Creek	1154	Y	Y
013 - M St.	20		
014 - M St	128		
015 - Navy Yard	31		
016 - Navy Yard	153		
017 - M St.	260		
018 - Barney Circle	49		
019- NEB Swirl	4242	Y	Y
019- NEB Bypass		Y	Y
Anacostia Subtotal	**7,064**	**6,317**	**6,129**
% Area Metered		**89%**	**87%**
Potomac River			
003 - Bolling OF	Entire Service Area-		Y
020 - Easby Point	573	Y	Y
021 - Potomac PS/Slash Run	474	Y	Y
022 - I St/22nd St	125		Y
024 - West Rock Creek DS	42		Y
025 - 31st St.	10		Y
026 - Wisconsin Av.	14		Y
027 - Potomac Ave	179		Y
028 - Key Bridge	21		Y
029 - College Pond	301		Y
Potomac River Subtotal	**1,739**	**1,047**	**1,739**
% Area Metered		**60%**	**100%**

NPDES No.	Drainage Area (acres)	Metered During LTCP	Metered during PCM
Rock Creek			
031	Separated		
032	10		
033	13		
034 - Slash Run	Same as 021		
035 - NW Bound. Sew.	547		
036	70		
037	Separated		
038	10		
039	54		
040	25		
041	27		
042	36		
043	70		
044	17		
045	17		
046	17		
047	18		
048	26		
049 - Piney Branch	2433	Y	Y
050	36		
051	12		
052	109		
053	Separated		
054	6		
056	Same as 024		
057	Separated		
058	Separated		
059 - Luzon Valley	Separated		
Rock Creek Subtotal	**3,554**	**2,433**	**2,433**
% Area Metered		**68%**	**68%**
GRAND TOTAL	**12,357**	**9,797**	**10,301**
% of Total		**79%**	**83%**

Using the data collected through flow monitoring, rainfall monitoring and receiving water monitoring, the model calibration/ validation was performed as explained in following steps.

1. Performed quality assurance and quality control of the data collected in Step 1, as described in the Quality Assurance Project Plan (QAPP) provided as Attachment G.

2. Updated the collection system model to incorporate all completed projects, any other system improvements completed since the LTCP calibration effort.
3. Continuous time-series of precipitation, dry weather flow and tide levels were input as boundary conditions in the calibration/validation model. The model was calibrated against all storms where reliable data was collected during the monitoring period.
4. The updated collection system model and the rainfall data collected during the monitoring period is utilized to run a continuous simulation of CSO discharges for the 12-month post-construction monitoring period. Manual operation logs and SCADA data for all the pumping stations were reviewed for the duration of the monitoring. At times, temporary rehabilitation and repair work on the sewer system including the Main Pumping Station, Potomac Pumping Station, Potomac Force Mains and Structure 24 inflatable dams and other components affected the ability to capture combined sewage. Upon reviewing the wetwell log data, the firm capacities for Main Pumping Station was changed from 240 MGD to 180 MGD and the firm capacity of Potomac Pumping Station was changed from 460 MGD to 350 MGD to better reflect available and observed pumping capacity during 2015. Operational settings for the pumps at these stations was also adjusted in the model to reflect the logs.
5. Compared CSO activation frequency in the continuous simulation outputs to the CSO monitoring data for the modeling period to determine whether re-calibration of the collection system model is needed. Based on the calibration results, it was determined that the outfall CSO 010 for Anacostia River and all Potomac CSOs required some calibration.
6. For the identified outfalls, model was calibrated by selecting appropriate number of rainfall events from the modeling period and refinements were made until model achieves at least the same degree of calibration as was achieved during the LTCP development process.
7. Once the model has been re-calibrated, another continuous simulation was performed for the monitoring period to verify the re-calibrated model. Results from continuous simulation outputs and CSO monitoring data were compared as described in Step 5, until the model achieves at least the same degree of calibration as was achieved during the LTCP development process, and there is a high degree of agreement between the model output and CSO monitoring data for activation frequency.

In previous calibration efforts, and in this calibration effort, the collection system model was calibrated focusing on reproducing metered data for annual overflow volume and annual overflow frequency. Internal system meter locations were used to calibrate runoff as part of calibration efforts. As part PCM modeling effort, reproducing metered overflow event durations has been identified as an area requiring additional refinement of the model calibration moving forward.

Table 3-8 compares the monitored and modeled flow volumes at the major metered locations and shows that the modeled flows for the overall collection system was within 4% the monitored overflow volume.

Table 3-8. Calibration Results

NPDES No.	Monitored Flow Volume (MG)	Modeled Flow Volume (MG)	Difference (%)
Anacostia River			
010	330.0	267.4	-23%
011a	12.7	0.0	N/A
012	91.8	104.8	12%
019- Swirl	726.4	787.9	8%
019- Bypass	359.7	464.2	23%
Anacostia Subtotal	**1,521**	**1,624**	**6%**
Potomac River			
003	1.1	0.0	N/A
020	2.6	7.2	64%
021	652.0	621.2	-5%
022	42.0	42.0	0%
024	14.9	37.3	60%
025	1.2	1.4	11%
026	0.0	0.0	N/A
027	8.2	13.0	37%
028	2.7	4.0	33%
029	21.6	20.6	-7%
Potomac River Subtotal	**746**	**747**	**0%**
Rock Creek			
049	83	75	-11%
Rock Creek Subtotal	**83**	**75**	**-11%**
GRAND TOTAL	**2,350**	**2,445**	**4%**

Table 3-9 provides overflow summary for the combined sewer system comparing the monitored data with model results for 2015 rainfall conditions.

Table 3-9. Combined Sewer System- Overflow Summary (2015 Rainfall Conditions)

Receiving Water	NPDES No.	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)
		PCM			Model		
Anacostia River	005 - Ft Stanton	69	24	4	69	24	4
	006 - Ft Stanton	separated			separated		
	007 - Ft Stanton	42	36	2	42	36	2
	009 - Canal St.	55	16	3	55	16	3
	010 - B St/NJ Ave	33	330	3	15	267	5
	011 - B St/NJ Ave	22	6	0.1	22	6	0.1
	011a - B St/NJ Ave	6	13	1	0	0	N/A
	012 - Tiber Creek	16	92	1	8	105	2
	013 - M St.	65	30	4	65	30	4
	014 - M St	38	42	3	38	42	3
	015 - Navy Yard	38	7	1	38	7	1
	016 - Navy Yard	30	28	2	30	28	2
	017 - M St.	51	59	4	51	59	4
	018 - Barney Circle	42	37	2	42	37	2
	019- NEB Swirl	35	726	3	34	788	12
	019- NEB Bypass	45	360	2	19	464	4
	Sub Total	**69**	**1,806**		**69**	**1,910**	
Potomac River	003 - Bolling OF	7	1	3	0	0	-
	020 - Easby Point	20	3	1	31	7	2
	021 - Potomac PS/Slash Run	29	652	1	38	621	3
	022 - I St/22nd St	56	42	2	56	42	2
	024 - West Rock Creek DS	29	15	1	35	37	2
	025 - 31st St.	40	1	4	25	1.4	1
	026 - Wisconsin Av.	9	0.01	0	0	0	N/A
	027 - Potomac Ave	62	8	3	26	13	1
	028 - Key Bridge	50	3	1	40	4	2
	029 - College Pond	51	22	3	56	21	1
	Sub Total	**66**	**746**		**56**	**747**	

Receiving Water	NPDES No.	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)
		LTCP			**PCM**		
Rock Creek	031	Separated			Separated		
	032	0	0	N/A	0	0	N/A
	033	0	0	N/A	0	0.00	N/A
	034 - Slash Run	0	0	N/A	0	0	N/A
	035 - NW Bound. Sew.	0	0	N/A	0	0	N/A
	036	23	0.6	1	23	0.6	1
	037	Separated			Separated		
	038	1	0.0003	0.1	1	0.0003	0.1
	039	2	0.06	0.2	2	0.06	0.2
	040	4	0.07	0.1	4	0.07	0.1
	041	1	0.04	0.1	1	0.04	0.1
	042	7	0.5	0.2	7	0.5	0.2
	043	17	3	0.3	17	3	0.3
	044	11	0.3	0.1	11	0.3	0.1
	045	17	0.5	0.3	17	0.5	0.3
	046	13	0.2	0.2	13	0.2	0.2
	047	10	0.2	0.2	10	0.2	0.2
	048	15	1	0.3	15	1	0.3
	049 - Piney Branch	22	83	1	34	75	2.0
	050	0	0	N/A	0	0	N/A
	051	0	0	N/A	0	0	N/A
	052	0	0	N/A	0	0	N/A
	053	Separated			Separated		
	054	0	0	N/A	0	0	N/A
	056	0	0	N/A	0	0	N/A
	057	Separated			Separated		
	058	Separated			Separated		
	059 - Luzon Valley	Separated			Separated		
	Sub Total	**23**	**90**		**34**	**81**	
GRAND TOTAL			**2,642**			**2,738**	
Blue Plains Flows							
	001		362			444	
	002		105,198			107,766	
	Total		**105,560**			**108,210**	

4 Receiving Water Monitoring

4.1 Introduction

A receiving water monitoring program for the Anacostia River, Potomac River, and Rock Creek was conducted concurrently with the CSS monitoring to collect sufficient amount of water quality data to quantify real-time impacts associated with CSOs and other pollutant sources. The receiving water modeling program utilized existing LTCP models for each receiving water. The models were updated and modified to assess the performance achieved by Phase I CSO controls.

4.2 Permit Requirements

The receiving water monitoring required by the permit under Phase I is tabulated below.

Table 4-1. Receiving Water Monitoring – Permit Requirements

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Receiving Water Monitoring-Dissolved Oxygen (1)	Continuous D.O. monitors	Continuous D.O. monitors	Approximately 30 minute intervals
Receiving Water Monitoring-Bacteria, Field Parameters (1) (2)	Bacteria Samples	Bacteria Samples	4 storms Minimum

(3) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

(4) Samples shall be analyzed for fecal Coliform, *E.coli*, CBOD5 and TSS.

(5) Monitoring shall be conducted for a continuous period of 12 months.

4.3 Summary of Monitoring

DC Water has retained Metropolitan Washington Council of Governments (MWCOG or COG) to perform receiving water monitoring. Detailed maps are included in Appendix D and data collected at each monitoring site are included in Appendix C. A summary of monitoring effort is provided as follows.

4.3.1 Dissolved Oxygen Monitoring

Dissolved oxygen (D.O.) monitoring was performed on the Anacostia and Potomac Rivers in the locations as indicated in Table 4-2. Rock Creek is naturally aerated due to turbulence caused by irregular bottom of the creek bed. Hence, no D.O monitoring was conducted for Rock Creek. The D.O. meters collected data at minimum 30 minute intervals for a continuous period of 12 continuous months. The D.O. sampling locations are presented in Figure 4-1.

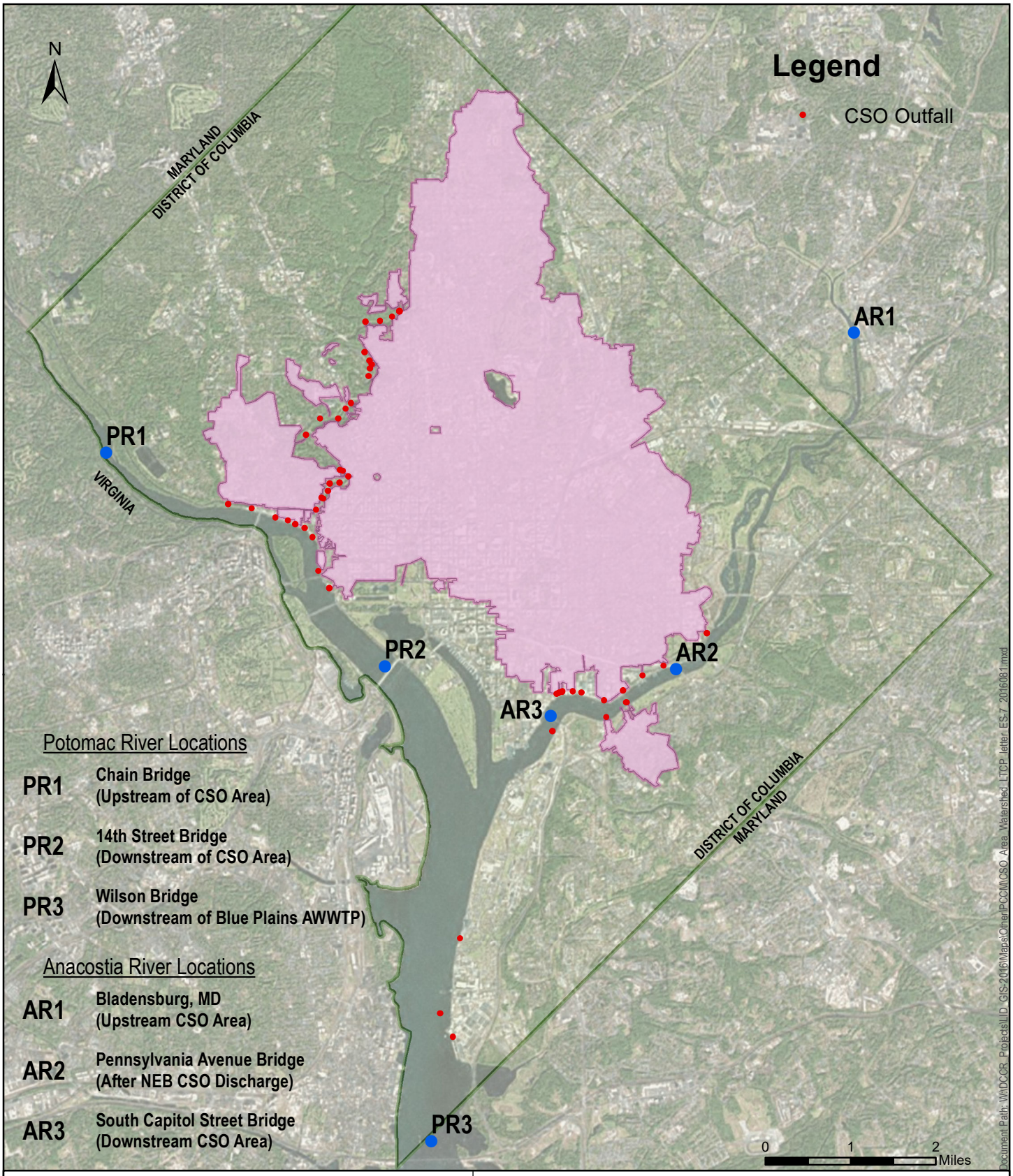
Table 4-2. D.O. Monitoring Locations

Receiving Water	D.O. Meter Location	Location Rationale
Anacostia River	Bladensburg, MD	Upstream of CSO area
	Pennsylvania Avenue Bridge (Seafarer's Yacht Club)	After Northeast Boundary CSO discharge
	South Capitol Street Bridge	Downstream of CSO area
Potomac River	Chain Bridge	Upstream of CSO area
	14th Street Bridge	Downstream of CSO area
	Wilson Bridge	Downstream of Blue Plains AWWTP

The table below presents the data summary for each D.O. station.

Table 4-3. D.O. Data Summary – PCM (Year 2015 Data)

Receiving Water	Monitoring Location	No. of Days with Daily Mean < 5 mg/l	Min. Day D.O., mg/l
Anacostia River	Bladensburg	27	1.45
	Pennsylvania Ave	160	1.08
	S Capitol	101	1.02
Potomac River	Chain Bridge	0	7.26
	14th Street	0	5.28
	Wilson Bridge	27	4.62



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DC Clean Rivers Project
Post Construction Monitoring Phase-1

Receiving Water Monitoring - D.O. for Potomac and Anacostia Rivers

Date: August 2016

Figure 4-1

4.3.2 Receiving Water Sampling

The receiving water sampling effort is divided into regular sampling and wet weather sampling.

4.3.2.1 Regular Sampling

Regular water quality sampling was conducted at the locations listed in Table 4-3 and shown in Figure 4-2. A total of seventy one (71) samples were collected at each site during the monitoring period. The sampling was typically conducted twice on one week and once the following week. Since the sampling was at regular intervals, the data collected represents wet and dry weather conditions. Sampling is conducted while flow monitors are installed on the CSOs and the D.O. meters are operating on the receiving water. Table 4-4 lists the parameters analyzed.

Table 4-4. Receiving Water Monitoring Locations

Receiving Water	Sample Stations	Rationale
Anacostia River	Bladensburg, MD	Boundary condition
	Benning Road Bridge	Upstream of CSO area
	Pennsylvania Avenue Bridge	After Northeast Boundary CSO discharge
	South Capitol Street Bridge	Downstream of CSO area
	Hains Point	Confluence with Potomac
Potomac River	Three Sisters Island	Boundary Condition
	Upstream of Rock Creek	After Georgetown CSOs
	14th Street Bridge	Downstream of CSO area
	Wilson Bridge	Boundary Condition
Rock Creek	Boundary Bridge	Boundary Condition
	Tilden Street	Upstream of CSO area
	Porter Street	Downstream of CSO area
	Pennsylvania Ave	Upstream of confluence with Potomac River

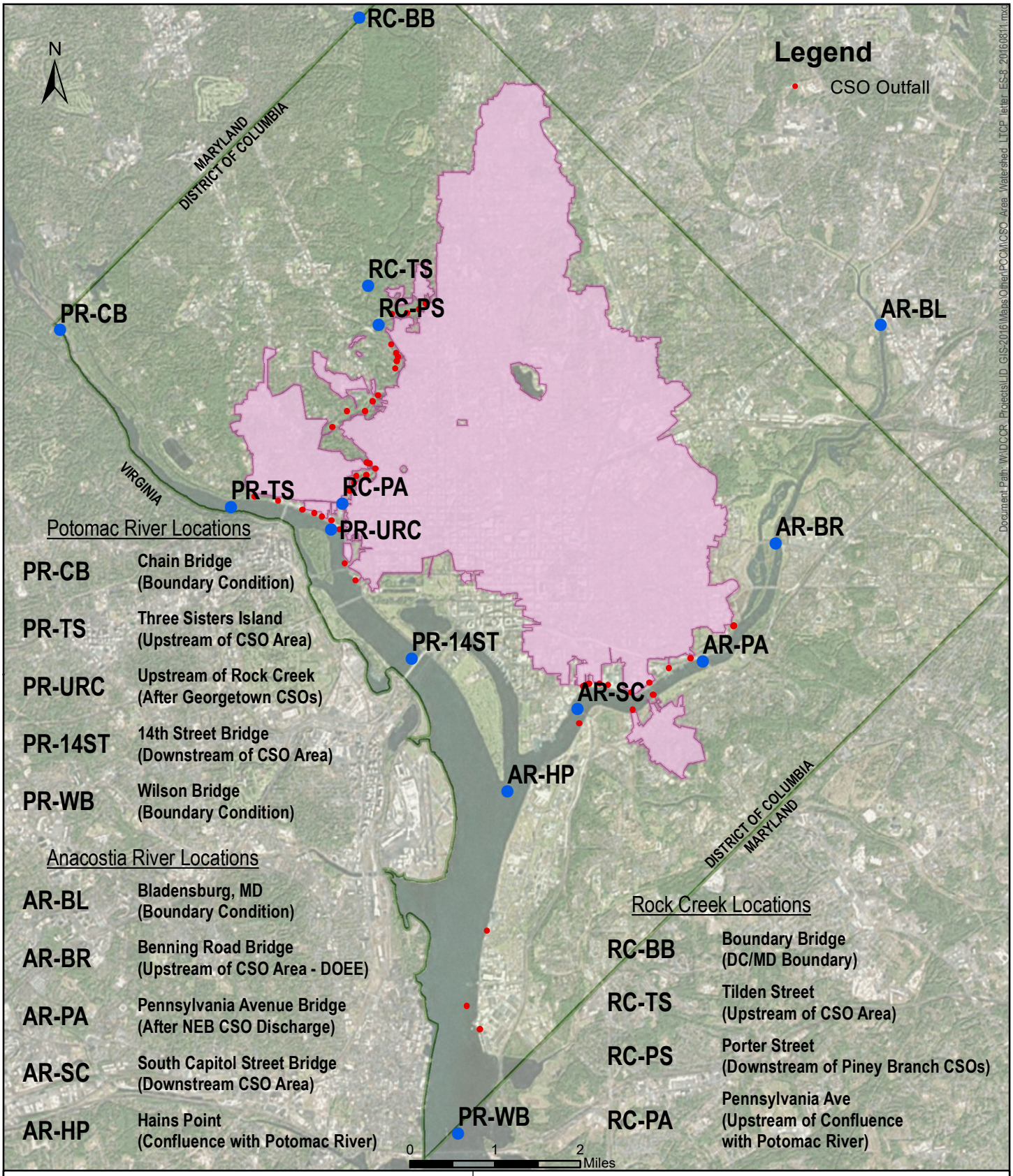
The purpose of boundary condition monitoring was to assess the pollutant load in the receiving waters at the District Boundaries, both upstream and downstream of CSO area. MWCOG collects water quality data at Chain Bridge as part of their ongoing water quality monitoring program. The data collected for 2015 at Chain Bridge was acquired and evaluated as part of the PCM. It was observed that the limited amount of data collected at Chain Bridge will not be adequate to compute monthly geomeans. Based on the evaluation of the available data at Chain Bridge, the data collected at Three Sisters (as part of PCM) was found to be in the same magnitude. Due to the availability of the large data set, Three Sisters was selected as a reasonable representative upstream boundary condition for Potomac River.

Table 4-5. Receiving Water Monitoring – Sampling Analysis

Analysis	Method (1)
Field Parameters	PH – SM 4500 H-B Temperature – EPA 170.1 Dissolved Oxygen – SM 4500 – G
Fecal Coliform	SM 9221 – E (A1-Medium)
	SM 9221 – E (EC-Medium)
E.coli	SM 9223 B-94 (Quantitray)
	SM 9221 –F (EC-MUG)
CBOD5 (total)	SM 5210 B -01
TSS	SM 2540 D -97
Chlorophyll a	SM 10200 - H

Notes:

(1) SM= Standard Methods



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Post Construction Monitoring Phase-1

Receiving Water Monitoring Locations

Date: August 2016 | Figure 4-2

4.3.2.2 Wet Weather Sampling

Wet weather sampling was performed to determine impacts of CSO and stormwater on water quality during and after a storm. This data is also used to support model calibration and verification. In total, four (4) wet weather sampling events were performed in the receiving waters. For each event, samples were collected at all locations listed in Table 4-3 for a 40-hour period. Analyses included field parameters and bacteriological parameters listed in Table 4-4, for each storm.

The monthly geomeans of the bacteria data collected during PCM is tabulated below.

Table 4-6. Monthly Geomeans for *E.coli* (MPN/100 ml) – Year 2015 Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anacostia River												
Ana PA Ave	**920**	**130**	160	134	**49**	1,799	274	194	85	1,110	77	181
Benning Road	**567**	**540**	197	301	175	1,597	330	178	112	984	105	193
Bladensburg	**981**	**3,500**	360	349	317	5,701	814	663	504	1,500	790	347
South Capitol	**1,075**	**230**	156	106	**260**	2,137	86	130	70	781	129	234
Hains Point	**101**	**49**	38	65	17	281	16	25	31	264	80	135
Potomac River												
Three Sisters	24	**8**	13	19	28	442	21	11	6	333	35	42
14th St Bridge	**26**	**17**	14	20	21	295	74	26	6	285	49	51
Wilson Bridge	**124**	**23**	78	21	17	171	21	11	23	347	52	140
Rock Creek												
Boundary Bridge	**482**	**350**	94	150	540	4,984	706	435	700	552	276	351
Upstream Rock Creek	**49**	**2**	16	15	29	240	37	48	27	402	39	50
Porter Street	**309**	**920**	74	87	131	4,577	523	562	300	571	83	87
RC PA Ave	**669**	**1,300**	174	285	327	3,550	2,338	173	212	577	178	270
Tilden Street	**401**	**920**	88	132	153	5,005	1,067	461	283	557	107	120

Notes:

1. Monthly geomean based on fewer than 5 samples is bolded above.

The monthly geomeans of the fecal coliform data collected during PCM is tabulated below.

Table 4-7. Monthly Geomeans for Fecal Coliform (MPN/ 100 ml) – Year 2015 Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anacostia River												
Ana PA Ave	**920**	**130**	177	171	**49**	6,544	386	572	220	1,579	115	484
Benning Road	**567**	**540**	212	398	320	3,601	634	189	160	2,043	202	260
Bladensburg	**981**	**3,500**	429	272	636	8,807	1,468	991	807	3,443	775	434
South Capitol	**1,075**	**230**	223	134	229	4,604	208	151	151	1,188	252	216
Hains Point	**116**	**49**	69	72	51	415	16	33	40	401	115	316
Potomac River												
Three Sisters	27	**8**	27	17	37	740	38	28	22	409	52	25
14th St Bridge	**30**	**33**	27	18	30	362	97	47	18	411	64	69
Wilson Bridge	**124**	**23**	138	26	22	389	31	17	27	489	73	157
Rock Creek												
Boundary Bridge	**482**	**350**	120	162	642	15,840	891	873	1,076	788	317	528
Upstream Rock Creek	**54**	**5**	18	11	52	458	79	69	33	583	87	76
Porter Street	**512**	**920**	113	145	252	9,970	775	672	300	1,121	92	125
RC PA Ave	**669**	**1,300**	181	226	504	10,467	4,086	470	250	1,401	380	316
Tilden Street	**401**	**920**	93	133	327	6,617	941	591	604	896	115	182

Notes:

1. Monthly geomean based on fewer than 5 samples are bolded above.

The statistics of the Total Suspended Solids data collected during PCM is tabulated in Table 4-8.

Table 4- 8. Summary Statistics for Total Suspended Solids (mg/l) – Year 2015 Data

	Anacostia River				
Parameter	**Bladensburg**	**Benning Road**	**Ana PA Ave**	**South Capitol**	**Hains Point**
Minimum	1	9	8	4	1
25th Quartile	7	16	16	8	6
50th Quartile	11	23	21	12	8
75th Quartile	22	33	35	15	12
Maximum	440	930	210	120	55
Mean	32	43	33	15	11
Geomean	13	26	25	12	8
Number of samples	100	99	103	100	103

	Potomac River			
Parameter	**Three Sisters**	**Upstream Rock Creek**	**14th Street**	**Wilson Bridge**
Minimum	1	1	1	4
25th Quartile	5	4	6	8
50th Quartile	8	7	8	9
75th Quartile	18	14	12	13
Maximum	91	82	61	44
Mean	16	13	12	12
Geomean	9	8	9	11
Number of samples	98	102	100	100

The statistics of the CBOD5 data collected during PCM is tabulated below.

Table 4- 9. Summary Statistics for CBOD5 (mg/l) – Year 2015 Data

	Anacostia River				
Parameter	**Bladensburg**	**Benning Road**	**Ana PA Ave**	**South Capitol**	**Hains Point**
Minimum	2	2	2	2	2
25th Quartile	2	2	2	2	2
50th Quartile	2	2	2	2	2
75th Quartile	3	2	2	2	2
Maximum	19	20	15	12	16
Mean	3	3	3	3	2
Geomean	3	2	2	2	2
Number of samples	100	99	101	104	100
	Potomac River				
Parameter	**Three Sisters**	**Upstream Rock Creek**		**14th Street**	**Wilson Bridge**
Minimum	2	2		2	2
25th Quartile	2	2		2	2
50th Quartile	2	2		2	2
75th Quartile	2	2		2	2
Maximum	12	12		26	16
Mean	2	2		3	2
Geomean	2	2		2	2
Number of samples	101	100		100	97

4.4 Event Mean Concentrations

Running the receiving water models requires the input of flows and loads from many sources. This includes both upstream sources and sources within the District. Water quality of these sources was characterized by event mean concentrations (EMCs). As tabulated in Table 4-10, EMCs developed using the water quality data collected during monitoring period are compared against the EMCs generated in the LTCP to see if there is any need to update them for forecasting purposes of LTCP.

Table 4-10. Receiving Water Boundary Conditions – Event Mean Concentrations

		Anacostia[1]		Potomac		Rock Creek	
		Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow
Fecal Coliform (MPN/ 100ml)	LTCP	500	8,000	60	350	280	2,100
	PCM	1,143	2,616	50	212	597	2,425
E.coli (MPN/ 100ml)	LTCP	200	3,500	30	190	230	900
	PCM	754	2,248	35	133	449	1,476
CBOD5 (mg/l)	LTCP	1	6.78	2.70	3.20	2.70	3.20
	PCM	2.44	3.36	2.27	2.04	2.26	2.14

Notes:

1. During LTCP, upstream boundary data for Anacostia River was collected at Northeast (NE) and Northwest (NW) branches. For PCM, upstream boundary is observed as Bladensburg, MD which is located within a mile south from NE and NW confluence. For comparison with PCM EMCs, the LTCP EMCs for NE and NW branches are averaged in the table.

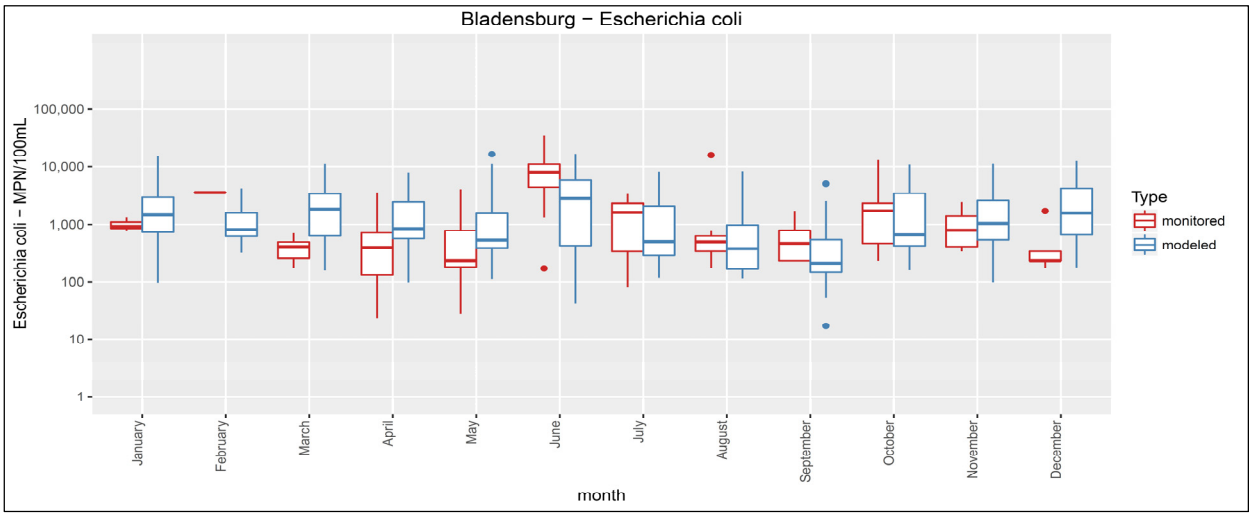
4.5 Receiving Water Modeling Program

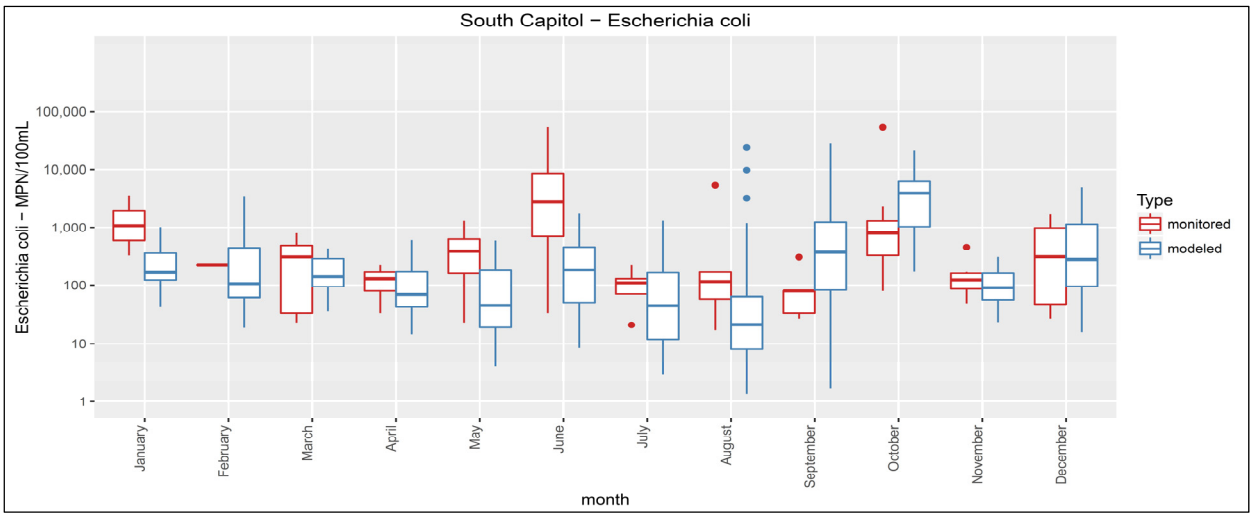
The same models used for LTCP predictions were used to model data collected during PCM. Figures 4-3 through 4-7 presents the model calibration plots for selected locations along each receiving water for bacteria and dissolved oxygen. A detailed receiving water model documentation which includes calibration plots and model segmentation for each receiving water is included in Appendix B.

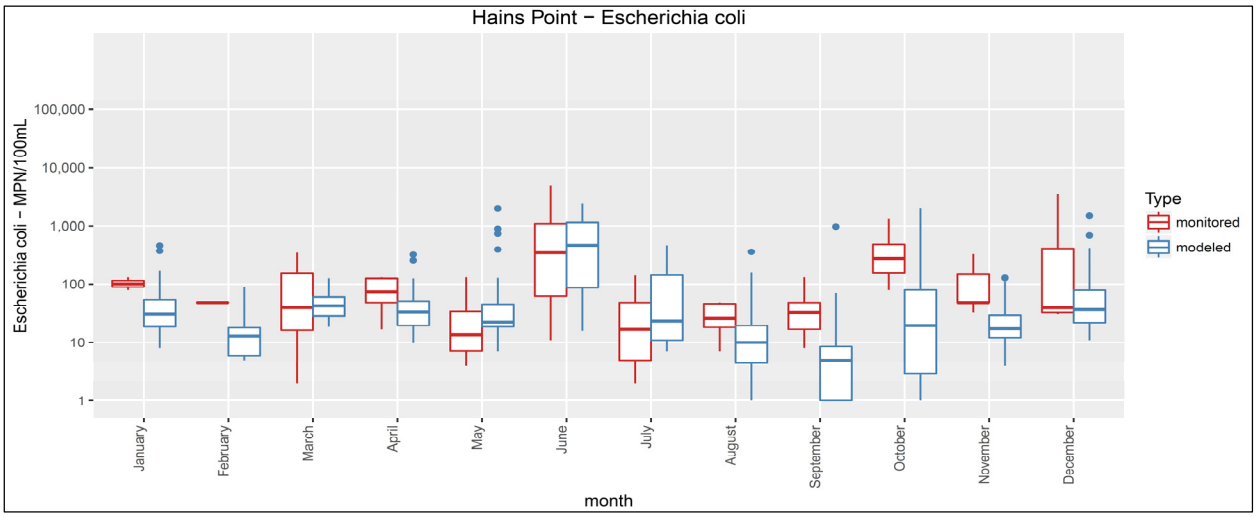
Post Construction Monitoring- Phase I

Figure 4-3

Anacostia River: Water Quality Model Calibration Plots- Bacteria



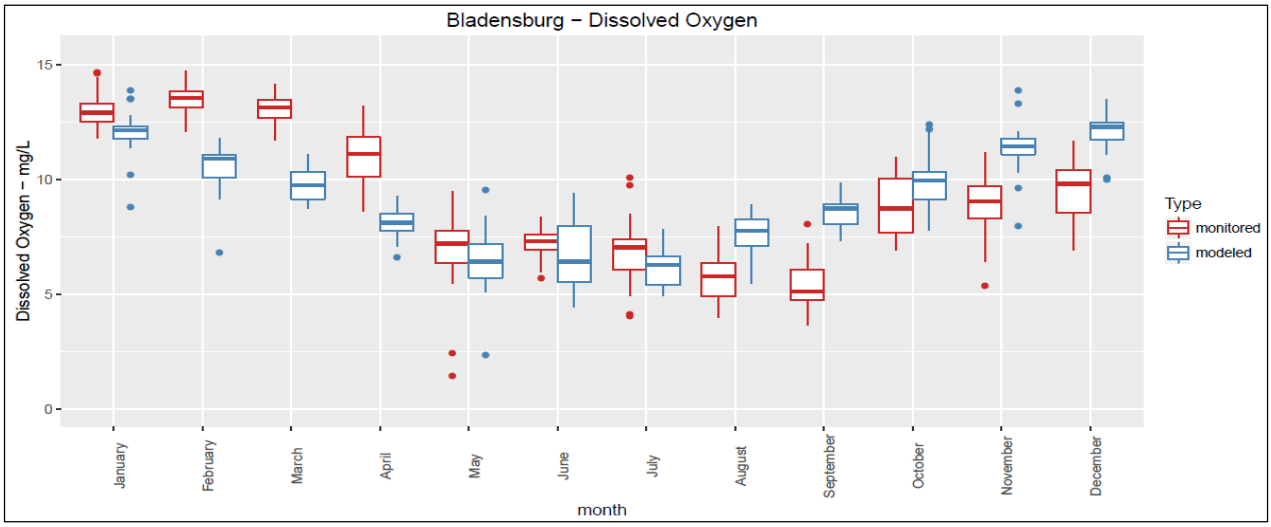


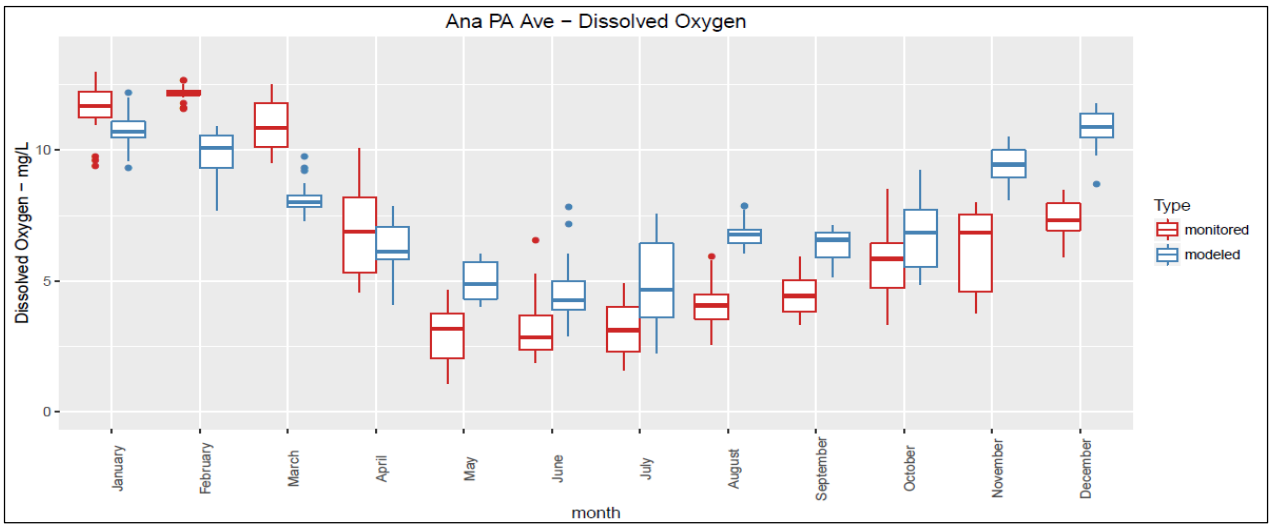


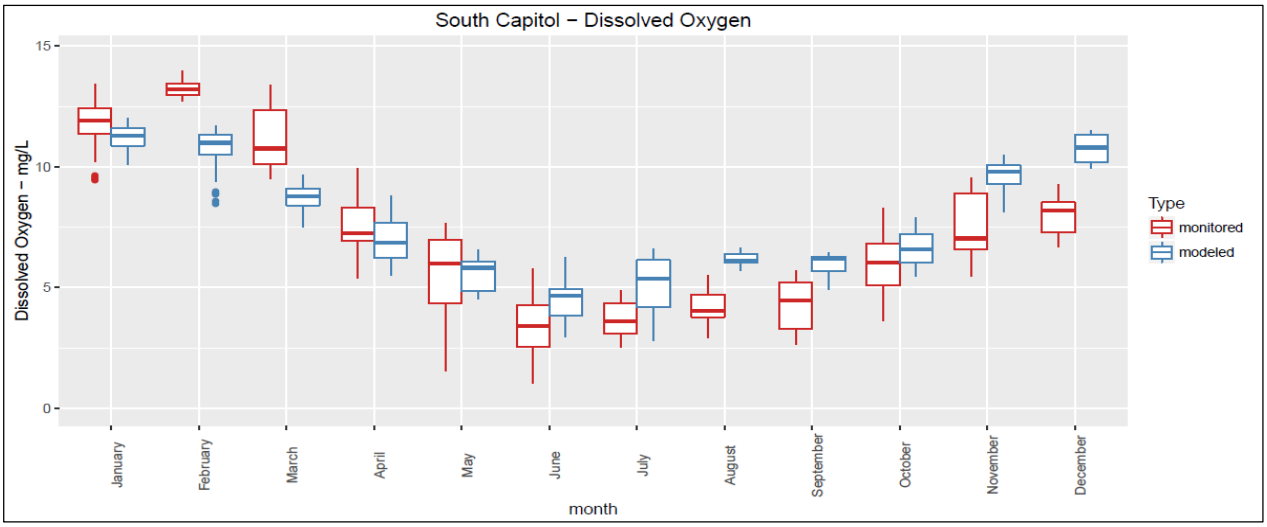
Post Construction Monitoring- Phase I

Figure 4-4

Anacostia River: Water Quality Model Calibration Plots- Dissolved Oxygen



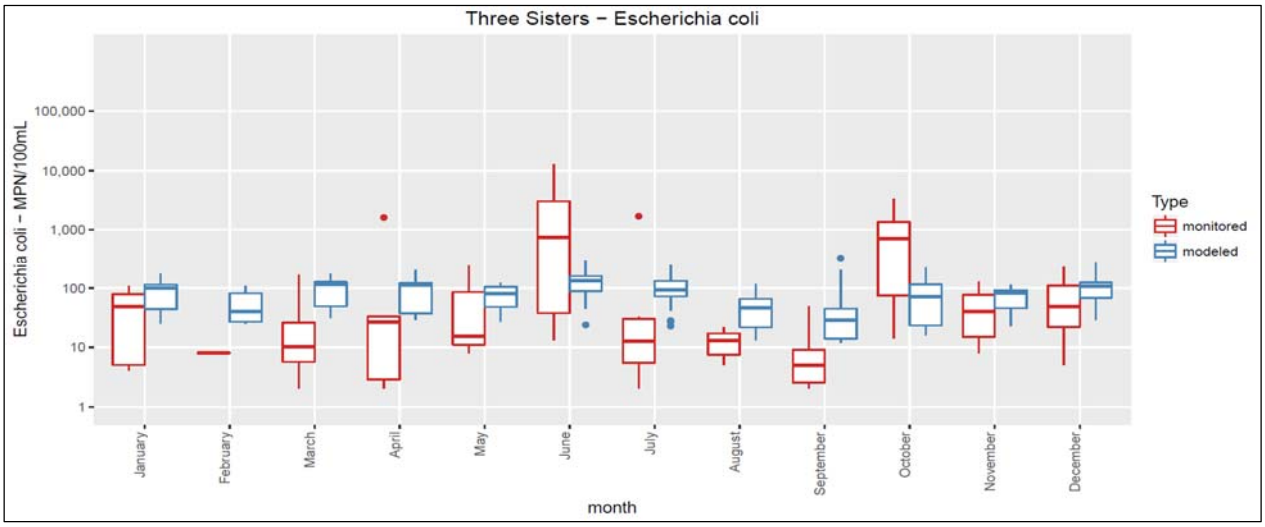


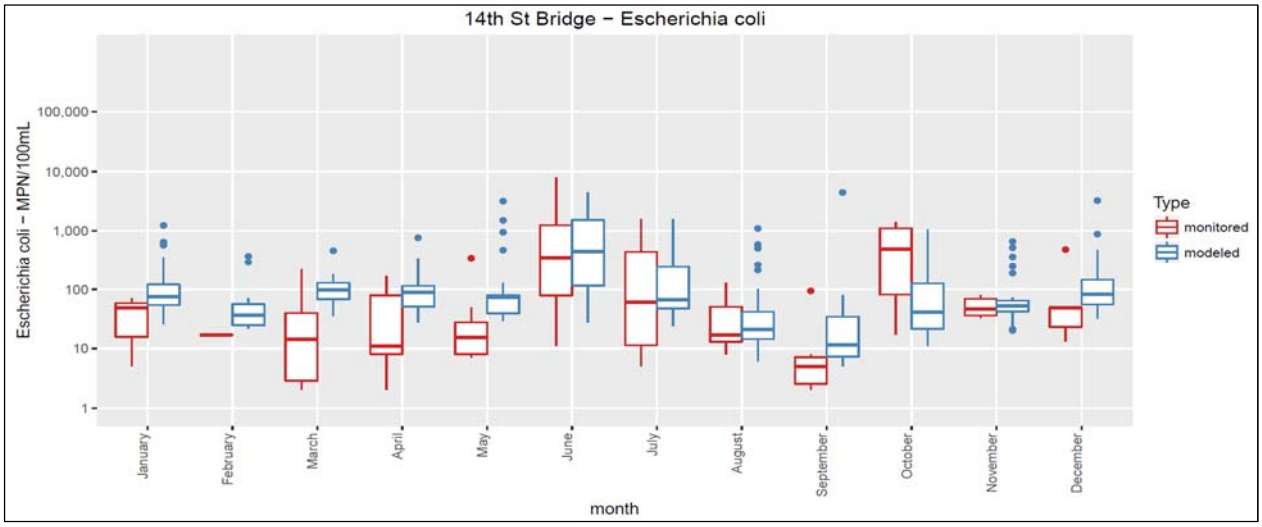


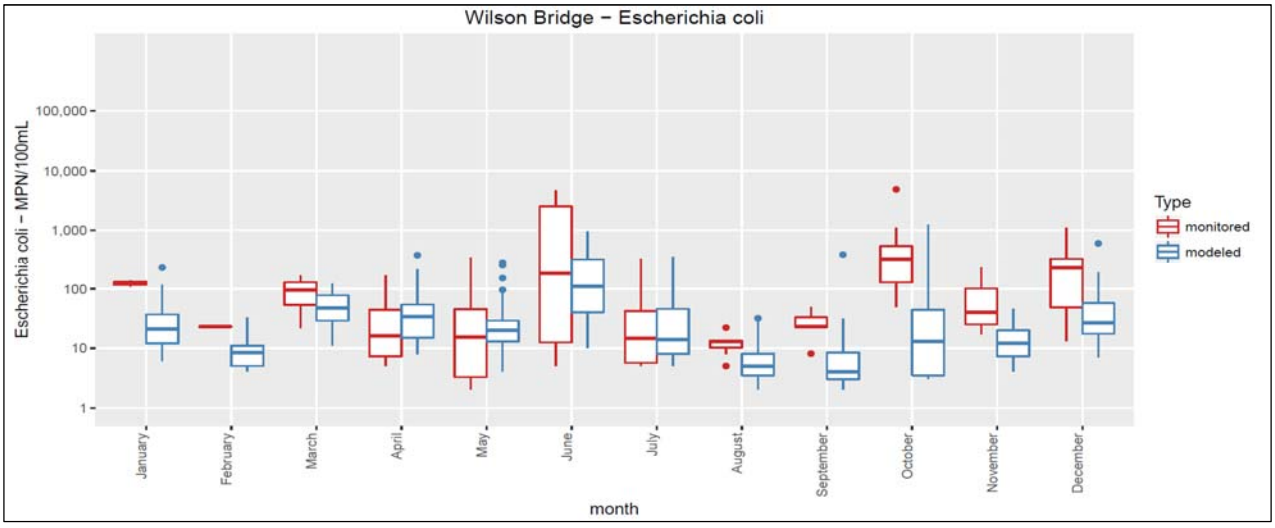
Post Construction Monitoring- Phase I

Figure 4-5

Potomac River: Water Quality Model Calibration Plots- Bacteria



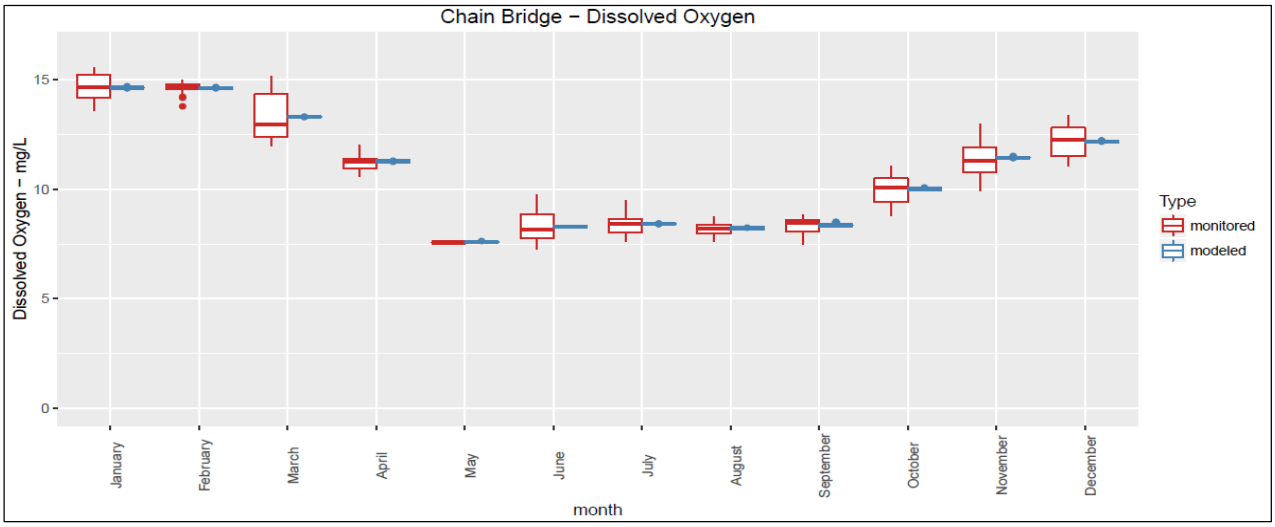


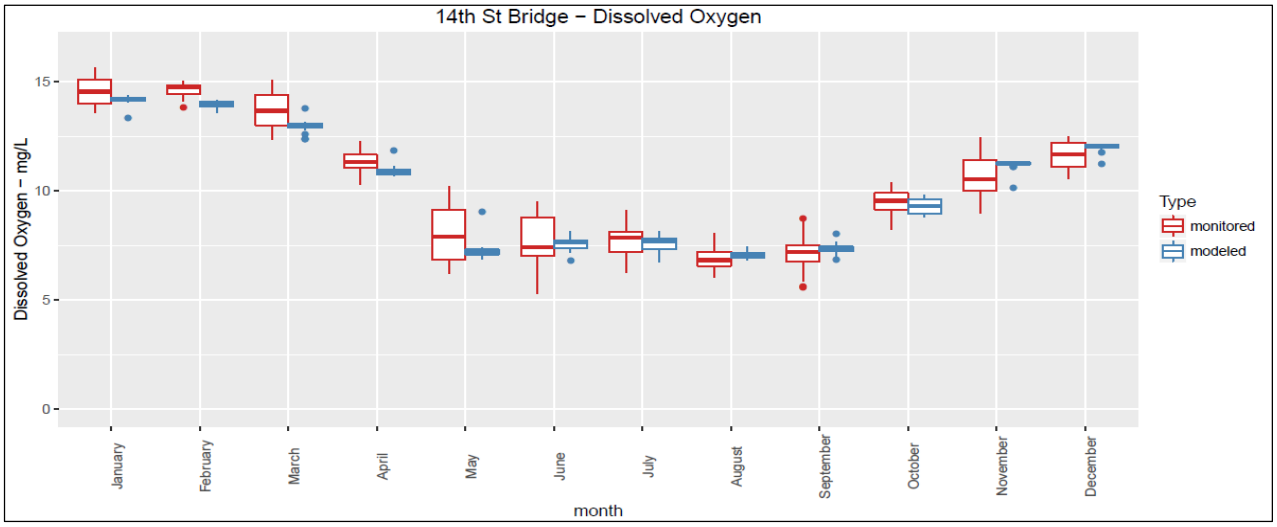


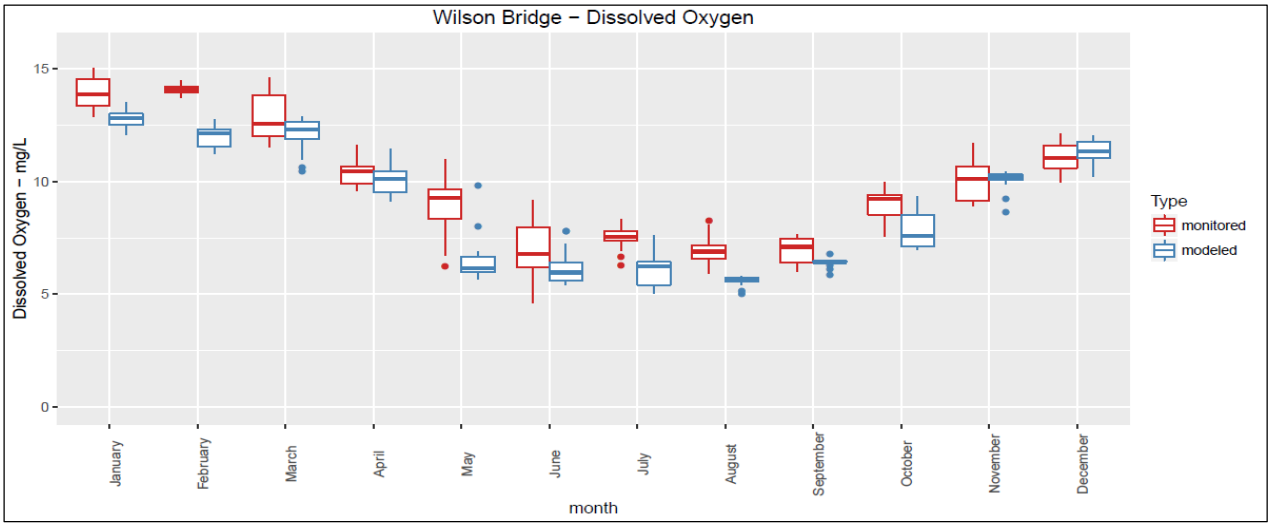
Post Construction Monitoring- Phase I

Figure 4-6

Potomac River: Water Quality Model Calibration Plots- Dissolved Oxygen



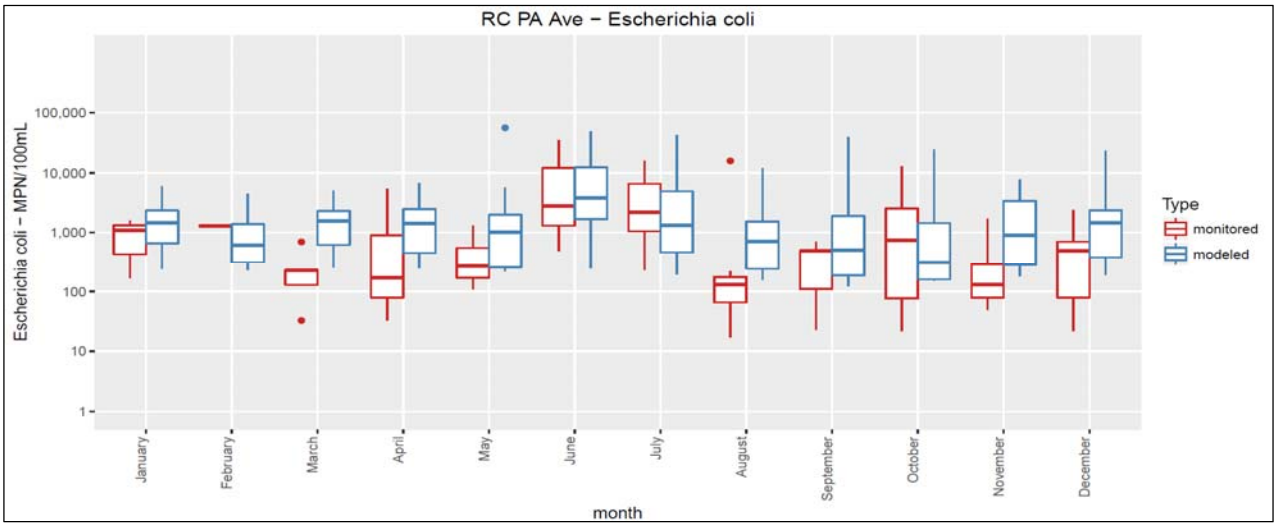


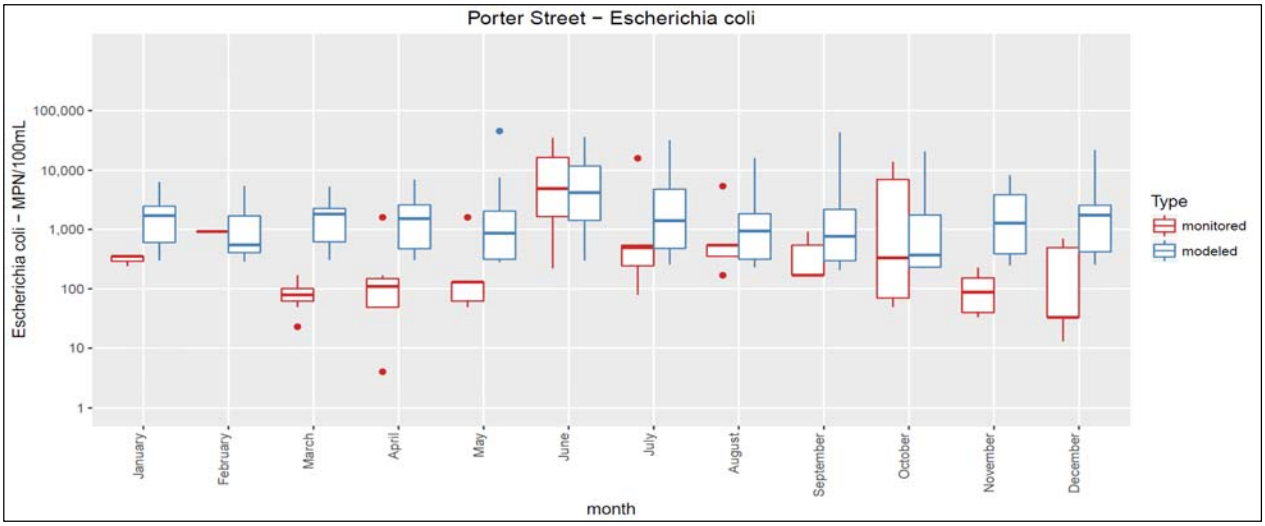


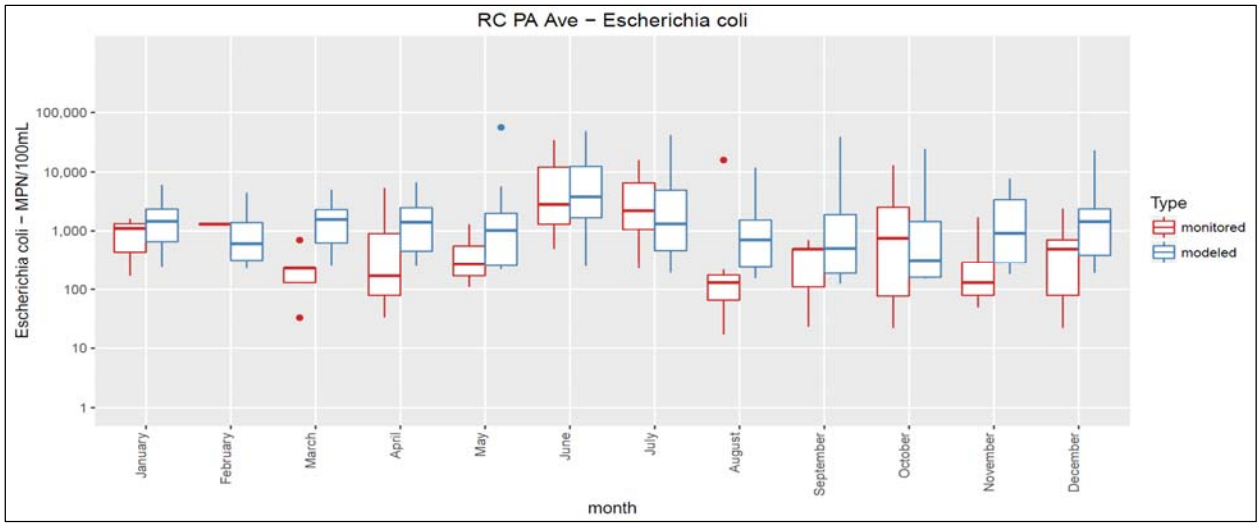
Post Construction Monitoring- Phase I

Figure 4-7

Rock Creek: Water Quality Model Calibration Plots- Bacteria







5 Phase I CSO Controls Assessment

This section presents the performance assessment of Phase I CSO controls against predictions established as part of LTCP development. The assessments include the following.

- Comparison of monitored overflow magnitude and duration with LTCP predictions;
- Comparison of monitored water quality in receiving waters with LTCP predictions;
- Comparison of monitored CSO reductions with LTCP predictions;
- Comparison of performance to TMDLs and allocations established for CSOs and approved bypasses in the receiving waters; and
- Overall evaluation as to whether or not CSO controls are providing degree of control predicted for LTCP conditions and whether or not modifications or additions to the LTCP are required.

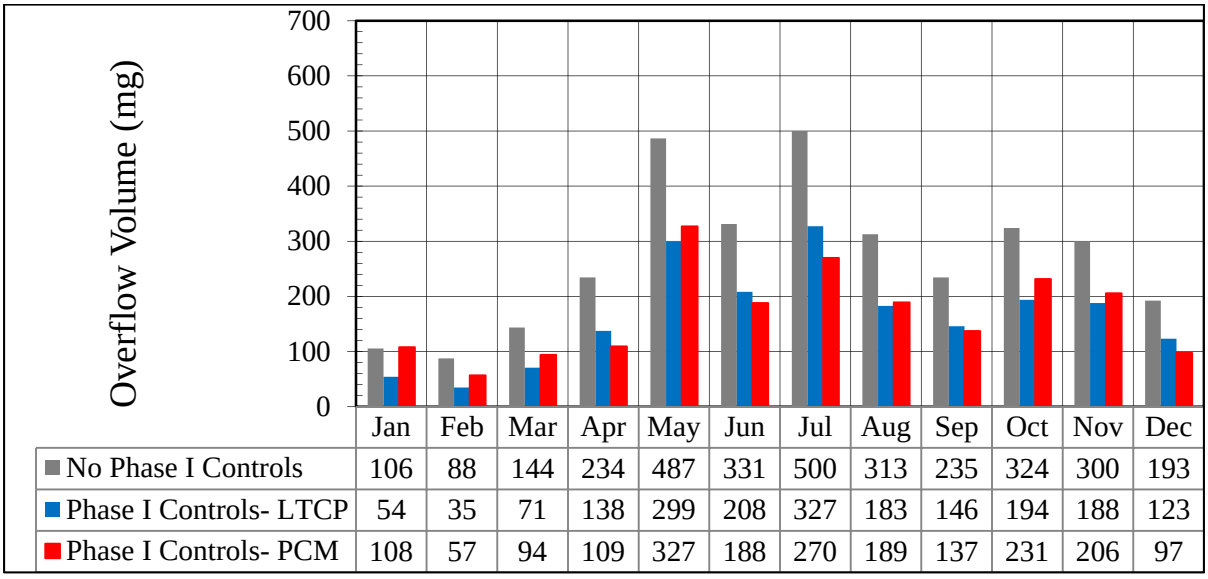
5.1 CSO Overflow Magnitude and Duration

In the LTCP, the combined sewer system model predicted CSO overflow frequency and volume for the average year conditions (defined as the arithmetic average of the predictions for years 1988, 1989 and 1990). A summary of the overflows predicted in the LTCP before and after the Phase I Controls compared to that predicted based on post construction monitoring is summarized in Table 5-1.

Table 5-1. Annual CSO Overflow Volume for Average Year

	Anacostia River CSOs	Potomac River CSOs	Rock Creek CSOs	CSO Total
No Phase I Controls	2,142	1,063	49	3,254
Phase I CSO Controls- LTCP	1,282	639	49	1,969
% Reduction with No Phase I Controls	*40%*	*40%*	*0%*	*39%*
Phase I CSO Controls- PCM	1,313	677	35	2,025
% Reduction with No Phase I Controls	*39%*	*36%*	*29%*	*38%*

The predicted and monitored CSO overflow volume on a monthly basis is shown in Figure 5-1.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No Phase I Controls	106	88	144	234	487	331	500	313	235	324	300	193
Phase I Controls- LTCP	54	35	71	138	299	208	327	183	146	194	188	123
Phase I Controls- PCM	108	57	94	109	327	188	270	189	137	231	206	97

Figure 5-1. Monthly CSO Overflow Volume (Million Gallons)
Average Year (1988-1990)

The following observations are made:

- Phase I controls have achieved significant overflow volume reductions for each receiving water as predicted by LTCP.
- An overall CSO volume reduction of 38% is achieved by Phase I controls compared to no CSO controls.

The predicted and monitored CSO overflow frequency, volume and duration for each CSO outfall FOR Average Year rainfall condition is shown in Table 5-2.

Table 5-2. Annual CSO Overflow Volume and Frequency- Outfalls Summary (Average Year)

Receiving Water	NPDES No.	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)
		LTCP			PCM		
Anacostia River	005 - Ft Stanton	73	17	4	58	14	5
	006 - Ft Stanton	Separated			Separated		
	007 - Ft Stanton	64	37	4	34	14	7
	009 - Canal St.	54	17	3	77	10	2
	010 - B St/NJ Ave	18	247	2	43	292	1
	011 - B St/NJ Ave	0	0	-	0	0	-
	011a - B St/NJ Ave	0	0	-	0	0	-
	012 - Tiber Creek	6	22	1	3	5	1
	013 - M St.	28	10	2	49	18	1
	014 - M St	49	39	3	32	20	5
	015 - Navy Yard	12	1	1	25	2	0.4
	016 - Navy Yard	24	13	1	23	10	1
	017 - M St.	32	20	2	54	42	1
	018 - Barney Circle	35	5	2	36	21	1
	019- NEB Swirl	36	646	3	36	769	3
	019- NEB Bypass	13	209	1	13	95	1
	Sub Total	**73**	**1,282**		**77**	**1,313**	
Potomac River	003 - Bolling OF	0	0	-	0	0	-
	020 - Easby Point	21	55	1	21	2	1
	021 - Potomac PS/Slash Run	30	458	2	39	601	2
	022 - I St/22nd St	30	30	2	32	6	2
	024 - West Rock Creek DS	17	16	1	26	41	1
	025 - 31st St.	14	0.2	1	13	0.3	1
	026 - Wisconsin Av.	0	0	-	0	0	-
	027 - Potomac Ave	72	53	4	22	7	4
	028 - Key Bridge	13	0.5	1	41	4	2
	029 - College Pond	56	26	3	58	15	0.6
	Sub Total	**72**	**639**		**58**	**677**	

Receiving Water	NPDES No.	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)	No. of Overflows	CSO Overflow (MG)	Avg. Overflow Duration (Hours)
		LTCP			PCM		
Rock Creek	031	Separated			Separated		
	032	0	0	-	0	0	-
	033	6	4	1	0	0	-
	034 - Slash Run	0	0	-	0	0	-
	035 - NW Bound. Sew.	0	0	-	0	0	-
	036	29	1.6	2	29	0.7	2
	037	Separated			Separated		
	038	0	0	-	0	0	-
	039	0	0	-	0	0	-
	040	1	0.03	0.4	0	0	-
	041	0	0	-	0	0	-
	042	0	0	-	0	0	-
	043	1	0.15	1	1	0.006	1
	044	0	0	-	0	0	-
	045	2	0.03	1	0	0	-
	046	2	0.01	1	0	0	-
	047	3	0.25	0.5	0	0	-
	048	2	0.08	1	0	0	-
	049 - Piney Branch	25	40	2	32	34	1
	050	0	0	-	0	0	-
	051	0	0	-	0	0	-
	052	0	0	-	0	0	-
	053	Separated			Separated		
	054	0	0	-	0	0	-
	056	0	0	-	0	0	-
	057	Separated			Separated		
	058	Separated			Separated		
	059 - Luzon Valley	Separated			Separated		
	Sub Total	**29**	**49**		**32**	**35**	
GRAND TOTAL			**1,969**			**2,025**	

The original LTCP report included only wet weather flows for Blue Plains- 002 outfall. As the LTCP model was extensively recalibrated in 2006- 2007 by updating the runoff, the Blue Plains excess flow has been adjusted to be comparable with the predictions for PCM as tabulated as follows.

Table 5-3. Blue Plains Flow Summary (Average Year)

Blue Plains	Phase I Controls-LTCP	Phase I Controls-LTCP Updated	Phase I Controls-PCM
001- Excess Flow	2,428	1,101	838
002- Complete	66,668	135,860	136,230
Total	**69,096**	**136,961**	**137,068**

5.2 Receiving Water Quality

5.2.1 Current Water Quality Standards

The three major waterways in the District are assigned current use classifications, designated use classifications and associated WQS by the District Department of Energy and Environment (DOEE). The designated uses, current classification and water quality standards of the District receiving waters are shown in Tables 5-4 and 5-5.

Table 5-4. Receiving Water Use Classifications

Receiving Water	Current use	Designated Use
Anacostia River	B, C, D, E	A, B, C, D, E
Potomac River	B, C, D, E	A, B, C, D, E
Rock Creek	B, C, D, E	A, B, C, D, E
Use Classes		
A – Primary contact recreation B - Secondary contact recreation and aesthetic enjoyment C – Protection and propagation of fish, shellfish and wildlife D – Protection of human health related to consumption of fish and shellfish E - Navigation		

Table 5-5. D.C. Water Quality Standards (DC Register, 2013)

Constituent	Criteria for Classes		
	A	B	C
Bacteriological (MPN/100 mL)			
E.coli[1]			
Geometric Mean (Maximum 30 day	126		
geometric mean for 5 samples)			
Single Sample Value	410		
Physical			
Dissolved Oxygen (mg/L) Instantaneous minimum (Year-round) [2]			5.0
February 1 through May 31 [3,5]			
7-day mean			6.0
Instantaneous minimum			5.0
June 1 through January 31 [3,5]			
30-day mean			5.5
7-day mean			4.0
Instantaneous minimum [4]			3.2
Temperature (°C)			
Maximum			32.2
Maximum change above ambient			2.8
pH			
Greater than	6.0	6.0	6.0
And less than	8.5	8.5	8.5
Turbidity increase above ambient (NTU)	20	20	20
Secchi Depth [3,5] (m)(seasonal segment average)			
April 1 through October 31			0.8
Total dissolved gases (maximum % saturation)			110
Hydrogen Sulfide (maximum μg/L)			2.0
Oil & grease (mg/L)			10.0
Biological			
Chlorophyll *a* [3,5] (μg/L)(seasonal segment average)			
July 1 through September 30			25

Notes:

[1] The geometric mean criterion shall be used for assessing water quality trends and for permitting. The single sample value criterion shall be used for assessing water quality trends only.

[2] This criterion applies to nontidal waters.

[3] Attainment of the dissolved oxygen, water clarity and chlorophyll *a* water quality criteria that apply to tidal influenced Class C waters will be determined following the guidelines documented in the 2003

United States Environmental Protection Agency publication: Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and its Tidal Tributaries, EPA-903-R-03-002, April 2003, Region III Chesapeake Bay Program Office, Annapolis, Maryland; 2004 Addendum, EPA-903-R-04-005, October 2004; 2007 Addendum, EPA 903-R-07-003 CBP/TRS 285/07, July 2007; 2007 Chlorophyll Criterion Addendum, EPA 903-R-07-005 CBP/TRS 288-07, November 2007; 2008 Addendum, EPA 903-R-08-001 CBP/TRS 290-08, June 2008; and 2010 Criterion Addendum EPA 903-R-10-002 CBP/TRS-301-10, April 2010.

[4] At temperatures greater than 29°C, in tidally influenced waters, an instantaneous minimum dissolved oxygen concentration of 4.3 mg/L shall apply.

[5] Shall apply to tidally influenced waters only.

5.2.2 ANACOSTIA RIVER

The Anacostia River is a relatively stagnant water body with a long residence time that is significantly affected by the tide. Both dissolved oxygen and bacteria concentrations are problems.

5.2.2.1 Pollutant Loads to Anacostia River

Using the models for the CSS, data on boundary condition flow rates for the average year condition (1988-1990), and the event mean concentrations for each pollutant source; the pollutant load to the Anacostia River was calculated for the average year.

The load sources were divided into the following categories:

- CSO Overflow – represents overflow from the CSS and includes CSO that is treated by the Northeast Boundary Swirl Facility.
- D.C. Storm Water – this consists of District's separate storm water system and flow from Hickey Run and Watts Branch.
- Other Storm Water – represents storm water from park lands on each side of the Anacostia that are not conveyed through storm pipes, but instead run off directly to the river. Examples include Anacostia Park and portions of the National Arboretum.

As part of Phase I controls assessment, the storm water load sources (both DC & Other) have not been updated. Load estimates comparison of LTCP predictions and monitored water quality are summarized in Table 5-6.

Table 5-6. Sources of Pollutant Loads to Anacostia River Within District

Pollutant Source	CBOD5 (lb/yr x 1000)				
	No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	755	443	13.9%	475	15.0%
D.C. Storm Water	771	771	24.1%	771	24.4%
Other Storm Water	44	44	1.4%	44	1.4%
Upstream	1,937	1,937	60.6%	1,870	59.2%
Total	**3,507**	**3,195**		**3,160**	

Pollutant Source	TSS (lb/yr x 1000)				
	No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	3,029	1,490	1.2%	1,494	1.3%
D.C. Storm Water	3,815	3,815	3.1%	3,815	3.2%
Other Storm Water	376	376	0.3%	376	0.3%
Upstream	115,967	115,967	95.3%	112,002	95.2%
Total	**123,187**	**121,648**		**117,686**	

Pollutant Source	Fecal Coliforms (#/yr x 10^{14})				
	No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	764	254	61.2%	254	61.7%
D.C. Storm Water	52	52	12.5%	52	12.6%
Other Storm Water	5	5	1.2%	5	1.2%
Upstream	104	104	25.1%	101	24.5%
Total	**925**	**415**		**412**	

Pollutant Source	*E.coli* (#/yr x 10^{14})				
	No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	558	181	69.6%	181	70.1%
D.C. Storm Water	30	30	11.5%	30	11.6%
Other Storm Water	3	3	1.2%	3	1.2%
Upstream	46	46	17.7%	44	17.1%
Total	**636**	**260**		**258**	

From Table 5-6, significant reduction in CSO and upstream load sources was observed for all the parameters due to Phase I controls, as predicted. While upstream sources still predominate among the load sources for CBOD5 and TSS, CSO loads are a significant source for bacteriological parameters.

5.2.2.2 Water Quality Assessment for Anacostia River

Using the pollutant loads and monitored CSO overflows, the Anacostia River receiving water model was run continuously for the average year condition (1988-1990).

- **E.coli**

The effect of Phase I controls on *E.coli* levels was evaluated for the entire calendar year as well as for the period May through September. May through September is typically the period of primary contact recreation since the ambient and water temperatures are usually above 60-65 degrees Fahrenheit for comfortable recreation.

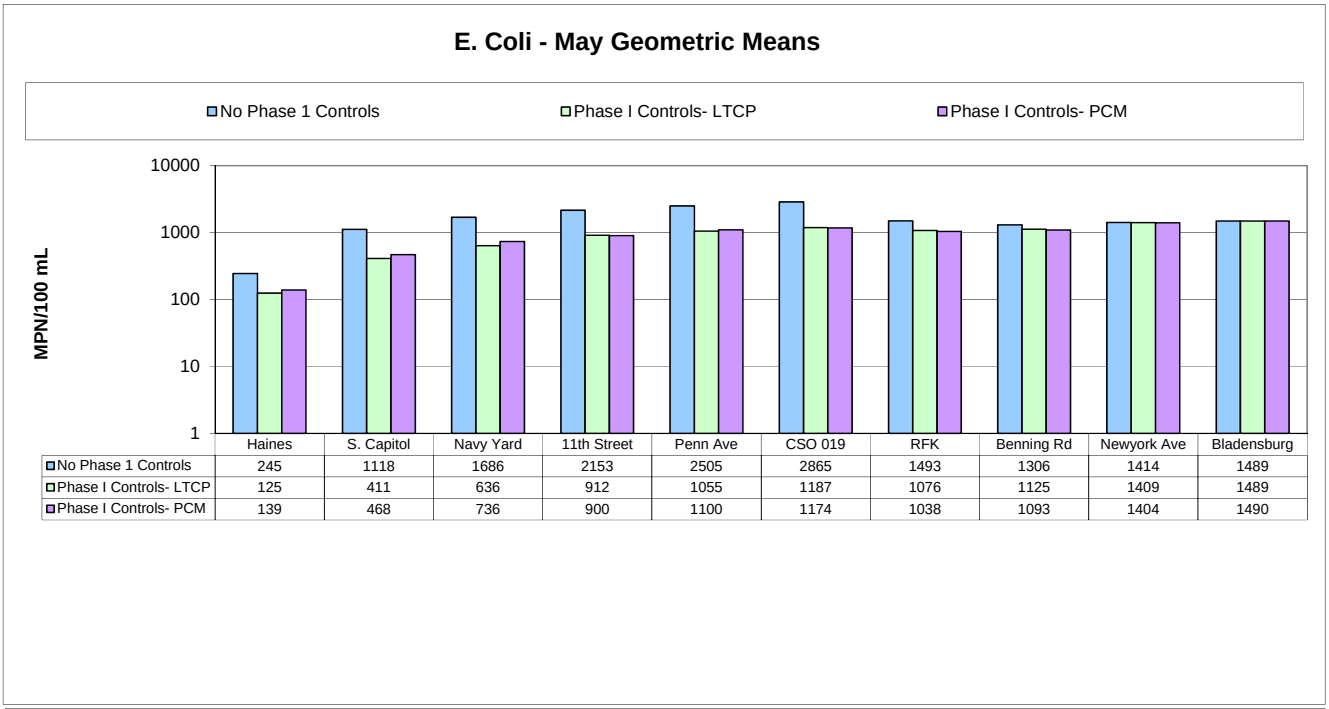
Results are presented in Table 5-7 and Figures 5-2, 5-3 and 5-4.

Table 5-7. Effect of Phase I Controls on *E.coli* in Anacostia River (Avg. Year)

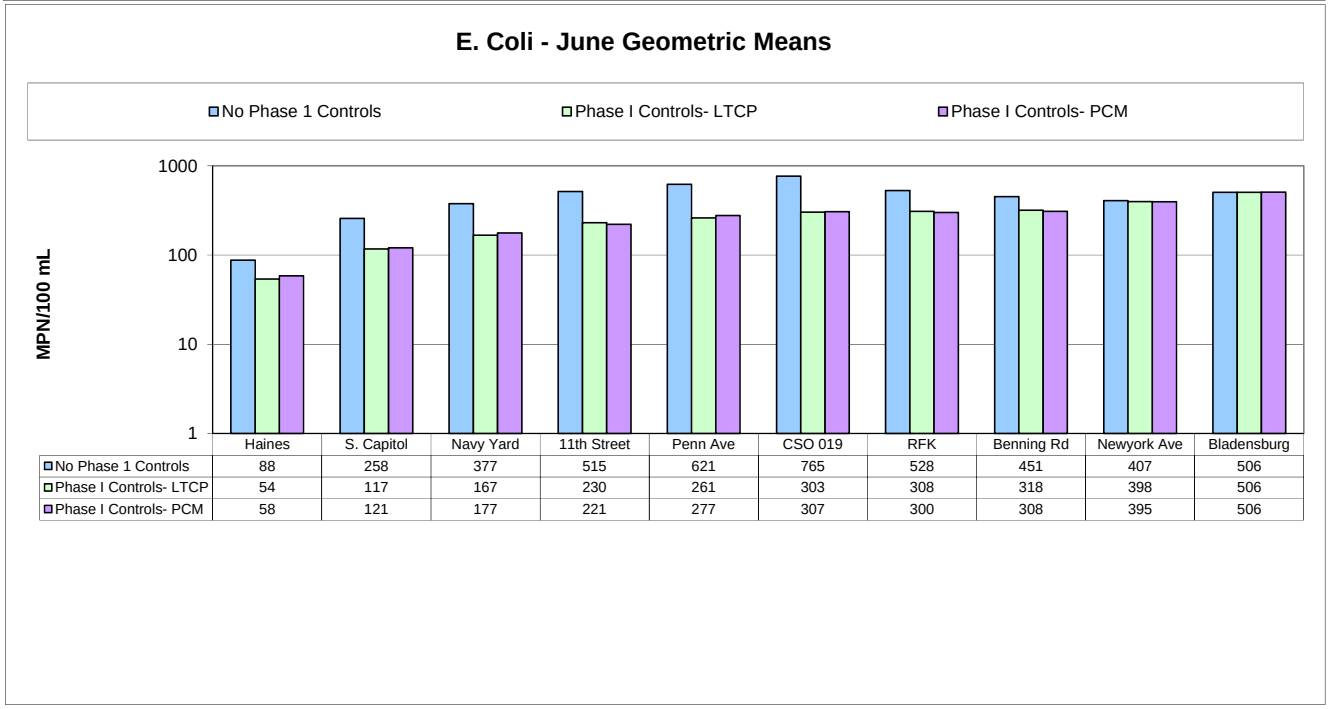
	LTCP- No Phase I CSO Controls		Phase I CSO Controls- ALL LOADS				Phase I CSO Controls- CSO LOADS ONLY			
Location			**LTCP**		**PCM**		**LTCP**		**PCM**	
	All Year	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**
# Months Exceeding Class A Geometric Mean E. Coli Standard of 126/100 ml										
Bladensburg	12	5	12	5	12	5	0	0	0	0
New York Ave	12	5	12	5	12	5	0	0	0	0
Benning Rd	11	4	10	3	10	3	0	0	0	0
RFK	12	5	10	3	10	3	0	0	1	0
CSO 019	12	5	9	3	9	3	0	0	1	0
Penn Ave	11	4	9	3	9	3	0	0	3	1
11th Street	11	4	8	2	8	2	1	1	4	1
Navy Yard	10	3	8	2	8	2	1	1	4	1
S. Capitol	8	2	5	1	5	1	1	1	1	1
Hains Point	1	1	1	0	1	1	0	0	0	0

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-2
Anacostia River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



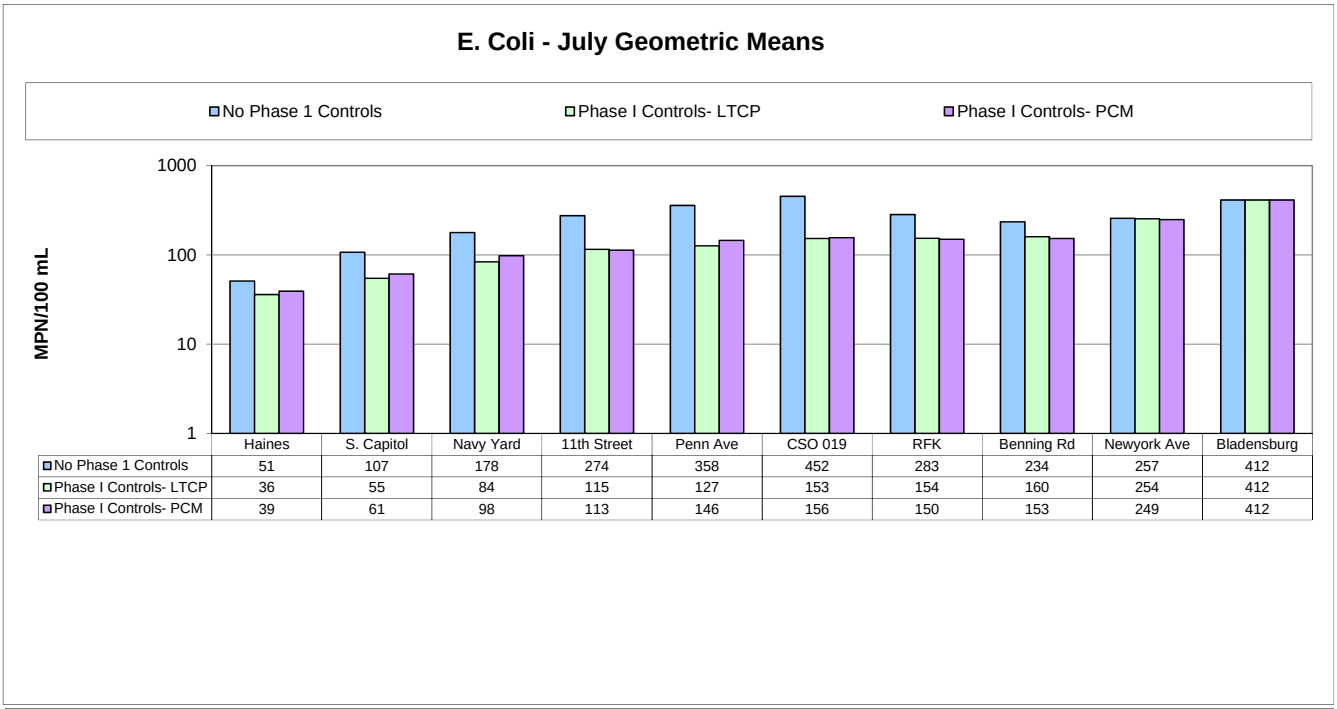
	Haines	S. Capitol	Navy Yard	11th Street	Penn Ave	CSO 019	RFK	Benning Rd	Newyork Ave	Bladensburg
No Phase 1 Controls	245	1118	1686	2153	2505	2865	1493	1306	1414	1489
Phase I Controls- LTCP	125	411	636	912	1055	1187	1076	1125	1409	1489
Phase I Controls- PCM	139	468	736	900	1100	1174	1038	1093	1404	1490



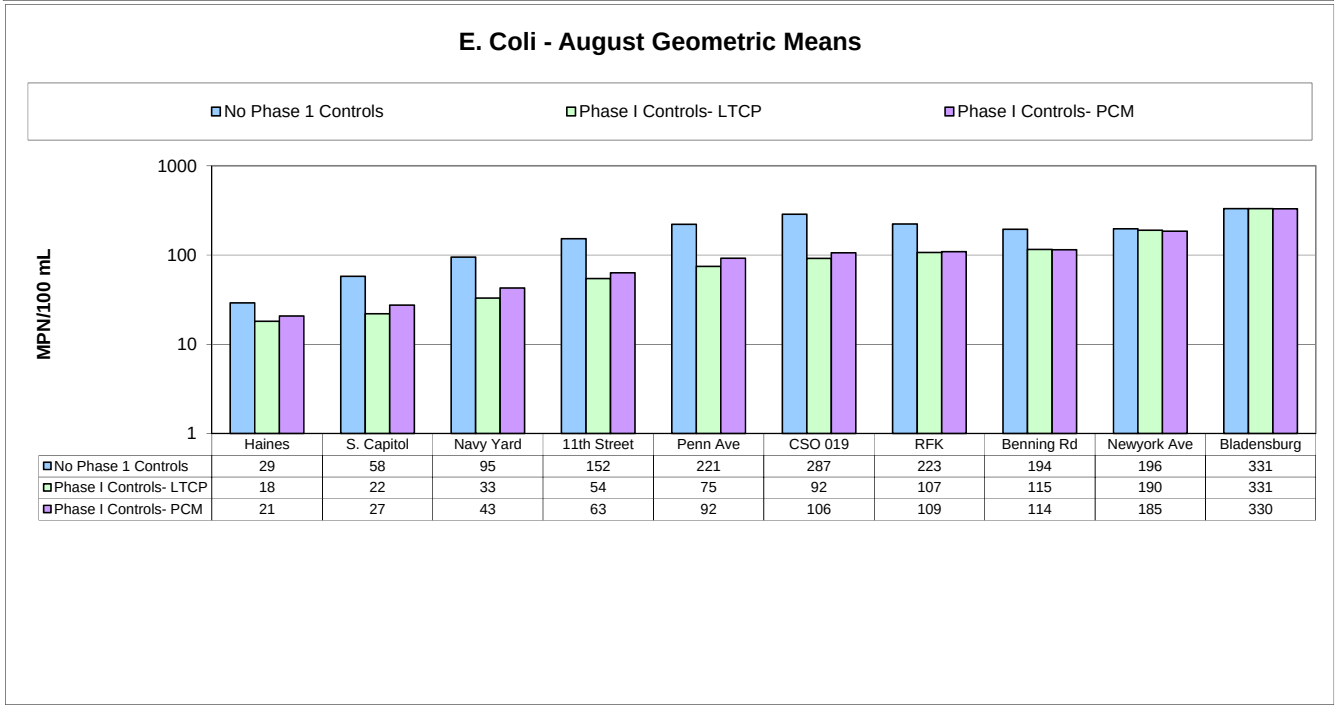
	Haines	S. Capitol	Navy Yard	11th Street	Penn Ave	CSO 019	RFK	Benning Rd	Newyork Ave	Bladensburg
No Phase 1 Controls	88	258	377	515	621	765	528	451	407	506
Phase I Controls- LTCP	54	117	167	230	261	303	308	318	398	506
Phase I Controls- PCM	58	121	177	221	277	307	300	308	395	506

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-3
Anacostia River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



	Haines	S. Capitol	Navy Yard	11th Street	Penn Ave	CSO 019	RFK	Benning Rd	Newyork Ave	Bladensburg
No Phase 1 Controls	51	107	178	274	358	452	283	234	257	412
Phase I Controls- LTCP	36	55	84	115	127	153	154	160	254	412
Phase I Controls- PCM	39	61	98	113	146	156	150	153	249	412



	Haines	S. Capitol	Navy Yard	11th Street	Penn Ave	CSO 019	RFK	Benning Rd	Newyork Ave	Bladensburg
No Phase 1 Controls	29	58	95	152	221	287	223	194	196	331
Phase I Controls- LTCP	18	22	33	54	75	92	107	115	190	331
Phase I Controls- PCM	21	27	43	63	92	106	109	114	185	330

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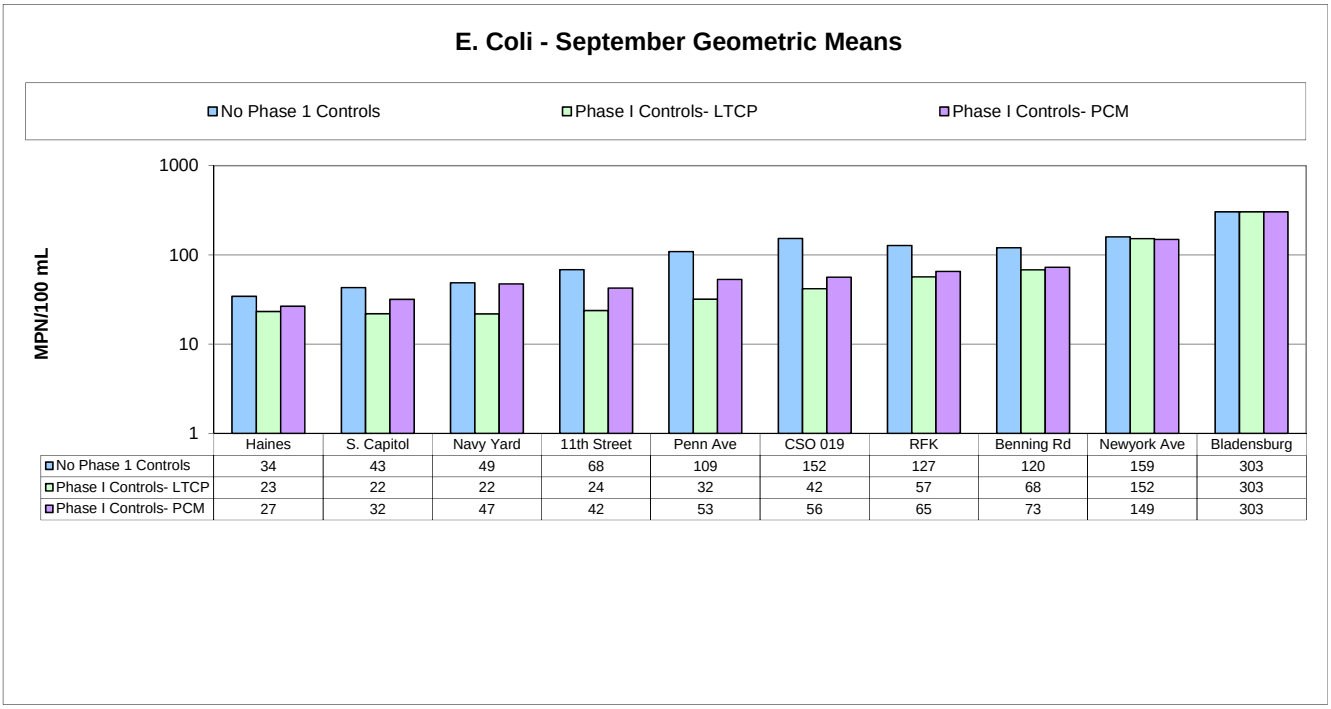
Figure 5-4
Anacostia River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



	Haines	S. Capitol	Navy Yard	11th Street	Penn Ave	CSO 019	RFK	Benning Rd	Newyork Ave	Bladensburg
No Phase 1 Controls	34	43	49	68	109	152	127	120	159	303
Phase I Controls- LTCP	23	22	22	24	32	42	57	68	152	303
Phase I Controls- PCM	27	32	47	42	53	56	65	73	149	303

The following observations are made:

- Phase I controls have reduced number of months exceeding the *E.coli* water quality standard at South Capitol Street by almost half, as predicted. Overall, the PCM results are consistent with the LTCP predictions for the number of months exceeding the bacteria standard.
- From Figures 5-2, 5-3 and 5-4, it can be observed that Phase I controls have reduced the *E.coli* concentrations during May through September.
- Overall, the monthly *E.coli* geometric means are strongly affected by the *E.coli* concentrations at the upstream boundary which are controlled by other sources beyond CSOs and DC storm water. Under CSO Loads Only scenario, modeling indicated that the monthly geometric mean exceedances will range from 1 to 4 months at several locations along Anacostia River.

- **Fecal Coliform**

The effect of Phase I controls on fecal coliform concentrations was analyzed. Results are presented in Table 5-8 below. The *E.coli* and fecal coliform results track each other very closely. Hence the observations made for *E.coli* are generally applicable to fecal coliform.

Table 5-8. Effect of Phase I Controls on Fecal Coliform in Anacostia River (Avg Year)

	LTCP-No Phase I CSO Controls		Phase I CSO Controls- ALL LOADS				Phase I CSO Controls- CSO LOADS ONLY			
Location			**LTCP**		**PCM**		**LTCP**		**PCM**	
	All Year	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**
# Months Exceeding 200/100 ml Geometric Mean										
Bladensburg	12	5	12	5	12	5	0	0	0	0
New York Ave	12	5	12	5	12	5	0	0	0	0
Benning Rd	12	5	11	4	11	4	0	0	0	0
RFK	12	5	11	4	11	4	0	0	1	0
CSO 019	12	5	10	3	10	3	0	0	1	0
Penn Ave	11	4	9	3	9	3	0	0	2	1
11th Street	11	4	8	2	8	2	1	1	2	1
Navy Yard	9	3	6	2	8	2	1	1	3	1
S. Capitol	8	2	4	1	5	1	1	1	1	1
Hains Point	1	1	1	1	1	1	0	0	0	0

- **Dissolved Oxygen**

The effects of Phase I CSO control on dissolved oxygen is evaluated. In addition to direct loads of oxygen consuming pollutants from CSO, storm water, and the upstream boundary, the sediments in the Anacostia River are known to exert a sediment oxygen demand (SOD). The change in the SOD in response to pollutant loads generated with Phase I controls in place was included in the receiving water modeling. Results are shown in shown in Table 5-9.

Table 5-9. Effect of Phase I Controls on Dissolved Oxygen in Anacostia River (Avg. Year)

	LTCP-No Phase I CSO Controls	Phase I CSO Controls- ALL LOADS		Phase I CSO Controls- CSO LOADS ONLY	
Location		**LTCP**	**PCM**	**LTCP**	**PCM**
# Days Dissolved Oxygen <5.0 mg/L					
Bladensburg	7	7	8	0	0
New York Ave	55	55	58	0	0
Benning Road	83	81	81	0	0
RFK	84	80	80	0	0
CSO 019	88	82	81	0	0
Penn Ave	89	83	83	0	0
11th Street	93	87	86	0	0
Navy Yard	93	82	80	0	0
S. Capitol	80	70	69	0	0
Hains	13	10	8	7	0
Minimum Day Dissolved Oxygen					
Bladensburg	4.3	4.3	4.3	8	8
New York Ave	1.7	1.7	1.6	7	7
Benning Road	1.4	1.4	1.5	6	6
RFK	1.4	1.5	1.6	6	6
CSO 019	1.6	1.7	1.9	5	6
Penn Ave	1.6	1.8	2	6	6
11th Street	1.6	2	2.1	6	7
Navy Yard	2.2	2.6	2.7	6	7
S. Capitol	2.8	3.1	3.3	6	7
Hains Point	4.3	4.5	4.5	5	7

The following observations are made:

- Except at upstream boundary, number of days D.O below 5 mg/l has reduced moderately along Anacostia River as predicted.
- Compared to no controls, except at boundary, noticeable improvements are generally observed in the minimum day dissolved oxygen due to Phase I controls but the year-round instantaneous minimum dissolved oxygen standard (5 mg/l) was not met in the Anacostia River.
- Dissolved oxygen levels below 2.0 mg/L occurred several times per summer month, with each episode lasting 1 to 2 days. Fish kills have been observed during post construction monitoring period. Low dissolved oxygen levels occurred in the months of May to September and typically followed a local or upstream wet weather event. The low dissolved oxygen is driven by the

naturally low saturation level of oxygen in the water due to the high water temperature and the influx of pollutant loads from wet weather events. As indicated in the LTCP Report (Section 9.5.3.3), the sluggish nature of the Anacostia River does not allow effective re-aeration of the river, contributing to the prolonged duration of low dissolved oxygen.

- Under the CSO Loads Only scenario, modeling indicated that there won't be any days of dissolved oxygen levels below 5 mg/l.
- The SOD in the model is driven by the particulate fraction of carbonaceous biochemical oxygen demand (CBOD). As indicated in the LTCP Report (Section 9.5.3.3), it was observed that reducing pollutant loads from any source (CSO, SSWS, or upstream) reduced the deposition of settleable matter and produced a corresponding reduction in SOD. The reduction in SOD was approximately proportional to the amount of particulate CBOD removed. In addition, the reduction in SOD was found to lag the load reduction in the pollutant source by approximately three to six years.

5.2.3 POTOMAC RIVER

The water quality of the Potomac River is much better than that in the Anacostia or Rock Creek.

5.2.3.1 Pollutant Loads to Potomac River

Using the models for the CSS, data on boundary condition flow rates for the years 1988-1990, and the event mean concentrations for each pollutant source, the pollutant load to Potomac River was calculated for the average year. The load sources were divided into the following categories:

- CSO Overflow – this is overflow from the CSS.
- D.C. Storm Water – this is comprised of District's separate storm water system
- Other Storm Water – this consists of Alexandria and Arlington storm water and Virginia streams such as Four Mile Run, Spout Run and others.
- Wastewater Treatment Plants - comprises loads from Arlington, Alexandria and Blue Plains Wastewater Treatment Plants, including Blue Plains excess flow treatment.

As part of Phase I controls assessment, the storm water load sources (both DC & Other) have not been updated. Load estimates are summarized Table 5-10.

Table 5-10. Sources of Pollutant Loads to Potomac River Within District

Pollutant Source	CBOD5 (lb/yr x 1000)				
	LTCP- No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	335	214	0.3%	242	0.3%
D.C. Storm Water	386	386	0.5%	386	0.5%
Other Storm Water	1,323	1,323	1.8%	1,323	1.8%
Upstream	64,942	64,942	87.3%	64,942	86.9%
Wastewater Treatment Plant	7,121	7,564	10.2%	7,844	10.5%
Total	**74,107**	**74,429**		**74,737**	

Pollutant Source	TSS (lb/yr x 1000)				
	LTCP- No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	1,230	791	0.0%	904	0.1%
D.C. Storm Water	1,910	1,910	0.1%	1,910	0.1%
Other Storm Water	20,424	20,424	1.1%	20,424	1.1%
Upstream	1,770,113	1,770,113	98.0%	1,770,113	98.0%
Wastewater Treatment Plant	11,707	12,712	0.7%	12,897	0.7%
Total	**1,805,384**	**1,805,950**		**1,806,248**	

Pollutant Source	Fecal Coliforms (#/yr x 10^{14})				
	LTCP- No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	381	237	35.4%	263	37.2%
D.C. Storm Water	26	26	3.9%	26	3.7%
Other Storm Water	59	59	8.8%	59	8.4%
Upstream	273	273	40.7%	273	38.6%
Wastewater Treatment Plant	51	75	11.2%	85	12.0%
Total	**791**	**670**		**706**	

Pollutant Source	*E.coli* (#/yr x 10^{14})				
	LTCP- No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total Load	PCM	% of Total Load
CSO Overflow	279	173	41.0%	192	42.8%
D.C. Storm Water	15	15	3.6%	15	3.3%
Other Storm Water	32	32	7.6%	32	7.3%
Upstream	148	148	35.1%	148	32.9%
Wastewater Treatment Plant	36	54	12.8%	61	13.6%
Total	**510**	**422**		**448**	

From Table 5-10, as predicted, significant reduction in CSO load was observed for all parameters even though not to the degree predicted. Upstream sources and CSOs still predominate among the load sources for all parameters. As predicted by LTCP, elevated loads from wastewater treatment can be observed for all parameters compared to no controls.

5.2.3.2 Water Quality Assessment for Phase I CSO Control in Potomac River

Using the loads and flows predicted above, the Potomac River receiving water model was run continuously for the period 1988-1990.

- **E.coli**

The effect of Phase I controls on *E.coli* levels was evaluated for the entire calendar year as well as for the period May through September. Results are presented in Table 5-11 and Figures 5-5, 5-6 and 5-7.

Table 5-11. Effect of Phase I Controls on *E.coli* in Potomac River (Avg. Year)

	LTCP- No Phase I CSO Controls		Phase I CSO Controls- ALL LOADS				Phase I CSO Controls- CSO LOADS ONLY			
Location			LTCP		PCM		LTCP		PCM	
	All Year	May to Sept	All Year	May to Sept	All Year	May to Sept	All Year	May to Sept	All Year	May to Sept
# Months Exceeding Class A Geometric Mean E. Coli Standard of 126/100 ml										
Boundary	1	1	1	1	1	1	0	0	0	0
3 Sis	0	0	0	0	0	0	0	0	0	0
Georgetown	0	0	0	0	1	1	0	0	0	0
U/S Rock Creek	1	1	1	1	1	1	0	0	0	0
Memorial	2	2	1	1	2	2	0	0	0	0
U/s Confluence	1	1	0	0	0	0	0	0	0	0
Hains Point	0	0	0	0	0	0	0	0	0	0
At 003	0	0	0	0	0	0	0	0	0	0
BP	0	0	0	0	0	0	0	0	0	0
Wilson	0	0	0	0	0	0	0	0	0	0

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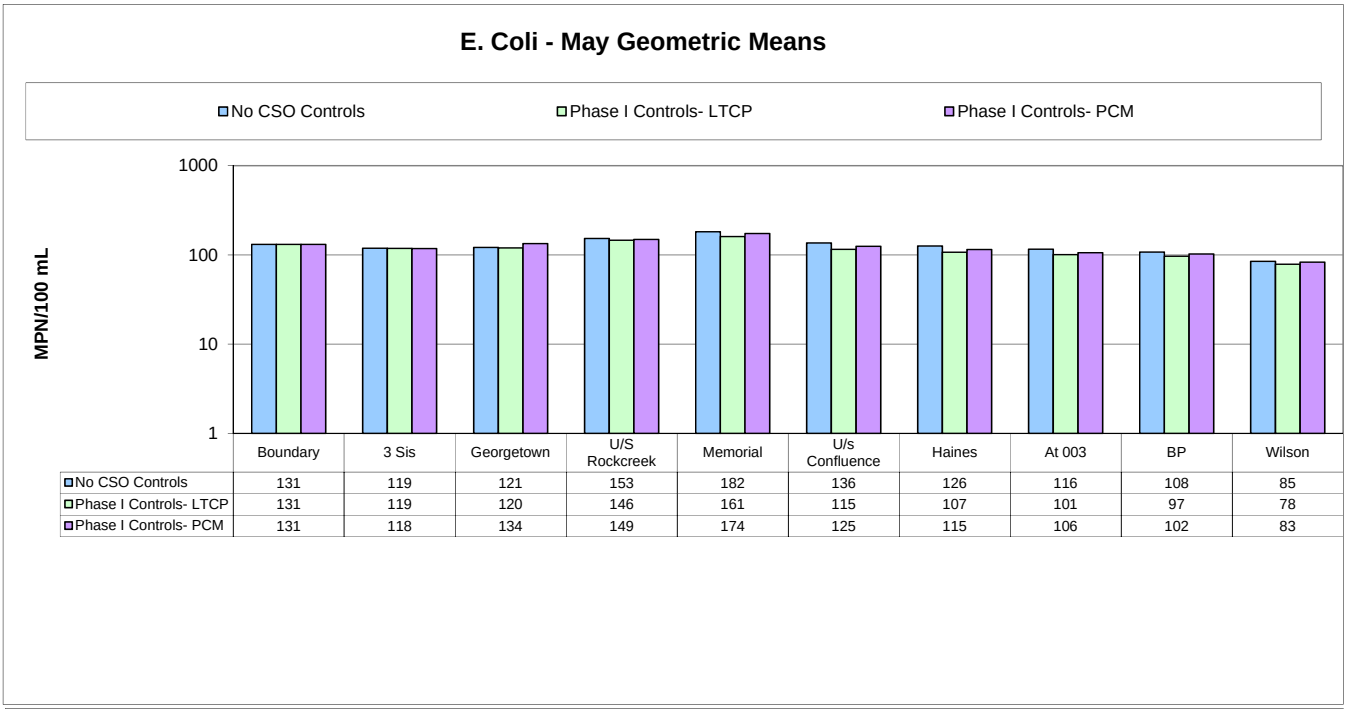
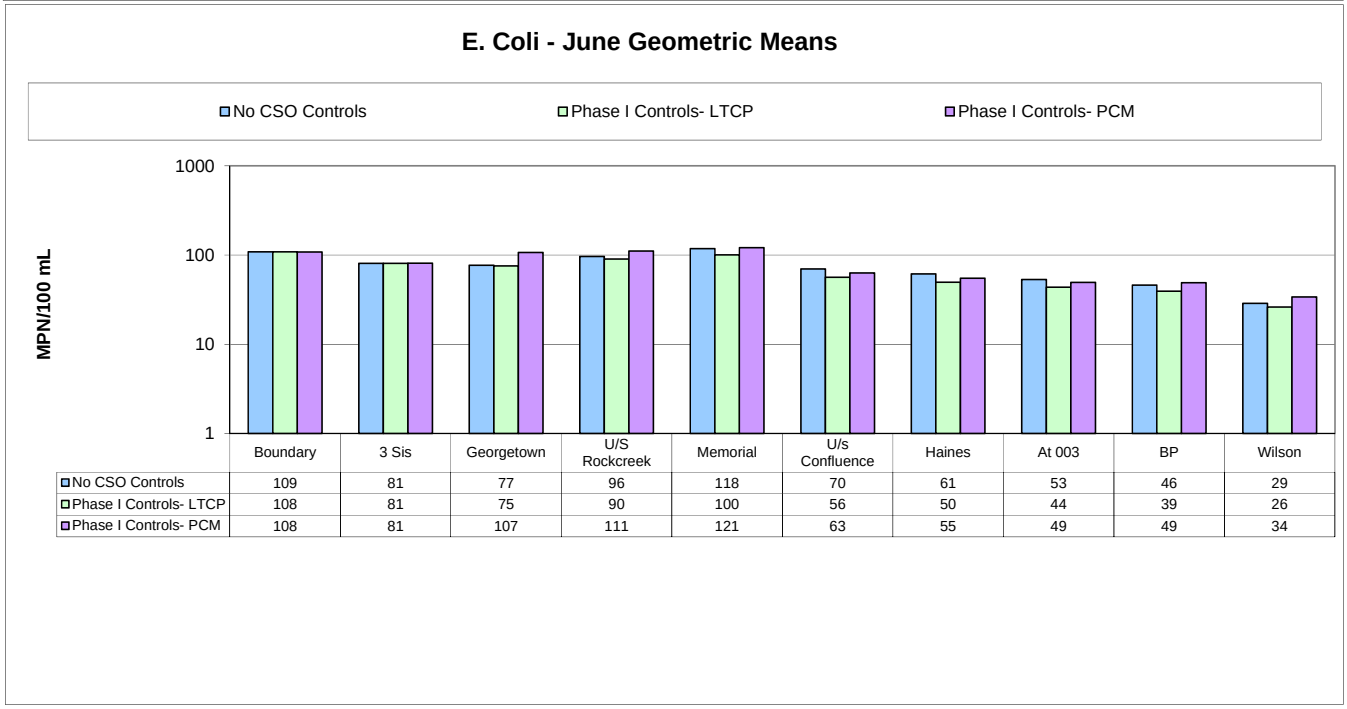
Post Construction Monitoring- Phase I

Figure 5-5
Potomac River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



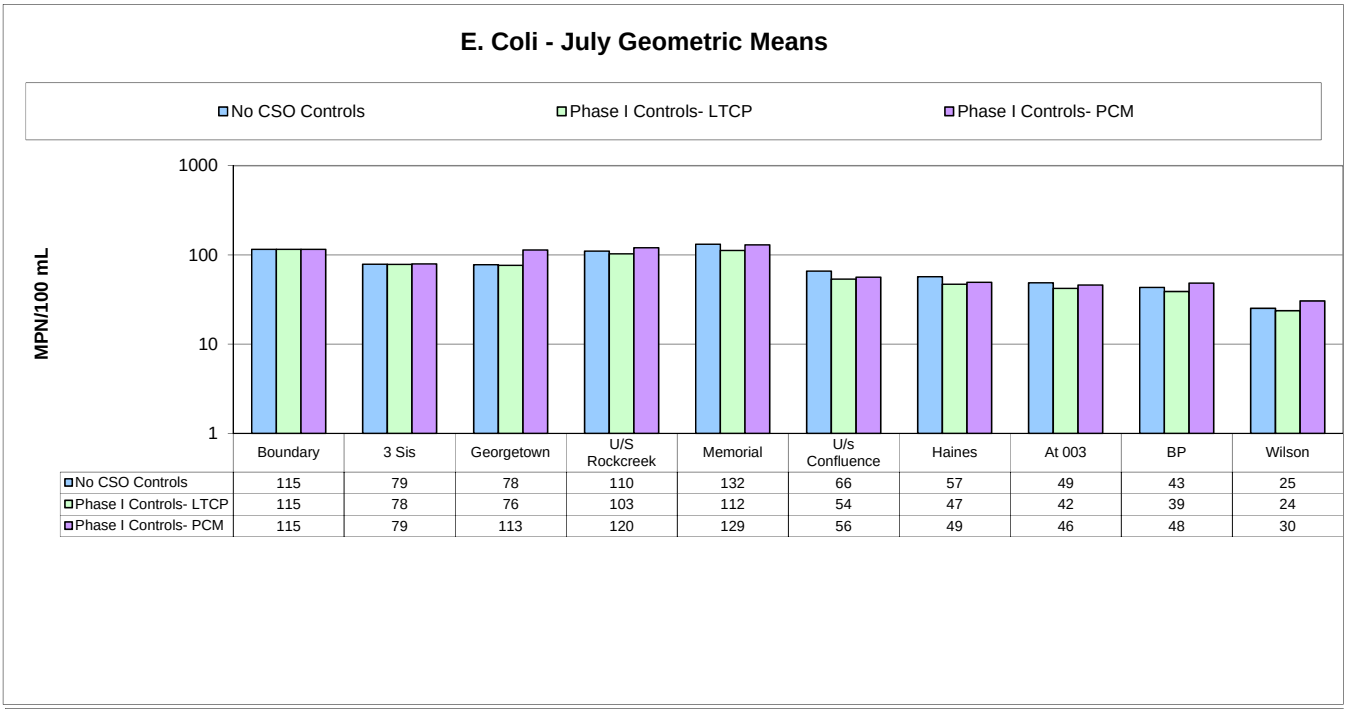
	Boundary	3 Sis	Georgetown	U/S Rockcreek	Memorial	U/s Confluence	Haines	At 003	BP	Wilson
No CSO Controls	131	119	121	153	182	136	126	116	108	85
Phase I Controls- LTCP	131	119	120	146	161	115	107	101	97	78
Phase I Controls- PCM	131	118	134	149	174	125	115	106	102	83



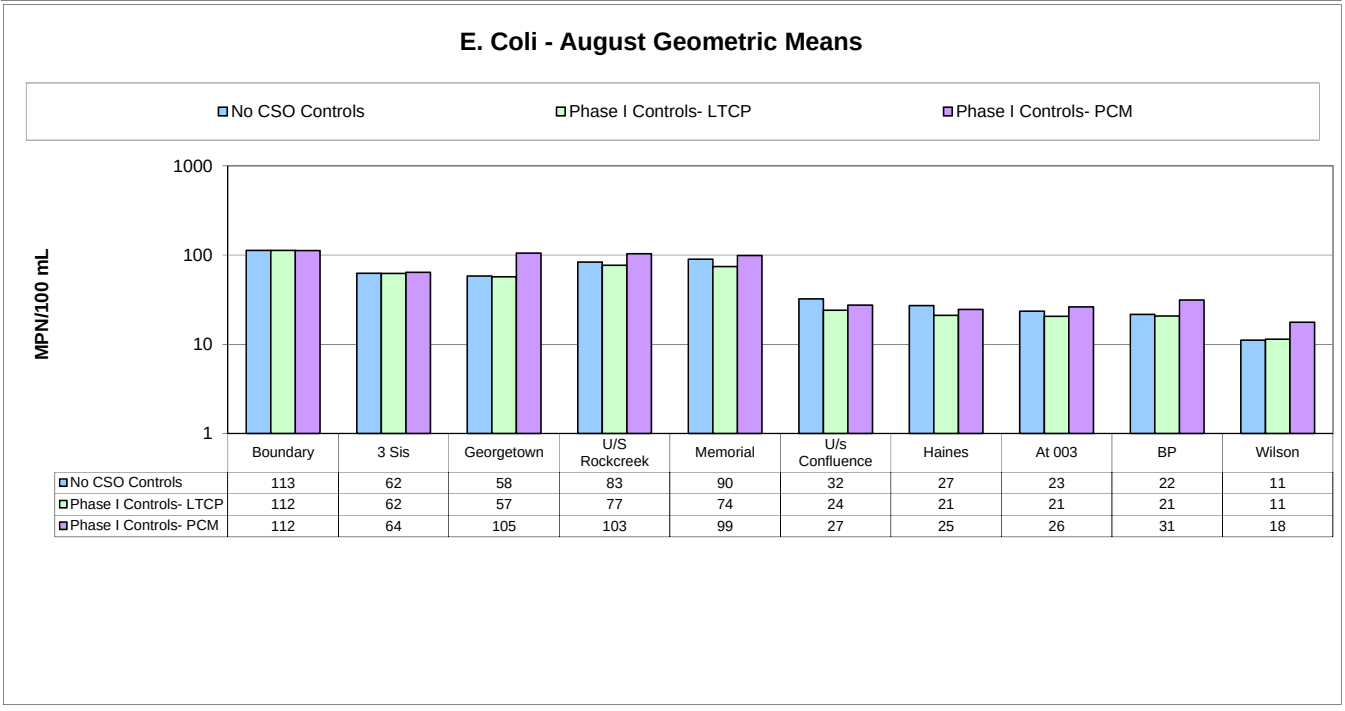
	Boundary	3 Sis	Georgetown	U/S Rockcreek	Memorial	U/s Confluence	Haines	At 003	BP	Wilson
No CSO Controls	109	81	77	96	118	70	61	53	46	29
Phase I Controls- LTCP	108	81	75	90	100	56	50	44	39	26
Phase I Controls- PCM	108	81	107	111	121	63	55	49	49	34

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-6
Potomac River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



	Boundary	3 Sis	Georgetown	U/S Rockcreek	Memorial	U/s Confluence	Haines	At 003	BP	Wilson
No CSO Controls	115	79	78	110	132	66	57	49	43	25
Phase I Controls- LTCP	115	78	76	103	112	54	47	42	39	24
Phase I Controls- PCM	115	79	113	120	129	56	49	46	48	30



	Boundary	3 Sis	Georgetown	U/S Rockcreek	Memorial	U/s Confluence	Haines	At 003	BP	Wilson
No CSO Controls	113	62	58	83	90	32	27	23	22	11
Phase I Controls- LTCP	112	62	57	77	74	24	21	21	21	11
Phase I Controls- PCM	112	64	105	103	99	27	25	26	31	18

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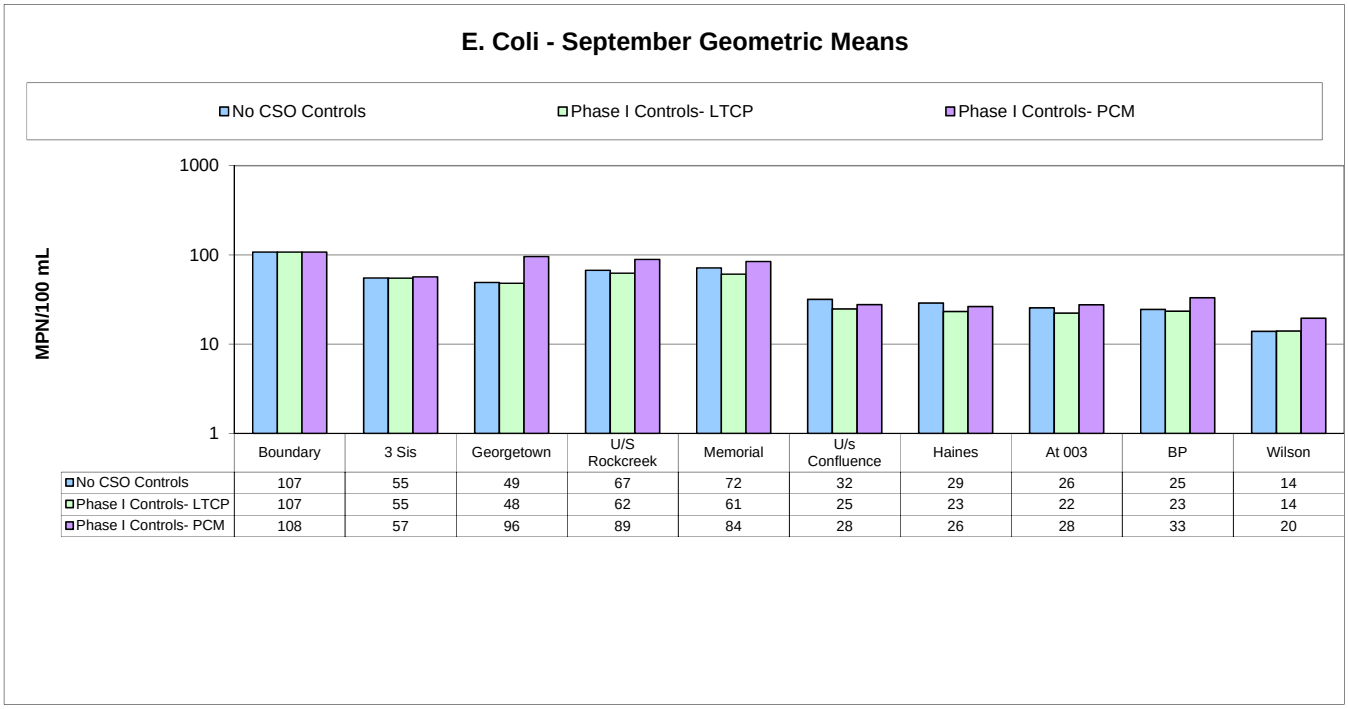
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-7
Potomac River: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



	Boundary	3 Sis	Georgetown	U/S Rockcreek	Memorial	U/s Confluence	Haines	At 003	BP	Wilson
No CSO Controls	107	55	49	67	72	32	29	26	25	14
Phase I Controls- LTCP	107	55	48	62	61	25	23	22	23	14
Phase I Controls- PCM	108	57	96	89	84	28	26	28	33	20

The following observations are made:

- The amount by which the Potomac River is exceeding the Class A Standard is small. For example, the *E.coli* concentration for one month exceedance at Upstream of Rock Creek is 149 MPN/ 100 ml whereas the concentrations for two months exceedance at Memorial Bridge are 174 MPN/ 100 ml and 129 MPN/ 100 ml .
- Downstream of the Memorial Bridge, no exceedances are predicted on a monthly basis. This is due both to the low pollutant loads and the size and dilution capacity of the river.
- As indicated in LTCP Report (Section 9.7.3.1), CSOs mostly cause transient elevations of bacteria levels in river reaches immediate downstream of outfalls in the Potomac River. The monthly *E.coli* geomeans is most affected by the boundary conditions and least affected by transient wet weather sources like CSOs and storm water.
- Under CSO Loads Only scenario, modeling indicated that total CSO removal will allow Potomac River to have zero monthly geometric mean exceedances.

- **Fecal Coliform**

As with *E.coli*, the effect of Phase I CSO control on fecal coliform concentrations was analyzed. Results are presented in Table 5-12. The *E.coli* and fecal coliform results track each other very closely. Hence the observations made for *E.coli* apply to fecal coliform.

Table 5-12. Effect of Phase I Controls on Fecal Coliform in Potomac River (Avg. Year)

	LTCP-No Phase I CSO Controls		Phase I CSO Controls- ALL LOADS				Phase I CSO Controls- CSO LOADS ONLY			
Location			**LTCP**		**PCM**		**LTCP**		**PCM**	
	All Year	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**
# Months Exceeding 200/100 ml Geometric Mean										
Boundary	8	5	8	5	8	5	0	0	0	0
3 Sis	1	1	1	1	1	1	0	0	0	0
Georgetown	1	1	1	1	1	1	0	0	0	0
U/S Rock Creek	1	1	1	1	1	1	0	0	0	0
Memorial	3	3	1	1	3	3	0	0	0	0
U/s Confluence	1	1	0	0	1	1	0	0	0	0
Hains Point	1	1	0	0	0	0	0	0	0	0
At 003	0	0	0	0	0	0	0	0	0	0
BP	0	0	0	0	0	0	0	0	0	0
Wilson	0	0	0	0	0	0	0	0	0	0

5.2.3.3 Dissolved Oxygen

The dissolved oxygen level in the Potomac River is generally very good. Fish kills were not observed during PCM period. The effects of Phase I CSO control on dissolved oxygen is evaluated and summarized in Table 5-13.

Table 5-13. Effect of Phase I Controls on Dissolved Oxygen in Potomac River (Avg. Year)

	LTCP- No Phase I CSO Controls	Phase I CSO Controls- ALL LOADS		Phase I CSO Controls- CSO LOADS ONLY	
Location		**LTCP**	**PCM**	**LTCP**	**PCM**
# Days Dissolved Oxygen <5.0 mg/L					
Boundary	0	0	0	0	0
3 Sis	0	0	0	0	0
Georgetown	0	0	0	0	0
U/S Rock Creek	0	0	0	0	0
Memorial	0	0	0	0	0
U/s Confluence	10	8	8	0	0
Hains Point	15	14	14	0	0
At 003	21	21	20	0	0
BP	28	27	28	0	0
Wilson	35	35	36	0	0
Minimum Day Dissolved Oxygen					
Boundary	4.3	7.4	7.4	7	7
3 Sis	2.8	7.0	7.0	7	7
Georgetown	2.2	6.6	6.6	7	7
U/S Rock Creek	1.6	6.2	6.3	7	7
Memorial	1.6	5.9	5.9	7	7
U/s Confluence	1.6	4.8	4.8	7	7
Hains Point	1.4	4.7	4.7	7	7
At 003	1.4	4.5	4.5	6	6
BP	1.7	4.3	4.3	6	6
Wilson	4.3	4.2	4.2	5	5

The following observations are made:

- In general, the PCM results are within the range of accuracy of the modeling used to make the LTCP predictions. The model predicts that the water quality standard for dissolved oxygen is always met at Memorial Bridge and upstream. Slight depressions from the standard are predicted from the confluence with the Anacostia to the south of the Wilson Bridge.
- When the dissolved oxygen standard is not met, it is typically only slightly below the standard.
- Under the CSO Loads Only scenario, modeling indicated that Potomac River would have zero days of dissolved oxygen below 5 mg/l.

5.2.4 ROCK CREEK

5.2.4.1 Pollutant Loads to Rock Creek

Using the models for the CSS, data on boundary condition flow rates for the average year condition (1988-1990), and the event mean concentrations for each pollutant source, the pollutant load to Rock Creek was calculated for the average year. The load sources were divided into the following categories:

- CSO Overflow – this is overflow from the CSS.
- D.C. Storm Water – this is comprised of District's separate storm water system and includes Broad Branch and Luzon Valley.
- Other Storm water – this is comprised of storm water from park lands on each side of Rock Creek, such as from Rock Creek Park.

As part of Phase I controls assessment, the storm water load sources (both DC & Other) have not been updated. Load estimates are summarized Table 5-14.

Table 5-14. Sources of Pollutant Loads to Rock Creek Within District

Pollutant Source	CBOD5 (lb/yr x 1000)				
	LTCP-No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total	PCM	% of Total
CSO Overflow	n/a	42	6.0%	11	1.7%
D.C. Storm Water	n/a	226	32.4%	226	33.9%
Other Storm Water	n/a	10	1.4%	10	1.6%
Upstream	n/a	419	60.1%	419	62.9%
Total		**697**		**666**	

Pollutant Source	TSS (lb/yr x 1000)				
	LTCP-No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total	PCM	% of Total
CSO Overflow	n/a	189	1.7%	40	0.4%
D.C. Storm Water	n/a	1,116	10.0%	1,116	10.2%
Other Storm Water	n/a	67	0.6%	67	0.6%
Upstream	n/a	9,765	87.7%	9,765	88.9%
Total		**11,137**		**10,988**	

Pollutant Source	Fecal Coliforms (#/yr x 10^{14})				
	LTCP-No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total	PCM	% of Total
CSO Overflow	n/a	18	40.9%	13	33.1%
D.C. Storm Water	n/a	15	34.1%	15	38.7%
Other Storm Water	n/a	1	2.3%	1	3.1%
Upstream	n/a	10	22.7%	10	25.1%
Total		**44**		**39**	

Pollutant Source	*E.coli* (#/yr x 10^{14})				
	LTCP-No Phase I CSO Controls	Phase I CSO Controls			
		LTCP	% of Total	PCM	% of Total
CSO Overflow	n/a	14	50.0%	10	40.7%
D.C. Storm Water	n/a	9	32.1%	9	37.4%
Other Storm Water	n/a	1	3.6%	1	3.0%
Upstream	n/a	4	14.3%	4	18.9%
Total		**28**		**23**	

From Table 5-14, as predicted, significant reduction in CSO and upstream load sources was observed for all the parameters. While upstream sources still predominate among the load sources for CBOD5 and TSS, CSO loads and storm water are a significant source for bacteriological parameters.

5.2.4.2 Water Quality Assessment for Phase I CSO Control in Rock Creek

Using the loads and monitored CSO overflows, the Rock Creek receiving water model was run continuously for the average year period (1988-1990).

- **E.coli**

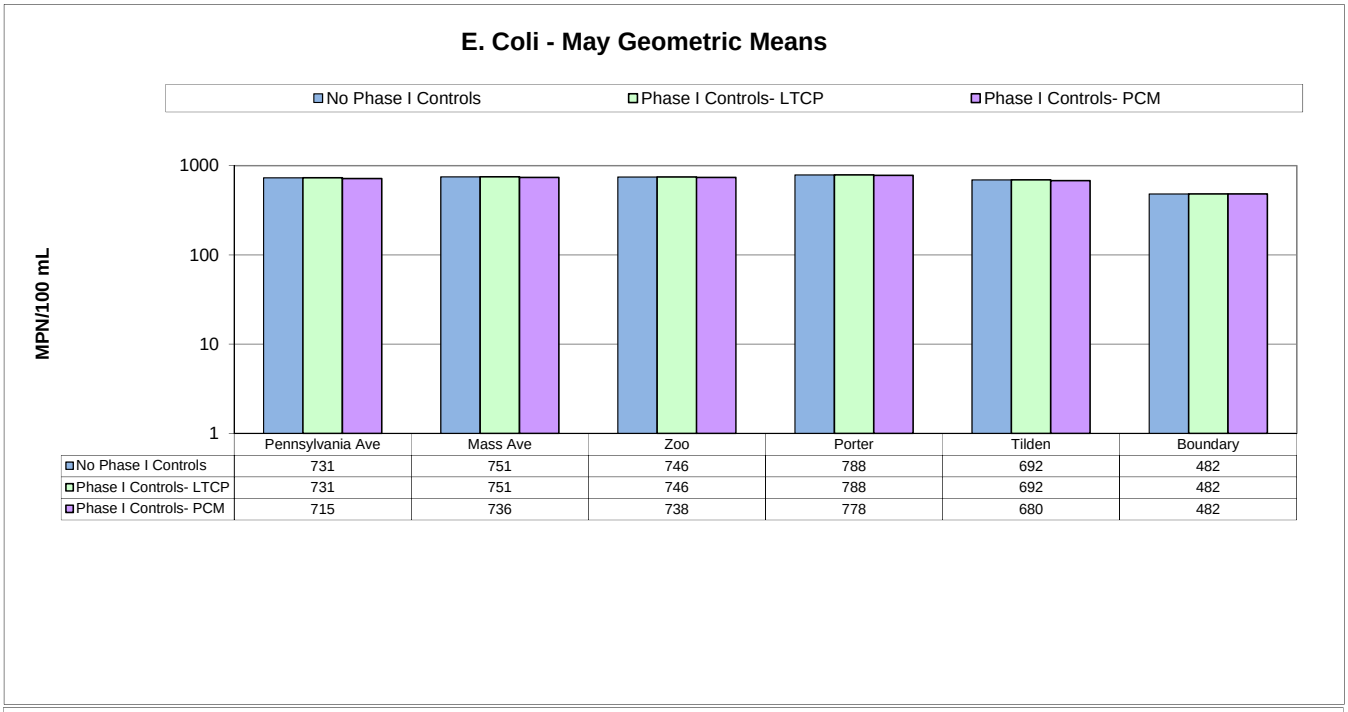
The effect of Phase I CSO control on *E.coli* levels was evaluated for the entire calendar year as well as for the period May through September. Results are presented in Table 5-15 and Figures 5-8, 5-9 and 5-10.

Table 5-15. Effect of Phase I Controls on *E.coli* in Rock Creek (Avg. Year)

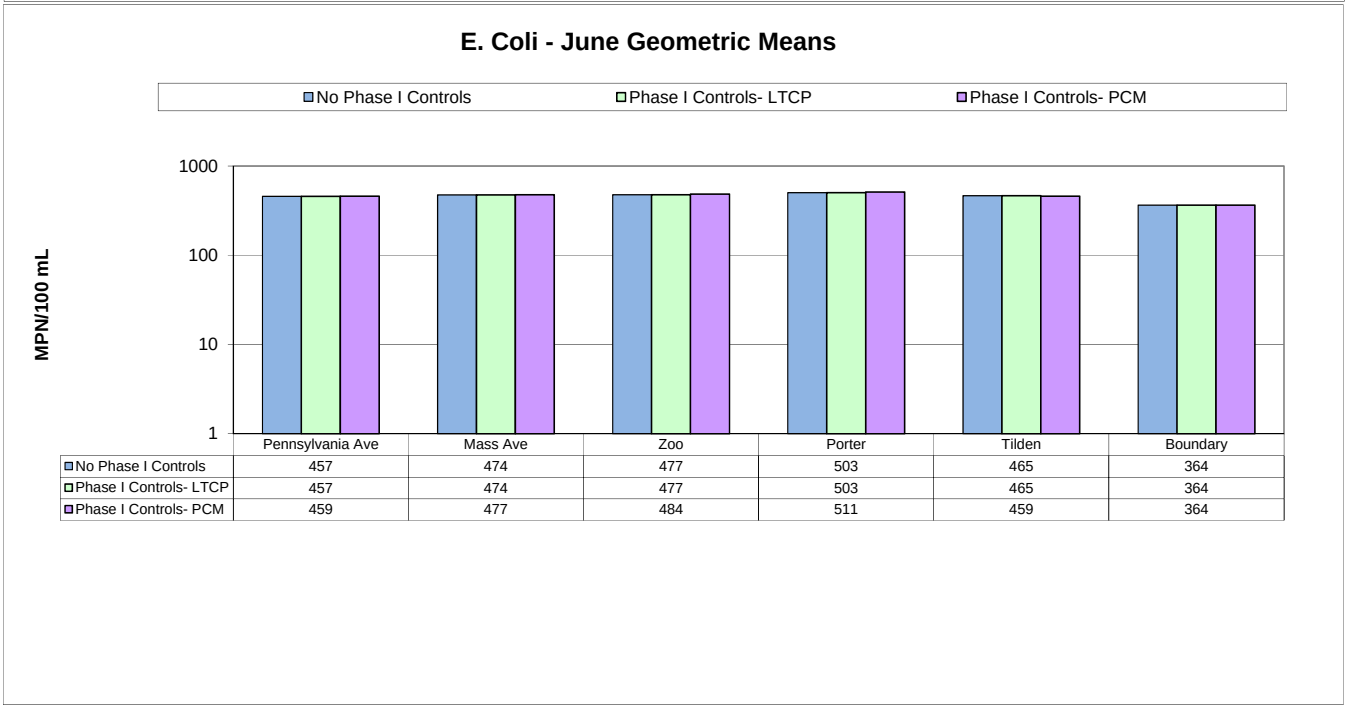
	LTCP-No Phase I CSO Controls		Phase I CSO Controls- ALL LOADS				Phase I CSO Controls- CSO LOADS ONLY			
Location			**LTCP**		**PCM**		**LTCP**		**PCM**	
	All Year	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**
# Months Exceeding Class A Geometric Mean E. Coli Standard of 126/100 ml										
Boundary Bridge	12	5	12	5	12	5	0	0	0	0
Tilden Street	12	5	12	5	12	5	0	0	0	0
Porter Street	12	5	12	5	12	5	0	0	0	0
Zoo	12	5	12	5	12	5	0	0	0	0
Mass Ave	12	5	12	5	12	5	0	0	0	0
Pennsylvania Ave	12	5	12	5	12	5	0	0	0	0

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-8
Rock Creek: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



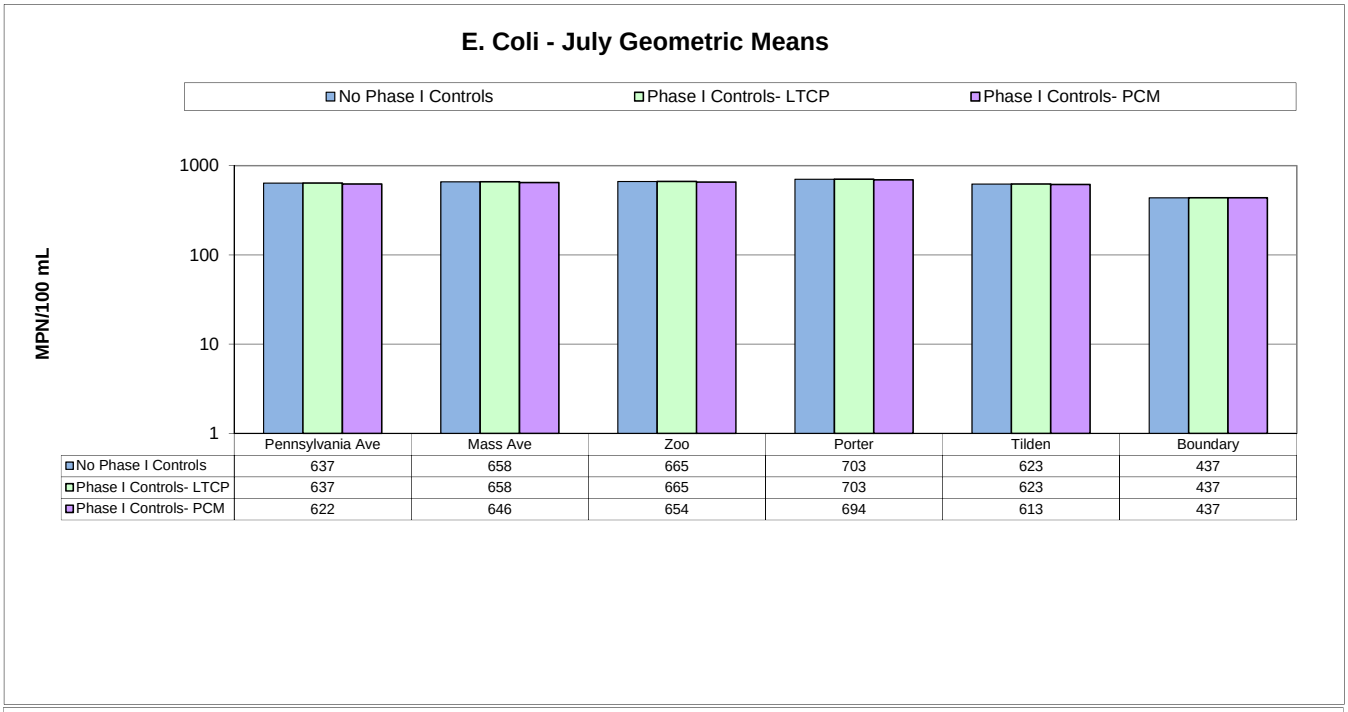
	Pennsylvania Ave	Mass Ave	Zoo	Porter	Tilden	Boundary
No Phase I Controls	731	751	746	788	692	482
Phase I Controls- LTCP	731	751	746	788	692	482
Phase I Controls- PCM	715	736	738	778	680	482



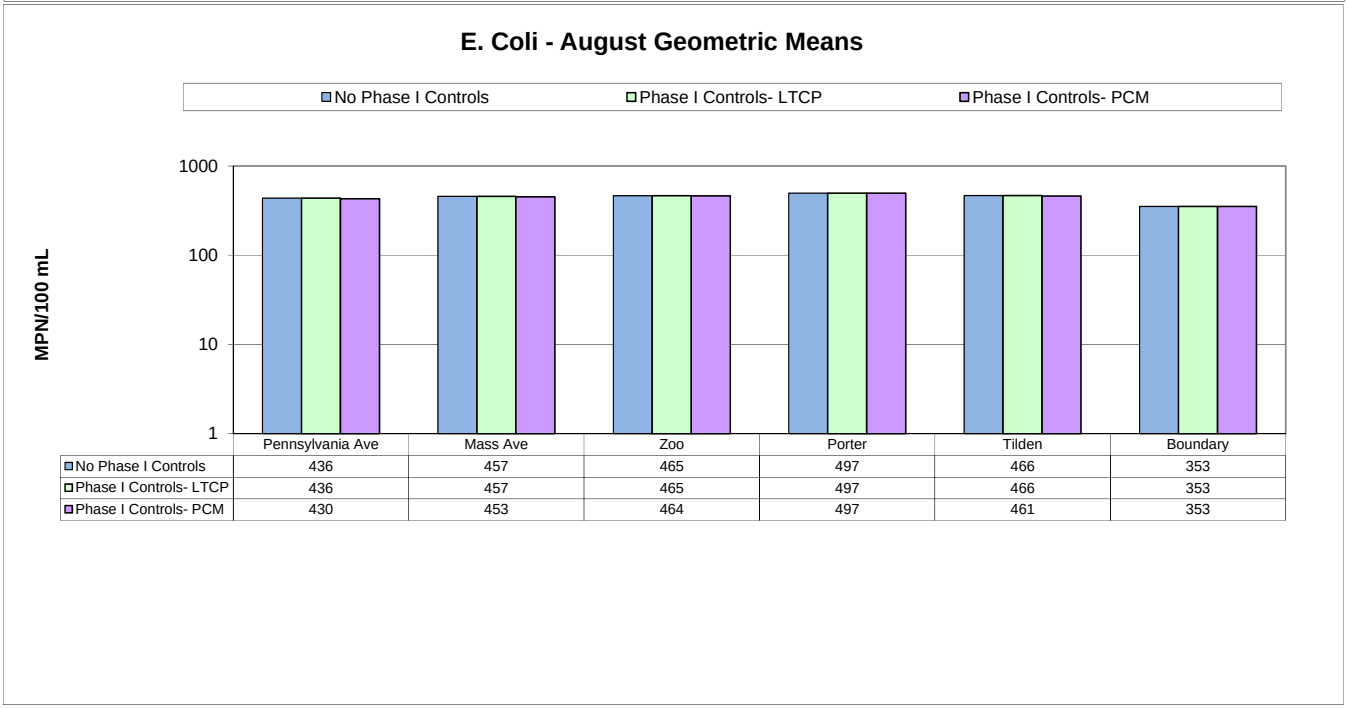
	Pennsylvania Ave	Mass Ave	Zoo	Porter	Tilden	Boundary
No Phase I Controls	457	474	477	503	465	364
Phase I Controls- LTCP	457	474	477	503	465	364
Phase I Controls- PCM	459	477	484	511	459	364

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-9
Rock Creek: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



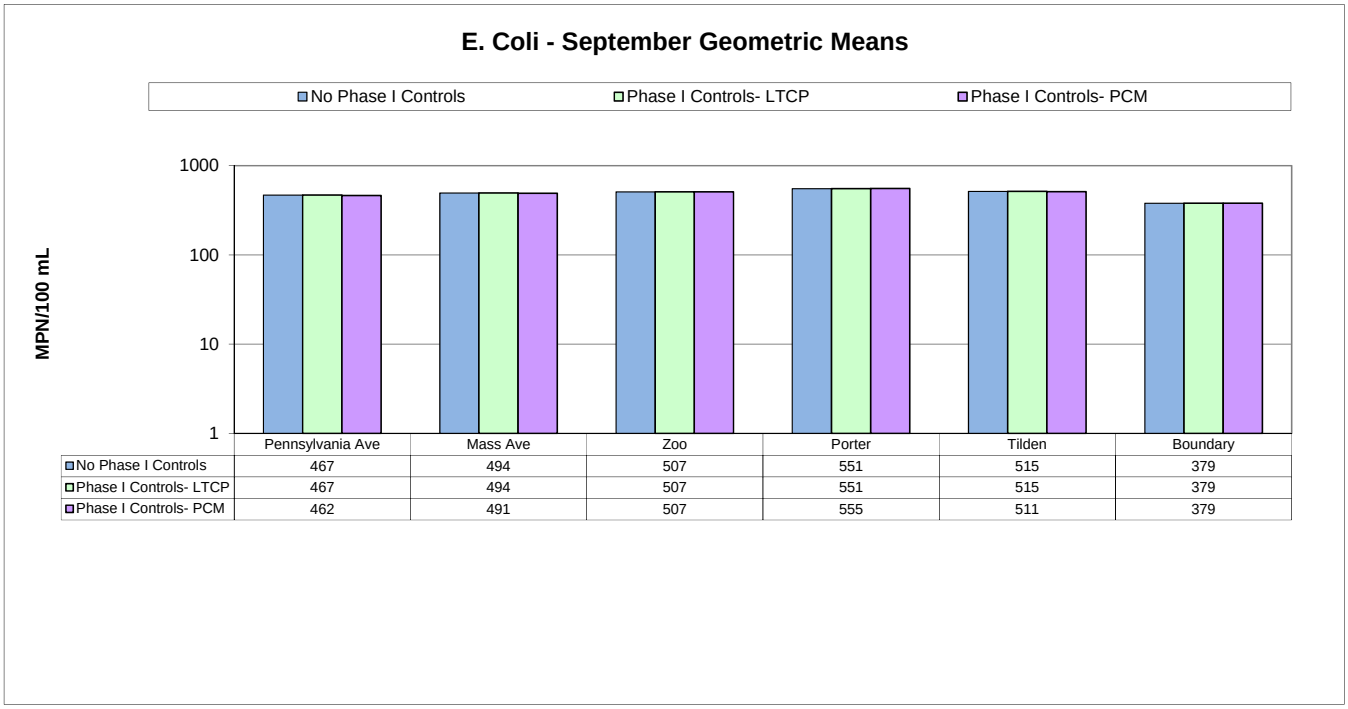
	Pennsylvania Ave	Mass Ave	Zoo	Porter	Tilden	Boundary
No Phase I Controls	637	658	665	703	623	437
Phase I Controls- LTCP	637	658	665	703	623	437
Phase I Controls- PCM	622	646	654	694	613	437



	Pennsylvania Ave	Mass Ave	Zoo	Porter	Tilden	Boundary
No Phase I Controls	436	457	465	497	466	353
Phase I Controls- LTCP	436	457	465	497	466	353
Phase I Controls- PCM	430	453	464	497	461	353

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Post Construction Monitoring- Phase I

Figure 5-10
Rock Creek: Effect of CSO Control on E.Coli Concentrations
(No Change in Upstream or Stormwater Loads)



	Pennsylvania Ave	Mass Ave	Zoo	Porter	Tilden	Boundary
No Phase I Controls	467	494	507	551	515	379
Phase I Controls- LTCP	467	494	507	551	515	379
Phase I Controls- PCM	462	491	507	555	511	379

The following observations are made:

- Bacterial concentrations are the primary concerns in Rock Creek. The flow of water in Rock Creek in any particular reach is relatively small. As a result, it is not able to dilute significant wet weather loads without causing relatively high concentrations in the creek.
- The monthly *E.coli* geometric mean is most affected by the boundary conditions.
- From Figures 5-8, 5-9 and 5-10, the *E.coli* concentrations for the months of May through September are within range of predictions.
- As predicted, Rock Creek exceeds the Class A standard every month of the year. Under CSO Loads Only scenario, modeling indicated Rock Creek would have zero monthly exceedances of geometric mean.

- **Fecal Coliform**

As with *E.coli*, the effect of Phase I CSO control on fecal coliform concentrations was analyzed. Results are presented in Table 5-16 below. The *E.coli* and fecal coliform results track each other very closely. Hence the observations made for *E.coli* apply to fecal coliform.

Table 5-16. Effect of Phase I Controls on Fecal Coliform in Rock Creek (Avg. Year)

	LTCP- No Phase I CSO Controls		Phase I CSO Controls-ALL LOADS				Phase I CSO Controls-CSO LOADS ONLY			
Location			**LTCP**		**PCM**		**LTCP**		**PCM**	
	All Year	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**	**All Year**	**May to Sept**
# Months Exceeding 200/100 ml Geometric Mean										
Boundary Bridge	12	5	12	5	12	5	0	0	0	0
Tilden Street	12	5	12	5	12	5	0	0	0	0
Porter Street	12	5	12	5	12	5	0	0	0	0
Zoo	12	5	12	5	12	5	0	0	0	0
Mass Ave	12	5	12	5	12	5	0	0	0	0
Pennsylvania Ave	12	5	12	5	12	5	0	0	0	0

- **Dissolved Oxygen**

Rock Creek is a free-flowing stream that is unaffected by the tide for the majority of its length. The turbulence caused by the irregular bottom of the creek bed allows for natural aeration. There was no evidence of dissolved oxygen problems in Rock Creek. Hence dissolved oxygen monitoring was not conducted as part of PCM.

5.3 CSO Overflow Reduction

The Table 5-17 presents the CSO overflow reduction by Phase I CSO control in Anacostia River, Potomac River and Rock Creek. For Anacostia River and Rock Creek, the PCM results are within the range of accuracy of the modeling used to make LTCP predictions. For Potomac River, about 22% overflow reduction is observed due to phase I controls.

Table 5-17. CSO Overflow Reduction by Phase I Controls (Avg. Year)

Item	Anacostia River	Potomac River	Rock Creek
Number of Overflows/ yr			
No Phase I CSO Controls	82	74	30
Phase I - LTCP	73	72	29
Phase I- PCM	77	58	32

5.4 Performance to TMDL Allocations

TMDLs have been established for selected pollutants in each waterbody. In each TMDL, wasteload allocations have been established for CSOs.

TMDL load summary for each receiving water is presented in Table 5-18. For TMDLs that use climate periods other than 1988-1990, modeling conducted as part of the Chesapeake TMDL covering 1985-2005 was used as a basis for the LTCP volumes presented in the table. Since this period encompassed the various local TMDL periods, the modeling results were used to scale the 1988-1990 PCM Phase I Controls scenario results for each of the TMDL periods. There were two sets of scaling factors developed: one set of factors used annual volumes, while the other set used maximum daily volumes. Scaling factors were developed for each grouping of CSO outfalls that coincided with specific TMDLs; for example, the grouping of CSOs in the Upper Anacostia had a specific scaling factor developed that was different from the scaling factor used for the Lower Anacostia CSO grouping.

The following observations are made:

- As predicted, significant reduction in CSO loads is observed after implementing Phase I controls.
- Progress has been made commensurate with the CSO volume reduction achieved for this interim stage of LTCP implementation.

Table 5-18. TMDL Summary

					TMDL						PCM Results						
TMDL	Parameter	TMDL Loads Expressed in?	Climate Condition Used to Develop existing loads	Date	Existing Loads for CSS	TMDL Loads for CSS	Max. Daily Loads (mass per day)	TMDL % Reduction	EMC	EMC units	LTCP- No CSO Controls, Volume (million gallons)	LTCP- No CSO Controls, Load	PCM - Phase 1 Controls, Volume	PCM- Phase I Controls, Load	PCM - Phase 1 Controls Max Daily Volume	PCM - Phase 1 Controls Max Daily Load	% Reduction
TMDL Summary- Anacostia River																	
Anacostia	**Bacteria**	Annual	Average annual load for period from 1988-1990.	Jul-14	3.20E+16	1.41E+15	1.67E+15	96%	686,429	MPN/100mL, E. coli	1,957	5.09E+16	1,313	3.41E+16	121	3.15E+15	33%
Anacostia-Upper	**BOD, lb/yr**	Annual and Daily	Actual annual load over 1995-1997 period.	Apr-08	330,662	52,472	49,647	84%	50.2	mg/L, BOD5	1,299	544203	891	373432	99	41437	31%
Anacostia- Lower					327,623	56,801	34,334	83%	50.2	mg/L, BOD5	796	333476	512	214425	72	30346	36%
Anacostia-Upper	**TN, lb/yr**	Annual and Daily	Actual annual load over 1995-1997 period.	Apr-08	31,894	5,061	4,791	84%	4.84	mg/L, NH3+NO23+ON	1,299	52469	891	36004	99	3995	31%
Anacostia- Lower					31,601	5,479	3,312	83%	4.84	mg/L, NH3+NO23+ON	796	32152	512	20674	72	2926	36%
Anacostia-Upper	**TP, lb/yr**	Annual and Daily	Actual annual load over 1995-1997 period.	Apr-08	6,600	1,047	991	84%	1	mg/L, PO4+OP	1,299	10841	891	7439	99	825	31%
Anacostia- Lower					6,539	1,134	685	83%	1	mg/L, PO4+OP	796	6643	512	4271	72	605	36%
Anacostia-Upper	**Oil and Grease, lb/ day**	Per Day	None indicated	Oct-03	Not Impaired	201.8	N/A	N/A	10	mg/L, set at WQ criteria	1,299	108407	891	74389	99	8254	31%
Anacostia- Lower						137.6	N/A	N/A	10	mg/L, set at WQ criteria	796	66429	512	42714	72	6045	36%
Anacostia	**Organics & Metals**			Aug-03													
Anacostia	Total Arsenic, lb/yr	Annual	Average annual load for 1988-1990 period		15.9	2.36	N/A	85%	1.4	ug/L, (based on MS4 monitoring)	1,957	23	1,343	16	121	1	31%
Anacostia	Total Copper, lb/yr	Annual	Average annual load for 1988-1990 period		748	741	N/A	1%	40 - 103	ug/L, spatially varies	1,957	653 -1682	1,343	448 -1154	121	104	31%
Anacostia	Lead, lb/yr	Annual	Average annual load for 1988-1990 period		854	846	N/A	1%	64 - 96	ug/L, spatially varies	1,957	1045 -1568	1,343	717 -1076	121	97	31%
Anacostia	Zinc, lb/yr	Annual	Average annual load for 1988-1990 period		2,332	2,309	N/A	1%	181 - 256	ug/L, spatially varies	1,957	2956 -4181	1,343	2028 -2869	121	259	31%
Anacostia	Chlordane , lb/yr	Annual	Average annual load for 1988-1990 period		0.107	0.0106	N/A	90%	0.009829	ug/L, CSO "storm"	1,957	0	1,343	0	121	0	31%
Anacostia	DDD, lb/yr	Annual	Average annual load for 1988-1990 period		0.0752	0.0074	N/A	90%	0.003	ug/L, CSO "storm"	1,957	0	1,343	0	121	0	31%
Anacostia	DDE, lb/yr	Annual	Average annual load for 1988-1990 period		0.1707	0.0169	N/A	90%	0.0133	ug/L, CSO "storm"	1,957	0	1,343	0	121	0	31%
Anacostia	DDT, lb/yr	Annual	Average annual load for 1988-1990 period		0.4602	0.0456	N/A	90%	0.0342	ug/L, CSO "storm"	1,957	1	1,343	0	121	0	31%
Anacostia	Total Dieldrin, lb/yr	Annual	Average annual load for 1988-1990 period		0.00918	0.00636	N/A	31%	0.00029	ug/L, CSO "storm"	1,957	0	1,343	0	121	0	31%
Anacostia	Heptachlor Epoxide, lb/yr	Annual	Average annual load for 1988-1990 period		0.0158	0.00313	N/A	80%	0.000957	ug/L, CSO "storm"	1,957	0	1,343	0	121	0	31%
Anacostia	Total PAH, lb/yr	Annual	Average annual load for 1988-1990 period		78.523	1.57	N/A	98%	7.5	ug/L, CSO "storm" PAH1+PAH2+PAH3	1,957	122	1,343	84	121	8	31%
Anacostia- Upper	**Sediments/ TSS, tons/ yr**	Annual and Daily	Average daily loads over the annual and growing seasons over the period 1995-1997.	Jun-07	351	83.9	84.61	50%	160.8	mg/L	1,957	1313	1,313	881	121	81	33%
Anacostia- Lower						90.8	67.1		160.8	mg/L	1,299	872	891	598	99	66	31%
Anacostia- Upper		Growing Season (April 1- Oct 31) Total and Daily			244	61.7	84.61	44%	160.8	mg/L	796	534	512	343	72	49	36%
Anacostia- Lower						74.6	67.1		160.8	mg/L	1,299	872	891	598	99	66	31%
Anacostia- Upper	**Total PCB, g/yr**	Annual and Daily	Annual load of PCBs in 2005	28-Sep-07	2.8	0.0562	0.026	98%	120	ng/L,Total PCB	1,556	706	1,068	484	132	60	31%
Anacostia- Lower					109.0	2.18	0.795	98%	120	ng/L,Total PCB	915	415	589	267	95	43	36%
Anacostia- Upper	**Trash, lb/yr REMOVED**	Annual	Average annual load for 3 year period from 1988-1990	Aug-10	62,401	62,401	N/A	100%	73	lbs/MG	1,296	94634	864	63080	80	5829	33%
Anacostia- Lower					31,185	31,185	N/A	100%	73	lbs/MG	801	58498	449	32777	48	3532	44%

TMDL	Parameter	TMDL Loads Expressed in?	Climate Condition Used to Develop existing loads	Date	Existing Loads for CSS	TMDL Loads for CSS	Max. Daily Loads (mass per day)	TMDL % Reduction	EMC	EMC units	LTCP- No CSO Controls, Volume (million gallons)	LTCP- No CSO Controls, Load	PCM - Phase 1 Controls, Volume	PCM- Phase I Controls, Load	PCM - Phase 1 Controls Max Daily Volume	PCM - Phase 1 Controls Max Daily Load	% Reduction
TMDL Summary- Potomac River																	
Potomac - Upper: CSO	**Bacteria**	Annual and Daily	Average annual load for 3 year period from 1988-1990.	Dec-14	7.37E+14	2.7E+13	7.16E+13	96%	686,429	MPN/100mL, E. coli	93	2.42E+15	15	3.97E+14	3	8.69E+13	84%
Potomac- Middle: CSO					2.42E+16	1.78E+15	1.99E+15	93%	686,429	MPN/100mL, E. coli	468	1.22E+16	651	1.69E+16	77	2.01E+15	-39%
Potomac- Lower: CSO					N/A	2.55E+14	4.11E+14	N/A	0	MPN/100mL, E. coli	0	0.00E+00	0	0.00E+00	0		
Potomac- Lower: Blue Plains WWTP 002					4.61E+15	6.77E+14	2.47E+12 - wet days 1.76E+12 - dry days	-45%	126	MPN/100mL, E. coli	114,841	5.48E+14	137,068	6.54E+14	631	3.01E+12	-19%
Potomac- Lower: Blue Plains WWTP 001						5.99E+15	4.37E+14 - when 002 exceeds operational limts 0 - when discharge not allowed		51,250	MPN/100mL, E. coli	1,939	3.76E+15	2309	4.48E+15	208	4.10E+14	-19%
Potomac - Upper: CSO	**Total PCB, g/yr**	Annual and Daily	Annual load of PCBs in 2005	28-Sep-07	30.2	0.604	0.002	98%	120	ng/L,Total PCB	112	51	18	8	6	0.00	100%
Potomac- Middle: CSO					179.0	3.58	1.190	98%	120	ng/L,Total PCB	702	318	977	443	126	0.00	100%
Potomac- Lower: CSO					1,660.0	33.2	7.250	98%	120	ng/L,Total PCB	0	0	0	0	0		
Potomac- Lower: Blue Plains WWTP					701.0	30.3	3.090	96%	120	ng/L,Total PCB	121,705	55284	145,255	65982	958	435	-19%
TMDL Summary- Chesapeake Bay																	
DC CSO	**TN, lb/ yr**	Annual and Daily	Loads based on average annual average flow data from 1991-2000.	29-Nov-10	87,111	3,809	28.29	96%	4.9	mg/L	2,222	91	1,734	71	366	15	22%
Blue Plains WWTP					2,418,240	2,063,900	37,937	15%	17	mg/L	116,780	16568	139,376	19774	840	119	-19%
DC CSO	**TP, lb/yr**	Annual and Daily	Loads based on average annual average flow data from 1991-2000.	29-Nov-10	18,598	810	7.58	96%	1	mg/L	2,222	19	1,734	14	366	3	22%
Blue Plains WWTP					85,333	93,693	2,076	-10%	2.4	mg/L	116,780	2339	139,376	2792	840	17	-19%
DC CSO	**Sediments, lb/yr**	Annual and Daily	Loads based on average annual average flow data from 1991-2000.	29-Nov-10	2,013,257	87,724	218.8	96%	130	mg/L	2,222	2411	1,734	1881	366	397	22%
Blue Plains WWTP					2,236,612	2,551,977	81,738	-14%	130.1	mg/L	116,780	126792	139,376	151326	840	911	-19%
TMDL Summary- Rock Creek & Tributaries																	
Rock Creek- Upper	**Bacteria**	Annual and Daily	Average annual load for 1988-1990.	Jul-14	0	0	0	N/A	686,429	MPN/100mL, E. coli	0	0.00E+00	0	0.00E+00	0	0.00E+00	100%
Rock Creek- Lower					1.36E+15	9.94E+13	1.64E+14	93%	686,429	MPN/100mL, E. coli	62	1.62E+15	35	9.03E+14	8	1.95E+14	44%
Rock Creek	**Metals**		Average annual load for 1988-1990.	Feb-04													
	Copper, lb/yr	Annual			2.6	2.5	N/A	4%	26	ug/L	62	13	35	8	8	1.63	44%
	Zinc, lb/yr	Annual			11.15	10.59	N/A	5%	110	ug/L	62	57	35	32	8	6.89	44%
	Lead, lb/yr	Annual			3.55	0.66	N/A	81%	35	ug/L	62	18	35	10	8	2.19	44%
	Mercury , lb/yr	Annual			0.04	0.008	N/A	80%	0.4	ug/L	62	0	35	0	8	0.03	44%
Piney Branch	**Organics and Metals**		Average annual load for 1988-1990.	Feb-04													
	Arsenic, lb/yr	Annual			0.4632	0.01621	N/A	97%	1.4	ug/L	54	1	34	0	7	0.08	37%
	Copper, lb/yr	Annual			25.15	0.88025	N/A	97%	76	ug/L	54	34	34	22	7	4.58	37%
	Lead, lb/yr	Annual			26.47	0.92645	N/A	97%	80	ug/L	54	36	34	23	7	4.82	37%
	Zinc, lb/yr	Annual			70.47	2.46645	N/A	97%	213	ug/L	54	95	34	60	7	12.84	37%
	Chlordane, lb/yr	Annual			0.003252	0.00011	N/A	97%	0.00983	ug/L	54	0	34	0	7	0.00	37%
	DDD, lb/yr	Annual			0.0009926	0.00003	N/A	97%	0.003	ug/L	54	0	34	0	7	0.00	37%
	DDE, lb/yr	Annual			0.004401	0.00015	N/A	97%	0.0133	ug/L	54	0	34	0	7	0.00	37%
	DDT, lb/yr	Annual			0.01132	0.0004	N/A	96%	0.0342	ug/L	54	0	34	0	7	0.00	37%
	Dieldrin, lb/yr	Annual			0.00009595	0.0000034	N/A	96%	0.00029	ug/L	54	0	34	0	7	0.00	37%
	Heptachlor Epoxide, lb/yr	Annual			0.0003166	0.0000111	N/A	96%	0.000957	ug/L	54	0	34	0	7	0.00	37%
	PAH, lb/yr	Annual			2.4813	0.08685	N/A	96%	7.5	PAH1+PAH2+PAH3, ug/L	54	3	34	2	7	0.45	37%
	PCB, lb/yr	Annual			0.02667	0.00093	N/A	97%	0.0806	ug/L	54	0	34	0	7	0.00	37%

5.5 Overall Evaluation of Phase I CSO Controls

The NPDES Permit indicates that the results from the monitoring phases are be used to assess the performance of CSO controls against predictions established as part of LTCP development and its supplements. The evaluation is to consist of the following:

- Comparison of monitored overflow magnitude and duration with the LTCP predictions
- Comparison of monitored water quality in receiving waters with LTCP predictions
- Comparison of monitored CSO reductions with LTCP reductions
- Comparison of performance to TMDLs and allocations established for CSOs and approved bypasses in the receiving waters; and
- Overall evaluation as to whether or not CSO controls are providing degree of control predicted for LTCP conditions and whether or not modifications or additions to the LTCP are required.

An overall evaluation of phase I controls as required by the NPDES permit is provided below.

- The Post Construction Monitoring results for the total system show the reduction in CSO volume, with Phase I controls in place, to be 38%, which is 1% percent less than predicted. This is within the range of accuracy of modeling used to make LTCP predictions.
- The NPDES permit identifies the required minimum flows to receive complete treatment at Blue Plains. DC Water operated the plant conservatively and provided complete treatment to an estimated 266 million gallons of combined sewage beyond that required by its NPDES permit in 2015.
- At times, temporary rehabilitation and repair work on the sewer system including the Potomac Pumping Station, Potomac Force Mains and Structure 24 inflatable dams and other components affected the ability to capture combined sewage. Notices of temporary measures to take equipment out of service for repair were provided to EPA as required. It is predicted that this repair work may improve CSO capture by approximately 8%. Such situations are unusual and do not reflect a need to consider modifications to the LTCP. The tunnel system is designed to capture flow not intercepted by the existing sewer system. When the LTCP is in place, flow not handled by the existing sewer systems is designed to be captured by the tunnel, up to the capacity of the tunnel system.
- The predicted water quality in the receiving waters is consistent with LTCP predictions, within the range of accuracy used to make the modeling predictions.
- TMDLs for the receiving waters have established wasteload allocations (WLAs) for CSOs. The WLAs for CSOs are typically based on complete implementation of the LTCP. The Phase I CSO controls have made progress toward meeting TMDL allocations in proportion to the volume of CSO reduced at this stage of the program. Detailed calculations for each TMDL are included in the report.

In conclusion, the post construction monitoring shows that the CSO program is tracking LTCP predictions and that modifications or additions to LTCP do not need to be considered.

Appendix A Phase I: Post Construction Monitoring Collection System Model Documentation

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

Phase I: Post-Construction Monitoring Collection System Model Documentation

August 2016

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

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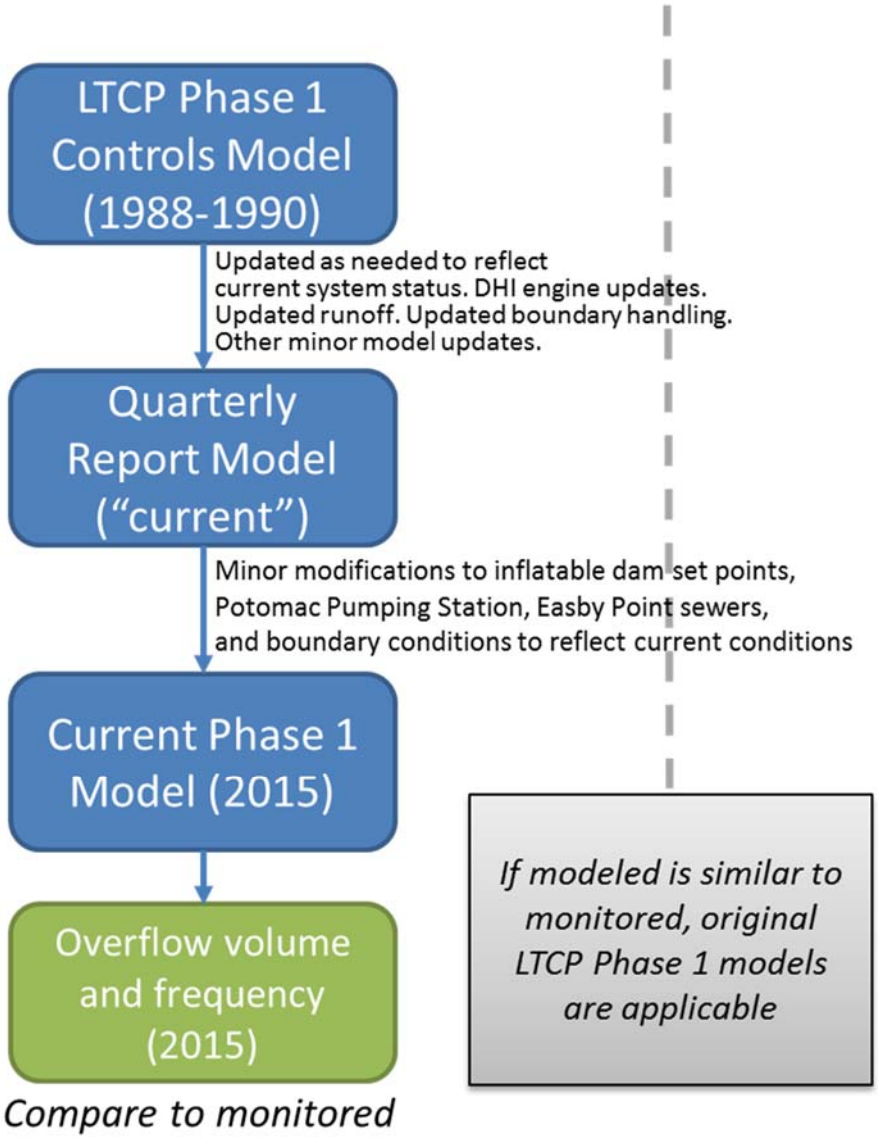
1 Introduction

1.1 Background

The development and calibration of the combined sewer model used for the LTCP is documented in *Study Memorandum LTCP 5-4: CSS Model Documentation* that was published with the LTCP in 2001. This report builds upon that model. The LTCP model was recalibrated in 2006-2007; current model parameters and inputs are described in the *Anacostia River Projects Facility Plan, Volume IV: Operational Plan and Hydraulic Report.*



1.2 Scope and Modeling Objectives

An extensive monitoring program was performed from December 2014 – February 2016 to collect flow data from throughout the DC Water system. More information on the monitoring program can be found in the *Phase I: Post-Construction Monitoring Report*.

The following activities were performed to prepare the model to analyse Phase 1 controls:

- Gather information about operational conditions during 2015 including rainfall, boundary conditions, inflatable dam operations, pump operations, and modification to the sewer system
- Compare the collection system model, updated to reflect 2015 operating conditions, to flow monitoring data
- Make any necessary modifications to the operations aspects of the model to obtain flow results similar to the collected monitoring data
- Apply the updated model to the 1988-1990 regulatory time period to quantify the status of CSO overflows in the system

Performance of the model is dependant on representing the true overall system behavior, making it possible to address questions about present and future operation of the collection system under a broad range of flow conditions. The goal of the model update is to develop a model that reflects the current operating state of the DC Water collection system with respect to quantifying CSO overflows.

The Danish Hydraulic Institute's MOUSE model was used to model the combined sewer system in the original LTCP. The selection of this model was described in Study Memorandum LTCP-5-3: CSS Model Justification and Selection (EPMC-III, 1999). The model was subsequently converted to DHI's MIKE URBAN model, which is the successor to MOUSE. The existing model was updated to ensure accurate simulation of current operating conditions. The following data were used to perform a model verification for the 2015 monitoring time period:

- Pump stations and their operation procedures
- Inflatable dams and their operation procedures
- Boundary flows from suburban jurisdictions served by DC Water
- Diversion structures

System-wide flow monitoring data, along with gage-adjusted radar rainfall (GARR), were used for model validation.

The monitored precipitation data was analyzed and validation events were developed to include low, medium and severe storms in both calibration and validation processes.

1.3 Phase 1 System Updates

- All inflatable dams in operation.Potomac and Main pumping stations rehabilitated and at full capacity.
  - Potomac Pumping Station: firm capacity of 460 mgd.
  - Main Sanitary Pumping Station: firm capacity of 240 mgd.

2 Data Development

2.1 Rainfall Monitoring

Rainfall data is critical to analyze the response of the CSS to rainfall. Gage-adjusted radar rainfall data was obtained from OneRain for the area encompassing the DC Water collection system service area.

2.2 Flow Monitoring

An essential element of the LTCP is characterization of the existing sewer system to establish baseline conditions from which control alternatives can be evaluated. An extensive monitoring plan is critical to provide data reflecting the inputs to the sewer system, making it possible to understand the response of CSS to a range of precipitation conditions.

Accurate flow monitoring is particularly important because CSO overflows are such complex events. The magnitude of overflow is dependent not only on total rainfall but also on other factors such as rain intensity, the way rainfall distributions vary in space and time over the CSS area, the hydraulic interaction of control structures in the system, the operation of the system and antecedent moisture conditions. As a result, different amounts of overflow are expected for the same amount of rainfall. This is evident in the monitoring data.

In addition to the monitoring stations located in the study area, WASA operates a Supervisory Control and Data Acquisition (SCADA) system, which allows remote monitoring of various locations including pump stations and the suburban sanitary areas (boundary flow) contributing flow to Blue Plains. SCADA data was used in conjunction with flow monitoring data to update the collection system model.

2.2.1 Log Sheet Data From Pumping Stations and BPWWTP

In some cases data obtained from pump station log sheets was used as a substitute when SCADA system data was incomplete or inconsistent with a stations log sheet records. Locations where log data was used to update the model include Potomac Pumping Station and Main Pumping Station.

2.3 Dry Weather Flow Calculations

For the 2002 LTCP, D.C. dry weather flow model inputs consisted of 100 different time series of dry weather flow, accounting for both sanitary flow and baseflow (infiltration and groundwater). For the current Mike Urban model, the sanitary flow component is separated from the baseflow component, so that there are two separate inputs for every dry weather flow input node. This approach is based on the results of the 2005 document, *Technical Memorandum No. 18: District of Columbia Wastewater Quantity Assessment*.

Using the metering data collected in 2003-2004 as part of WASA's Sewer System Assessment Program, a better understanding of both sanitary flow and infiltration in D.C. was obtained. Sanitary flow was estimated by comparing population and other demographic data with metered data (it had

previously been assigned based on land area and land use) and then disaggregating to the sewershed level for unmetered areas. Sanitary flow inputs to the model became constant values, with diurnal factors applied based on several different diurnal patterns identified from the metered data. Infiltration inputs were determined by identifying the baseflow in the metering data and disaggregating this flow to unmetered areas, based on inch-miles of pipe. Groundwater pumping data was also included in the baseflow calculations. Infiltration inputs to the model became constant values, which can be scaled based on the system-wide dry weather flow balance. Scaling of the baseflow constants can also be based on the rainfall record. If dry weather flow is known, however, this method could affect the overall flow balance; instead, rainfall records are used to check whether the infiltration scaling is reasonable, given the overall dry weather flow balance.

The Boundary dry weather flow for 2015 were determined by using the monthly averages obtained from the Blue Plains Service Area Flow Reports. Regression-based wet weather flows at each boundary location were then subtracted from the monthly averages to avoid double-counting of flows. Diurnal patterns developed during the 2003-2004 assessment period were then applied to the monthly values. Comparison of Service Area Flow Reports with available boundary SCADA data led to further adjustment at several locations, notably a reduction in the dry weather flow values for the Potomac Interceptor.

3 Operational Update and Model Validation

- The Potomac Pumping Station firm capacity was adjusted from 460 mgd to 350 mgd, based on pumping logs in combination with metering data from nearby combined sewer outfalls. Start/stop levels for pumps were also adjusted based on analysis of wet well log data. Also, pumping logs revealed that only three of four pumps were in operation, so the fourth pump was removed from the model to reflect this.
- The Main Sanitary Pumping Station firm capacity was adjusted from 240 mgd to 180mgd, based on pumping logs in combination with metering data from nearby combined sewer outfalls. Also, pumping logs revealed that only two of three pumps were in operation, so the third pump was removed from the model to reflect this.
- Inflatable dam operation setpoints were returned to documented values; they had previously been adjusted for some dams during previous calibrations. Metering data at or near inflatable dams revealed that documented setpoints were more appropriate.The 60” pipe connecting the Easby Point Trunk Sewer to Potomac Pumping Station was restored to its full capacity. It had previously been modeled with a reduced capacity to reflect clogging, but that pipe has since been verified as clean/unobstructed.
- Diversion structures 29 and 30, which can divert flow from the Easby Point Trunk Sewer to the B Street Trunk Sewer, had their weir crest hieghts adjusted to match the values from the Structure Book. Roughness values for both structures’ diversion pipes were also reset to default values. The crest heights and diversion pipe roughness values had been increased in previous model calibrations, in order to keep more flow in the Easby Point Trunk Sewer. The 2015 metering data indicated that more flow was needed in the B Street Trunk Sewer.
- Diversion structures for sewersheds 027, 028, and 029 were all checked against current structure drawings, and model results were compared with metering data, with the following changes made:
    - Structure 43a (027) structure inverts and weir crest were updated to match the record drawing.
    - Structure 45 (028) diversion pipe roughness value was decreased to improve model response when compared with 028 metering.
    - Structure 46 (029) diversion pipe roughness value was decreased to improve model response when compared with 029 metering.
- The structure 35 (021 sewershed) diversion pipe roughness value was increased to improve model response when compared with 021 metering and Potomac Pumping Station log data.

Model Verification results are presented in Appendix A.

Appendix A Model Verification Results

Table A-1: Summary of 2015 Rain Events
(compiled using an average of all OneRain Grid Cells; events < 0.01 inches excluded)

Event #	Start Date / Time	End Date / Time	Duration (hours)	Total Depth (inches)	Average intensity (in/hr)	Maximum 5-minute intensity (in/hr)
1	01/03/15 04:10	01/04/15 21:35	41.50	0.63	0.02	0.35
2	01/06/15 01:50	01/06/15 14:40	12.92	0.07	0.01	0.03
3	01/11/15 20:25	01/13/15 02:00	29.67	0.71	0.02	0.14
4	01/14/15 02:40	01/14/15 19:30	16.92	0.01	0.001	0.02
5	01/18/15 06:10	01/18/15 19:05	13.00	0.57	0.04	0.32
6	01/21/15 10:20	01/21/15 18:15	8.00	0.08	0.01	0.07
7	01/23/15 15:20	01/24/15 15:00	23.75	1.13	0.05	0.37
8	01/26/15 02:25	01/27/15 04:10	25.83	0.21	0.01	0.07
9	01/29/15 15:40	01/29/15 17:35	2.00	0.04	0.02	0.18
10	01/30/15 09:30	01/30/15 12:10	2.75	0.01	0.004	0.02
11	02/01/15 07:55	02/02/15 13:10	29.33	0.16	0.01	0.15
12	02/09/15 16:35	02/10/15 07:05	14.58	0.09	0.01	0.04
13	02/12/15 08:25	02/12/15 15:40	7.33	0.04	0.01	0.04
14	02/14/15 10:20	02/14/15 20:05	9.83	0.08	0.01	0.16
15	02/16/15 14:30	02/17/15 05:15	14.83	0.12	0.01	0.04
16	02/18/15 15:05	02/18/15 18:55	3.92	0.05	0.01	0.20
17	02/19/15 16:40	02/19/15 23:30	6.92	0.02	0.004	0.05
18	02/21/15 09:55	02/22/15 06:30	20.67	0.60	0.03	0.27
19	02/26/15 02:35	02/26/15 09:35	7.08	0.09	0.01	0.04
20	03/01/15 07:55	03/01/15 19:45	11.92	0.33	0.03	0.10
21	03/03/15 10:40	03/03/15 19:55	9.33	0.11	0.01	0.06
22	03/04/15 03:40	03/05/15 21:50	42.25	0.87	0.02	0.12
23	03/10/15 09:50	03/11/15 11:35	25.83	0.45	0.02	0.12
24	03/13/15 19:40	03/14/15 15:50	20.25	0.63	0.03	0.12
25	03/20/15 00:10	03/20/15 20:50	20.75	0.53	0.03	0.17
26	03/26/15 08:10	03/26/15 10:20	2.25	0.02	0.01	0.06
27	03/26/15 18:40	03/27/15 11:25	16.83	0.67	0.04	0.37
28	03/30/15 02:40	03/30/15 05:00	2.42	0.01	0.01	0.02
29	04/03/15 03:10	04/04/15 03:55	24.83	0.16	0.01	0.05
30	04/07/15 01:10	04/07/15 08:20	7.25	0.12	0.02	0.09
31	04/07/15 17:20	04/08/15 10:00	16.75	0.16	0.01	0.16
32	04/09/15 02:55	04/09/15 05:00	2.17	0.05	0.02	0.07
33	04/14/15 03:00	04/15/15 00:45	21.83	0.54	0.02	0.15
34	04/16/15 16:50	04/17/15 03:20	10.58	0.09	0.01	0.06

35	04/17/15 14:30	04/18/15 00:35	10.17	0.02	0.002	0.03
36	04/19/15 15:20	04/20/15 05:50	14.58	1.02	0.07	0.37
37	04/20/15 14:35	04/21/15 04:20	13.83	0.48	0.04	1.27
38	04/22/15 12:25	04/22/15 16:40	4.33	0.02	0.004	0.02
39	04/25/15 15:50	04/25/15 23:45	8.00	0.21	0.03	0.16
40	04/30/15 08:50	05/01/15 05:40	20.92	0.33	0.02	0.46
41	05/05/15 15:55	05/05/15 19:55	4.08	0.14	0.03	0.51
42	05/06/15 12:55	05/06/15 20:55	8.08	0.07	0.01	0.07
43	05/10/15 13:00	05/10/15 17:30	4.58	0.01	0.002	0.02
44	05/16/15 15:30	05/17/15 14:05	22.67	1.86	0.08	3.88
45	05/18/15 10:15	05/19/15 01:45	15.58	0.58	0.04	1.12
46	05/21/15 02:05	05/21/15 14:15	12.25	0.26	0.02	0.08
47	05/27/15 14:40	05/27/15 19:20	4.75	0.05	0.01	0.24
48	05/28/15 14:00	05/28/15 18:10	4.25	0.06	0.01	0.07
49	05/29/15 15:05	05/29/15 20:55	5.92	0.03	0.01	0.09
50	05/31/15 15:40	06/01/15 04:30	12.92	0.20	0.02	0.30
51	06/01/15 14:35	06/03/15 04:50	38.33	2.61	0.07	1.92
52	06/03/15 18:10	06/05/15 17:05	47.00	0.65	0.01	0.40
53	06/08/15 16:15	06/09/15 07:35	15.42	0.88	0.06	1.81
54	06/12/15 17:25	06/12/15 18:20	1.00	0.02	0.02	0.07
55	06/14/15 14:00	06/15/15 17:45	27.83	0.31	0.01	0.54
56	06/17/15 10:15	06/18/15 02:55	16.75	0.24	0.01	0.17
57	06/18/15 13:20	06/21/15 05:10	63.92	2.76	0.04	1.99
58	06/23/15 17:10	06/23/15 20:25	3.33	0.94	0.28	1.89
59	06/25/15 14:05	06/25/15 23:55	9.92	0.69	0.07	2.61
60	06/26/15 22:40	06/28/15 01:40	27.08	2.39	0.09	1.26
61	06/30/15 07:40	07/01/15 02:10	18.58	0.77	0.04	2.13
62	07/01/15 15:45	07/02/15 15:05	23.42	0.34	0.01	0.56
63	07/03/15 15:35	07/04/15 16:35	25.08	0.71	0.03	0.68
64	07/05/15 16:50	07/06/15 20:25	27.67	0.13	0.005	0.08
65	07/08/15 05:30	07/09/15 01:05	19.67	0.46	0.02	0.69
66	07/09/15 16:50	07/09/15 23:15	6.50	0.12	0.02	0.72
67	07/10/15 22:10	07/11/15 08:20	10.25	0.03	0.003	0.02
68	07/12/15 23:25	07/14/15 02:30	27.17	0.02	0.001	0.02
69	07/15/15 09:30	07/15/15 16:25	7.00	0.01	0.002	0.04
70	07/18/15 08:30	07/18/15 10:35	2.17	0.04	0.02	0.11
71	07/21/15 01:45	07/21/15 02:35	0.92	0.02	0.02	0.09
72	07/21/15 10:50	07/21/15 21:05	10.33	0.02	0.002	0.12
73	07/25/15 16:30	07/25/15 18:25	2.00	0.01	0.01	0.02
74	07/26/15 21:25	07/27/15 04:55	7.58	0.26	0.03	0.89
75	07/27/15 12:30	07/27/15 15:50	3.42	0.31	0.09	0.67
76	07/28/15 14:35	07/28/15 18:50	4.33	0.24	0.05	0.58
77	07/30/15 12:40	07/30/15 19:50	7.25	0.64	0.09	1.32

78	08/10/15 01:05	08/11/15 05:50	28.83	0.46	0.02	0.39
79	08/11/15 13:40	08/11/15 18:15	4.67	0.05	0.01	0.24
80	08/18/15 11:45	08/18/15 17:35	5.92	0.02	0.003	0.06
81	08/19/15 17:25	08/20/15 08:45	15.42	0.16	0.01	0.45
82	08/20/15 17:40	08/20/15 21:45	4.17	0.11	0.03	0.11
83	08/24/15 16:35	08/24/15 23:35	7.08	0.41	0.06	0.94
84	09/03/15 12:55	09/03/15 23:05	10.25	0.04	0.004	0.07
85	09/09/15 19:35	09/10/15 04:45	9.25	0.06	0.01	0.08
86	09/10/15 12:30	09/10/15 21:50	9.42	0.01	0.002	0.01
87	09/12/15 05:00	09/12/15 21:05	16.17	0.24	0.01	0.31
88	09/13/15 04:40	09/13/15 11:10	6.58	0.01	0.002	0.02
89	09/21/15 04:25	09/22/15 07:10	26.83	0.19	0.01	0.05
90	09/29/15 12:45	09/29/15 21:45	9.08	2.08	0.23	1.19
91	10/01/15 01:05	10/03/15 07:10	54.17	2.23	0.04	0.47
92	10/09/15 05:15	10/09/15 22:05	16.92	0.47	0.03	1.57
93	10/24/15 19:20	10/25/15 09:15	14.00	0.02	0.001	0.02
94	10/27/15 12:10	10/29/15 00:30	36.42	0.68	0.02	1.21
95	10/31/15 23:00	11/01/15 09:00	10.08	0.03	0.003	0.04
96	11/04/15 19:00	11/05/15 01:45	6.83	0.22	0.03	0.20
97	11/06/15 19:40	11/06/15 21:20	1.75	0.06	0.04	0.11
98	11/07/15 06:20	11/07/15 18:30	12.25	0.23	0.02	0.14
99	11/09/15 14:45	11/10/15 22:00	31.33	0.74	0.02	0.43
100	11/12/15 08:20	11/12/15 12:15	4.00	0.01	0.00	0.02
101	11/19/15 02:50	11/19/15 16:45	14.00	0.64	0.05	0.35
102	11/28/15 14:15	11/29/15 13:00	22.83	0.19	0.01	0.06
103	11/30/15 05:40	12/02/15 21:50	64.25	1.11	0.02	0.27
104	12/14/15 15:35	12/15/15 02:30	11.00	0.11	0.01	0.28
105	12/17/15 06:50	12/17/15 19:40	12.92	0.42	0.03	0.13
106	12/21/15 20:50	12/22/15 14:05	17.33	0.10	0.01	0.05
107	12/23/15 04:15	12/23/15 22:15	18.08	1.62	0.09	1.68
108	12/24/15 04:40	12/24/15 15:50	11.25	0.33	0.03	0.52
109	12/25/15 10:35	12/25/15 20:05	9.58	0.35	0.04	0.50
110	12/27/15 19:05	12/28/15 00:30	5.50	0.09	0.02	0.21
111	12/28/15 09:55	12/29/15 09:10	23.33	0.71	0.03	0.55
112	12/30/15 15:20	12/30/15 20:55	5.67	0.05	0.01	0.08

Table A-2: Maximum PS Capacities across all CS Model scenarios

Pump Station	Main Sanitary	Potomac	O Street Sanitary	Poplar Point	Eastside	Rock Creek
Capacity (MGD)	240	460	45	45	45	60

Table A-3: Summary of Modeled Inflatable Dams

Inflatable Dam Structure No.	**From Node**	**To Node**	**Operational Status**
14	10-D14	MNPSST	Operational
14	10-D14A	MNPSST	Operational
15	N-36127-A-3-SW	N-36178-A-3-SW	Operational
15A	10-163A	10-163B	Operational
16	12-D16	12-D16A	Operational
16	12-D16B	12-D16C	Operational
24-east	BN-3506-H-2-SE-a	BN-3506-H-2-SE-b	Operational
24-center	M-50241-H-2-SE-a	M-50241-H-2-SE-b	Operational
24-west	M-50240-H-2-SE-a	M-50240-H-2-SE-b	Operational
34	N-36180-I-1-NW	BN-864-I-1-NW	Operational
35	N-36183-K-1-NW	N-36182-K-1-NW	Operational
52	M-13604-H-6-NW-a	M-13604-H-6-NW-b	Operational

Table A-4 Inflatable Dam Modeled Operational Setpoints

Structure No.	**Location**	**No. of Dams**	**Control Method**	**Upstream Setpoint Elevation**	**High Level Alarm Elevation**	**Deflation Elevation**	**Flow Setpoint (MGD)**
14	B St. / N.J. Avenue	2	upstream level	3.00	3.25	1.75	-
15		1		-3.00	-0.75	-4.30	-
15a		1		-1.00	-0.75	-2.3	-
16	Tiber Creek	2		4.00	4.25	2.75	-
24 (center & west)	Northeast Boundary Sewer	2	flow & upstream level	12.00	14.5	13.00	350
24 (east)		1		12.50	15.00	13.50	400
34	Easby Point	1	upstream level	8.50	8.75	7.25	-
35	East Rock Creek	1		8.50	8.75	7.25	-
52	Slash Run	1		30.00	30.25	28.75	-

Table A-5: Summary of Modeled Overflow Structures and Weirs

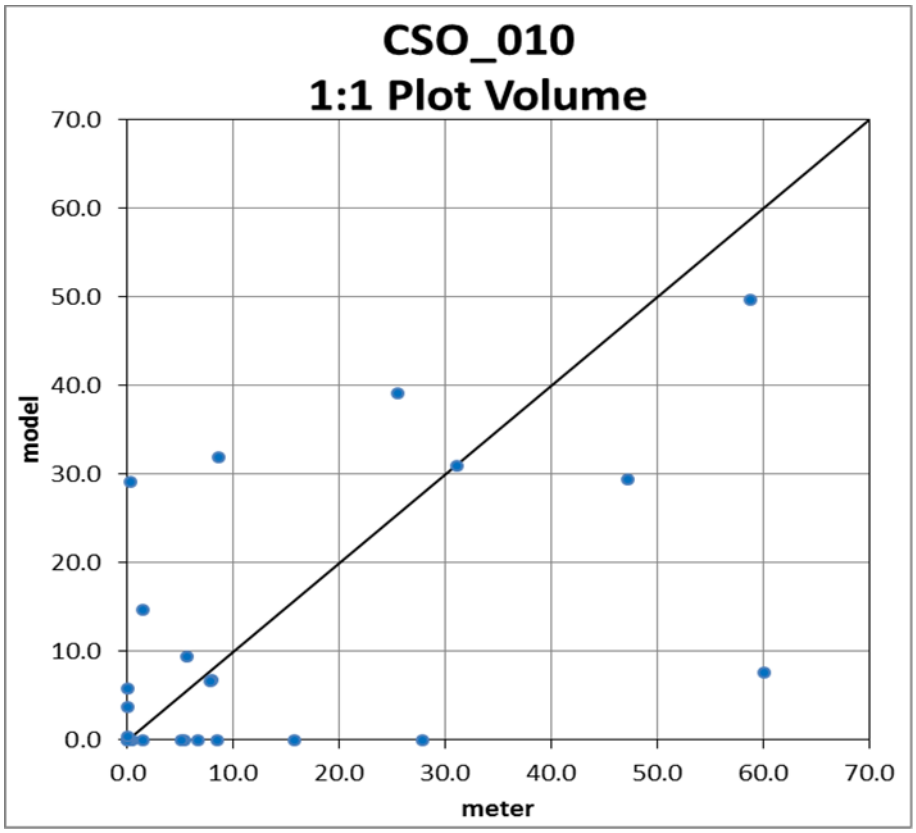
Structure No.	From Node	To Node	Weir Crest Elevation (ft)	Weir Width (ft)
1A	N-30082-CD-23-24-SW	N-30082-CD-23-24-SW	2.00	14.00
1B	N-30084-CD-21-22-SW	BN-1440-CD-21-22-SW	1.00	4.00
1C	N-30085-AB-23-24-SE	N-30088-AB-23-24-SE	24.00	4.00
2	N-30092-CD-19-20-SW_a	N-30092-CD-19-20-SW_b	4.09	32.00
2	N-30093-CD-19-20-SW_a	N-30093-CD-19-20-SW_b	4.97	32.00
2A	M-22608-AB-13-14-SW	N-30094-AB-13-14-SW_a	1.00	15.65
4	N-30097-AB-19-20-SW	z-WTO-18A	5.79	72.33
4	M-22220-AB-19-20-SW	N-30097-AB-19-20-SW	5.79	72.33
5B	N-30106-AB-9-10-SE_a	N-37775-AB-9-10-SE_b	-12.76	4.50
5B	N-30106-AB-9-10-SE_a	N-30106-AB-9-10-SE_c	-12.76	9.00
5B	N-30106-AB-9-10-SE_b	N-30106-AB-9-10-SE_a	25.00	9.00
5B	N-37775-AB-9-10-SE_a	N-37775-AB-9-10-SE_b	25.00	7.00
6	N-34928-CD-9-10-SE-a	N-34928-CD-9-10-SE-b	9.52	3.50
7	N-34929-CD-9-10-SE	05-009A	3.62	2.00
8	N-35932-CD-7-8-SE	06-002A	3.65	2.23
9	BN-2789-EF-7-8-SE	BN-2789-EF-7-8-SE-a	4.00	7.90
9A	BN-2791-EF-7-8-SE	BN-2792-EF-7-8-SE	1.68	8.00
10	N-36107-IK-1-2-NE	CSO-008p	10.00	14.75
17	BN-2937-B-6-SE	BN-2931-B-6-SE	0.39	4.80
17A	BN-3590-C-4-SE	N-36166-C-4-SE	9.18	2.75
18	BN-2942-B-5-SE	BN-2944-B-5-SE	4.47	6.25
19	M-36616-C-5-SE	N-36172-C-5-SE-a	32.72	4.00
19A	M-36625-C-5-SE	M-36625-C-5-SE-a	35.30	4.00
20A	16-012	16-012A	37.30	4.00
21	17-022	17-022A	15.06	5.19
22D	17-018	18-005	44.56	3.56
22E	17-010	17-010B	53.69	4.41
23	N-36147-G-1-SE	N-36147-G-1-SE-b	28.52	4.75
28	M-15458-H-1-NW	BN-902-H-1-NW	5.20	2.60
29	M-49846-H-1-NW	M-49846-I-1-NW-b	4.58	10.67
30	20-101	20-101A	7.70	9.20
33	20-26	20-026A	19.73	4.20
36	BN-3836-K-4-NW	BN-807-K-4-NW	12.46	4.75
36A	22-005	22-005A	40.76	4.50
36H	BN-925-G-5-NW	N-36202-G-5-NW	43.80	14.00
37	BN-816-K-4-NW	BN-3840-K-4-NW	16.25	18.96
38	BN-3826-K-4-NW	WRC-11A	2.06	9.50
38A	BN-823-K-4-NW	BN-823-K-4-NW-b	2.54	9.50

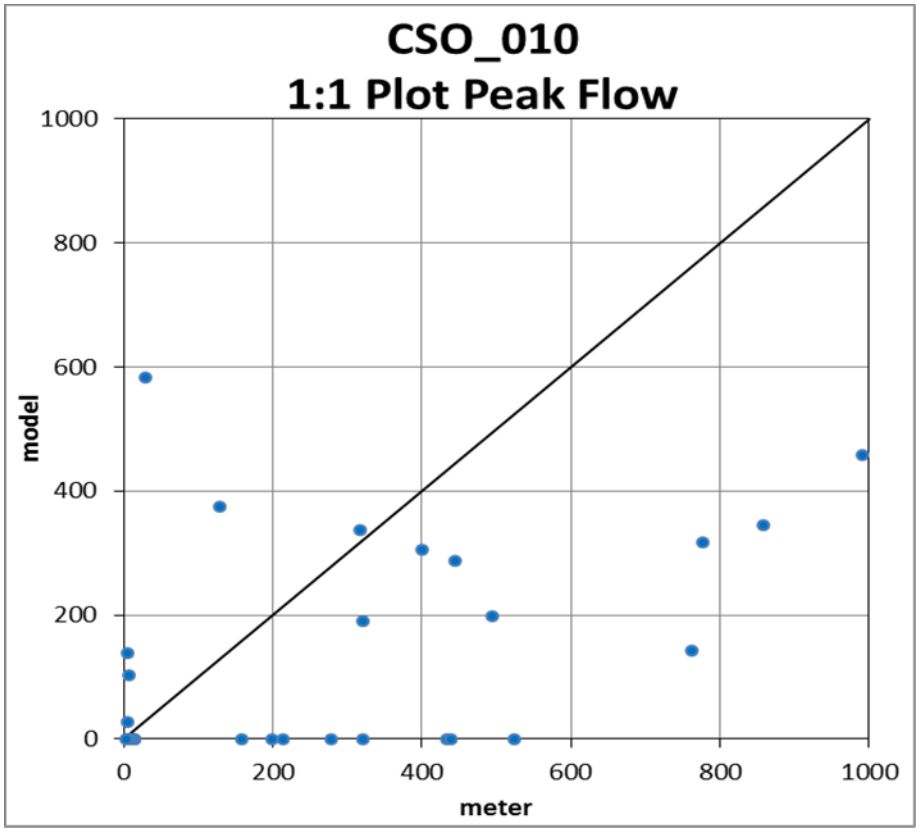
43A	27-008A	27-008B	8.33	4.00
44	UPI-17A	27-008C	7.80	6.00
45	N-36756-N-5-NW	N-36756-N-5-NW-b	9.76	5.00
46	N-36225-O-5-NW	N-36224-O-5-NW	36.23	6.00
47	N-37691-N-8-NW	29-117A	128.67	6.00
50	BN-784-K-5-NW	BN-3902-K-5-NW	27.52	3.00
51	33-004	RCM-50A	26.91	2.00
51	RCM-50A	33-004A	16.52	4.00
53	34-053	34-013A	27.70	10.27
53A	34-033	34-033A	28.01	2.87
53B	34-053A	34-053D	32.42	10.63
54	34-015A	34-015B	22.20	3.00
55	35-015	35-015A	34.55	12.20
55A	N-36698-H-7-NW	35-015C	33.00	20.00
56	36-014	36-014A	63.51	10.00
57	36-016	36-016A	16.96	3.80
60	39-005	39-005A	42.63	2.24
61	40-003	40-003A	43.01	9.50
62	41-004	41-004A	49.80	6.80
63	42-003	42-003A	48.40	2.27
64	43-008	43.008A	51.40	2.40
65	44-002	44-002A	93.85	2.50
67	46-003	46-003A	101.73	2.00
69	48-003	48-003A	87.07	2.00
70-Mid	49-031	49-OF2	93.96	9.00
70-North	49-031	49-OF1	92.25	6.50
70-South	49-031	49-OF3	95.00	10.75
70C	N-36721-CD-21-22-NW-a	N-36721-CD-21-22-NW-b	165.60	5.00
70D	N-36720-CD-21-22-NW	49-017B	161.53	2.66
71	N-36727-K-5-NW	N-36727-K-5-NW-b	11.60	4.00
72	WRC-007	51-004A	13.50	6.70
73	N-36730-I-6-NW	52-010A	18.47	7.00
74	23-020	23-020A	50.79	1.75
75	N-36732-K-9-NW	CSO-054p	25.00	9.00
77	RCR-004	56-001	27.63	7.67
78	57-008	57-008A	27.82	1.56
79	BN-3795-IK-11-12-NW	N-36106-IK-11-12-NW	32.15	4.10
80	59-080	59-080B	185.10	20.00

Table A-6: Summary of Monitored and Modeled Flow

Location	Monitored Flow Volume (MG)	Modeled Flow Volume (MG)	Difference (%)
Pump Stations			
Potomac	42,948	45,991	7.1%
Main Sanitary	23,745	25,435	7.1%
O Street Sanitary	1,554	1,886	21.3%
Poplar Point	7,504	5,173	-31.1%
Eastside	2,869	2,308	-19.6%
Rock Creek	3,866	1,169	-69.8%
Outfalls			
010 - B St/NJ Ave	330.00	267.37	-19.0%
011a - B St/NJ Ave	12.69	0.00	-100.0%
012 - Tiber Creek	91.82	104.78	14.1%
019- NEB Swirl	726.35	787.92	8.5%
019- NEB Bypass	359.70	464.21	29.1%
003 - Bolling OF	1.14	0.00	-100.0%
020 - Easby Point	2.60	7.18	176.1%
021 - Potomac PS/Slash Run	652.00	621.16	-4.7%
022 - I St/22nd St	19.82	41.96	111.7%
024 - West Rock Creek DS	14.91	37.35	150.5%
025 - 31st St.	1.24	1.40	12.8%
026 - Wisconsin Av.	0.01	0.00	-100.0%
027 - Potomac Ave	8.21	13.75	67.4%
028 - Key Bridge	2.69	4.99	85.7%
029 - College Pond	10.31	14.72	42.8%
049 - Piney Branch	83.00	74.80	-9.9%
001 - Blue Plains Overflow	362.36	444	22.5%
002 - Blue Plains Treated	105198.00	107766	2.4%

CSO 010 (Structures 15 & 15A only)





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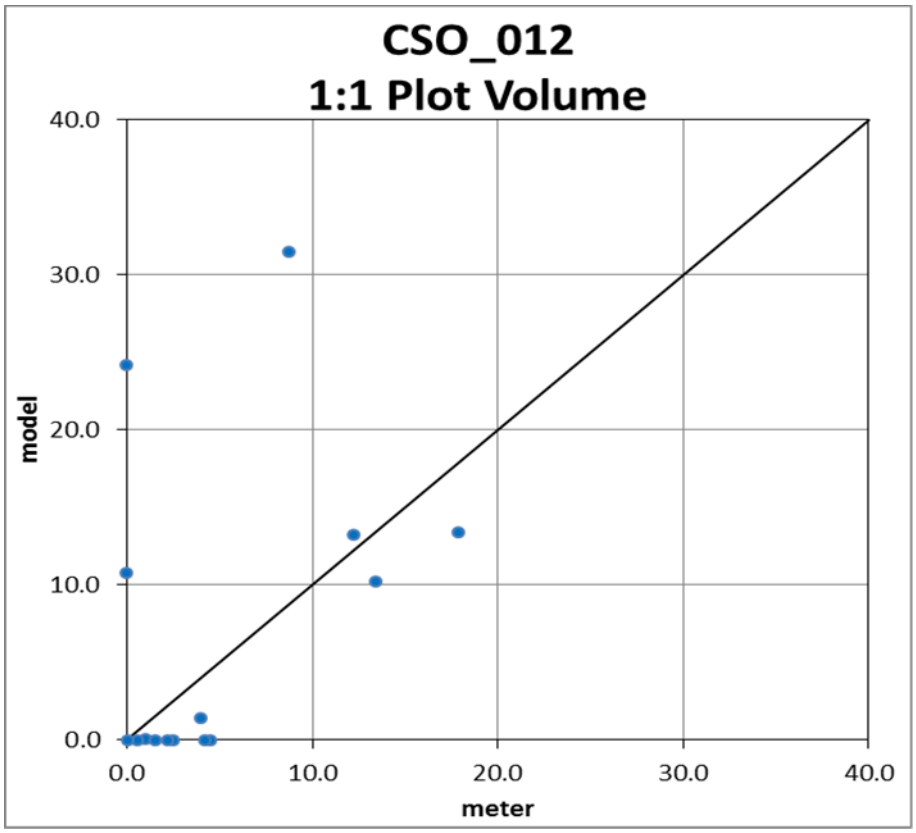
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model
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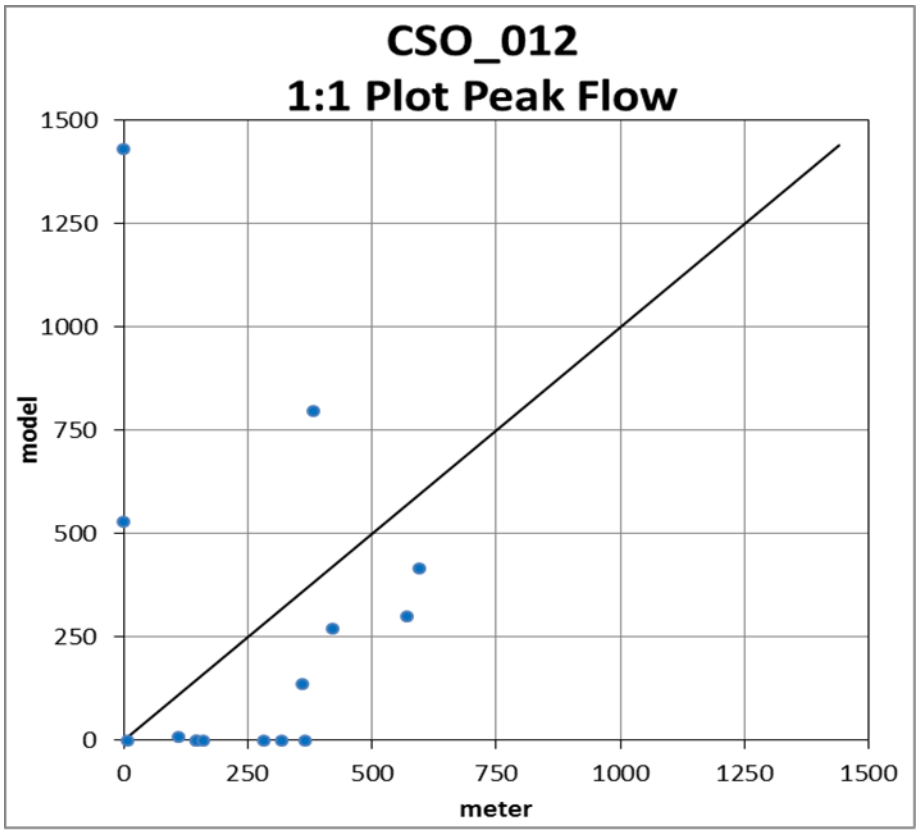
30.0
40.0
meter


CSO_012
1:1 Plot Peak Flow
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1250
1000
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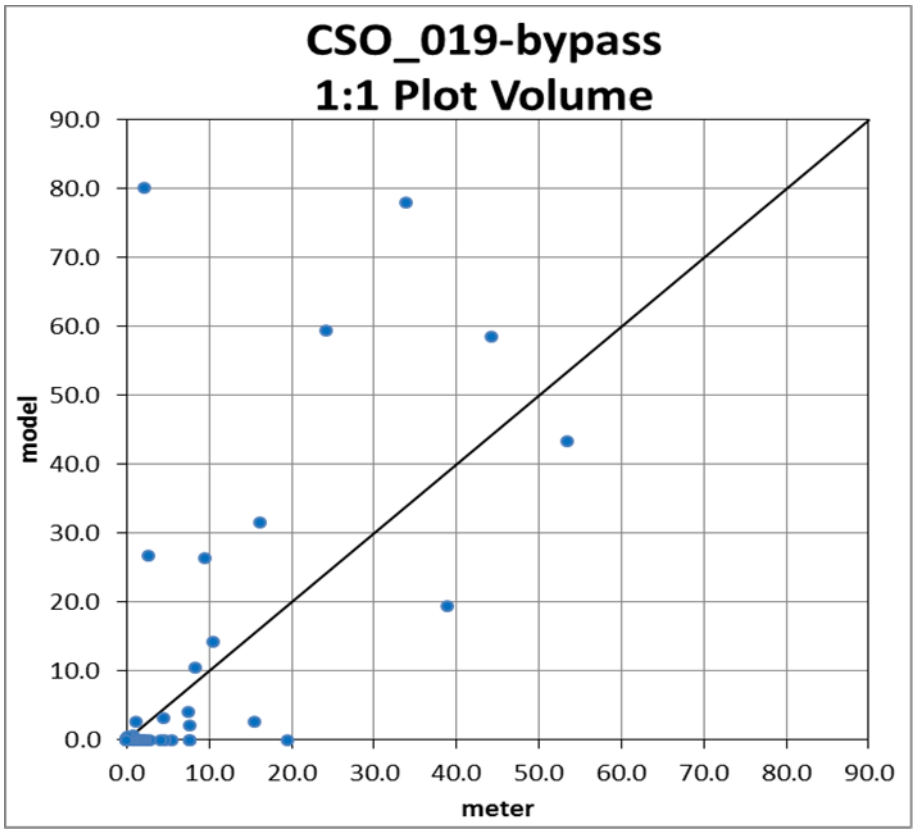
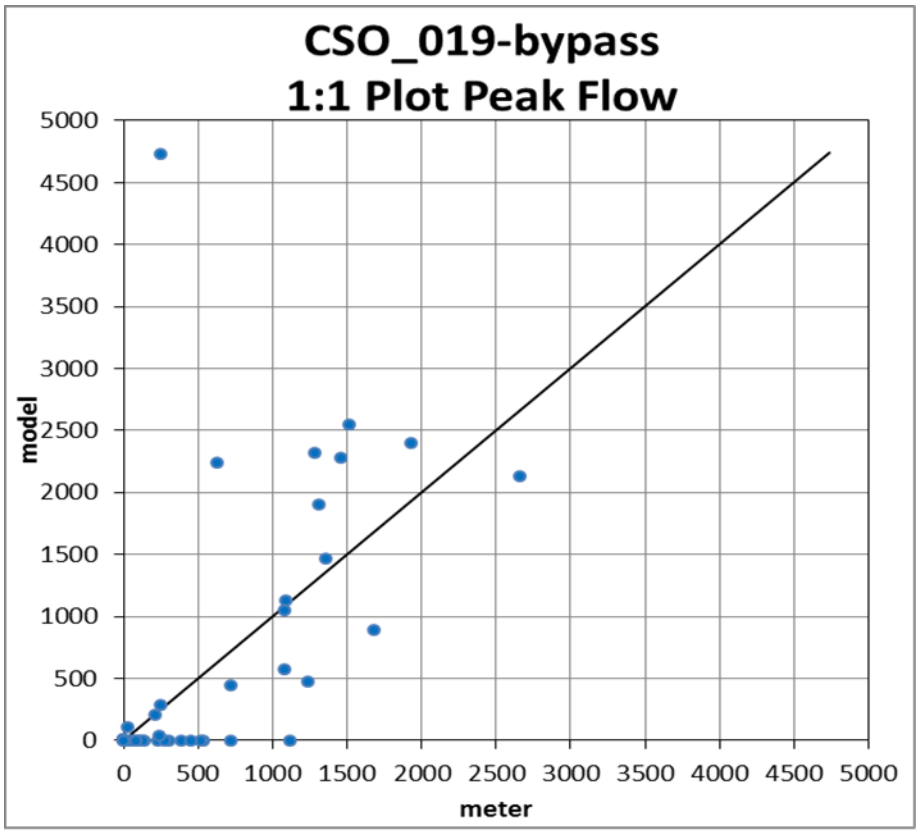
500
250
0
model
0
250
500
750
1000
1250
1500
meter

CSO 019 - Swirl Bypass





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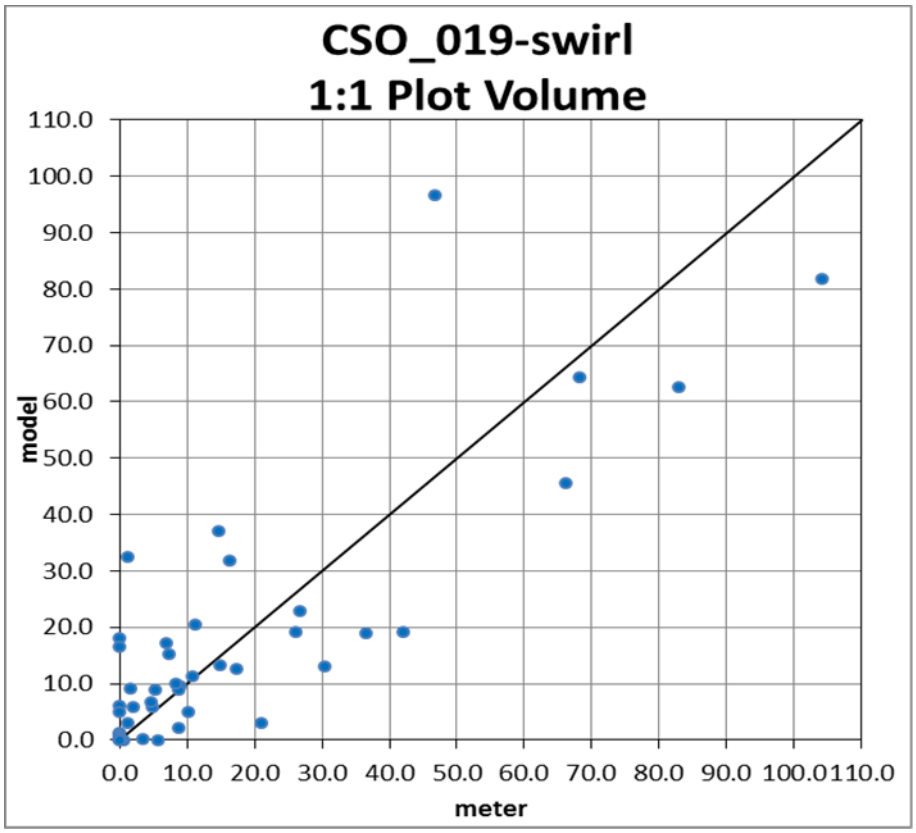

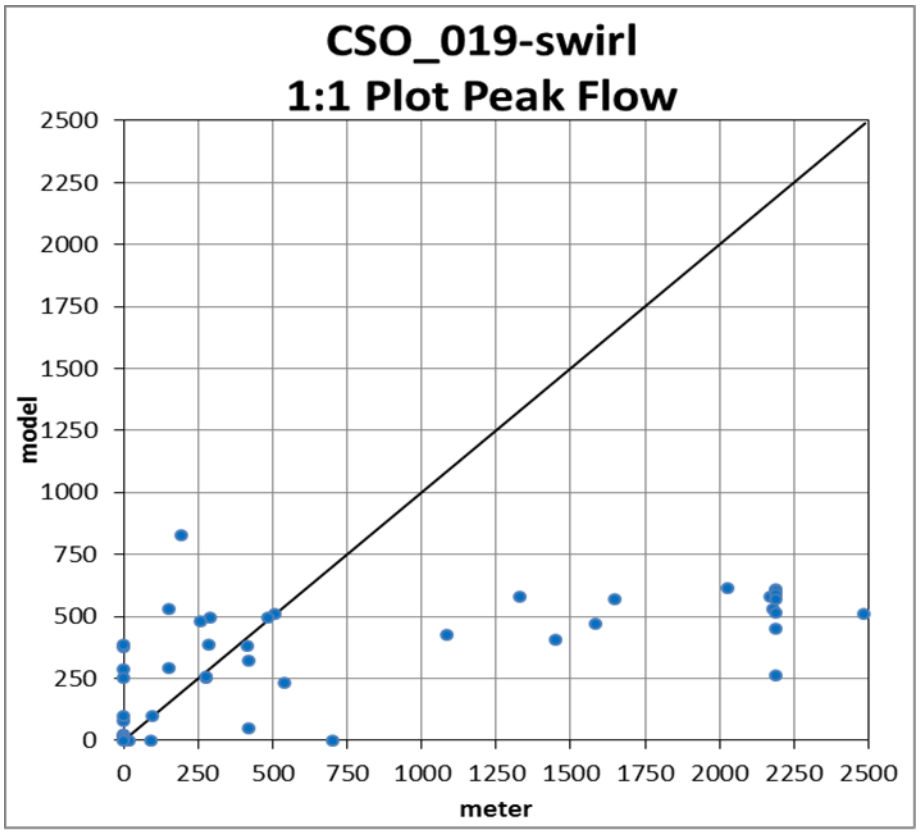

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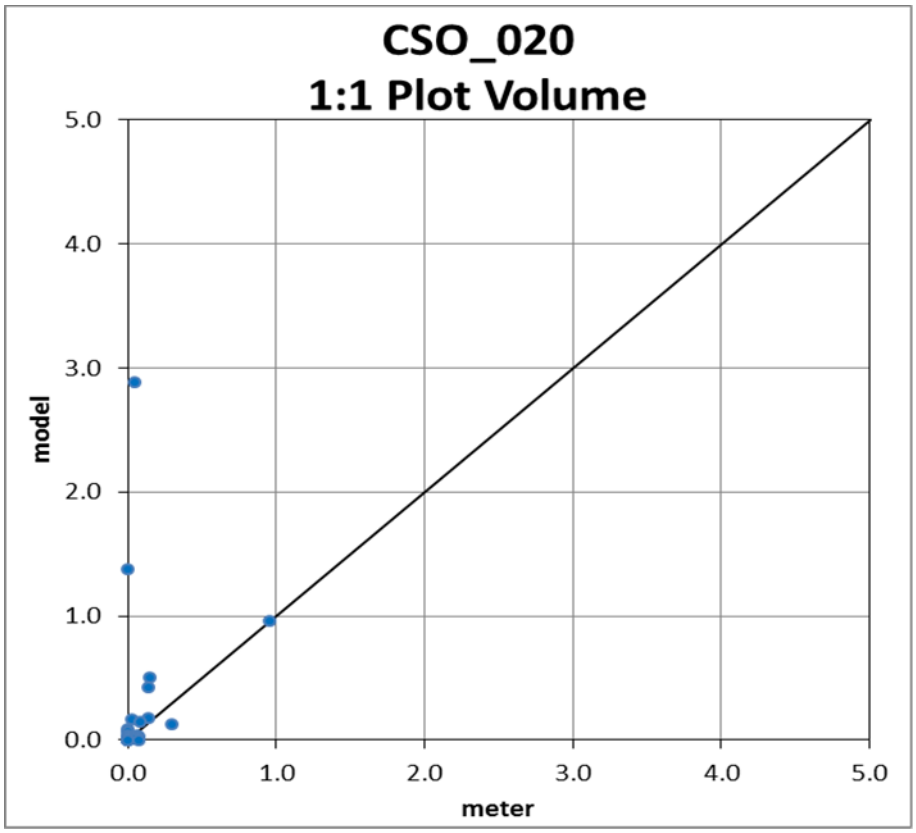
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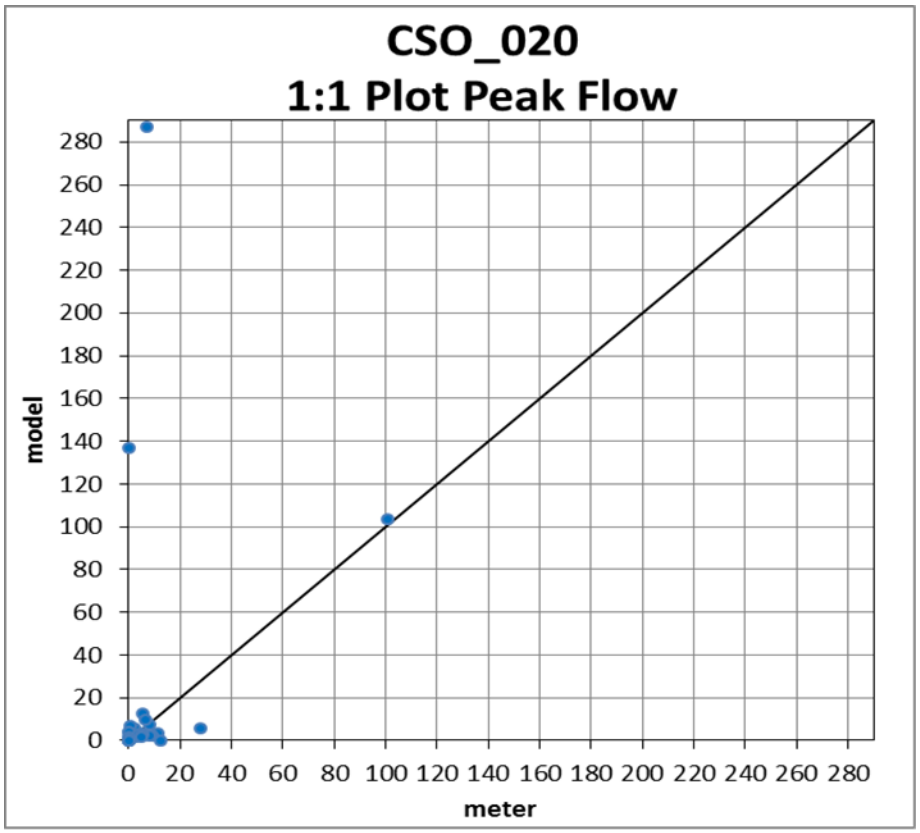
4.0
5.0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meter
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80
100
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140
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180
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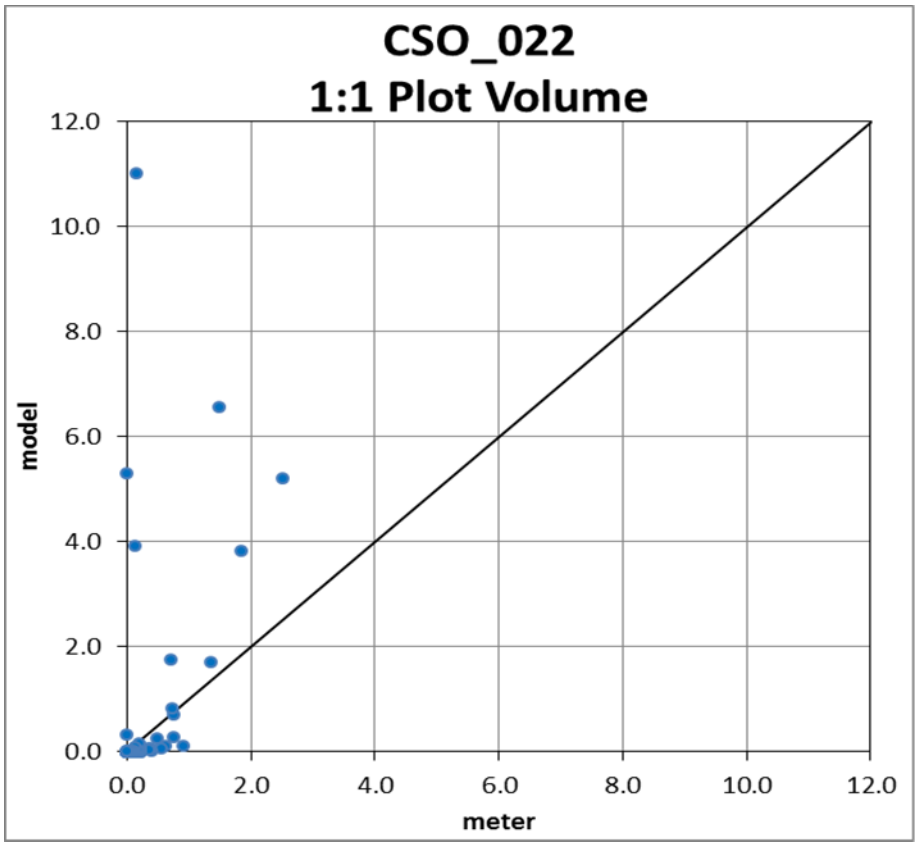
260
280

CSO 022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4.0
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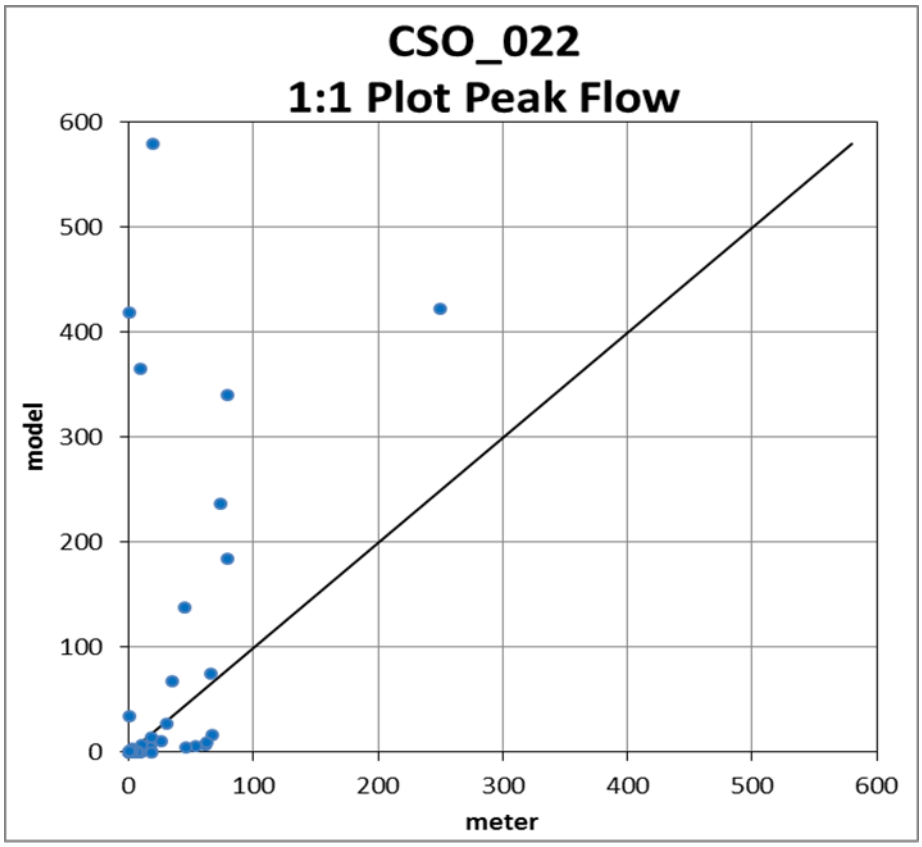
10.0
12.0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model
meter
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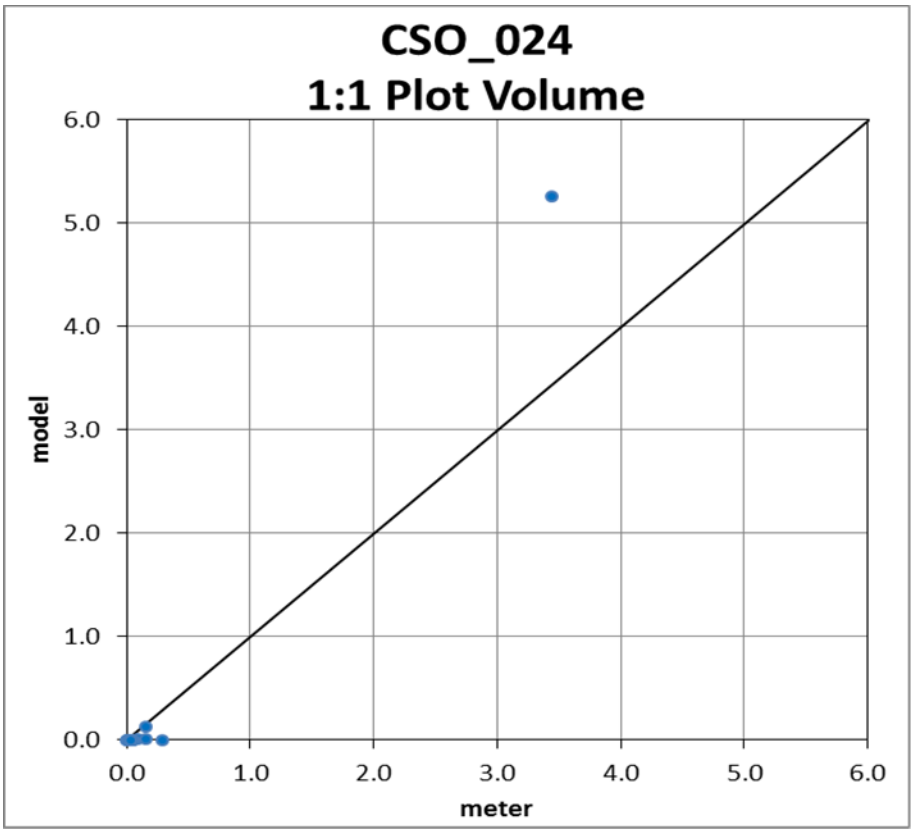
100
200
300
400
500
600

CSO 024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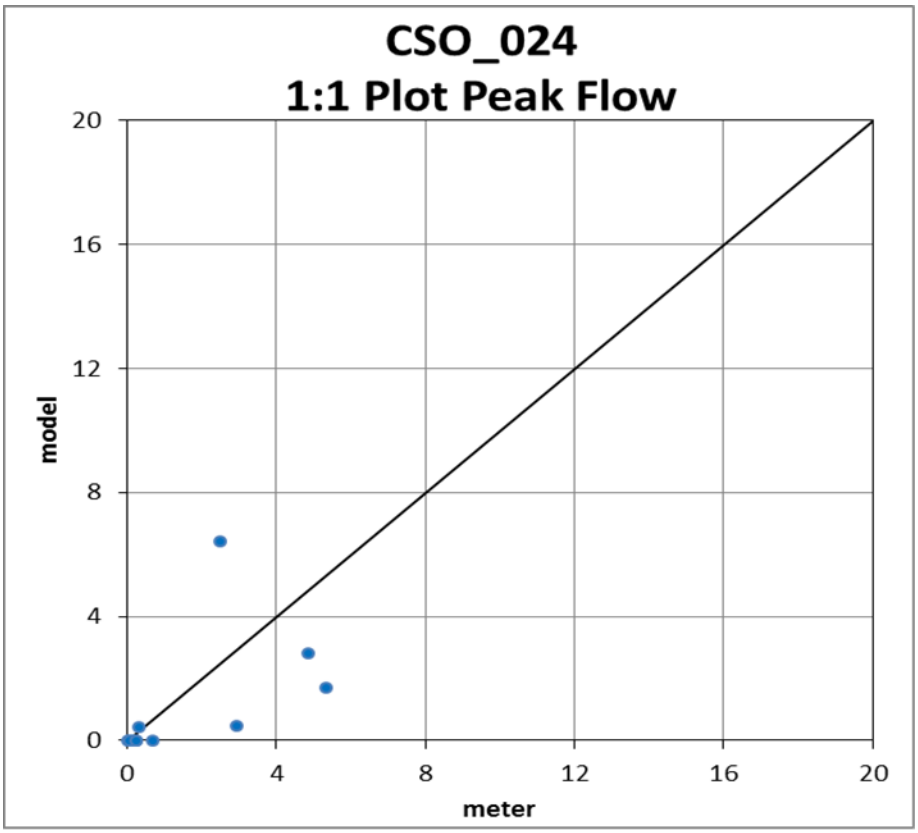
6.0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meter
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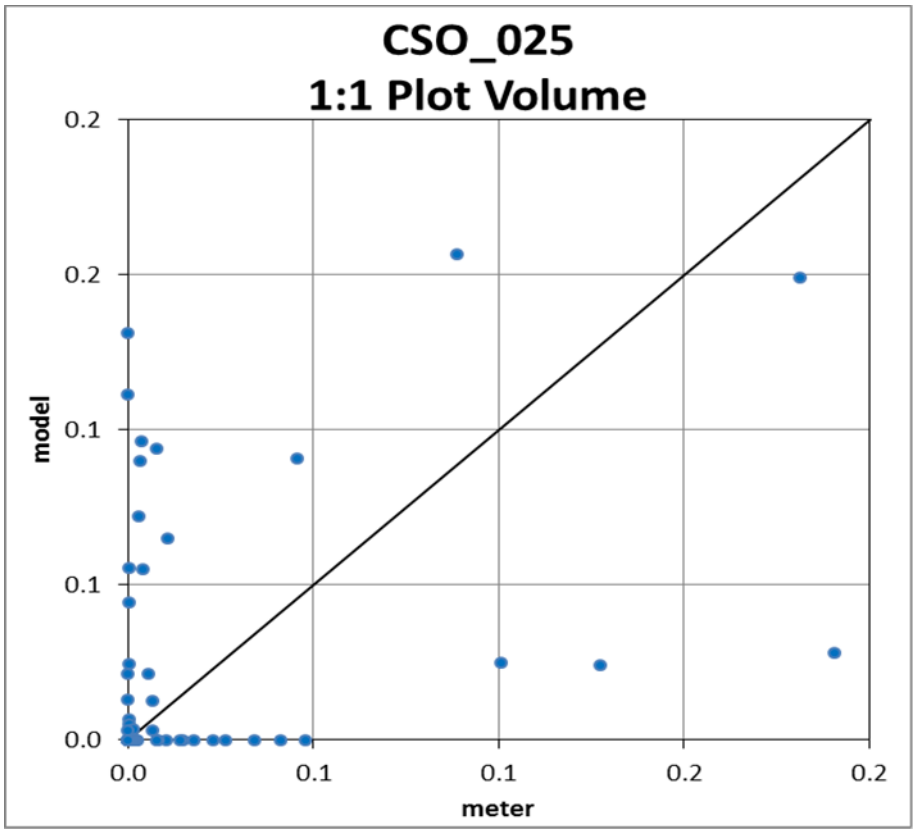
4
8
12
16
20

CSO 025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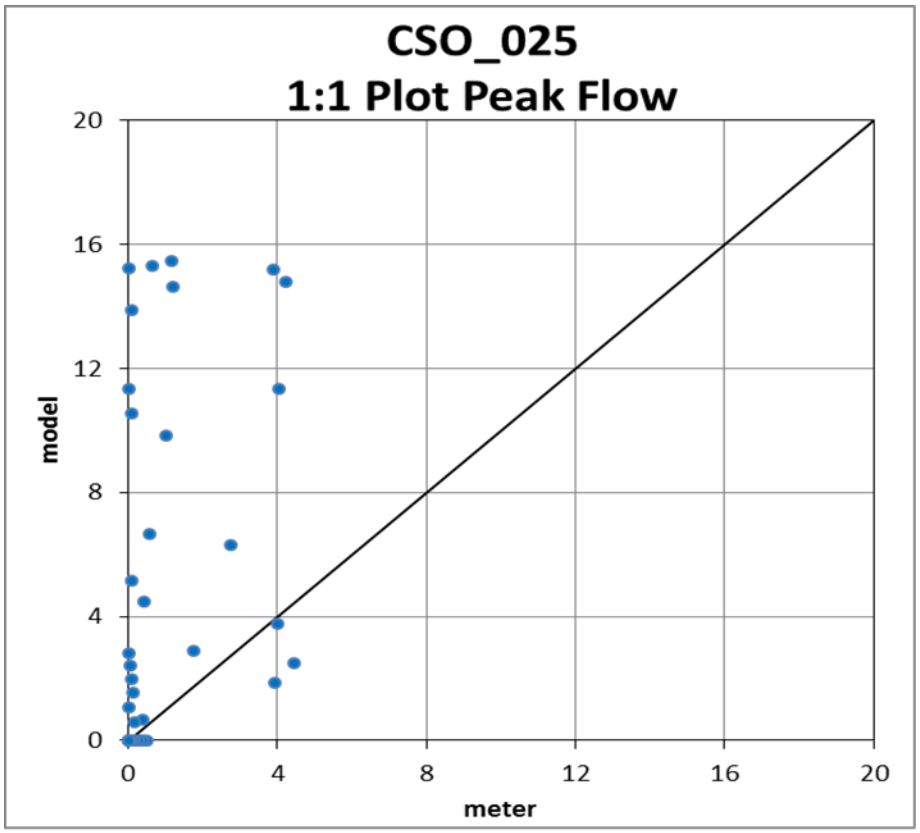
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12
16
20
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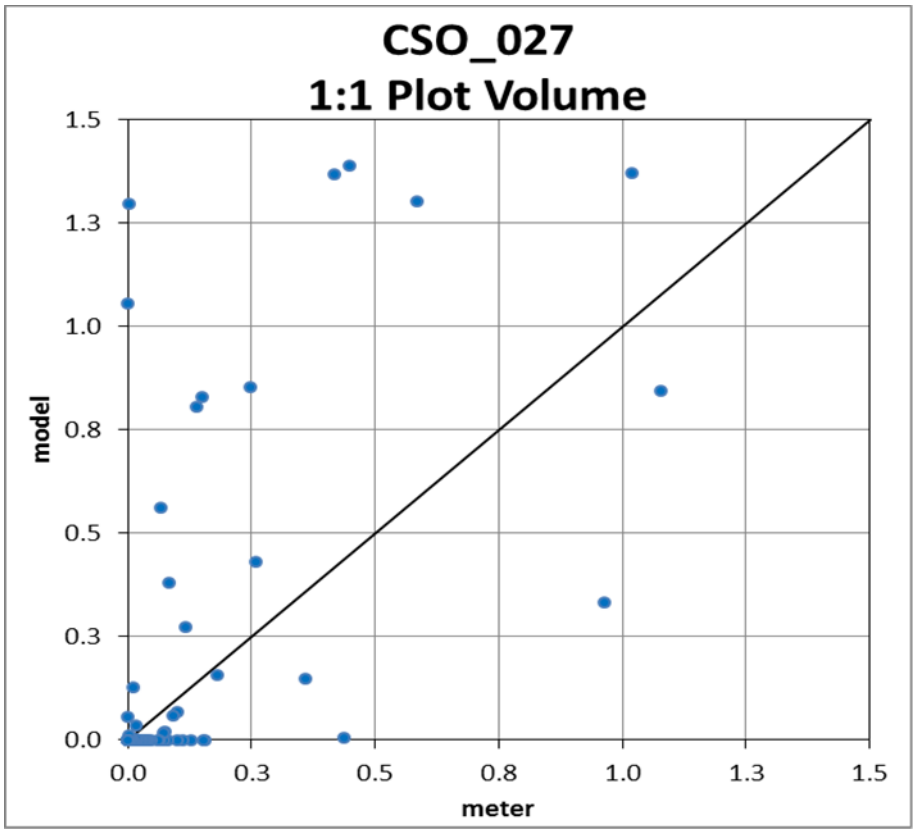
4
8
12
16
20

CSO 027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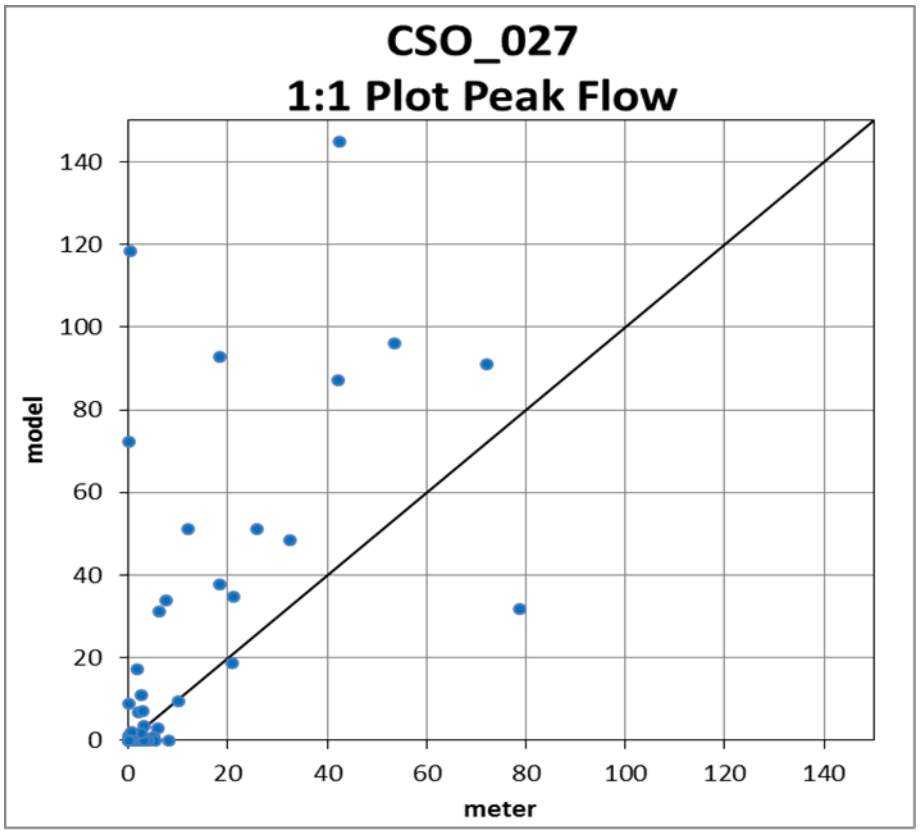
1.5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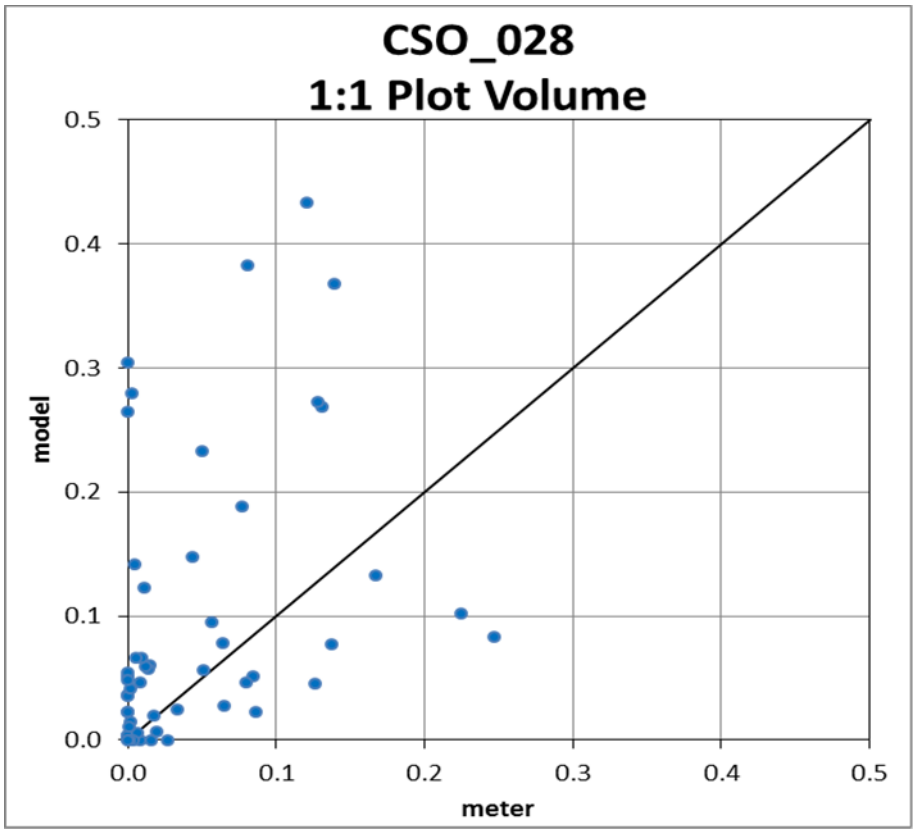
model
meter
0
20
40
60
80
100
120
140

CSO 028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model
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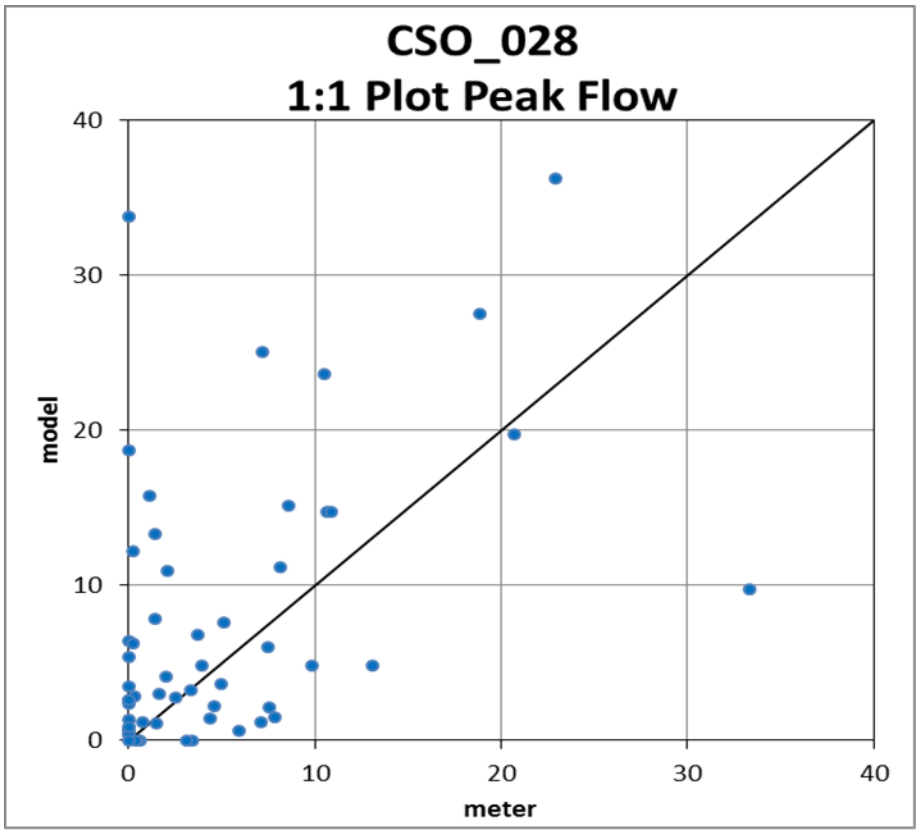
0.4
0.5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meter
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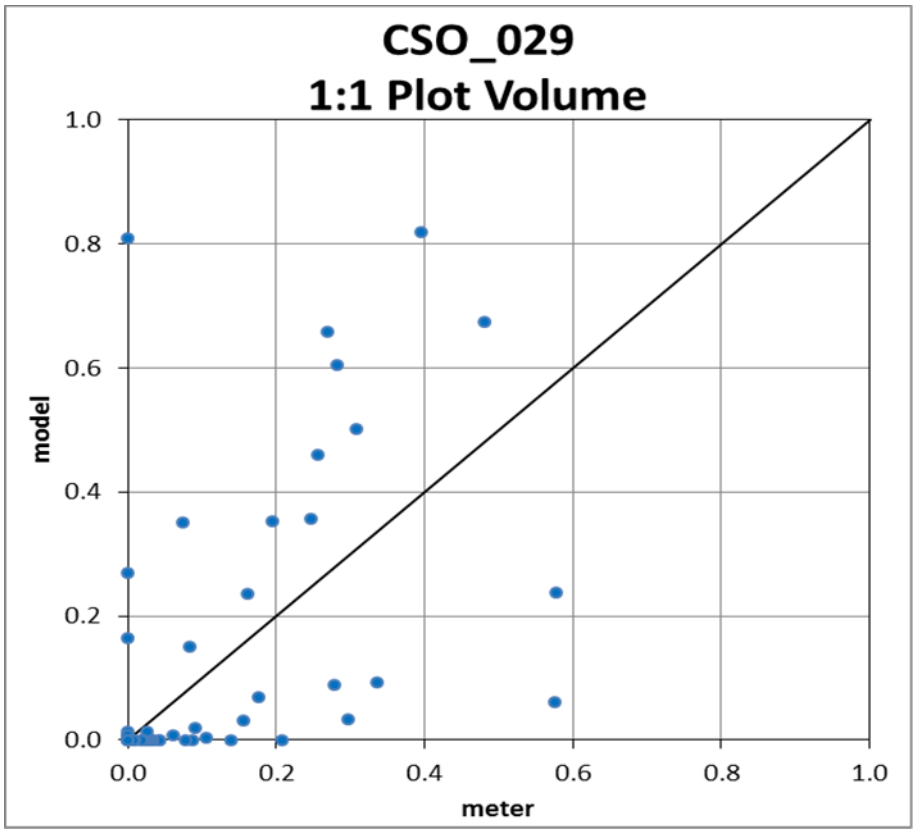
10
20
30
40

CSO 029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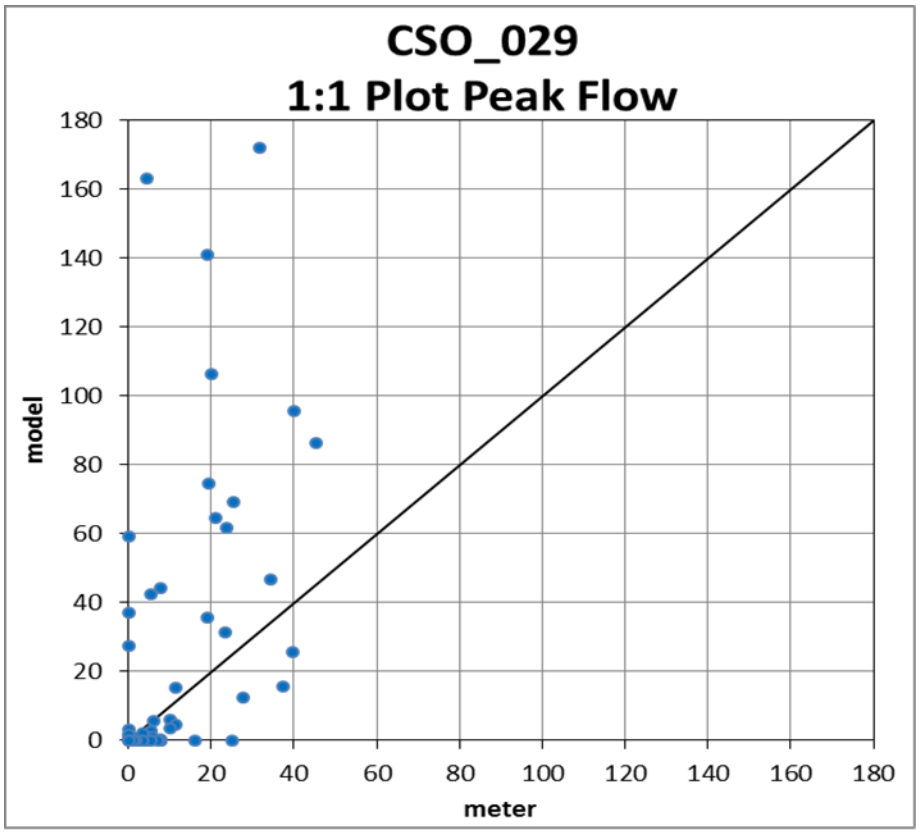
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100
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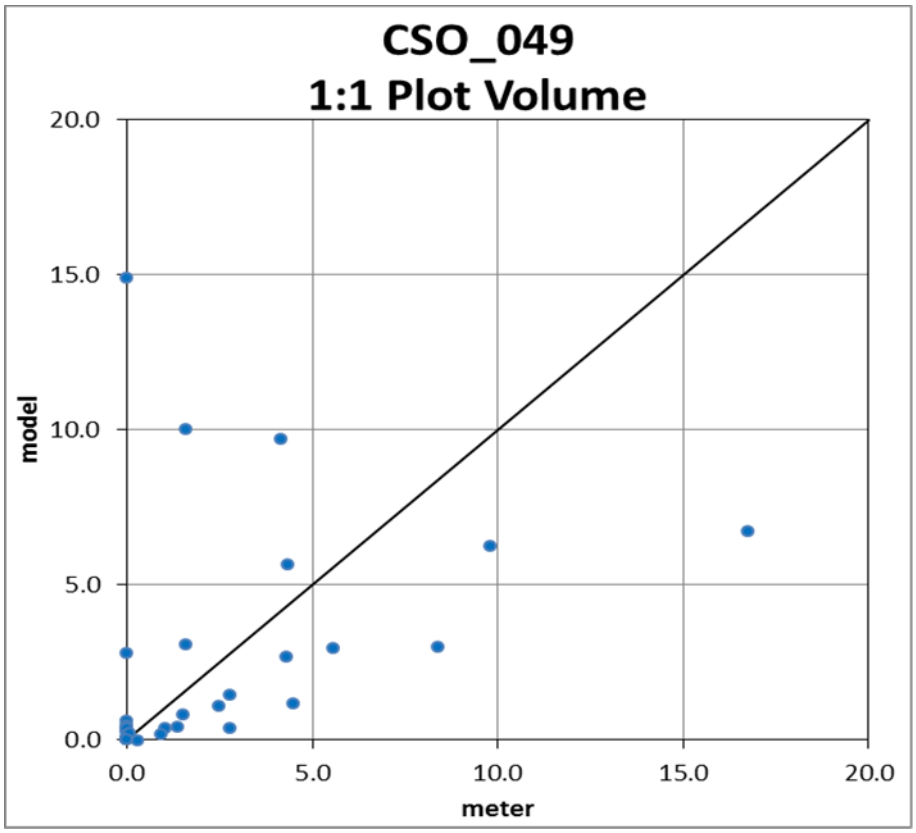
140
160
180

CSO 049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5.0
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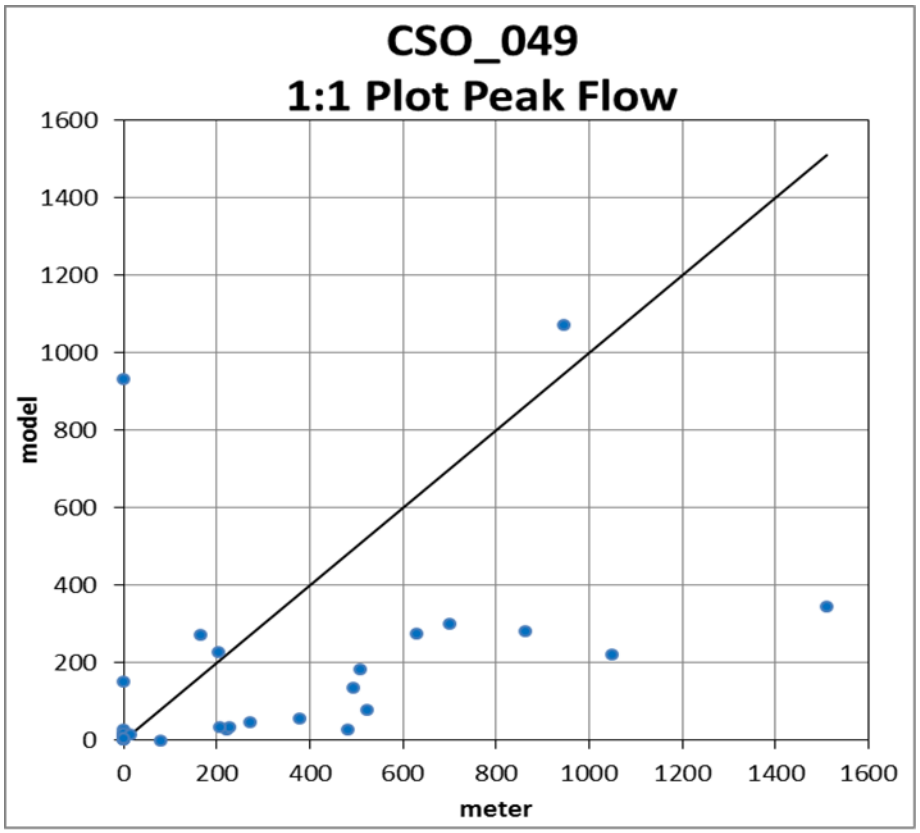
model
0.0
5.0
10.0
15.0
20.0
meter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1600
1400
1200
1000
800
600
400
200
0
model
0
200
400
600
800
1000
1200
1400
1600
meter

Appendix B Phase I: Post Construction Monitoring Receiving Water Model Documentation

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

Phase I: Post-Construction Monitoring Receiving Water Model Documentation

August 2016

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

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1 Introduction

1.1 Background

Three major receiving water bodies flow through the District of Columbia. The Potomac River, the Anacostia River, and Rock Creek each have several water quality impairments, and consequently, certain load allocations must be met in order to maintain the health and function of these ecosystems. These water bodies receive pollutant loads from various sources. Upstream loads from urban areas in Maryland flow into each of the water bodies. Separated stormwater (through direct drainage and separated storm sewer systems) conveys loads off of the District's landscape into each waterbody. Several permitted waste water treatment facilities discharge into the Potomac River within the District's boundaries. Finally, combined sewer overflows (CSOs) deliver pollutant loads to these water bodies when the combined sewer system (CSS) capacity is exceeded during precipitation events.

In accordance with the NPDES permit requirements, DC Water has prepared a Phase 1 post-construction monitoring report. As part of the post-construction monitoring, study memoranda were prepared to document changes to the modeling tools used in this analysis. This report summarizes the utilization of and modifications to the water quality models used in the Long Term Control Plan (LTCP) to accurately characterize the conditions of the District's receiving water bodies and compare to original model calibration quality.

1.2 Existing Model Documentation

The development and calibration of the receiving water quality models used for the Anacostia River, Potomac River, and Rock Creek in the LTCP are documented in *Study Memorandum LTCP 6-4, Study Memorandum LTCP 6-5,* and *Study Memorandum LTCP 6-6.* These memoranda were published with the LTCP in 2001. This report builds on those models.

1.3 Scope and Modeling Objectives

The following activities were performed to prepare the receiving water quality models to analyze Phase 1 controls:

- Gather environmental conditional data for the District's receiving water body watersheds. This includes 2015 rainfall and boundary flow conditions
- Compare the water quality data from 2015 to the calibration data and event mean concentrations (EMCs) that were used in the original LTCP model
- Make necessary updates to the model inputs to reflect 2015 environmental conditions and produce results that are similar to the collected environmental data

The receiving water quality models were run for two time periods, the 2015 calendar year and the LTCP Average Year period (1988-1990). Updates that were made to model's environmental conditions or EMCs for the Phase 1 requirements were not made for the Average Year period. Modifications that were made to the collection system were, however, incorporated into both the 2015 and Average Year period runs.

2 Description of System

2.1 Background

A detailed description of the existing system at the time of model development for the LTCP can be found in *Study Memorandum LTCP 6-4*, *Study Memorandum LTCP 6-5,* and *Study Memorandum LTCP 6-6.*

2.1.1 Model Segmentation

The models for each of the receiving water quality models are broken into a number of segments. The model segments were developed without the aid of geospatial software, thus, the geospatial location of each segment is approximate. The LTCP documentation included hand sketched approximations with references to land marks. For this model update, these sketches were traced into ESRI shapefiles and mapped based on these landmarks (Figures 1, 2, and 3). While these maps are not exact, they accurately depict the model segments that have been historically associated with bridge crossings and landmarks.

Figure 1: Anacostia model segmentation and 2015 monitoring locations.

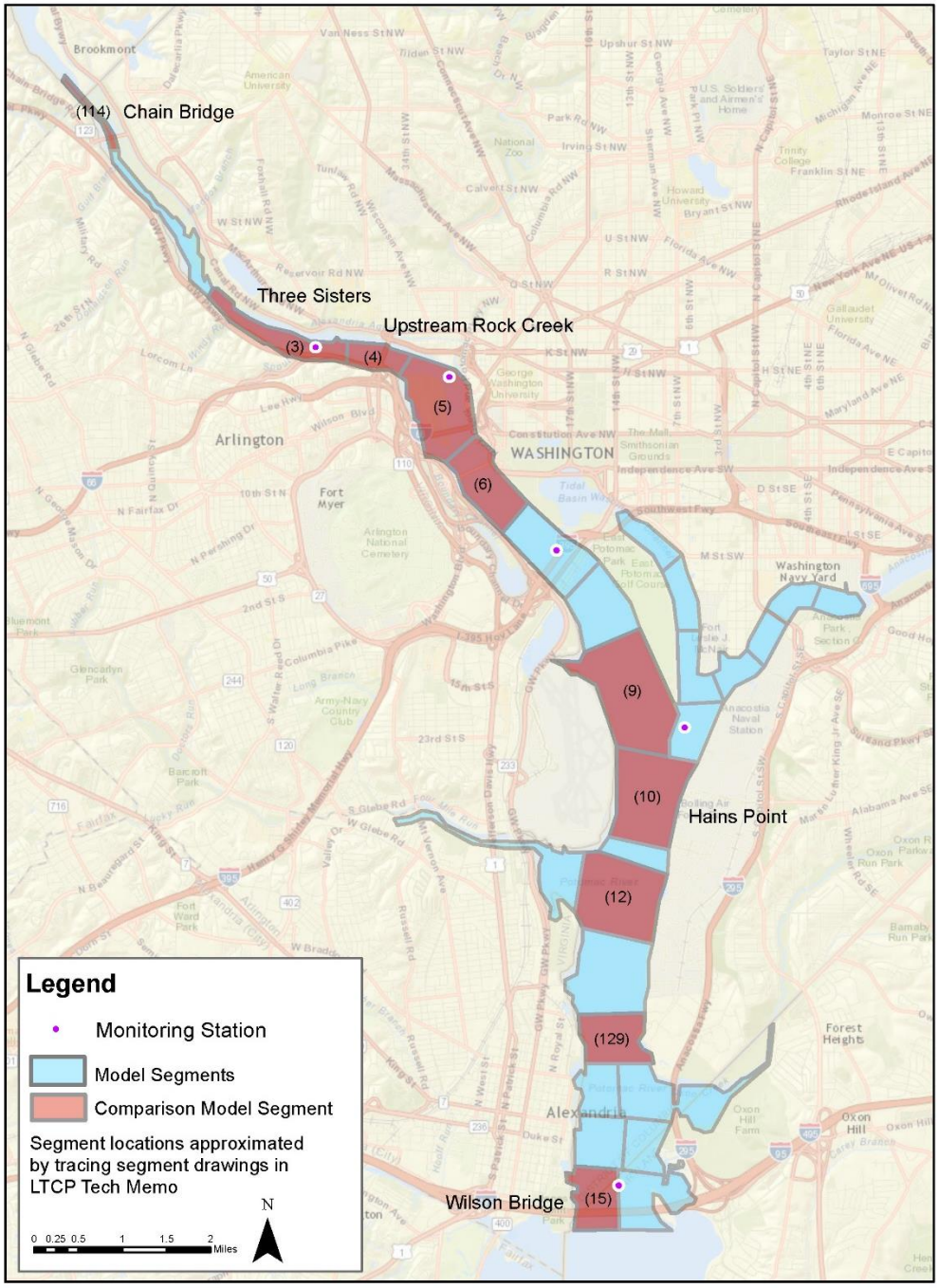


Figure 2: Potomac River segmentation and 2015 monitoring locations (model segments upstream and downstream of the District's boundary are not included in the figure).

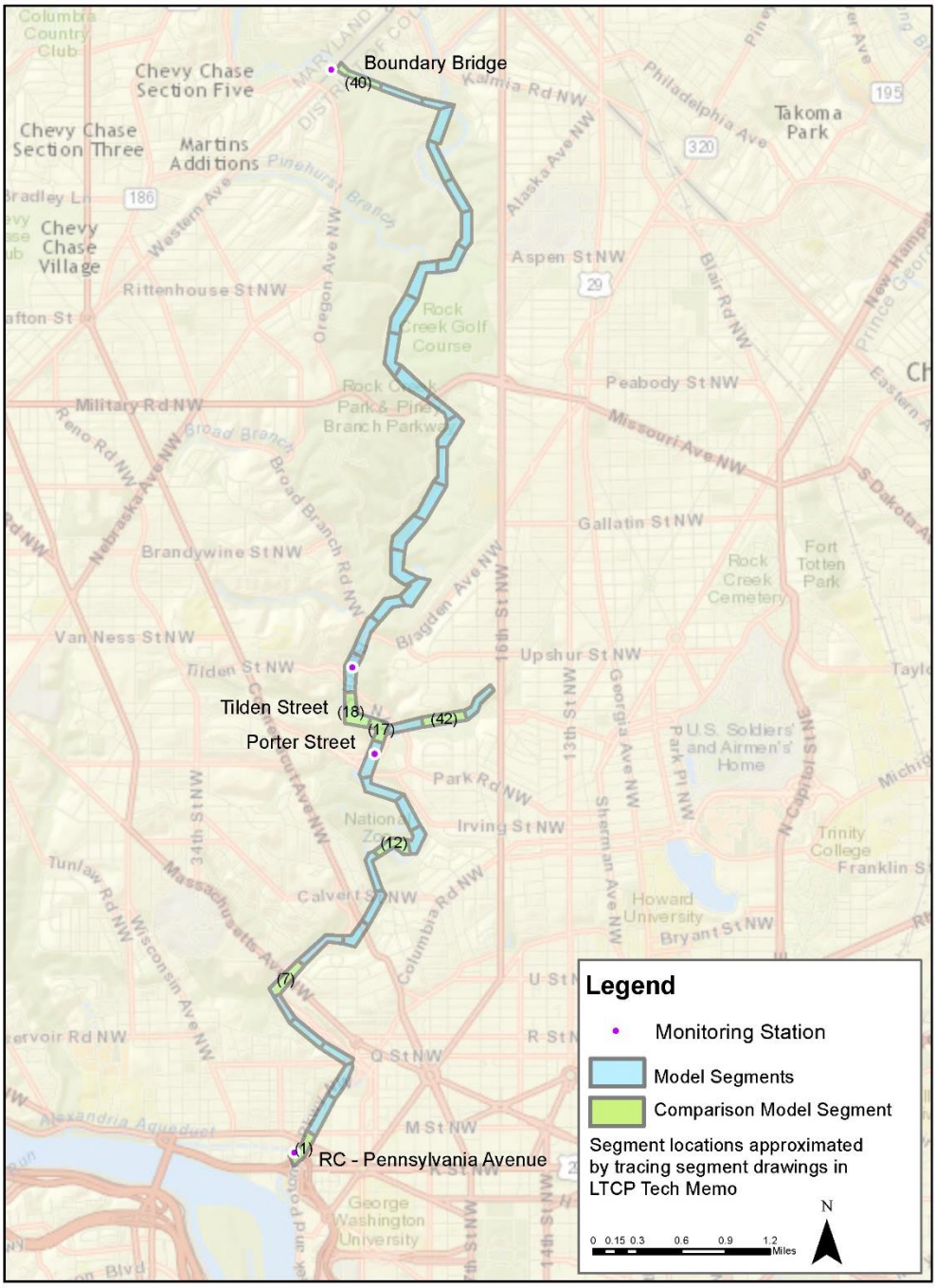


Figure 3: Rock Creek model segmentation and 2015 monitoring locations.

2.2 Phase 1 Model Updates

2.2.1 Environmental monitoring

A receiving water quality monitoring regime was employed to characterize wet and dry water quality conditions within the Potomac River, the Anacostia River, and Rock Creek. The sampling effort took place at 14 locations and was comprised of grab samples, field measurements, and continuous monitoring. Grab samples were collected approximately 5-10 times a month and analyzed for TSS, CBOD, Fecal Coliform Bacteria, and E. *coli*. Field measurements of temperature, DO, pH, and conductivity, were taking concurrently during grab sampling events. Continuous monitoring of DO was taken at select monitoring stations (Table 1). Sampling spanned from December 2014 to February 2016.

Table 1: Sampling Regime and Characteristics

Sampling Site	Mainstem	Coordinates	Grab Samples	Field Measurements	Continuous DO measurements
Bladensburg	Anacostia	38.934,-76.939	yes	yes	yes
Benning Road	Anacostia	38.897,-76.962	yes	yes	no
Ana PA Ave	Anacostia	38.877,-76.978	yes	yes	yes
South Capitol	Anacostia	38.869,-77.005	yes	yes	yes
Haines Point	Anacostia	38.855,-77.021	yes	yes	no
Chain Bridge	Potomac	38.930, -77.117	no	no	yes
Three Sisters	Potomac	38.903,-77.067	yes	yes	no
Upstream Rock Creek	Potomac	38.899,-77.059	yes	yes	no
14th St Bridge	Potomac	38.877,-77.042	yes	yes	yes
Wilson Bridge	Potomac	38.796,-77.031	yes	yes	no
Boundary Bridge	Rock Creek	38.987,-77.053	yes	yes	no
Tilden Street	Rock Creek	38.941,-77.051	yes	yes	no
Porter Street	Rock Creek	38.934,-77.049	yes	yes	no
RC PA Ave	Rock Creek	38.904,-77.057	yes	yes	no

Results from the environmental monitoring were used to update wet and dry flow upstream EMCs for the 2015 calendar year modeling runs.

Rainfall monitoring data was purchased from OneRain. Data was made available in 5-minute intervals for 6,077 1 square km pixels spanning from December 2014 to February 2016. The pixels covered the entirety of the Blue Plains drainage area.

2.2.2 Loading Inputs

There are multiple external loading sources to the receiving water quality models. CSO, Upstream, Separate Stormwater, Lateral Stormwater, Point Source discharge, and Tributary loads are all characterized by a daily mean flow and an event mean concentration. The PCM modeling runs were

performed for the 2015 calendar year and the Average Year model period. Updates to the LTCP model runs were made for the PCM runs upon the availability of monitored environmental data. These updates and approaches are described below and summarized in Table 2. Individual EMCs are documented in Appendix A: EMCs.

CSOs:

Flow: The CSO inputs into the 2015 and Average Year PCM models are based on the recalibrated collection system model that is described in the *Collection System Model Documentation*. In short, the recalibrated model from 2006 has been improved and refined in 2016 to better reflect the collection system monitoring that took place in 2015. These improvements include pipe edits, changes to operational parameters for pumping stations and inflatable dam structures, refinement of boundary flow inputs, and updates to several CSO diversion structures. The original LTCP model predictions assumed that the Potomac Pumping Station operated at 460 MGD and that the Main Sanitary Pumping Station operated at 240 MGD. Those capacities have been updated to reflect actual operation during 2015in the PCM runs, with Potomac Pumping Station's capacity set to 350 MGD and Main Pumping Station's capacity set to 180 MGD.

EMC: EMCs for all pollutants in the LTCP runs were based on monitoring data collected under several efforts. These data largely reflect the 1999-2000 period, though subsequent data collections did not provide any justification for updating the EMCs in the PCM runs.

Upstream:

Flow: Daily mean flow rates were collected from USGS gauges near the upstream boundaries for each receiving water model. Flow rates for Potomac and Rock Creek were area weighted to reflect the specific boundary locations. Flow from the NE Branch and NW Branch of the Anacostia River were summed to approximate the flow at the boundary for the 2015 PCM runs. Flow was separated into wet and dry conditions using USGS Hysep for both the PCM and LTCP runs, however, the flow separation software has been updated and the separation of flow in the LTCP runs could not be reproduced. Flow in the 2015 PCM runs was considered "dry" when baseflow was more than 83% of total flow, which resulted in annual Rock Creek sediment loads with the minimal error achievable when reproducing the Rock Creek TMDL.

EMCs: Upstream EMCs are based on monitoring datasets reflective of either the 2015 calendar year or Average Year period. Dry and wet weather EMCs were approximated by taking geomeans of samples collected at Bladensburg (Anacostia), Chain Bridge (Potomac), and Boundary Bridge (Rock Creek), with the exception that Potomac boundary bacteria concentrations were approximated using samples collected at Three Sisters. Three Sisters was substituted due to a lack of number of overall samples and the lack of any dry weather samples. Average Year EMCs are characterized in previous memoranda developed for the LTCP.

Stormwater:

Flow: Separate stormwater flow was approximated using the same Mike Urban model for the PCM and LTCP runs, however, rainfall inputs for 2015 were hourly summaries over a grid of 24 cells while the inputs for 1988-1990 were hourly summaries for only nine gauges. The 2015 rainfall data was acquired

from OneRain. Data were available in 5 minute summaries, but were aggregated to hourly totals to maintain consistency with the Average Year runs.

EMCs: Stormwater EMCs for both the 2015 and Average Year runs were based on outfall monitoring data collected by several monitoring programs between 1983 and 2000.

Lateral:
Flow: Lateral Stormwater flow, or direct drainage, was based on the use of the Simple Method using hourly rainfall at the nearest gauge (Average Year) and most central grid cell (2015). Land use characteristics were not adjusted for 2015 to maintain consistency with the LTCP runs.

EMCs: Stormwater EMCs for both the 2015 and Average Year runs were based on monitoring data collected by several monitoring programs between 1983 and 2000.

Point Sources:
Flow: Flow from Blue Plains is based on the collection system model output described in the *Collection System Model Documentation*. In the Average Year model runs, the Alexandria and Arlington wastewater treatment plant flows are described by a single annual rate. In the 2015 runs, Alexandria and Arlington are characterized by monthly average flows.

EMCs: EMCs from Blue Plains are characterized by the discharge limits in the NPDES Permit. In the Average Year model runs, the Alexandria and Arlington wastewater treatment plant EMCs are described by an annual mean discharge concentration. In the 2015 runs, Alexandria and Arlington are characterized by monthly mean discharge concentrations.

Tributaries:
Flow: In the Average Year runs, flow rates for the tributaries were taken from gauged monitoring, modeling, or area weighted scaling, as described in the LTCP tech memoranda. In the 2015 runs, no gauge or applicable models were available, so the flows were scaled to the nearest mainstem flow using a factor derived from the mean flow ratio during the Average Year inputs.

EMCs: The Average and 2015 model runs utilized MWCOG monitoring data taken on Piscataway Creek and Rock Creek for the remaining tributaries. These assumptions are documented in the LTCP technical memoranda.

Table 2: Flow and EMC updates for the PCM model runs. Categories with updates for the PCM Runs are highlighted in green.

Source	Component	2015 Model Runs (PCM)	Average Year Model Runs (PCM)	LTCP Model Predictions
CSO	Flow	Recalibrated model since 2006. Runoff based on land-cover, also higher pervious n results in lower peak flows for large events. New DWF distribution, handling of san & boundary wet weather flows via regressions. Rainfall for 2015.	Recalibrated model since 2006. Runoff based on land-cover, also higher pervious n results in lower peak flows for large events. New DWF distribution, handling of san & boundary wet weather flows via regressions. Rainfall for 1988-1990.	Original MOUSE model. Runoff based on land-use categories, small pervious n resulted in higher peak flows during large events. WW influence in san & boundary sheds represented by peaking factors.
	EMC	1979-1980 O'Brien & Gere; 1999 @ NEB Swirl Facility; 1999-2000 EPMC-III sampling	1979-1980 O'Brien & Gere; 1999 @ NEB Swirl Facility; 1999-2000 EPMC-III sampling	1979-1980 O'Brien & Gere; 1999 @ NEB Swirl Facility; 1999-2000 EPMC-III sampling
Upstream	Flow	USGS gauges for 2015 (RC: Sherrill Drive; POT: Little Falls, MD; ANA: NE Branch + NW Branch)	USGS gauges for 1988-1990 (RC: Sherrill Drive; POT: Little Falls, MD; ANA: NE Branch + NW Branch)	USGS gauges for 1988-1990 (RC: Sherrill Drive; POT: Little Falls, MD; ANA: NE Branch + NW Branch)
	EMC	2015 targeted monitoring data for bacteria, TSS, CBOD, Chlorophyll a. Monthly mean DO concentrations.	Data at boundary locations from MWCOG since early 1980s. Monthly DO concentrations based on recorded mean % saturation.	Data at boundary locations from MWCOG since early 1980s. Monthly DO concentrations based on recorded mean % saturation.
Stormwater Loads	Flow	MikeUrban output using 2015 hourly rainfall time series from 24 grids over the MS4 (OneRain). Did not change land use or runoff characteristics.	MikeUrban output using nine hourly rainfall gauges.	MikeUrban output using nine hourly rainfall gauges.

Source	Component	2015 Model Runs (PCM)	Average Year Model Runs (PCM)	LTCP Model Predictions
	EMC	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III
Lateral Loads	Flow	Simple method using 2015 hourly rainfall at single gauge. Did not change land use or runoff characteristics from LTCP models.	Simple method using hourly rainfall.	Simple method using hourly rainfall.
	EMC	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III	1983 NURP samples; 1994-1995 Part 2B SW Permit Applications; 1999-2000 EPMC-III
Point Source Loads	Flow	Blue Plains: CSO Model Output; Alexandria/Arlington: 2015 mean monthly flow	Blue Plains: CSO Model Output; Alexandria/Arlington: Single annual average flow rate	Blue Plains: CSO Model Output; Alexandria/Arlington: Single annual average flow rate
	EMC	Blue Plains: NPDES Permit; Alexandria: 2015 mean monthly concentrations; Arlington: NPDES	Blue Plains: NPDES Permit Alexandria: NPDES permit; Arlington: NPDES permit	Blue Plains: NPDES Permit Alexandria: NPDES permit; Arlington: NPDES permit
Tributaries	Flow	Scaled against 2015 mainstem flows using mean daily flow ratio approximated from LTCP inputs	Gauged, Hydrologic Simulation Program-FORTRAN generated, and drainage area scaled flows	Gauged, Hydrologic Simulation Program-FORTRAN generated, and drainage area scaled flows
	EMC	Rock Creek and Piscataway Creek water quality as surrogates (assumed from MWCOG)	Rock Creek and Piscataway Creek water quality as surrogates (assumed from MWCOG)	Rock Creek and Piscataway Creek water quality as surrogates (assumed from MWCOG)

2.3 Model vs. Monitoring Data Review

2.3.1 Seasonal Comparisons

The goal of a seasonal comparison was to gauge whether the receiving water model results were within the range expected based on the quality of calibration in the LTCP. Performance of the model is dependent on its ability to reflect the conditions evaluated through the use of environmental grab samples. Model results that incorporated changes made to the 2015 conditions were compared to the monitoring

data that was collected between January 2015 and December 2015 to verify that the updates improved the model's ability to reflect this period of time. The model calculates concentration for every hour of the analysis time frame and aggregates those results into daily mean concentrations. Since single grab samples do not compare appropriately to daily mean conditions, comparisons between the model and monitoring data were made on seasonal scales or based on wet and dry conditional breakdowns.

Overall, the model is producing logical results within the same degree of error observed in the LTCP model runs. Despite the overall strong comparison, there are specific instances in which the modeling and monitoring data are quite different. For example, Porter Street modeling concentrations of E. *coli* are considerably higher in the spring than what was monitored (Figure 4; Table 3). This difference, however, can be explained by the sampling regime during the spring in Rock Creek. Only 5 of the 21 samples were characterized as wet conditions by the field teams. Further, four of those wet weather samples were less than 130 MPN/100 mL (which is less than the annual wet weather geomean). This suggests that the 95 MPN/100 mL spring geomean from the monitoring set is reflective of dry conditions, whereas the modeled results characterize the peaks in bacteria concentrations during all wet conditions that occurred over the course of the spring. Most often, the maximum concentrations in the model are larger than what was monitored, again indicating that the monitoring effort did not capture the peak concentrations during large CSO events.

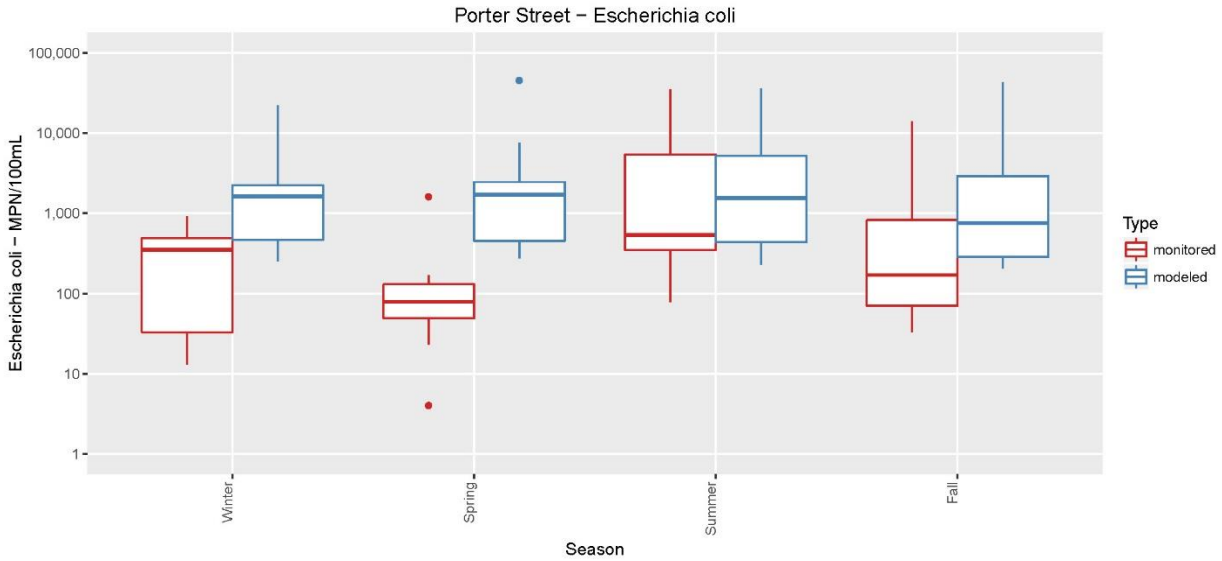


Figure 4: Seasonal Comparison of modeled and monitoring bacteria concentrations at Porter Street (Rock Creek model).

Table 3: Rock Creek model segmentation and 2015 monitoring locations.

E. coli (Rock Creek) - Spring								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	393	130	1615	130	1708	79	1427	225
Minimum	364	33	284	23	277	4	220	33
Maximum	2010	9200	5438	1600	45075	1600	55814	5400
25th Percentile	372	79	429	49	452	49	390	130

75th Percentile	1982	350	2174	240	2443	130	2328	428
Geomean	802	189	1121	121	1238	95	1127	256
n	92	19	92	21	92	21	92	22

The differences in the modeling and monitoring geomeans was observed in the LTCP as well. The Anacostia tech memo states "… differences are seen in comparing the model and monitoring data, but any changes to the calibration parameters (decay and temperature coefficient) result in an inferior calibration." (page 4-2). This suggests that the LTCP, and 2015 model, are within their limits of precision.

The differences in concentration even at the boundary segments, where 2015 data has been collected, but this is to be expected. Using Boundary Bridge as an example, it is clear that the model is predicting concentrations larger than what was monitored in the Spring, however, this simply reflects that the model inputs are derived from an annual geomean (for either wet or dry conditions), while the monitoring results display the intersample monitoring variability and intraseason differences in the conditions sampled (Figure 5). It was also previously described that the Spring monitoring set is heavily biased towards dry sampling conditions and that there is a higher proportion of wet conditions sampled in the summer, but the flow separation in Rock Creek indicates that the conditions in each season were relatively evenly split between dry/wet conditions. The bias towards dry weather samples was also observed in Anacostia and Potomac.

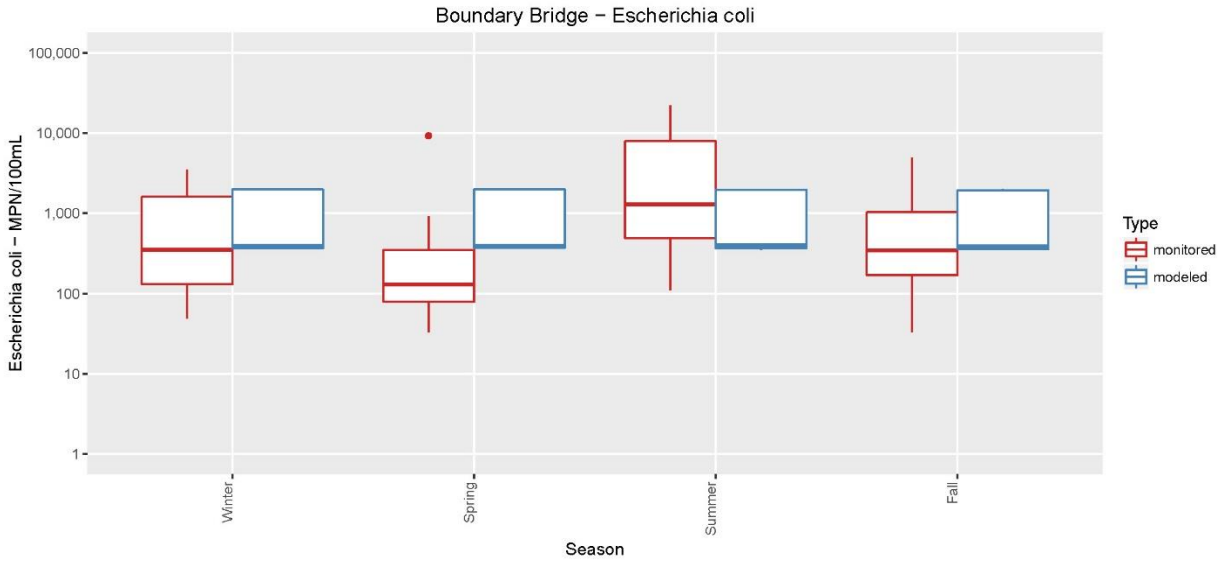


Figure 5: Seasonal Comparison of modeled and monitoring bacteria concentrations at Boundary Bridge (Rock Creek model).

A full set of seasonal comparisons are presented in figures and tables in Appendix B-D for each mainstem.

APPENDIX A: Event Mean Concentrations

		Potomac		Rock Creek		Anacostia	
		2015	AvgYear (LTCP)	2015	AvgYear (LTCP)	2015	AvgYear (LTCP)
TSS (mg/L)	Upstream NE (wet)	-	-	-	-	-	474.6
	Upstream NW (wet)	-	-	-	-	-	310.8
	Upstream NE (dry)	-	-	-	-	-	7.3
	Upstream NW (dry)	-	-	-	-	-	3.3
	Upstream (Wet)	19.4	35.0 - Q < 7500 46.5 - Q < 20000 104 - Q < 35000 212 - Q > 35000	13.9	94	44.7	-
	Upstream (Dry)	7.9	4.5 - Q < 2000 7.6 - Q < 5000 10 - Q < 8700 15.4 - Q >8700	6.9	12	9.4	-
	Stormwater	94	94	94	94	94	94
	CSO 009,010,011,011a	-	-	-	-	147	147
	CSO 012	-	-	-	-	186	186
	CSO 019 Effluent	-	-	-	-	112	112
	CSO 019 Bypass	-	-	-	-	182	182
	CSO (All Others)	130	130	130	130	171	171
	Alexandria**	0.5	7	-	-	-	-
	Arlington	7	7	-	-	-	-
	BP - 001	130.1	130.1	-	-	-	-
	BP - 002	7	7	-	-	-	-
Fecal (MPN/100 ml)	Upstream NE (wet)	-	-	-	-	-	8,000
	Upstream NW (wet)	-	-	-	-	-	8,000
	Upstream NE (dry)	-	-	-	-	-	500
	Upstream NW (dry)	-	-	-	-	-	500
	Upstream (Wet)	212	350	2,425	2,100	2,616	-
	Upstream (Dry)	50	60	597	280	1,143	-
	Stormwater	28,265	28,265	28,265	28,265	28,265	28,265
	CSO 009,010,011,011a	-	-	-	-	939,270	939,270
	CSO 012	-	-	-	-	939,270	939,270
	CSO 019 Effluent	-	-	-	-	191,309	191,309

		Potomac		Rock Creek		Anacostia	
		2015	AvgYear (LTCP)	2015	AvgYear (LTCP)	2015	AvgYear (LTCP)
	CSO 019 Bypass	-	-	-	-	939,270	939,270
	CSO (All Others)	939,270	939,270	939,270	939,270	939,270	939,270
	Alexandria**	6	1.8	-	-	-	-
	Arlington	1.8	1.8	-	-	-	-
	BP - 001	70,206	70,206	-	-	-	-
	BP - 002	200	200	-	-	-	-
E. coli (MPN/100ml)	Upstream NE (wet)	-	-	-	-	-	3,500
	Upstream NW (wet)	-	-	-	-	-	3,500
	Upstream NE (dry)	-	-	-	-	-	200
	Upstream NW (dry)	-	-	-	-	-	200
	Upstream (Wet)	133	190	1,476	900	2,248	-
	Upstream (Dry)	35	30	449	230	754	-
	Stormwater	16,238	16,238	16,238	16,238	16,238	16,238
	CSO 009,010,011,011a	-	-	-	-	686,429	686,429
	CSO 012	-	-	-	-	686,429	686,429
	CSO 019 Effluent	-	-	-	-	122,011	122,011
	CSO 019 Bypass	-	-	-	-	686,429	686,429
	CSO (All Others)	686,429	686,429	686,429	686,429	686,429	686,429
	Alexandria**	3	0.9	-	-	-	-
	Arlington	0.9	0.9	-	-	-	-
	BP - 001	51,250	51,250	-	-	-	-
	BP - 002	126	126	-	-	-	-
Chla (ug/L)	Upstream NE (wet)	-	-	-	-	-	1.00
	Upstream NW (wet)	-	-	-	-	-	1.00
	Upstream NE (dry)	-	-	-	-	-	1.09
	Upstream NW (dry)	-	-	-	-	-	1.37
	Upstream (Wet)	-	-	-	-	13.46	-
	Upstream (Dry)	-	-	-	-	12.15	-
	Stormwater	-	-	-	-	-	-
	CSO 009,010,011,011a	-	-	-	-	-	-
	CSO 012	-	-	-	-	-	-
	CSO 019 Effluent	-	-	-	-	-	-
	CSO 019 Bypass	-	-	-	-	-	-
	CSO (All Others)	-	-	-	-	-	-
	Alexandria**	-	-	-	-	-	-
	Arlington	-	-	-	-	-	-

		Potomac		Rock Creek		Anacostia	
		2015	AvgYear (LTCP)	2015	AvgYear (LTCP)	2015	AvgYear (LTCP)
	BP - 001	-	-	-	-	-	-
	BP - 002	-	-	-	-	-	-
CBOD5 (mg/L)	Upstream NE (wet)	-	-	-	-	-	5.55
	Upstream NW (wet)	-	-	-	-	-	8.02
	Upstream NE (dry)	-	-	-	-	-	1.08
	Upstream NW (dry)	-	-	-	-	-	1.00
	Upstream (Wet)	2.04	3.20	2.14	3.20	3.36	-
	Upstream (Dry)	2.27	2.70	2.26	2.70	2.44	-
	Stormwater	19	19	19	19	94	94
	CSO 009,010,011,011a	-	-	-	-	51	51
	CSO 012	-	-	-	-	74	74
	CSO 019 Effluent	-	-	-	-	39	39
	CSO 019 Bypass	-	-	-	-	34	34
	CSO (All Others)	36	36	36	36	53	53
	Alexandria**	14	2.0	-	-	-	-
	Arlington	2.0	2.0	-	-	-	-
	BP - 001	57	57	-	-	-	-
	BP - 002	5	5.0	-	-	-	-

**May represented, monthly values used as inputs

Dissolved Oxygen (all data in mg/L)	**Month:**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Upstream Anacostia	**2015**	13.0	13.5	13.1	11.1	6.9	7.2	6.7	5.7	5.4	8.9	9.0	9.6
	AvgYear	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat	90% Sat
Upstream Potomac	**2015**	14.6	13.3	11.3	7.6	8.3	8.4	8.2	8.3	10.0	11.4	12.2	14.5
	AvgYear	14.9	15.3	12.0	11.0	8.9	8.6	7.4	7.8	8.2	10.3	11.7	13.6
Storm-water	**2015**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	AvgYear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
CSO	**2015**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	AvgYear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Arlington	**2015**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	AvgYear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Alexandria	**2015**	9.9	9.6	9.4	9.2	8.5	8.0	8.0	7.8	7.4	8.2	8.2	8.7
	AvgYear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
BP01	**2015**	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	AvgYear	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
BP02	**2015**	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
	AvgYear	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8

APPENDIX B: Anacostia River

Anacostia – Fecal Coliform Bacteria

MPN Fecal Coliforms (Anacostia) - Winter								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	1780	790	1160	445	969	490	295	330
Minimum	161	170	129	79	53	79	25	33
Maximum	19800	3500	13800	1100	11600	5400	6900	3500
25th Percentile	1007	230	625	185	408	130	142	130
75th Percentile	3425	1300	2995	823	2640	920	754	700
Geomean	1935	718	1273	346	918	483	331	310
n	99	9	99	8	99	9	99	9

MPN Fecal Coliforms (Anacostia) - Spring								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	1480	330	899	230	531	130	144	230
Minimum	165	23	21	33	12	33	6	23
Maximum	28700	35000	14700	16000	3160	1600	925	2400
25th Percentile	745	230	262	130	219	95	65	48
75th Percentile	3838	490	2165	490	1090	263	383	370
Geomean	1685	398	771	319	444	156	136	186
n	92	25	92	25	92	12	92	16

MPN Fecal Coliforms (Anacostia) - Summer								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	1022	2950	574	700	364	1400	84	260
Minimum	65	130	12	14	12	23	2	17
Maximum	25200	54000	19800	160000	92100	35000	33100	54000
25th Percentile	381	565	103	170	115	230	24	79
75th Percentile	4435	13000	2330	5400	1313	7900	382	2800
Geomean	1281	2734	514	925	385	1318	98	599
n	92	26	92	25	92	21	92	21

MPN Fecal Coliforms (Anacostia) - Fall								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	903	790	1670	330	2030	475	461	700
Minimum	26	230	8	49	3	31	3	49
Maximum	16500	35000	52600	35000	111000	13000	38600	92000
25th Percentile	517	330	525	130	470	130	144	130
75th Percentile	2655	5400	4465	7900	8360	2375	4025	1550
Geomean	1104	1696	1449	642	1826	544	656	506
n	91	25	91	25	91	24	91	23

Anacostia – E. *coli*

E. coli (Anacostia) - Winter								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	1220	790	813	445	618	310	183	330
Minimum	97	170	77	49	34	33	16	27
Maximum	15200	3500	8270	920	7980	1400	4980	3500
25th Percentile	666	230	418	102	260	102	89	140
75th Percentile	2745	1300	1885	790	1650	920	495	1100
Geomean	1356	635	824	287	586	261	212	328
n	99	9	99	8	99	8	99	9

E. coli (Anacostia) - Spring								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	956	330	579	230	340	79	90	200
Minimum	98	23	13	33	9	33	4	23
Maximum	16700	4000	8460	16000	1860	1600	597	1300
25th Percentile	490	180	168	65	129	64	42	45
75th Percentile	2795	648	1343	385	692	340	238	445
Geomean	1164	340	495	226	283	133	87	157
n	92	22	92	24	92	11	92	14

E. coli (Anacostia) - Summer								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	713	1600	342	700	229	490	51	170
Minimum	42	79	8	9	8	13	1	17
Maximum	16700	35000	14300	92000	66900	17000	24200	54000
25th Percentile	248	490	69	130	66	79	15	70
75th Percentile	3043	7900	1433	1400	790	1700	245	1400
Geomean	857	1810	322	542	245	492	62	343
n	92	25	92	25	92	21	92	21

E. coli (Anacostia) - Fall								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	571	790	1080	220	1320	220	310	240
Minimum	17	230	5	33	2	17	2	27
Maximum	11100	13000	36100	17000	80200	13000	28100	54000
25th Percentile	337	330	343	79	282	79	90	79
75th Percentile	1810	2300	3025	2200	5760	1300	2910	828
Geomean	738	1008	950	340	1225	315	446	302
n	91	25	91	25	91	25	91	24

Anacostia – CBOD5

CBOD5 (Anacostia) - Winter								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	2	1	1	1	1	1	1	1
Minimum	0	1	0	1	0	1	0	1
Maximum	16	4	7	4	4	4	2	4
25th Percentile	1	1	1	1	0	1	1	1
75th Percentile	3	1	2	1	1	1	1	1
Geomean	2	1	1	1	1	1	1	1
n	99	16	99	13	99	13	99	13

CBOD5 (Anacostia) - Spring								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	2	1	1	1	1	1	1	1
Minimum	0	1	0	1	0	1	1	1
Maximum	16	19	9	20	4	15	3	12
25th Percentile	1	1	1	1	1	1	1	1
75th Percentile	4	3	2	3	2	1	1	1
Geomean	2	2	1	2	1	1	1	2
n	92	26	92	25	92	28	92	27

CBOD5 (Anacostia) - Summer								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	3	1	4	1	3	1	2	1
Minimum	0	1	0	1	0	1	0	1
Maximum	19	17	9	18	9	11	5	8
25th Percentile	2	1	2	1	2	1	2	1
75th Percentile	5	4	5	3	4	3	3	3
Geomean	3	2	3	2	3	2	2	2
n	92	30	92	29	92	28	92	30

CBOD5 (Anacostia) - Fall								
	Bladensburg		Benning Road		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	3	1	2	1	2	1	1	1
Minimum	0	1	0	1	0	1	0	1
Maximum	11	11	9	1	8	1	5	1
25th Percentile	1	1	1	1	1	1	1	1
75th Percentile	3	1	4	1	3	1	2	1
Geomean	2	1	2	1	1	1	1	1
n	91	24	91	25	91	25	91	25

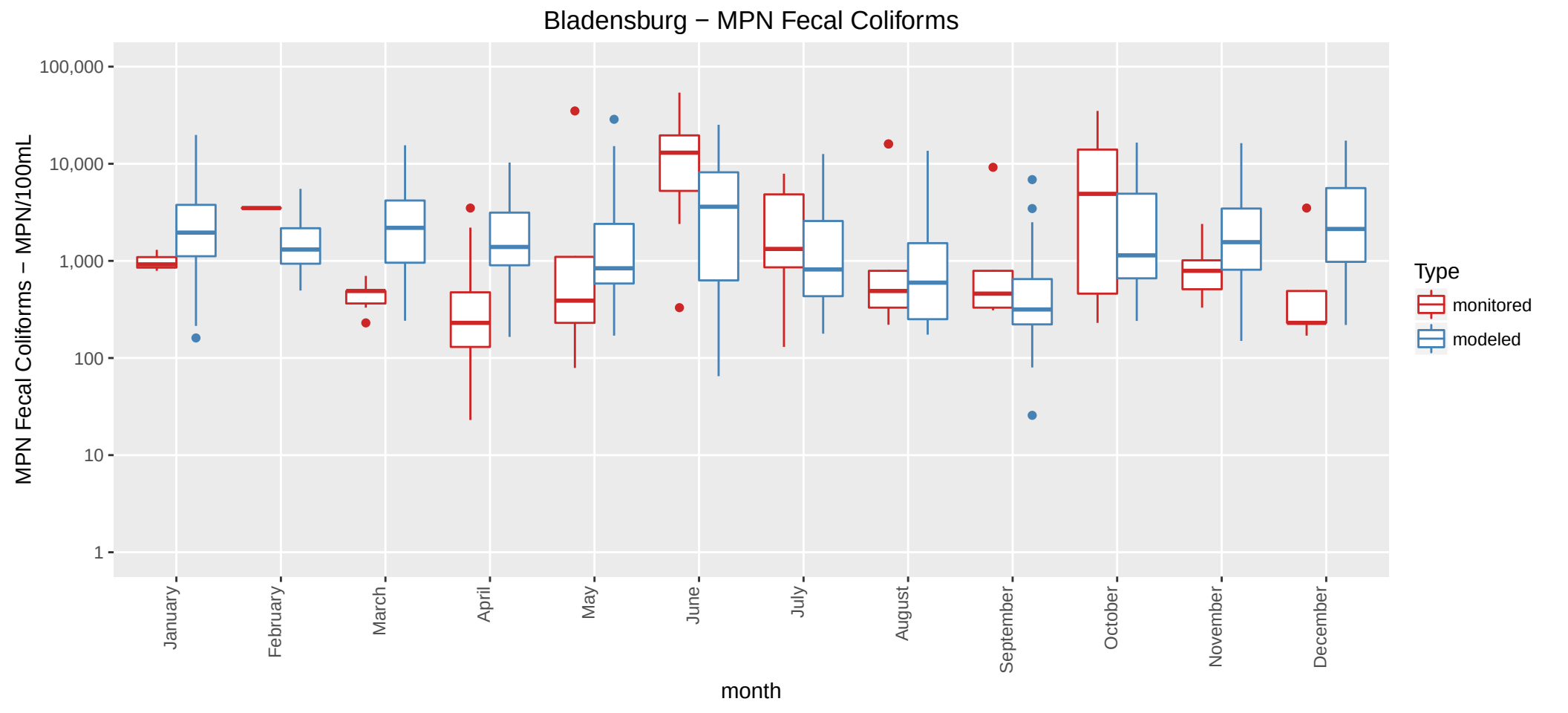
Potomac – Dissolved Oxygen

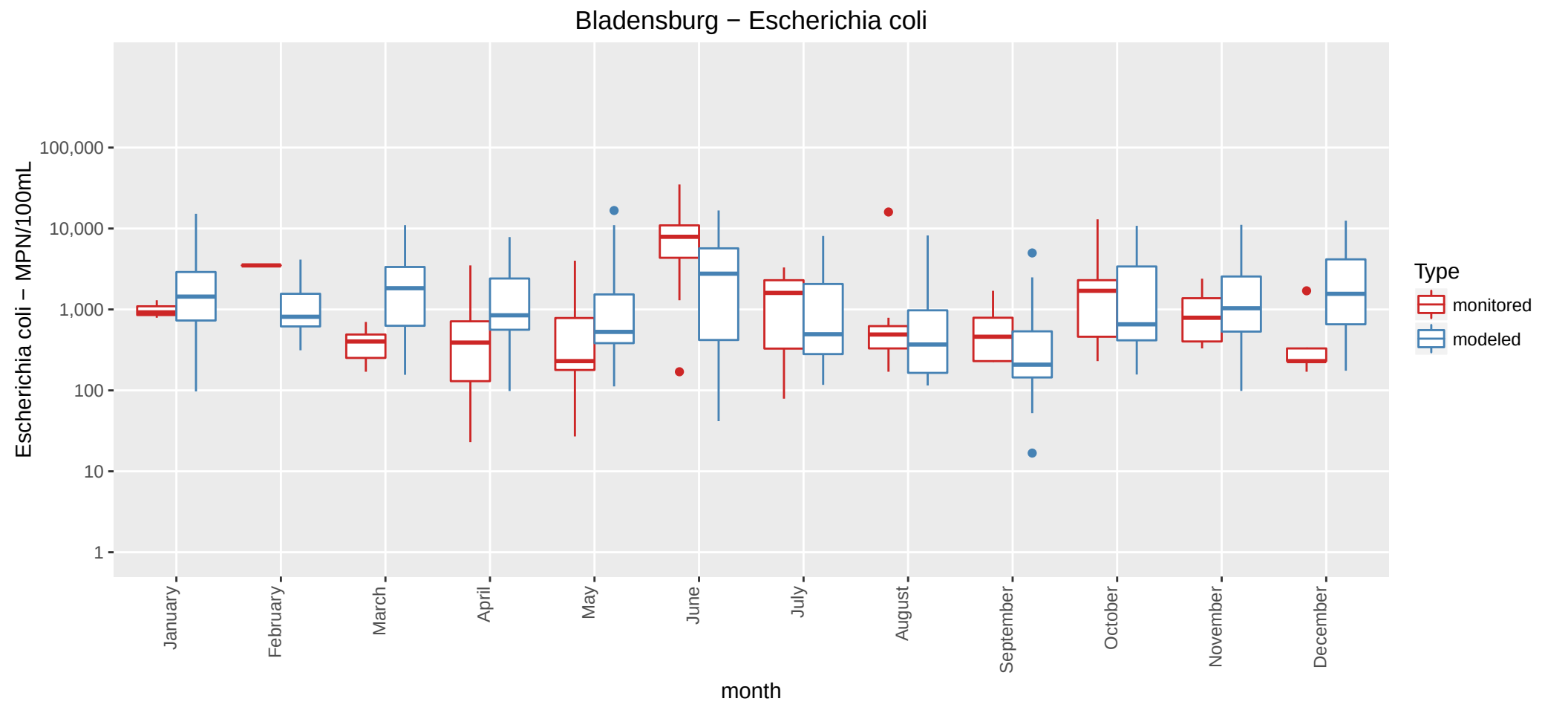
Dissolved Oxygen (Anacostia) - Winter						
	Bladensburg		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	11.8	12.7	10.7	11.5	11.1	11.7
Minimum	6.8	6.9	7.7	5.9	8.5	6.7
Maximum	13.9	14.7	12.2	13.0	12.0	14.0
25th Percentile	11.1	10.4	10.3	7.9	10.6	8.5
75th Percentile	12.4	13.4	11.1	12.2	11.5	13.1
Geomean	11.6	11.8	10.5	10.1	10.9	10.6
n	99	90	99	90	99	90

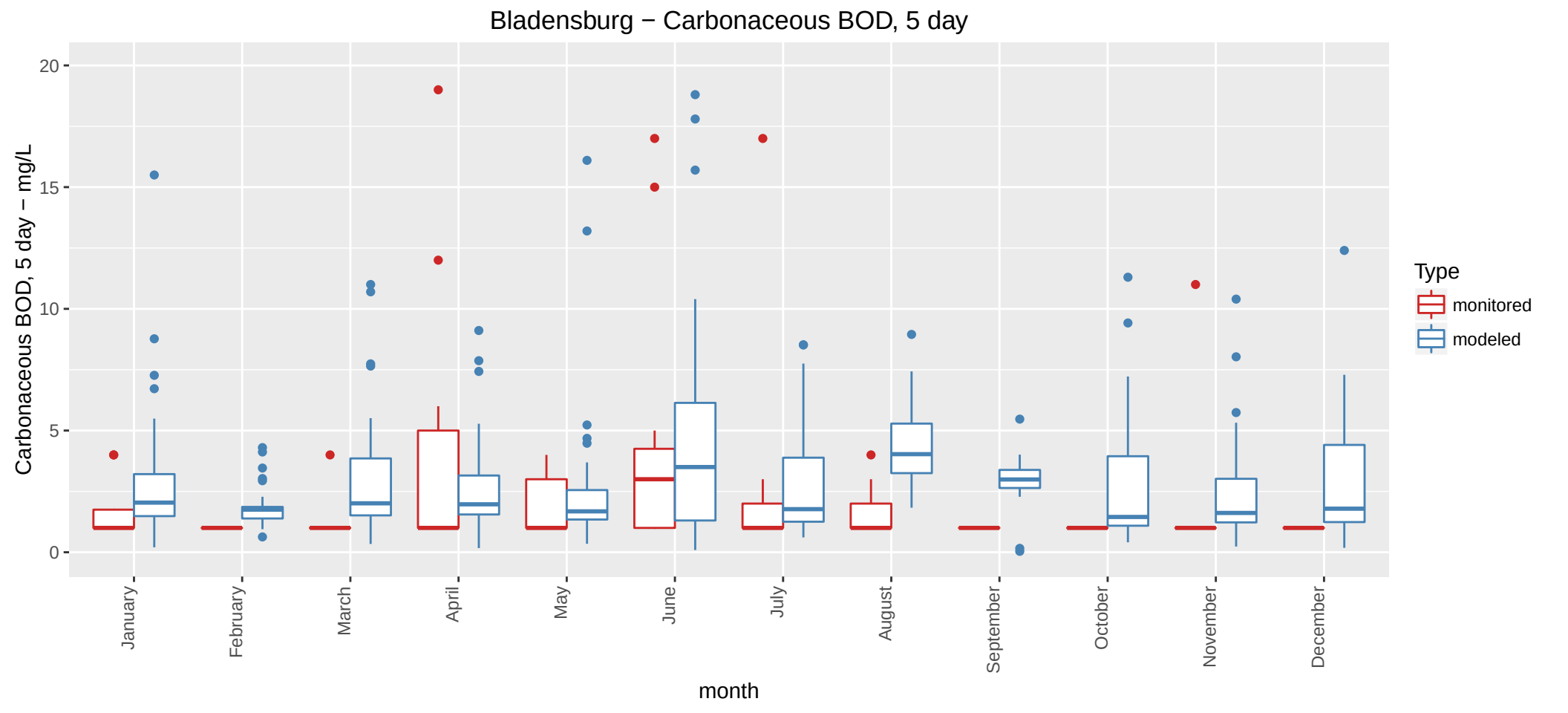
Dissolved Oxygen (Anacostia) - Spring						
	Bladensburg		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	8.2	11.1	6.1	6.9	6.9	7.5
Minimum	2.3	1.5	4.0	1.1	4.5	1.6
Maximum	11.1	14.2	9.8	12.5	9.7	13.4
25th Percentile	7.1	7.8	5.1	3.7	6.0	6.5
75th Percentile	9.2	12.8	7.8	10.1	8.5	10.1
Geomean	7.9	9.8	6.2	5.8	6.9	7.5
n	92	92	92	92	92	92

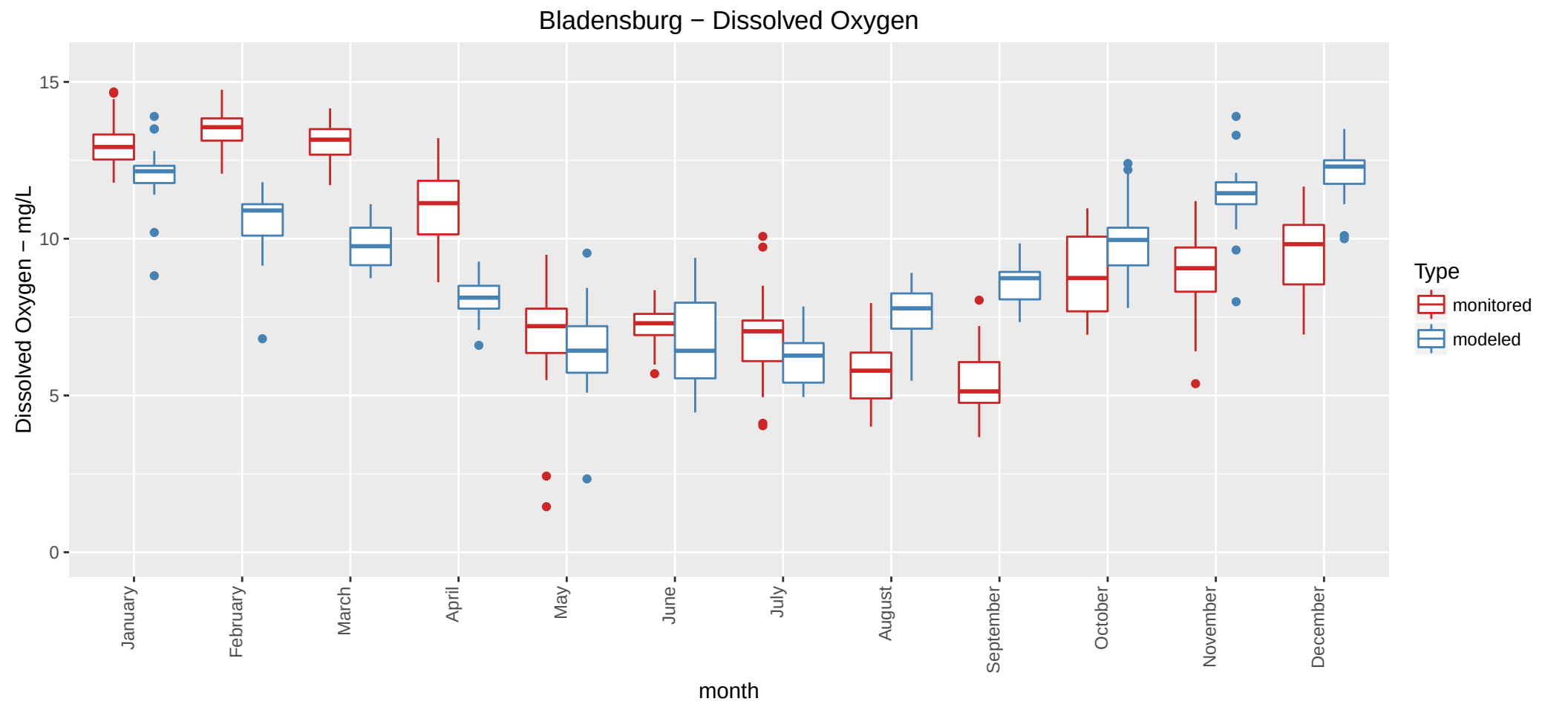
Dissolved Oxygen (Anacostia) - Summer						
	Bladensburg		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	6.8	6.9	5.8	3.5	5.6	3.9
Minimum	4.5	4.0	2.2	1.6	2.8	1.0
Maximum	9.4	10.1	7.9	6.6	6.7	5.8
25th Percentile	5.8	5.8	4.1	2.6	4.5	3.1
75th Percentile	7.9	7.3	6.8	4.2	6.2	4.5
Geomean	6.7	6.5	5.2	3.3	5.2	3.6
n	92	87	92	92	92	75

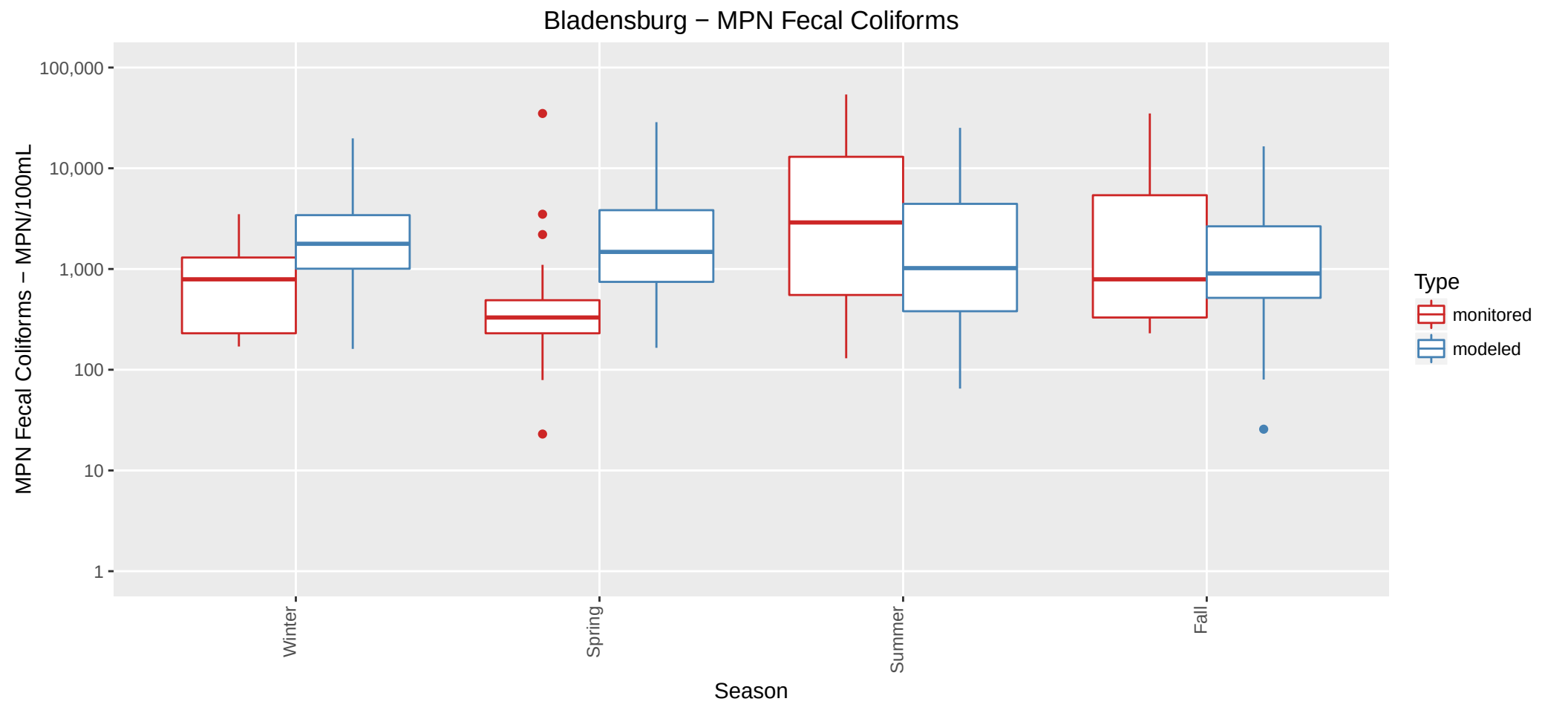
Dissolved Oxygen (Anacostia) - Fall						
	Bladensburg		Ana PA Ave		South Capitol	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	9.9	7.9	7.1	5.4	6.6	6.0
Minimum	7.3	3.7	4.9	3.3	4.9	2.6
Maximum	13.9	11.2	10.5	8.5	10.5	9.6
25th Percentile	8.8	6.0	6.2	4.3	6.2	5.1
75th Percentile	11.3	9.3	9.0	6.7	9.2	7.0
Geomean	9.9	7.5	7.3	5.3	7.2	5.7
n	91	91	91	91	91	91

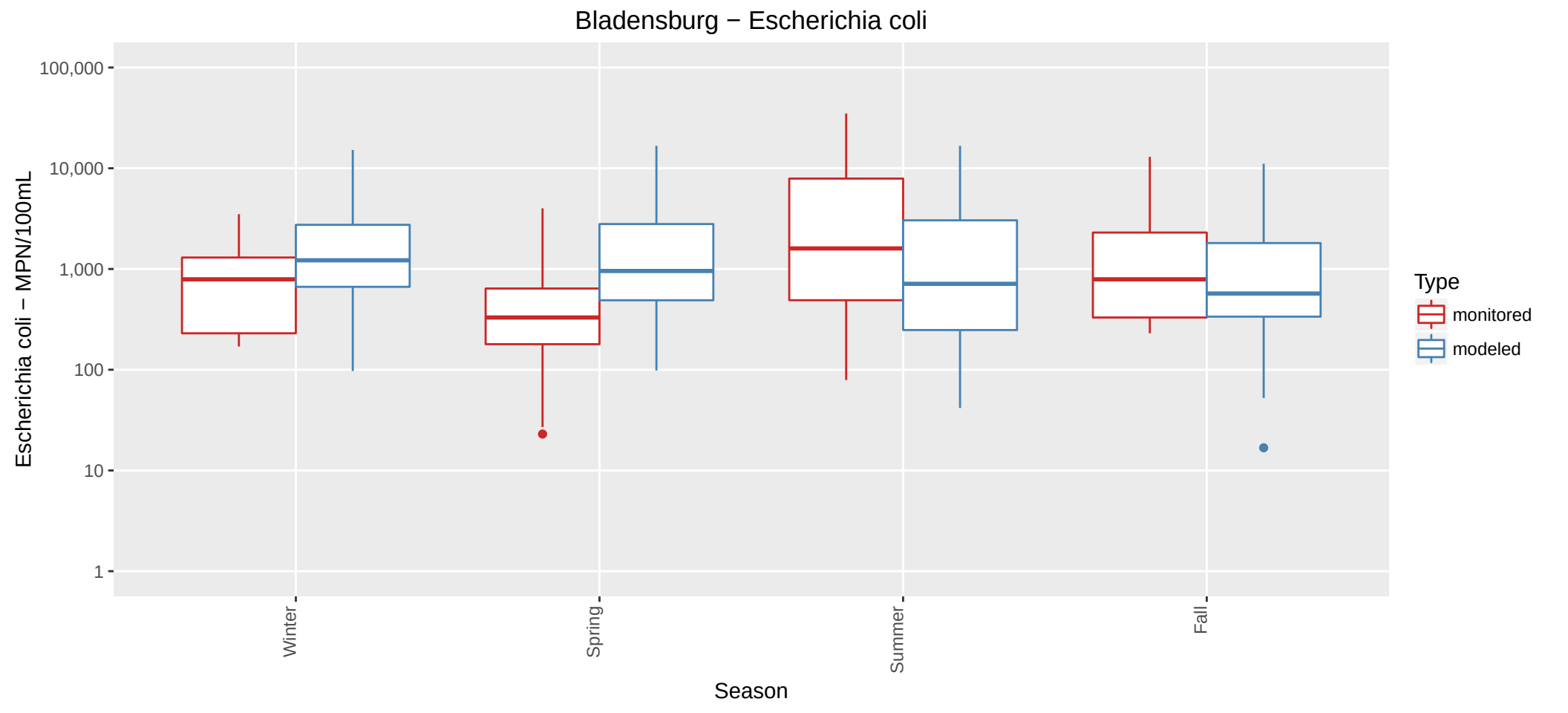

Bladensburg − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

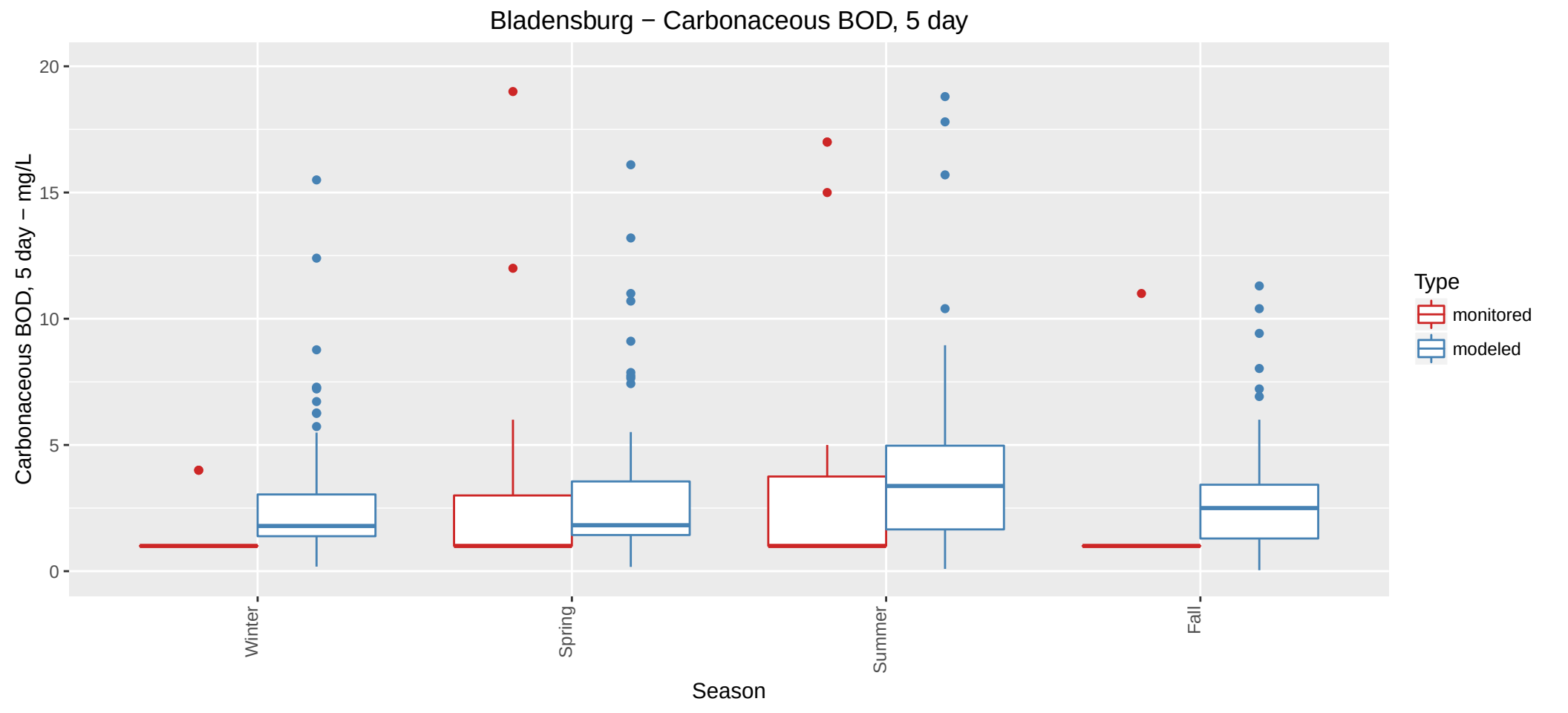

Bladensburg − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

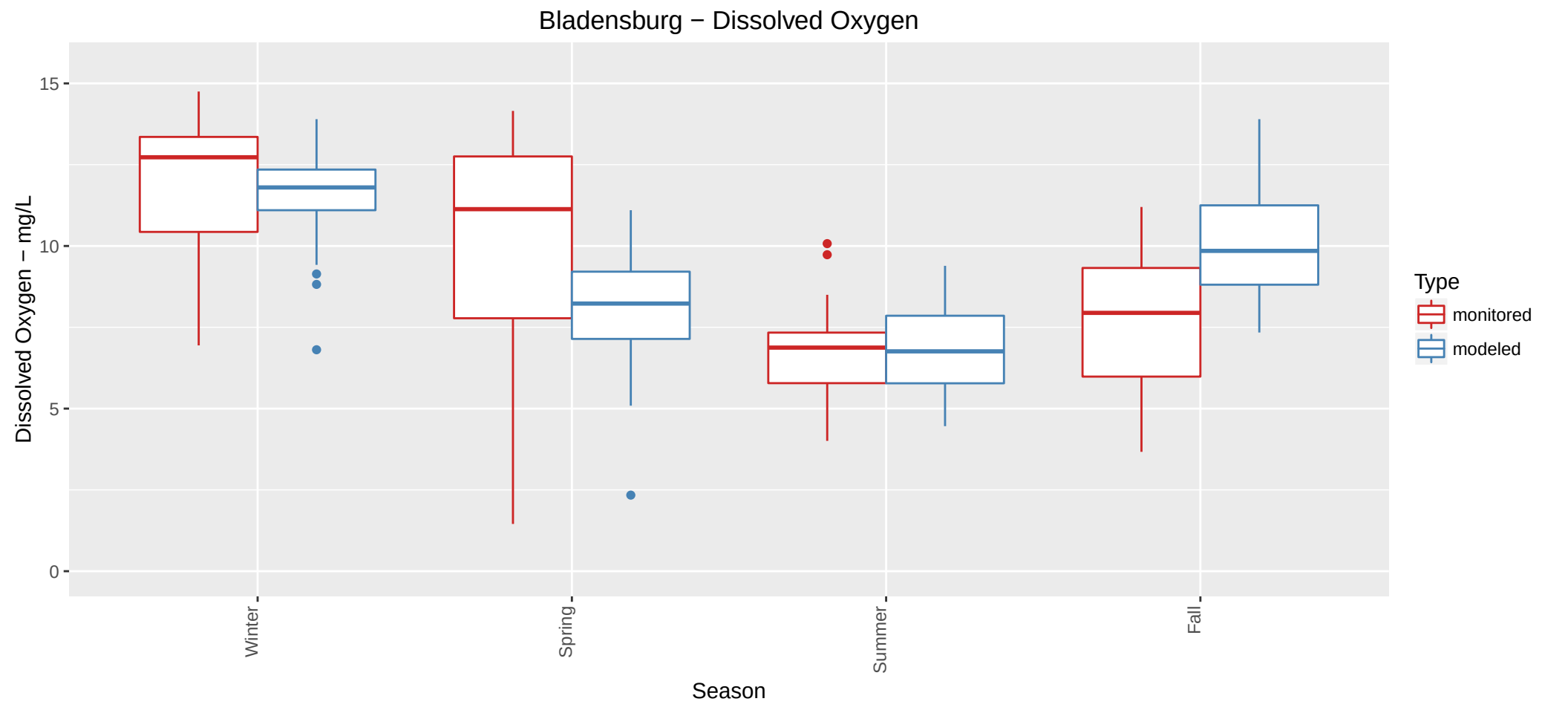

Bladensburg − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

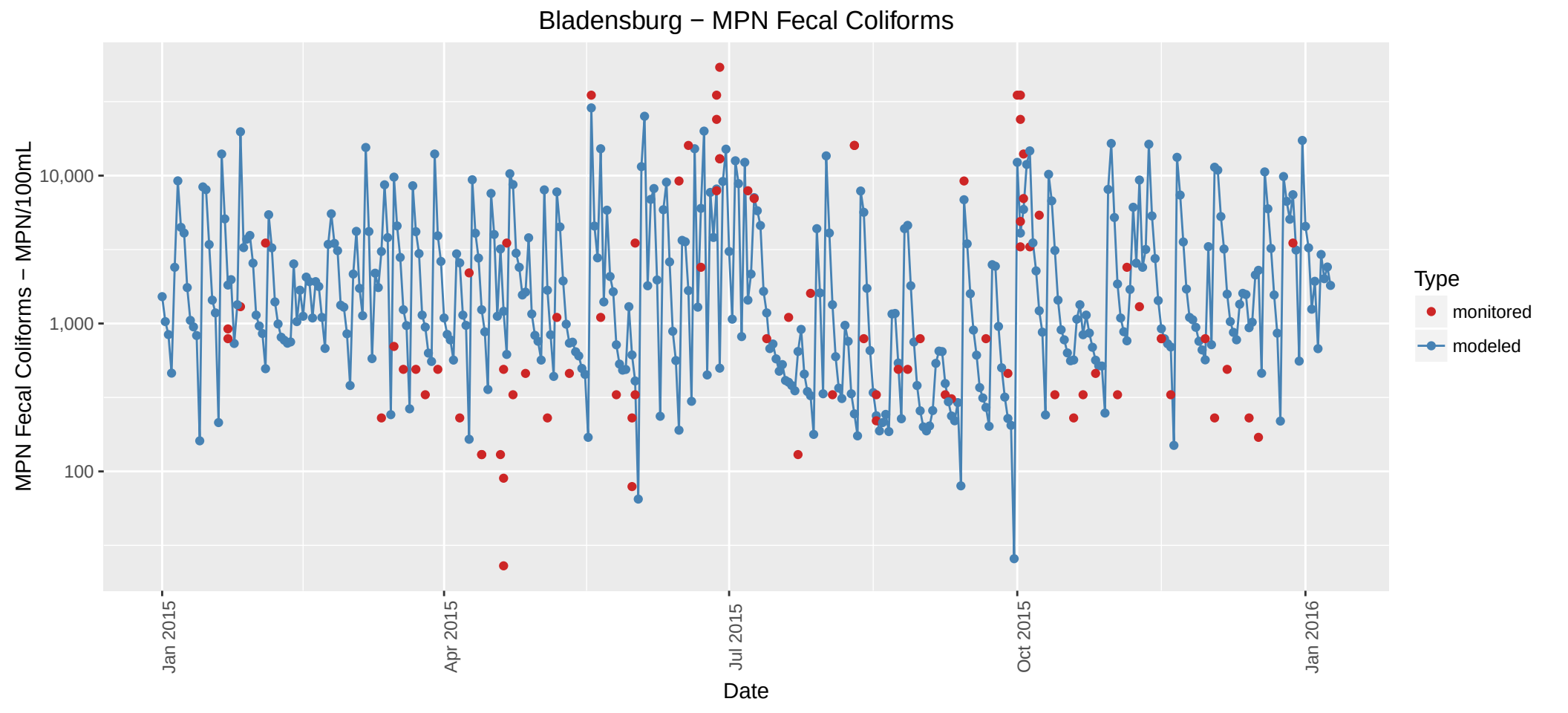

Bladensburg − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

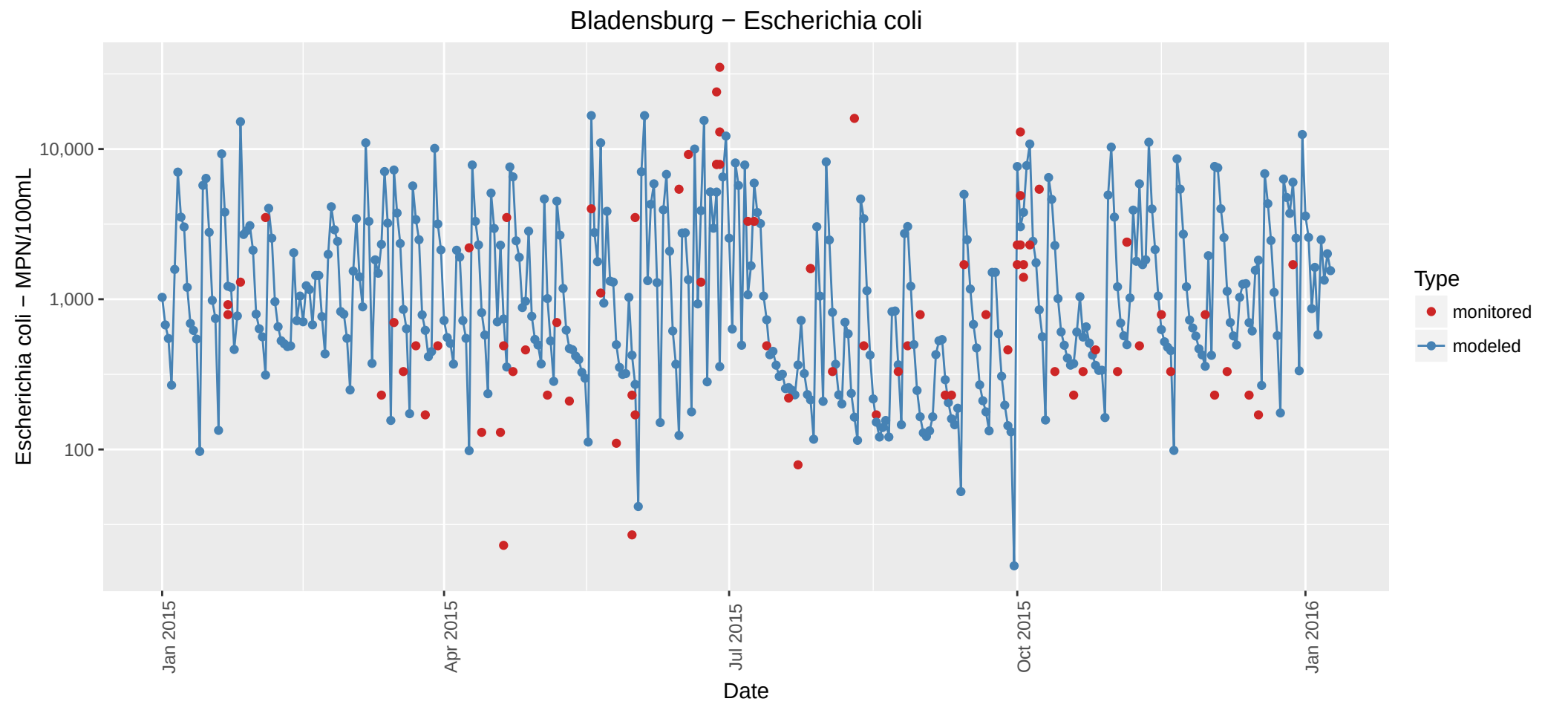

Bladensburg − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

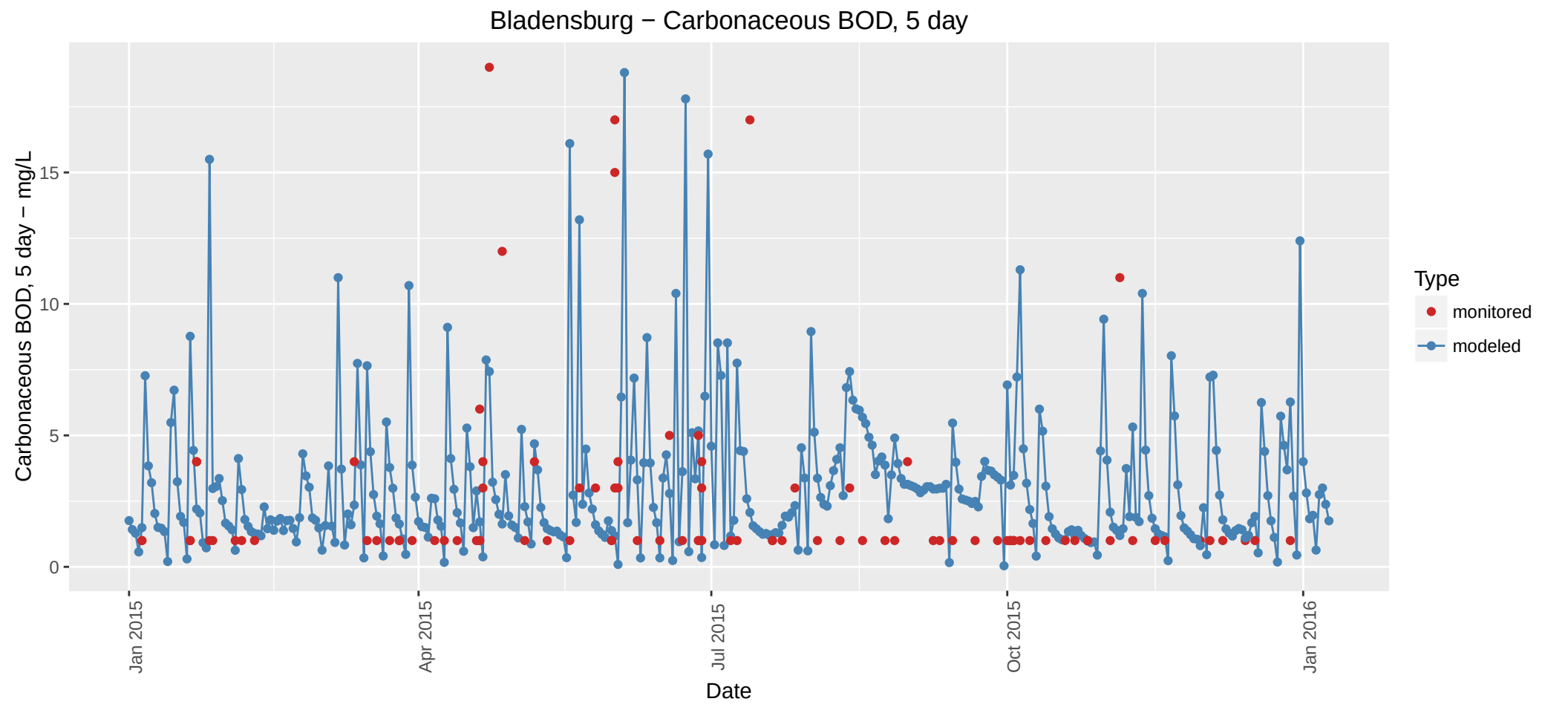

Bladensburg − Escherichia coli
100,000
10,000
1,000
100
10
1
Escherichia coli − MPN/100mL
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

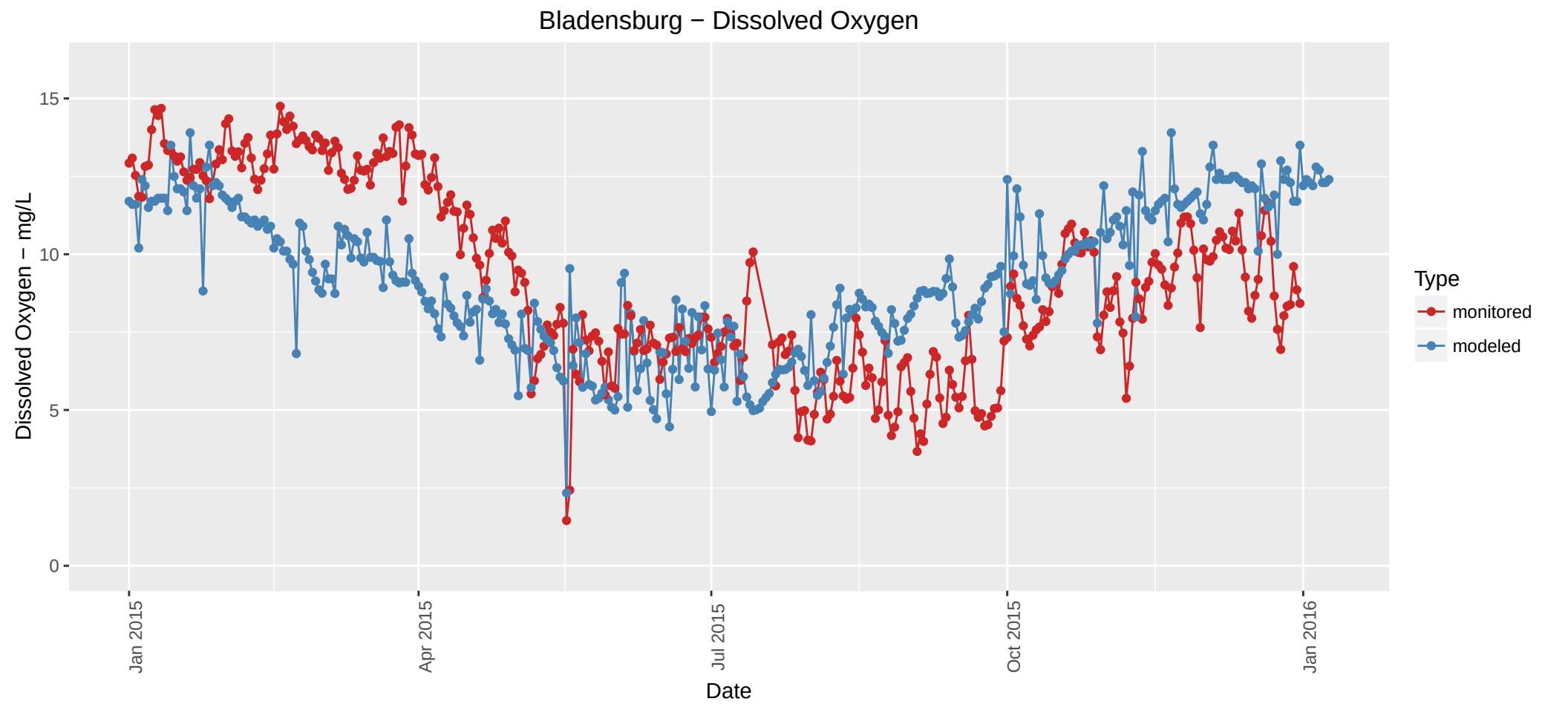

Bladensburg − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
20
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

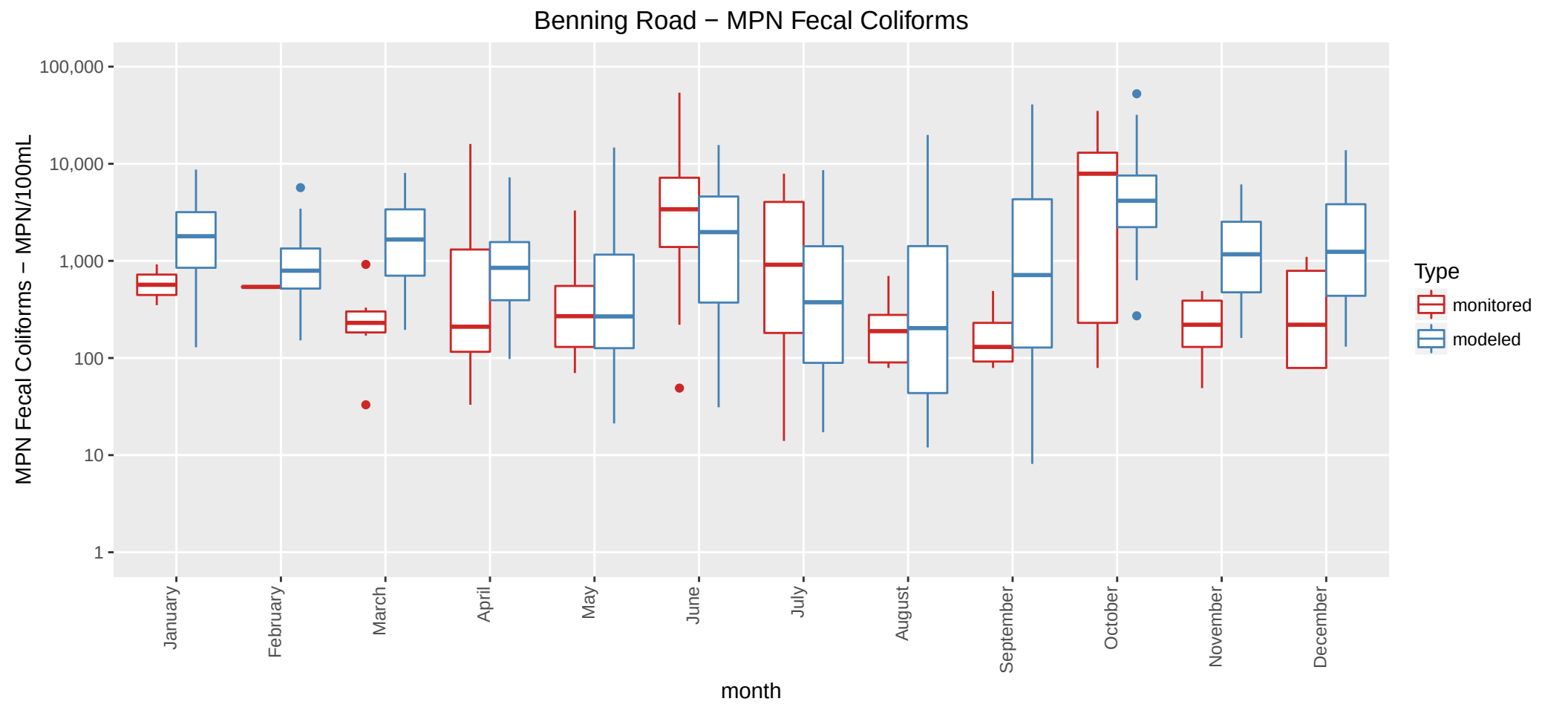

Bladensburg − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

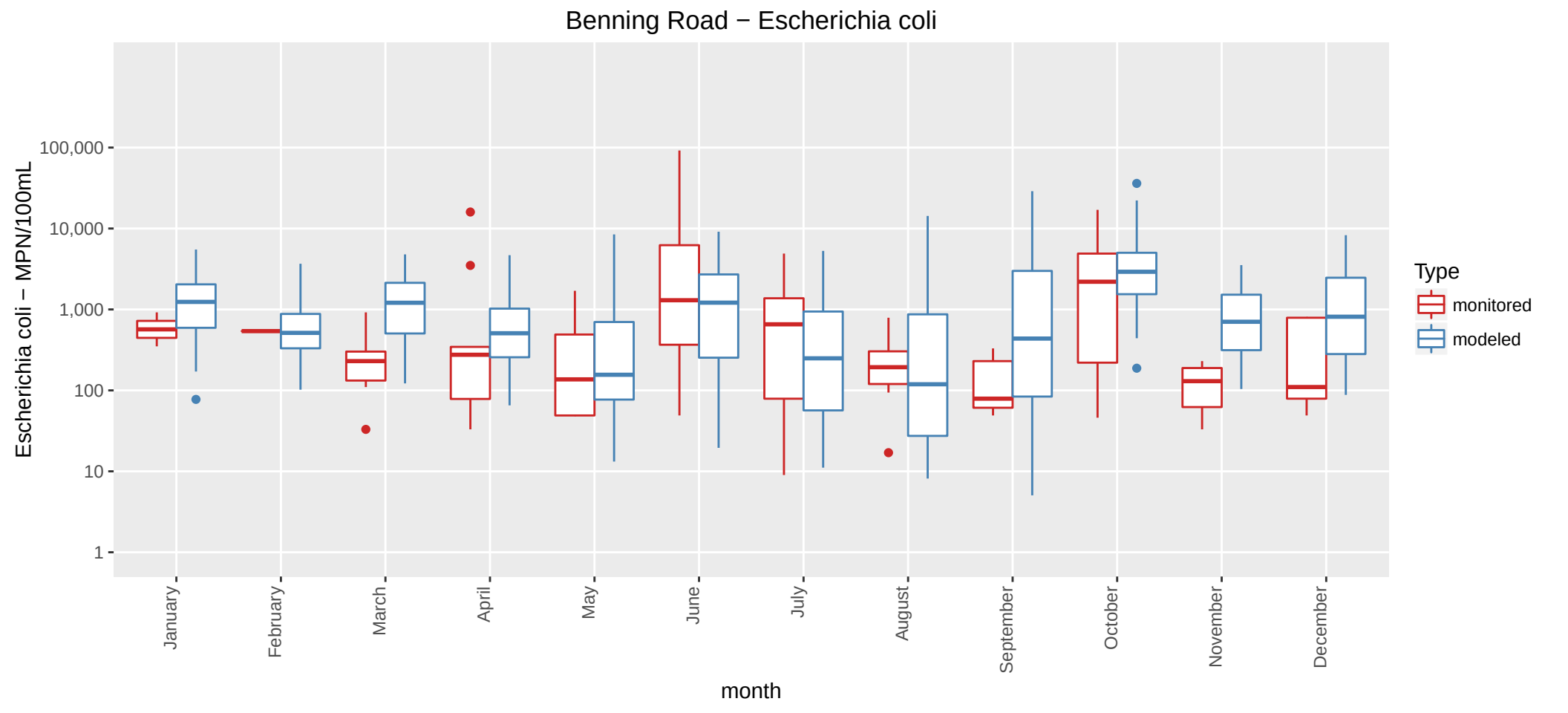

Bladensburg − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

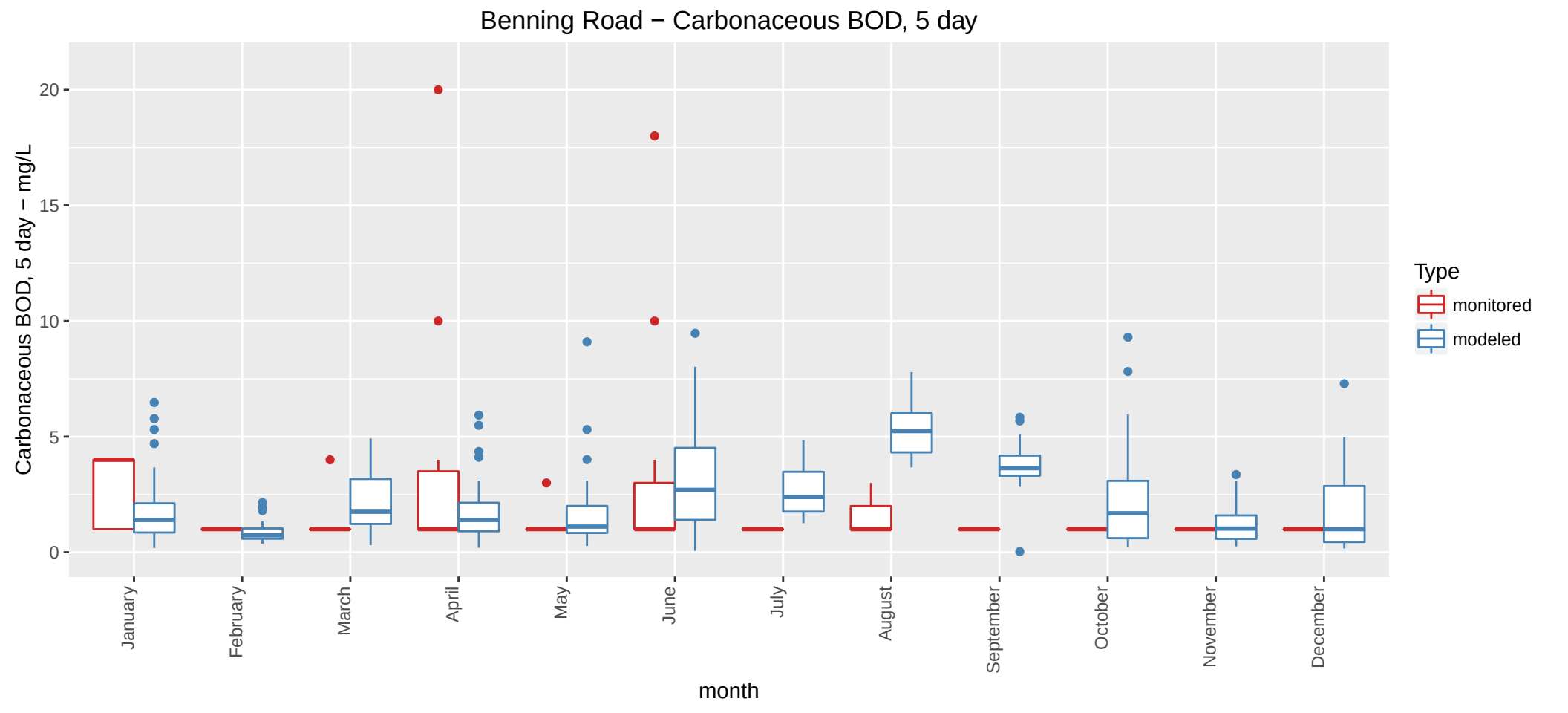

Bladensburg − Escherichia coli
Escherichia coli − MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

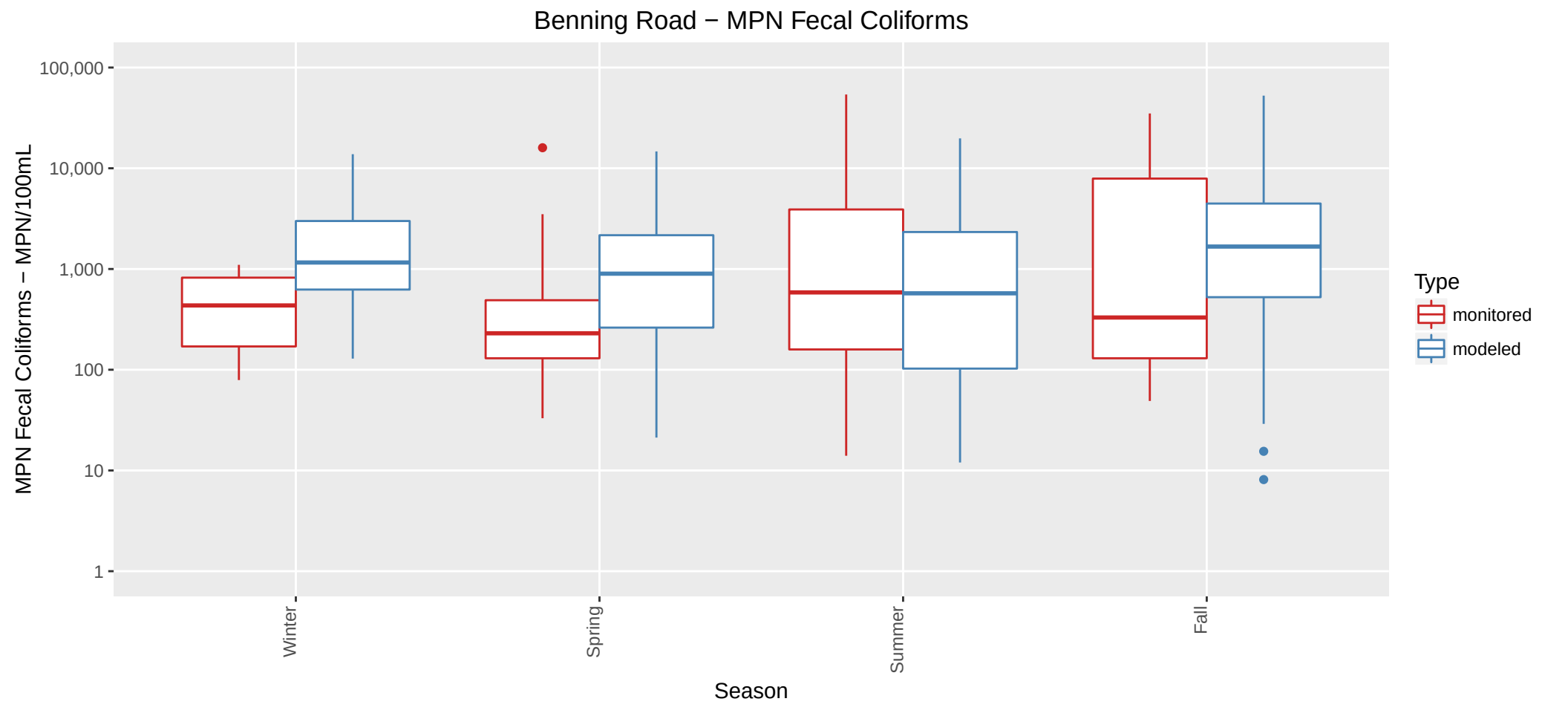

Bladensburg − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
0
5
10
15
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

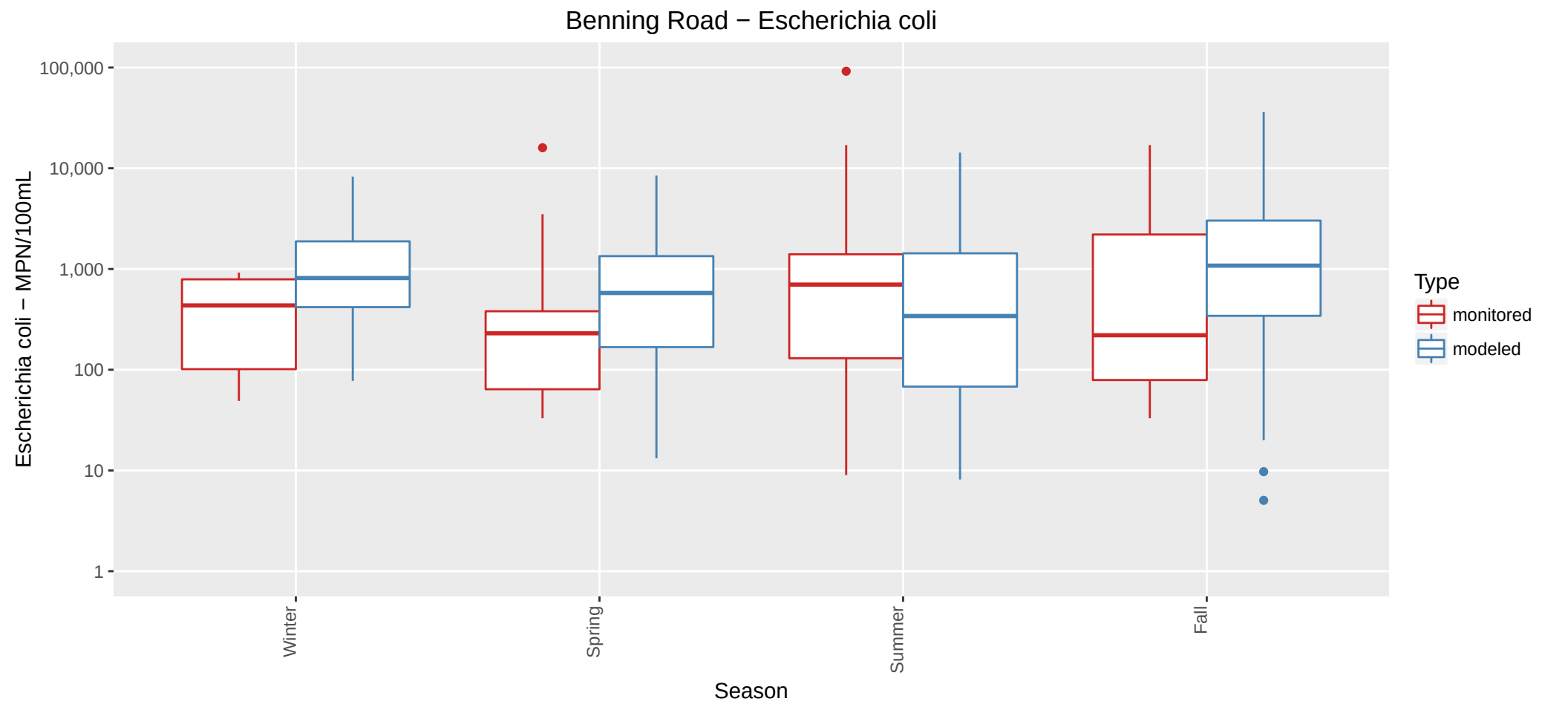

Bladensburg − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

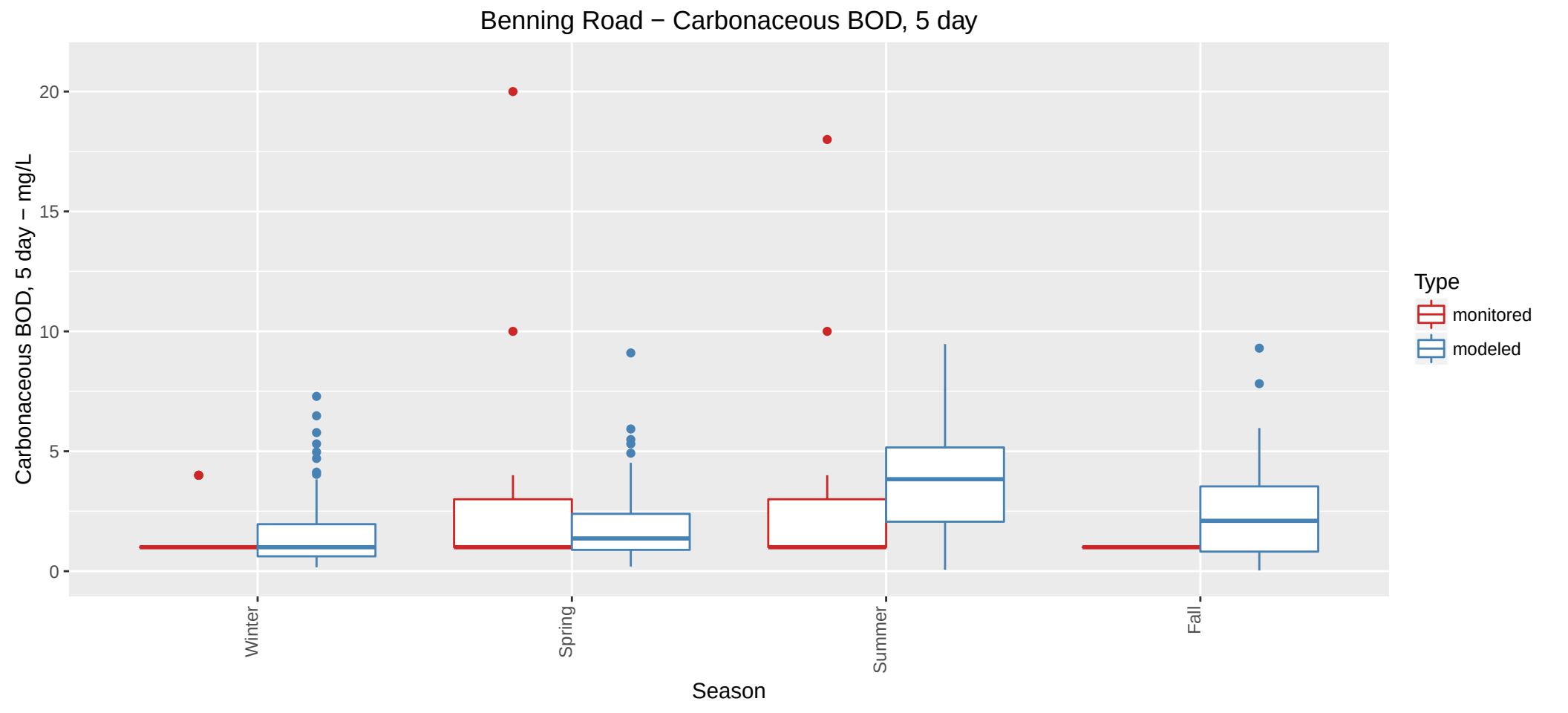

Benning Road − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

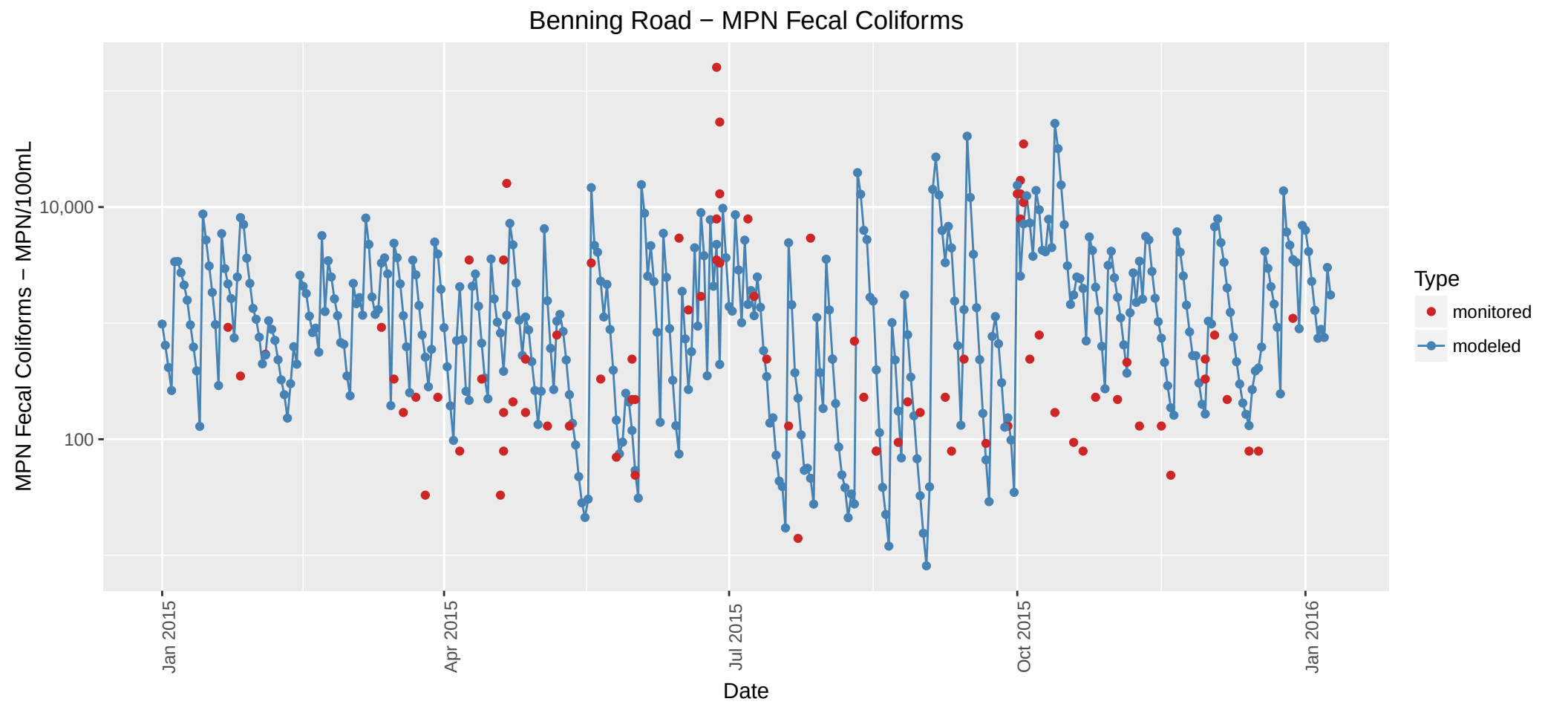

Benning Road − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

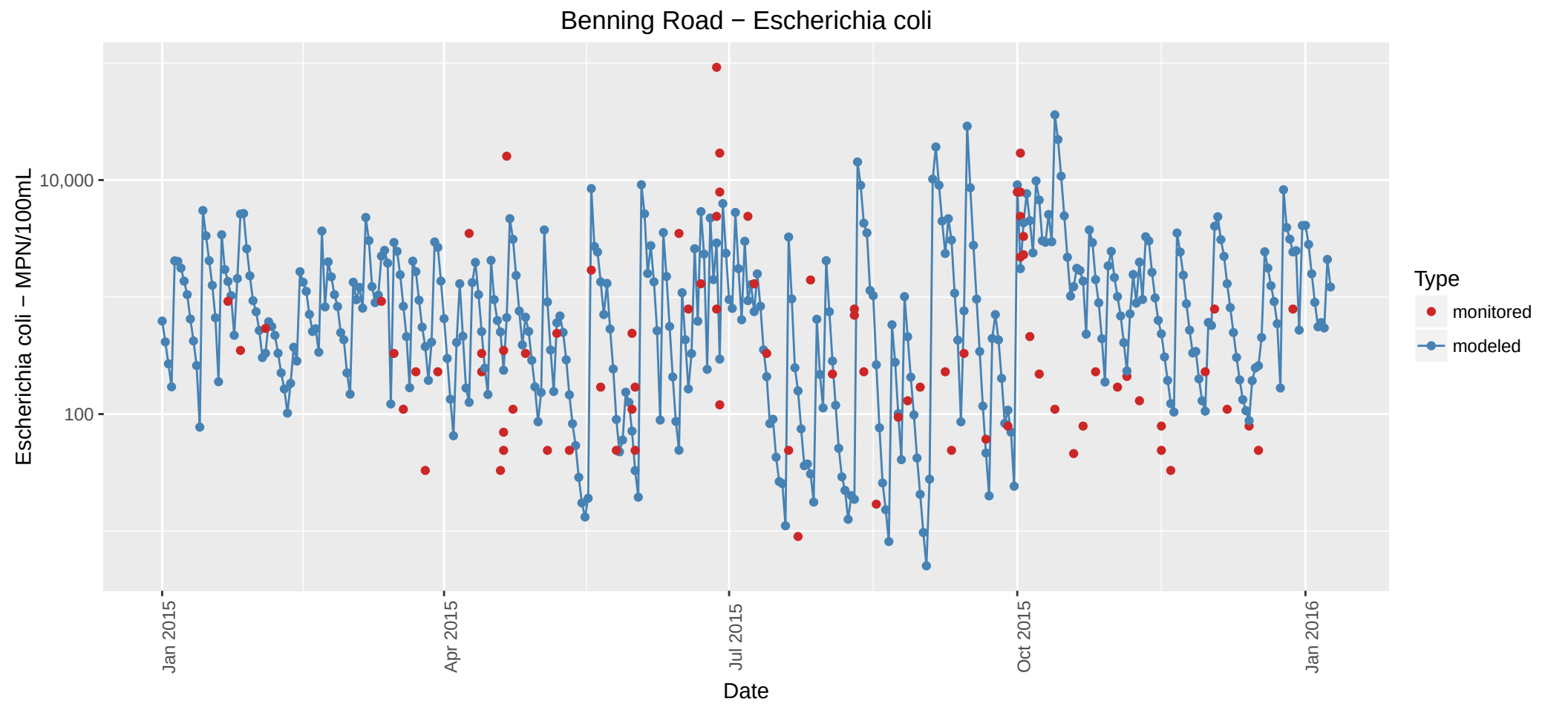

Benning Road − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

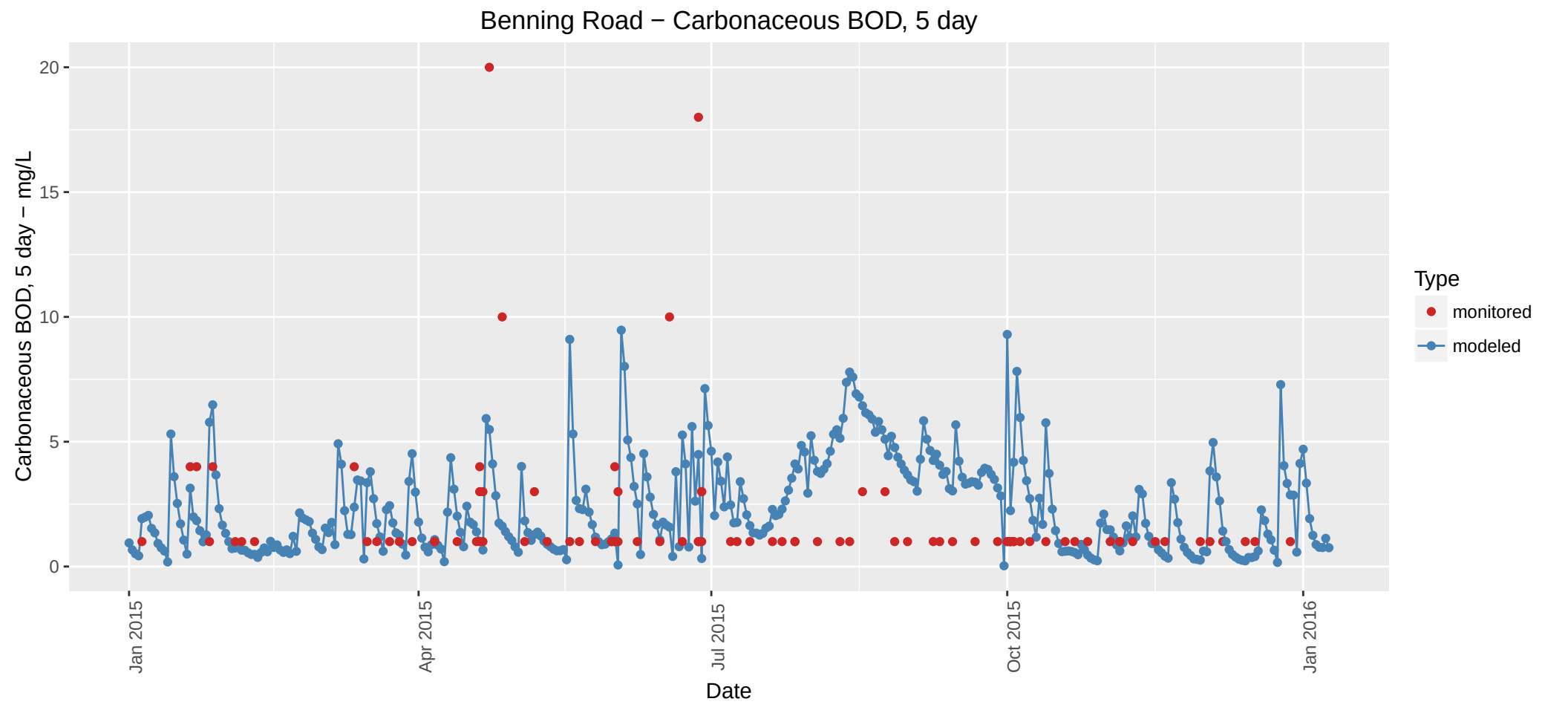

Benning Road − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

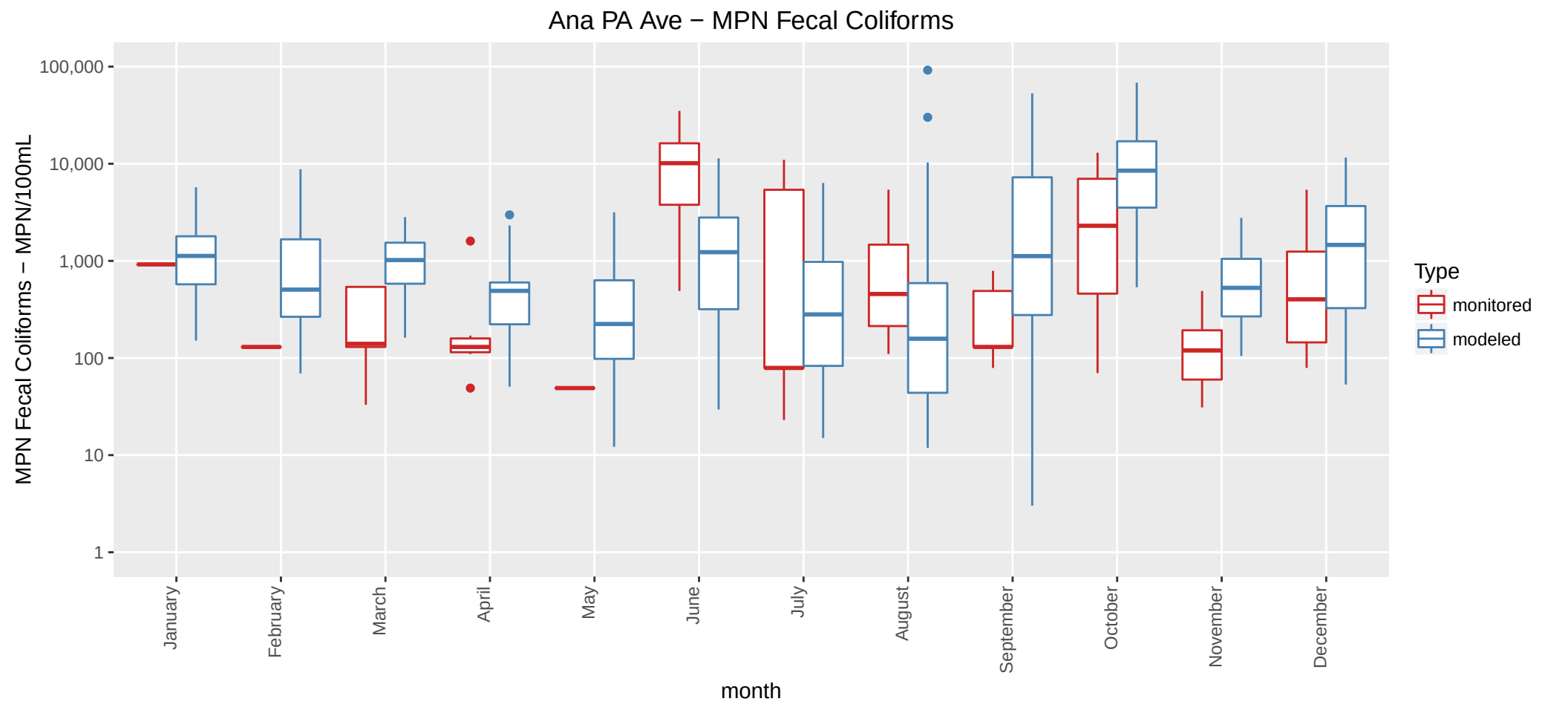

Benning Road − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

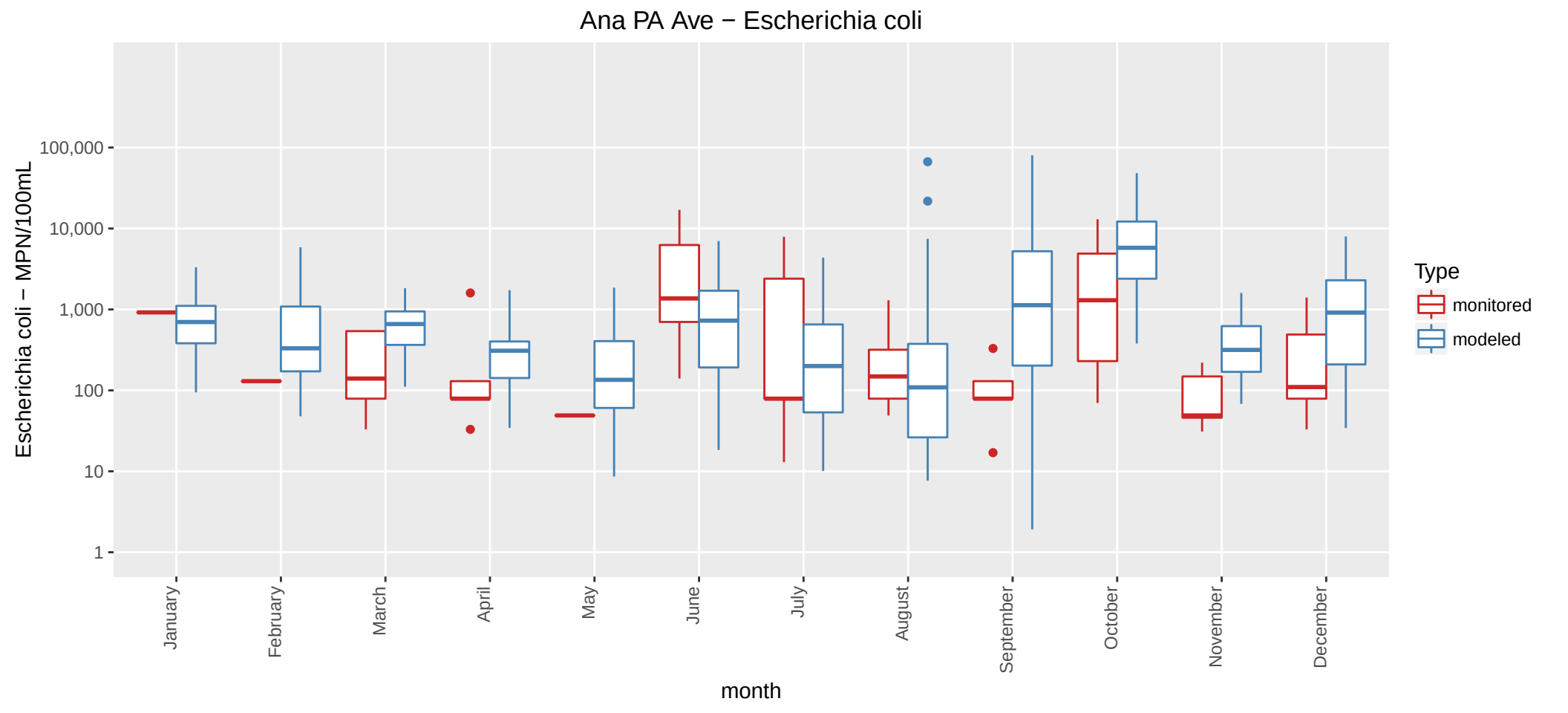

Benning Road − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
20
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

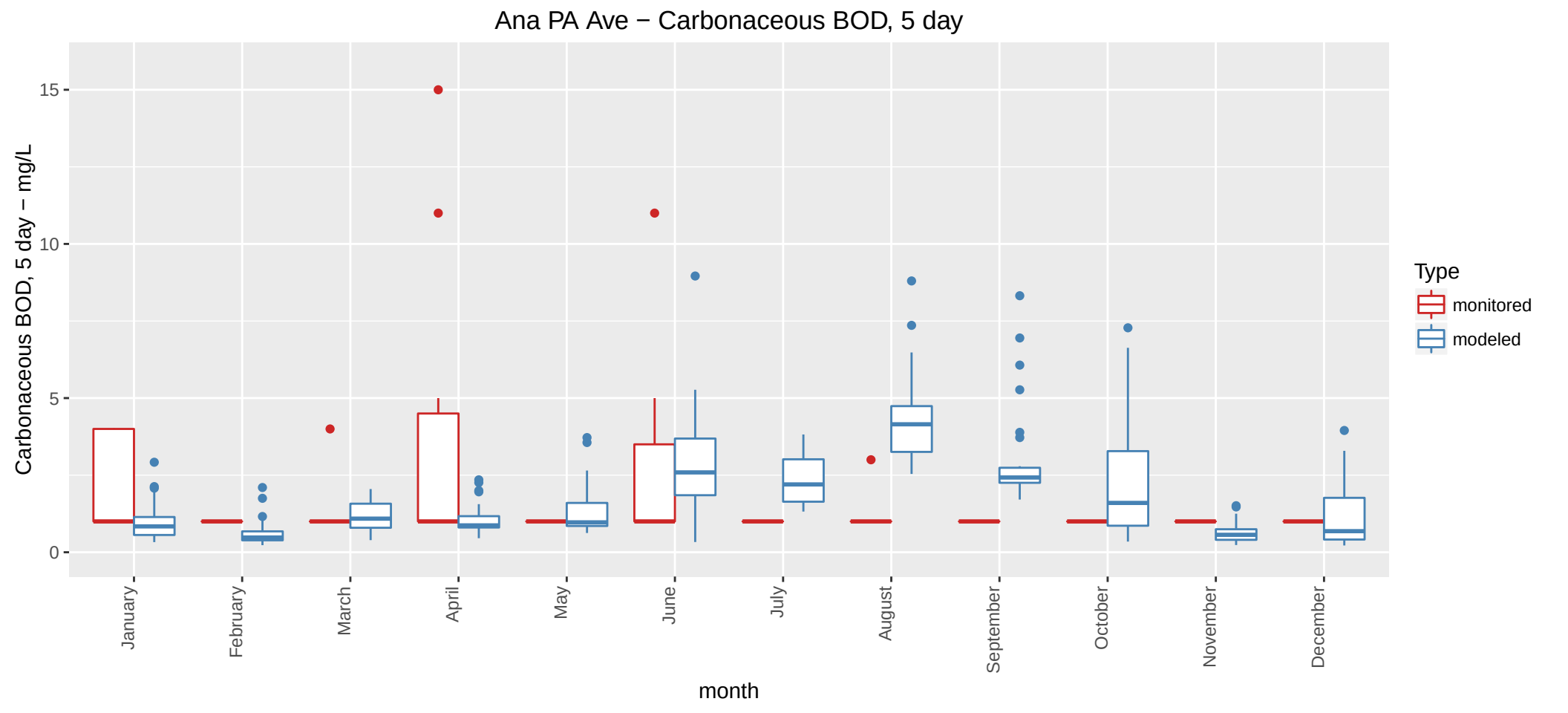

Benning Road − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
10,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

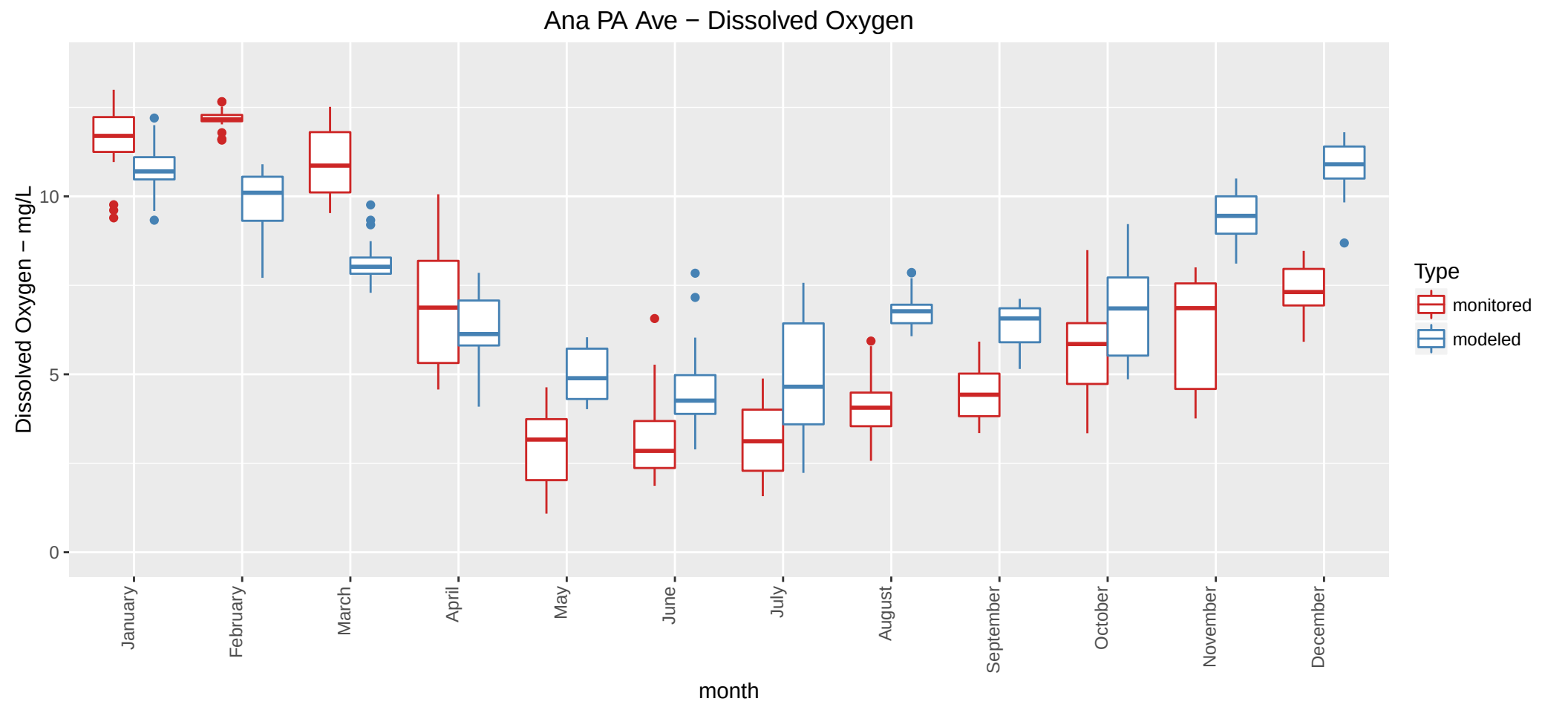

Benning Road − Escherichia coli
Escherichia coli − MPN/100mL
10,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

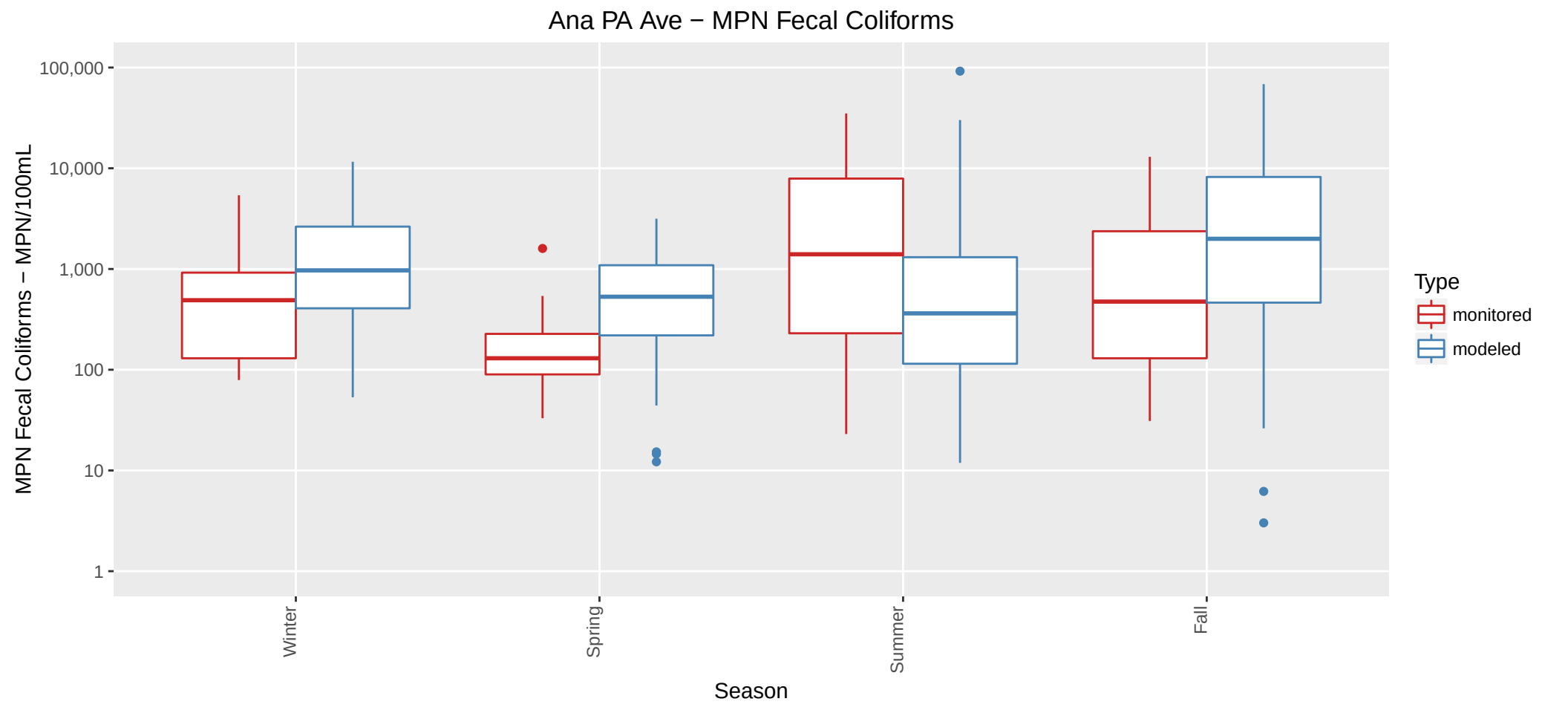

Benning Road − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
20
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

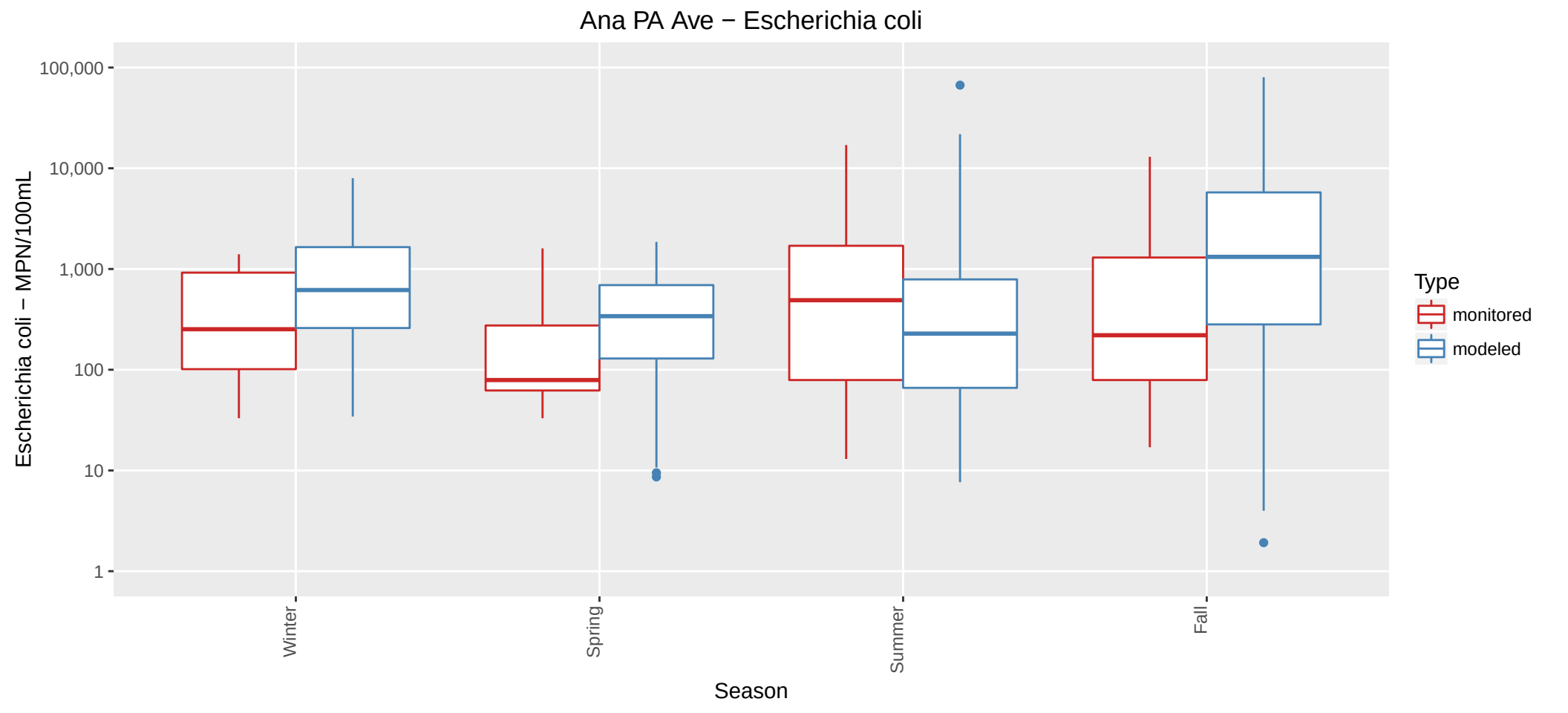

Ana PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

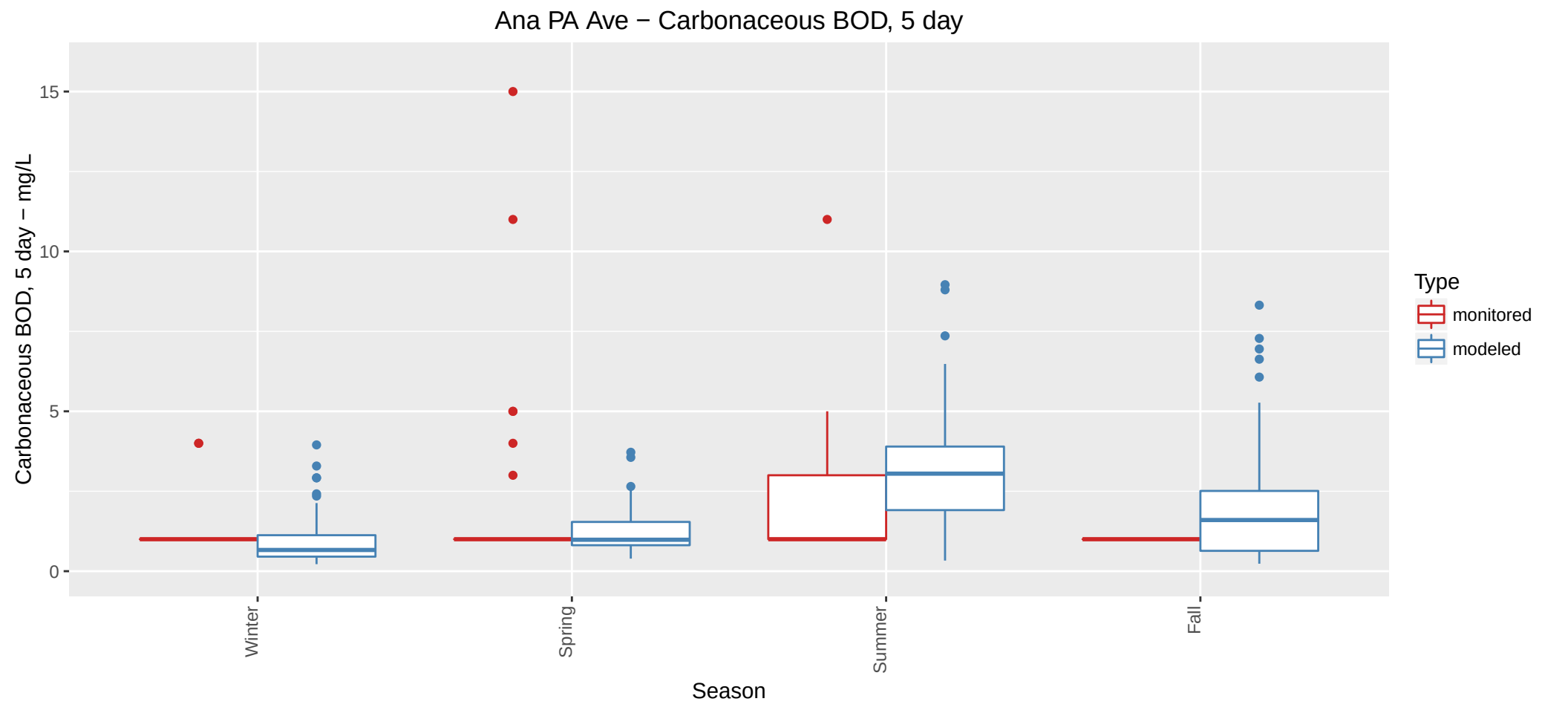

Ana PA Ave − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

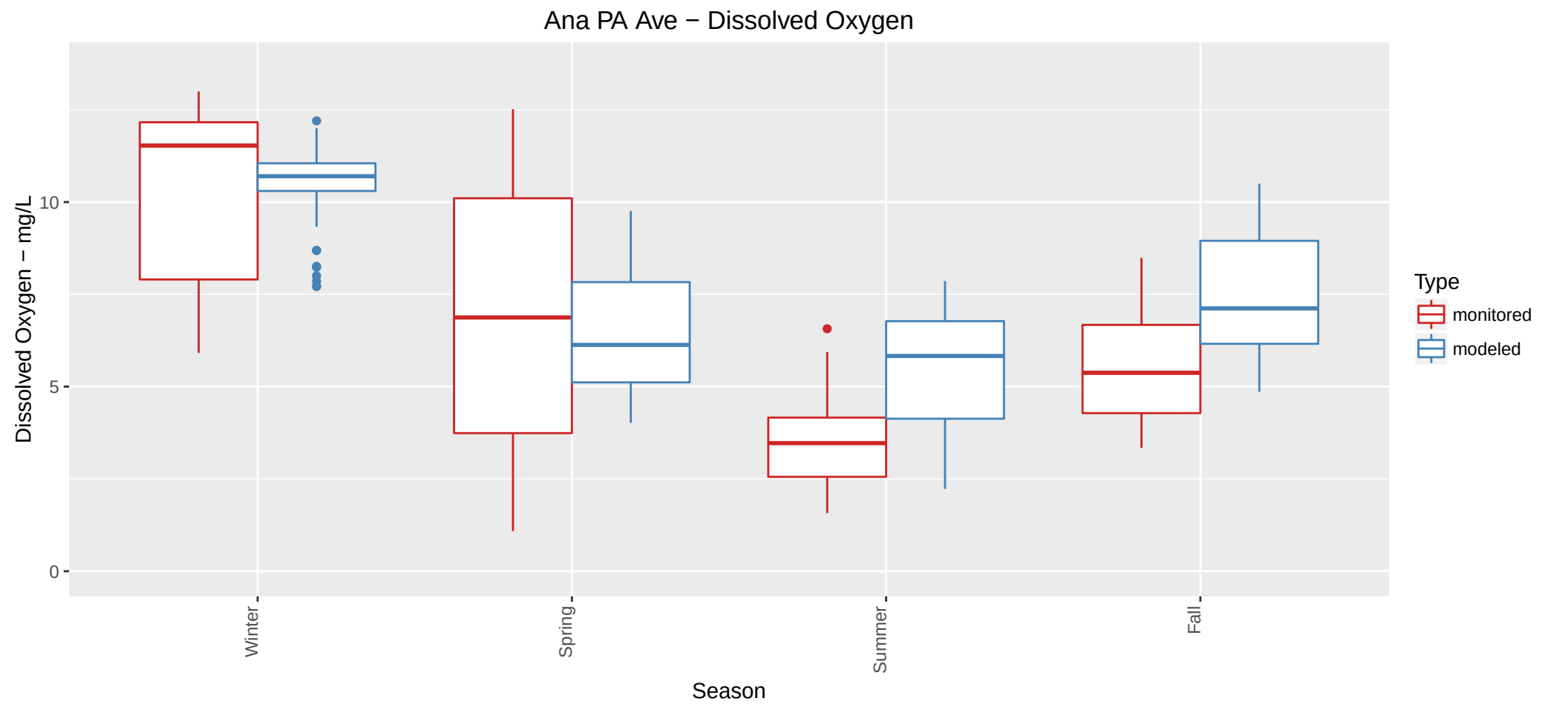

Ana PA Ave − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

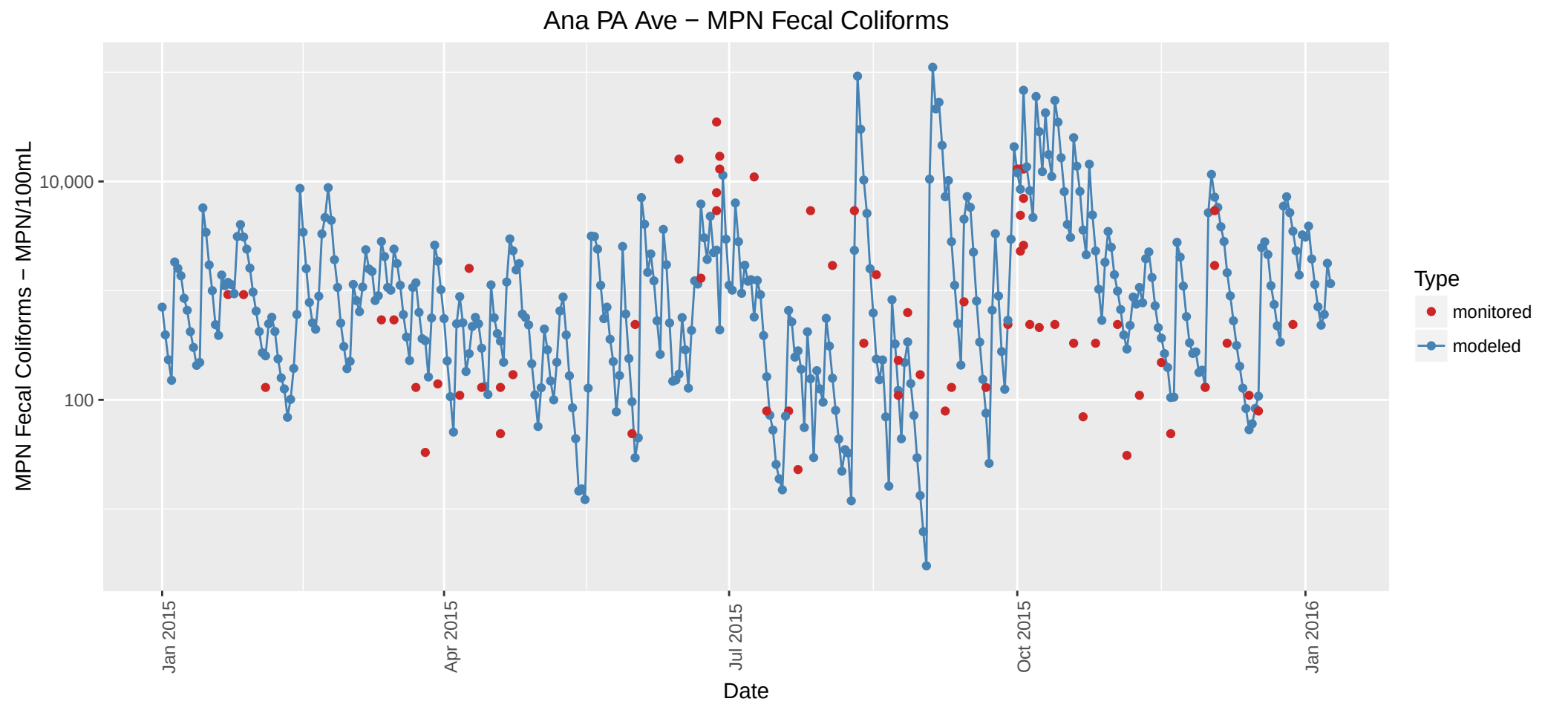

Ana PA Ave − Dissolved Oxygen
Dissolved Oxygen − mg/L
0
5
10
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

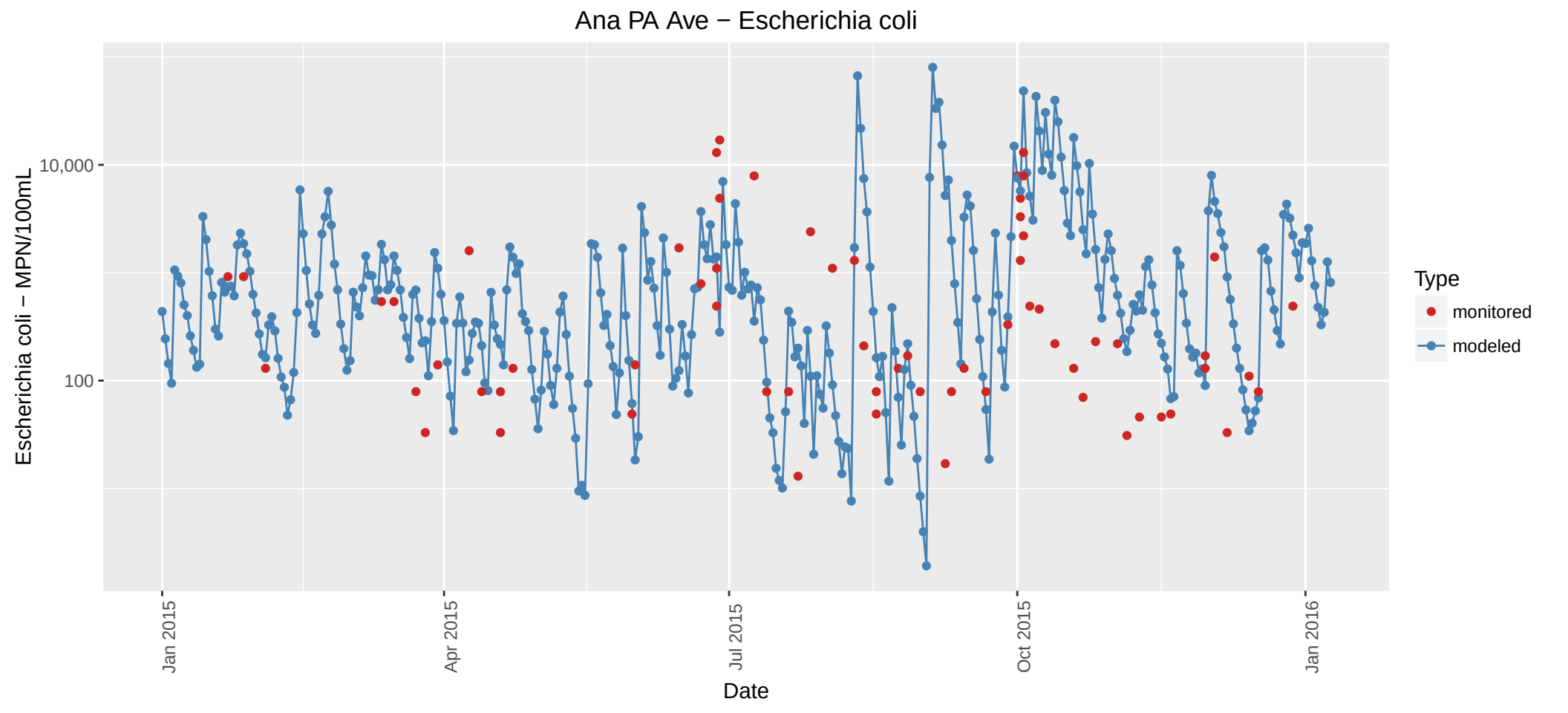

Ana PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

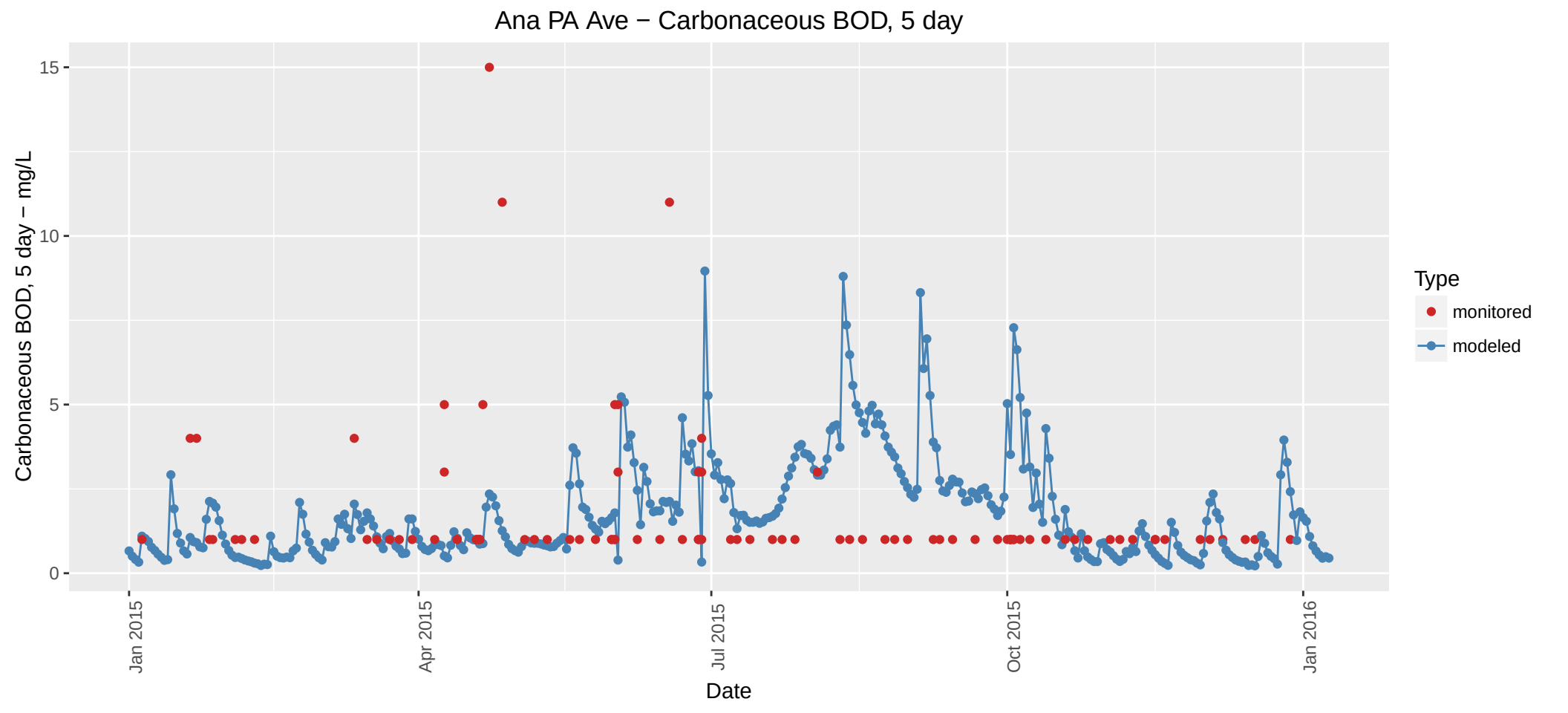

Ana PA Ave − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

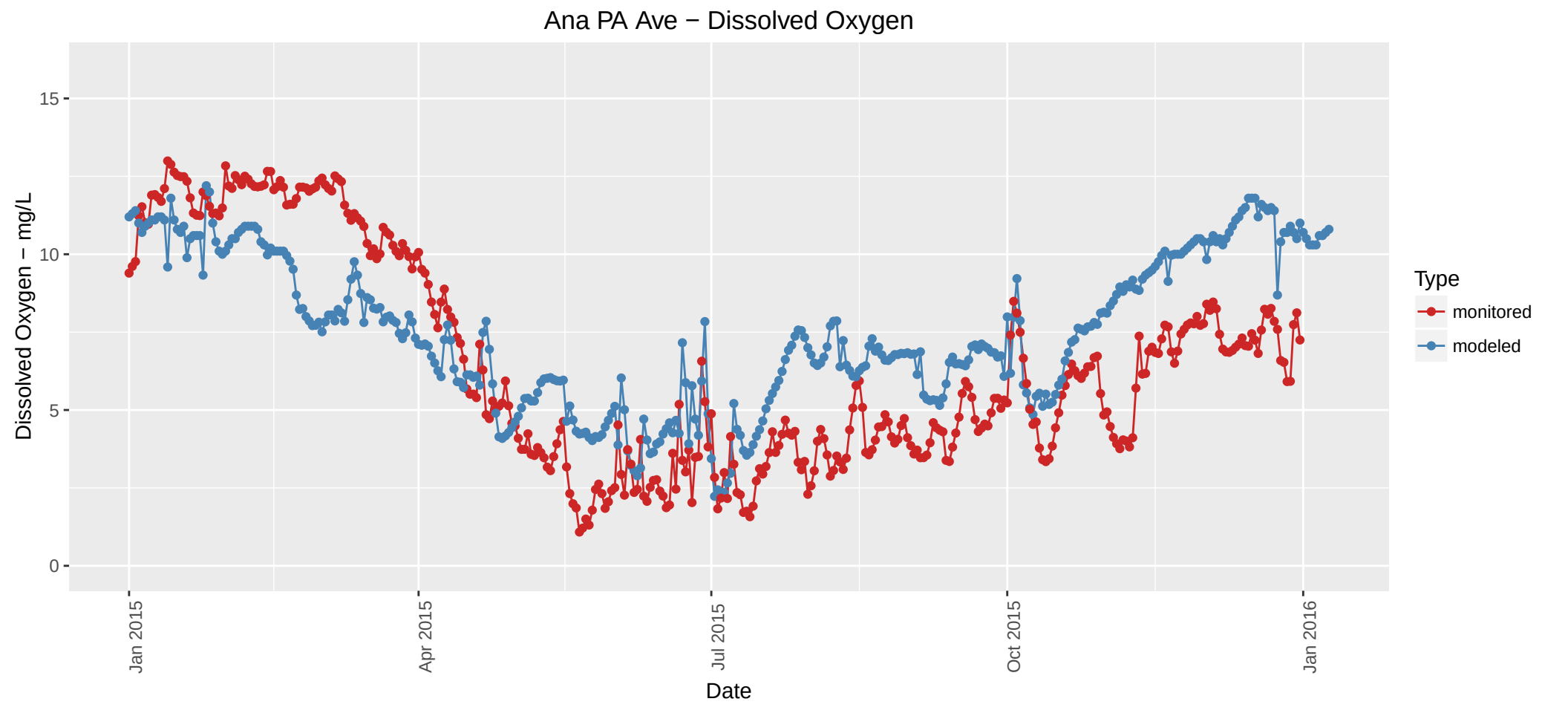

Ana PA Ave − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

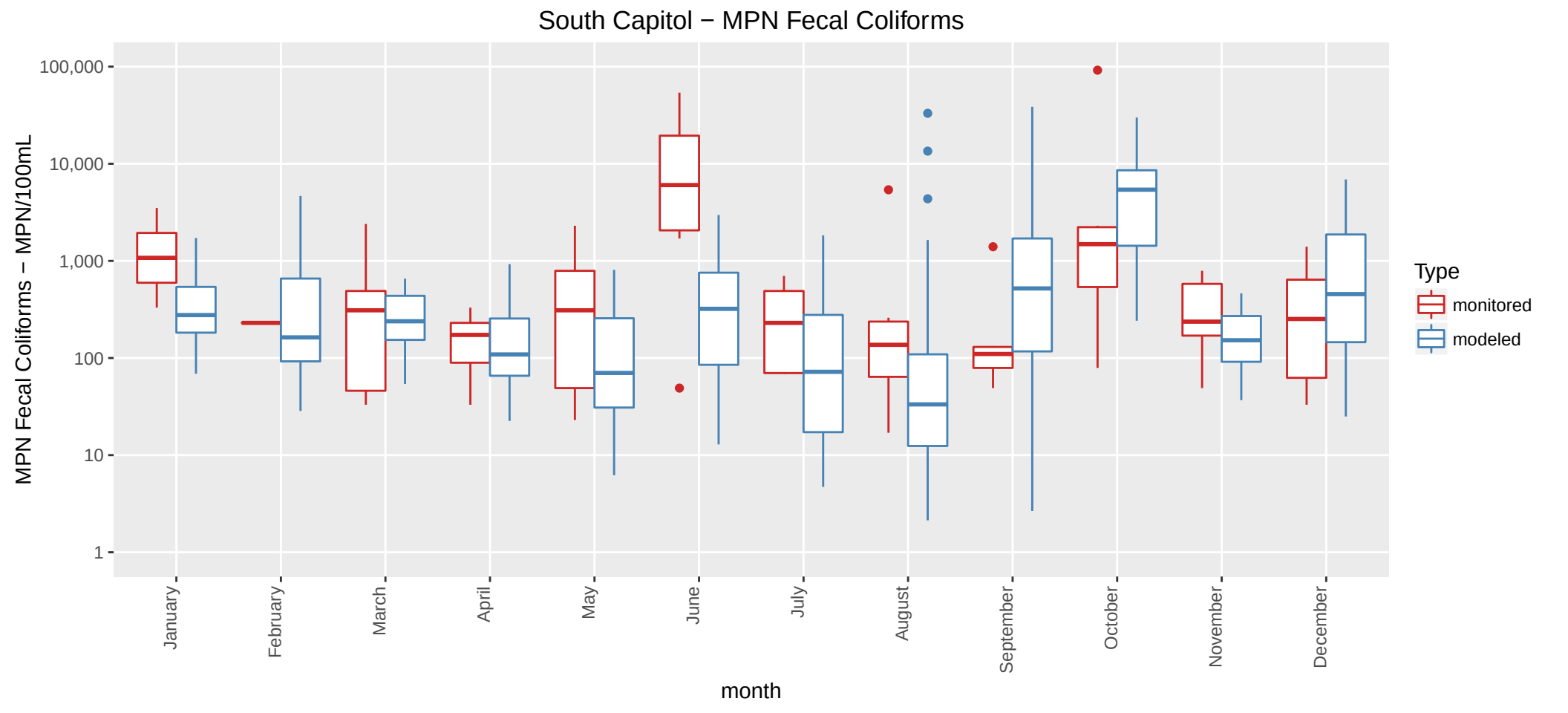

Ana PA Ave − Dissolved Oxygen
Dissolved Oxygen − mg/L
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

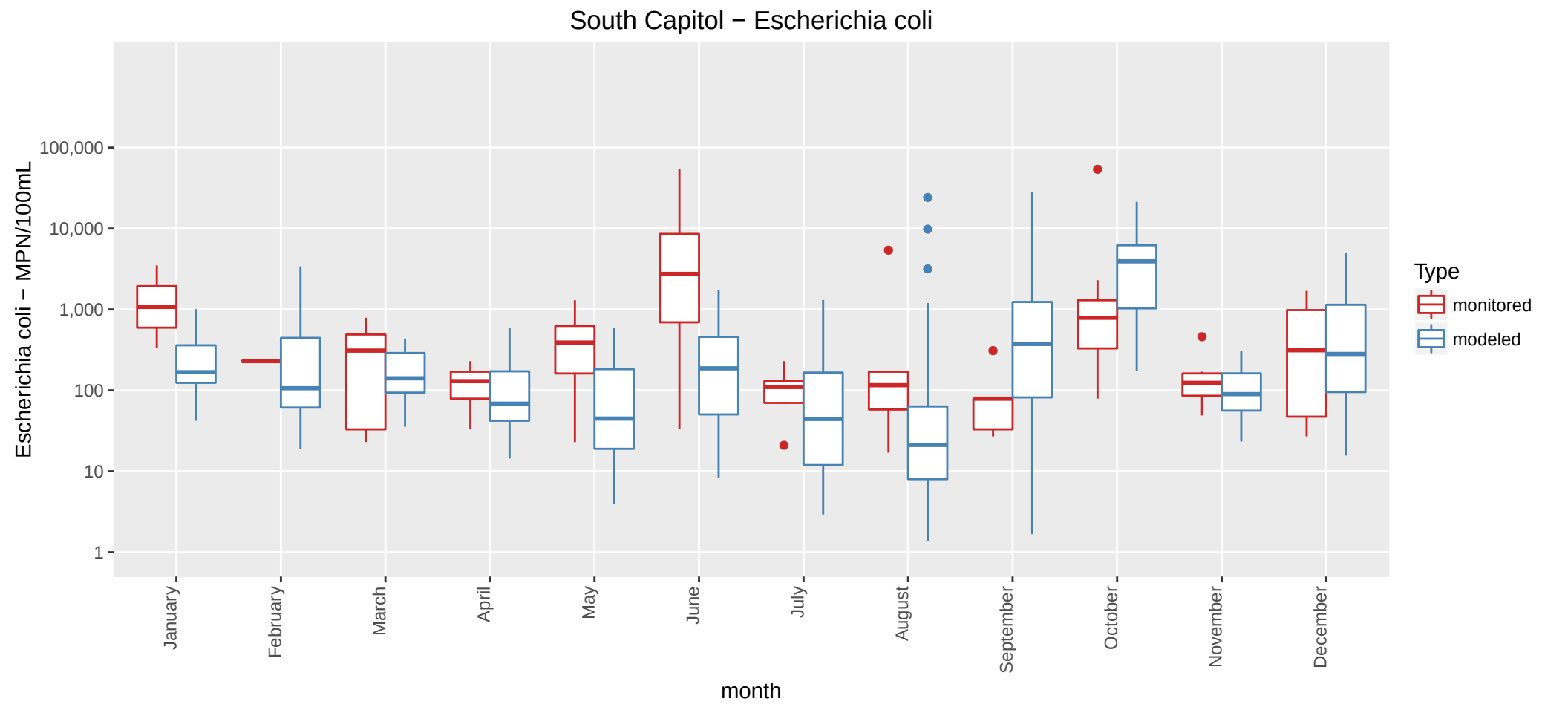

Ana PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
10,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

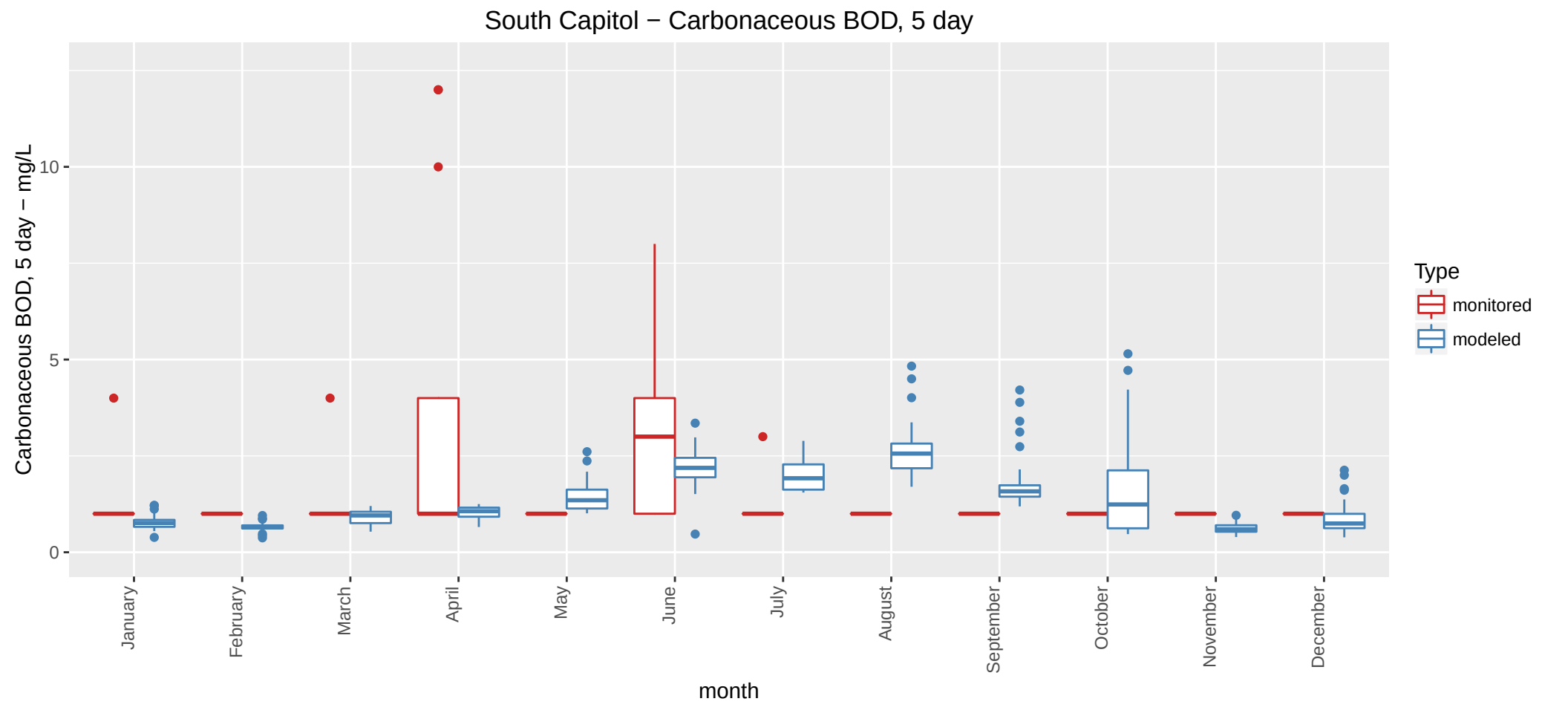

Ana PA Ave − Escherichia coli
Escherichia coli − MPN/100mL
10,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

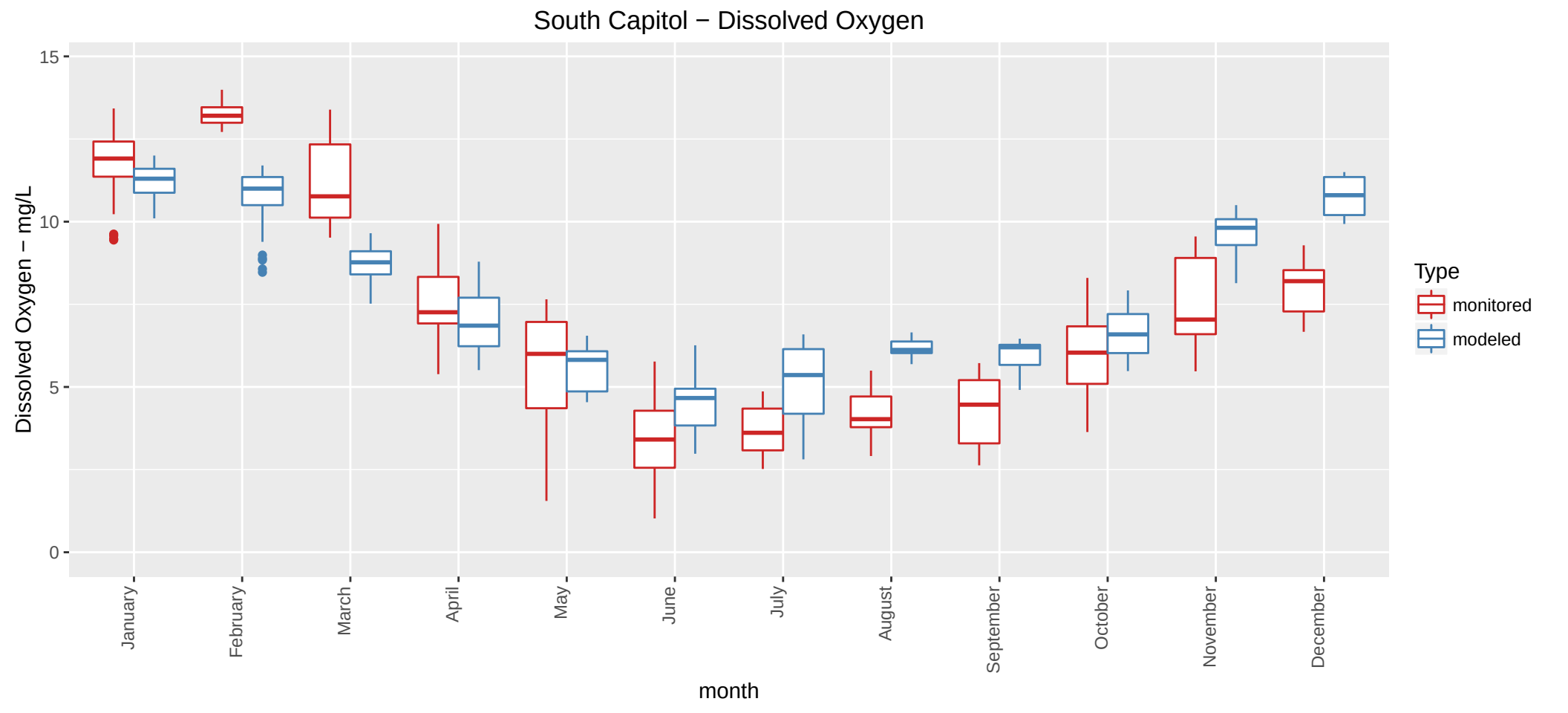

Ana PA Ave − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

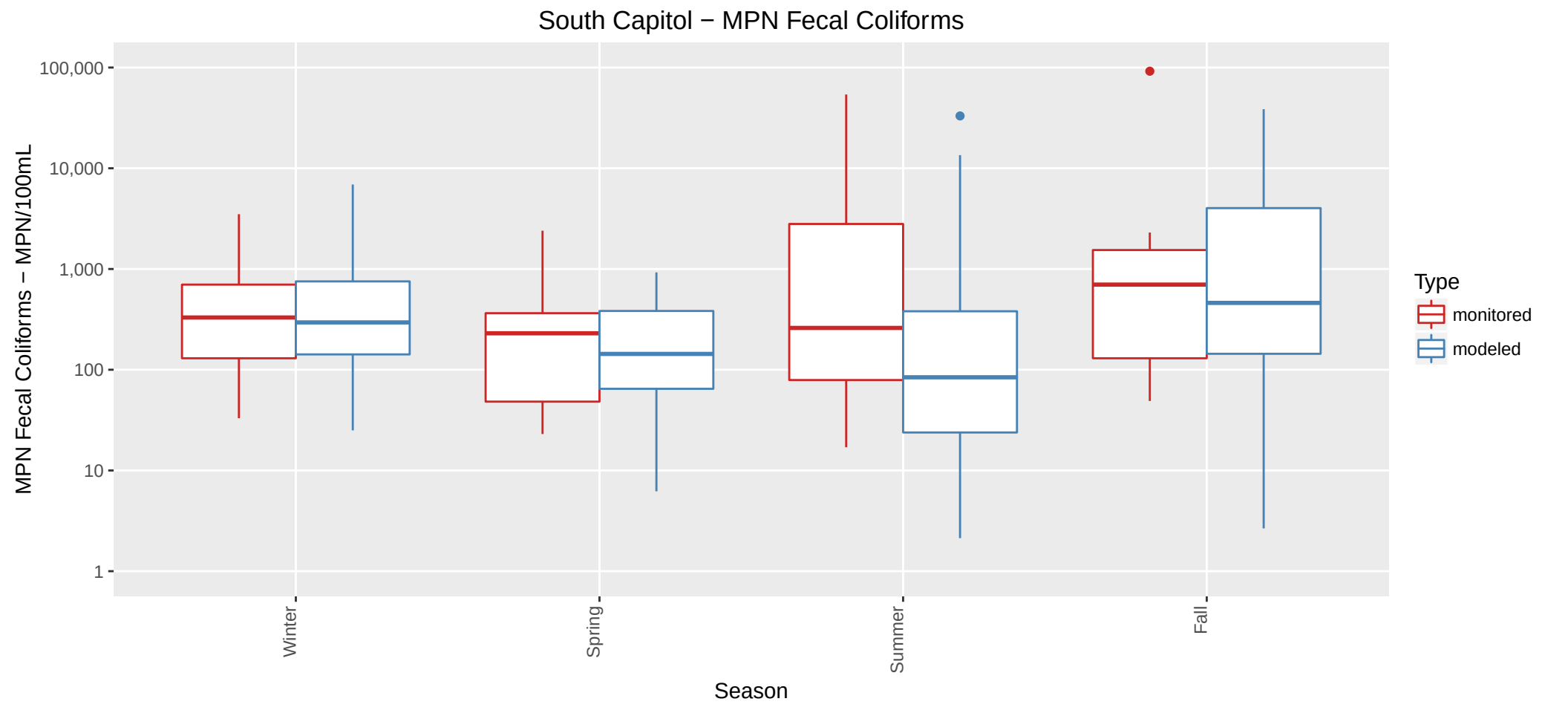

Ana PA Ave − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

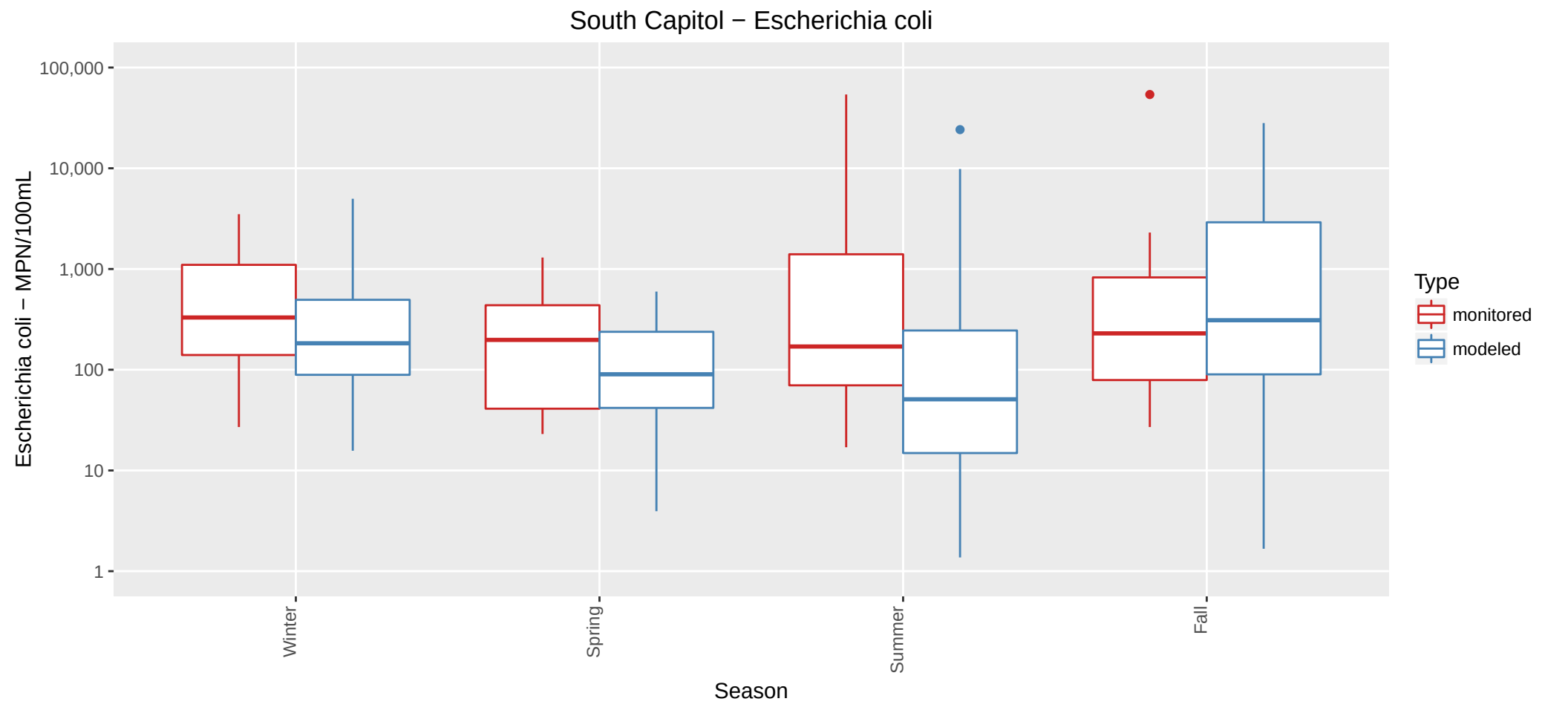

South Capitol − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

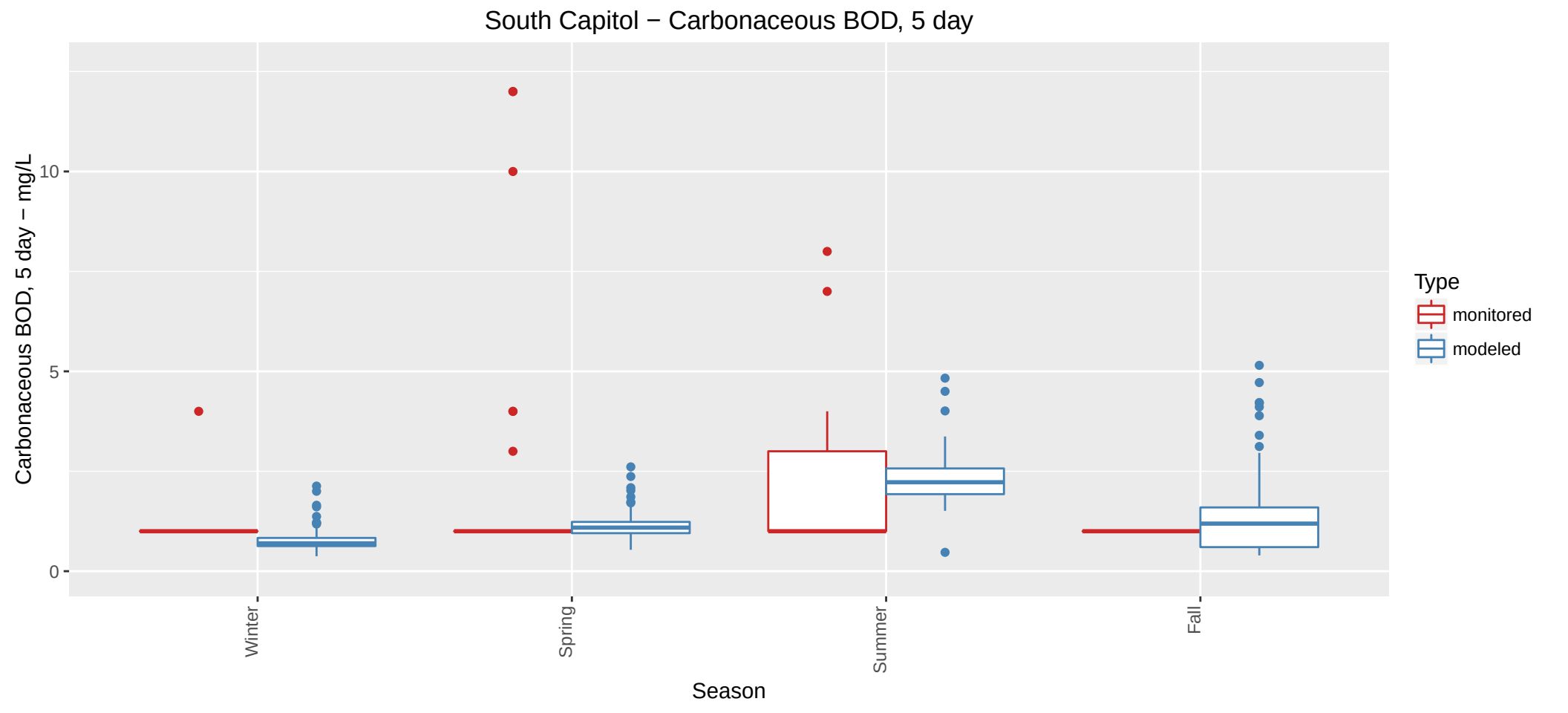

South Capitol − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

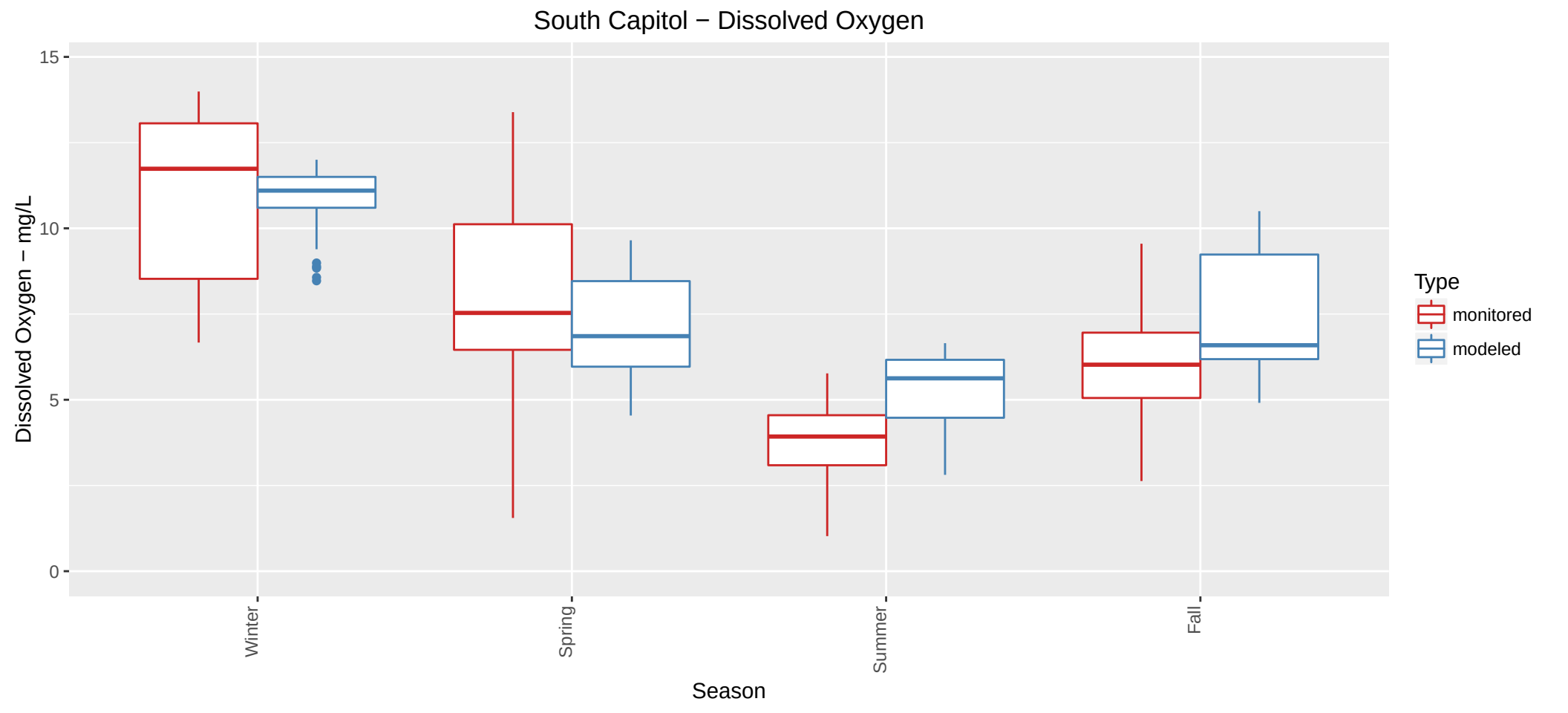

South Capitol − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

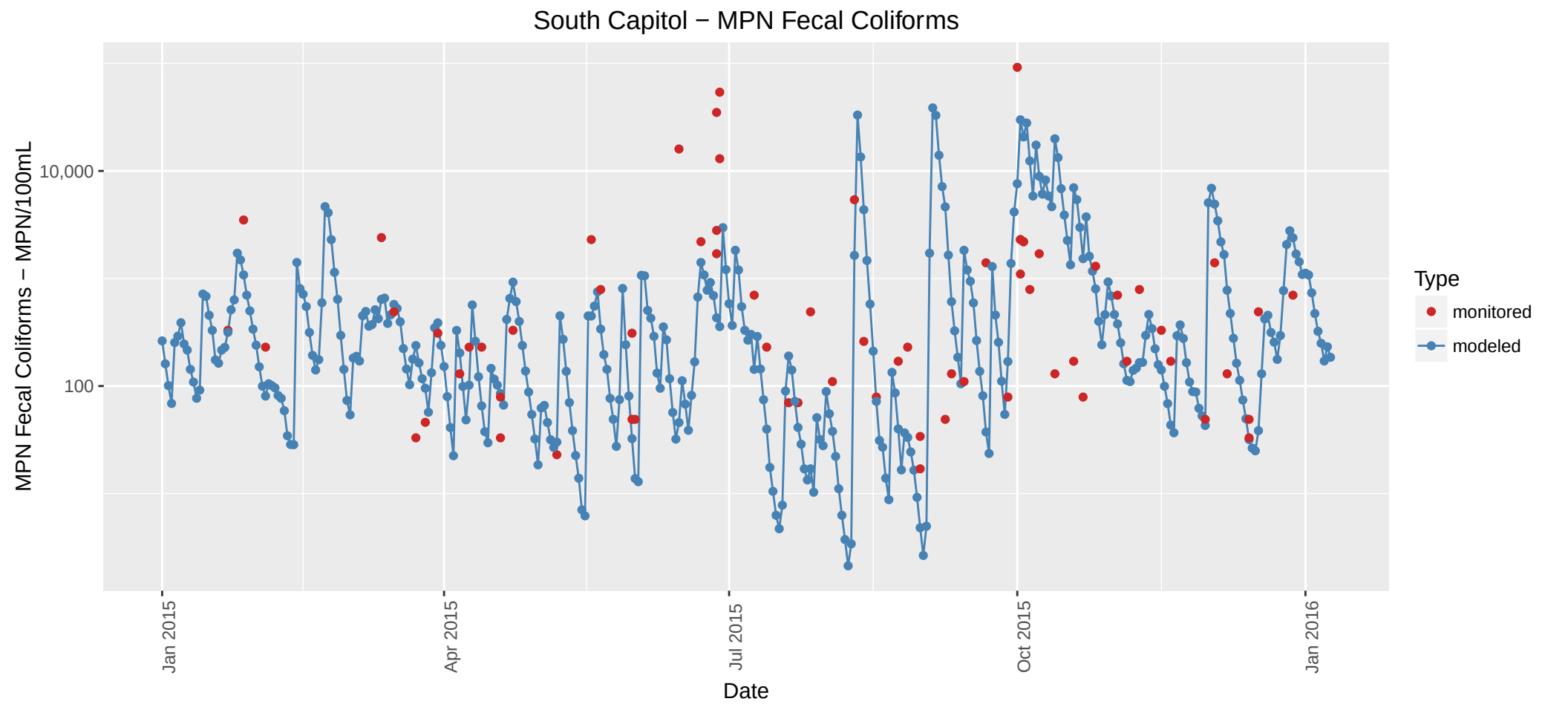

South Capitol − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

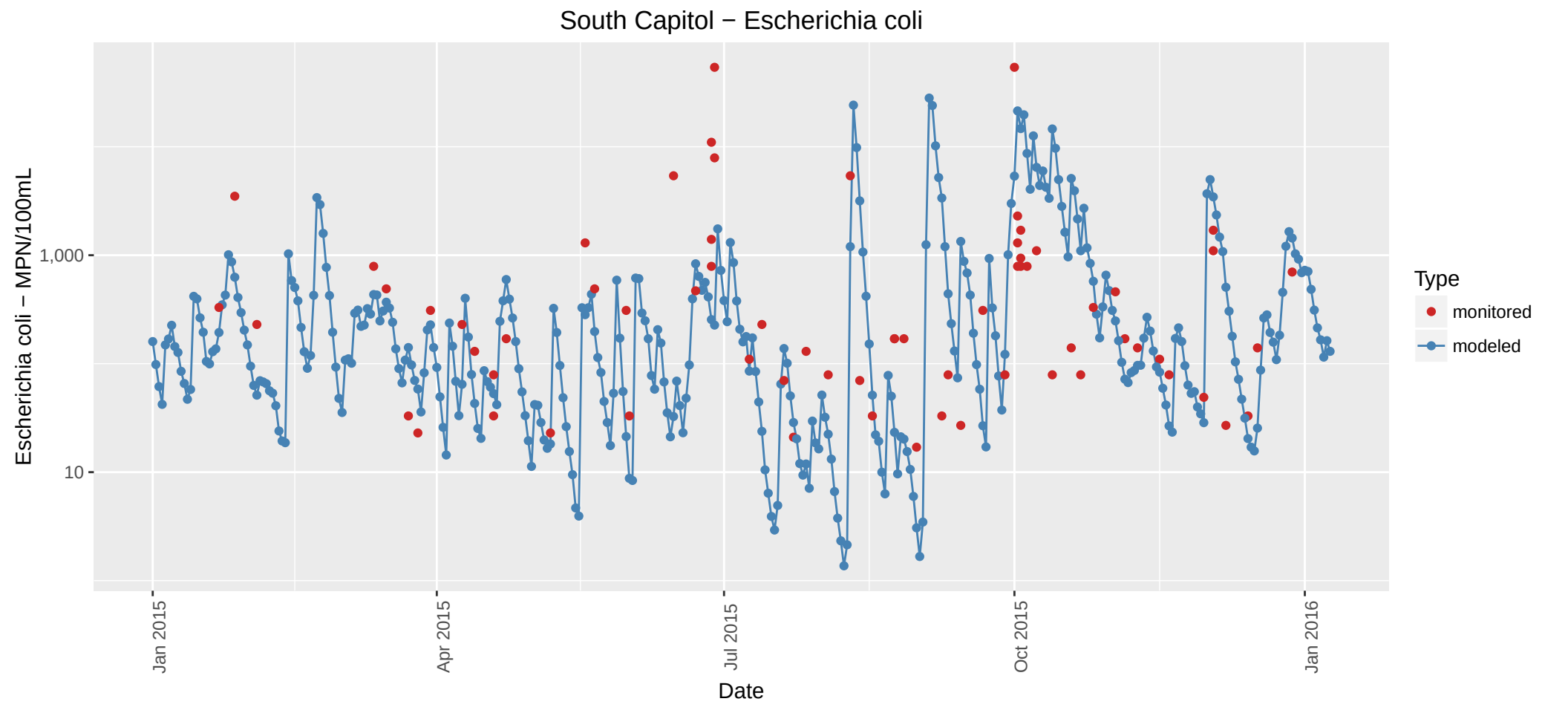

South Capitol − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

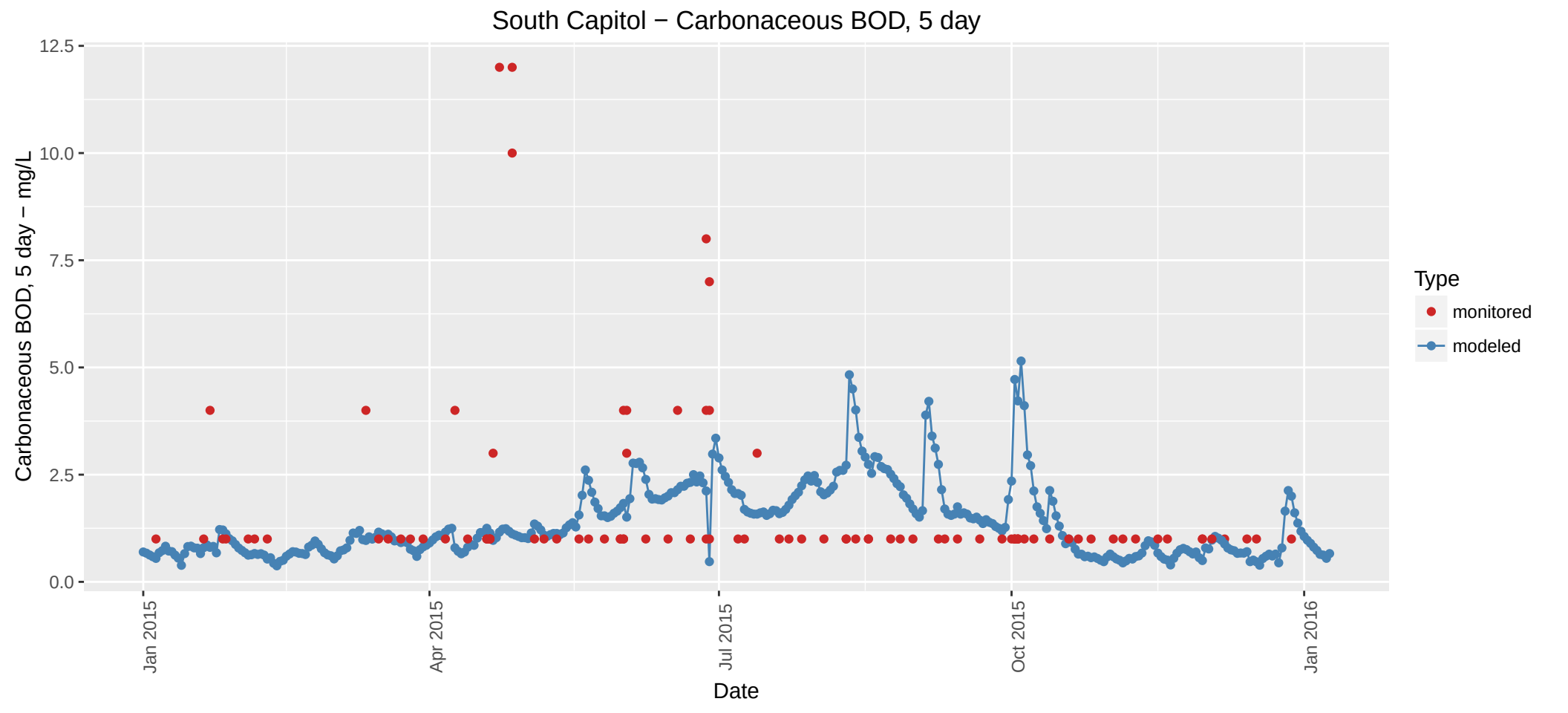

South Capitol − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

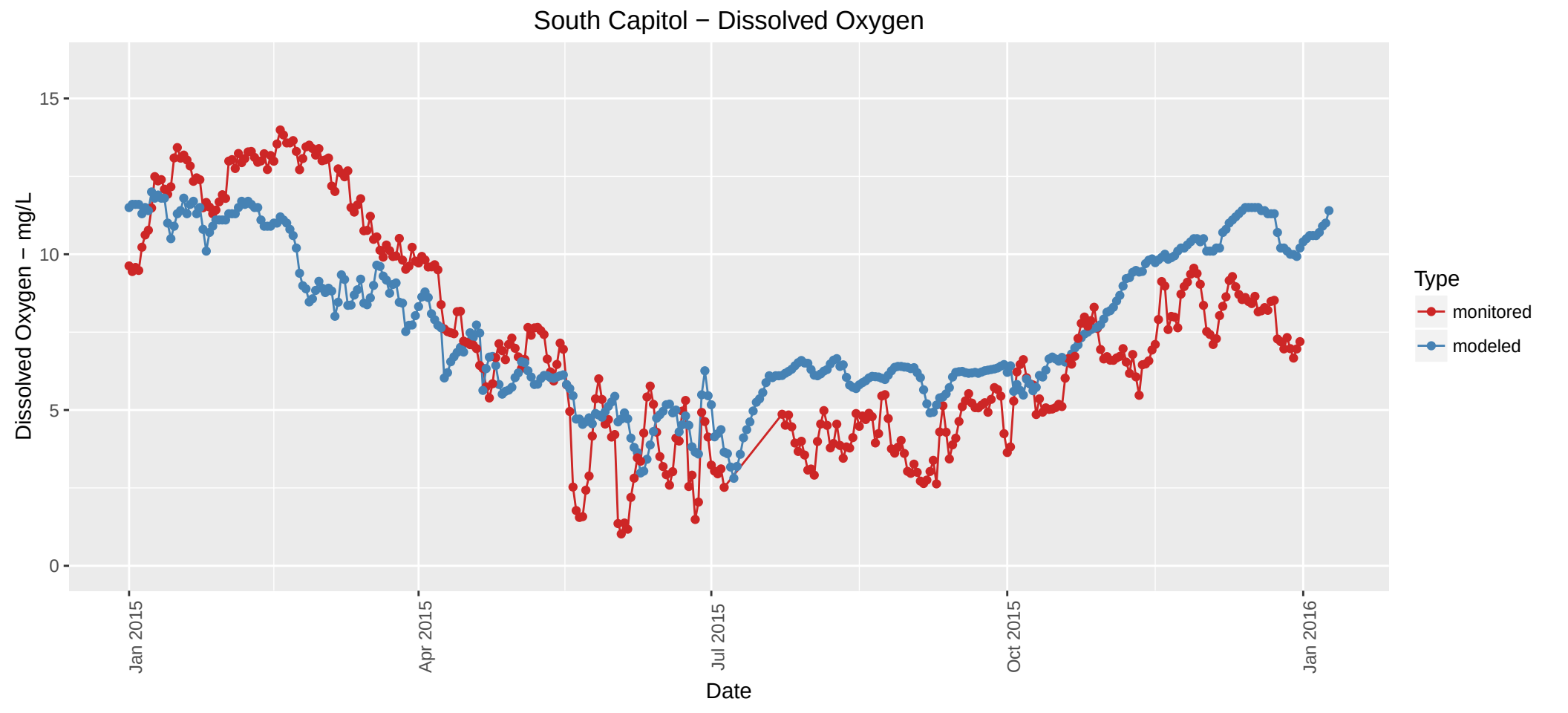

South Capitol − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled


South Capitol − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled


South Capitol − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
10,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


South Capitol − Escherichia coli
Escherichia coli − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


South Capitol − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
12.5
10.0
7.5
5.0
2.5
0.0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


South Capitol − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

APPENDIX C: Potomac River

Potomac – Fecal Coliform Bacteria

MPN Fecal Coliforms (Potomac) - Winter										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Hains Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	150	38	101	49	146	64	41	95	28	125
Minimum	35	1	20	5	27	5	8	31	6	23
Maximum	485	330	1568	790	363	1300	426	5400	161	1100
25th Percentile	48	5	61	23	70	14	24	49	16	43
75th Percentile	180	87	156	79	174	160	69	1003	53	255
Geomean	107	23	105	48	117	51	42	195	29	116
n	90	12	90	9	90	10	90	8	90	8

MPN Fecal Coliforms (Potomac) - Spring										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Hains Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	167	33	125	20	167	18	54	60	46	49
Minimum	39	1	38	1	36	1	11	1	7	1
Maximum	336	1600	703	540	342	540	231	540	234	350
25th Percentile	73	8	76	8	92	7	34	23	29	19
75th Percentile	195	95	180	79	192	72	88	240	92	183
Geomean	124	26	122	24	132	22	53	63	48	44
n	92	23	92	22	92	22	92	20	92	20

MPN Fecal Coliforms (Potomac) - Summer										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Hains Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	140	49	187	120	175	130	88	49	30	29
Minimum	18	4	11	7	32	7	3	1	4	8
Maximum	513	14000	5216	7900	517	9200	2302	13000	452	54000
25th Percentile	75	23	70	23	112	33	28	22	12	14
75th Percentile	206	1260	375	1600	236	1110	213	350	80	490
Geomean	121	126	181	143	164	163	82	95	33	93
n	92	23	92	24	92	23	92	23	92	26

MPN Fecal Coliforms (Potomac) - Fall										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Hains Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	96	130	139	110	148	135	54	150	19	200
Minimum	23	4	14	1	28	8	3	13	4	8
Maximum	576	3300	6275	1700	1406	11000	1747	2200	252	7900
25th Percentile	57	28	63	46	106	33	22	49	12	45
75th Percentile	151	595	501	1100	208	918	173	468	34	468
Geomean	92	111	182	134	161	176	58	165	20	167
n	91	23	91	24	91	24	91	24	91	24

Potomac – E. *coli*

E. coli (Potomac) - Winter										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	93	49	63	49	92	56	26	49	18	125
Minimum	24	4	14	5	19	2	6	31	4	13
Maximum	281	230	1144	490	217	350	311	3500	112	1100
25th Percentile	31	7	39	17	46	11	15	35	10	43
75th Percentile	113	95	98	49	110	125	41	117	33	255
Geomean	68	28	68	36	76	36	27	115	18	108
n	90	11	90	9	90	10	90	10	90	8

E. coli (Potomac) - Spring										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	105	14	79	14	106	13	35	41	29	41
Minimum	26	2	25	2	24	2	7	2	4	2
Maximum	202	1600	503	350	207	540	146	350	149	350
25th Percentile	46	8	50	8	61	8	22	13	18	10
75th Percentile	121	37	114	49	121	23	53	115	59	115
Geomean	79	20	79	19	85	20	34	33	30	30
n	92	23	92	21	92	22	92	20	92	18

E. coli (Potomac) - Summer										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	89	22	116	79	113	79	55	48	18	13
Minimum	12	2	7	5	23	5	2	2	2	5
Maximum	303	13000	3809	7900	339	2300	1679	4900	296	4700
25th Percentile	48	11	46	15	76	20	17	16	8	8
75th Percentile	127	975	254	525	151	665	139	335	52	330
Geomean	76	66	119	98	108	90	53	69	21	48
n	92	23	92	23	92	23	92	24	92	25

E. coli (Potomac) - Fall										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	64	49	88	63	96	150	35	130	11	120
Minimum	16	2	9	2	19	5	2	8	3	8
Maximum	332	3300	4601	1400	1028	2100	1278	1300	172	4900
25th Percentile	38	12	40	29	70	17	14	49	7	33
75th Percentile	95	515	355	438	142	790	116	330	20	363
Geomean	59	65	122	71	108	113	38	122	13	123
n	91	23	91	24	91	24	91	23	91	24

Potomac – CBOD5

CBOD5 (Potomac) - Winter										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	2	1	2	1	2	1	2	1	2	1
Minimum	2	1	2	1	2	1	2	1	2	1
Maximum	3	4	2	4	2	4	2	4	2	4
25th Percentile	2	1	2	1	2	1	2	1	2	1
75th Percentile	2	1	2	1	2	1	2	1	2	1
Geomean	2	1	2	1	2	1	2	1	2	1
n	90	15	90	15	90	13	90	15	90	12

CBOD5 (Potomac) - Spring										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	2	1	2	1	2	1	2	1	2	1
Minimum	2	1	2	1	2	1	1	1	1	1
Maximum	2	12	2	13	2	12	2	16	2	16
25th Percentile	2	1	2	1	2	1	2	1	2	1
75th Percentile	2	1	2	1	2	1	2	1	2	1
Geomean	2	1	2	1	2	2	2	1	2	1
n	92	27	92	25	92	26	92	27	92	25

CBOD5 (Potomac) - Summer										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	2	1	2	1	2	1	1	1	1	1
Minimum	2	1	1	1	2	1	1	1	1	1
Maximum	2	10	2	26	2	4	3	4	2	3
25th Percentile	2	1	2	1	2	1	1	1	1	1
75th Percentile	2	1	2	1	2	1	2	1	1	1
Geomean	2	1	2	1	2	1	1	1	1	1
n	92	29	92	29	92	29	92	28	92	29

CBOD5 (Potomac) - Fall										
	Three Sisters		14th St Bridge		Upstream Rockcreek		Haines Point		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	64	49	88	63	96	150	35	130	11	120
Minimum	16	2	9	2	19	5	2	8	3	8
Maximum	332	3300	4601	1400	1028	2100	1278	1300	172	4900
25th Percentile	38	12	40	29	70	17	14	49	7	33
75th Percentile	95	515	355	438	142	790	116	330	20	363
Geomean	59	65	122	71	108	113	38	122	13	123
n	91	23	91	24	91	24	91	23	91	24

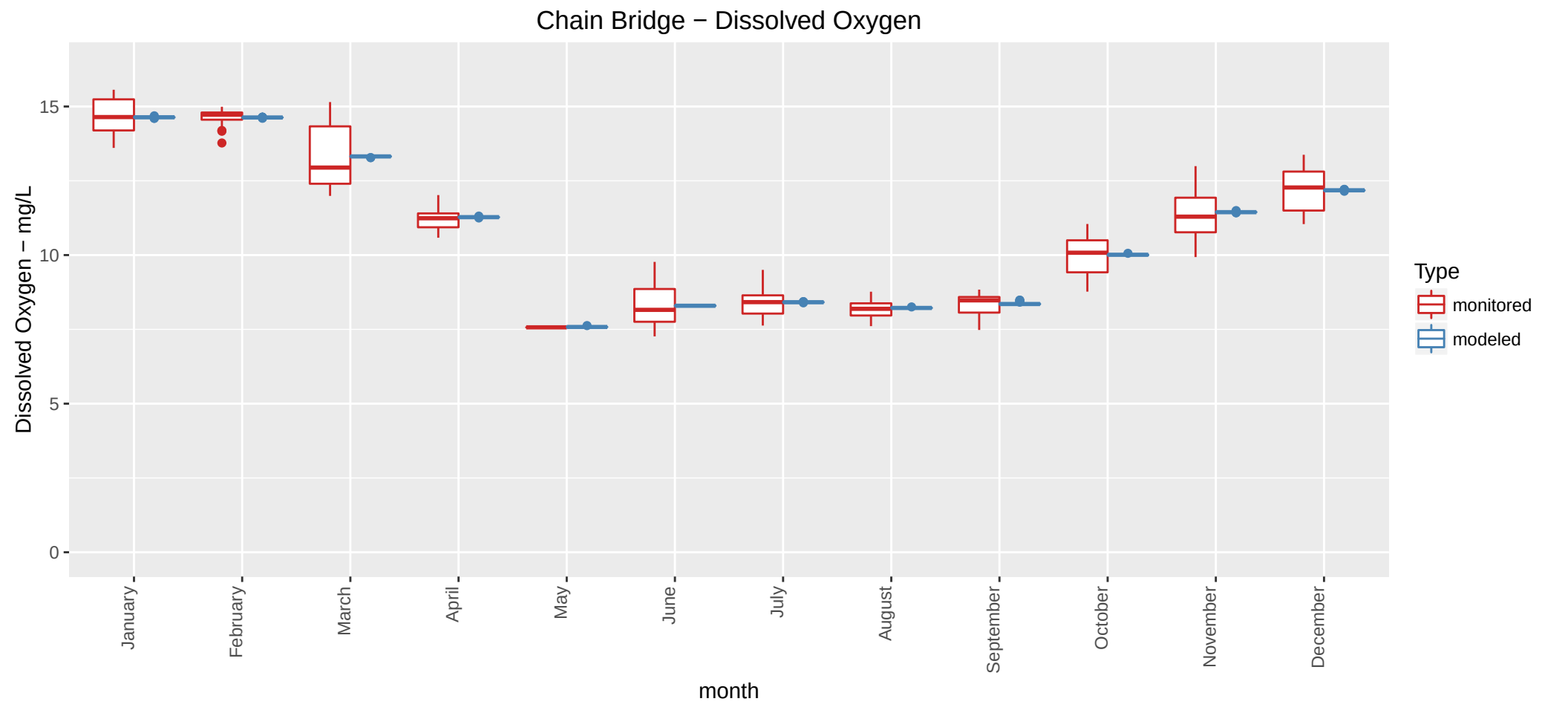
Potomac – Dissolved Oxygen

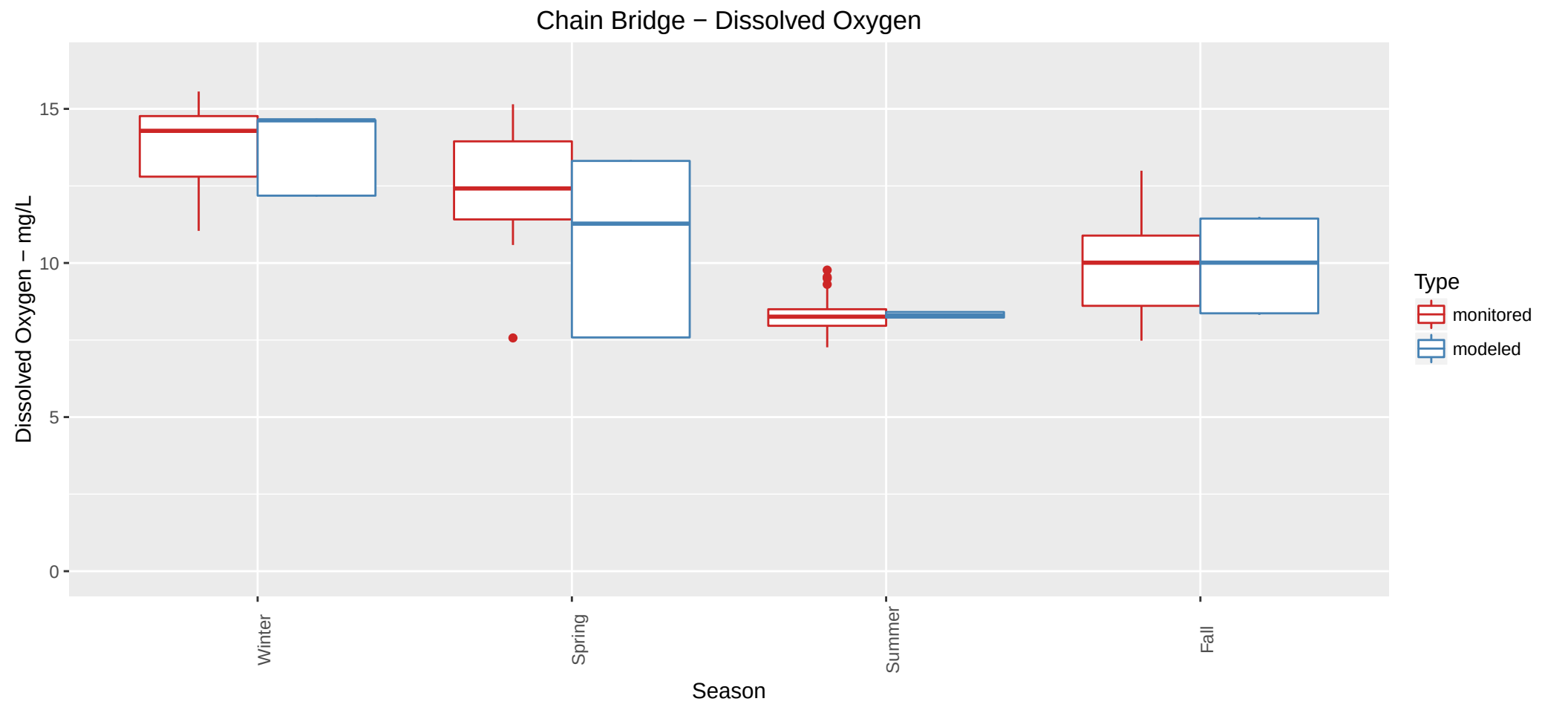
Dissolved Oxygen (Potomac) - Winter						
	Chain Bridge		14th St Bridge		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	8.3	8.3	7.4	7.3	12.1	13.7
Minimum	8.2	7.3	6.7	5.3	10.2	10.0
Maximum	8.4	9.8	8.2	9.5	13.5	15.0
25th Percentile	8.2	8.0	7.0	6.7	11.4	11.6
75th Percentile	8.4	8.5	7.7	8.0	12.5	14.2
Geomean	8.3	8.3	7.4	7.4	12.0	12.9
n	92	92	92	92	90	90

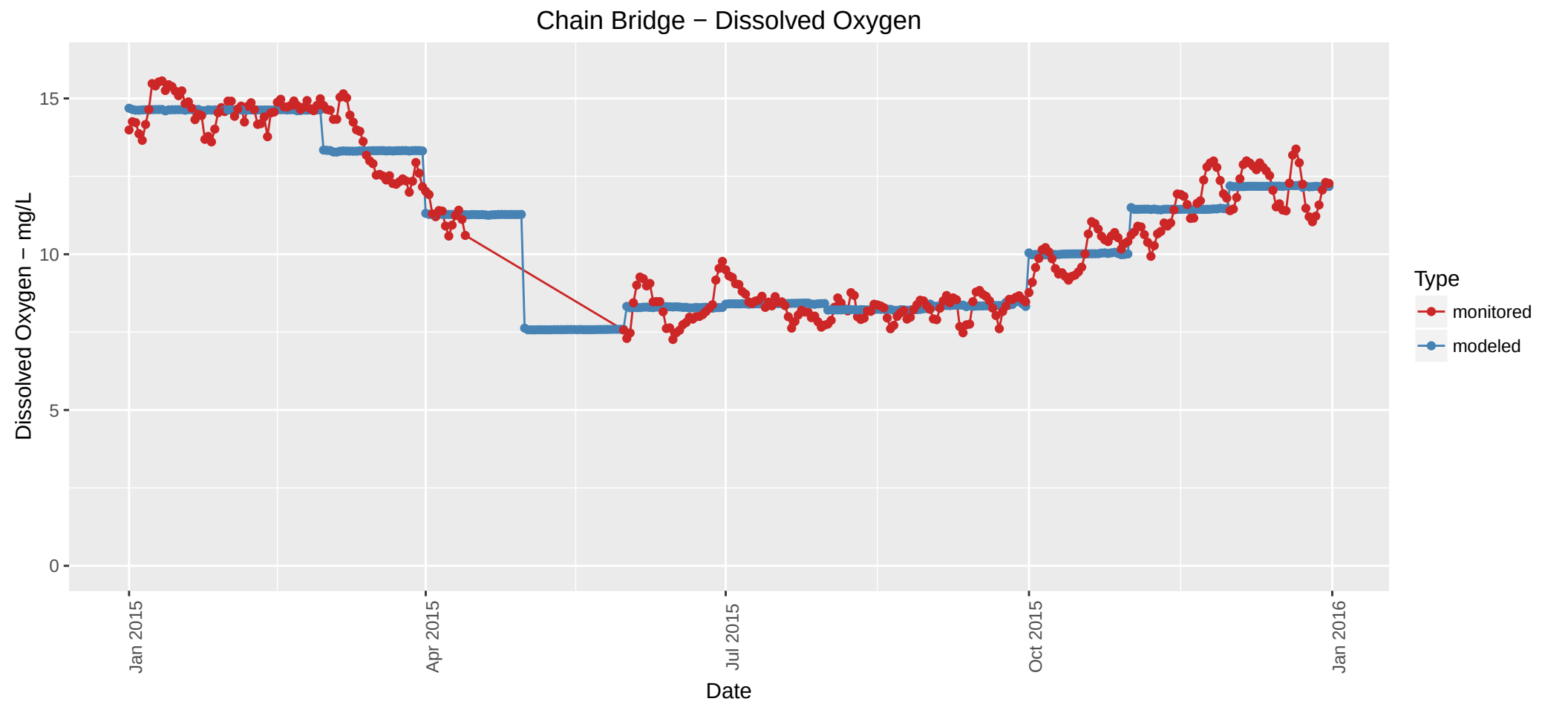
Dissolved Oxygen (Potomac) - Spring						
	Chain Bridge		14th St Bridge		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	8.3	8.3	7.4	7.3	10.1	10.5
Minimum	8.2	7.3	6.7	5.3	5.7	6.2
Maximum	8.4	9.8	8.2	9.5	12.9	14.6
25th Percentile	8.2	8.0	7.0	6.7	6.7	9.5
75th Percentile	8.4	8.5	7.7	8.0	11.8	12.1
Geomean	8.3	8.3	7.4	7.4	9.2	10.6
n	92	92	92	92	92	84

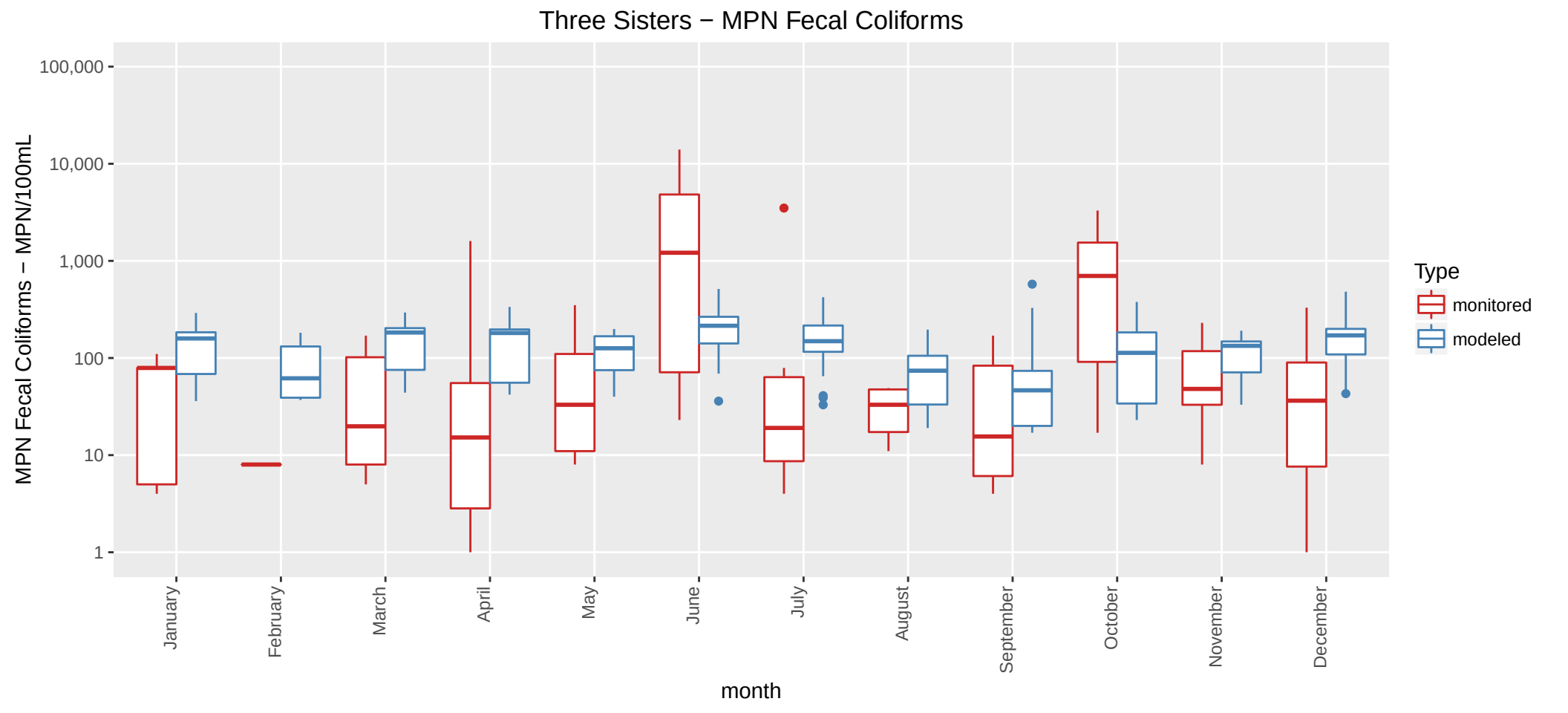
Dissolved Oxygen (Potomac) - Summer						
	Chain Bridge		14th St Bridge		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	8.3	8.3	7.4	7.3	5.8	7.1
Minimum	8.2	7.3	6.7	5.3	5.0	4.6
Maximum	8.4	9.8	8.2	9.5	7.8	9.2
25th Percentile	8.2	8.0	7.0	6.7	5.6	6.6
75th Percentile	8.4	8.5	7.7	8.0	6.3	7.7
Geomean	8.3	8.3	7.4	7.4	5.9	7.1
n	92	92	92	92	92.0	92.0

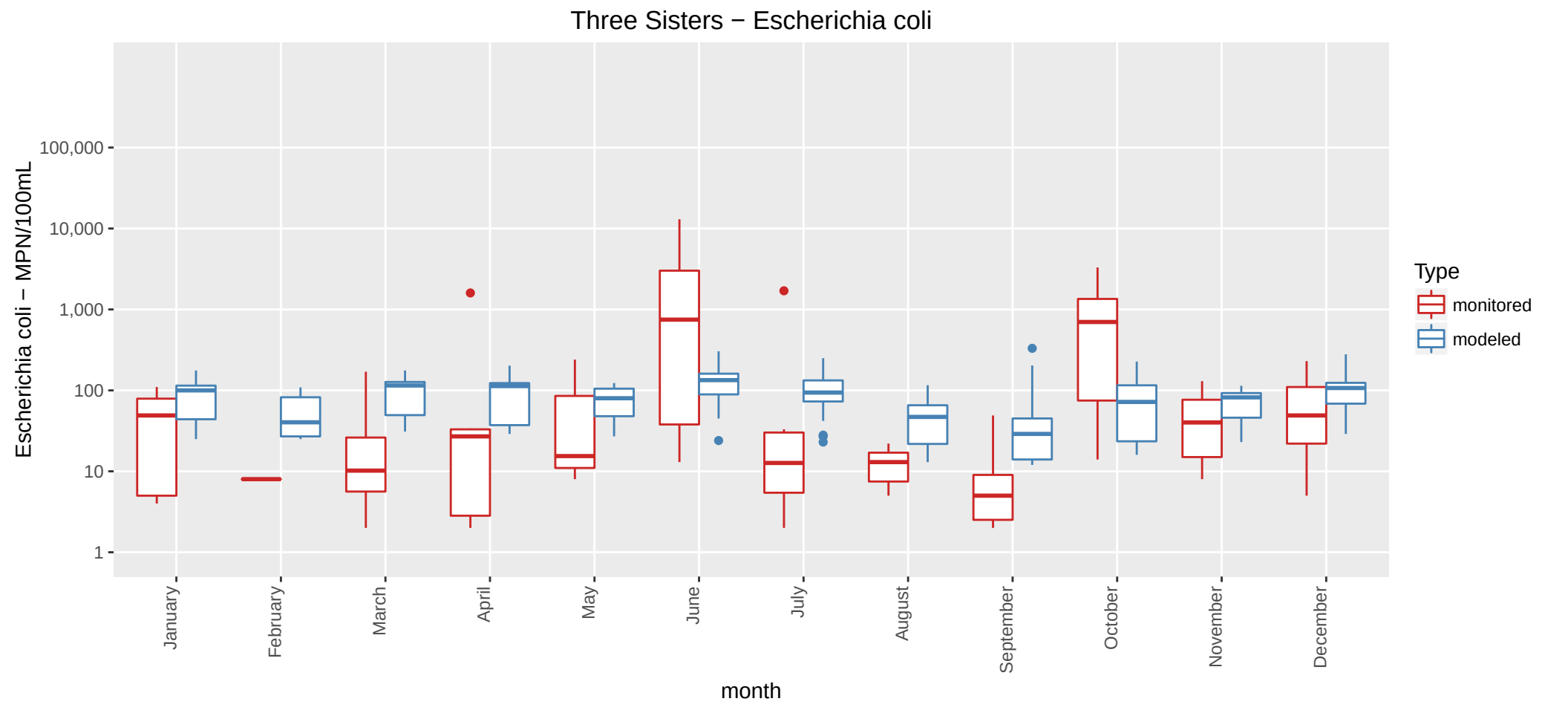
Dissolved Oxygen (Potomac) - Fall						
	Chain Bridge		14th St Bridge		Wilson Bridge	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	10.0	10.0	9.3	9.4	7.6	9.0
Minimum	8.3	7.5	6.8	5.6	5.8	6.0
Maximum	11.5	13.0	11.3	12.5	10.4	11.7
25th Percentile	8.4	8.6	7.5	7.6	6.5	7.5
75th Percentile	11.4	10.9	11.2	10.2	10.0	9.5
Geomean	9.9	9.8	9.1	9.0	8.0	8.5
n	91	91	91	91	91	91

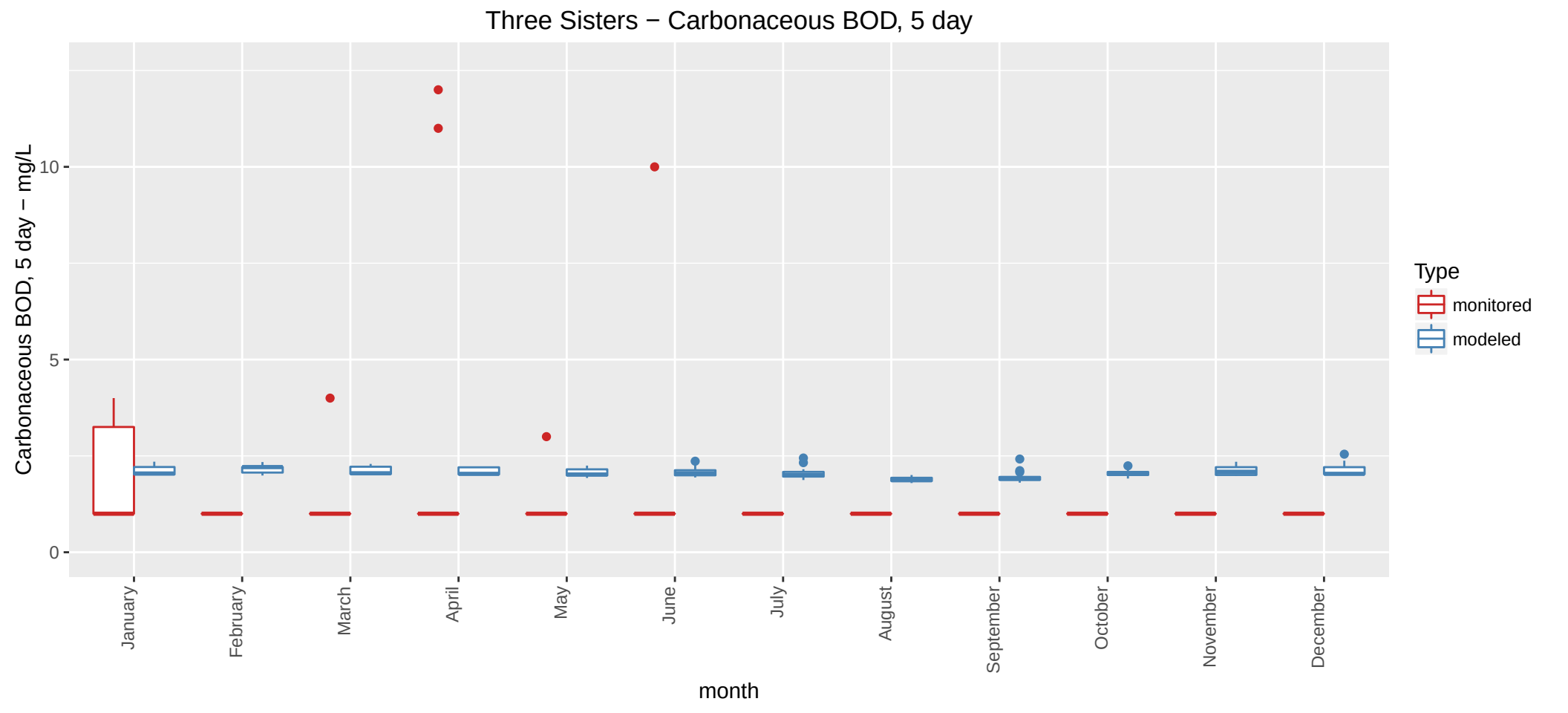

Chain Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

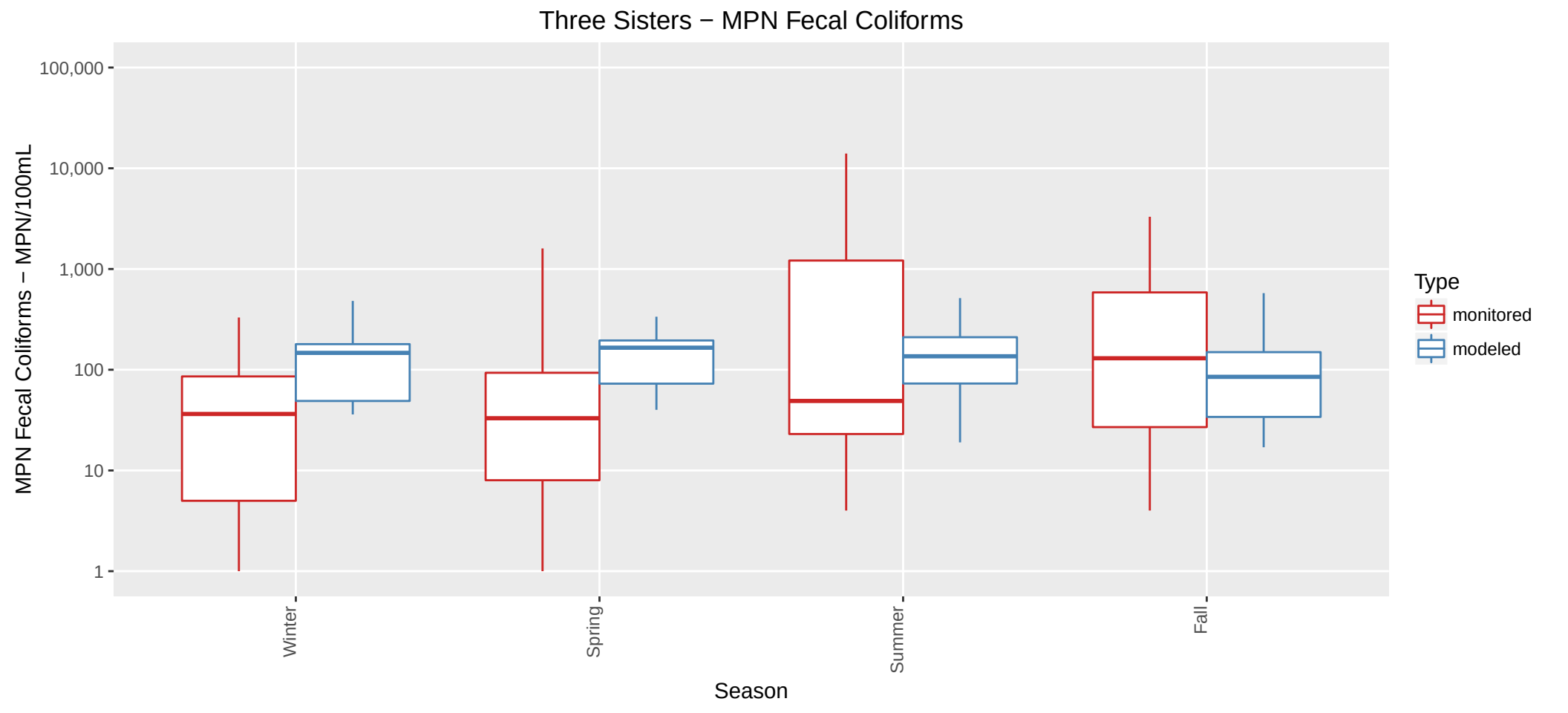

Chain Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

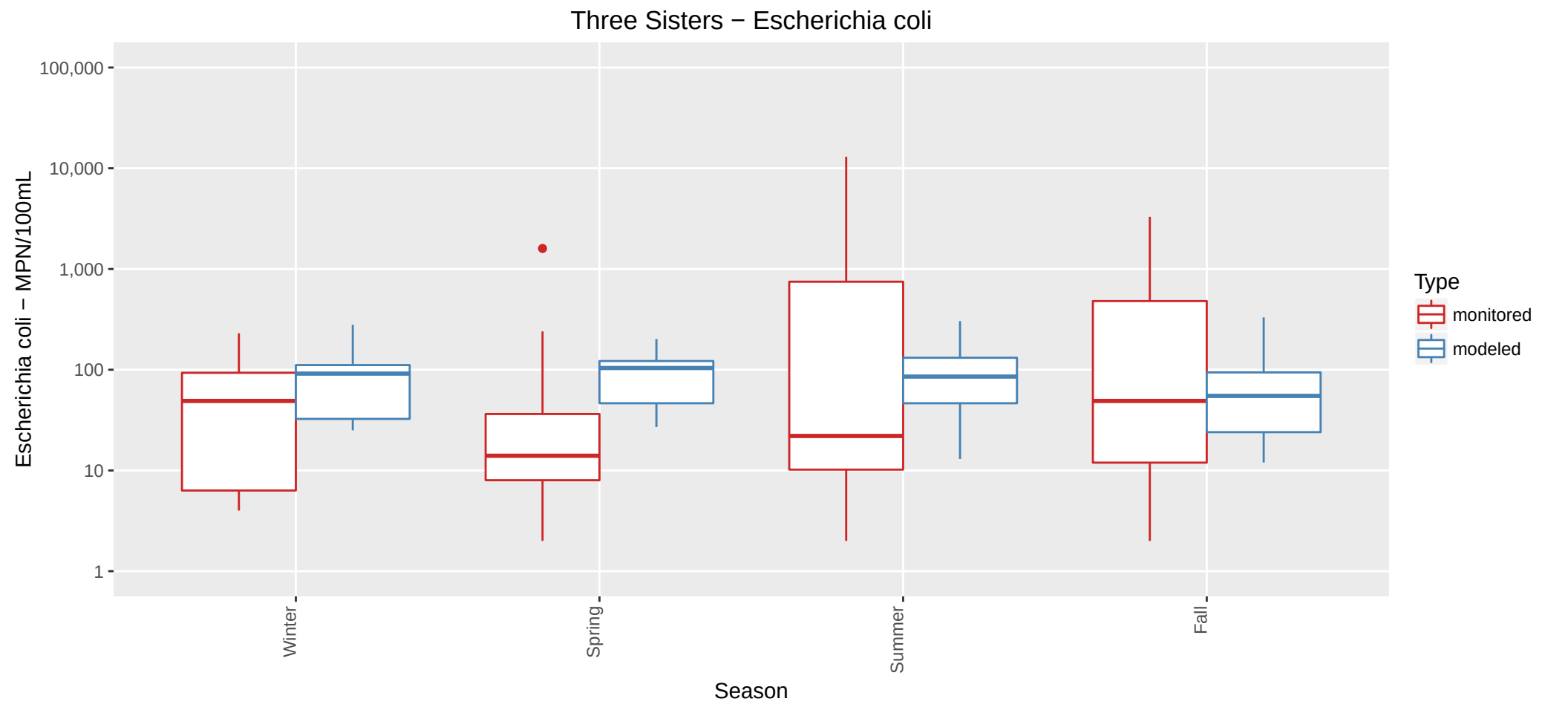

Chain Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

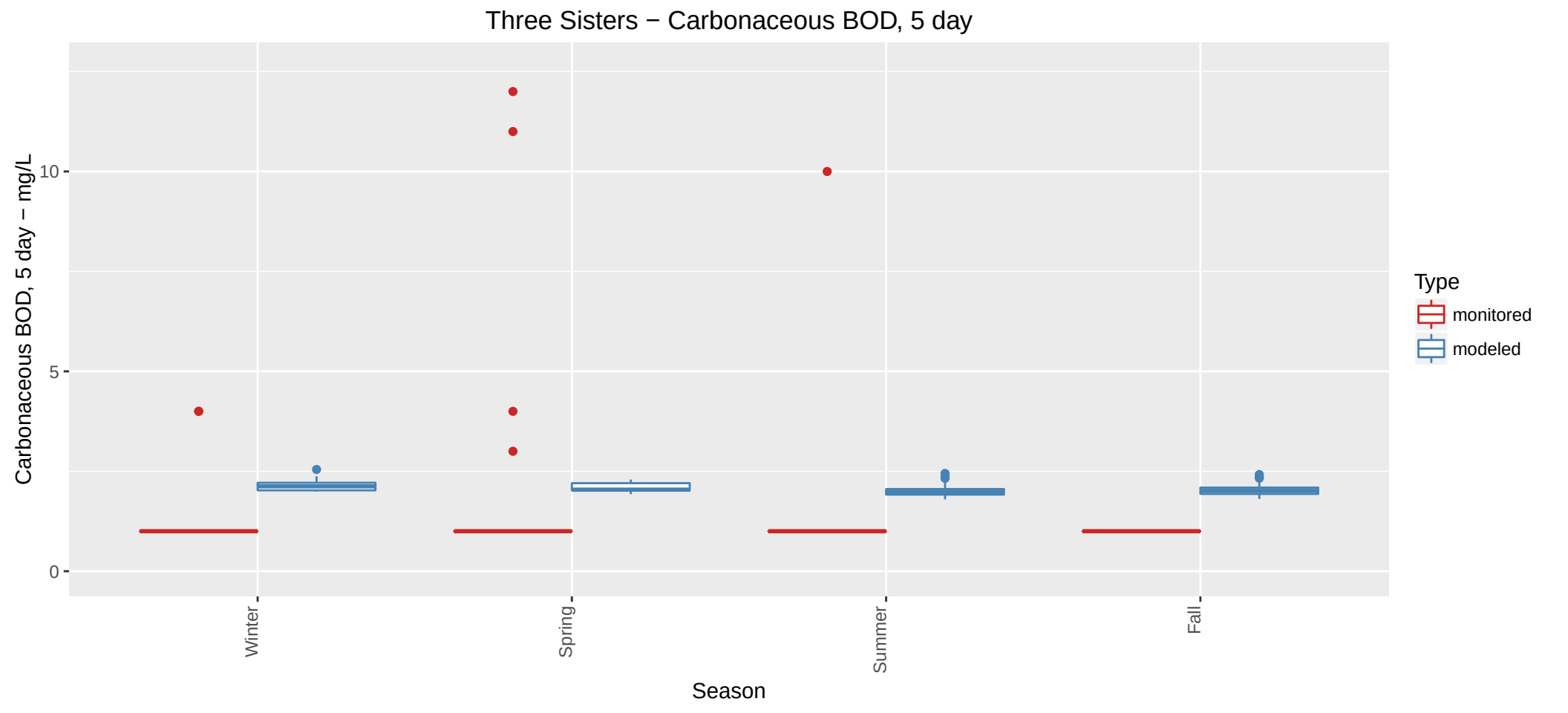

Three Sisters − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

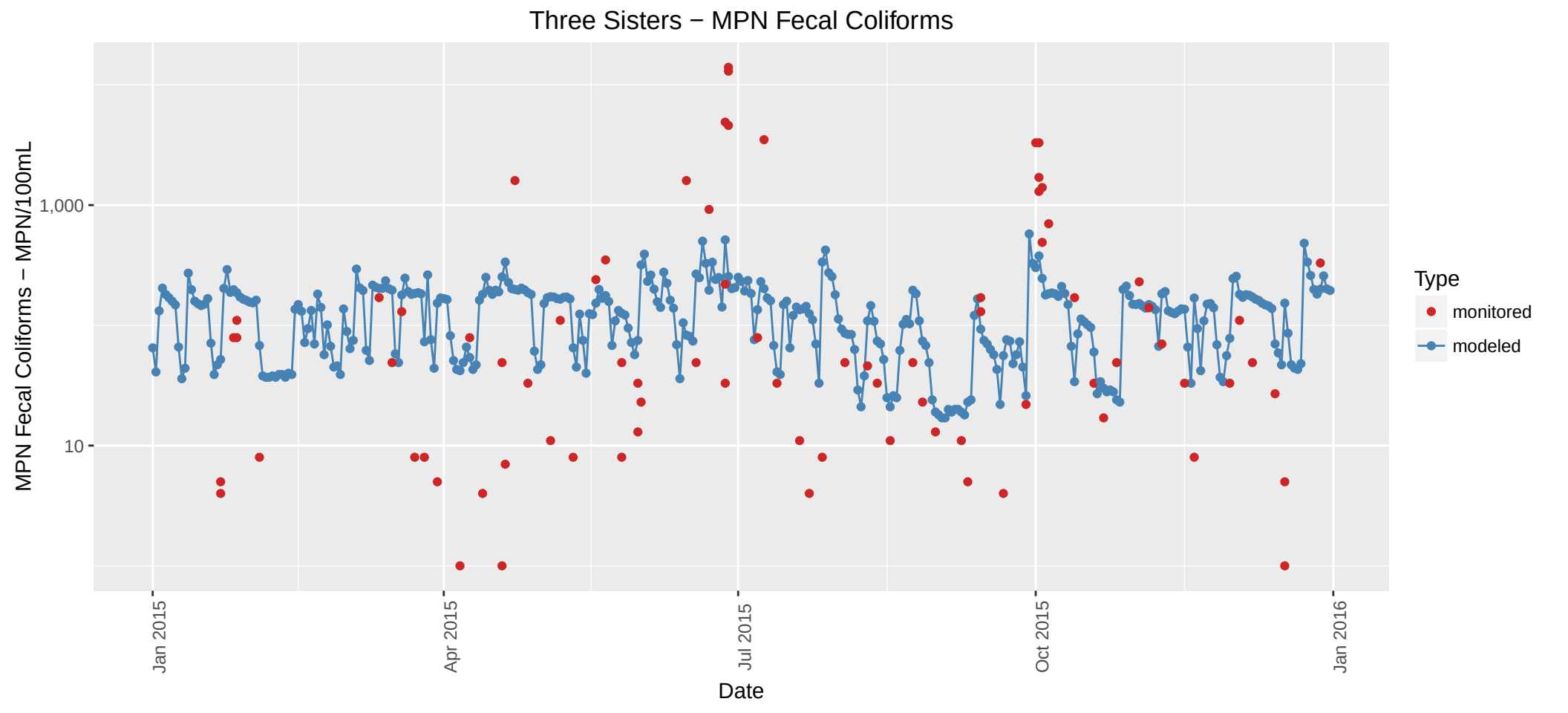

Three Sisters − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

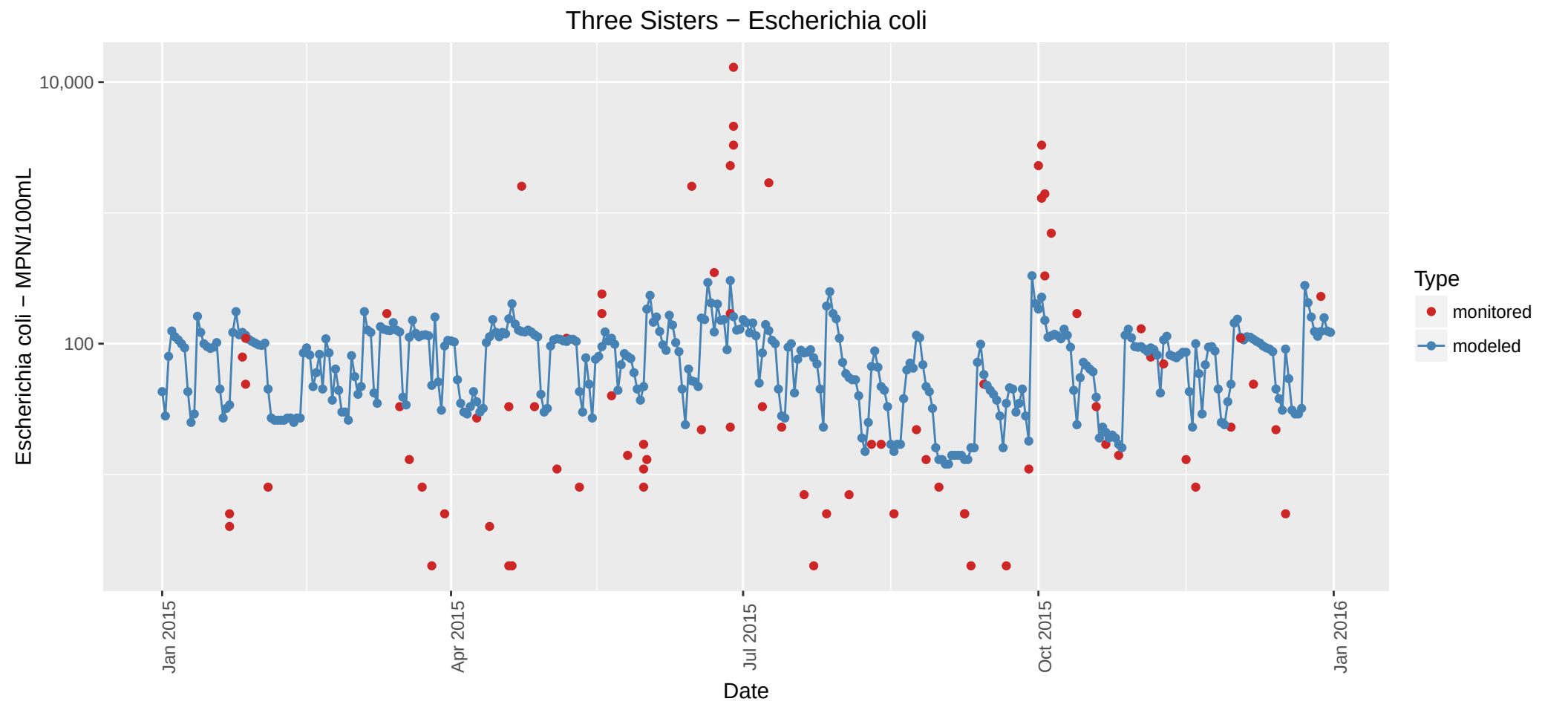

Three Sisters − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

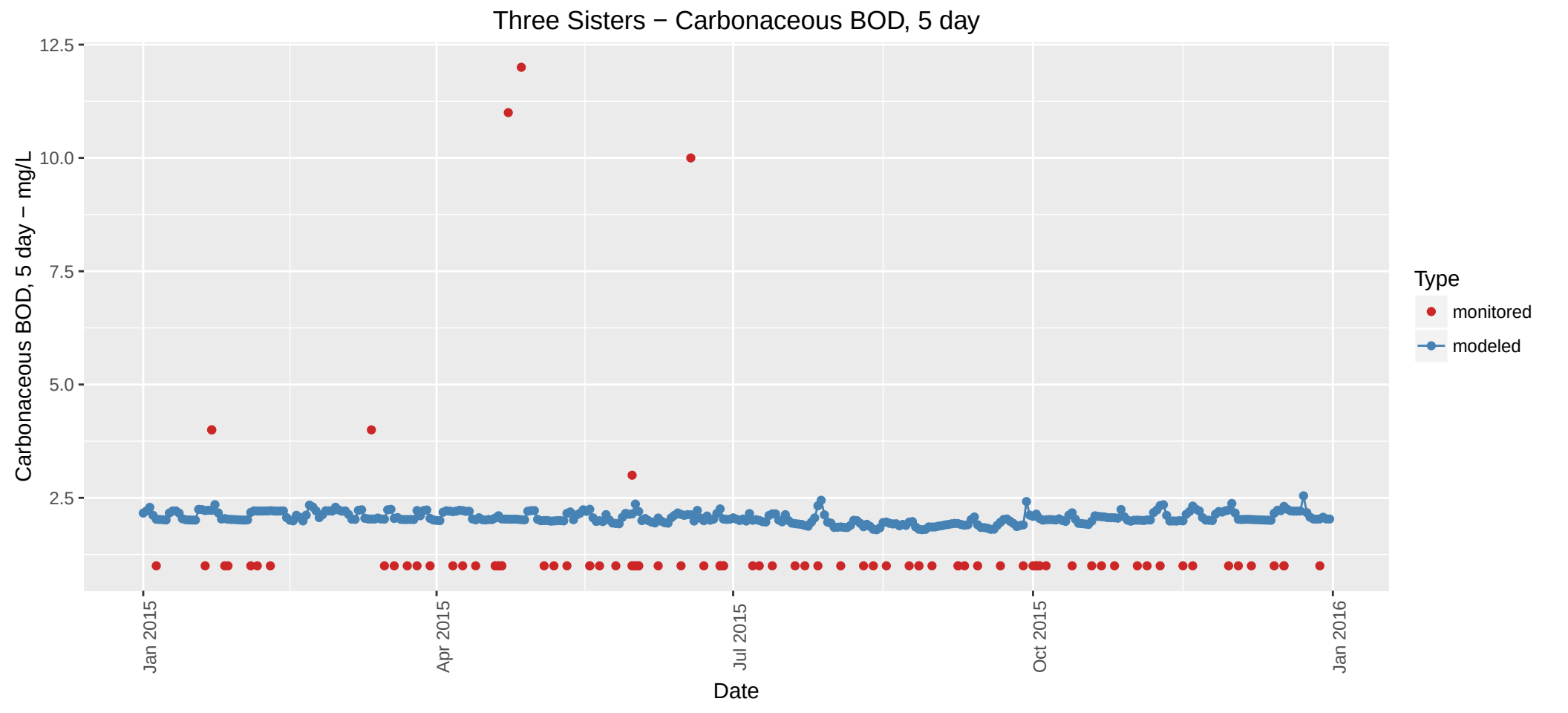

Three Sisters − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

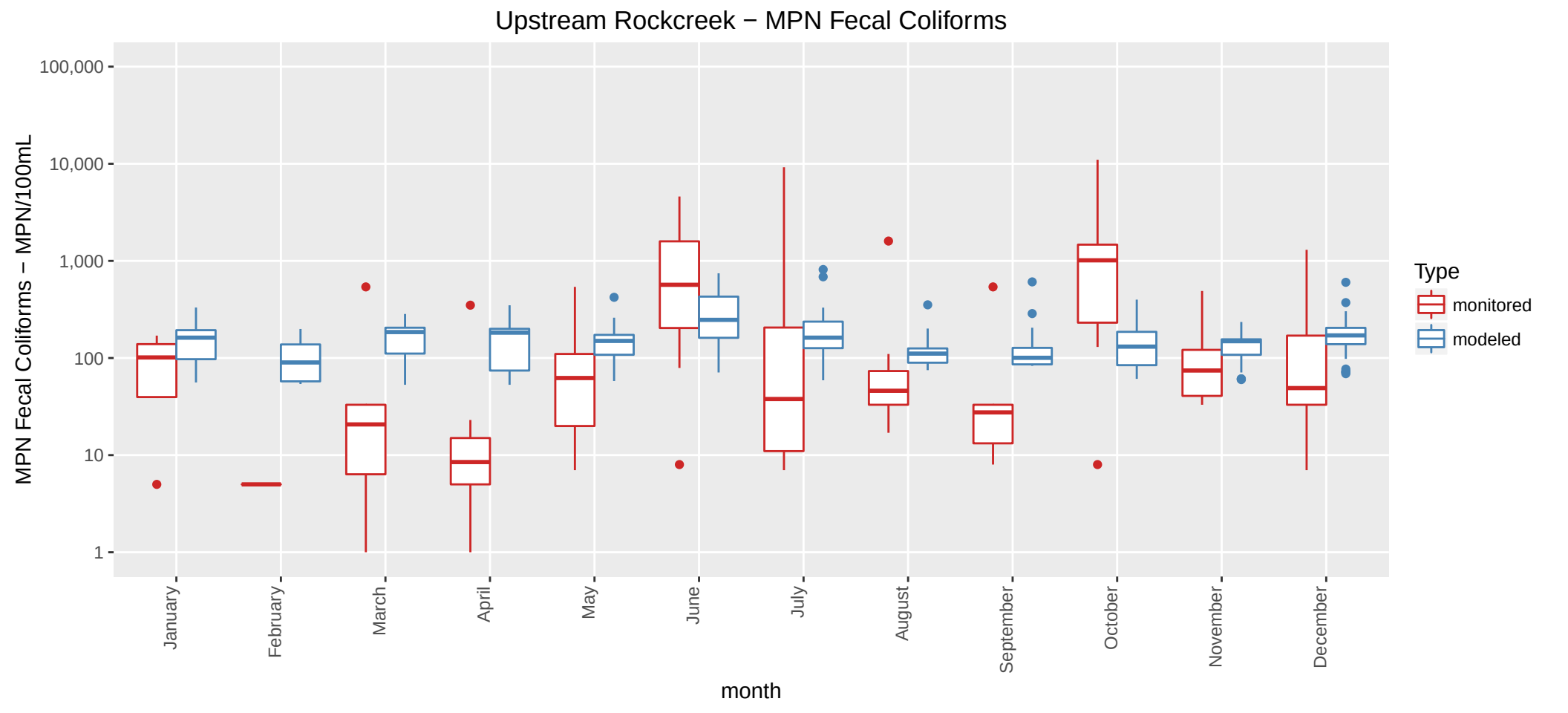

Three Sisters − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

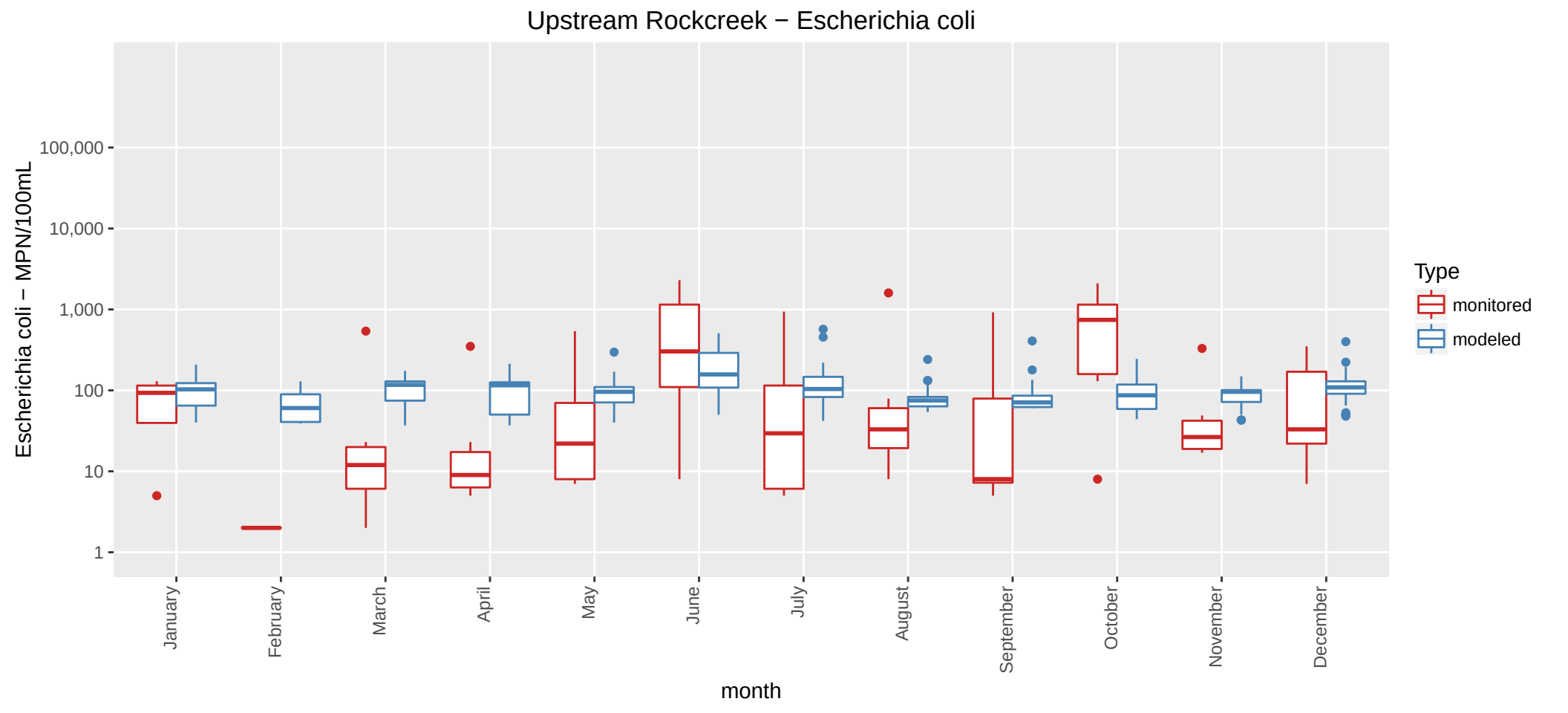

Three Sisters − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

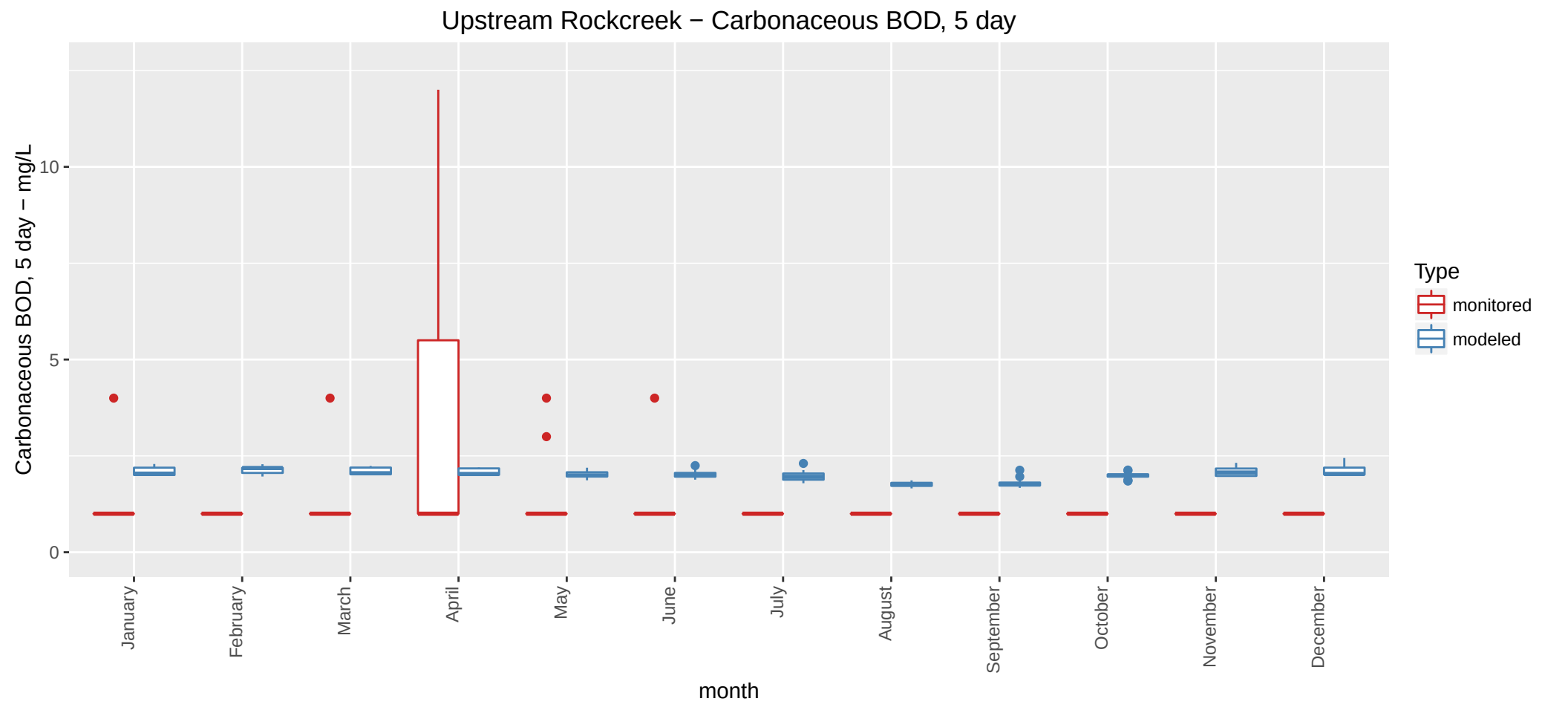

Three Sisters − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

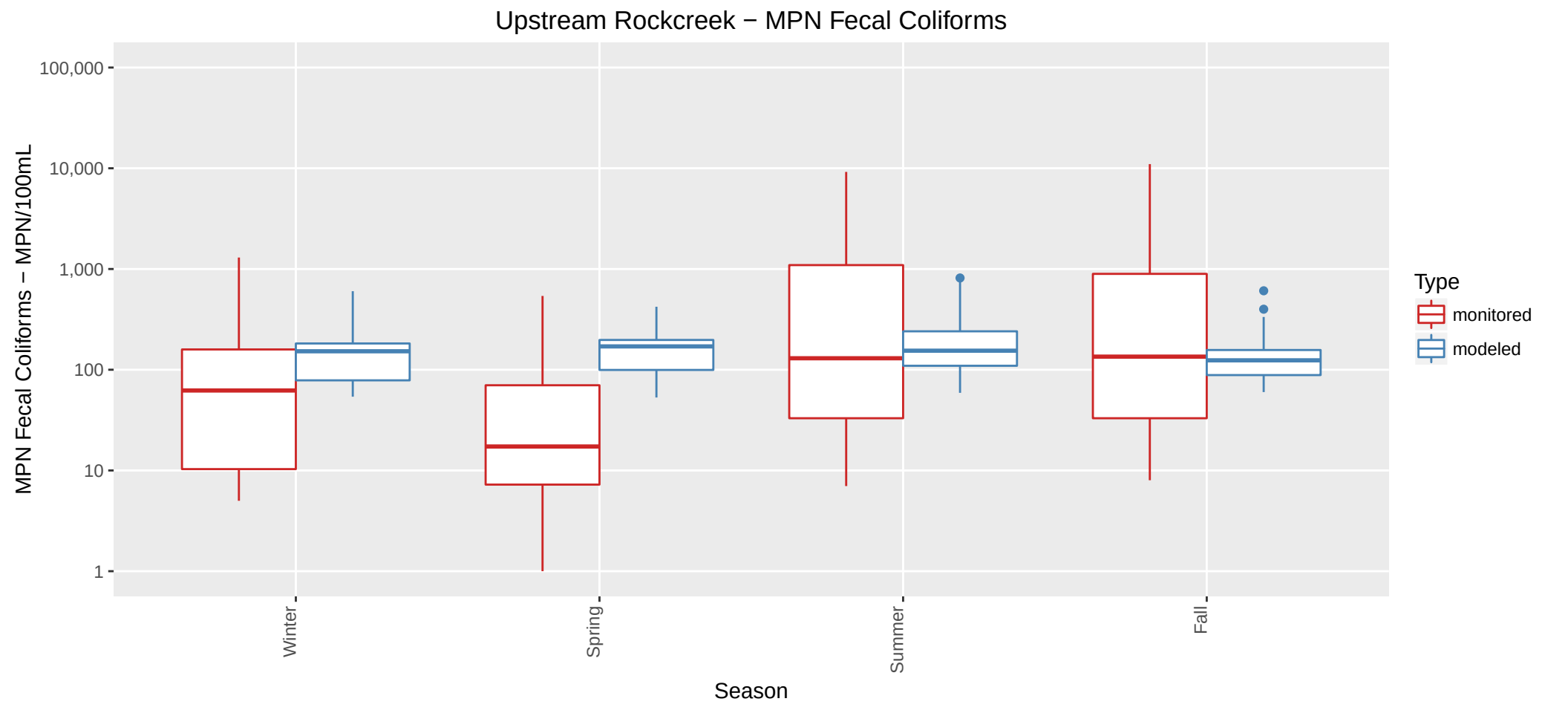

Three Sisters − Escherichia coli
10,000
100
Escherichia coli – MPN/100mL
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

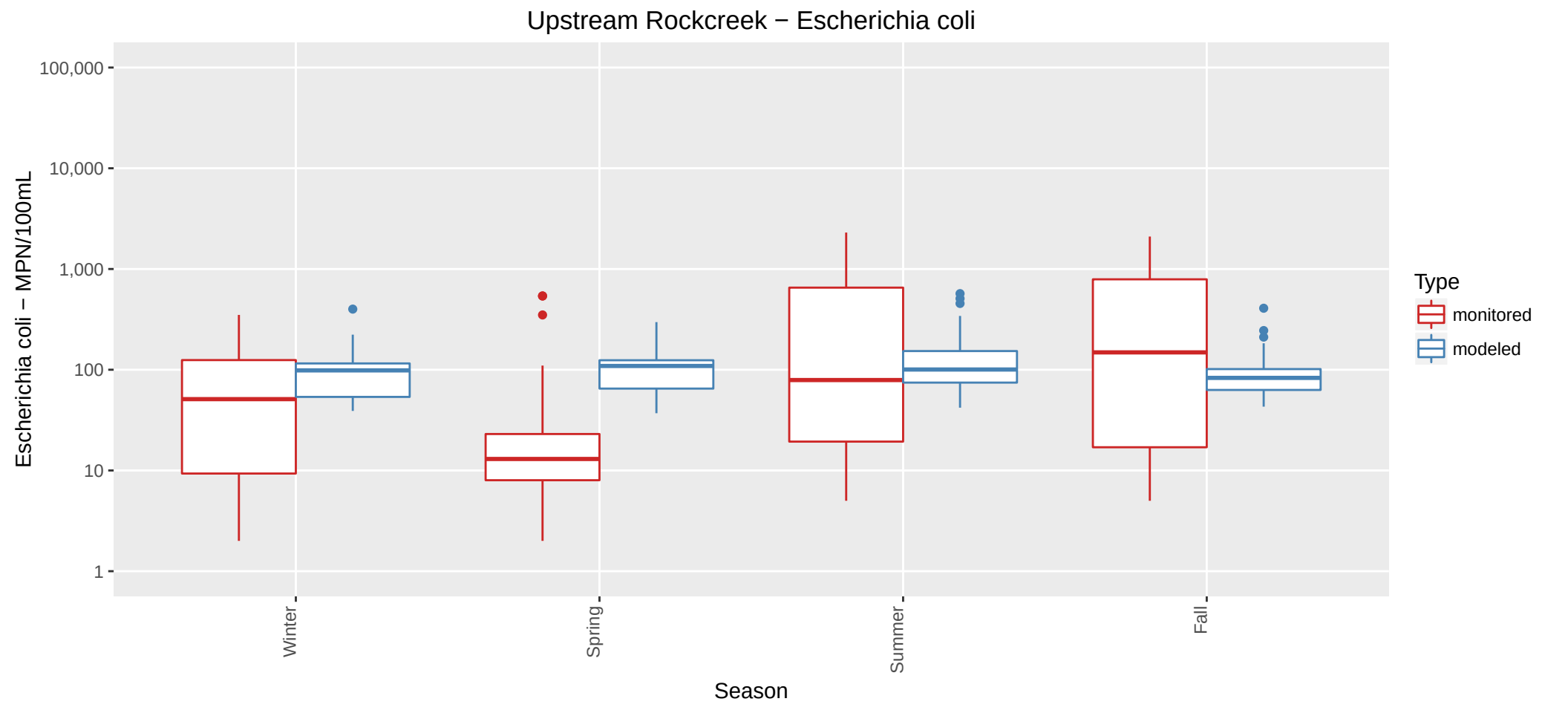

Three Sisters − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
12.5
10.0
7.5
5.0
2.5
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

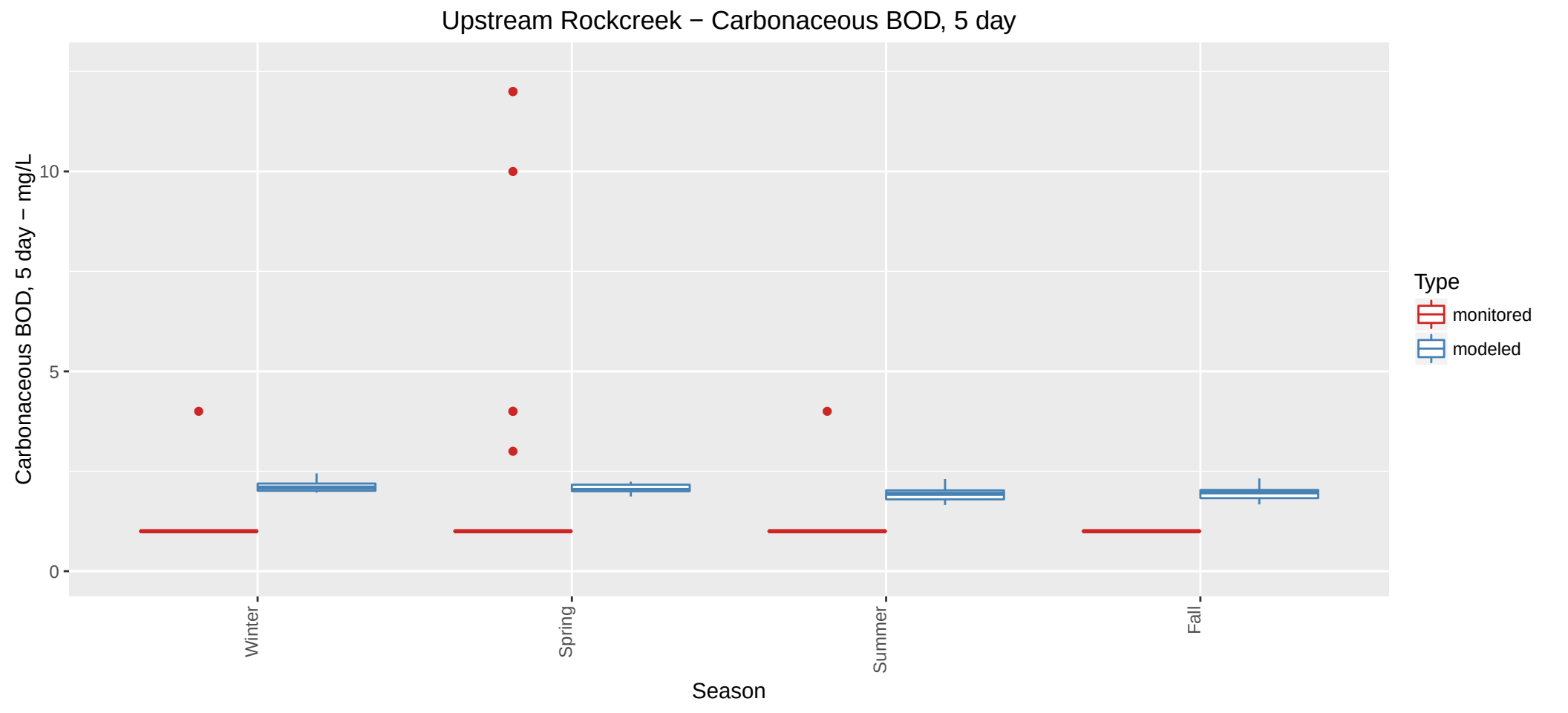

Upstream Rockcreek − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

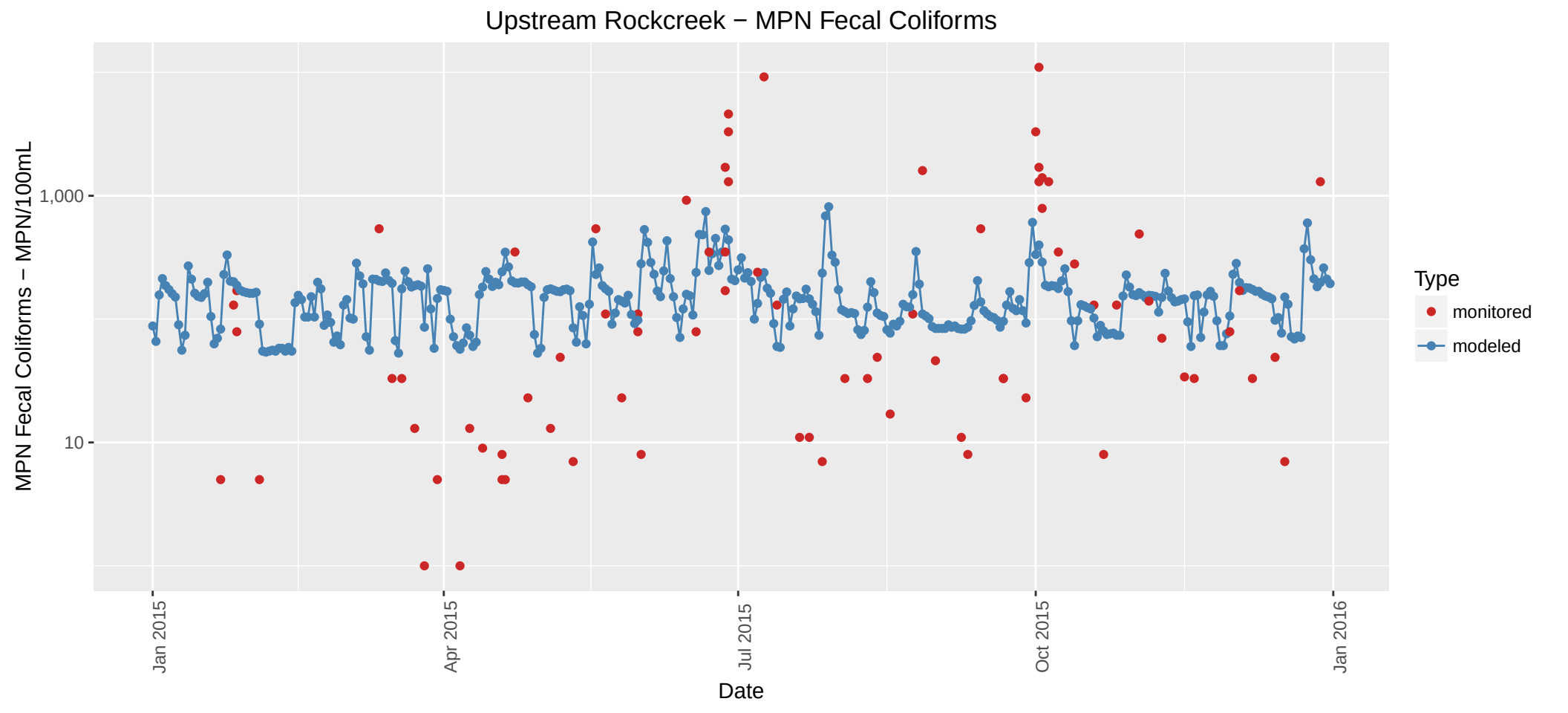

Upstream Rockcreek − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

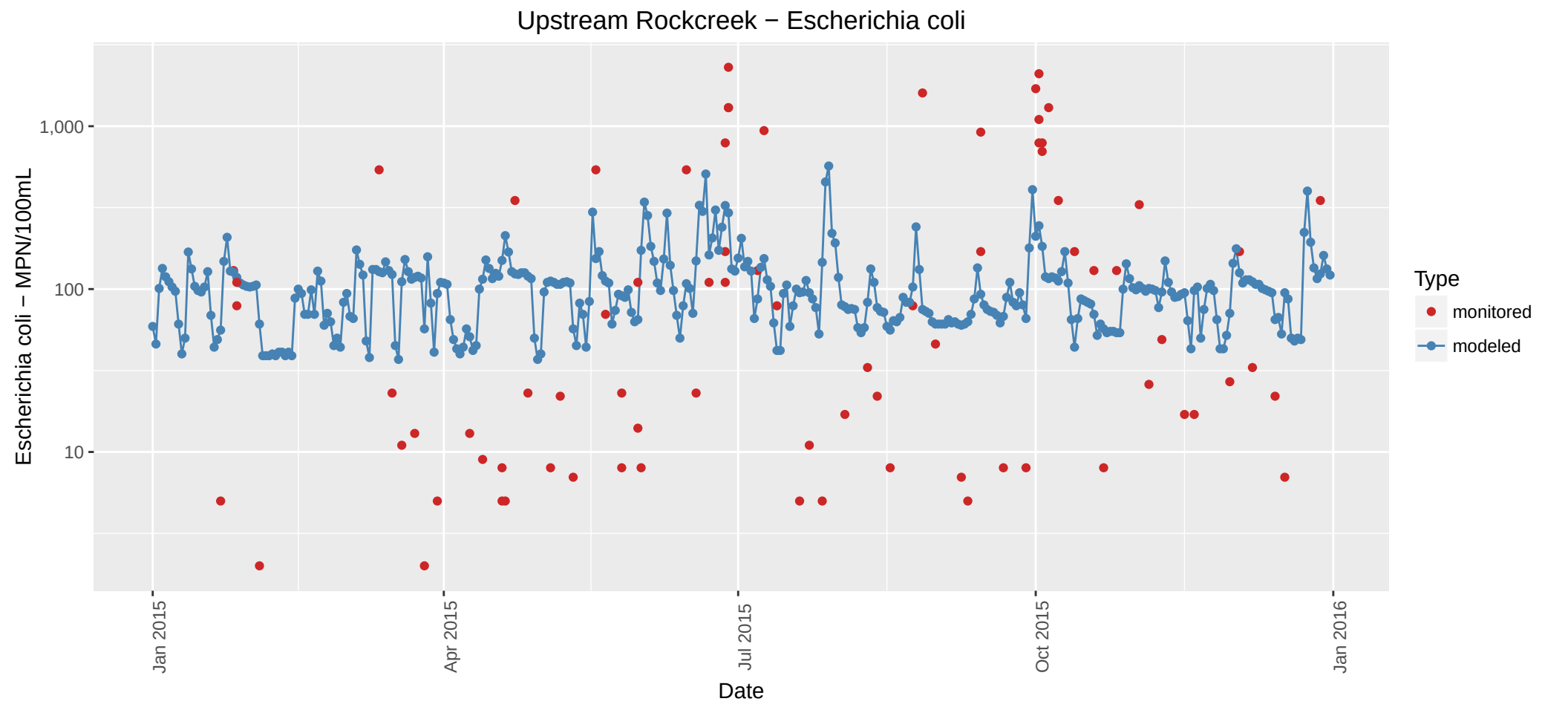

Upstream Rockcreek − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

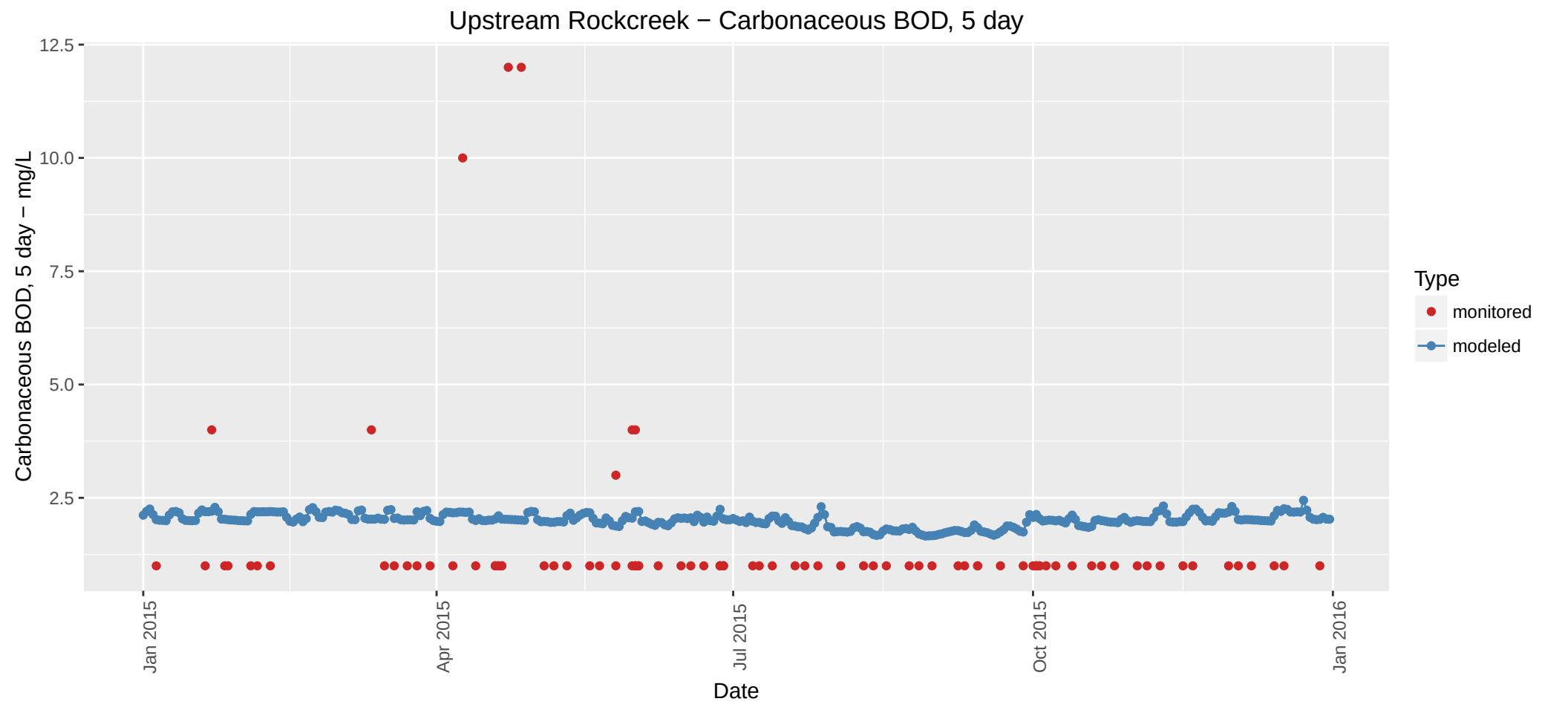

Upstream Rockcreek − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

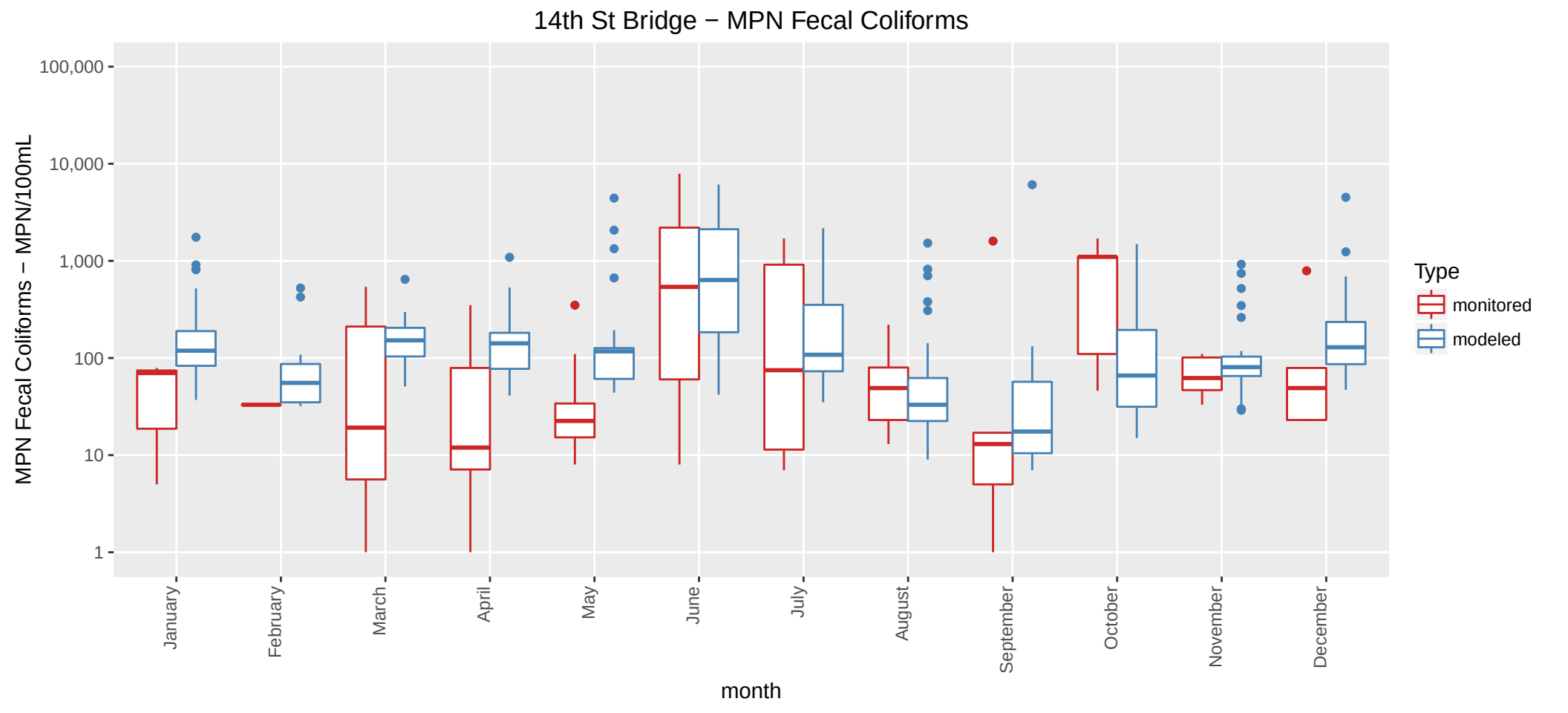

Upstream Rockcreek − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

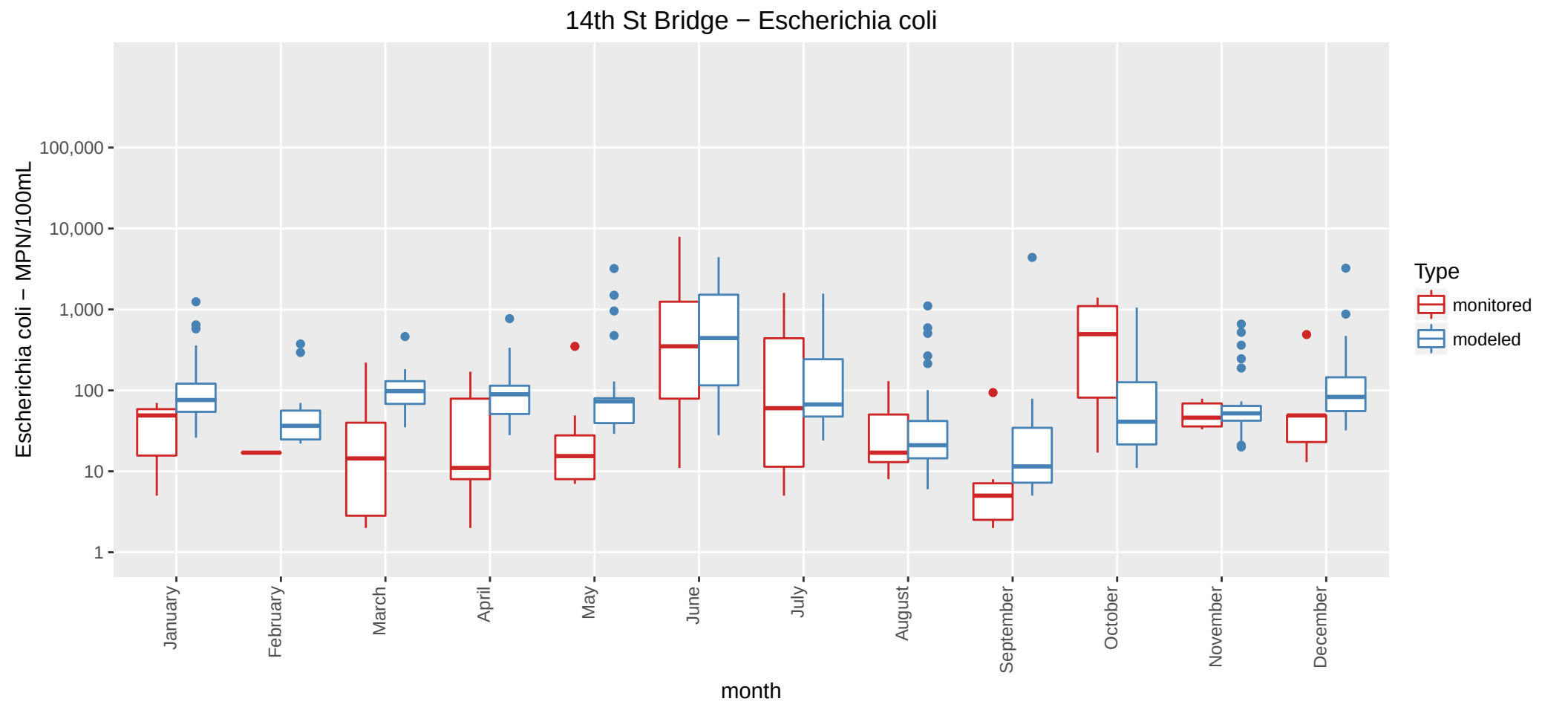

Upstream Rockcreek − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

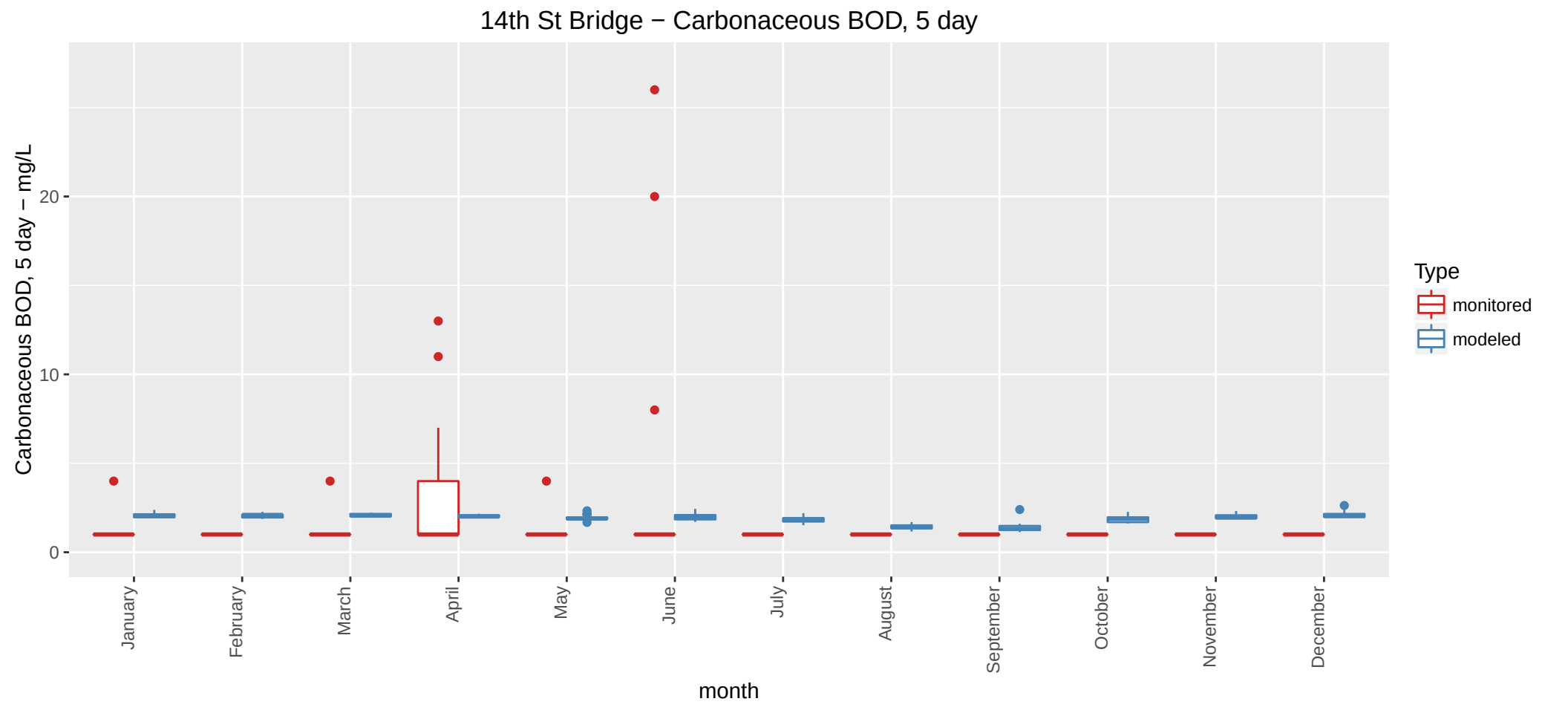

Upstream Rockcreek − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

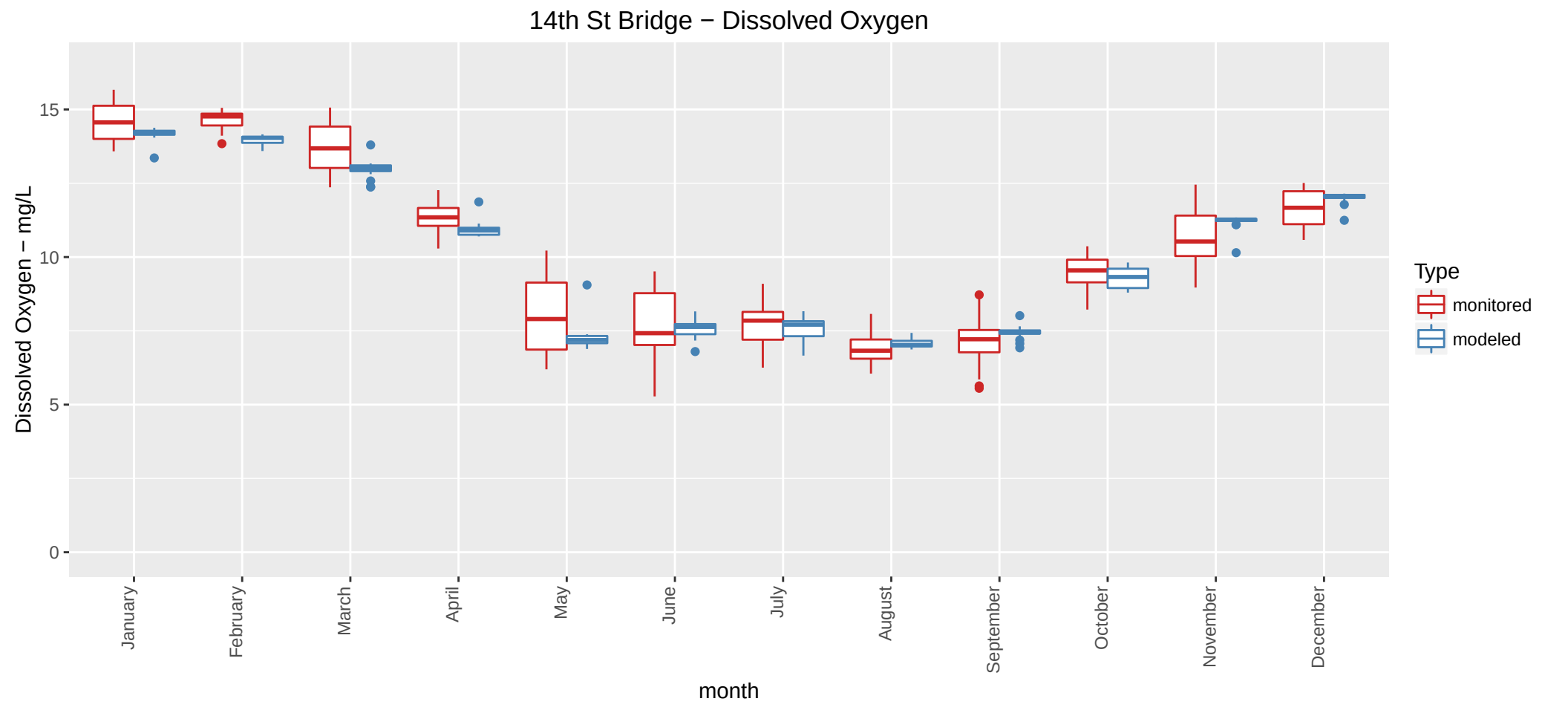

Upstream Rockcreek − Escherichia coli
Escherichia coli − MPN/100mL
1,000
100
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

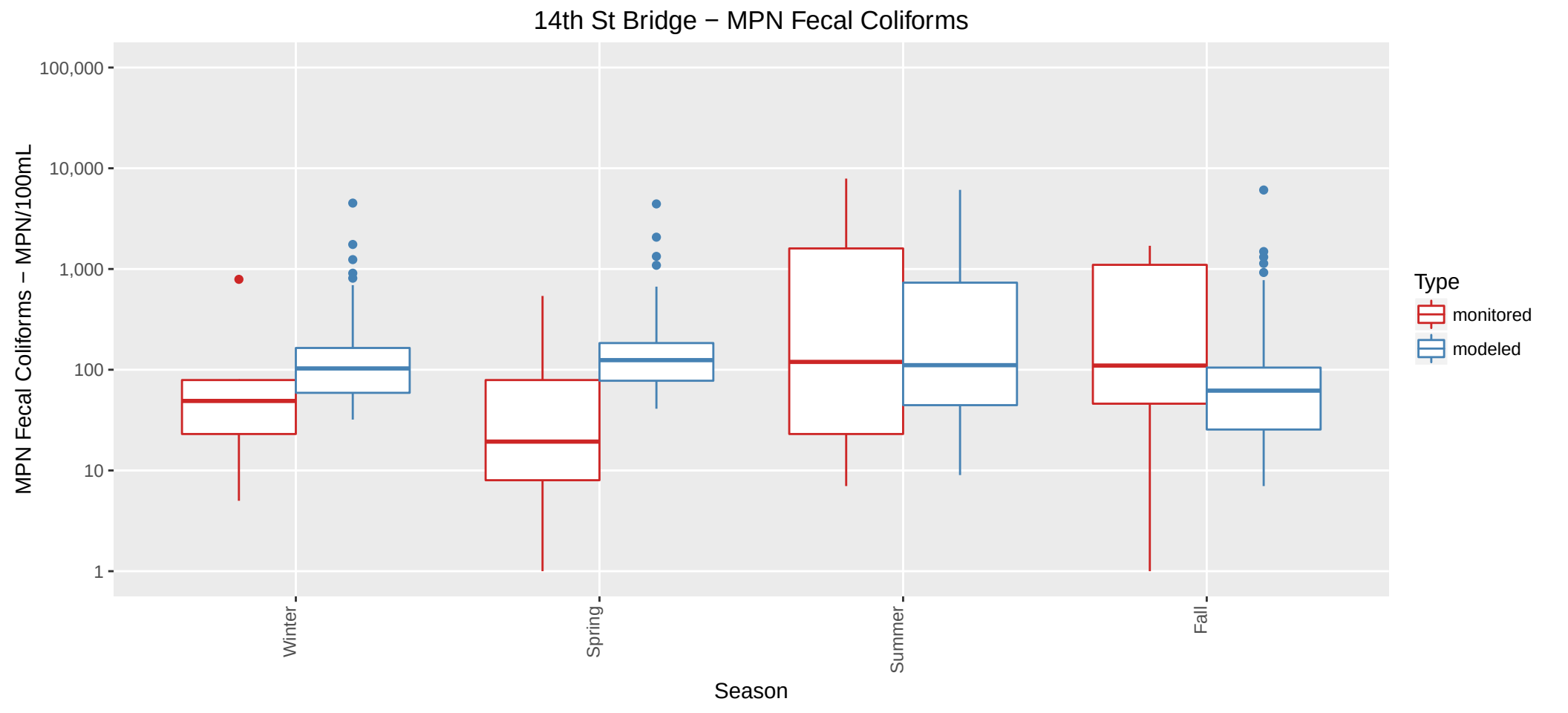

Upstream Rockcreek − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
12.5
10.0
7.5
5.0
2.5
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

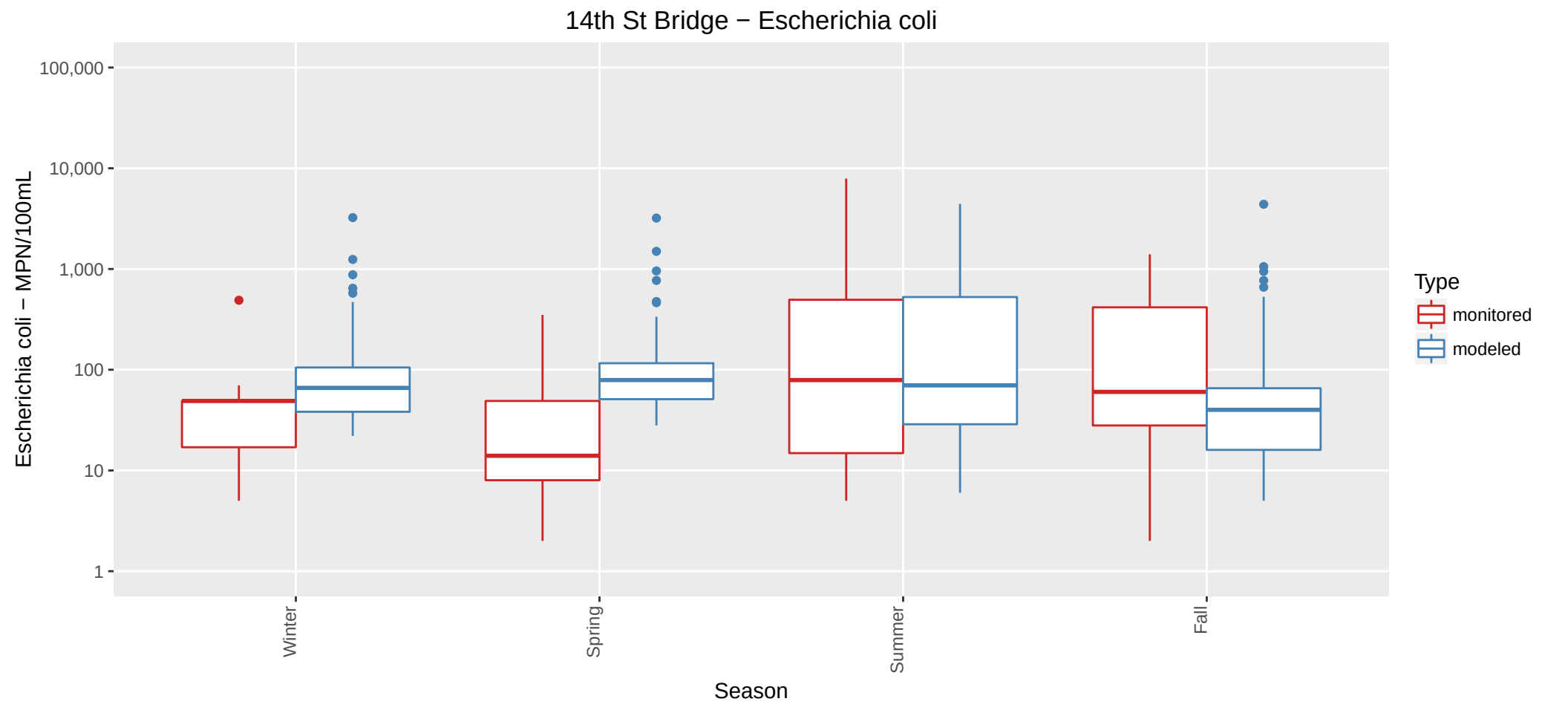

14th St Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

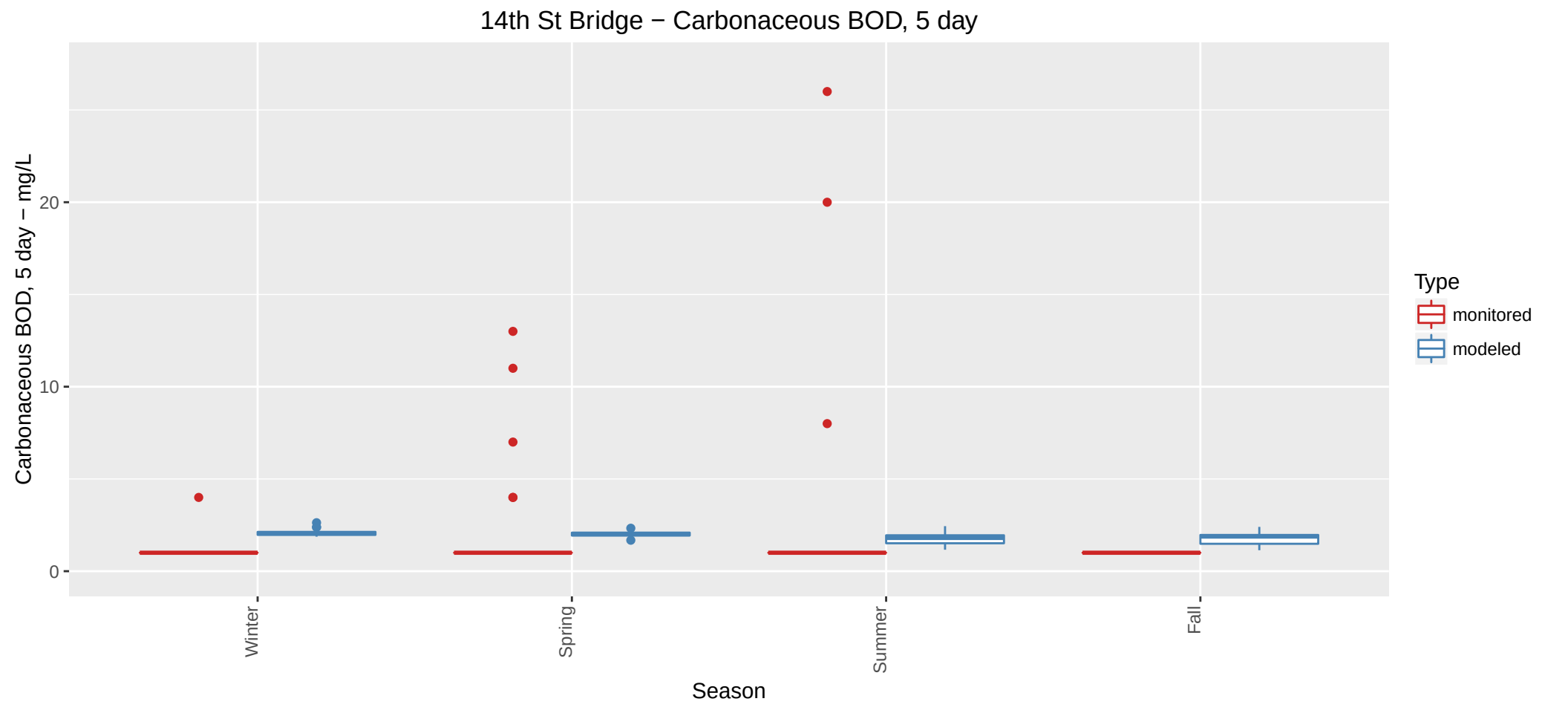

14th St Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

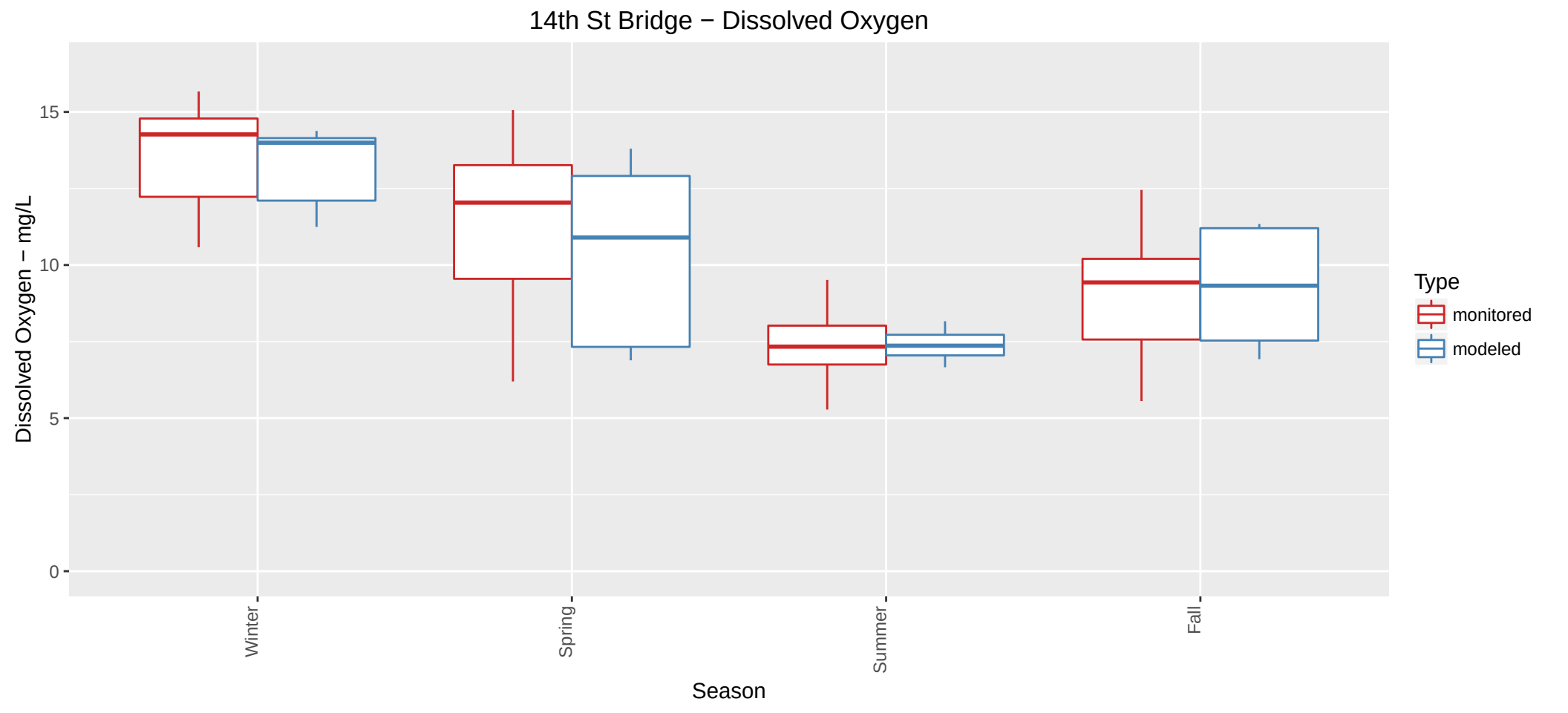

14th St Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
0
10
20
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

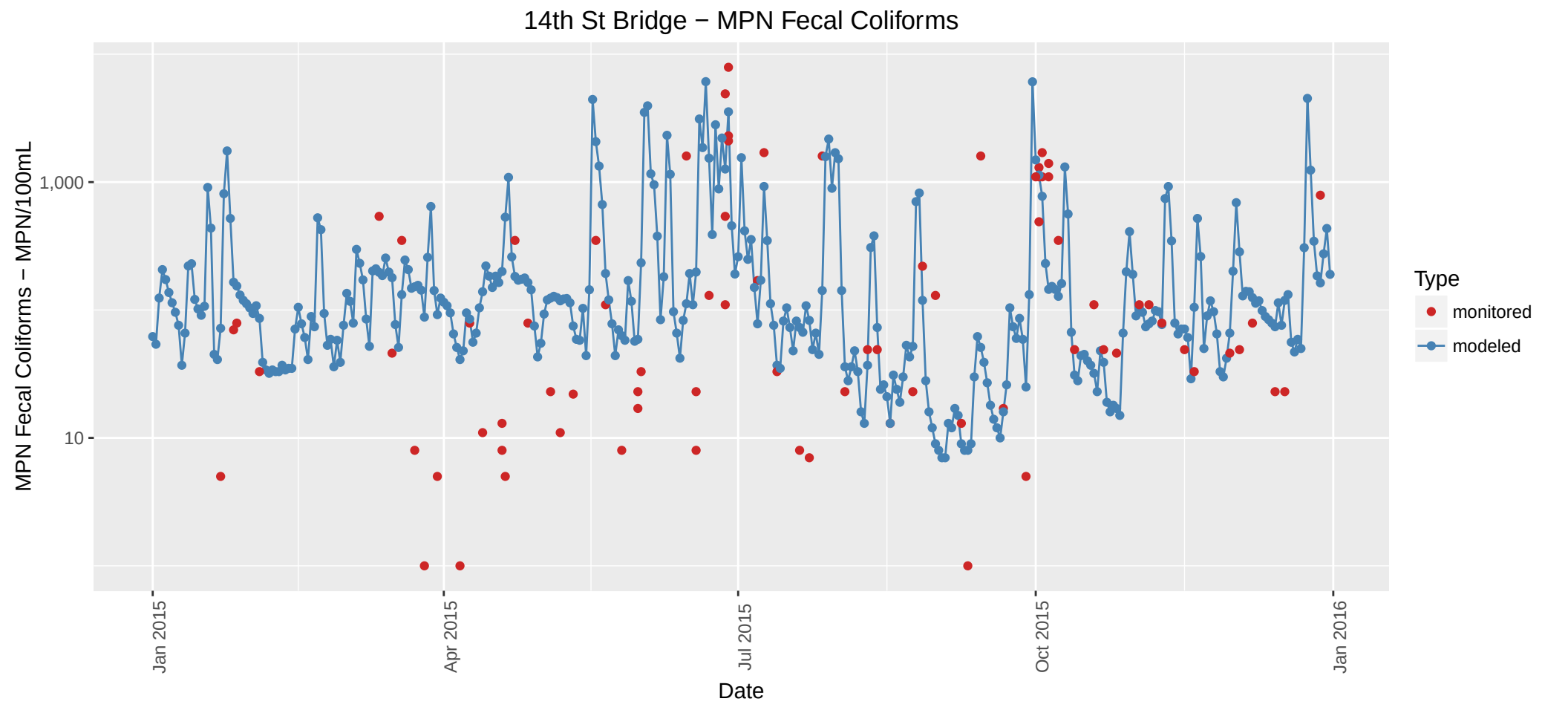

14th St Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

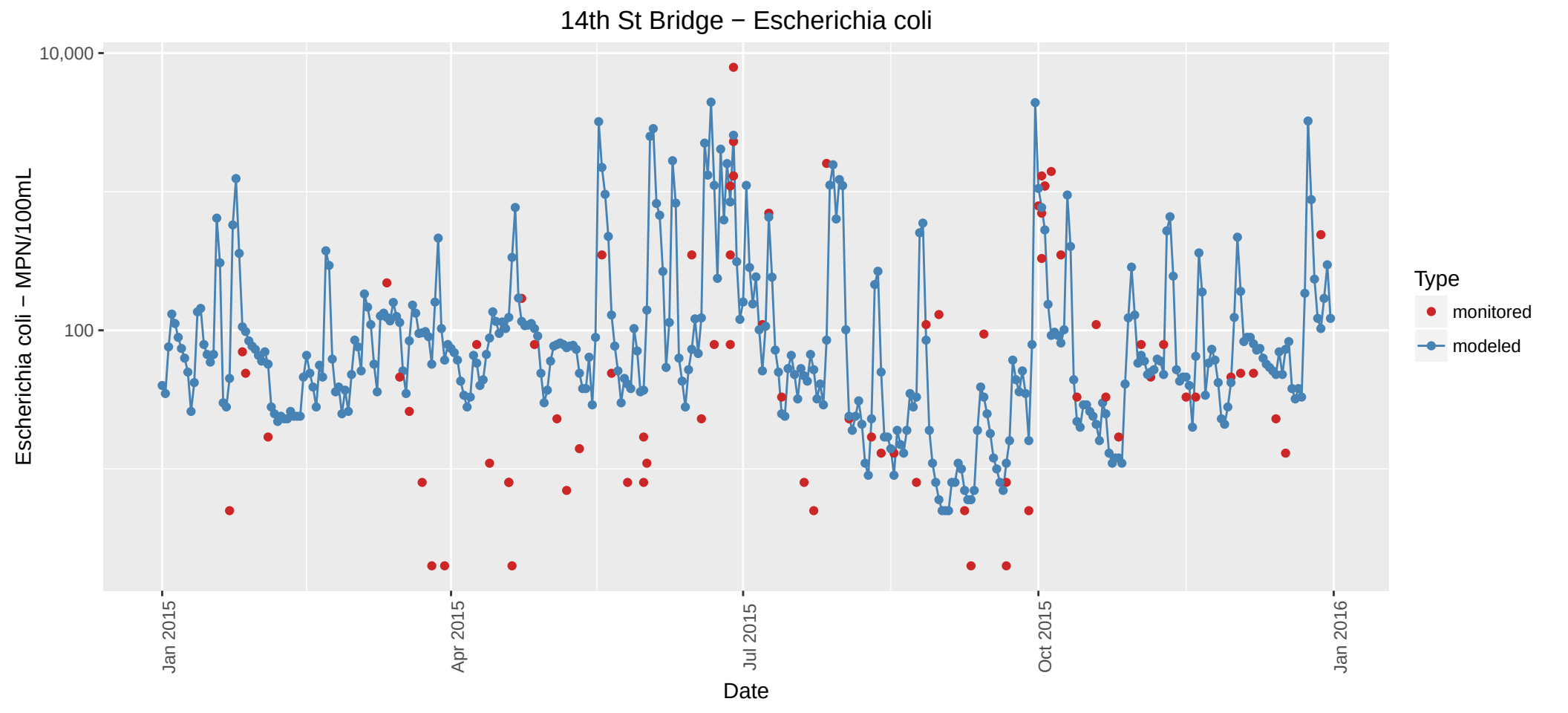

14th St Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

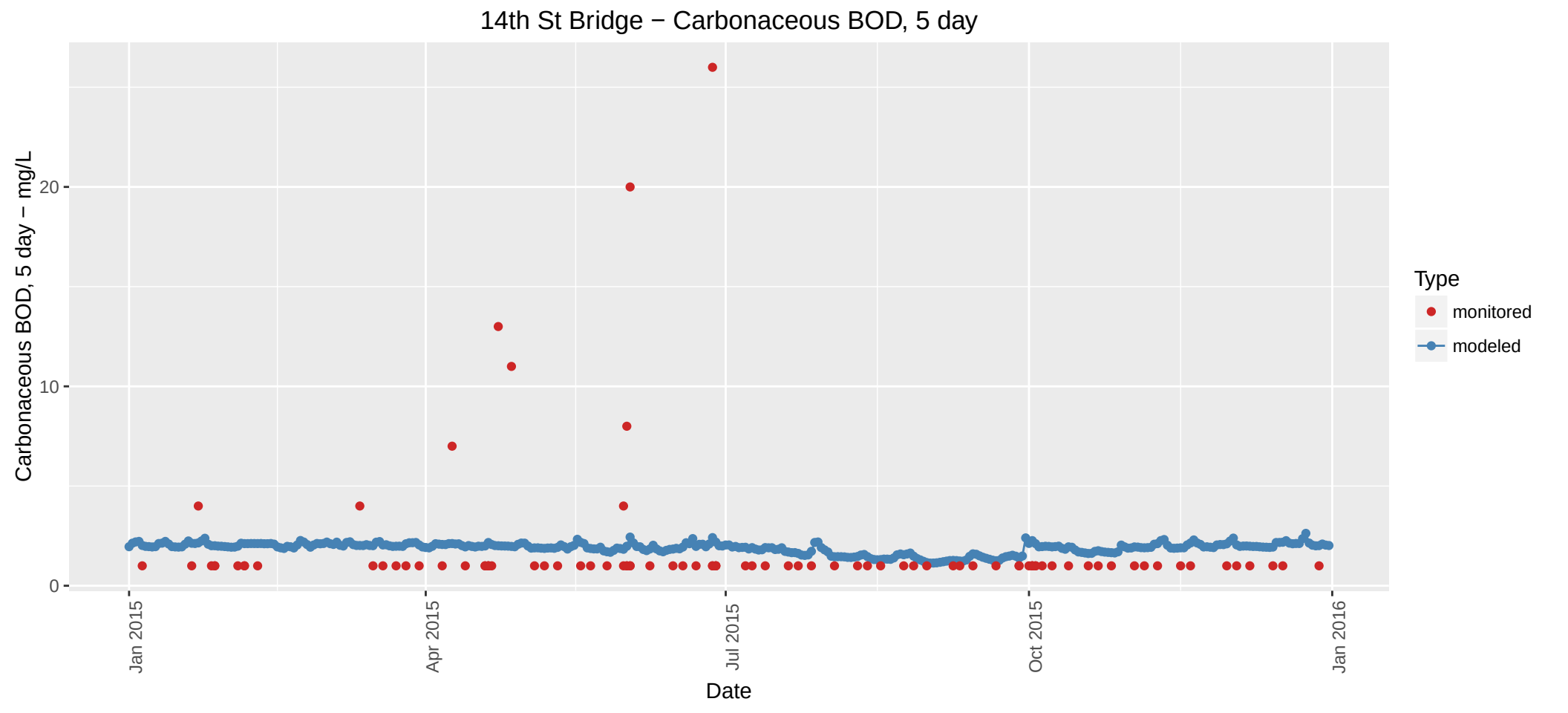

14th St Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

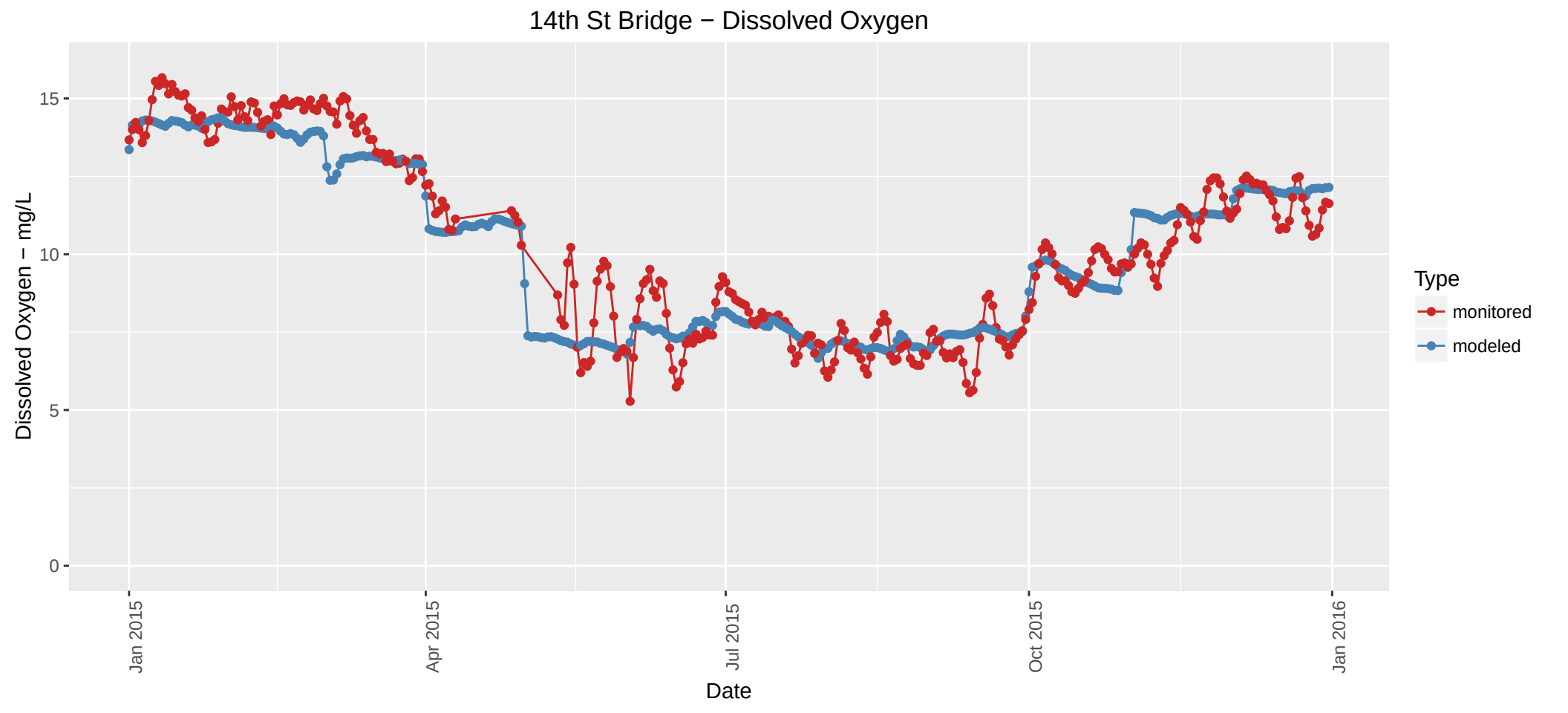

14th St Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
20
10
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

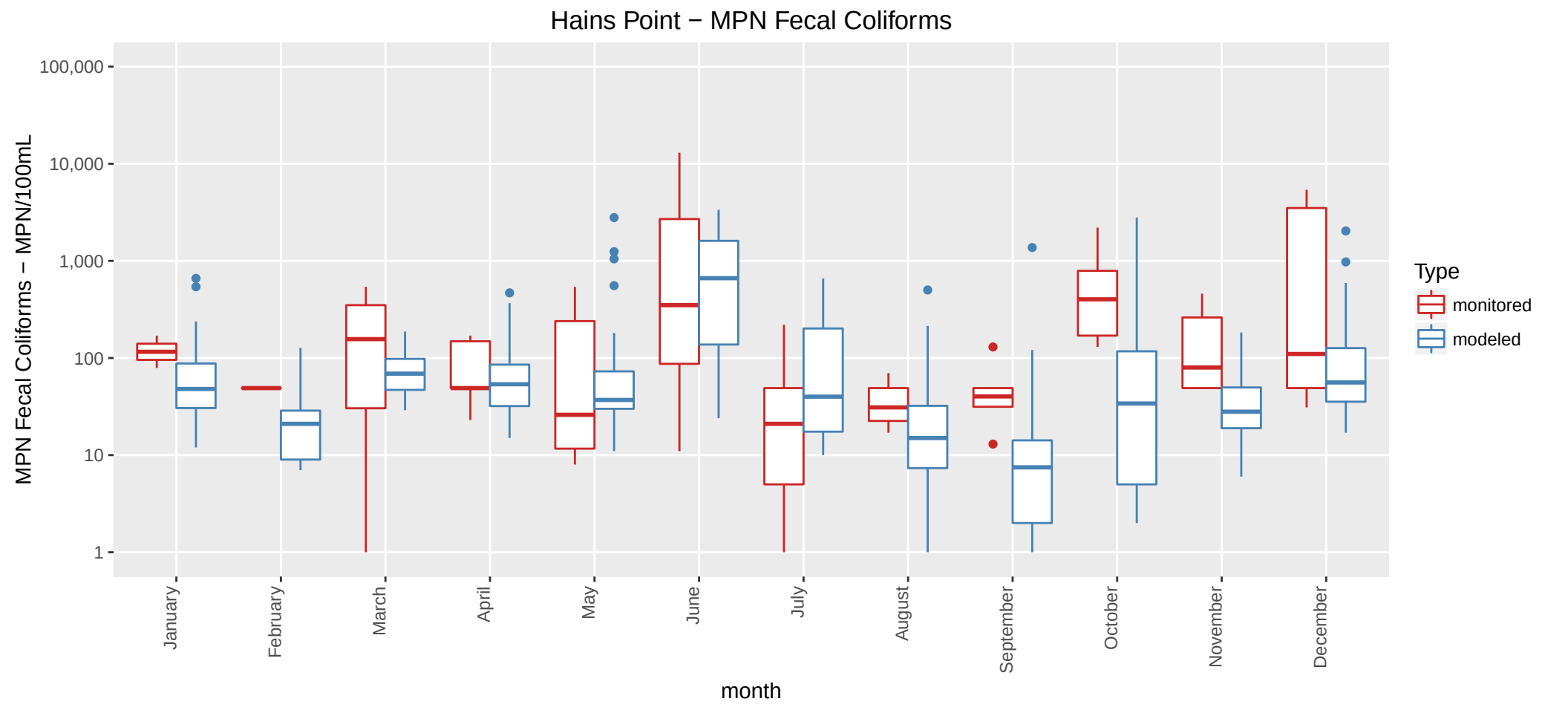

14th St Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

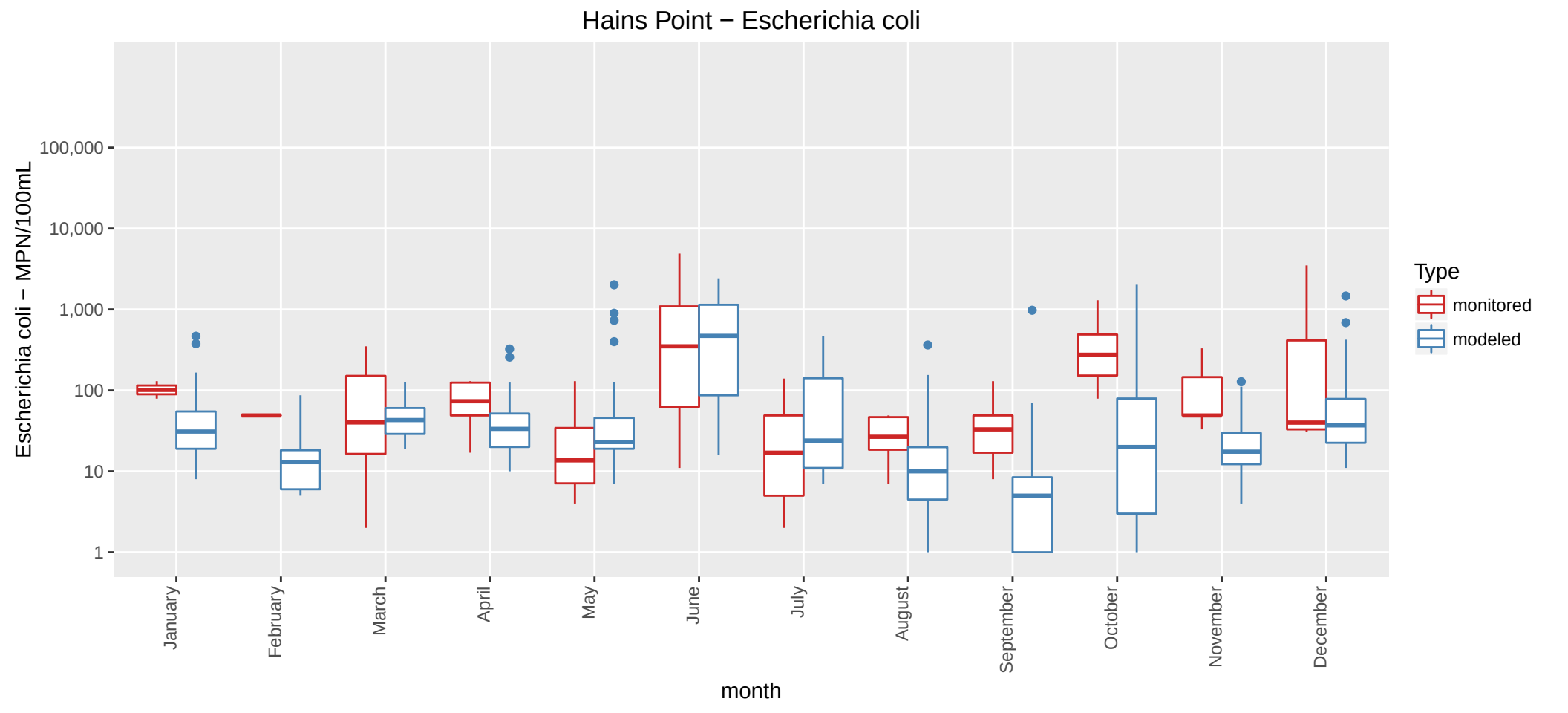

14th St Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

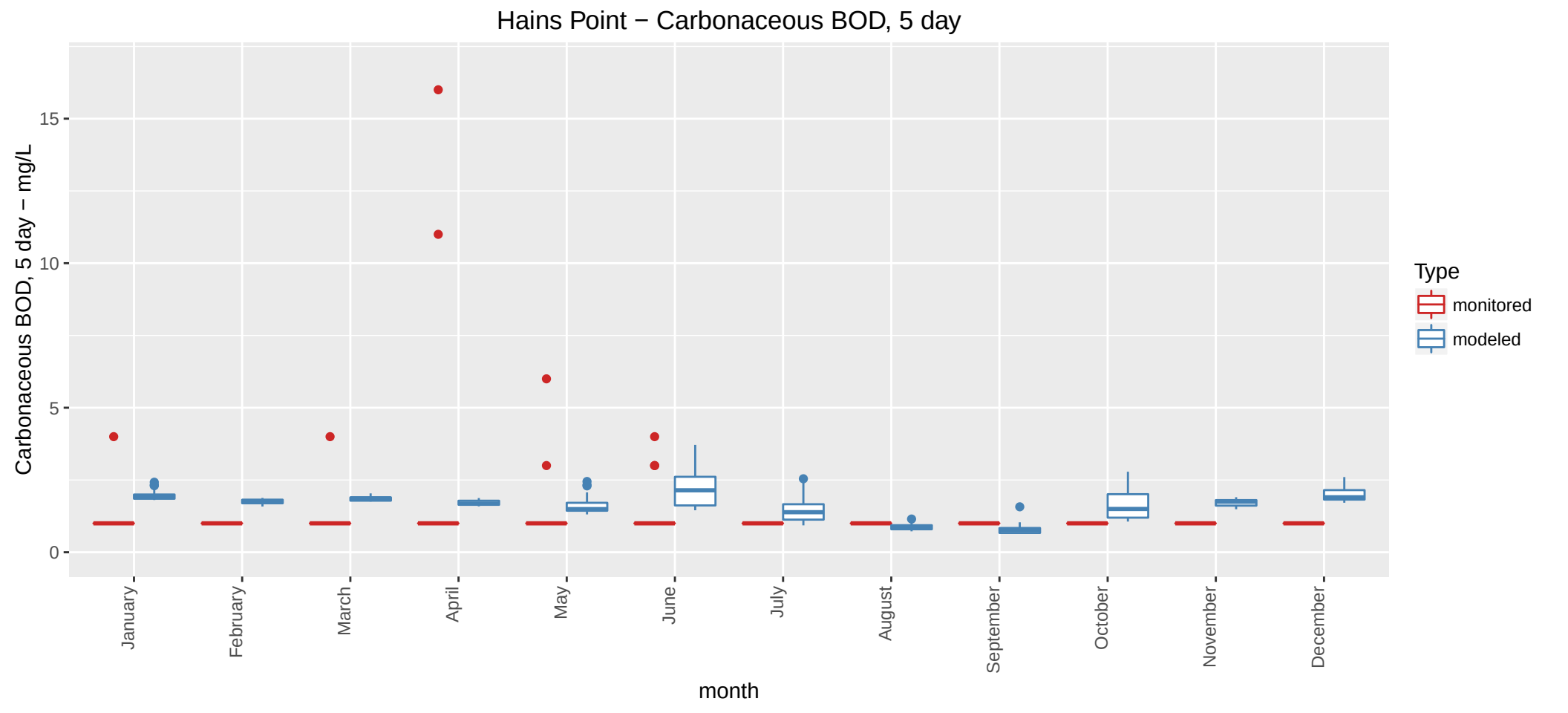

14th St Bridge − Escherichia coli
10,000
100
Escherichia coli – MPN/100mL
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

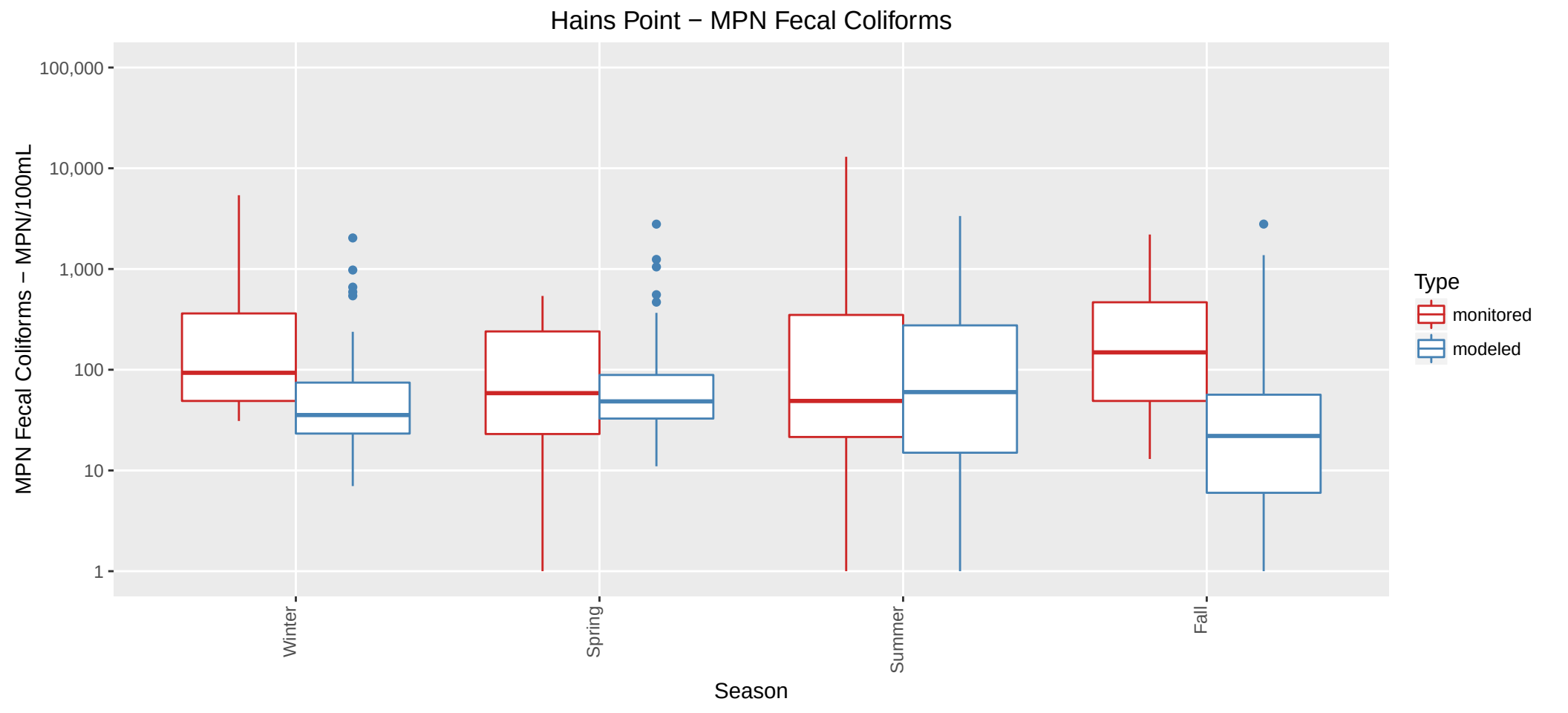

14th St Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day − mg/L
20
10
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

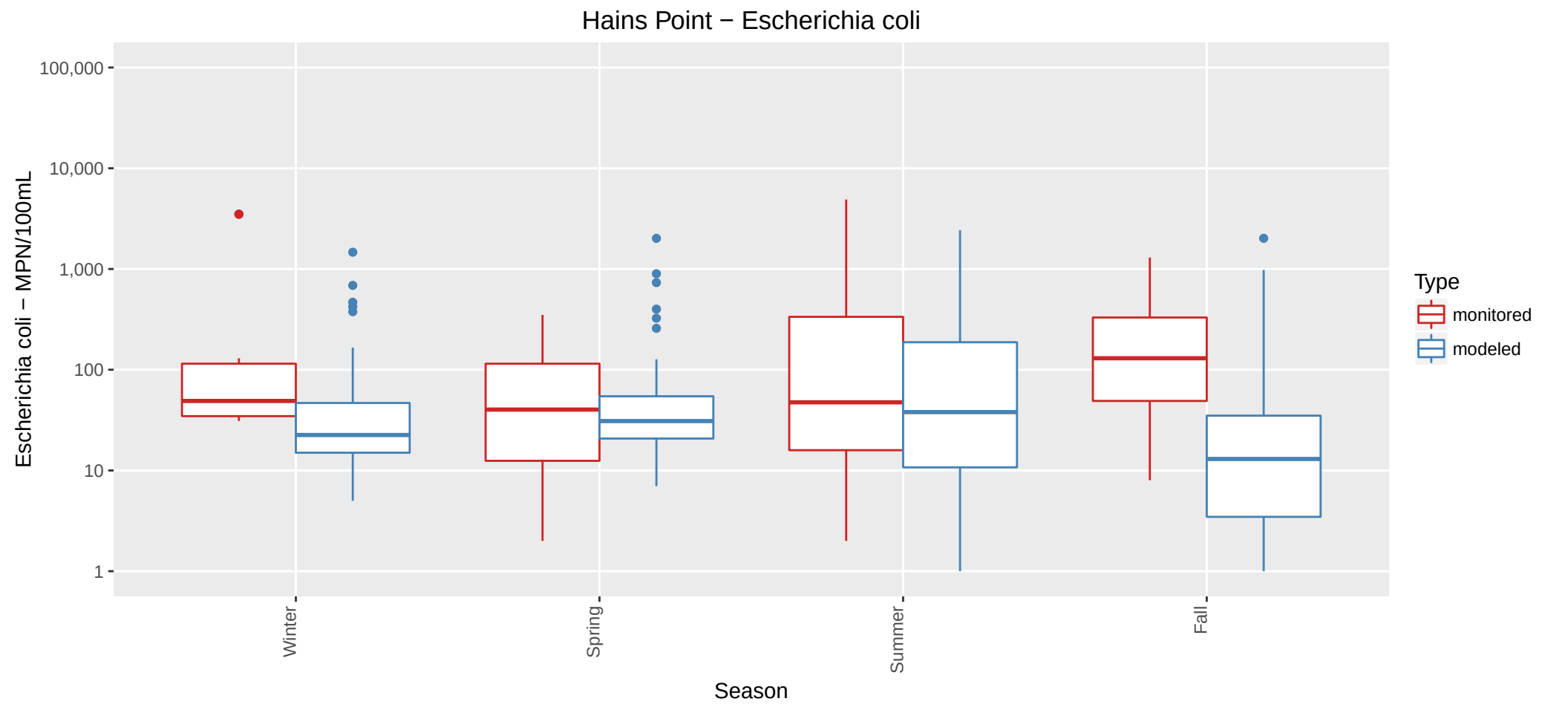

14th St Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

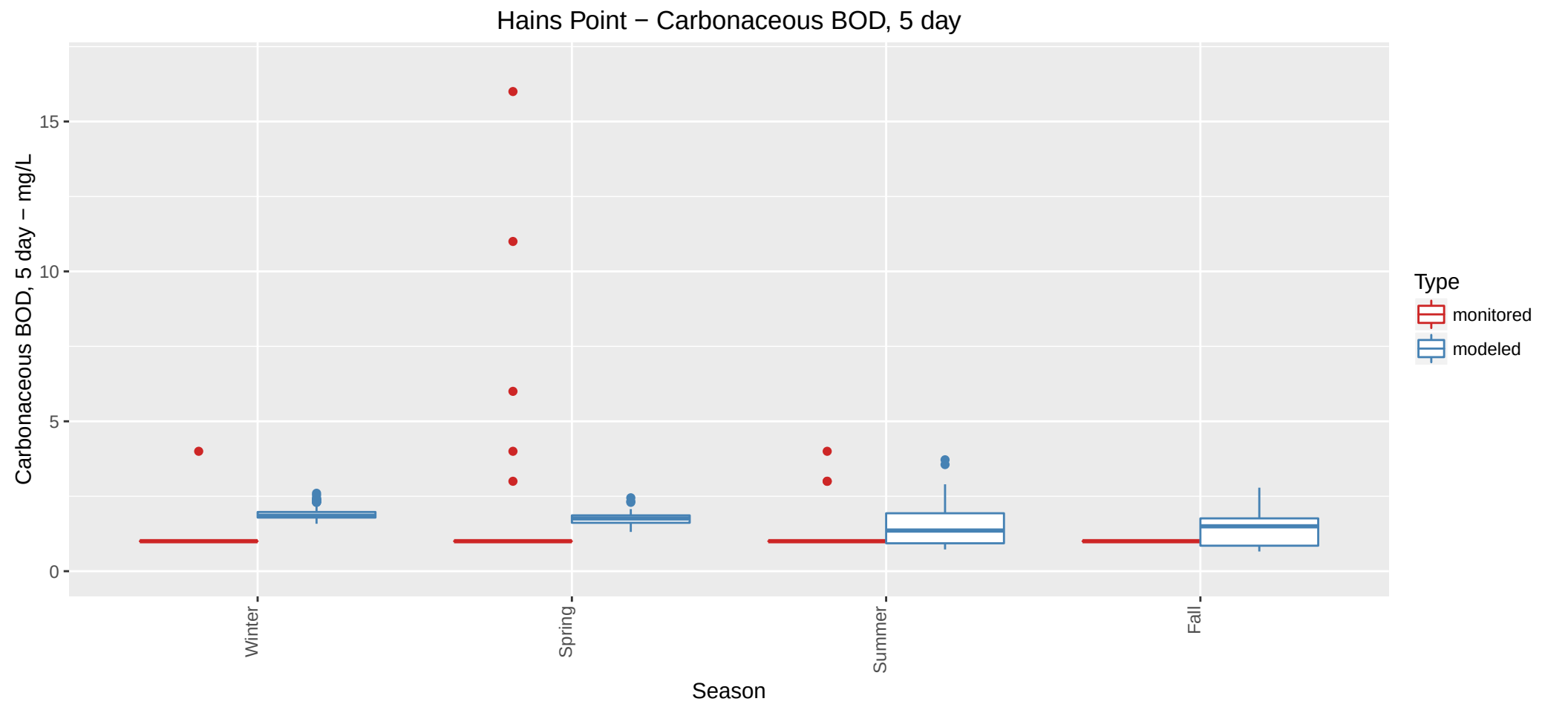

Hains Point − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

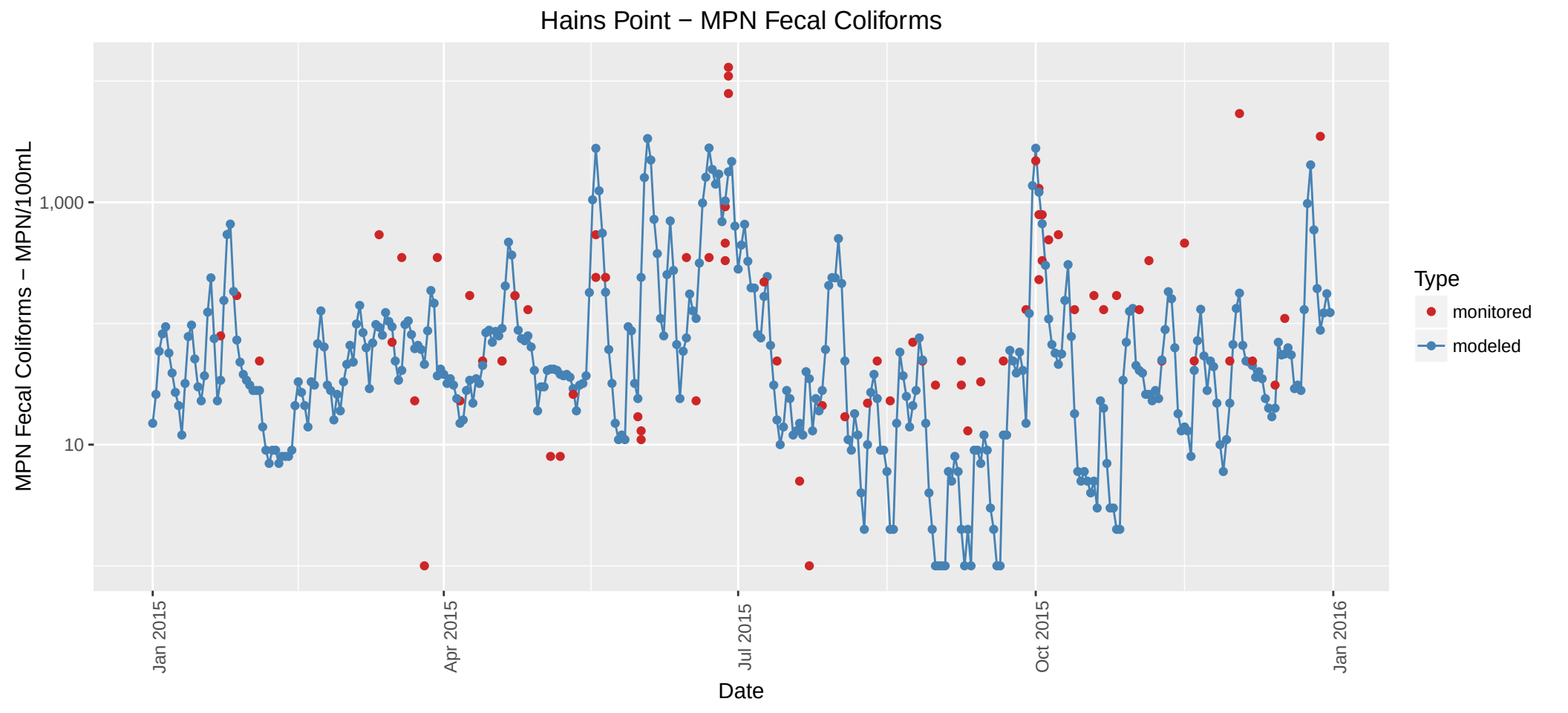

Hains Point − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

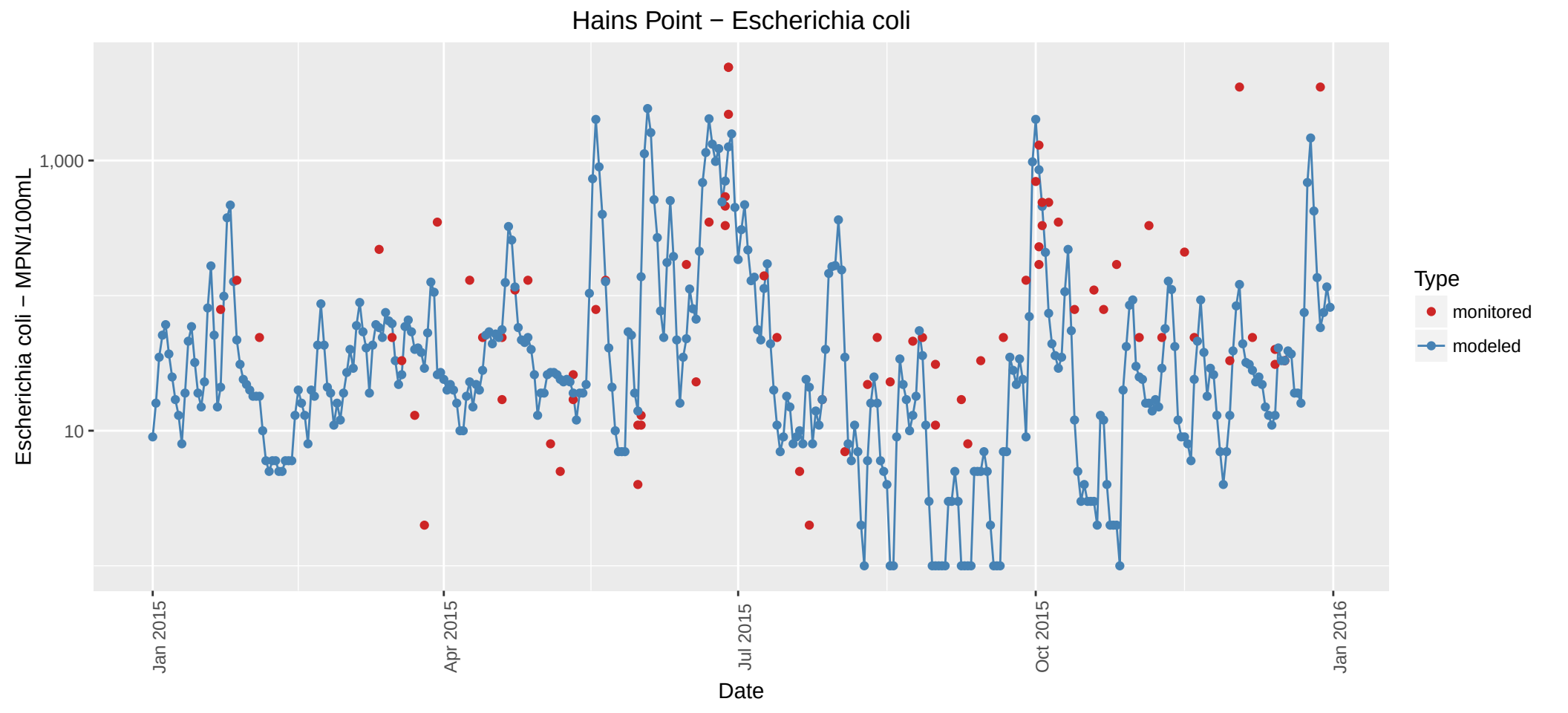

Hains Point − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

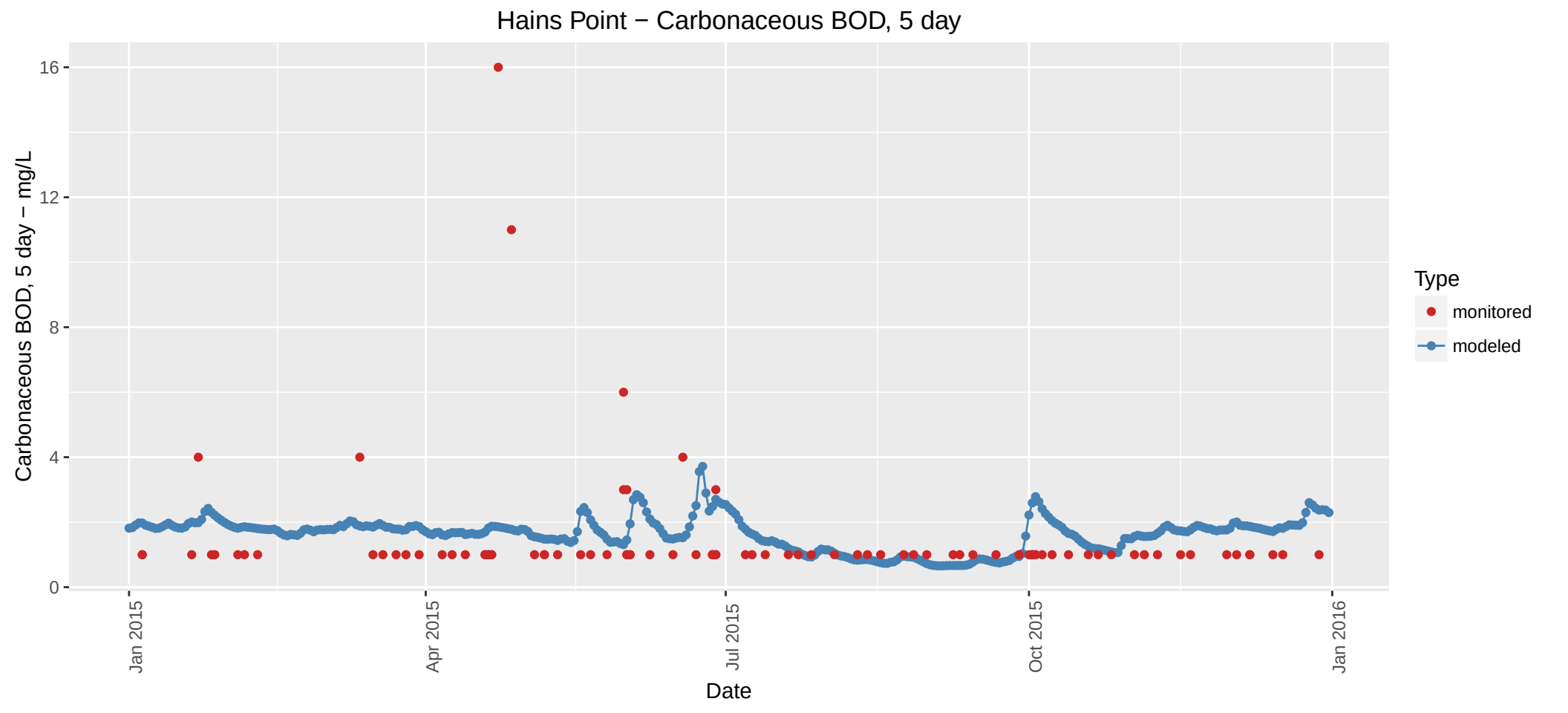

Hains Point − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

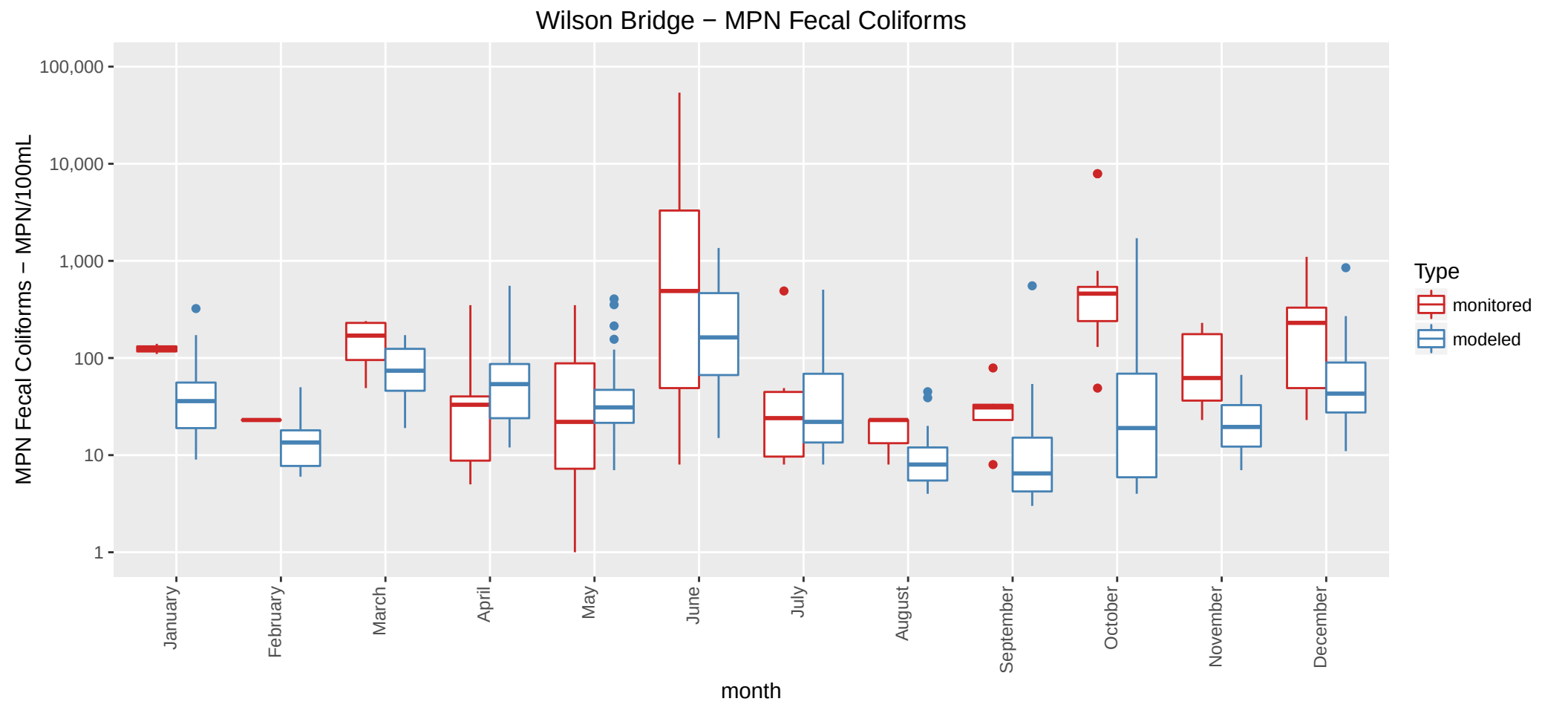

Hains Point − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

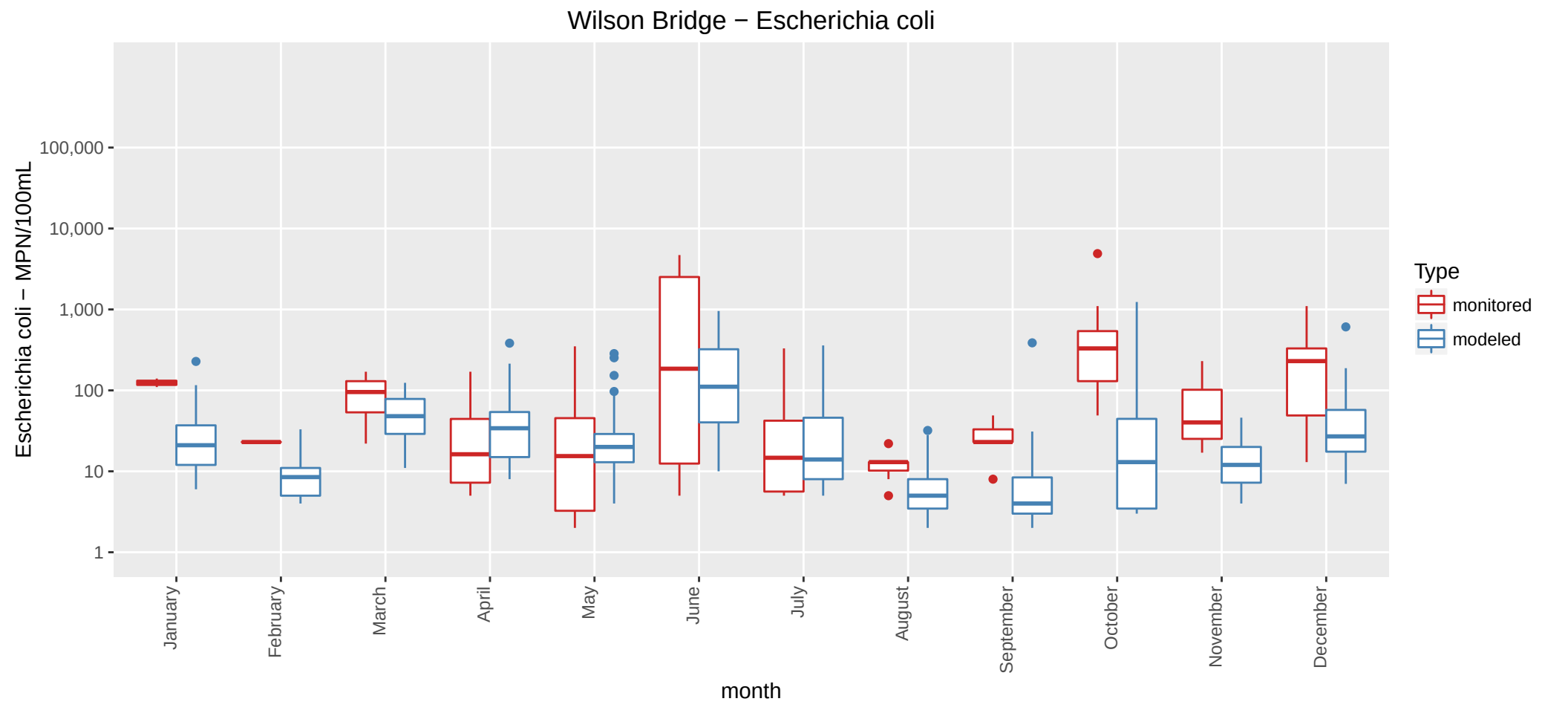

Hains Point − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

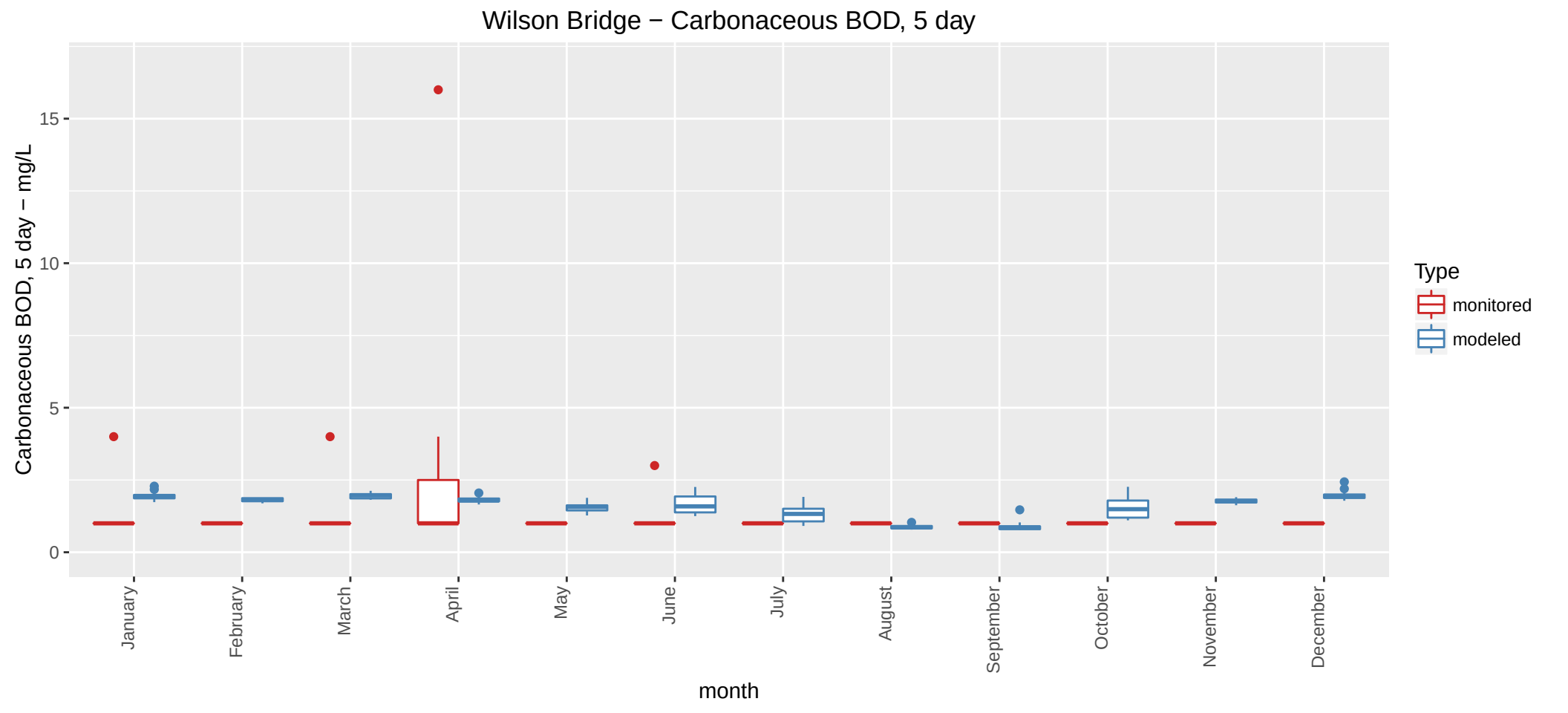

Hains Point − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

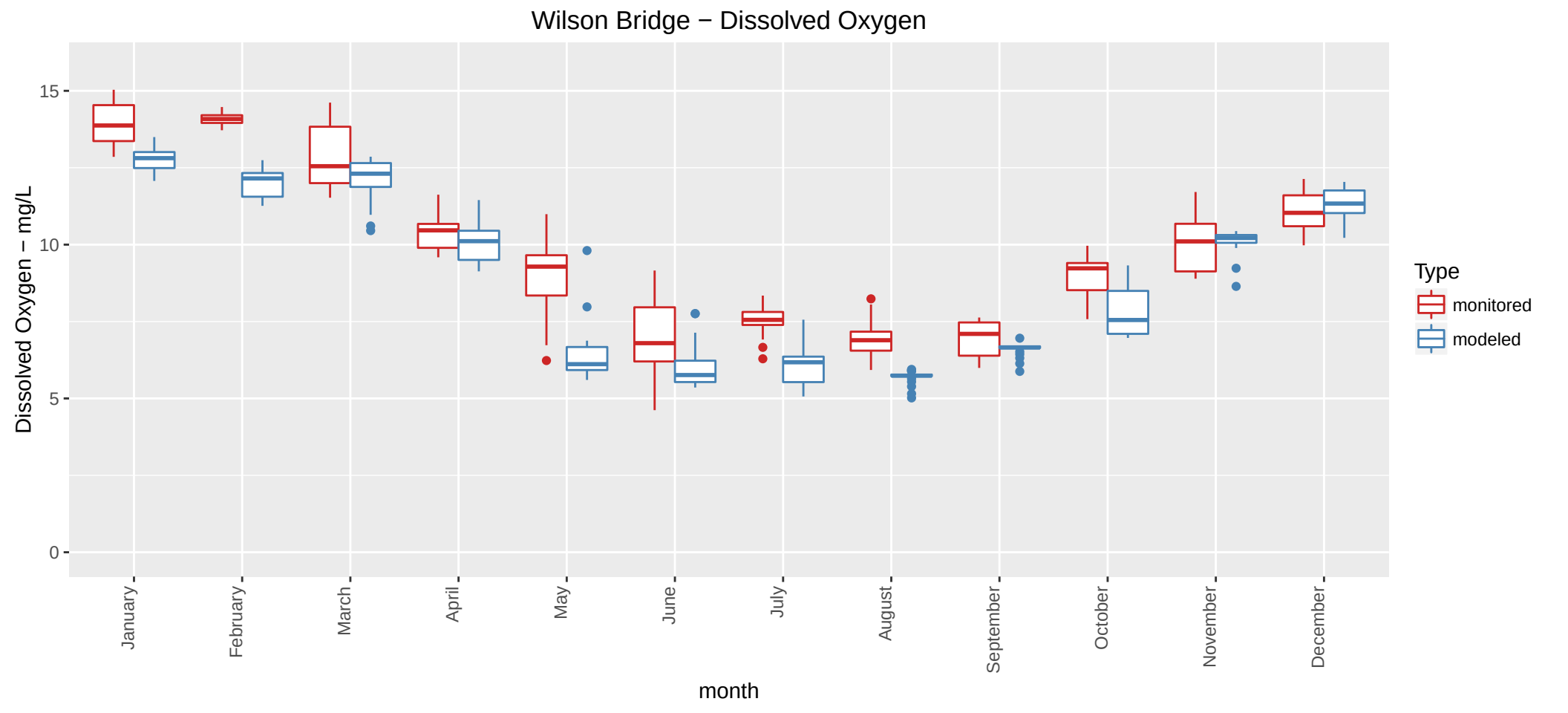

Hains Point − Escherichia coli
Escherichia coli − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

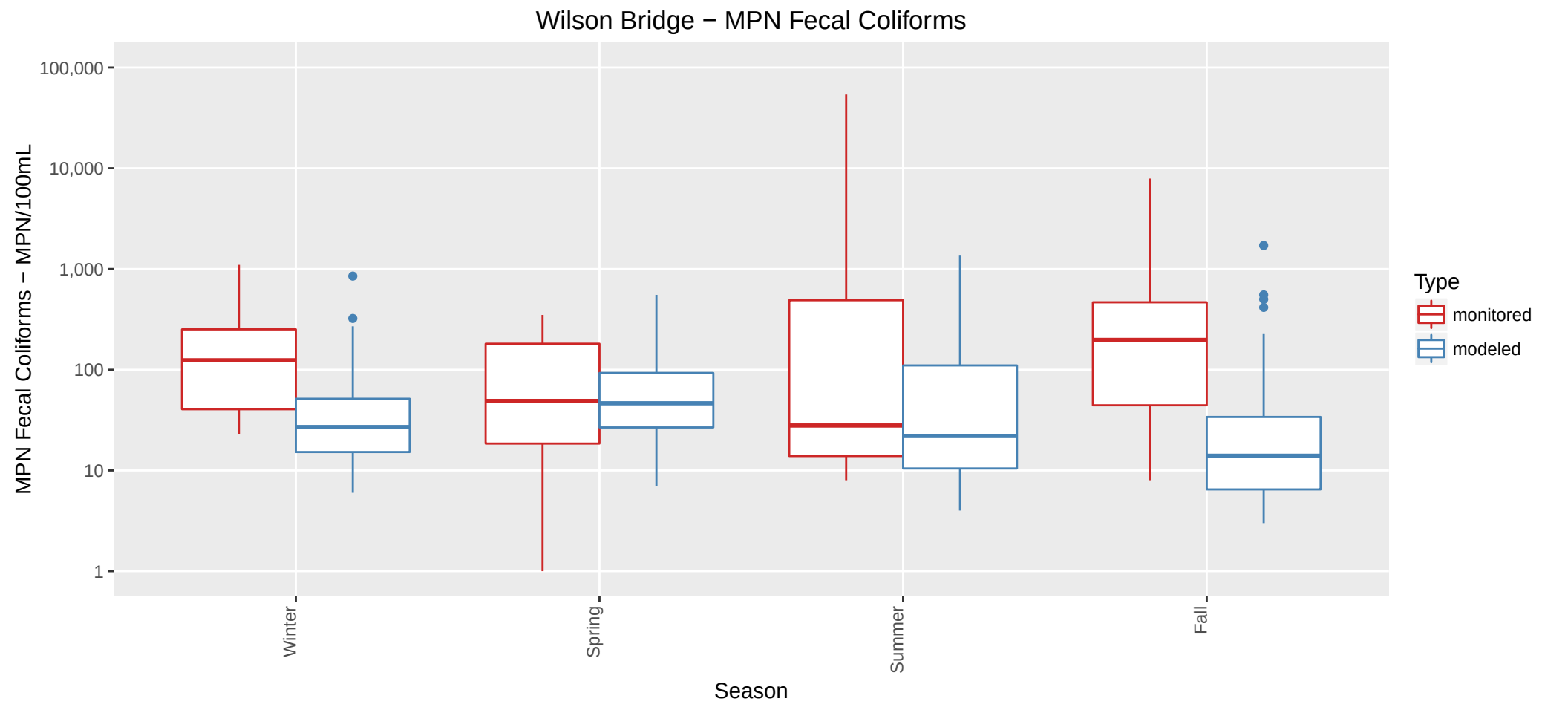

Hains Point − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
16
12
8
4
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

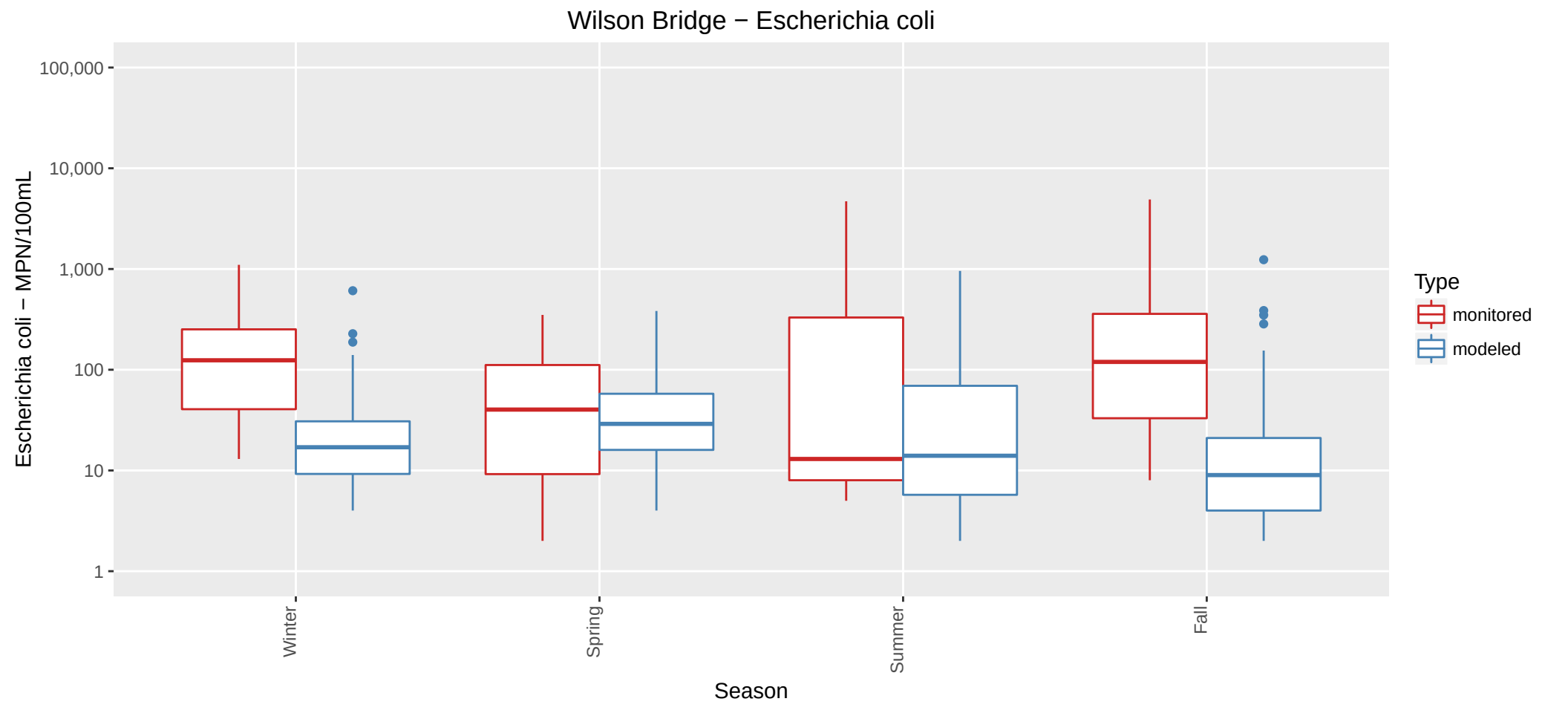

Wilson Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

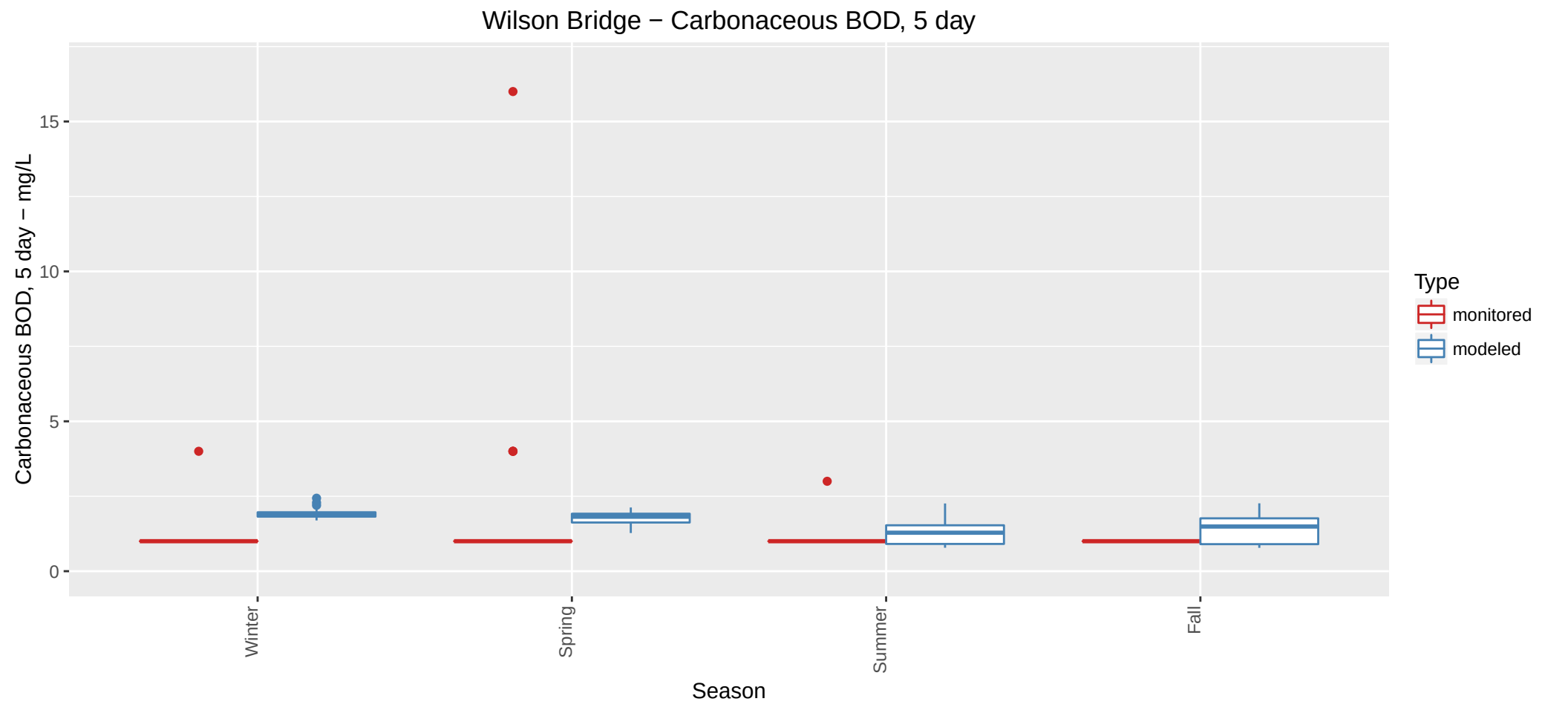

Wilson Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

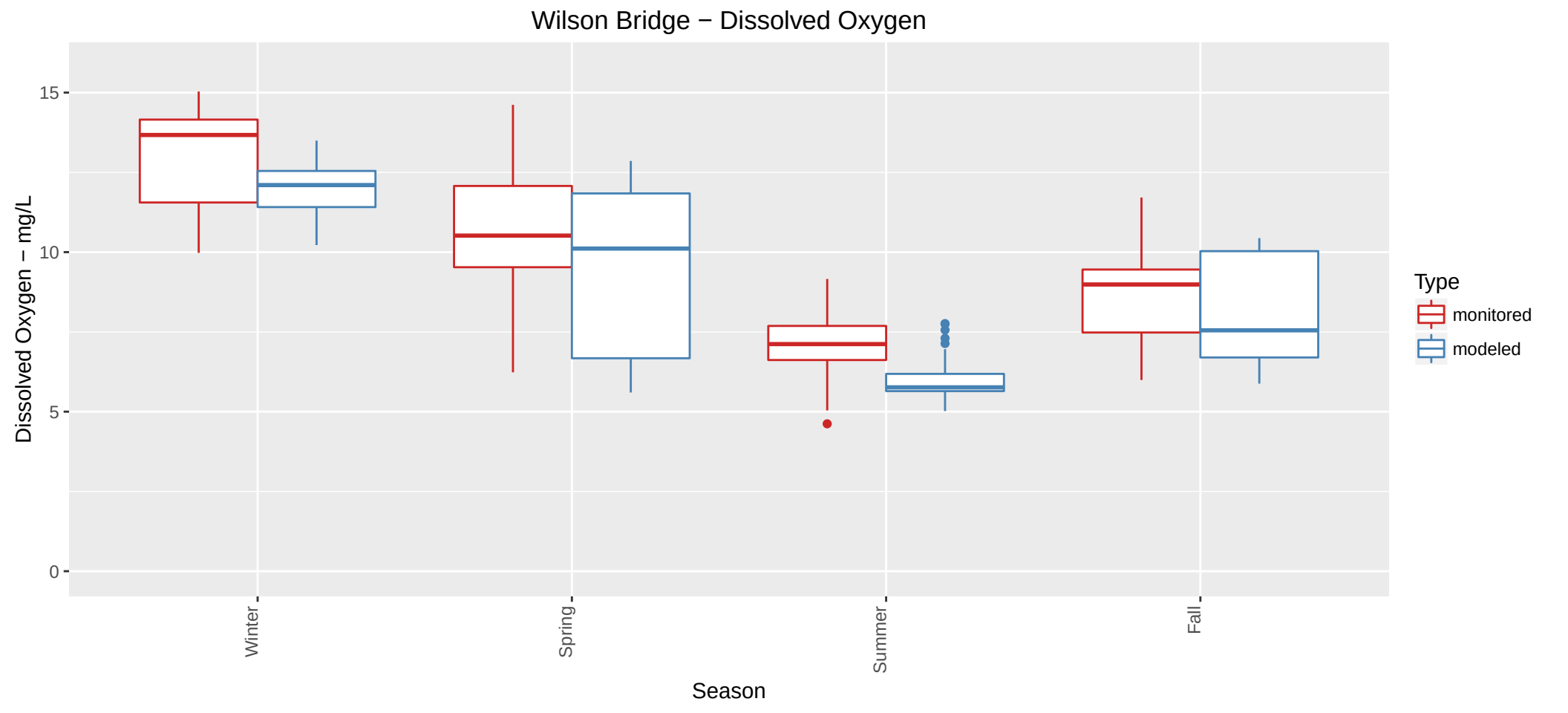

Wilson Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

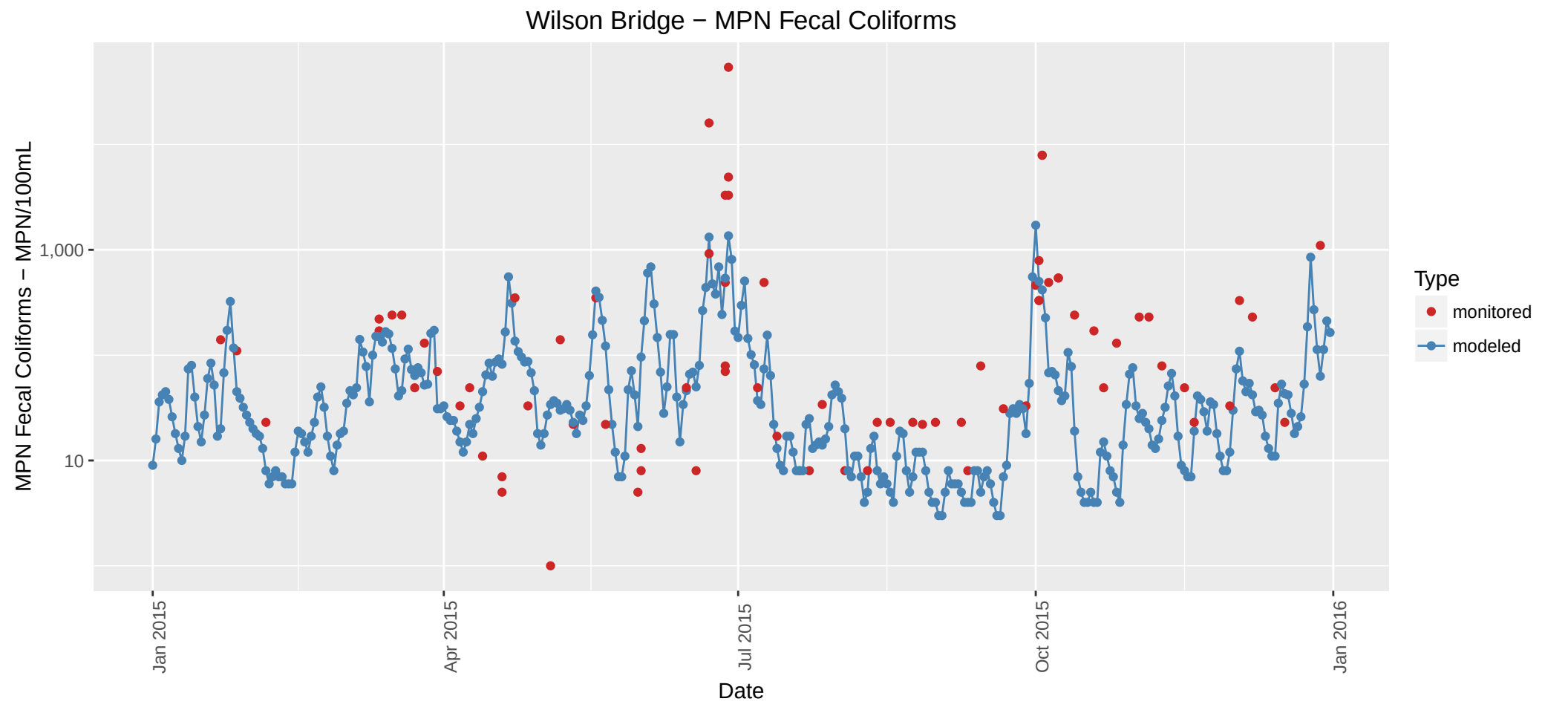

Wilson Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

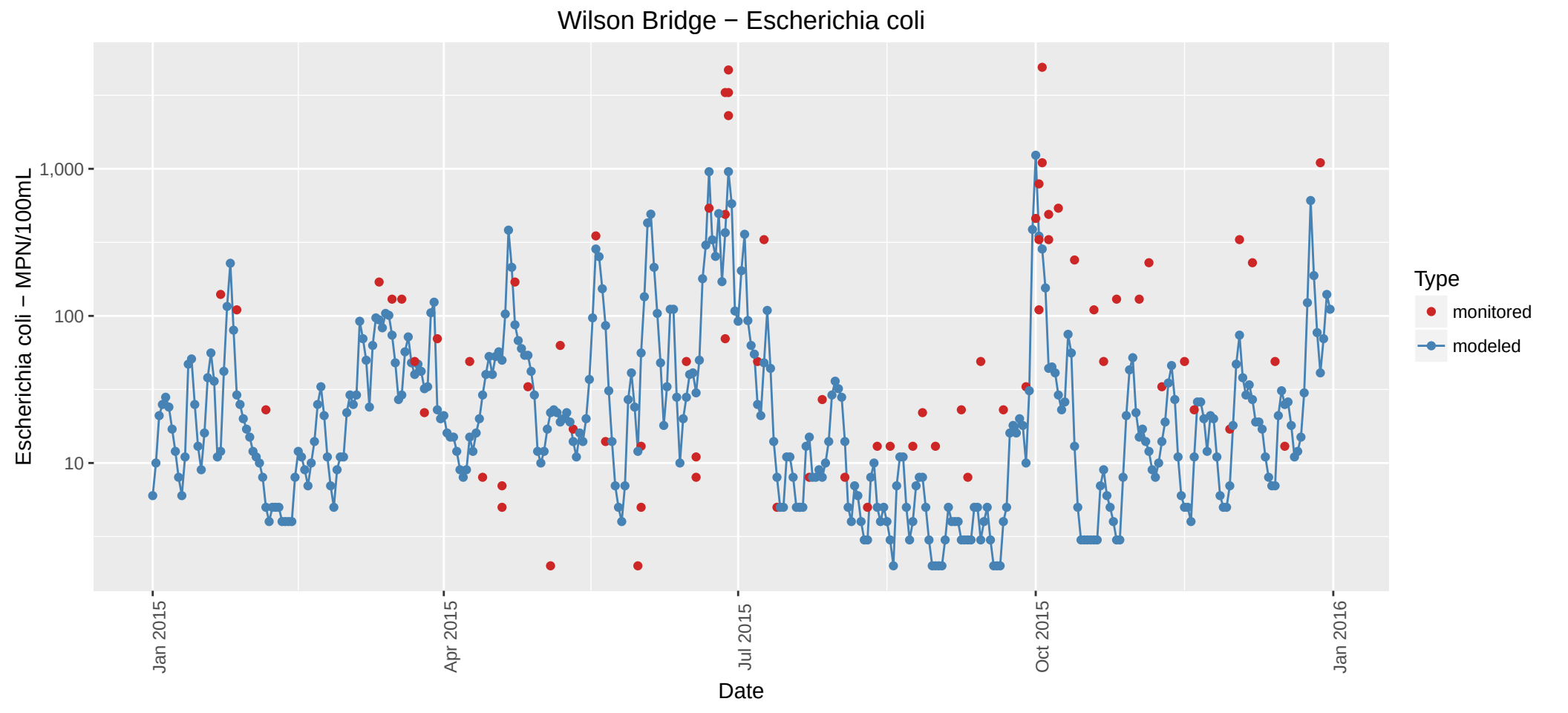

Wilson Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

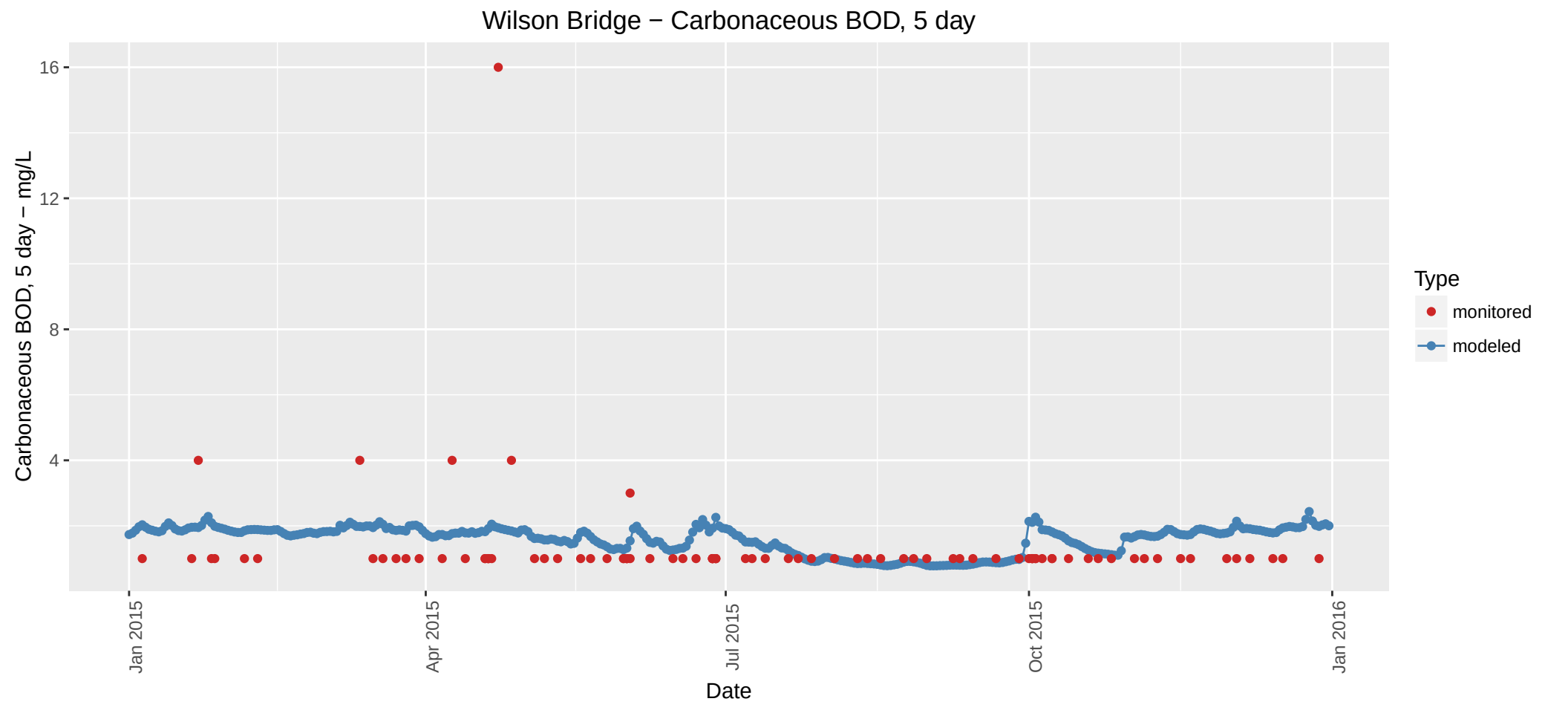

Wilson Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

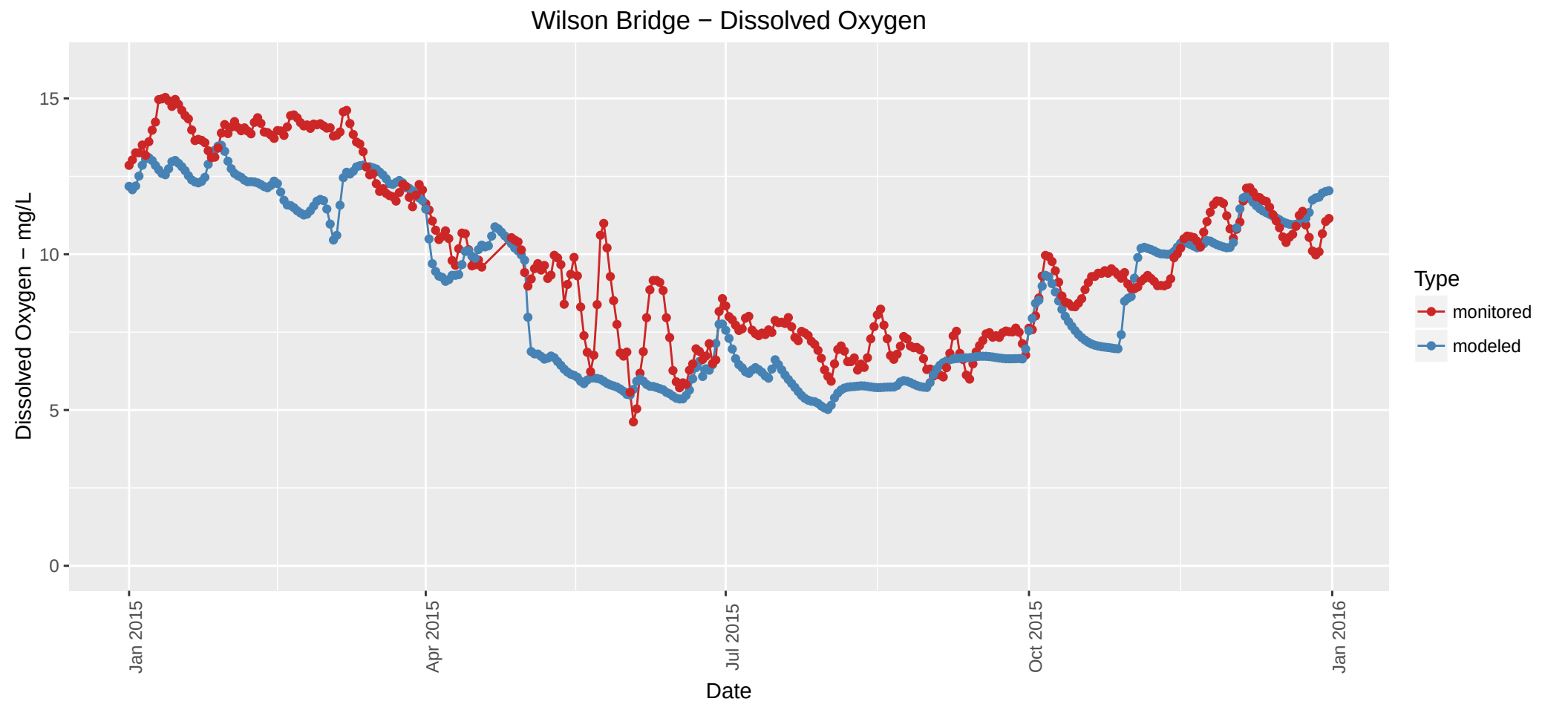

Wilson Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled


Wilson Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled


Wilson Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
1,000
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


Wilson Bridge − Escherichia coli
Escherichia coli − MPN/100mL
1,000
100
10
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


Wilson Bridge − Carbonaceous BOD, 5 day
Carbonaceous BOD, 5 day – mg/L
16
12
8
4
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


Wilson Bridge − Dissolved Oxygen
Dissolved Oxygen − mg/L
15
10
5
0
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

APPENDIX D: Rock Creek

Rock Creek – Fecal Coliform Bacteria

MPN Fecal Coliforms (Rock Creek) - Winter								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	612	350	1999	540	1971	350	1701	1100
Minimum	567	79	416	23	403	23	301	22
Maximum	2399	3500	11152	2200	31616	1700	33598	2400
25th Percentile	577	230	704	70	711	49	648	170
75th Percentile	2358	1600	2941	920	3071	920	3136	1300
Geomean	1089	489	1616	283	1717	250	1545	474
n	90	9	90	9	90	9	90	9

MPN Fecal Coliforms (Rock Creek) - Spring								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	611	230	2100	185	2144	130	1899	230
Minimum	572	33	448	23	437	4	346	33
Maximum	2401	16000	8946	1600	62563	1600	77490	9200
25th Percentile	583	79	670	70	692	79	639	95
75th Percentile	2365	350	3045	345	3490	323	3366	595
Geomean	1110	227	1665	158	1846	160	1681	282
n	92	19	92	22	92	22	92	23

MPN Fecal Coliforms (Rock Creek) - Summer								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	614	2200	2083	1010	2159	920	2079	3500
Minimum	553	330	375	130	362	240	245	130
Maximum	2431	160000	14279	92000	49915	160000	66780	160000
25th Percentile	575	490	681	493	710	540	688	490
75th Percentile	2358	16000	4895	14500	8491	11000	8492	16000
Geomean	1136	3094	2017	1852	2688	2291	2462	3374
n	92	23	92	24	92	25	92	25

MPN Fecal Coliforms (Rock Creek) - Fall								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	602	515	1063	340	1057	170	798	680
Minimum	550	33	340	33	323	33	195	23
Maximum	2407	11000	13032	28000	59251	35000	53714	24000
25th Percentile	565	170	469	125	454	102	308	130
75th Percentile	2310	3500	3843	1750	4650	1265	4214	2300
Geomean	985	669	1335	494	1430	411	1134	689
n	91	24	91	24	91	24	91	25

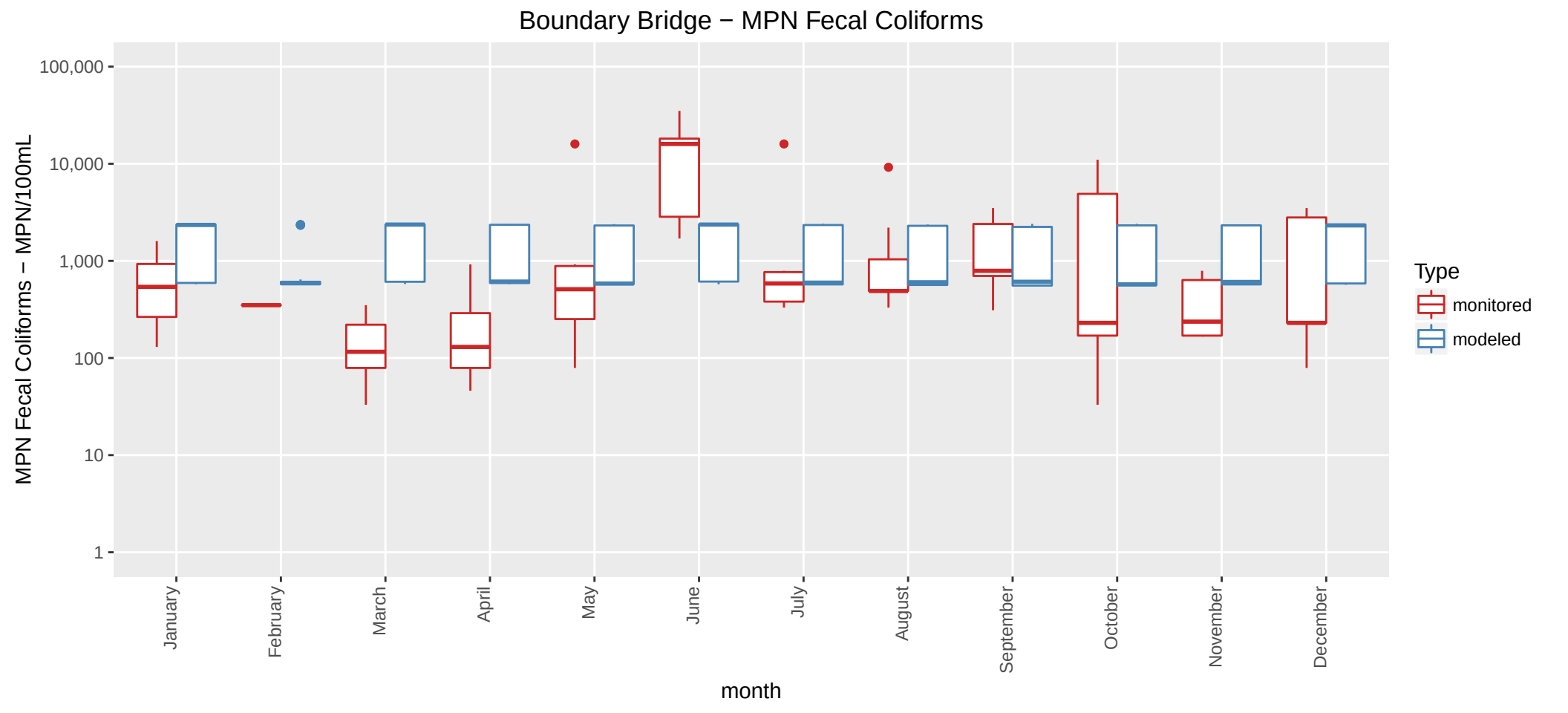
Rock Creek – E. *coli*

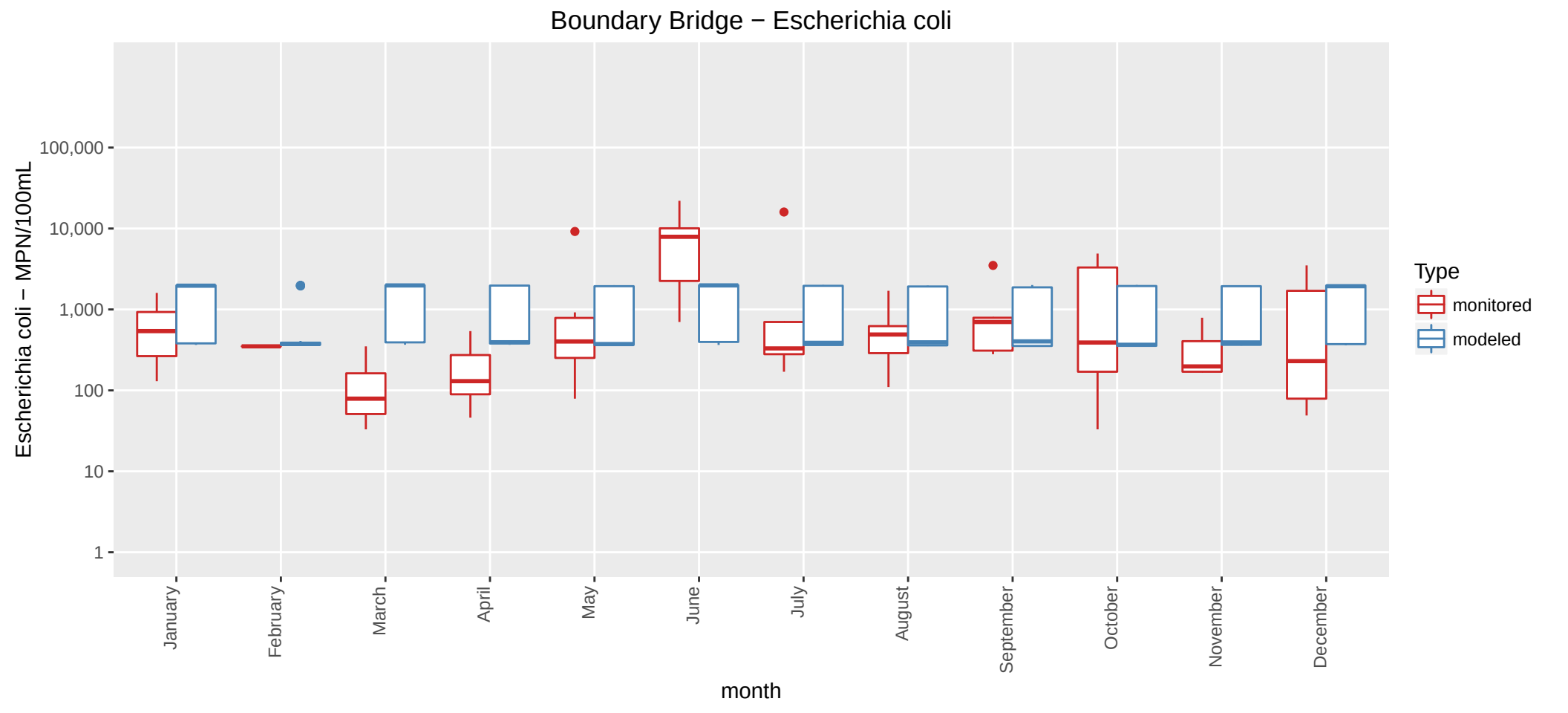
E. coli (Rock Creek) - Winter								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	395	350	1570	540	1624	350	1352	700
Minimum	360	49	264	23	256	13	191	22
Maximum	2005	3500	6752	1400	22065	920	23449	2400
25th Percentile	367	130	440	31	466	33	394	170
75th Percentile	1978	1600	2149	920	2234	490	2244	1300
Geomean	784	390	1091	225	1156	172	1038	435
n	90	9	90	9	90	9	90	9

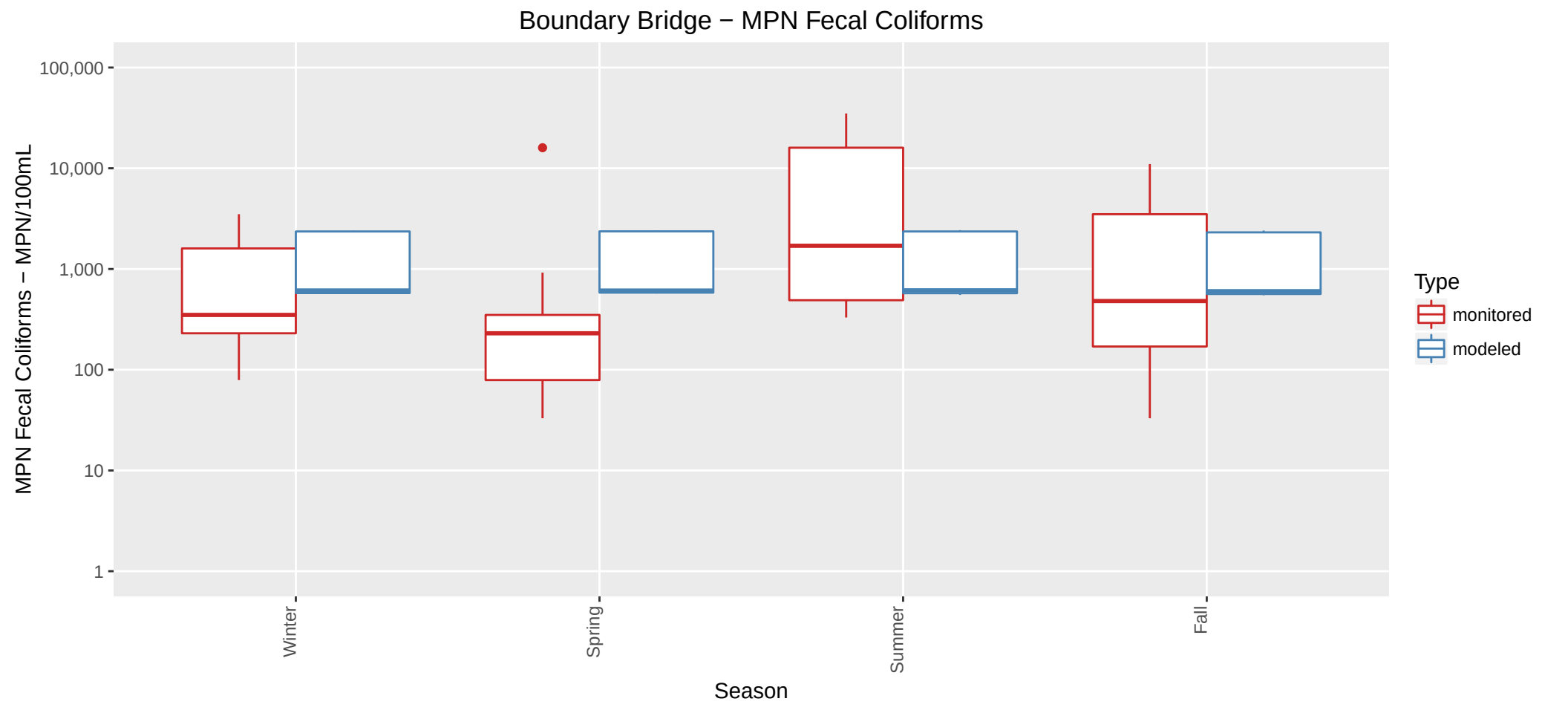
E. coli (Rock Creek) - Spring								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	393	130	1615	130	1708	79	1427	225
Minimum	364	33	284	23	277	4	220	33
Maximum	2010	9200	5438	1600	45075	1600	55814	5400
25th Percentile	372	79	429	49	452	49	390	130
75th Percentile	1982	350	2174	240	2443	130	2328	428
Geomean	802	189	1121	121	1238	95	1127	256
n	92	19	92	21	92	21	92	22

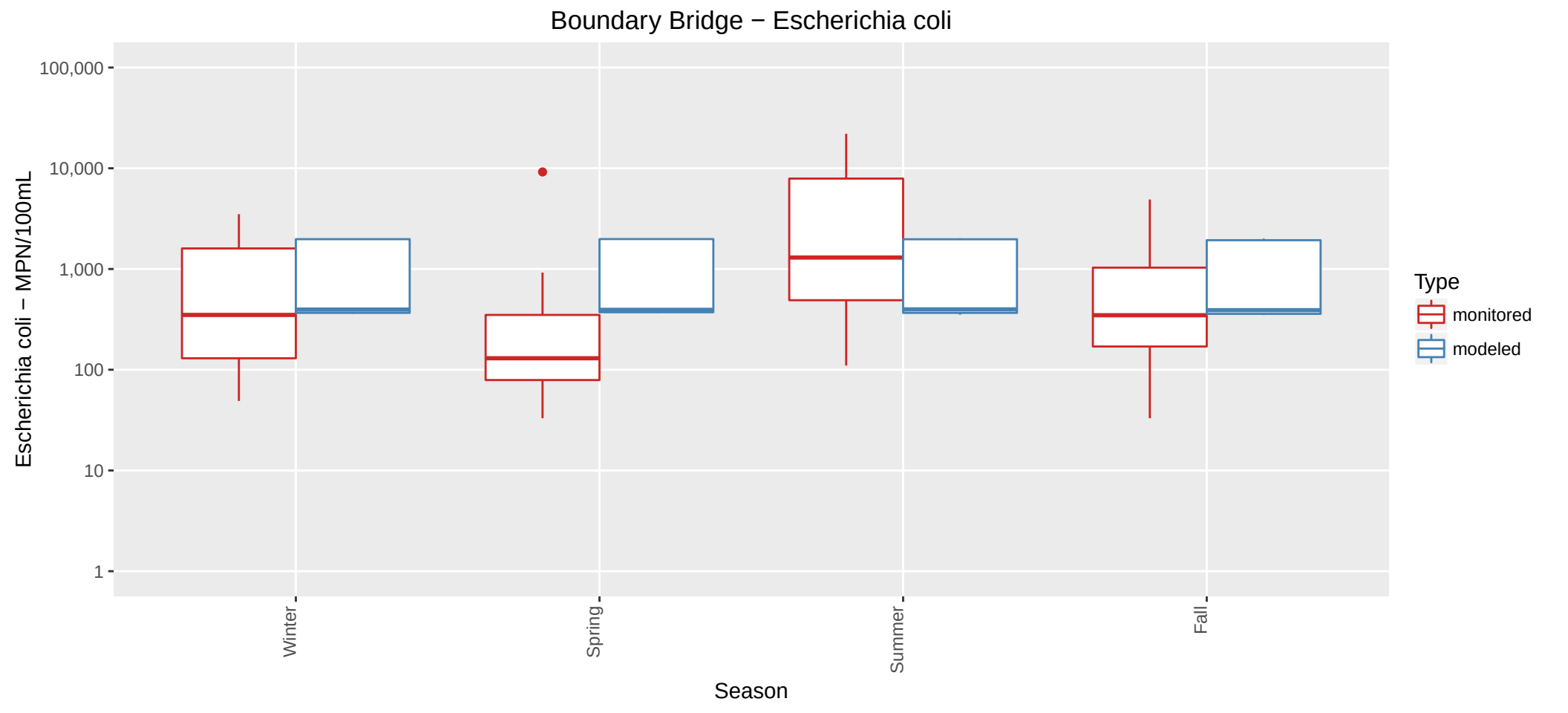
E. coli (Rock Creek) - Summer								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	397	1300	1502	1100	1548	540	1358	1550
Minimum	352	110	238	79	230	79	155	17
Maximum	2020	22000	8432	54000	35933	35000	48307	35000
25th Percentile	367	490	414	350	436	350	427	295
75th Percentile	1974	7900	3158	5975	5218	5400	5176	7275
Geomean	827	1552	1319	1590	1769	1386	1619	1407
n	92	23	92	24	92	25	92	26

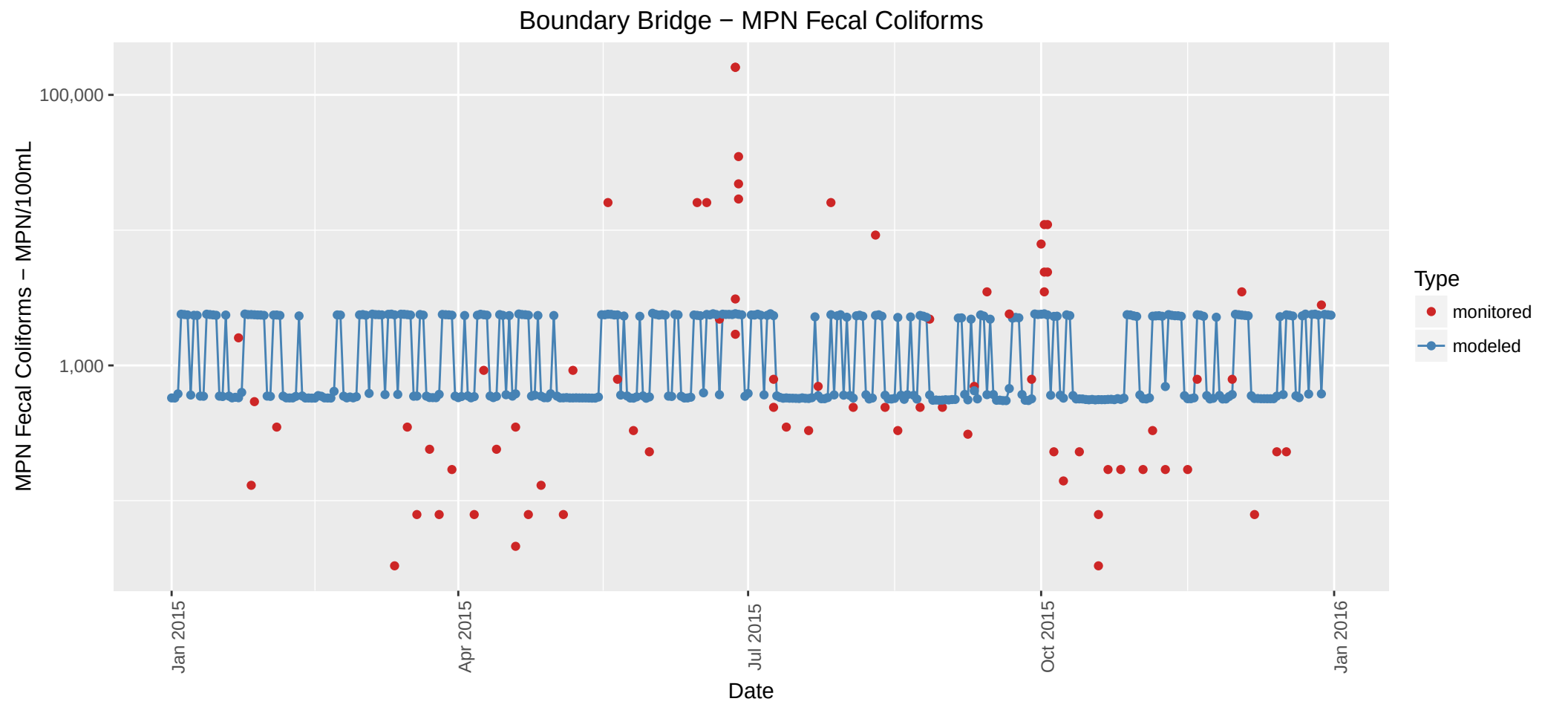
E. coli (Rock Creek) - Fall								
	Boundary Bridge		Tilden Street		Porter Street		RC PA Ave	
	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored	Modeled	Monitored
Median	390	350	708	200	756	170	622	285
Minimum	349	33	216	33	205	33	124	22
Maximum	2006	4900	7736	14000	43097	14000	38825	13000
25th Percentile	359	170	294	79	284	70	190	79
75th Percentile	1931	1168	2495	1375	2919	823	2624	1475
Geomean	699	487	881	321	941	308	746	332
n	91	24	91	24	91	24	91	24

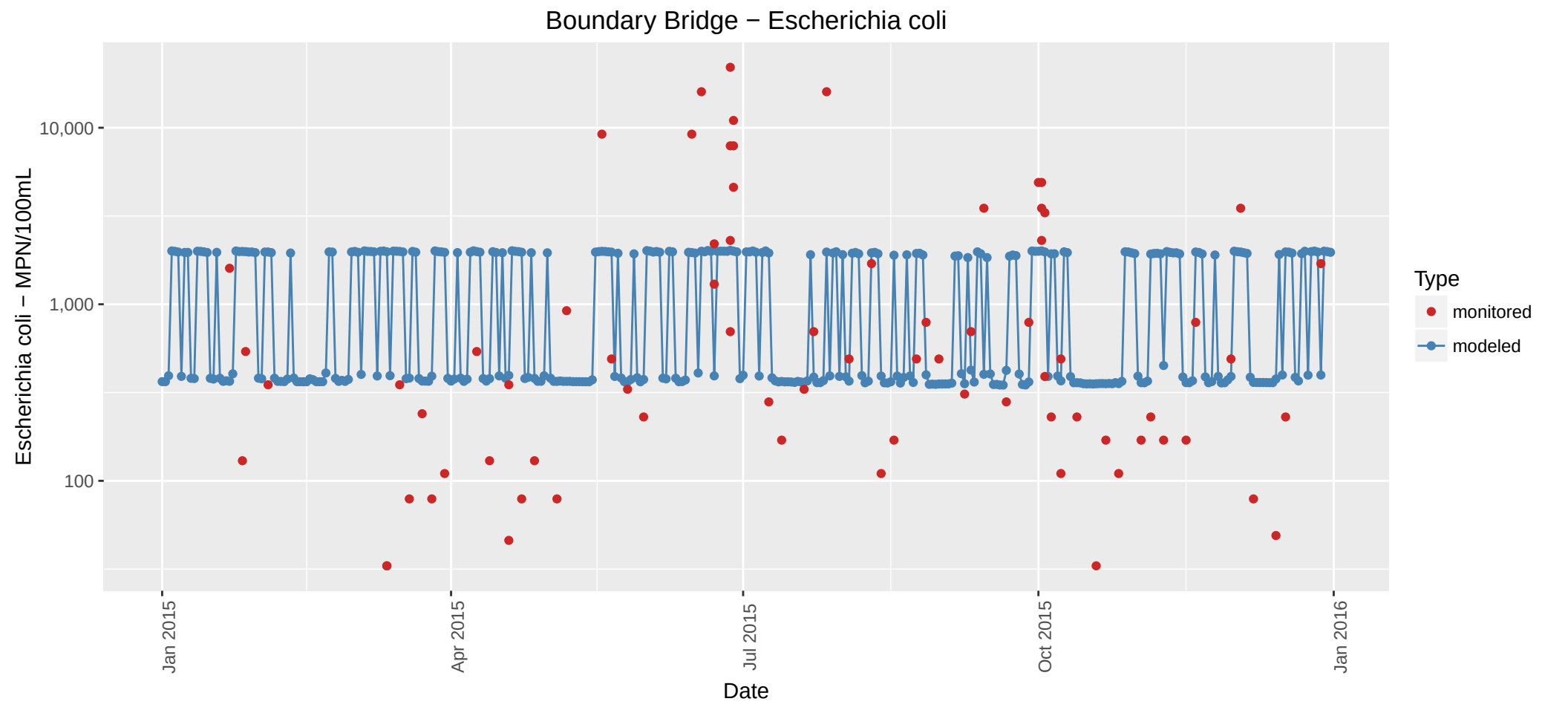

Boundary Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

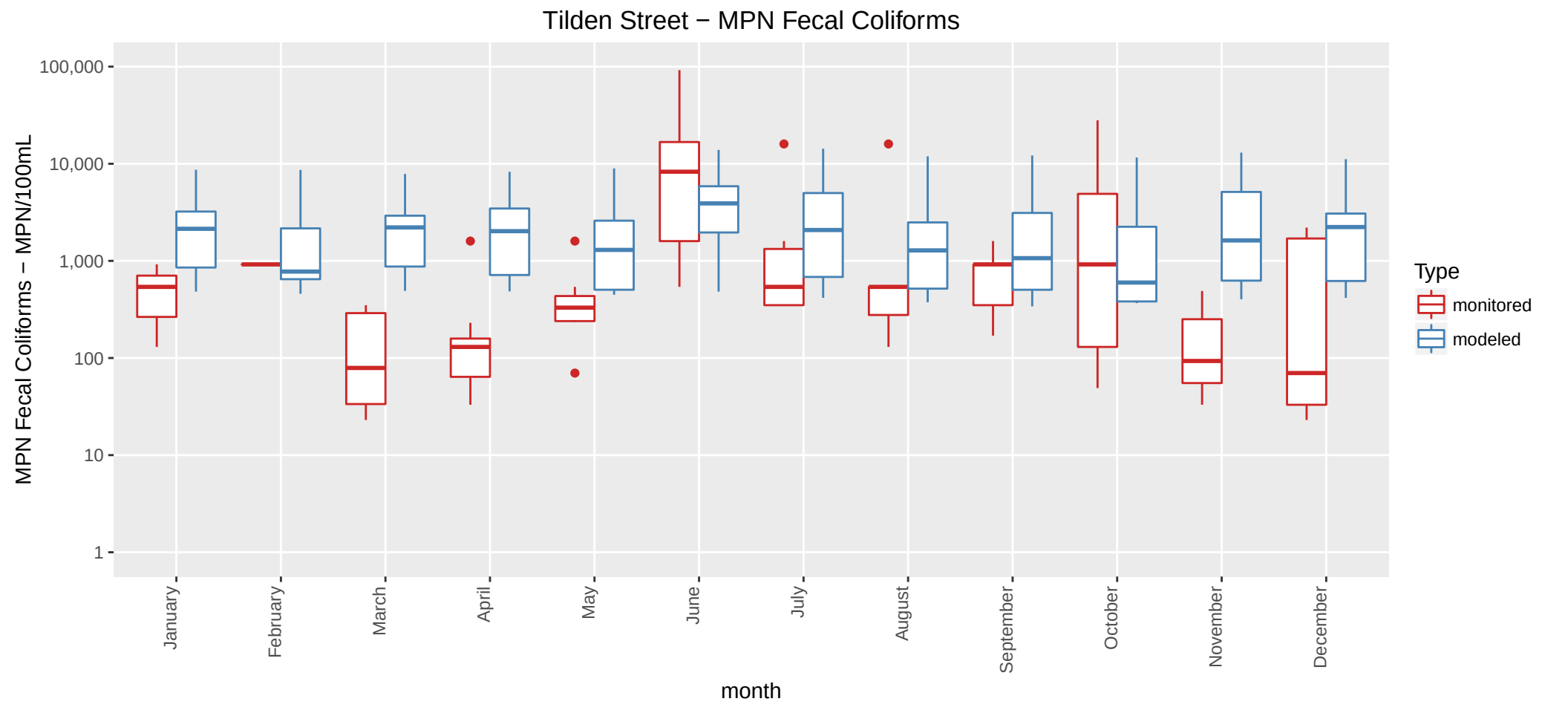

Boundary Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

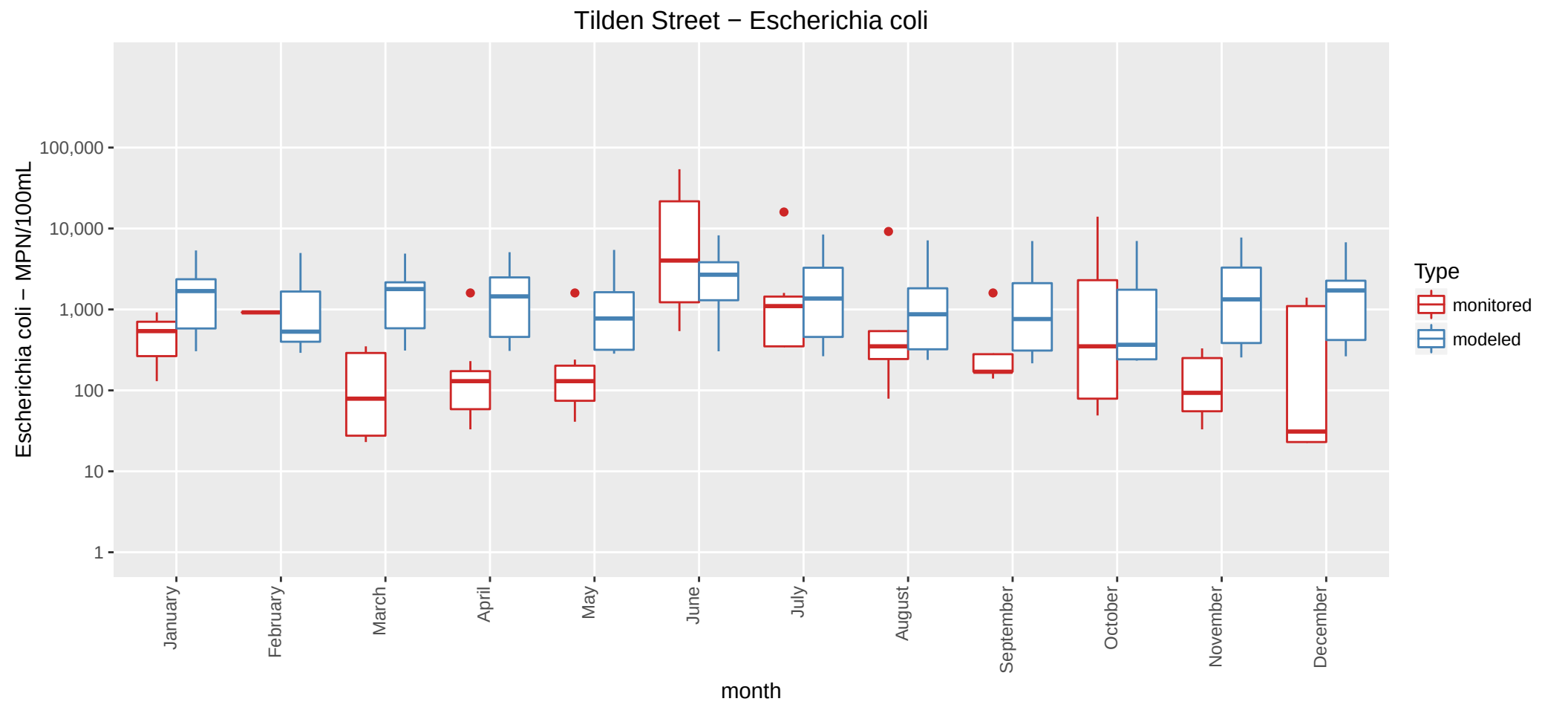

Boundary Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

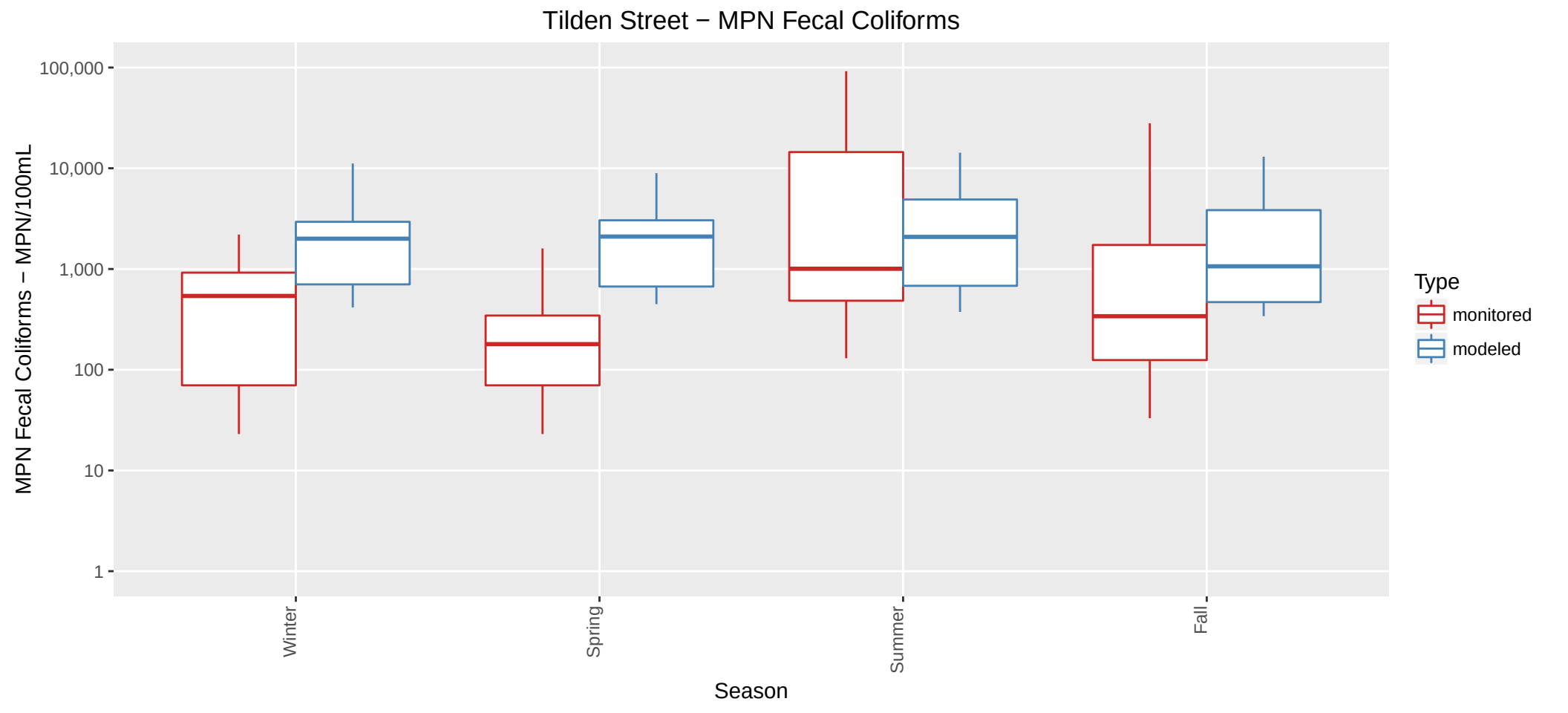

Boundary Bridge − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

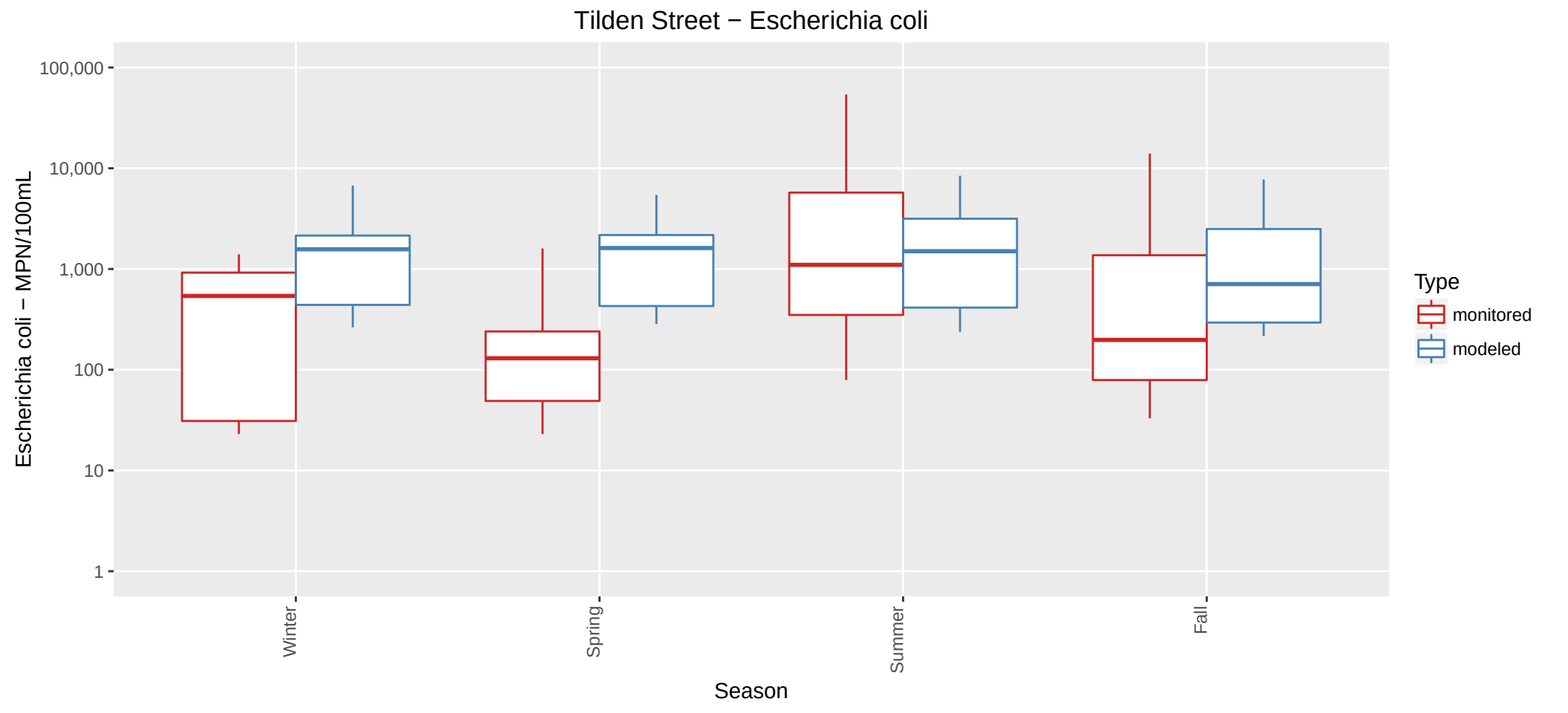

Boundary Bridge − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
1,000
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

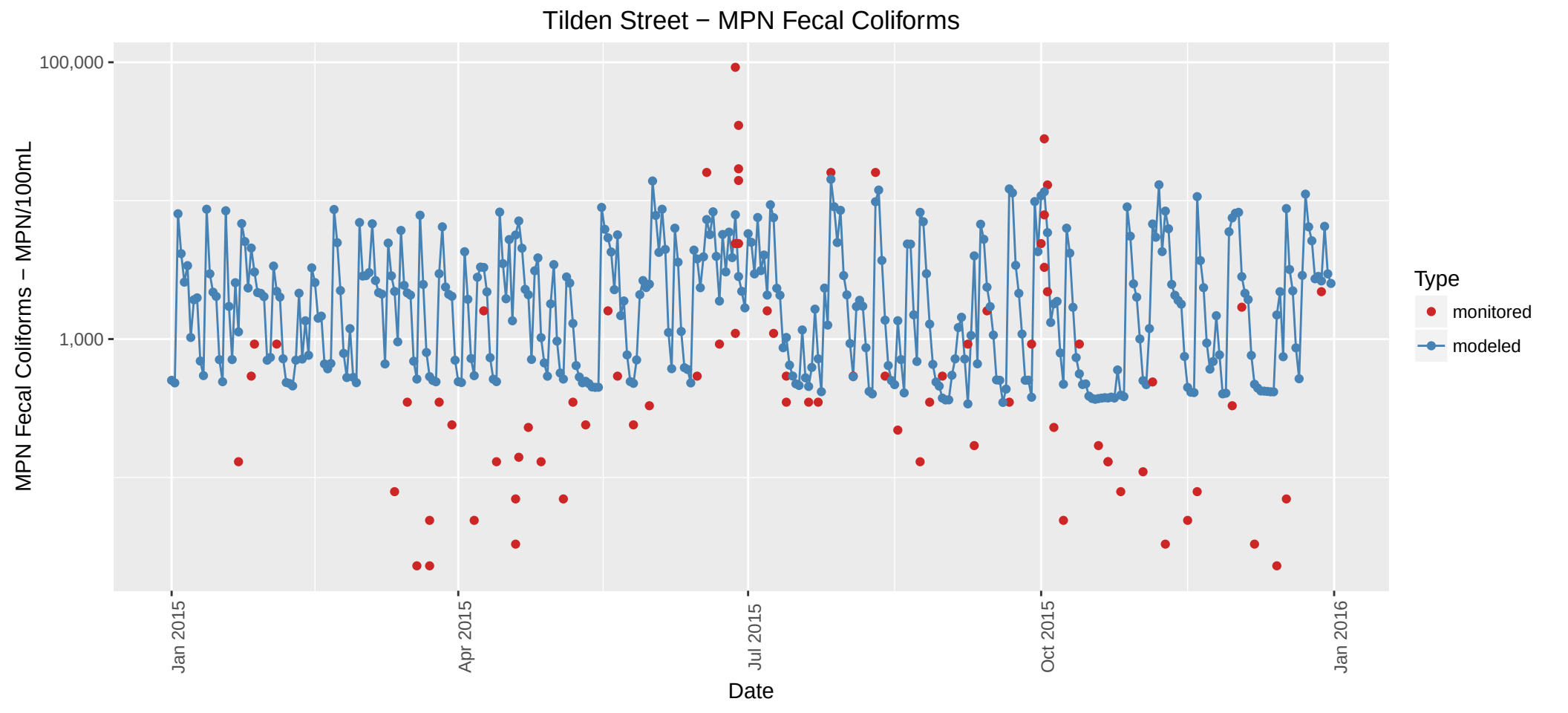

Boundary Bridge − Escherichia coli
Escherichia coli − MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

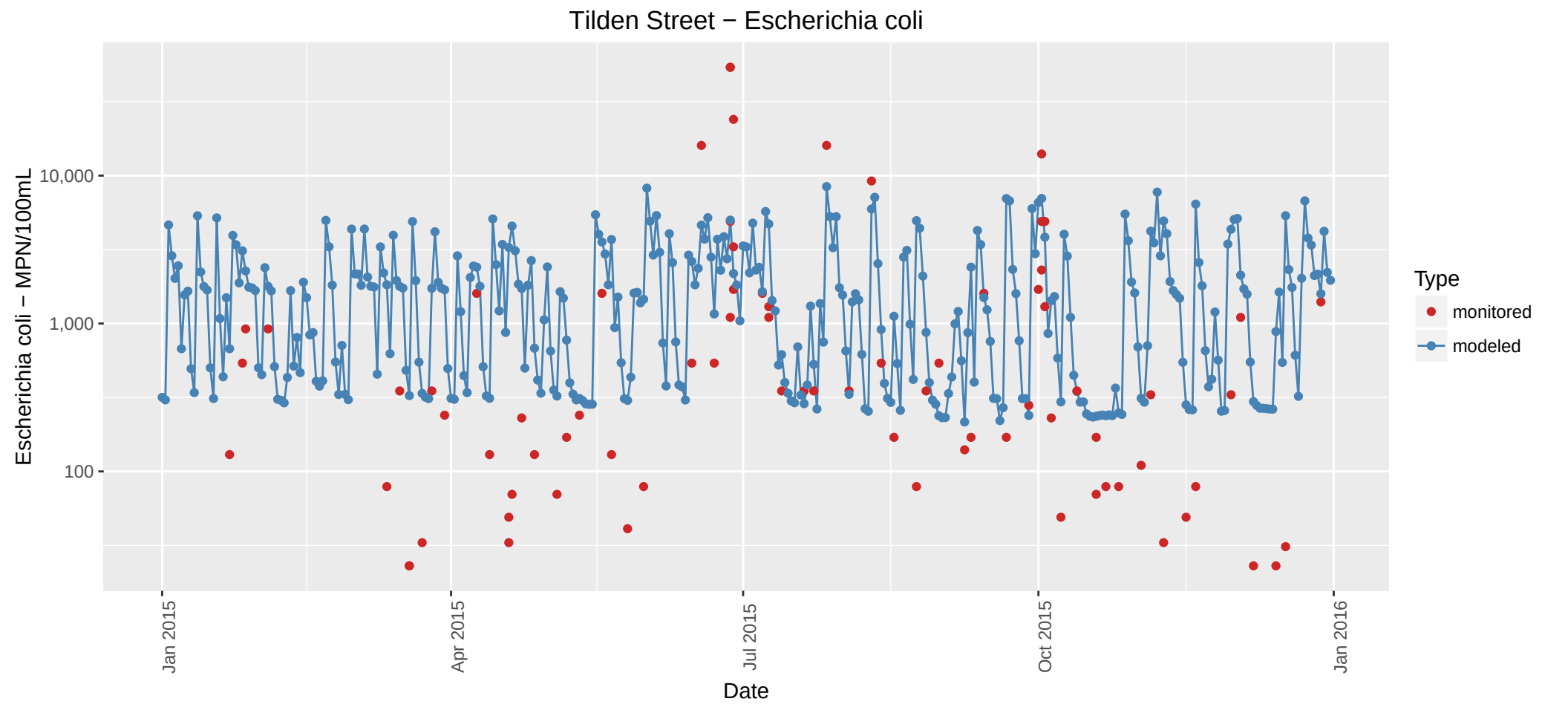

Tilden Street − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

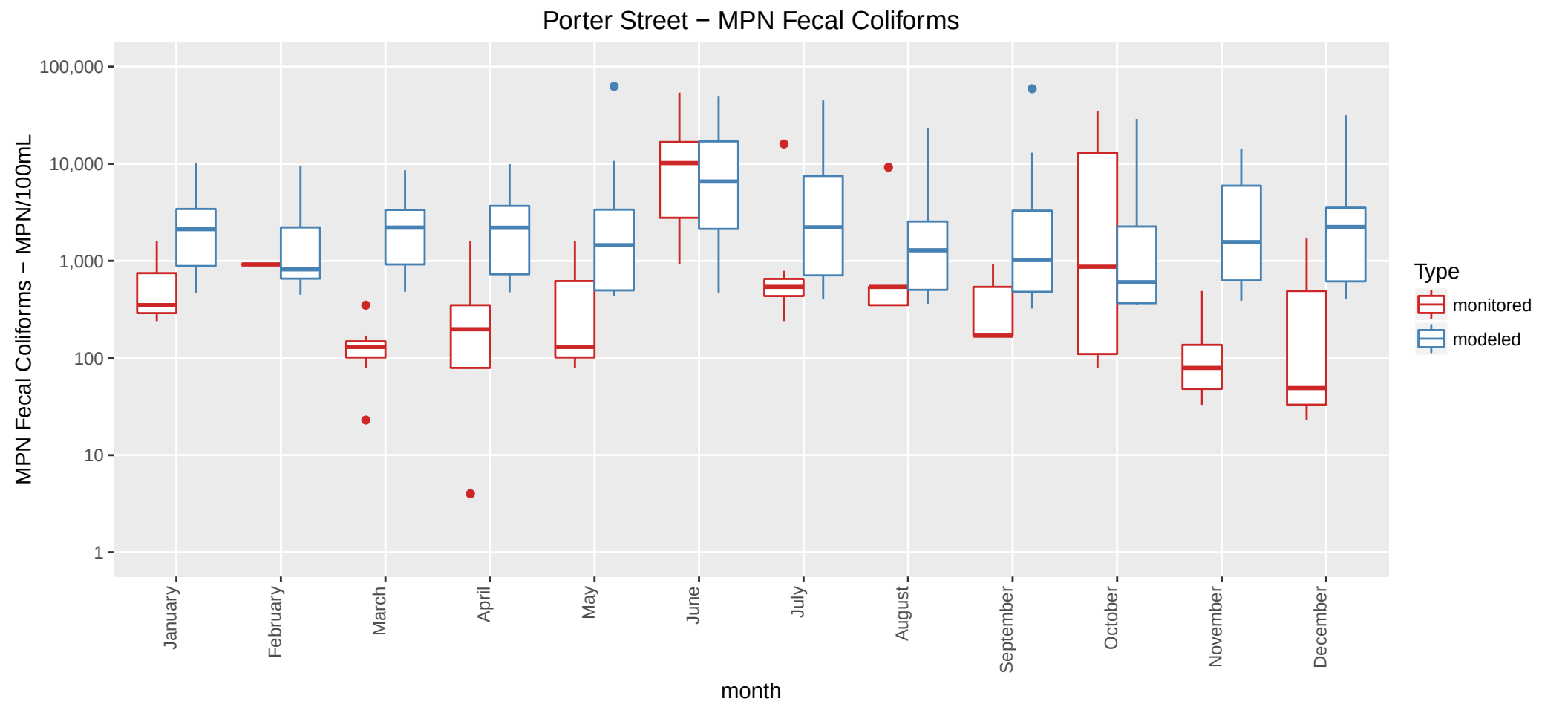

Tilden Street − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

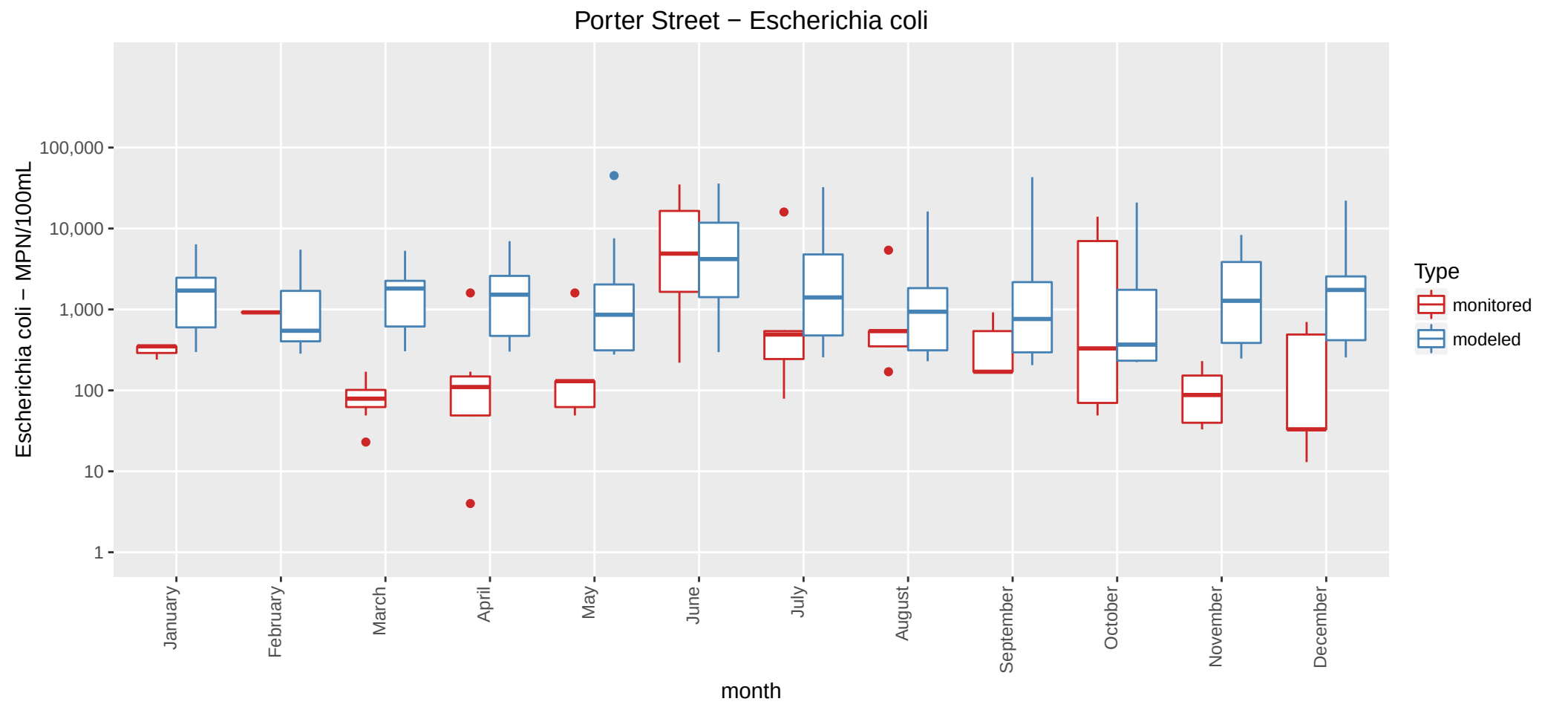

Tilden Street − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

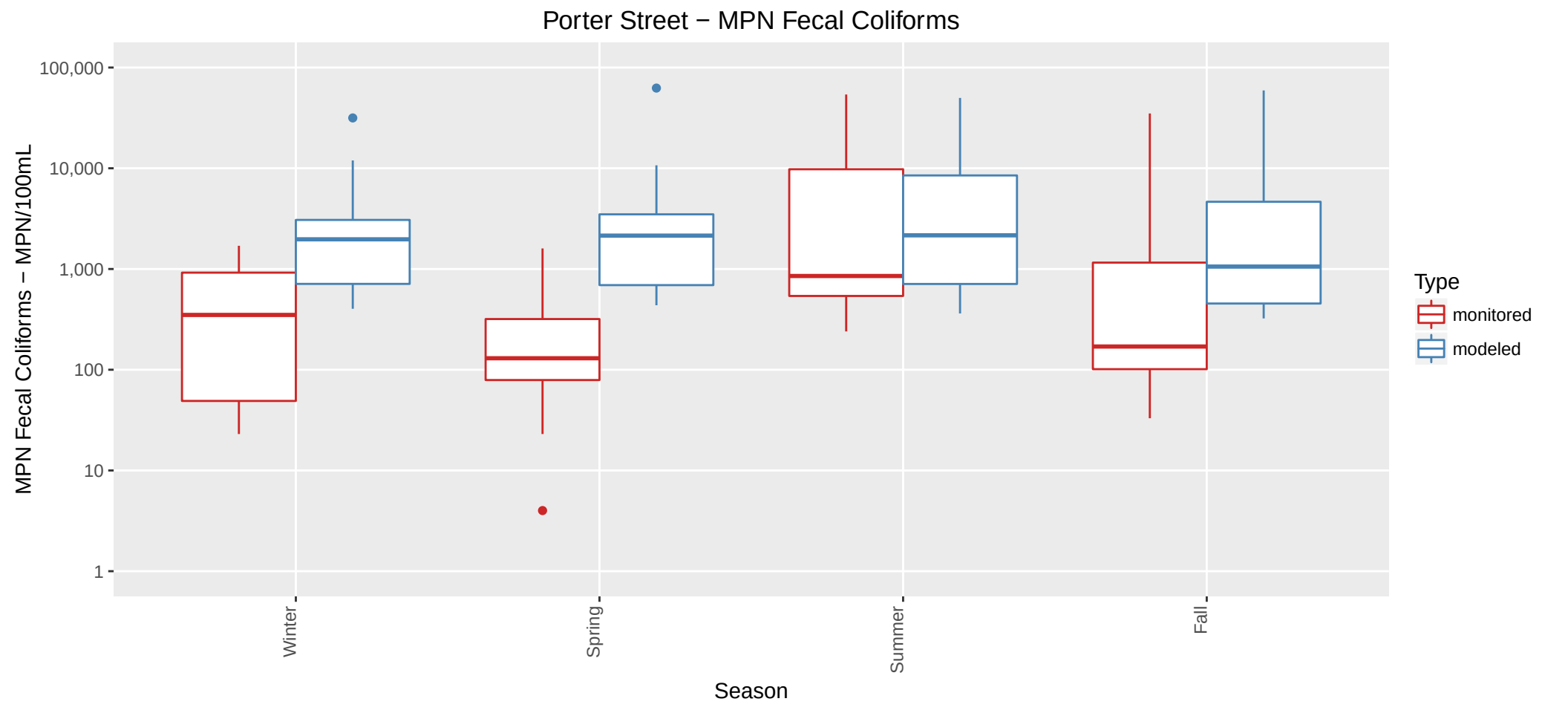

Tilden Street − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

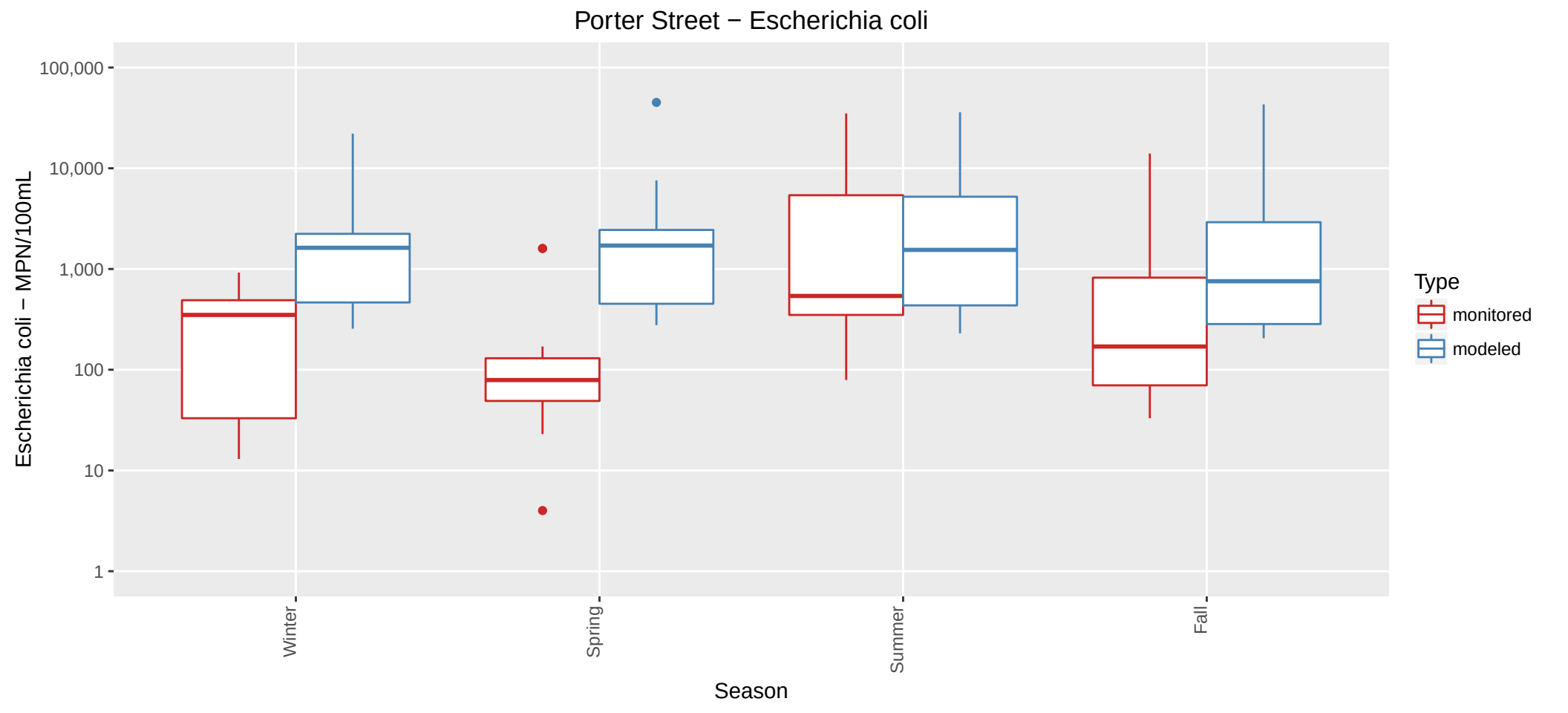

Tilden Street − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
1,000
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

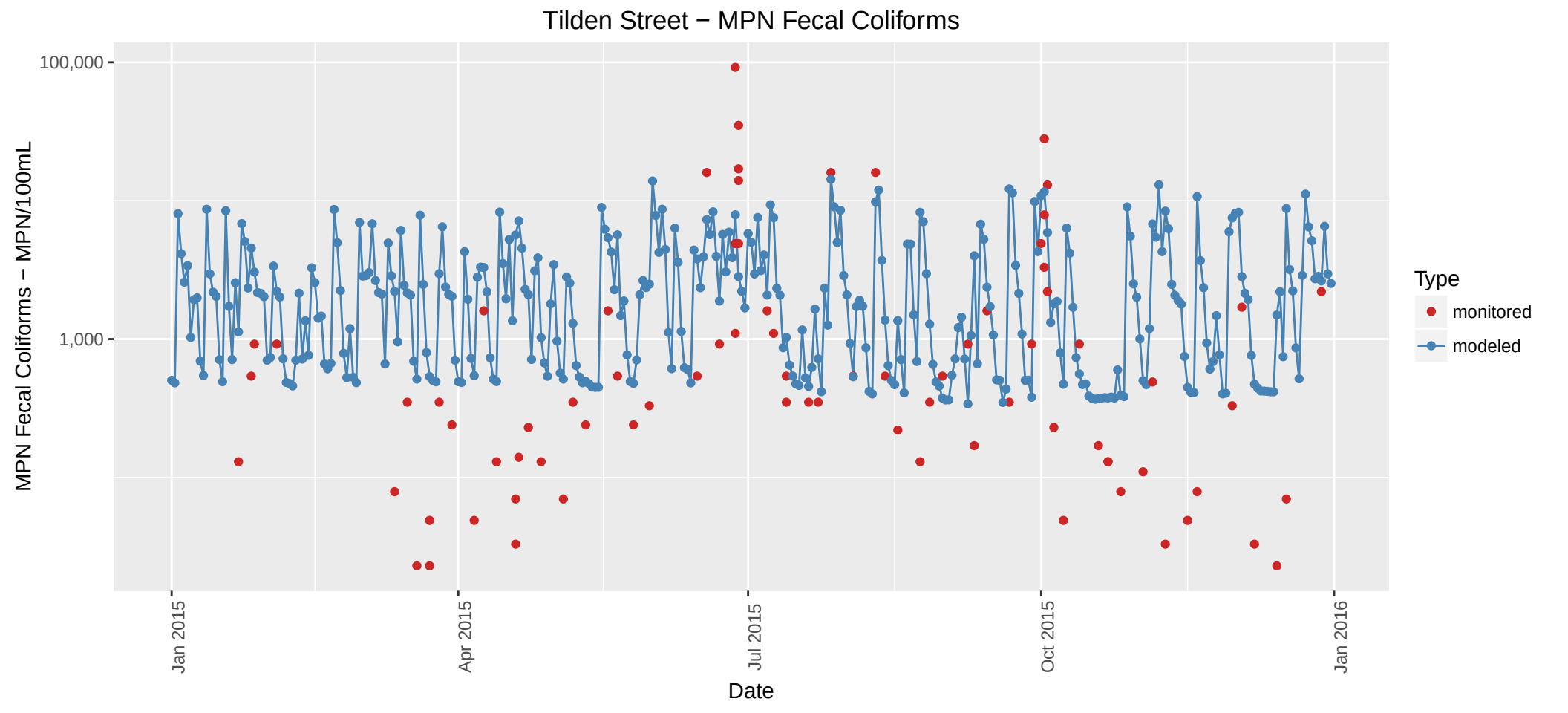

Tilden Street − Escherichia coli
Escherichia coli − MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

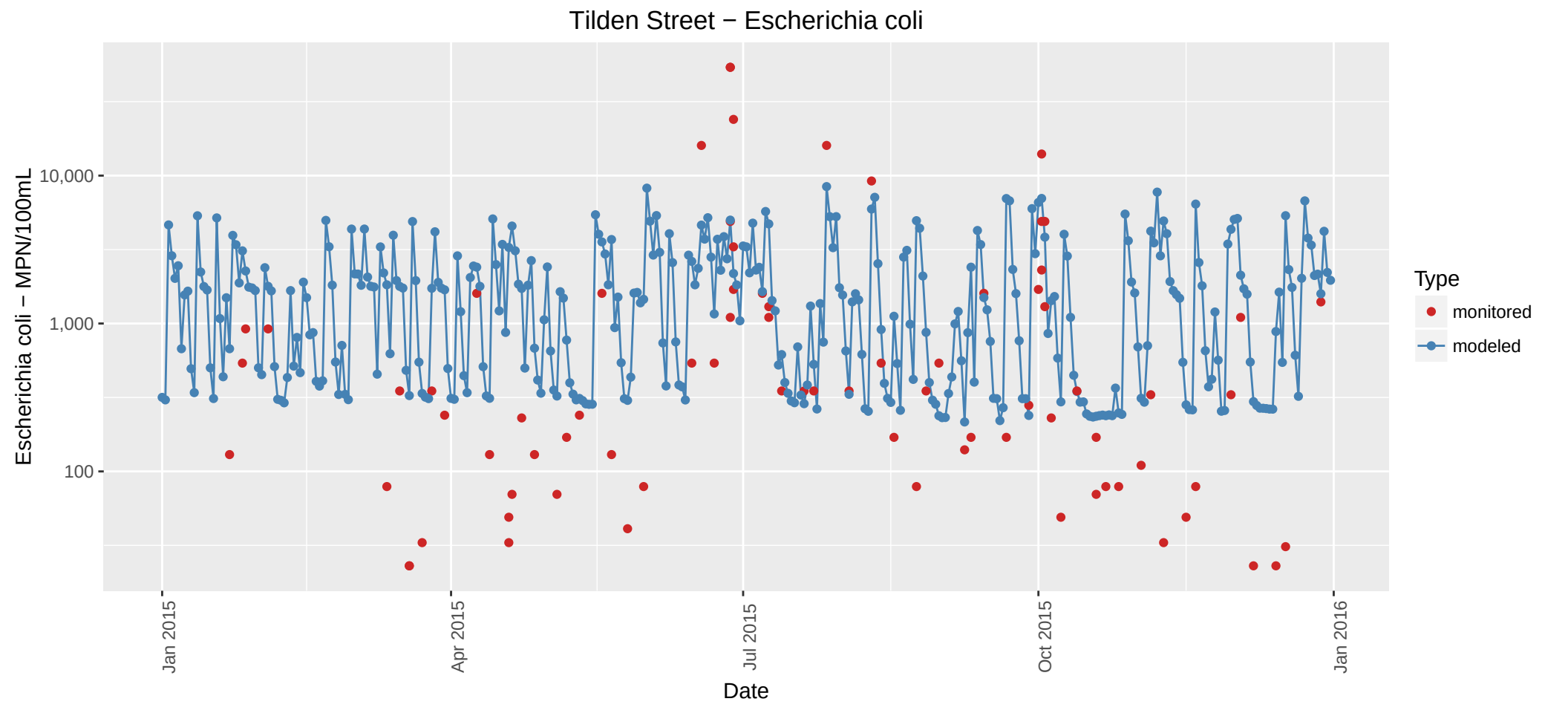

Porter Street − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

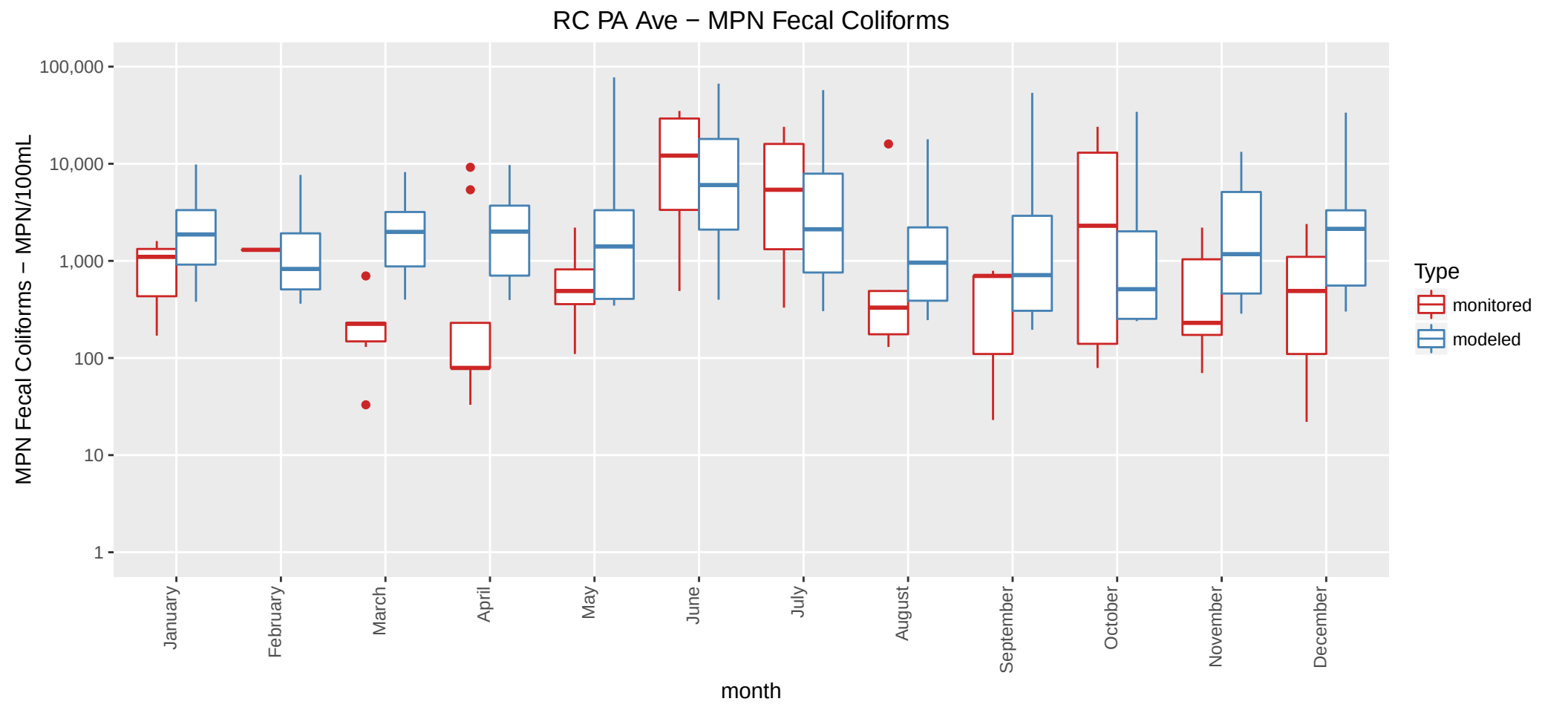

Porter Street − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled

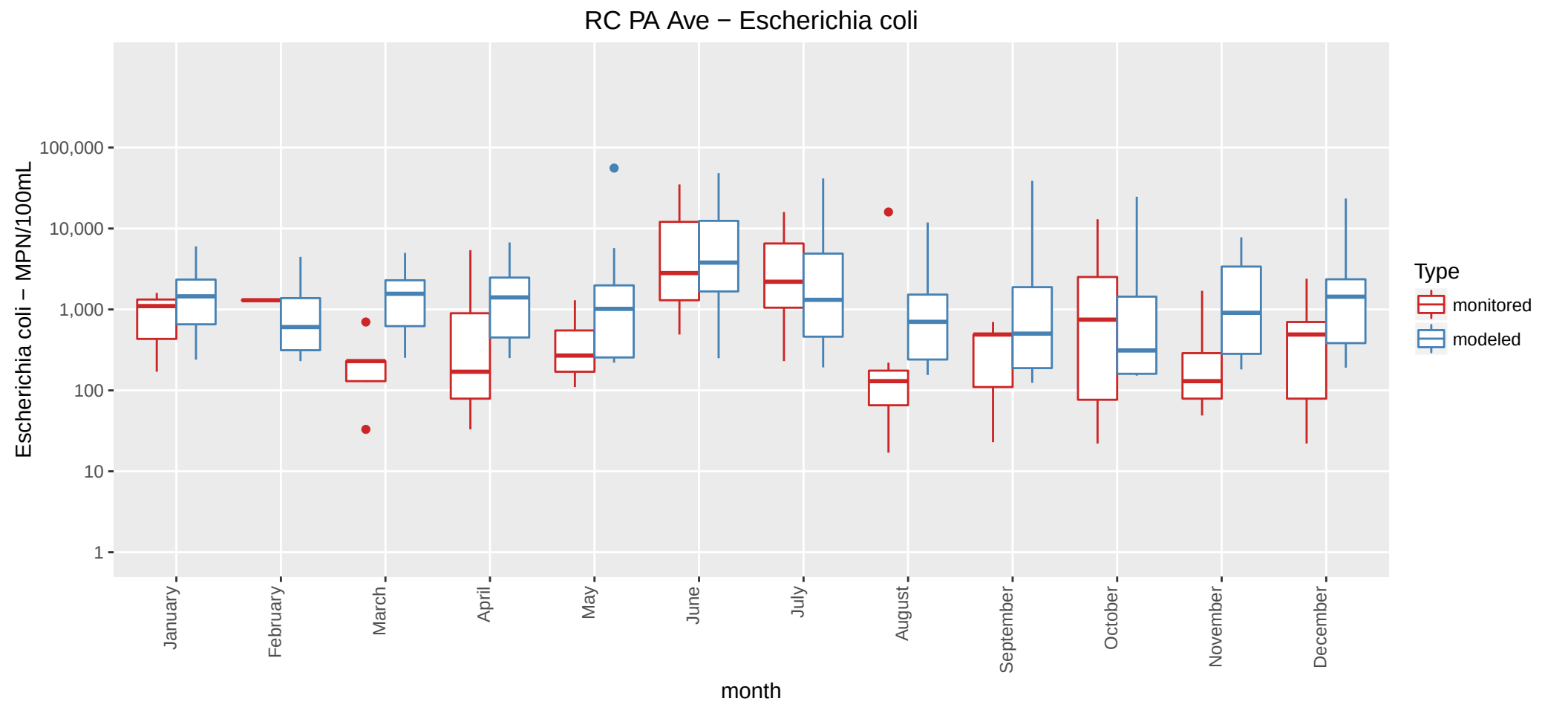

Porter Street − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

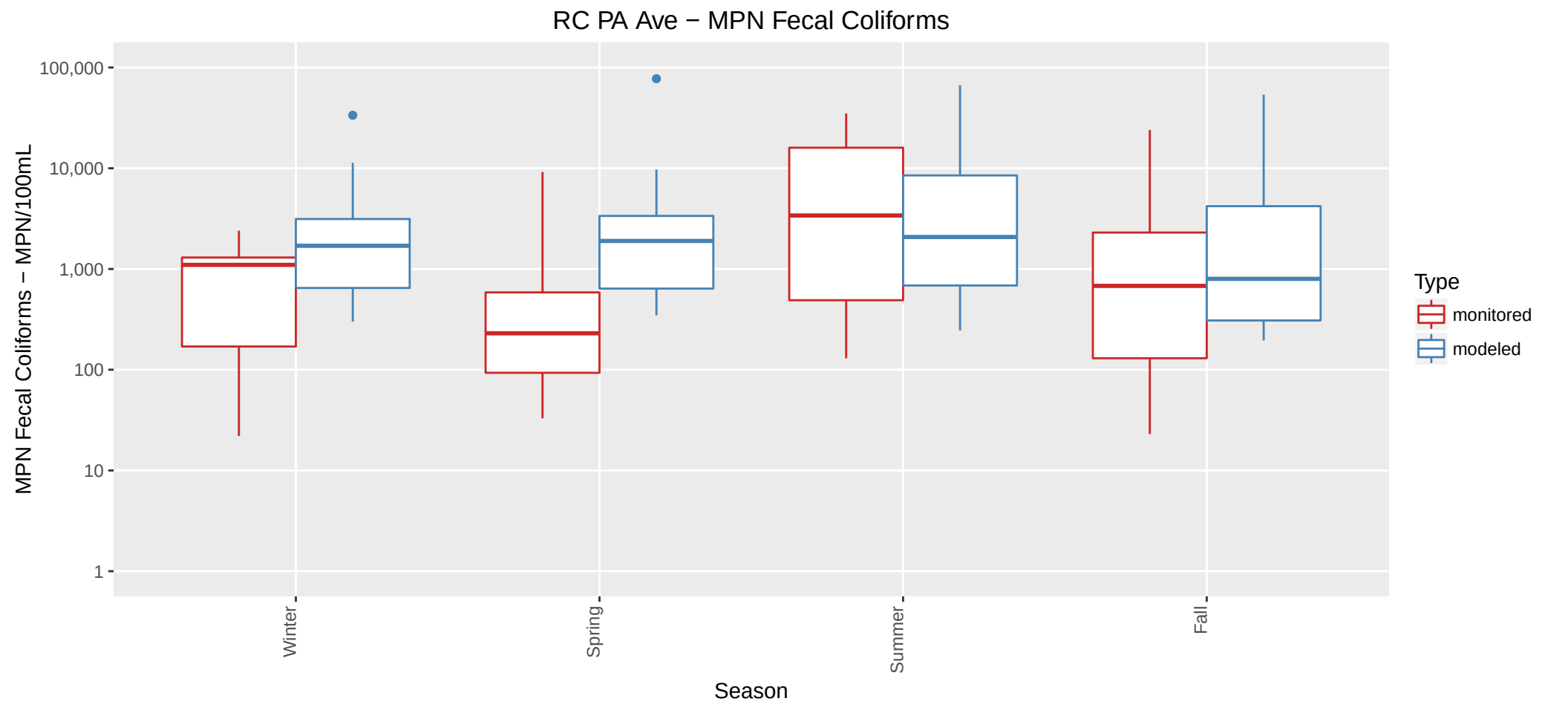

Porter Street − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

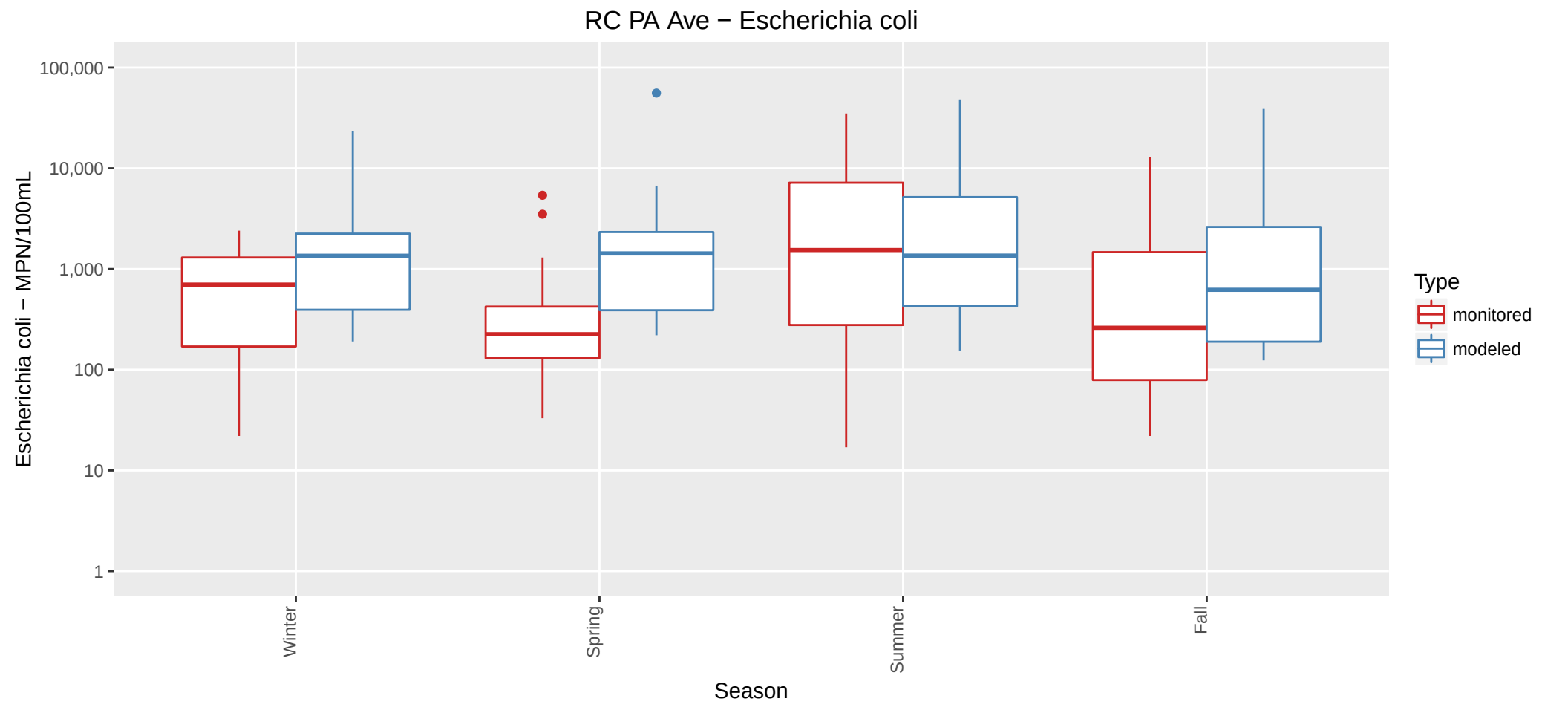

Tilden Street − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
1,000
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

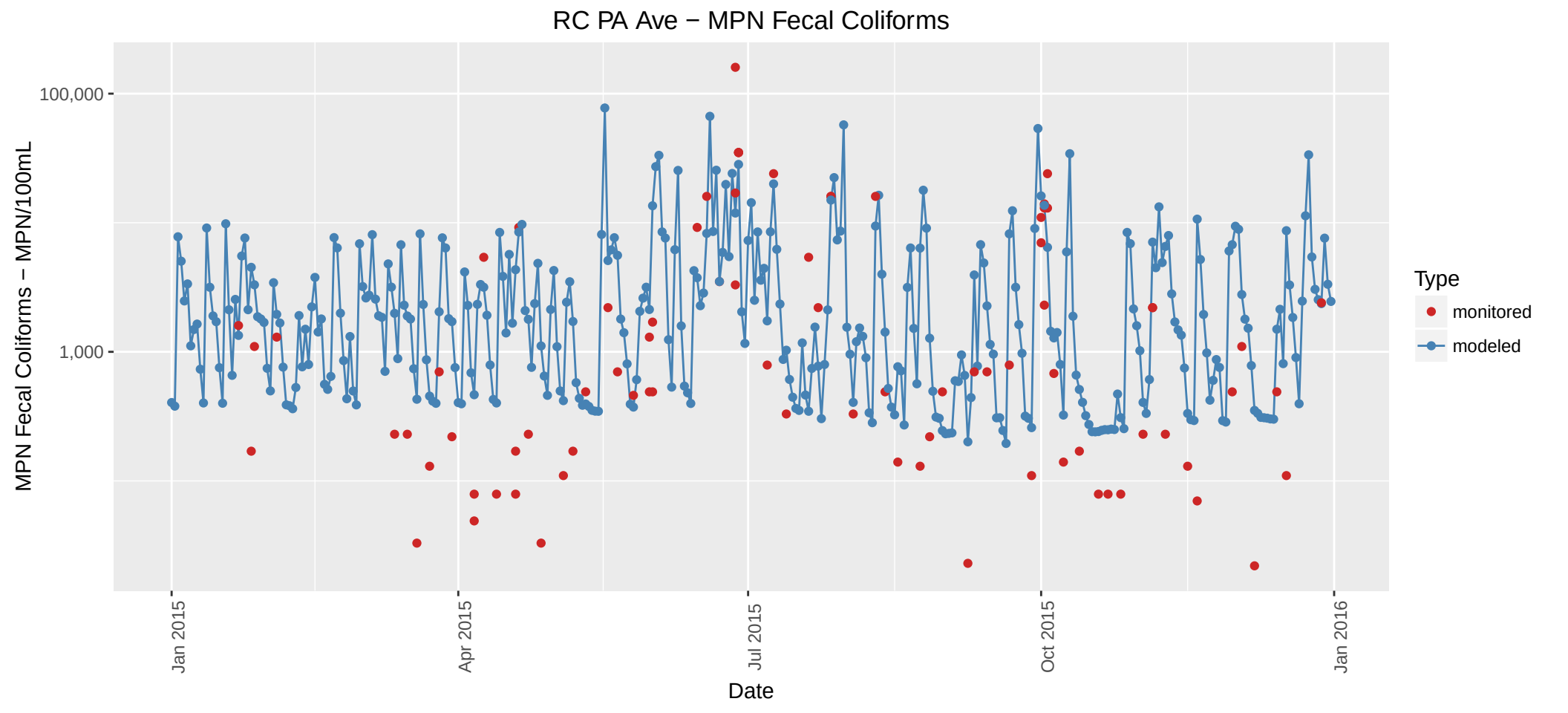

Tilden Street − Escherichia coli
Escherichia coli − MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

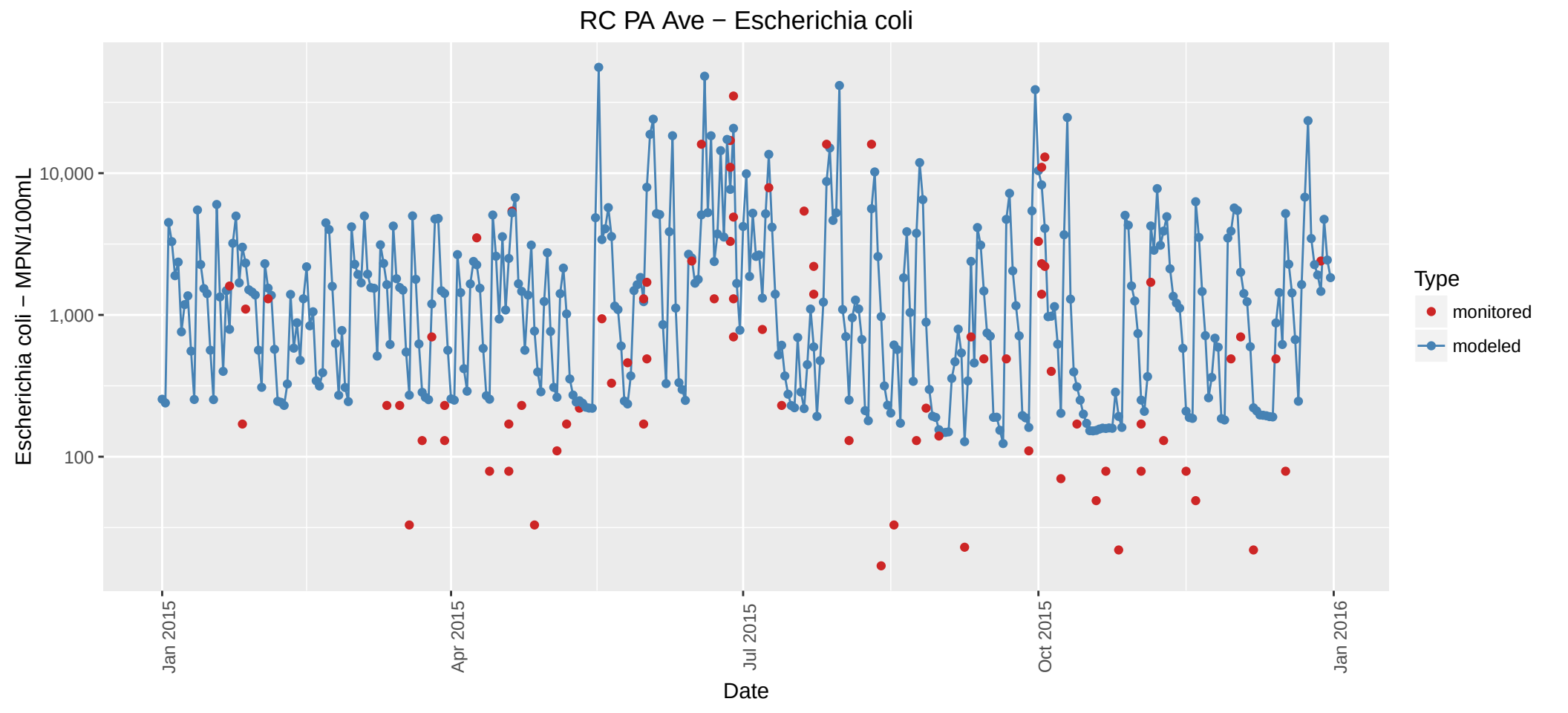

RC PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled


RC PA Ave − Escherichia coli
Escherichia coli − MPN/100mL
100,000
10,000
1,000
100
10
1
January
February
March
April
May
June
July
August
September
October
November
December
month
Type
monitored
modeled


RC PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms – MPN/100mL
100,000
10,000
1,000
100
10
1
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled

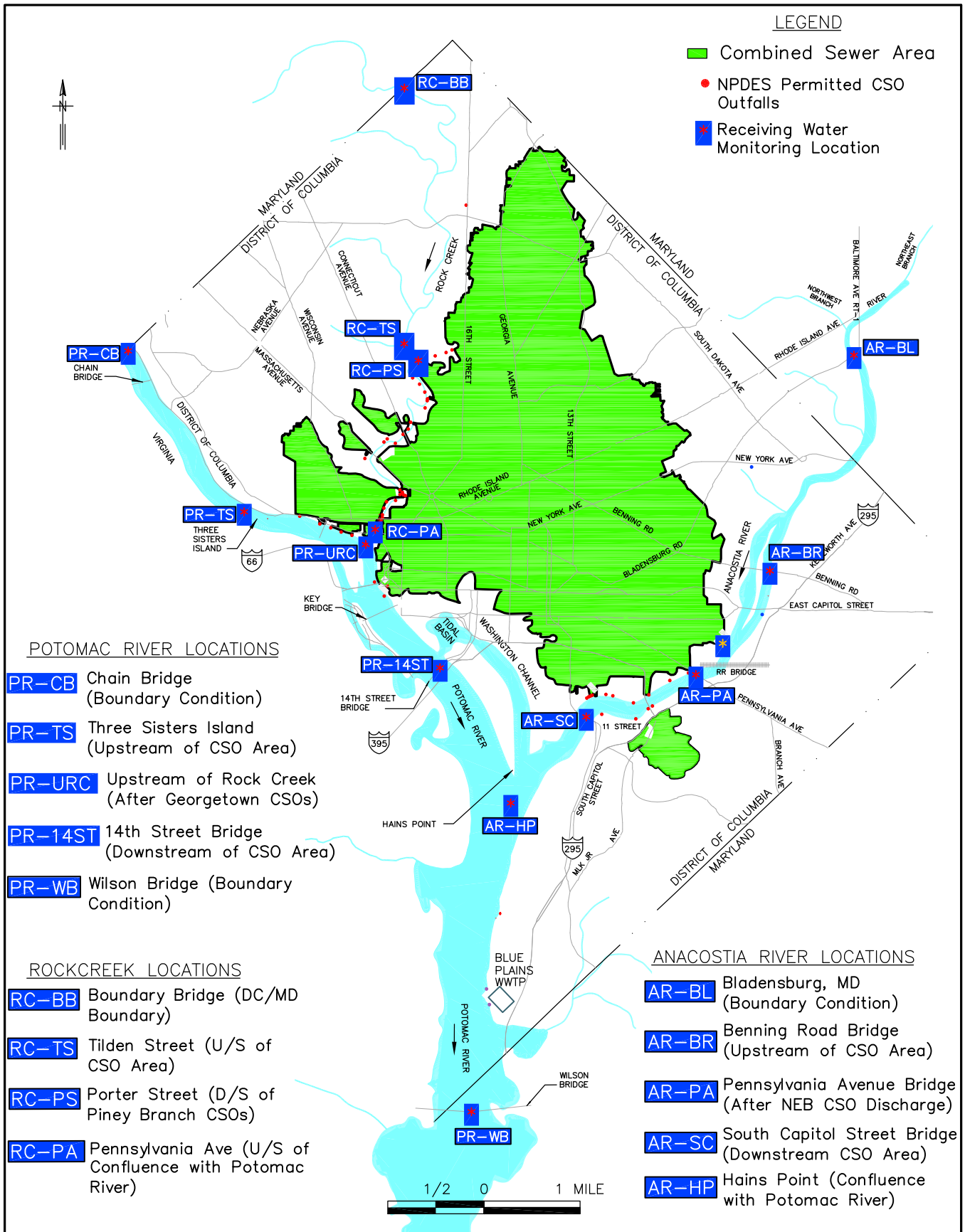

RC PA Ave − Escherichia coli
100,000
10,000
1,000
100
10
1
Escherichia coli − MPN/100mL
Winter
Spring
Summer
Fall
Season
Type
monitored
modeled


RC PA Ave − MPN Fecal Coliforms
MPN Fecal Coliforms − MPN/100mL
100,000
1,000
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled


RC PA Ave − Escherichia coli
Escherichia coli – MPN/100mL
10,000
1,000
100
Jan 2015
Apr 2015
Jul 2015
Oct 2015
Jan 2016
Date
Type
monitored
modeled

Appendix C Phase I: Post Construction Monitoring Data Plots

Receiving Water Quality Data Collected During PCM- Phase I



POTOMAC RIVER LOCATIONS

- **PR-CB** Chain Bridge (Boundary Condition)
- **PR-TS** Three Sisters Island (Upstream of CSO Area)
- **PR-URC** Upstream of Rock Creek (After Georgetown CSOs)
- **PR-14ST** 14th Street Bridge (Downstream of CSO Area)
- **PR-WB** Wilson Bridge (Boundary Condition)

ROCKCREEK LOCATIONS

- **RC-BB** Boundary Bridge (DC/MD Boundary)
- **RC-TS** Tilden Street (U/S of CSO Area)
- **RC-PS** Porter Street (D/S of Piney Branch CSOs)
- **RC-PA** Pennsylvania Ave (U/S of Confluence with Potomac River)

ANACOSTIA RIVER LOCATIONS

- **AR-BL** Bladensburg, MD (Boundary Condition)
- **AR-BR** Benning Road Bridge (Upstream of CSO Area)
- **AR-PA** Pennsylvania Avenue Bridge (After NEB CSO Discharge)
- **AR-SC** South Capitol Street Bridge (Downstream CSO Area)
- **AR-HP** Hains Point (Confluence with Potomac River)

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

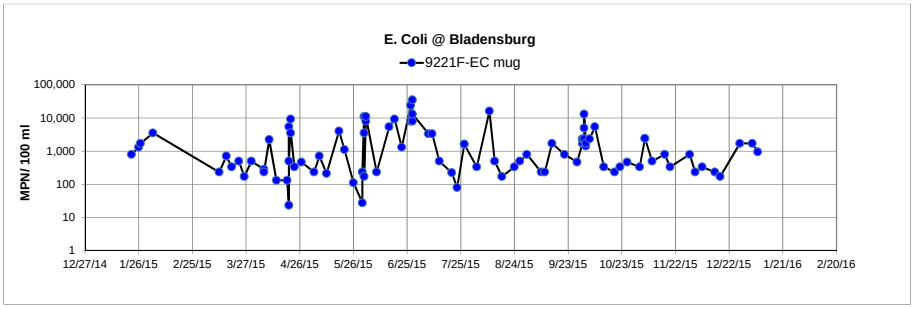
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE-I

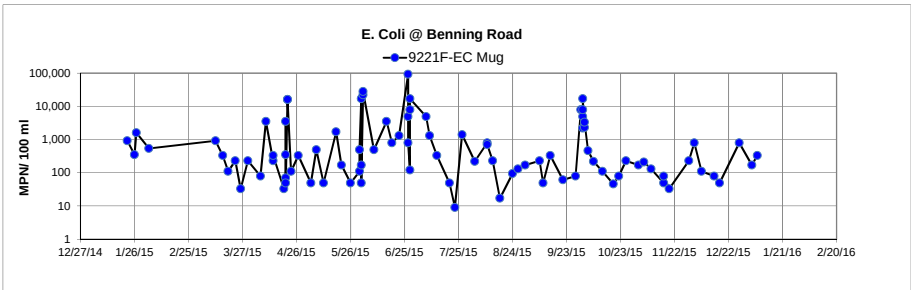
RECEIVING WATER MONITORING LOCATIONS

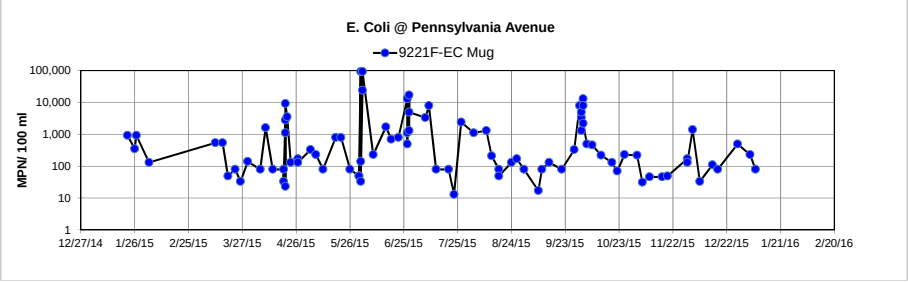
DATE: JULY 2016 | FIGURE 4-2

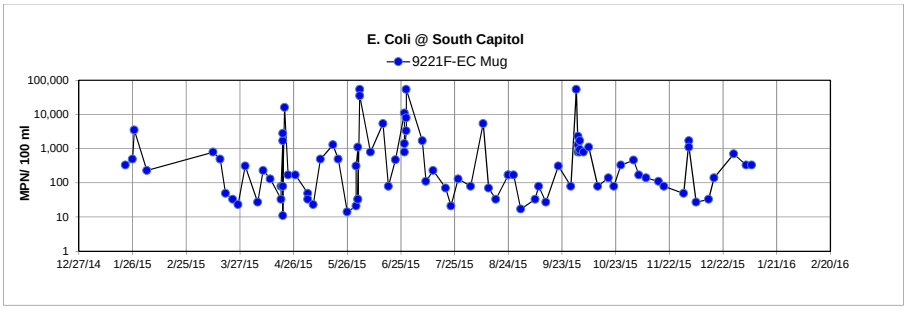
LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 4/11/2016 10:35:04 AM
DRAWING ID: E:\PROJECTS\POST CONSTRUCTION MONITORING\05 - REPORTING\PCM REPORT\FIG\FIGURE 4-2 RIVER SAMPLING- BACTERIA.DWG

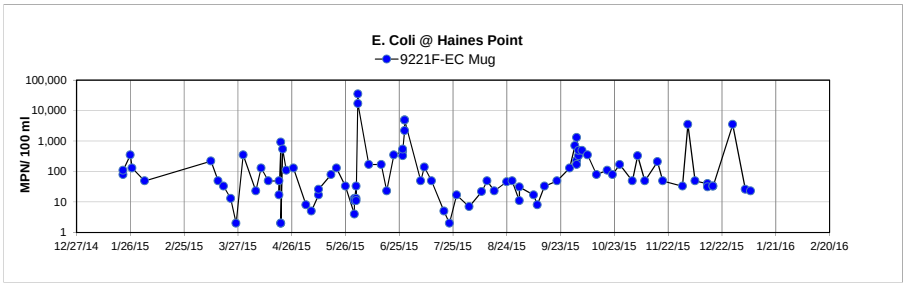
Anacostia River Water Quality- E. Coli

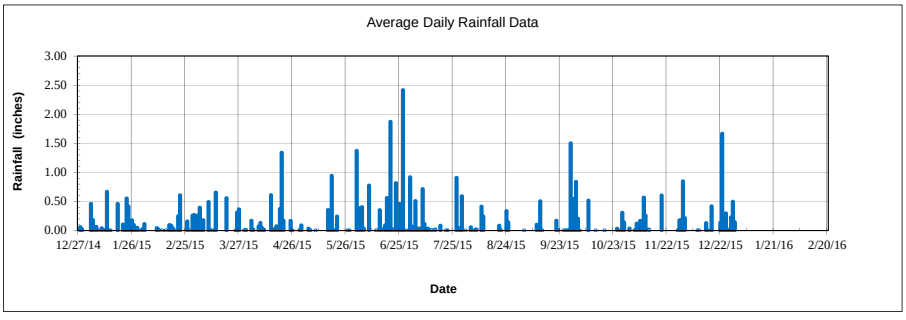




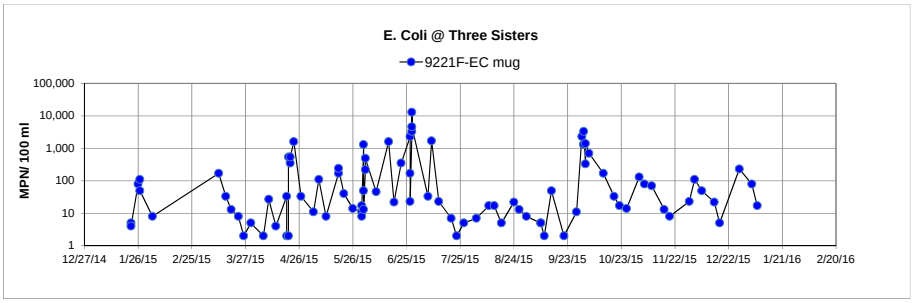


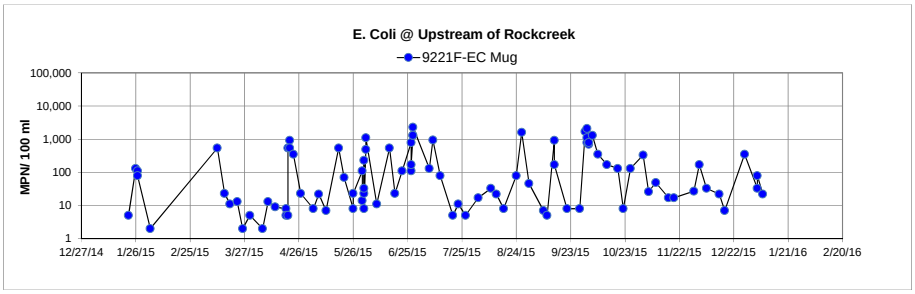


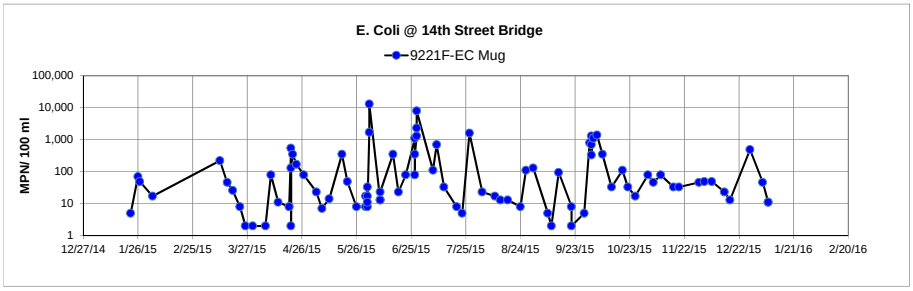


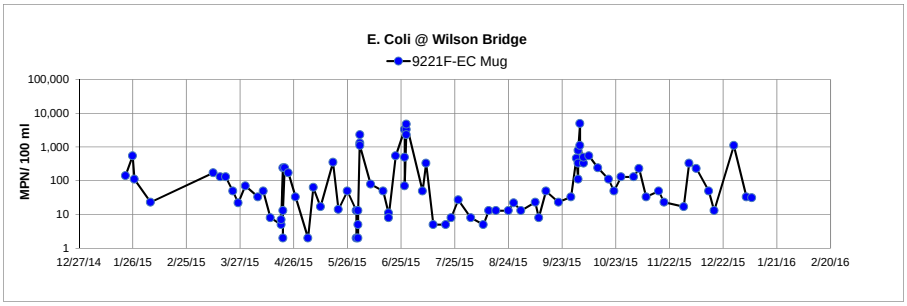


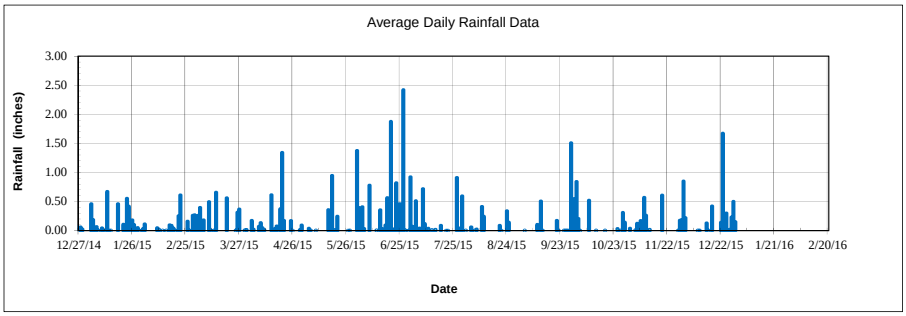
Potomac River Water Quality- E. Coli



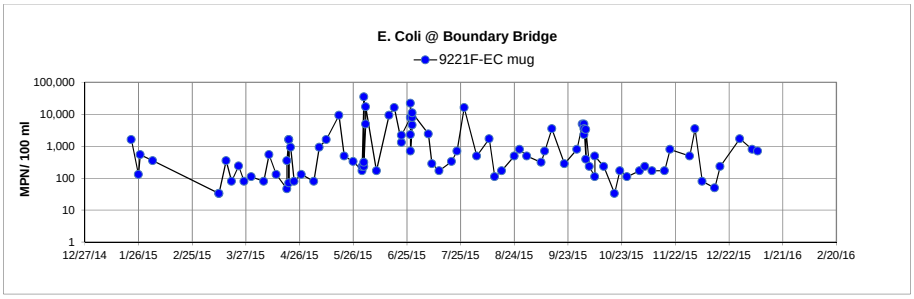


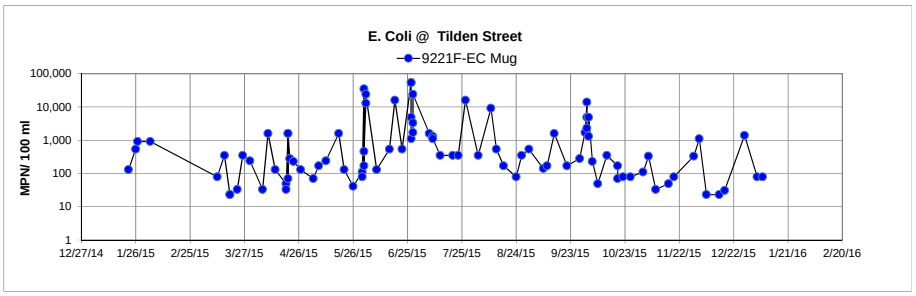


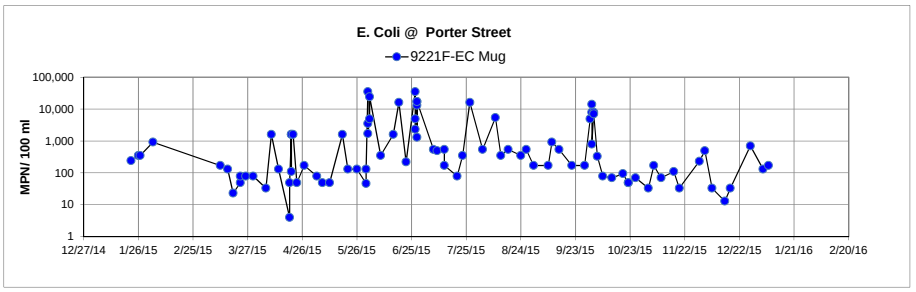


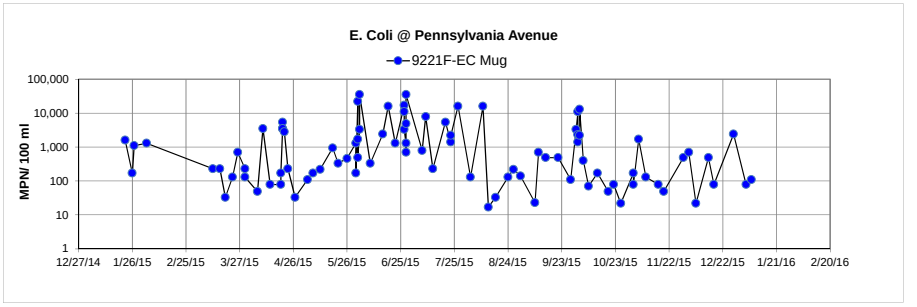


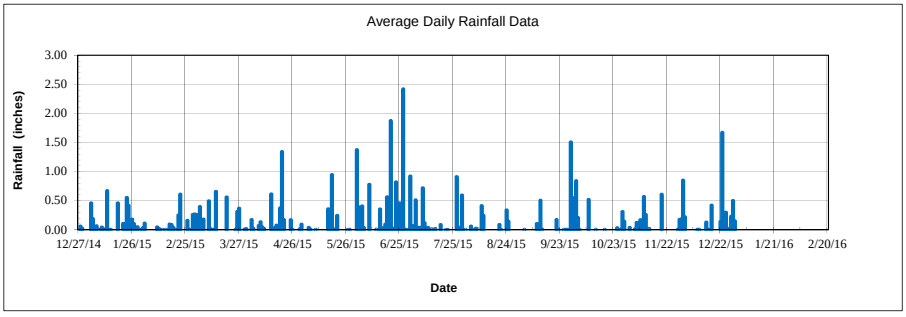
Rockcreek Water Quality- E. Coli



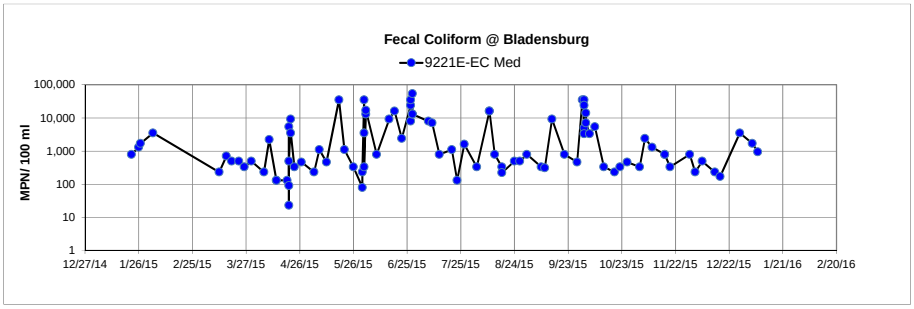


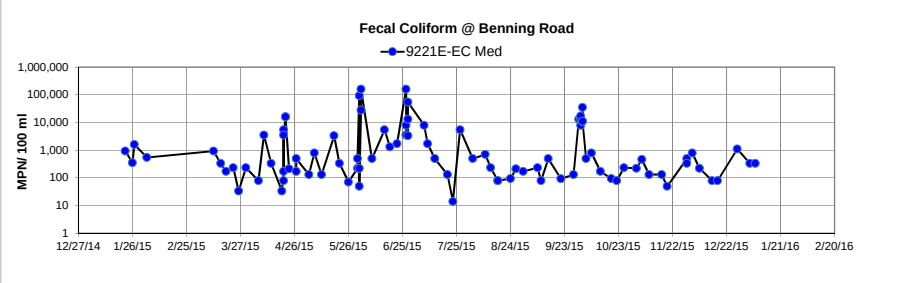


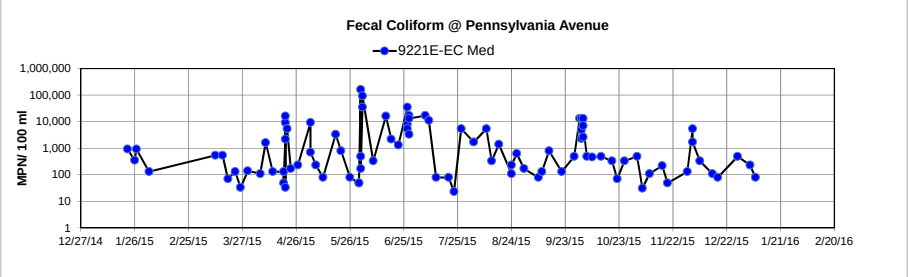


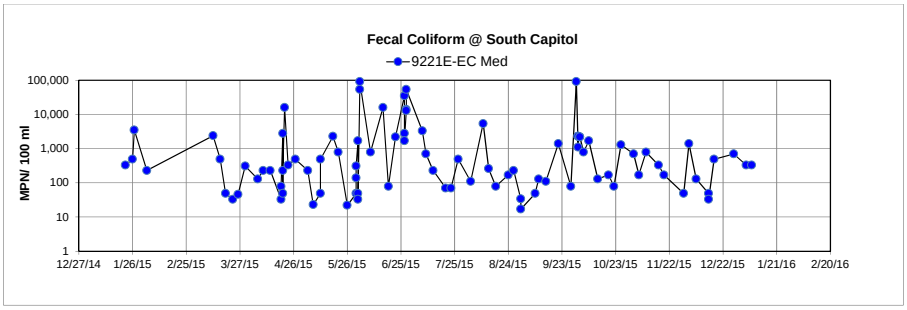


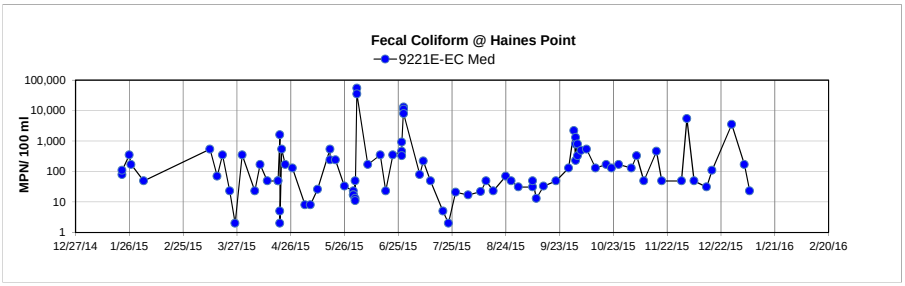
Anacostia River Water Quality- Fecal Coliform

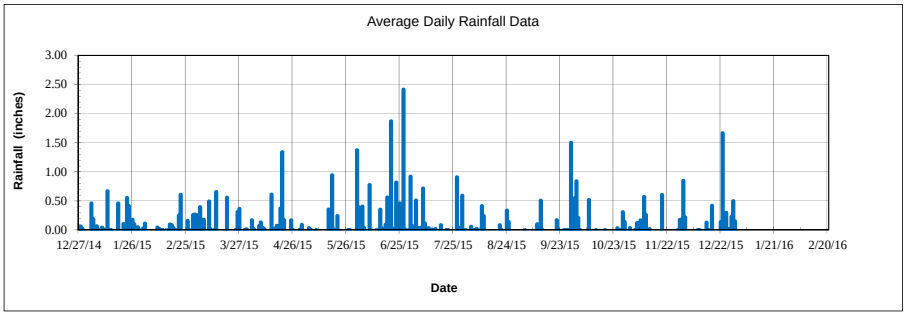




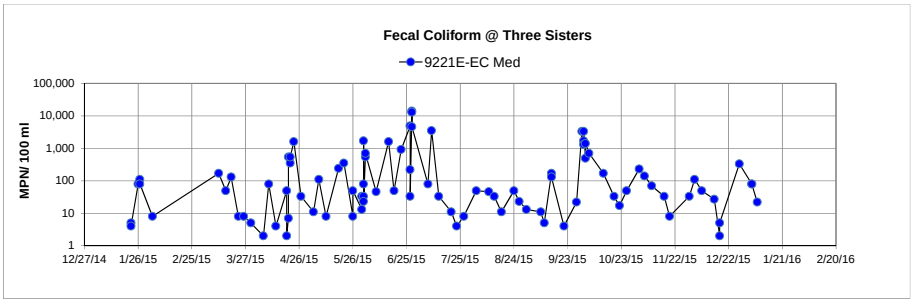


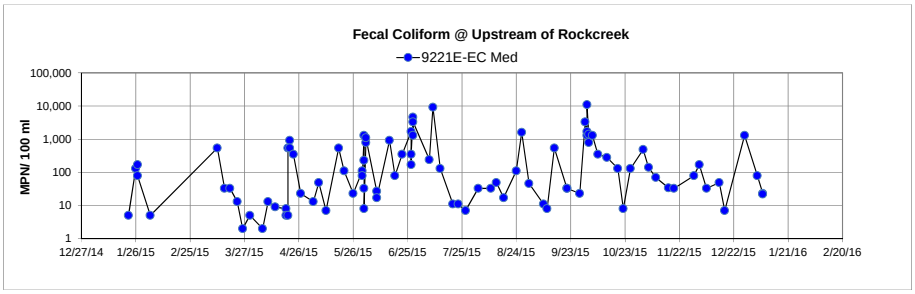


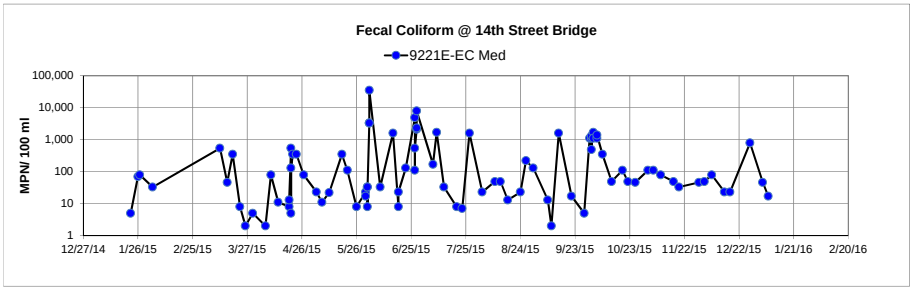


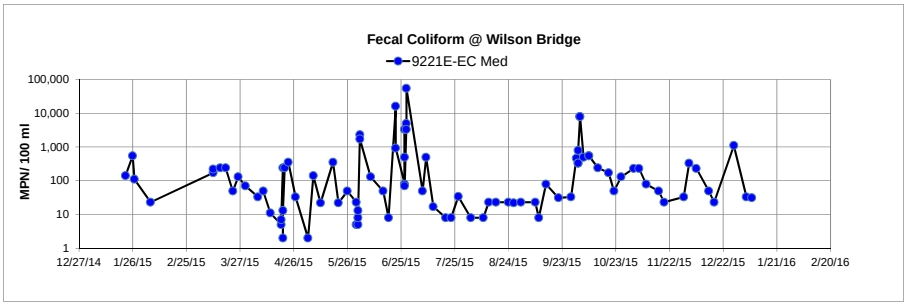


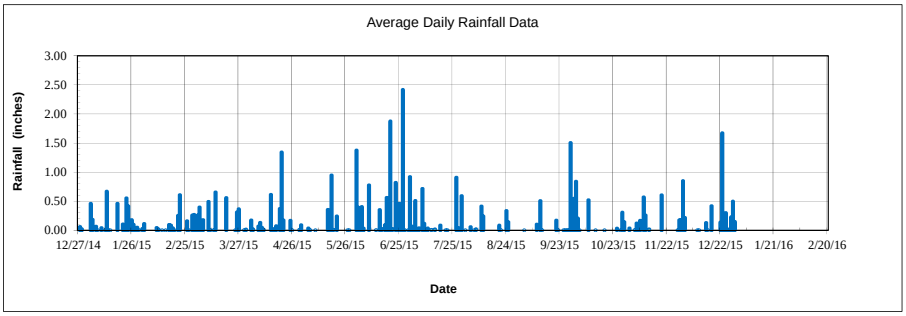
Potomac River Water Quality- Fecal Coliform



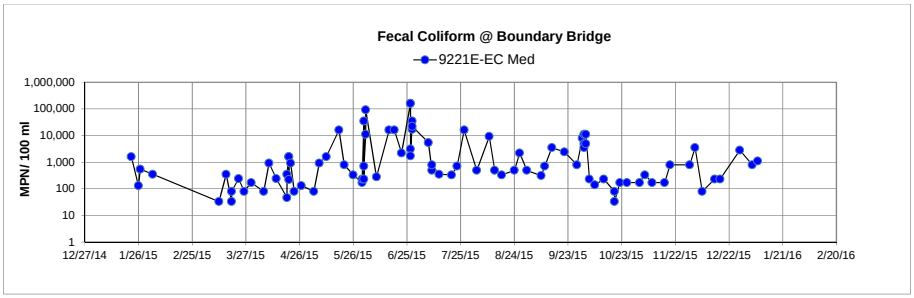


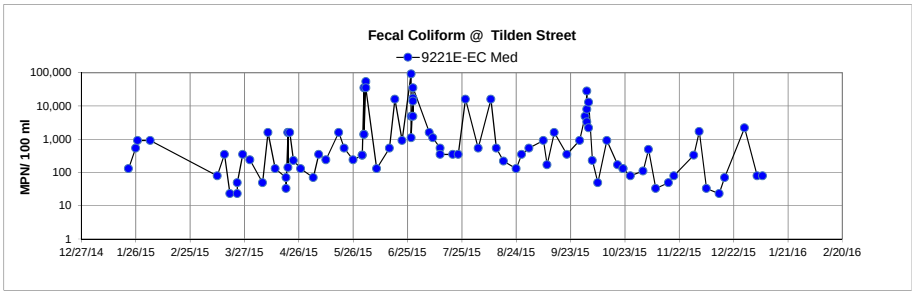


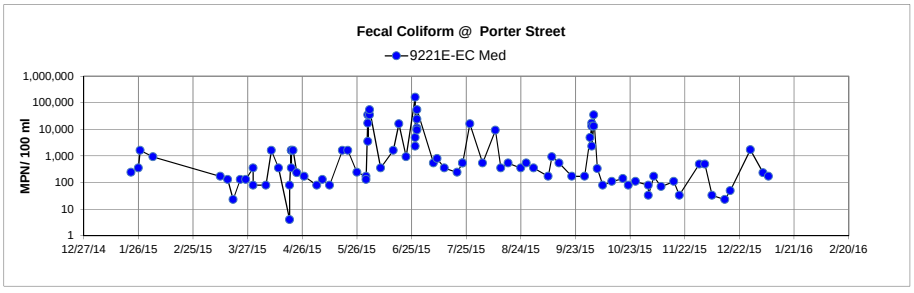


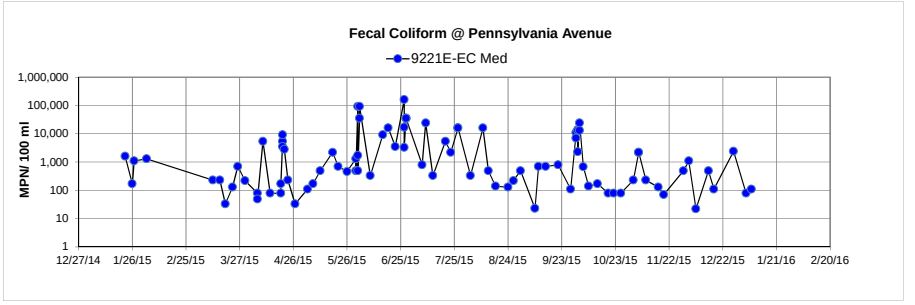


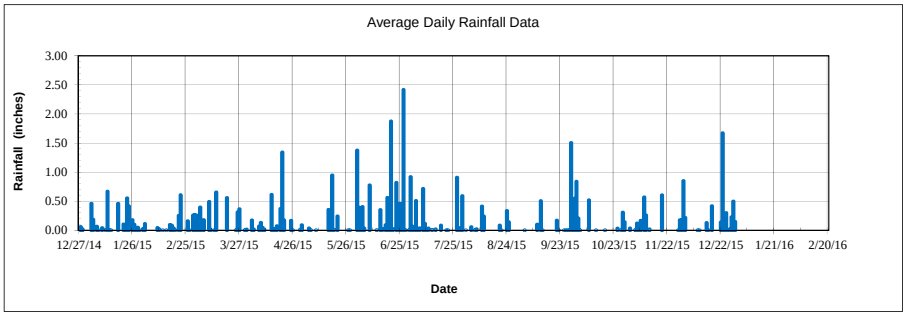
Rockcreek Water Quality- Fecal Coliform



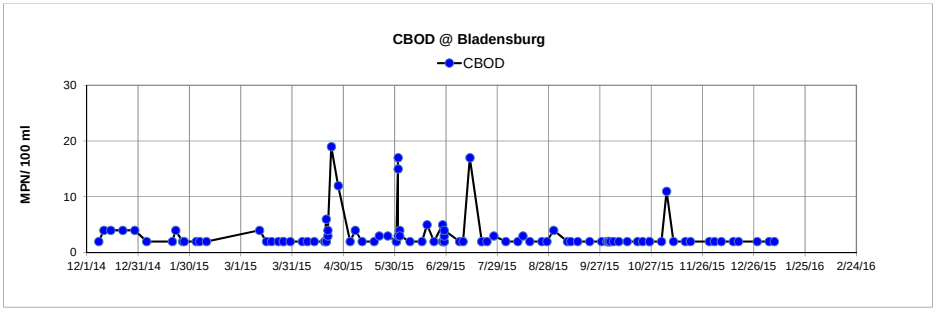


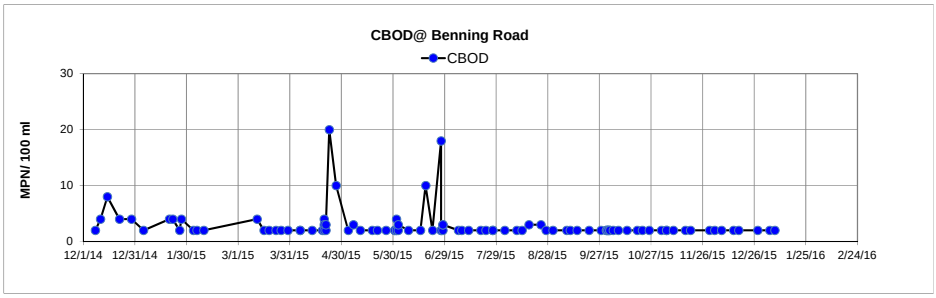


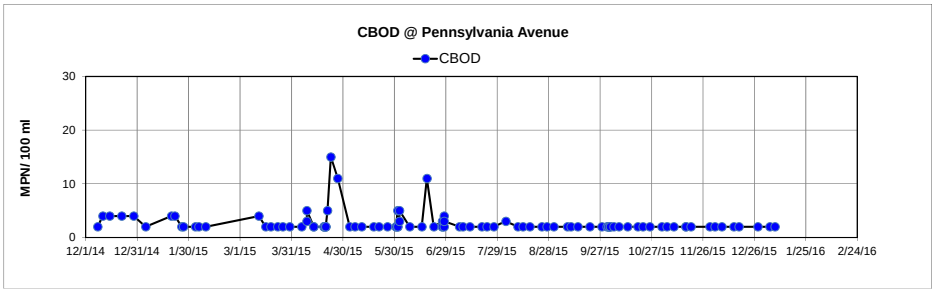


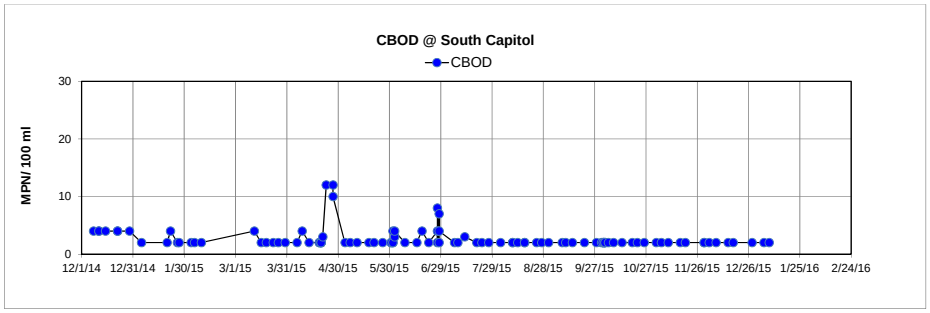


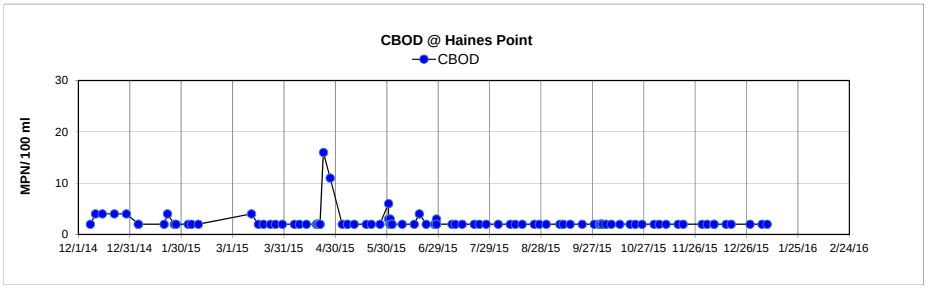
Anacostia River Water Quality- CBOD

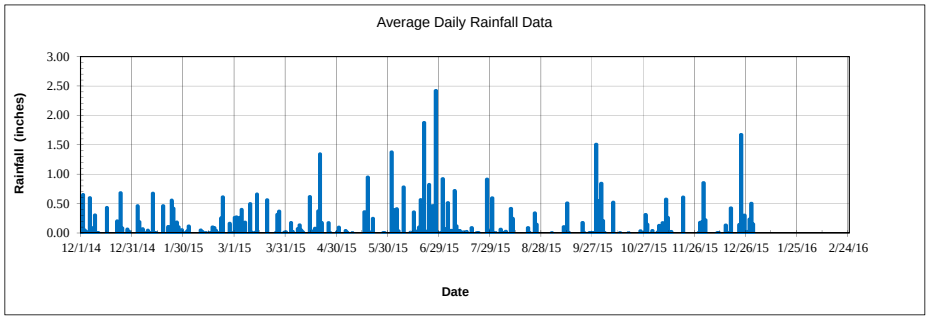




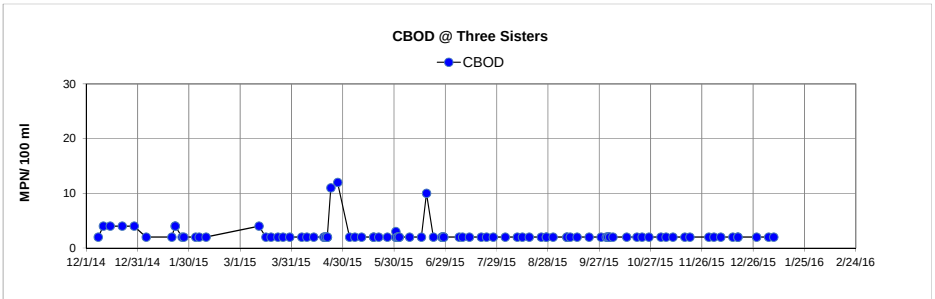


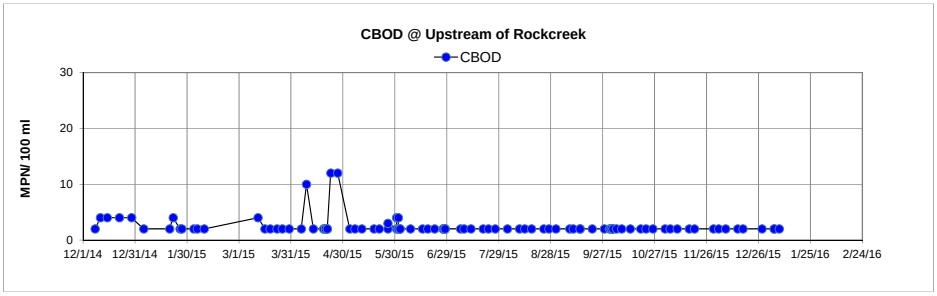


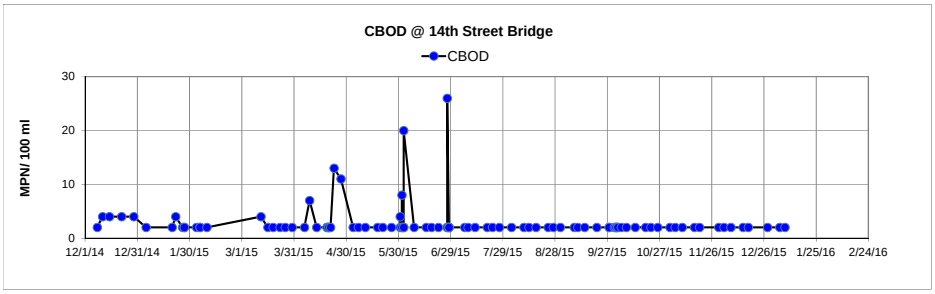


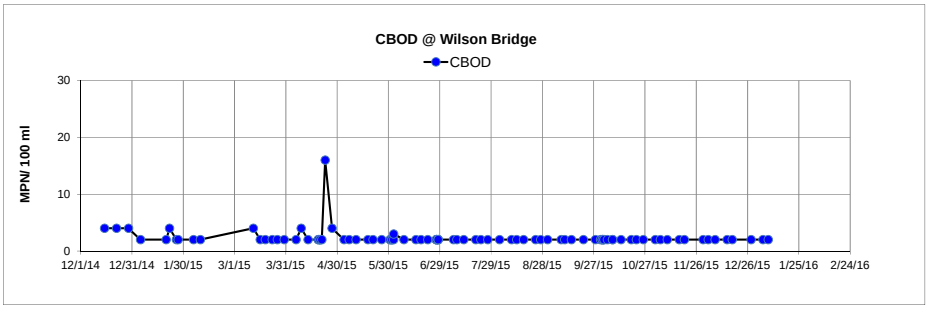


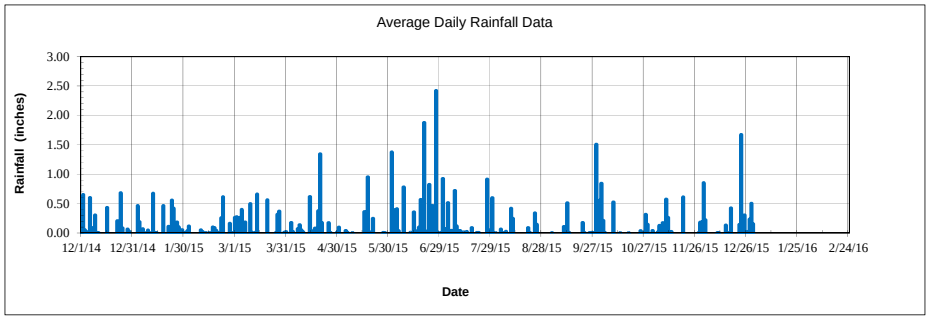
Potomac River Water Quality- CBOD



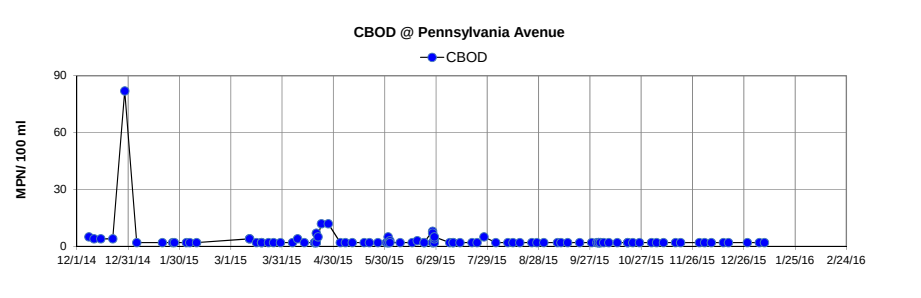


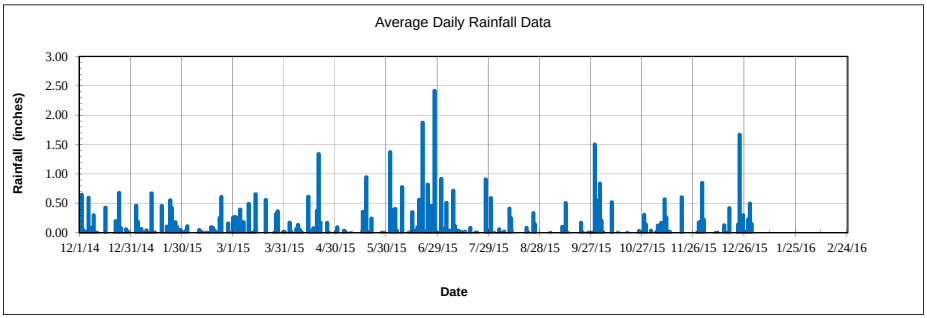




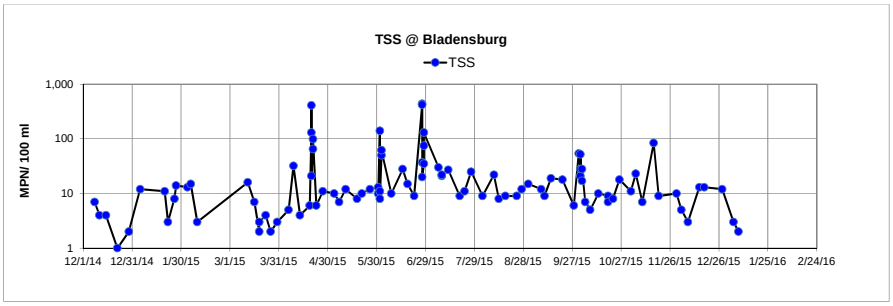


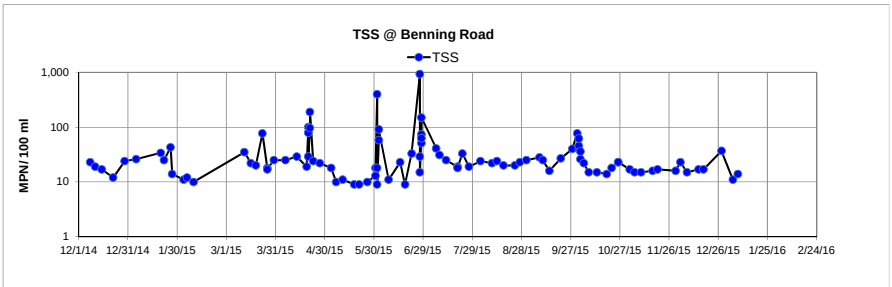
Rockcreek Water Quality- CBOD

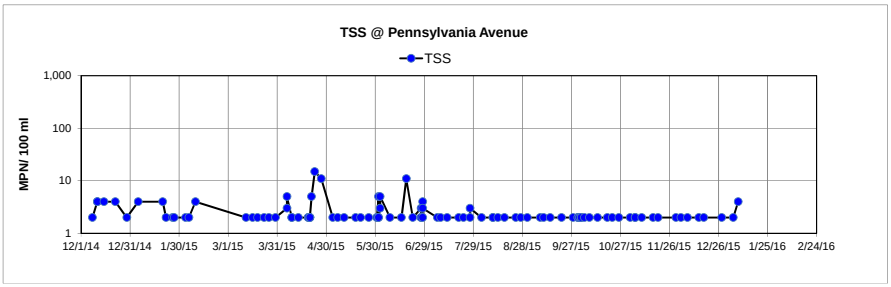


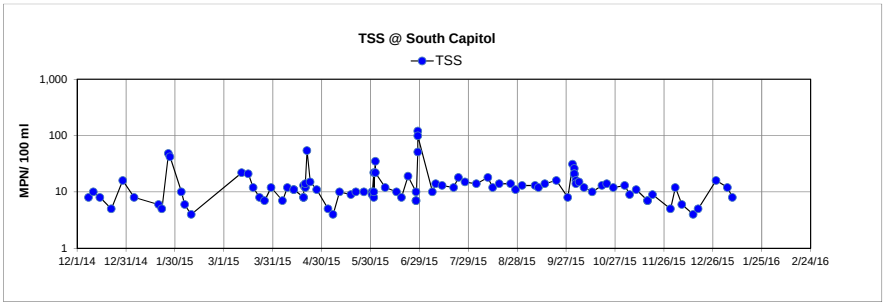


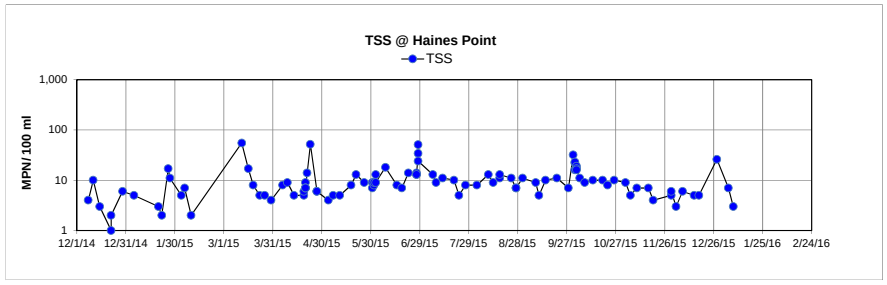
Anacostia River Water Quality- TSS

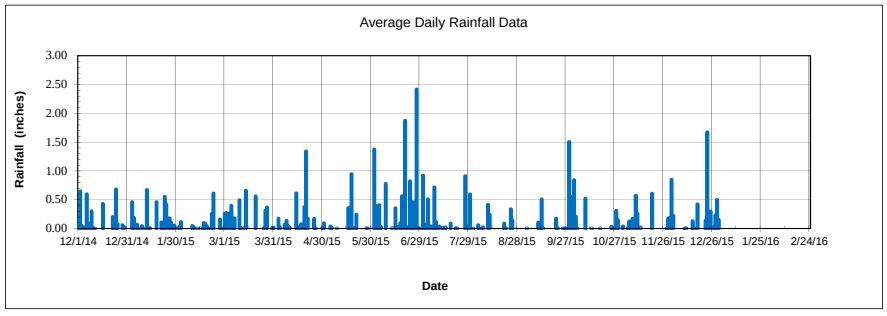




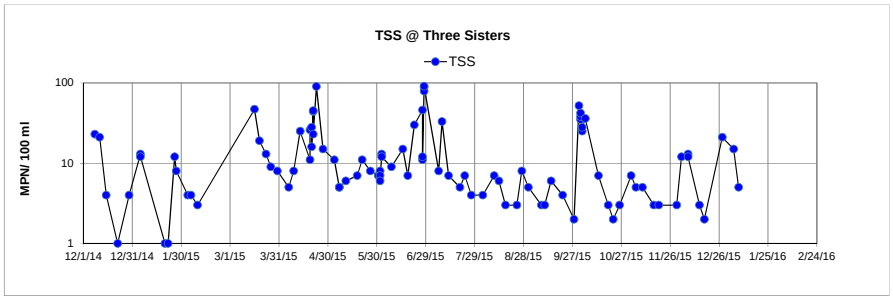


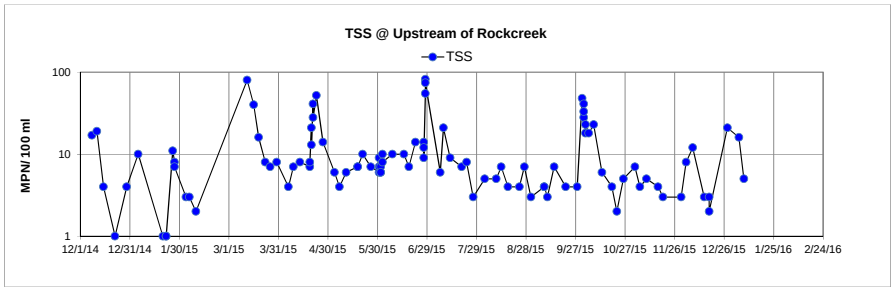


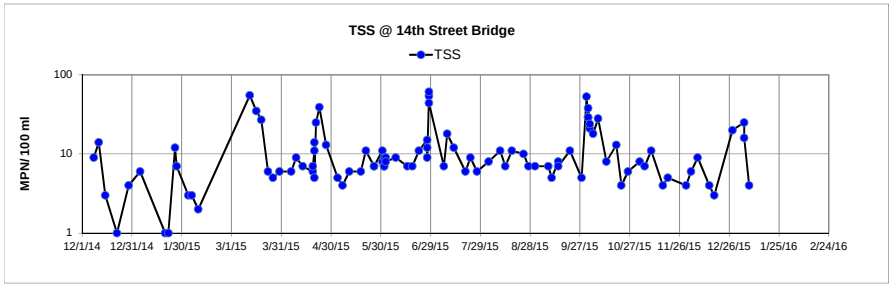


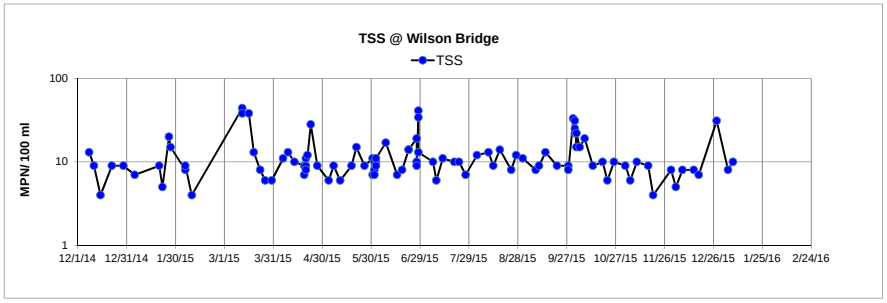


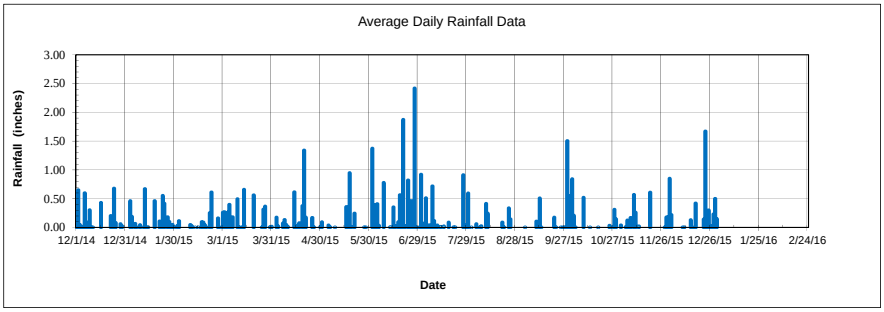
Potomac River Water Quality- TSS



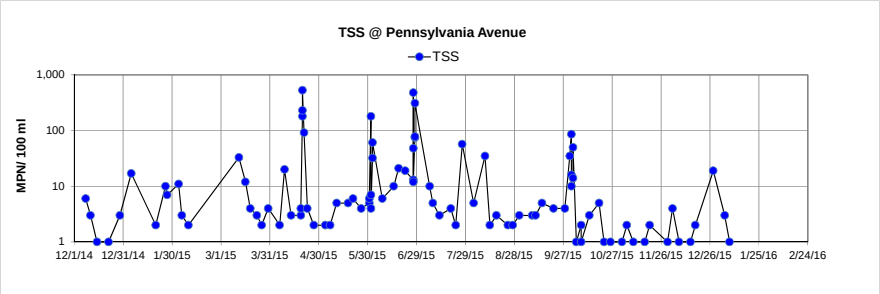


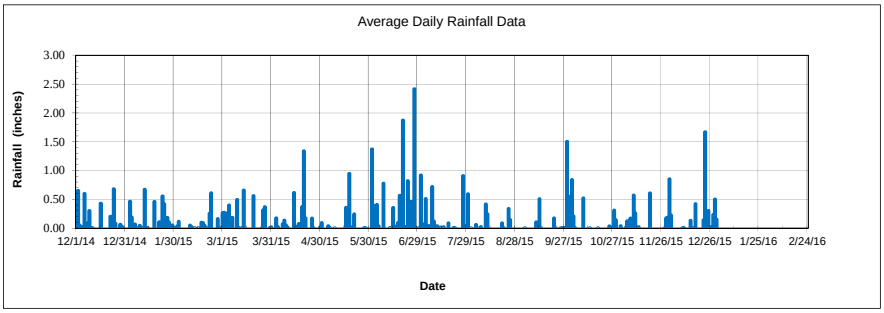




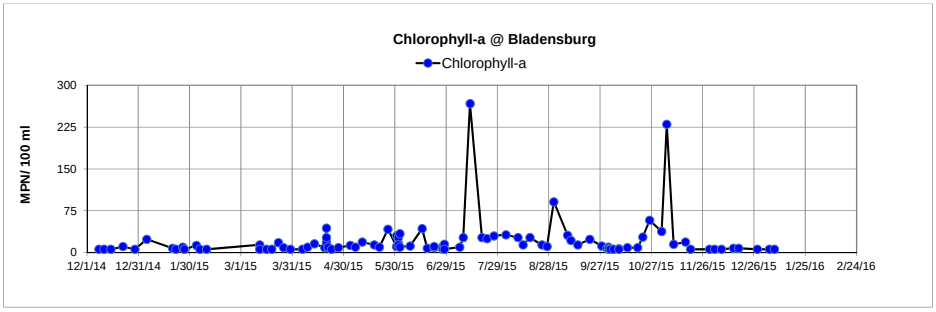


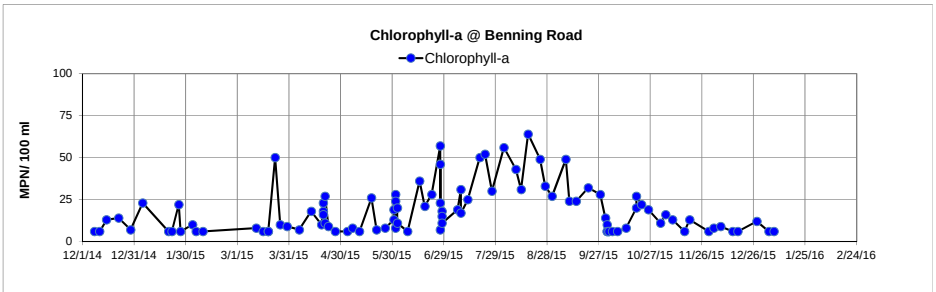
Rockcreek Water Quality- TSS

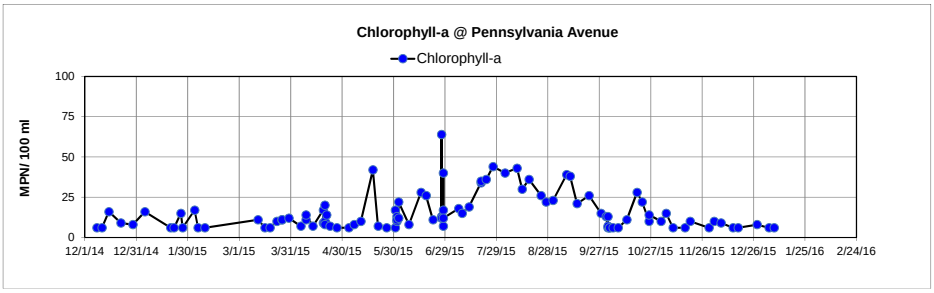


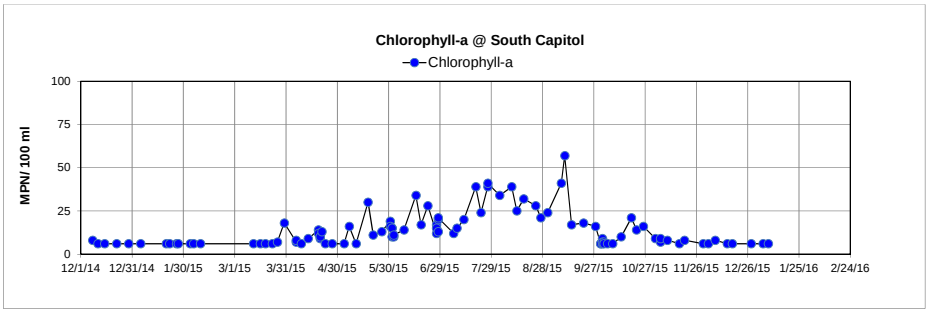


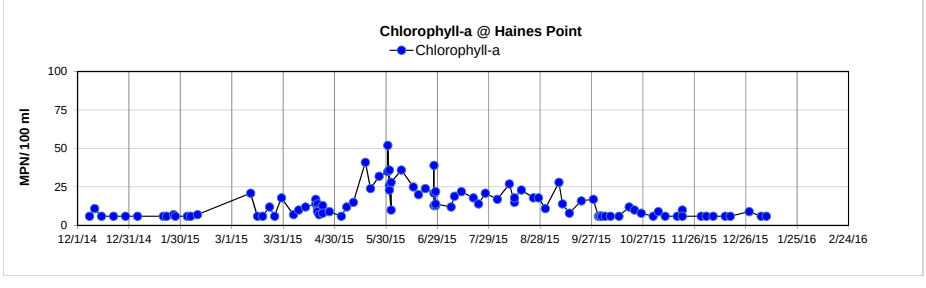
Anacostia River Water Quality- Chlorophyll-a

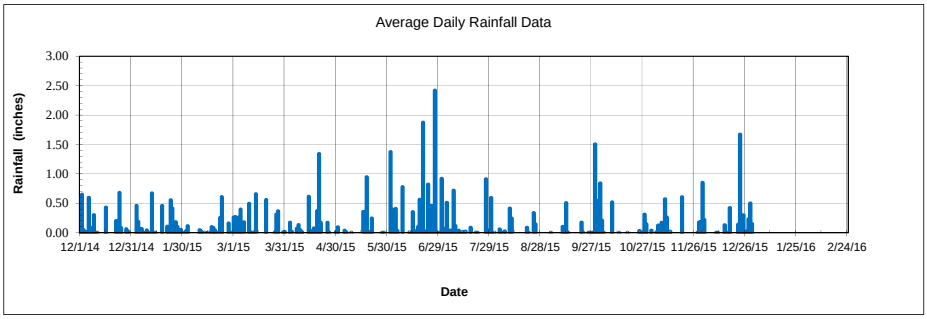




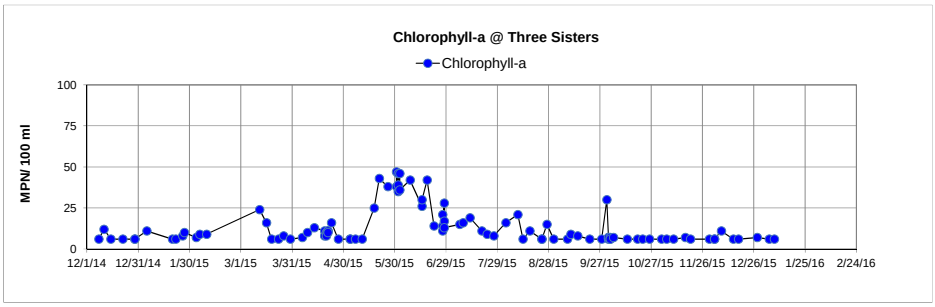


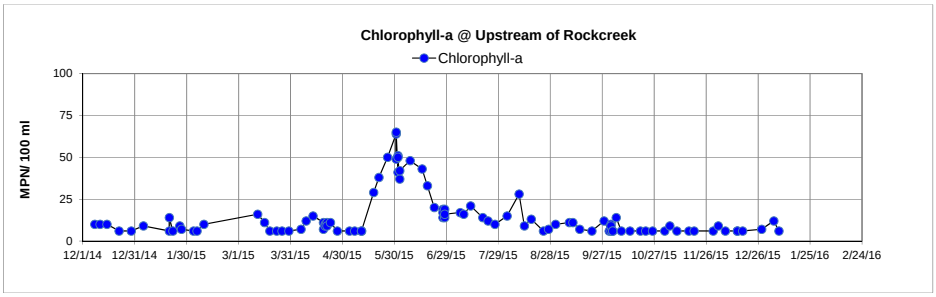


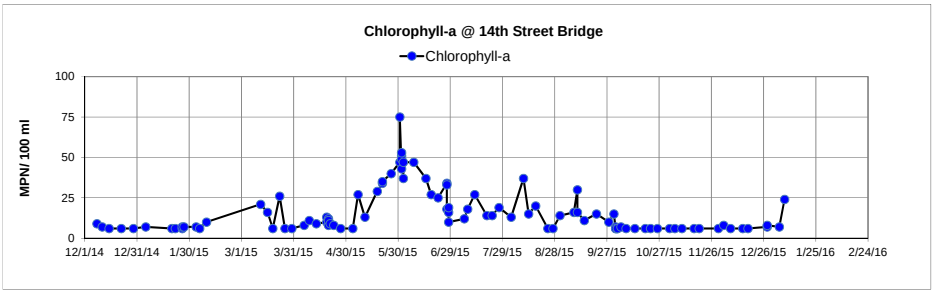


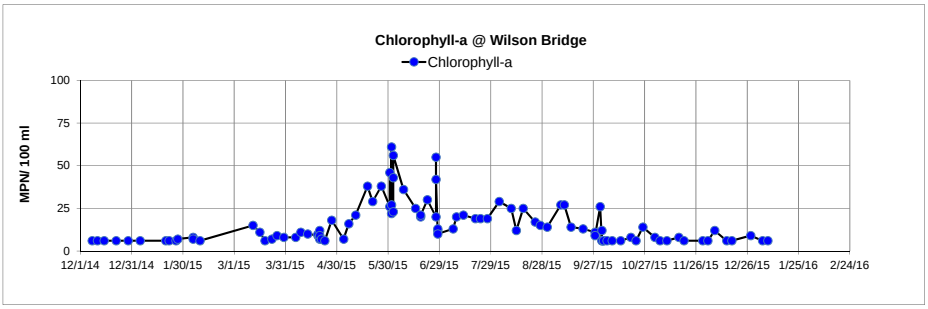


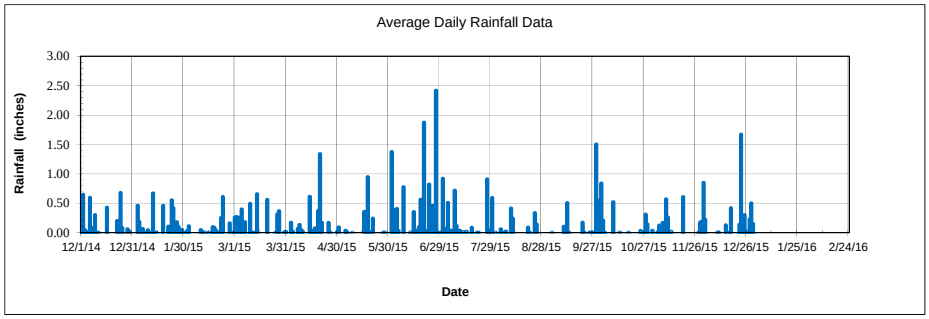
Potomac River Water Quality- Chlorophyll-a

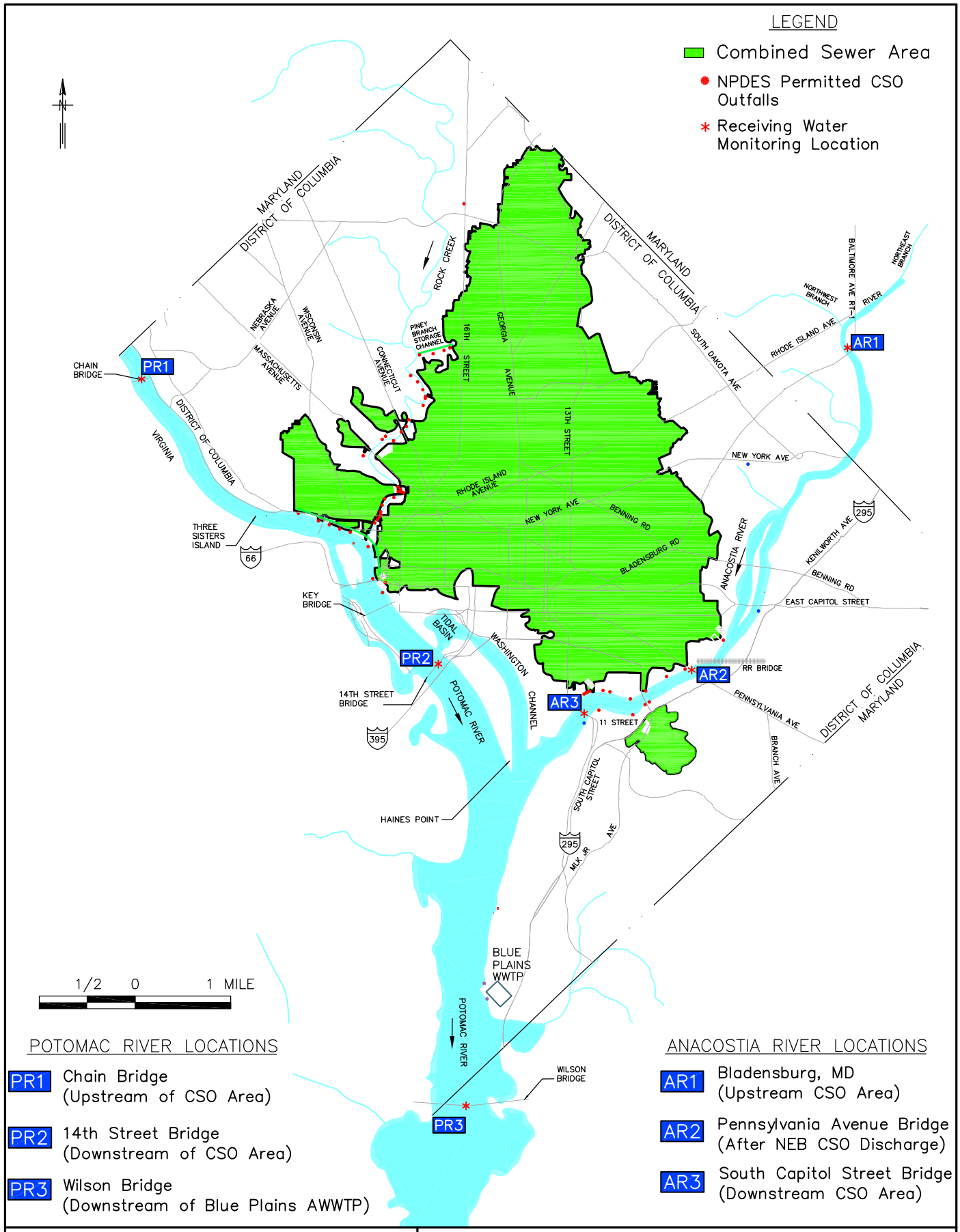












DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE-I

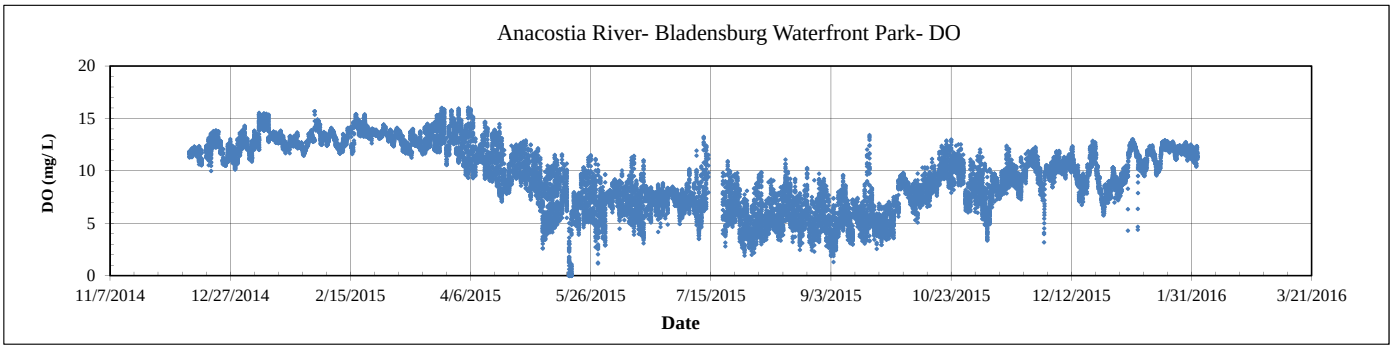
RECEIVING WATER MONITORING – D.O. FOR POTOMAC AND ANACOSTIA RIVERS

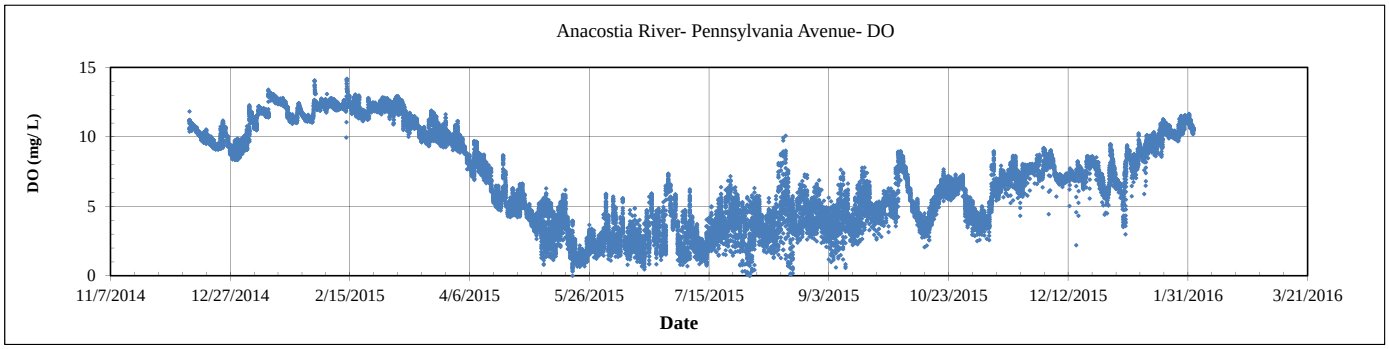
DATE: JULY 2016

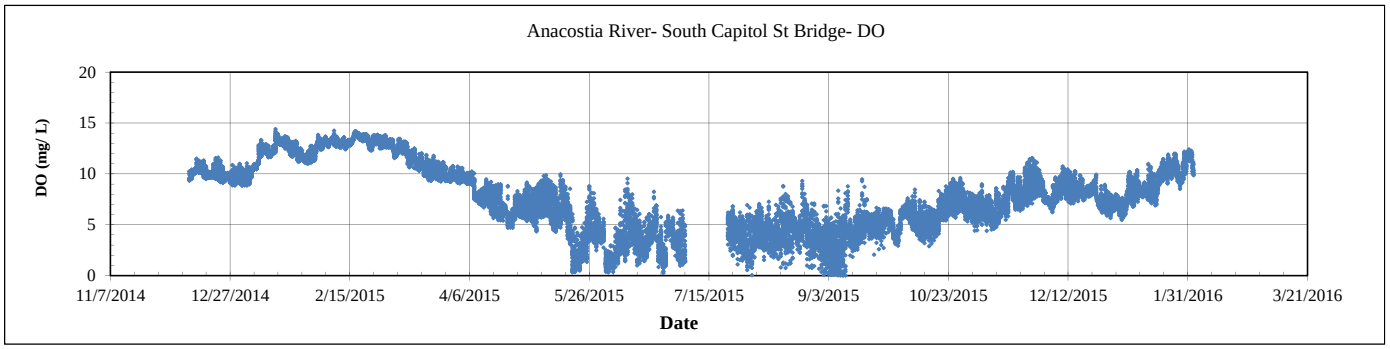
FIGURE 4-1

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 5/24/2016 9:32:25 AM
DRAWING ID: E:\PROJECTS\POST CONSTRUCTION MONITORING\05 - REPORTING\PCM REPORT\FIG\FIG 4-1 RIVER SAMPLING-DO.DWG

Anacostia River Water Quality- Dissolved Oxygen





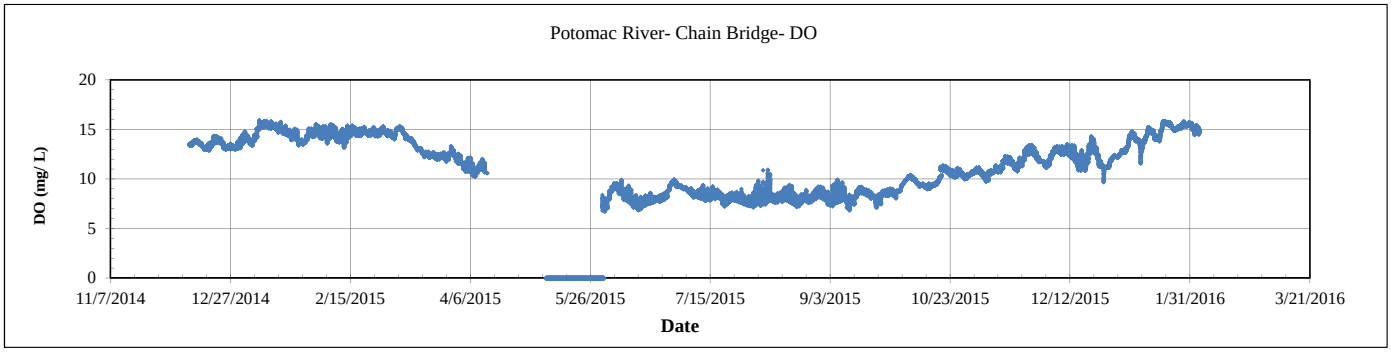


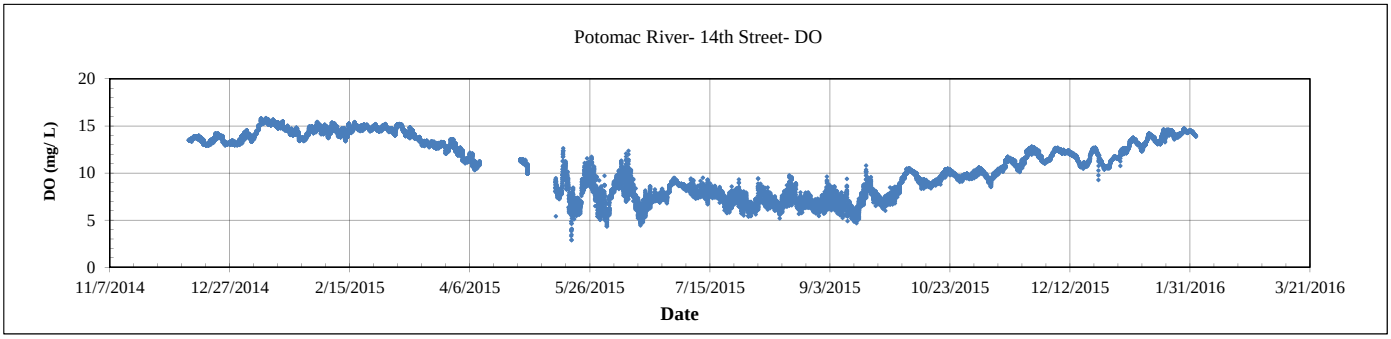
NOTES:

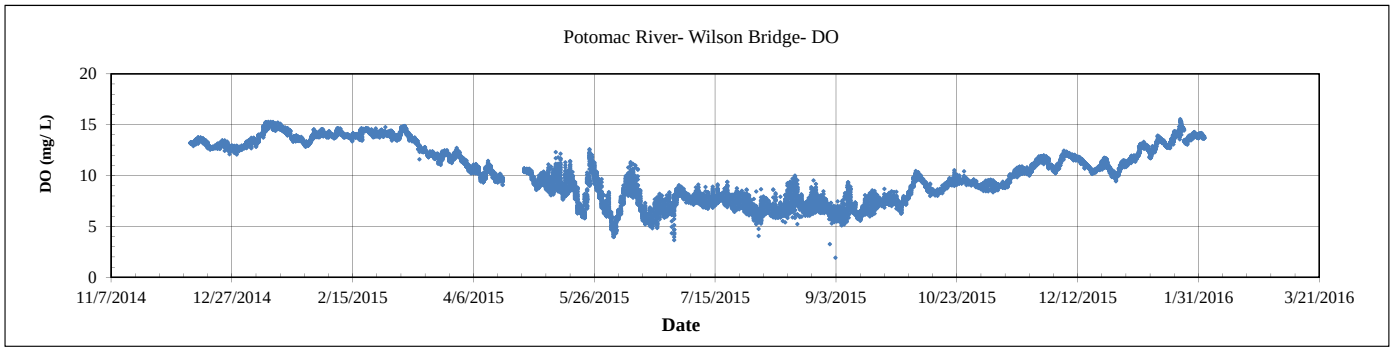
1) Bladensburg- Data gap from 12/15-12/17, 7/14-7/20

2) Pennsylvania Ave- No data gaps
3) South Capitol St- Data gap from 7/5-7/23

Potomac River Water Quality- Dissolved Oxygen





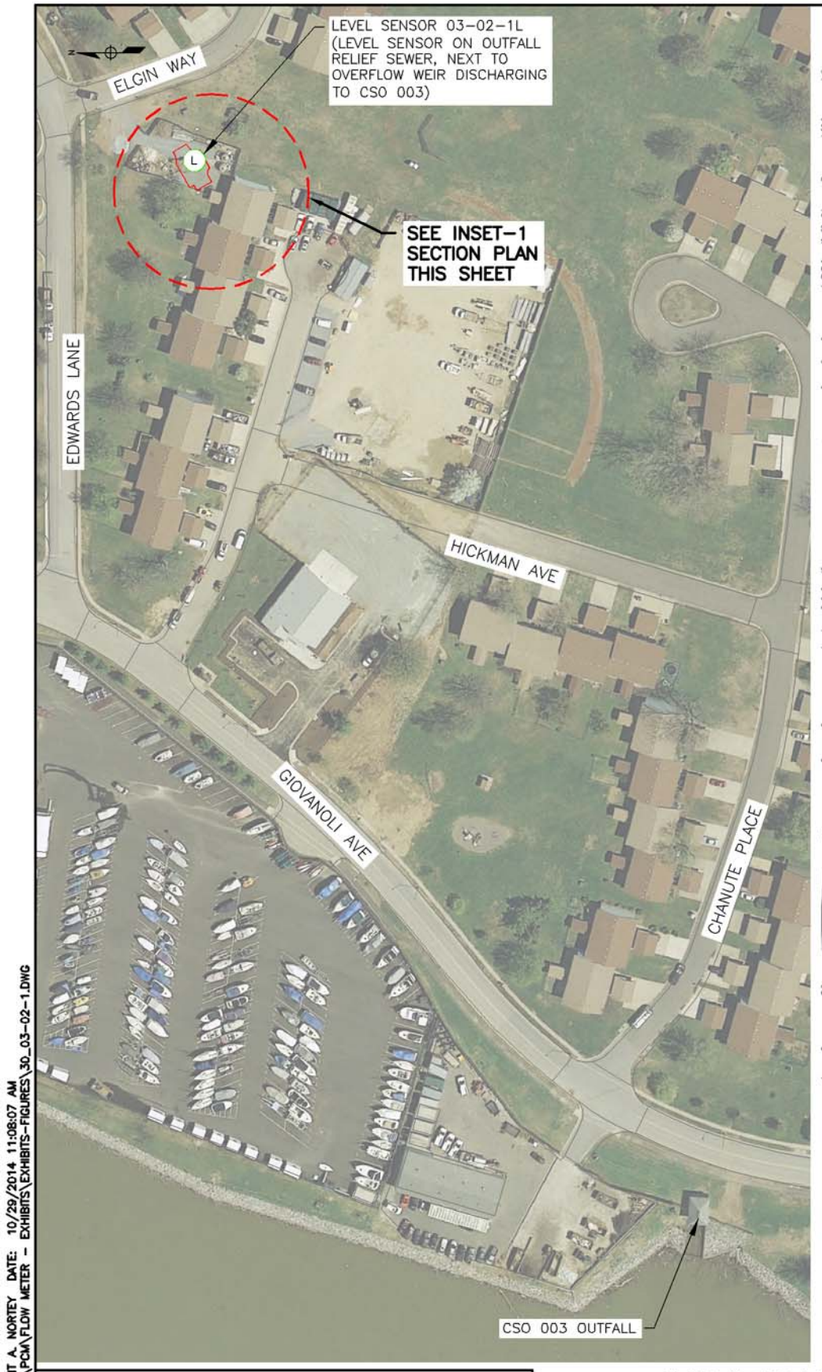


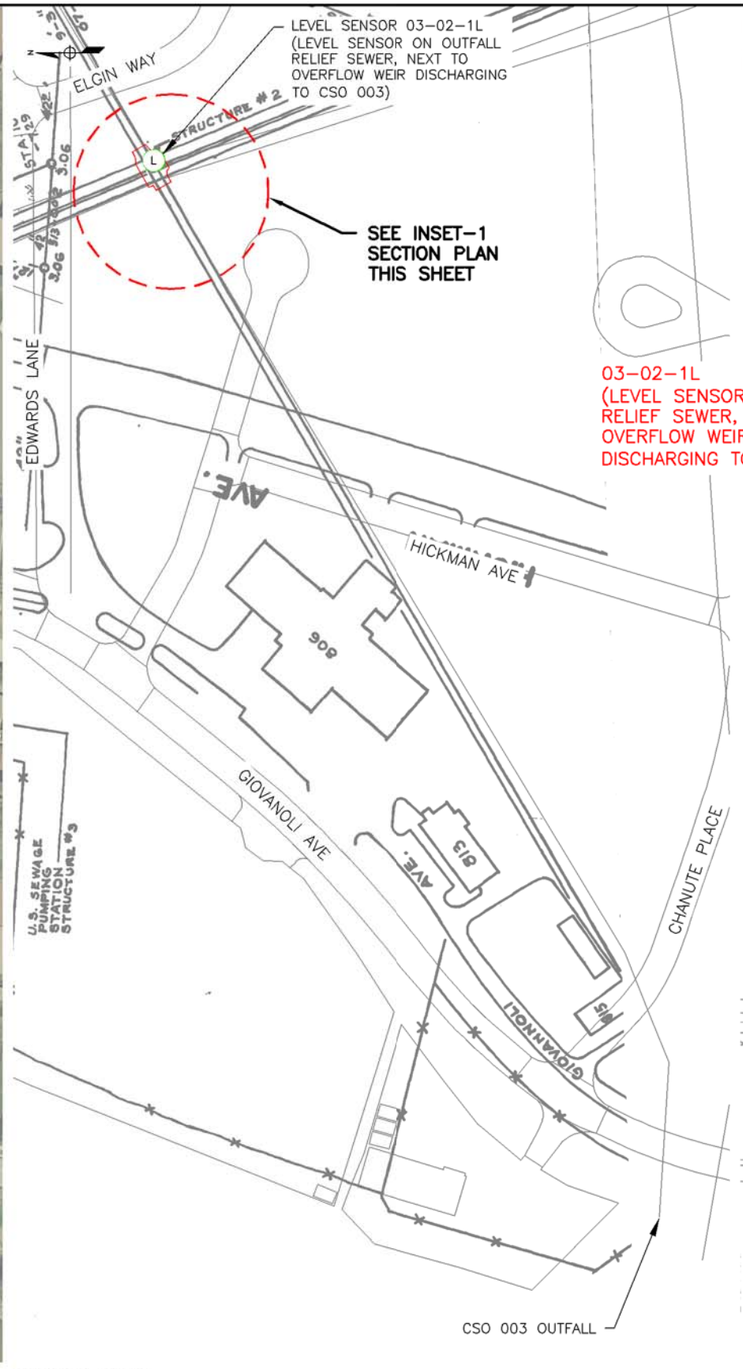
NOTES:

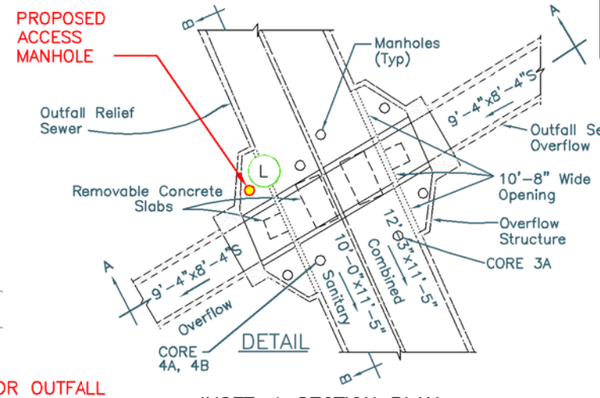
1) Chain Bridge- Data gap from 4/13- 5/31, 11/30-1/31. DO data collected at Little Falls station is used from 12/1/2015 - 2/3/2016 to supplement the data gap
2) 14th Street Bridge- Data gap from 4/10- 4/27, 5/1-5/11
3) Wilson Bridge- Data gap from 4/18- 4/27

Flow Monitoring Data Collected During PCM- Phase I

1 – LEVEL SENSOR



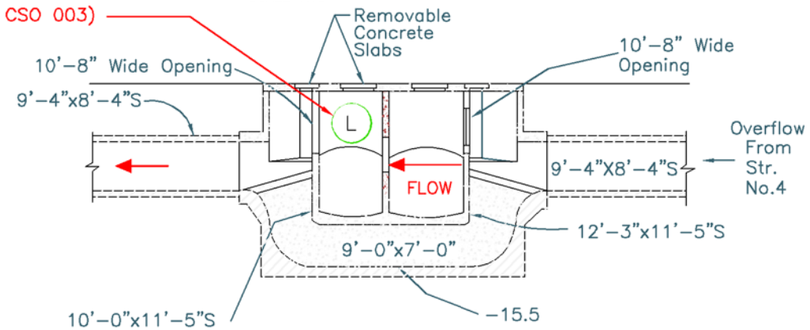




INSET-1 SECTION PLAN

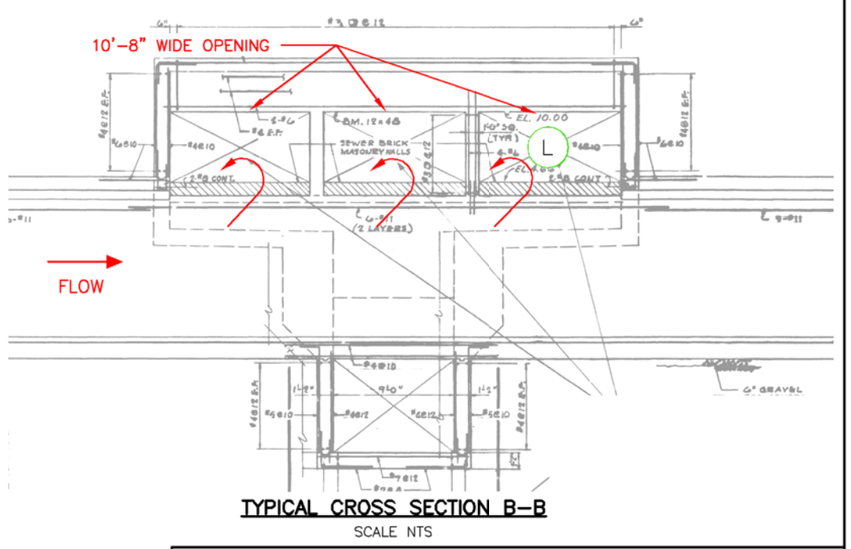
SCALE NTS

03-02-1L
(LEVEL SENSOR OUTFALL RELIEF SEWER, NEXT TO OVERFLOW WEIR DISCHARGING TO CSO 003)



CROSS SECTION A-A (SEWER PROFILE)

SCALE NTS



TYPICAL CROSS SECTION B-B

SCALE NTS

FLOW METER LOCATION PLAN

SCALE: 1"=30'

LEGEND

(L) LEVEL SENSOR LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

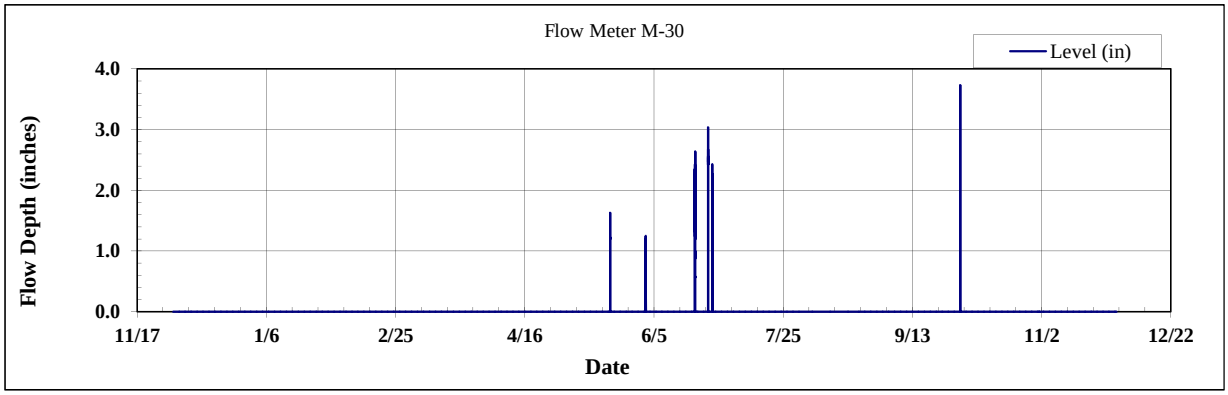
03-02-1L

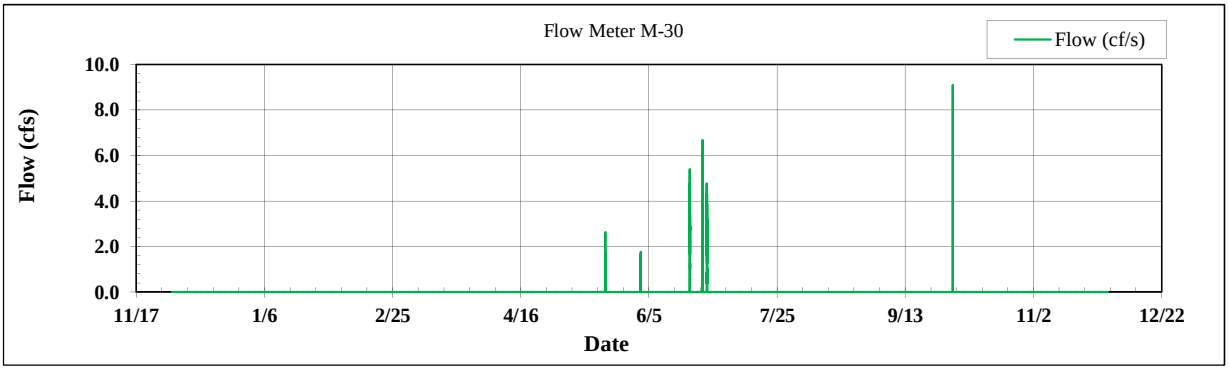
METER LOCATION AND TYPICAL CROSS SECTION

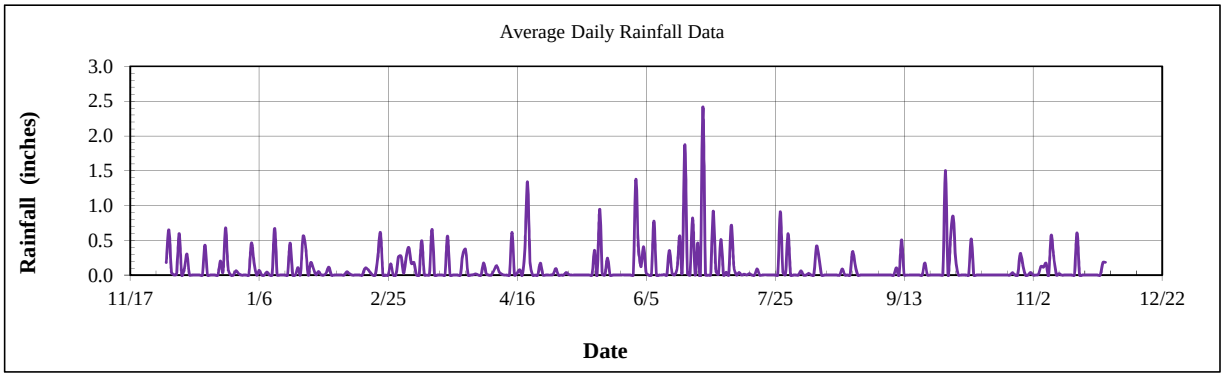
DATE: OCTOBER 2014 | SITE 30

LAST SAVED BY: CONSTANT A. NORTEY DATE: 10/29/2014 11:08:07 AM
DRAWING ID: L:\LTCP\PCM\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\30_03-02-1.DWG

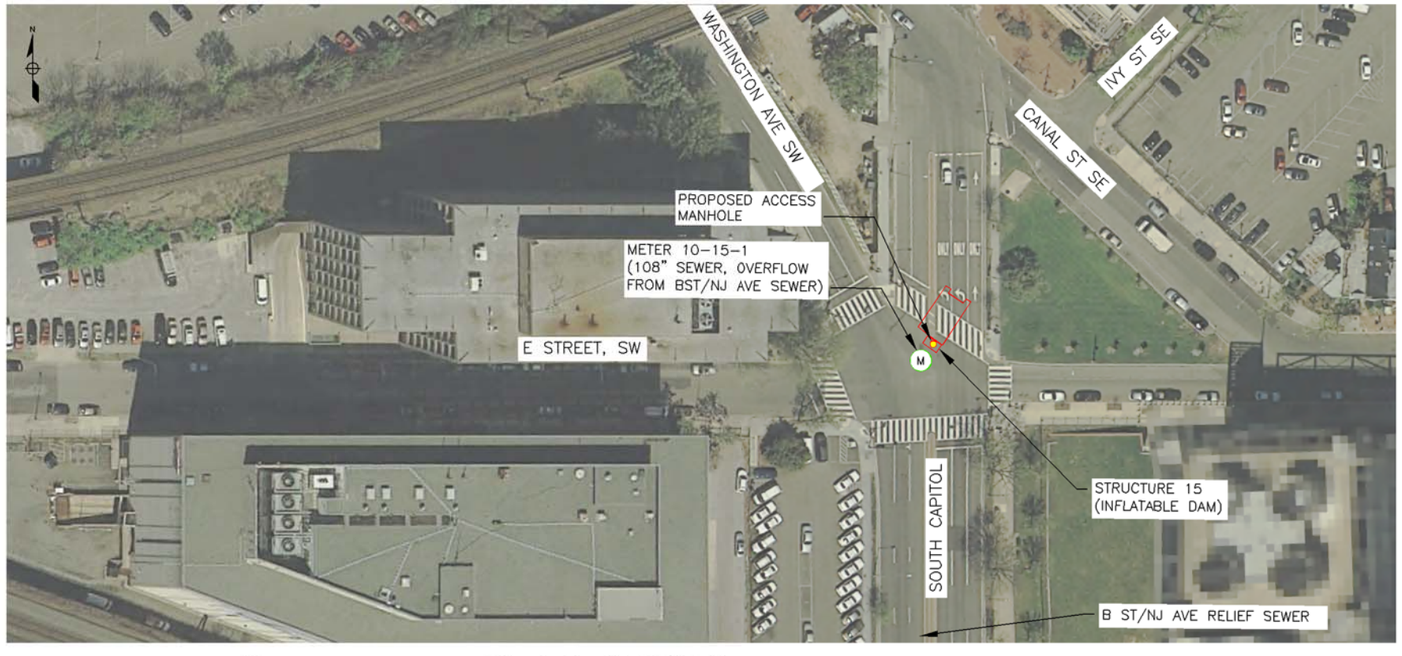
CSO 003 Overflow (03-02-1L)

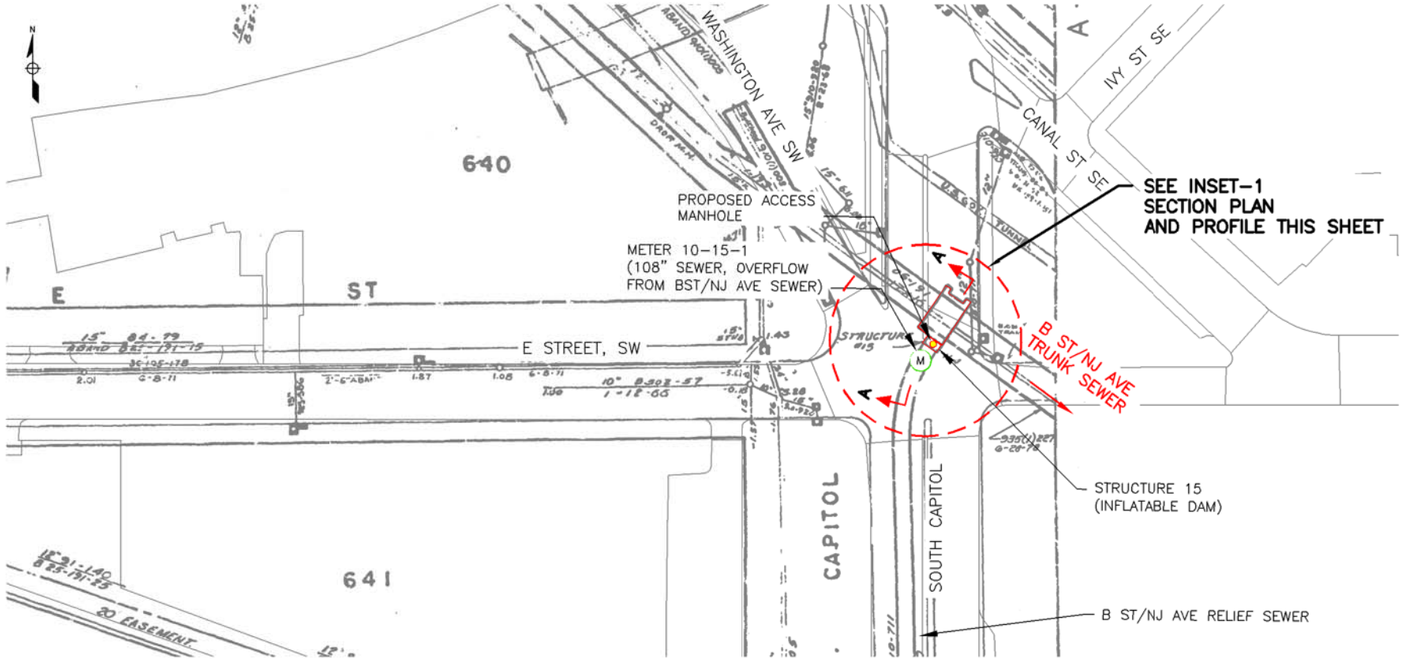




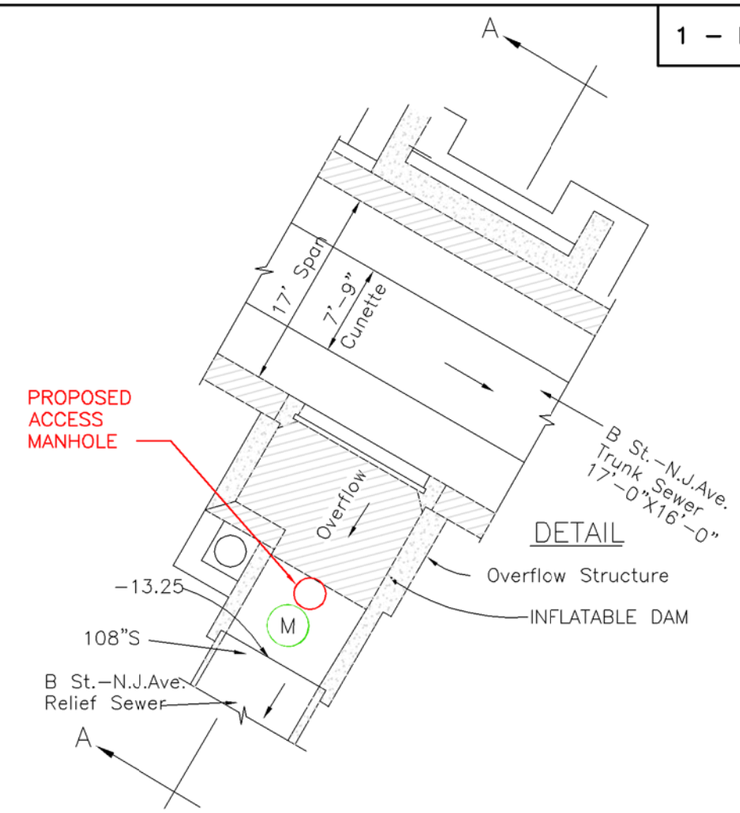


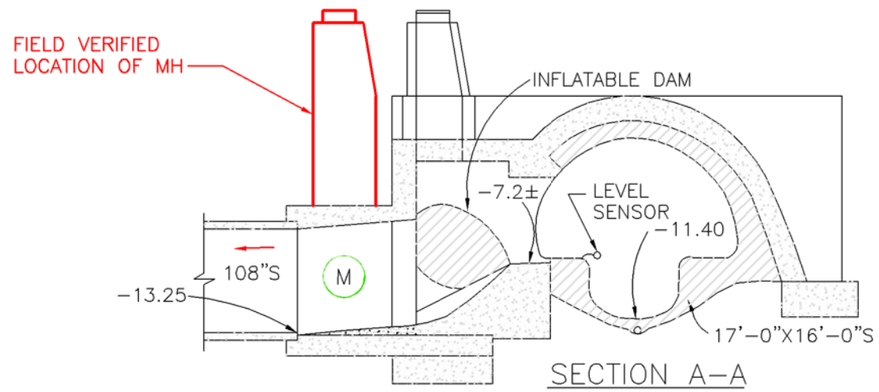
1 – FLOW METER





FLOW METER LOCATION PLAN
SCALE: NTS





INSET–1 SECTION PLAN AND PROFILE
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

10–15–1 METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 4

LAST SAVED BY: CONSTANT A. MORTEY DATE: 10/27/2014 12:02:54 PM
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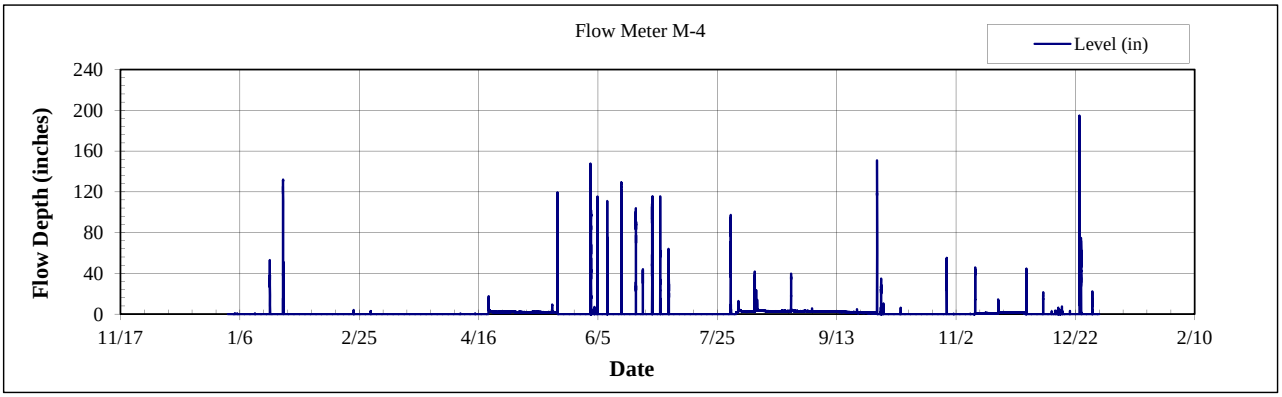
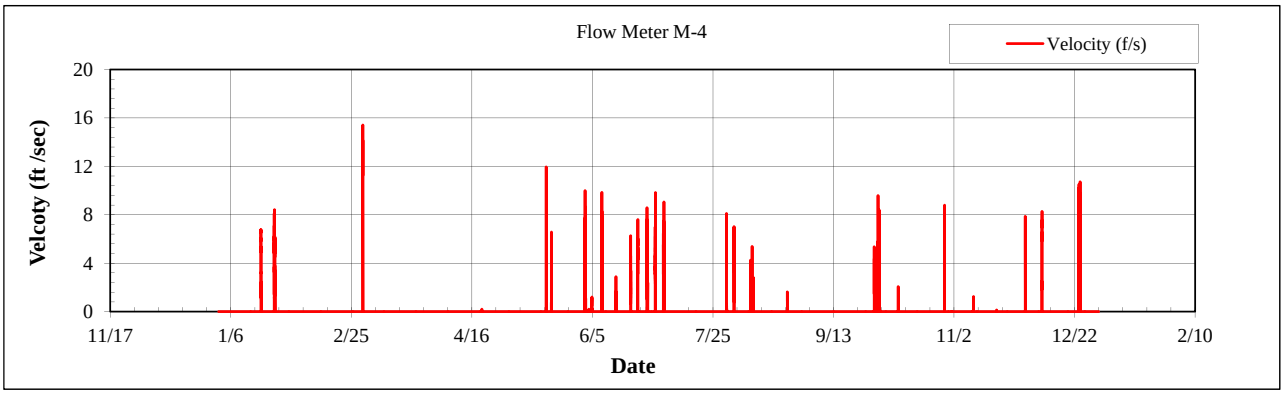
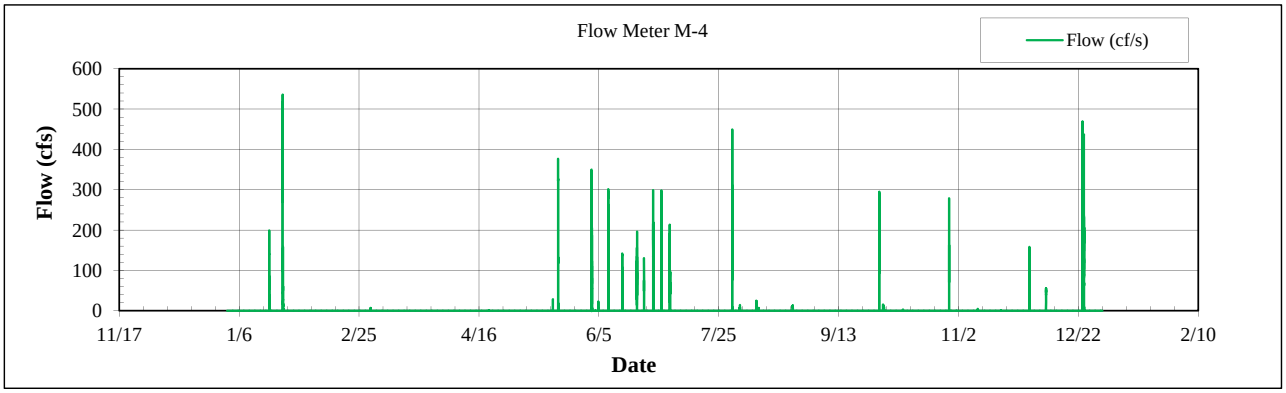
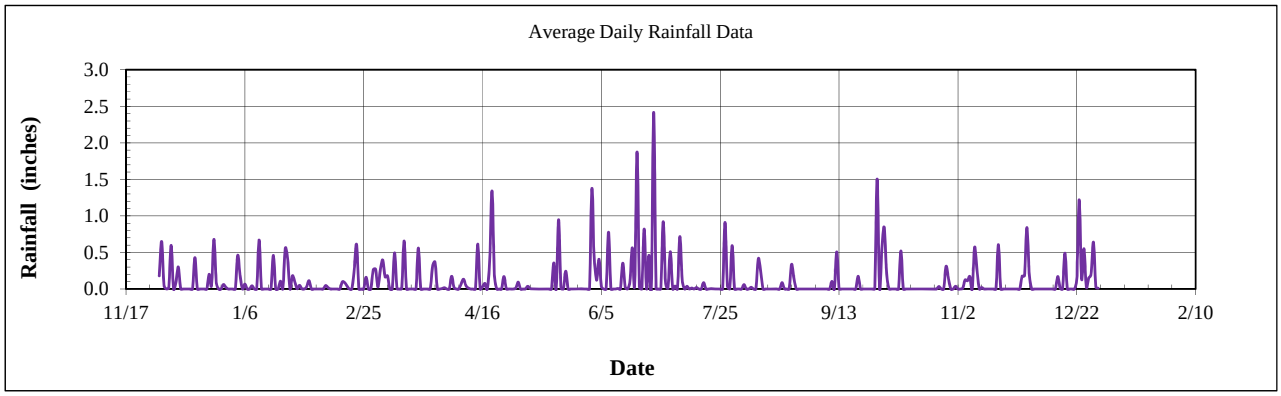
B ST/ NJ Ave Sewer to O Street PS- D/S of STR 15 (10-15-1)









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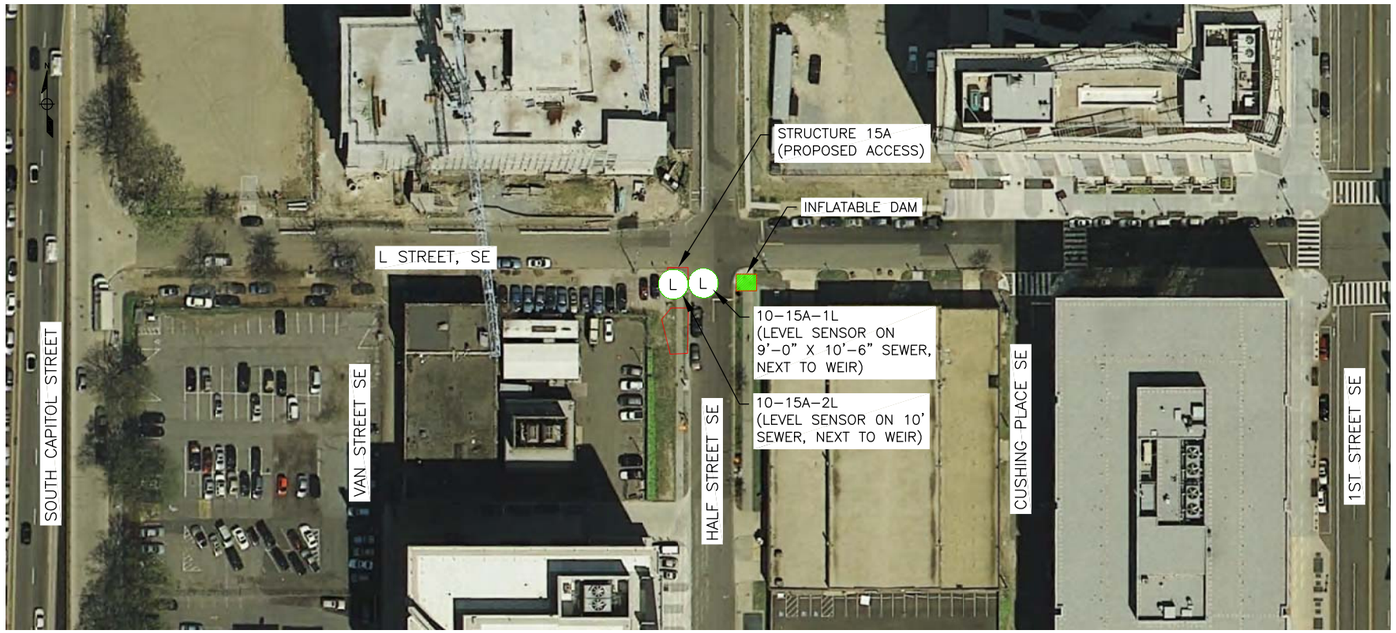
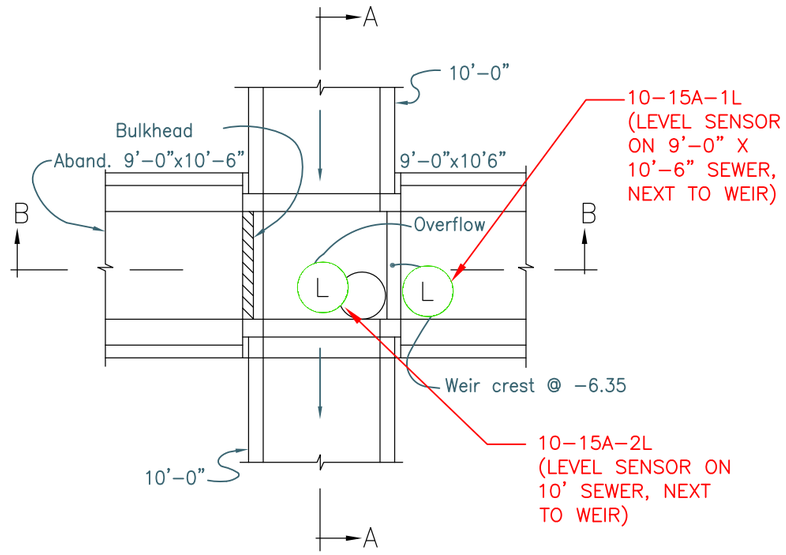
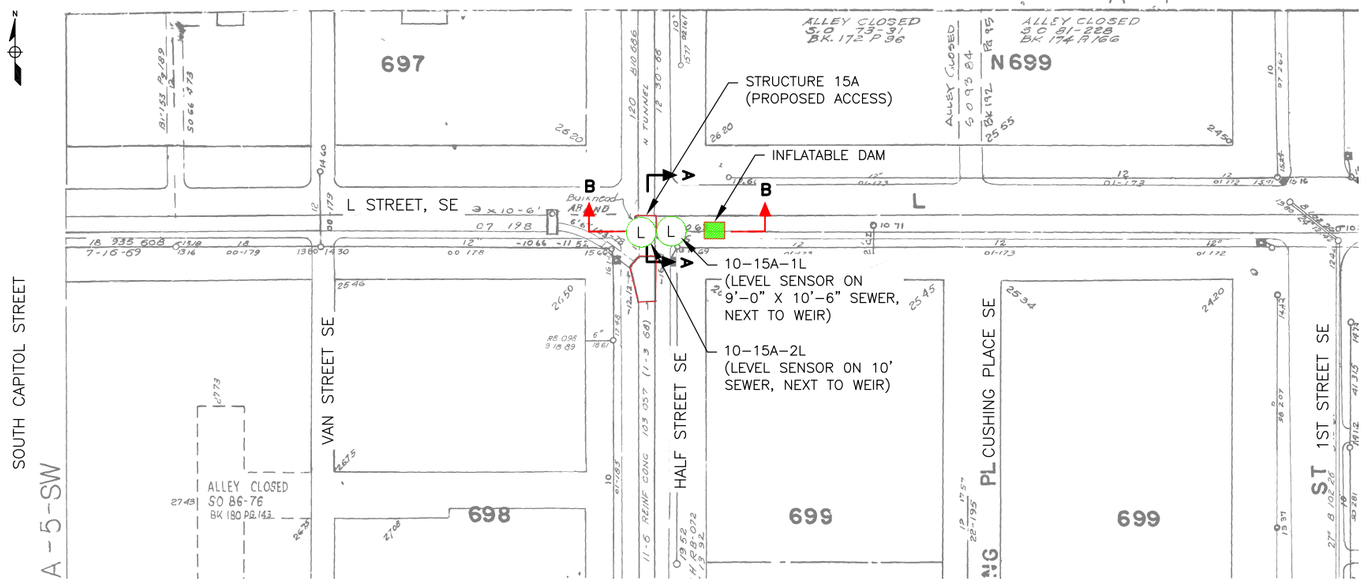
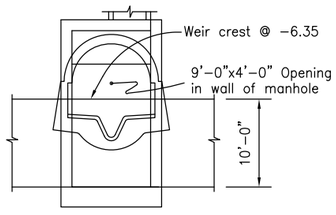




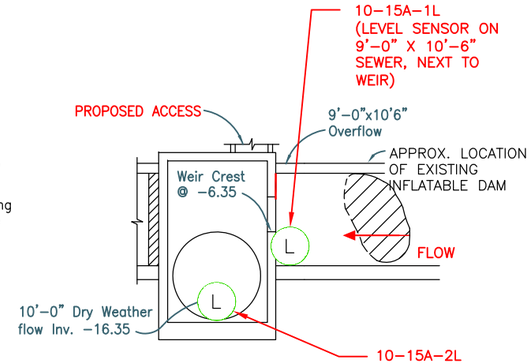
PLAN
SCALE: NTS



FLOW METER LOCATION PLAN
SCALE: NTS



TYPICAL CROSS SECTION A–A
SCALE: NTS



TYPICAL CROSS SECTION B–B
SCALE: NTS

LEGEND

(L) LEVEL SENSOR AND VELOCITY SENSOR

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
10–15A–1L & 10–15A–2L
LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 5

LAST SAVED BY: CONSTANT A. NORTEY DATE: 11/3/2014 5:05:18 PM
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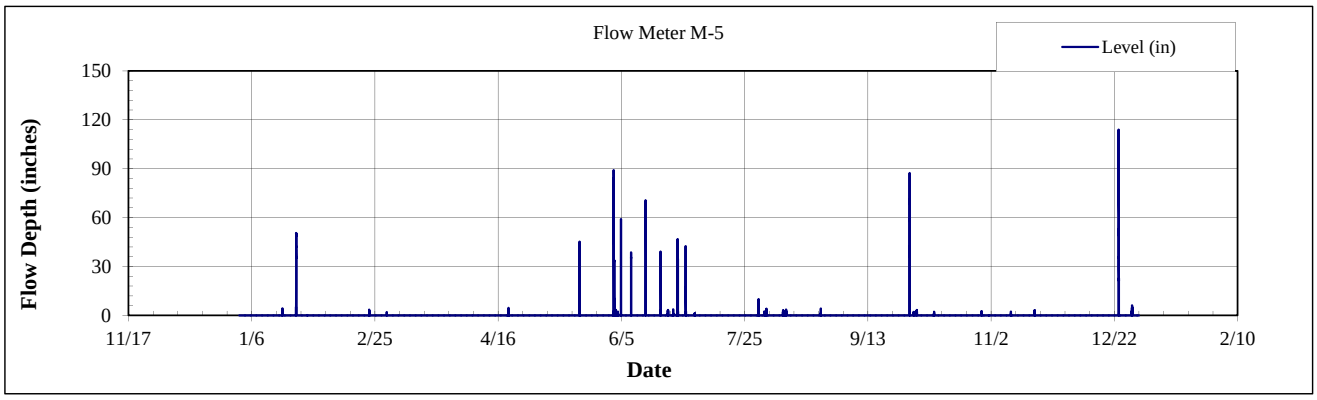
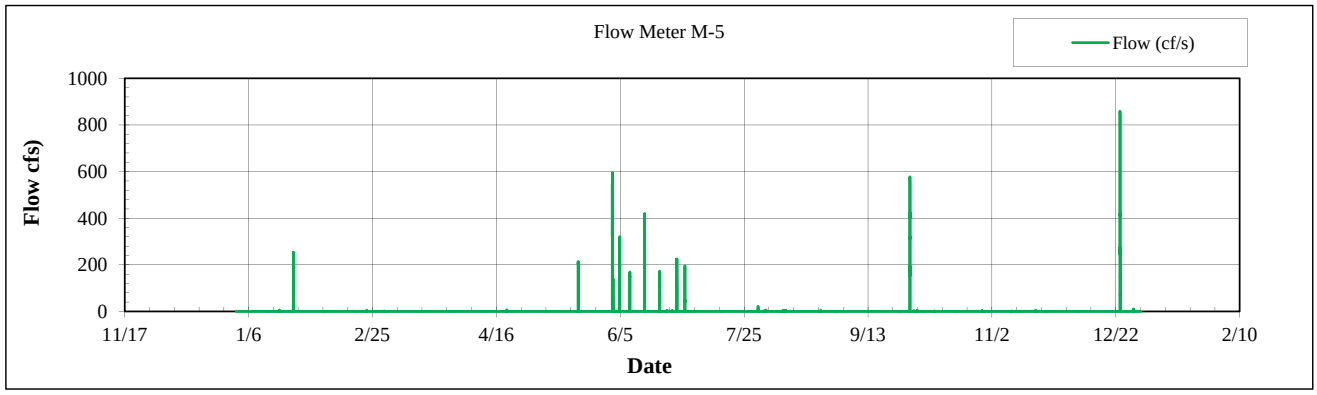
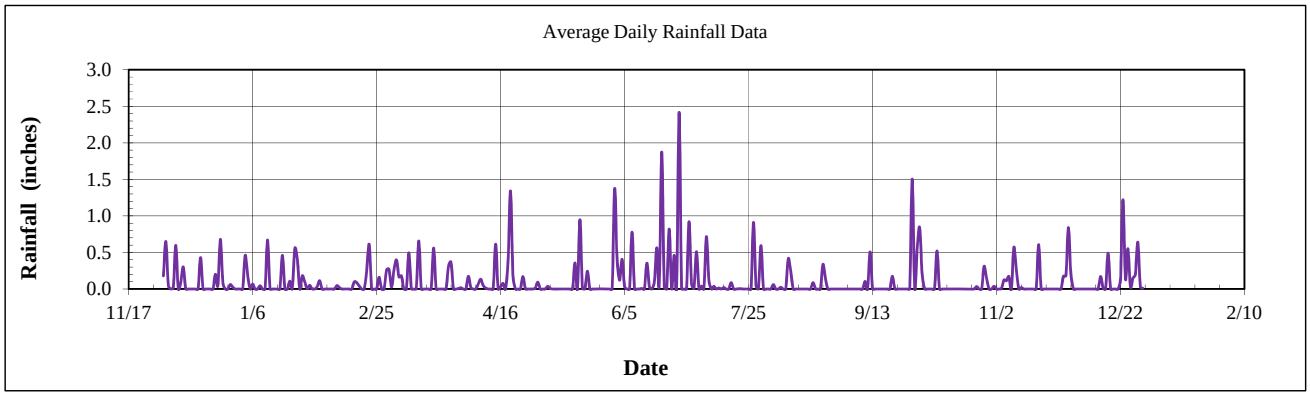
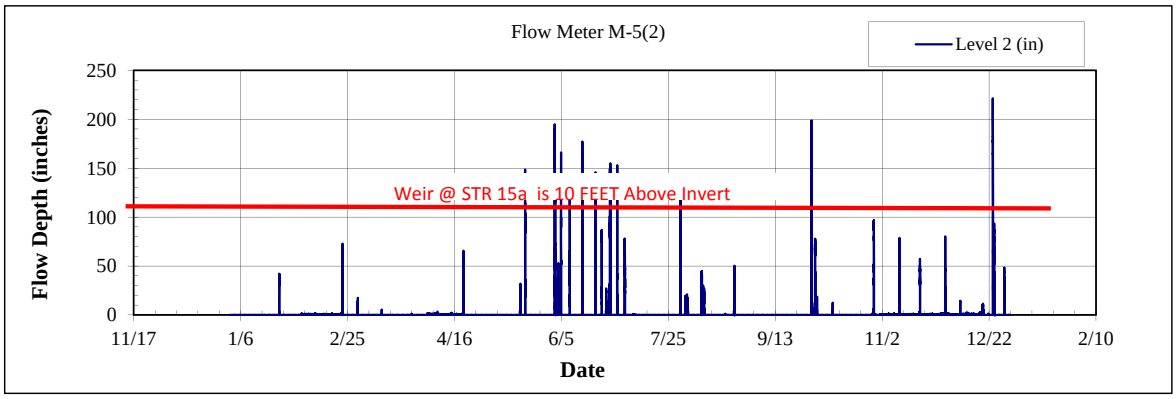
9' x 10'-6" Sewer to O Street PS- D/S of STR 15a (10-15A-1L)

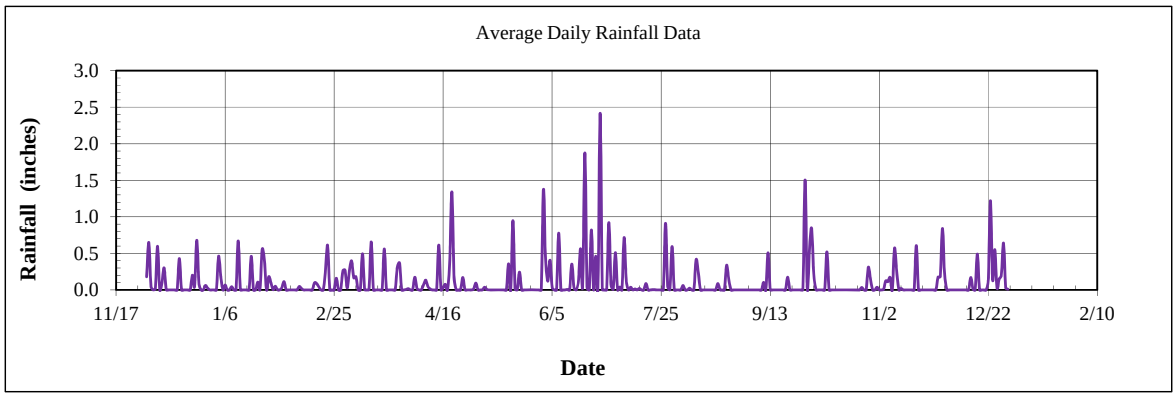




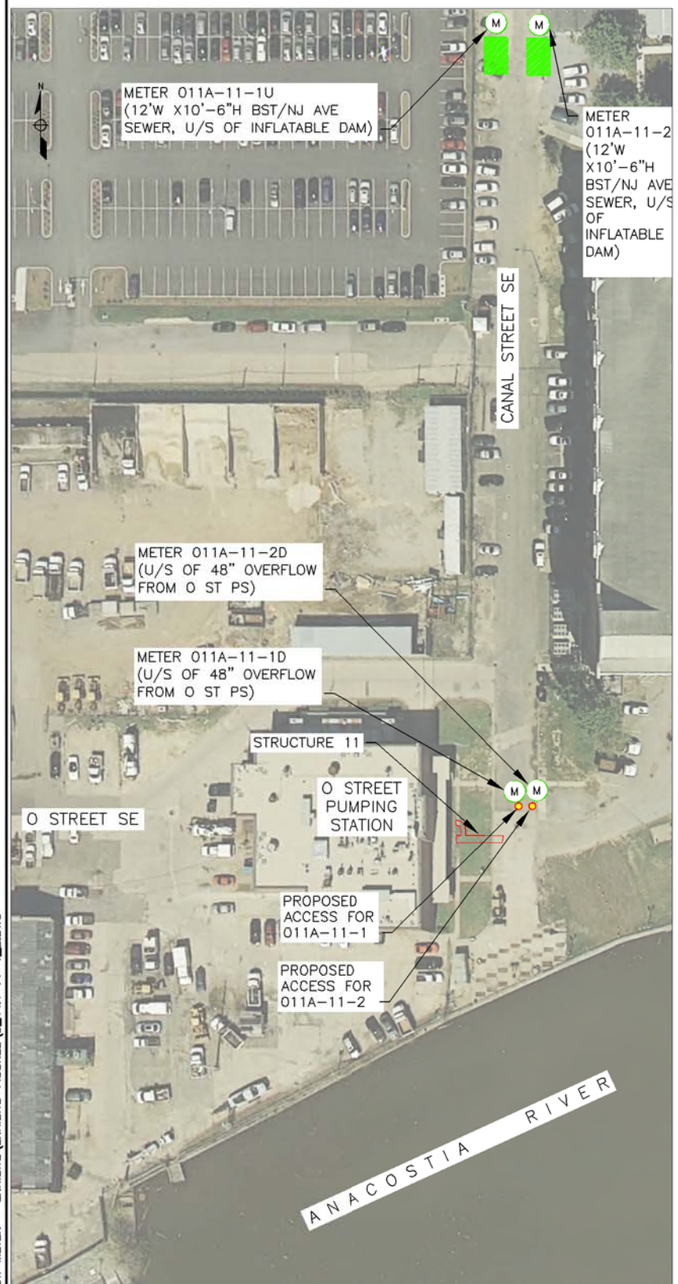


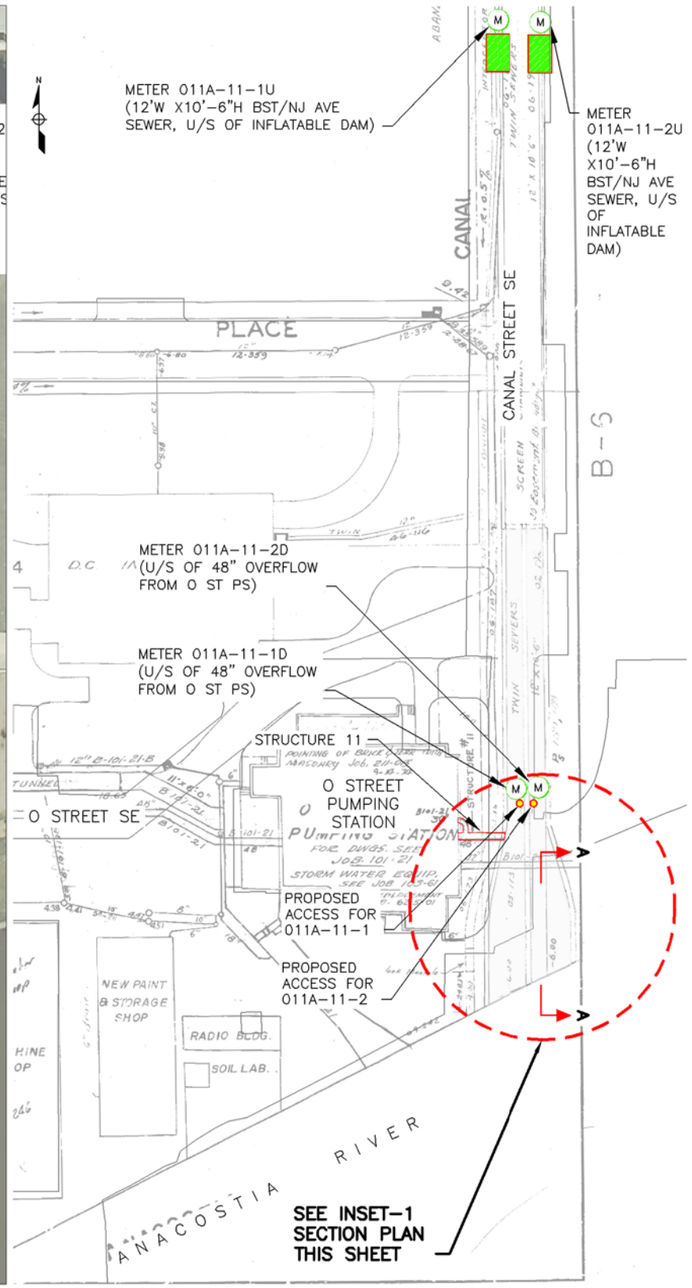
B St/ NJ Ave Sewer (10-15A-2L)



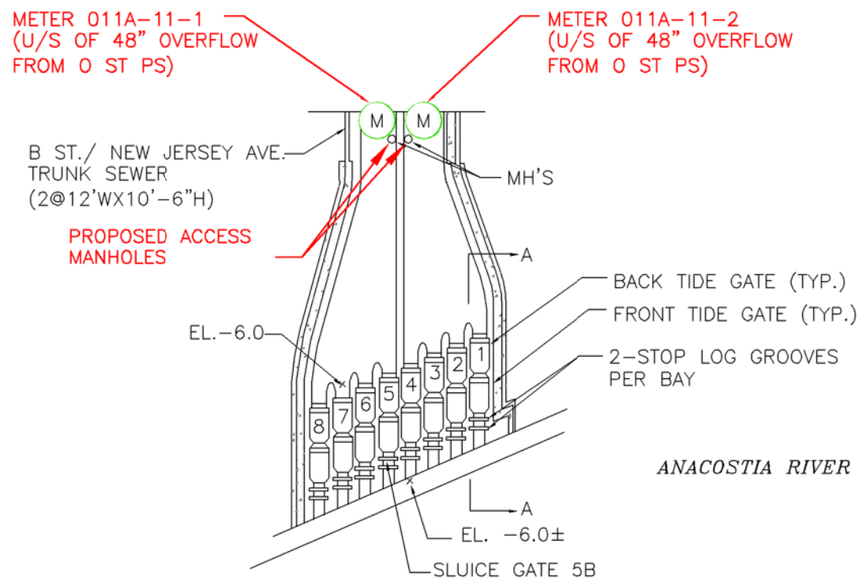


1 – FLOW METER

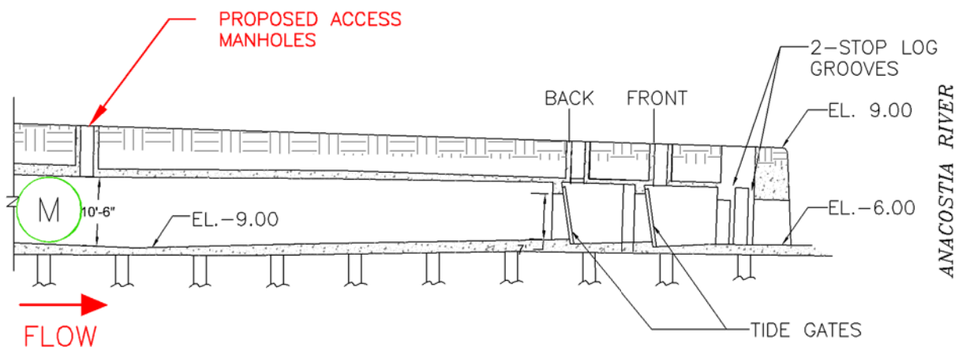




FLOW METER LOCATION PLAN
SCALE: NTS



INSET–1 SECTION PLAN
SCALE NTS



CROSS–SECTION A–A (PROFILE VIEW)
SCALE NTS

LEGEND

M FLOW METER LOCATION

dc clean RIVERS PROJECT

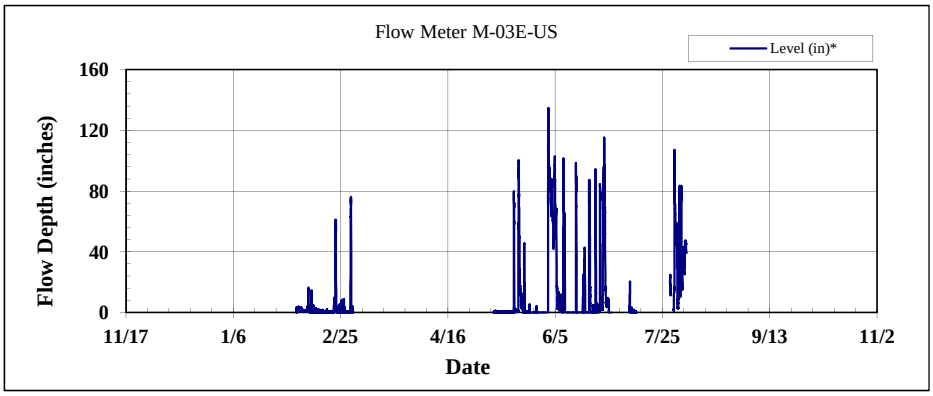
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

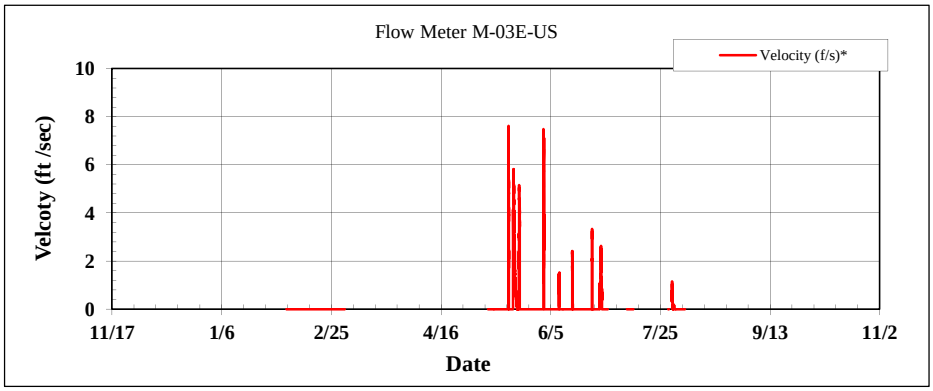
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
11A–11–1U,11A–11–1D,11A–11–2U AND 11A–11–2D
METER LOCATION AND TYPICAL CROSS SECTION

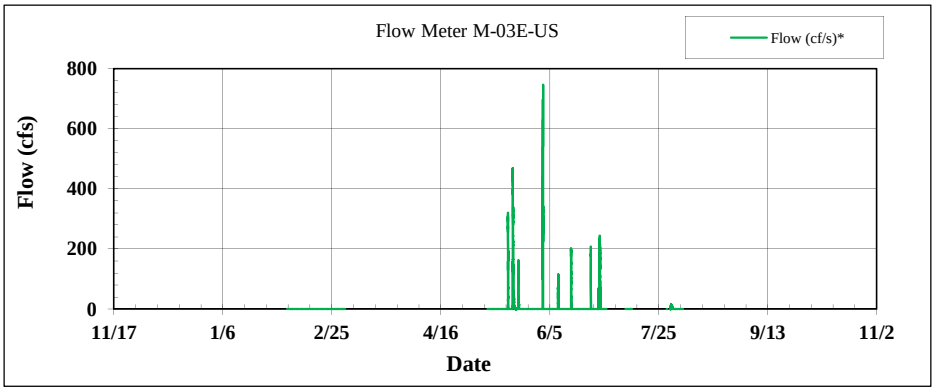
DATE: OCTOBER 2014	SITE 3

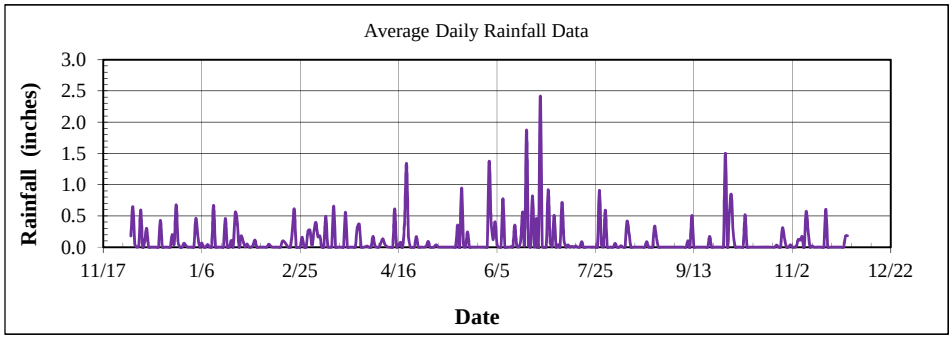
LAST SAVED BY: CONSTANT A. NORTEY DATE: 10/27/2014 12:01:24 PM
DRAWING ID: L:\LTCP\PCM\FLOW METER – EXHIBITS\EXHIBITS-FIGURES\3_11A-11-1_2.DWG

East Channel of BST/ NJ Ave (U/S) (11A-11-1U)

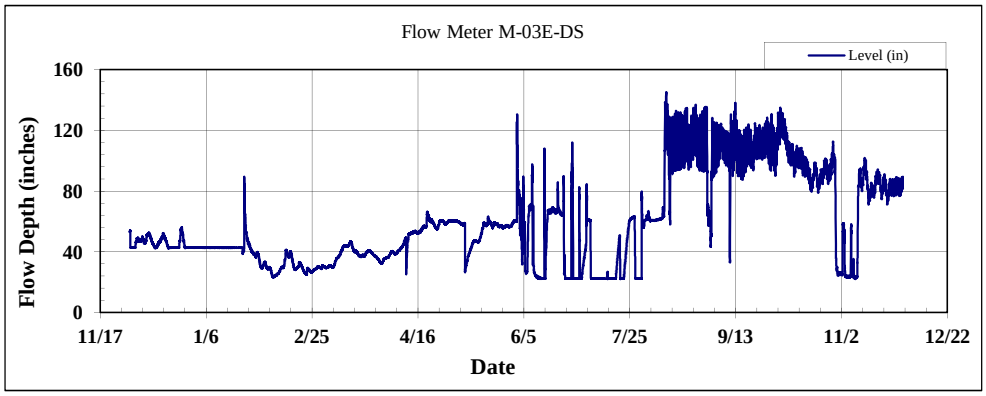


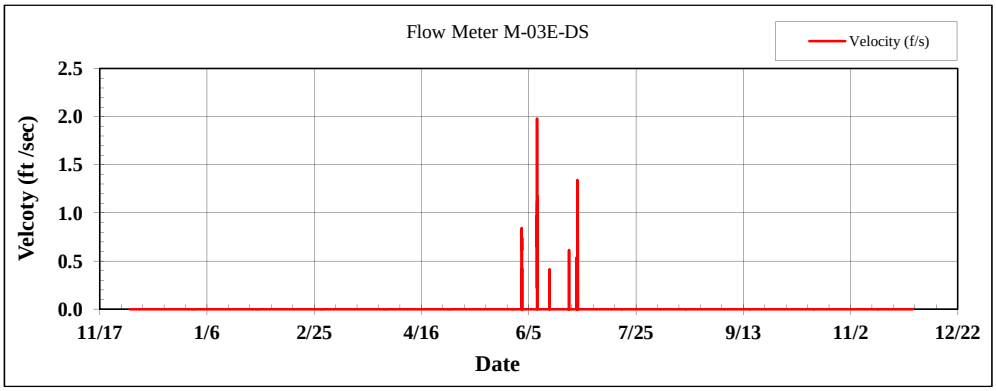


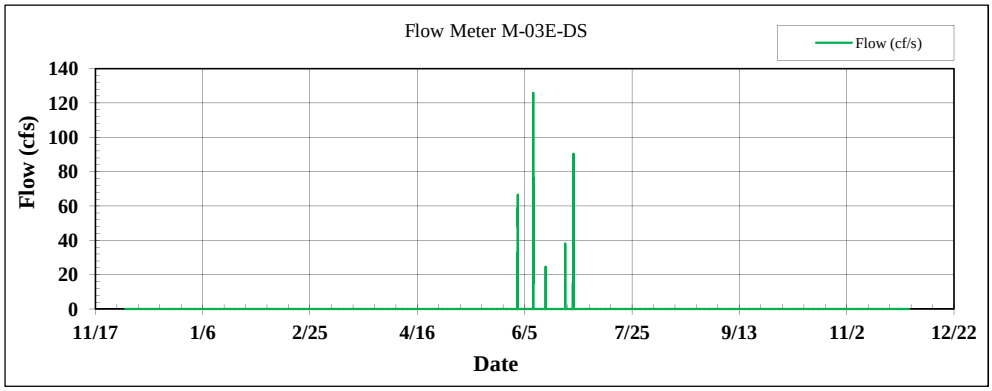


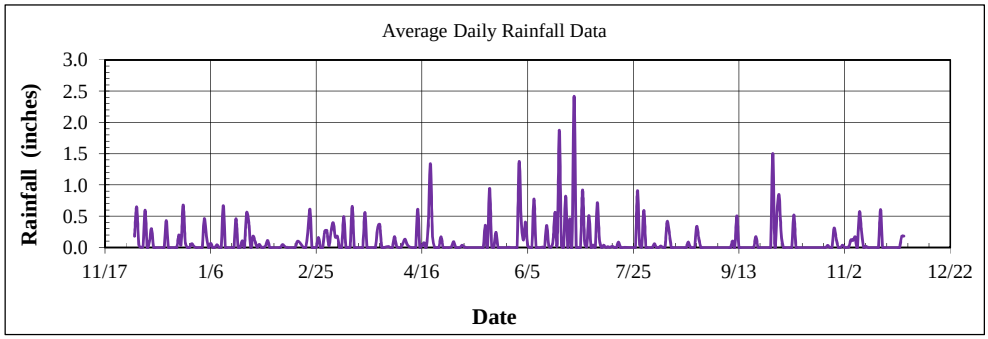


East Channel of BST/ NJ Ave (D/S) (11A-11-1D)

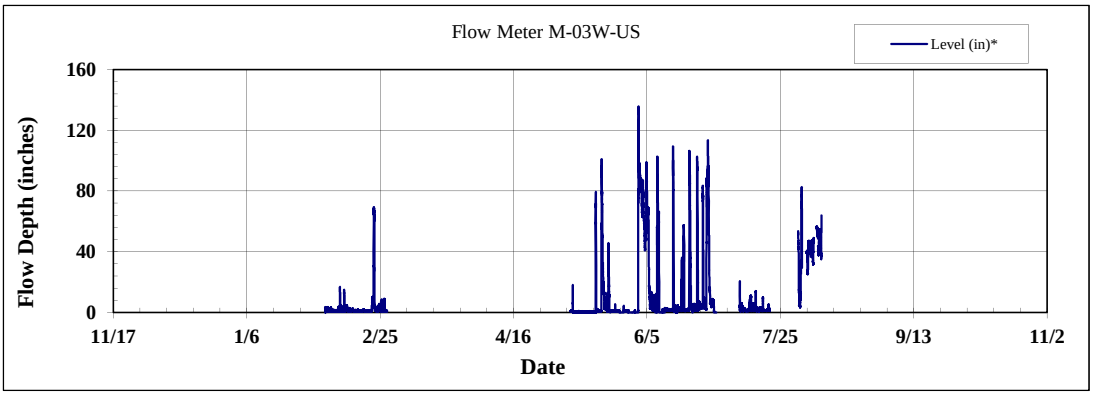


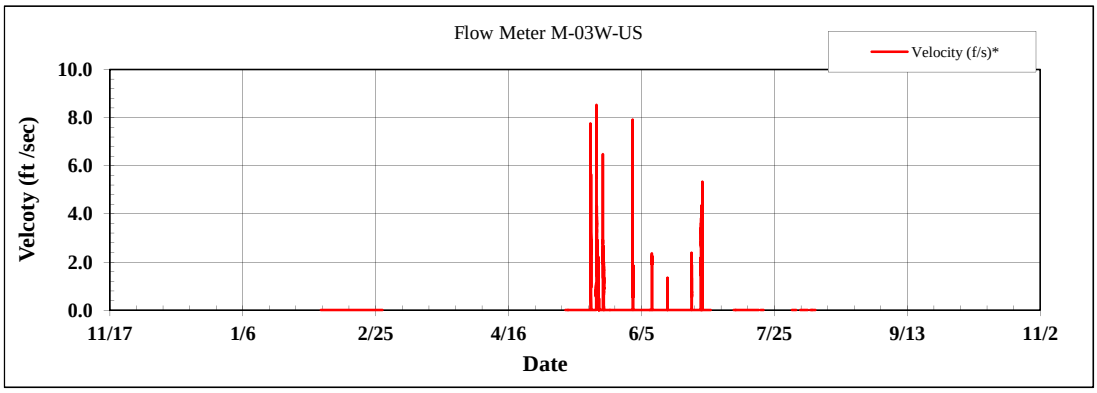


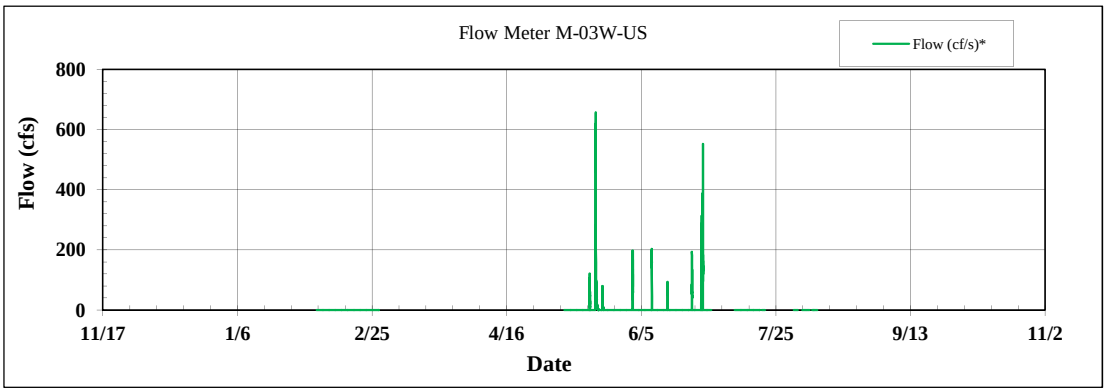


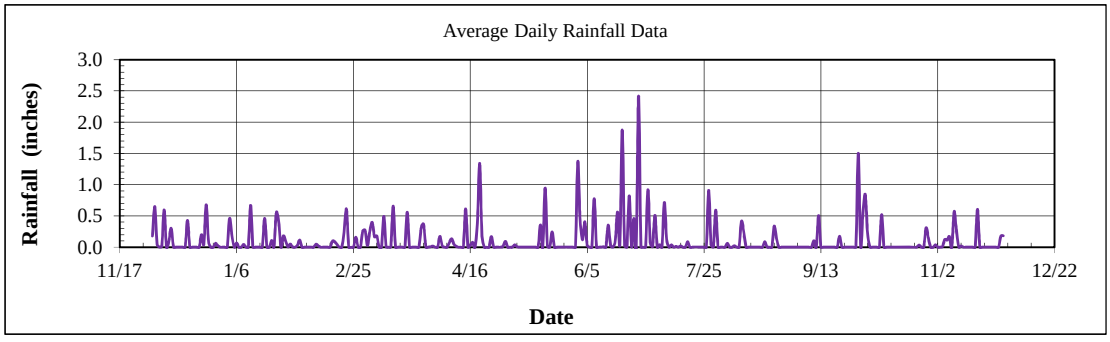


West Channel of BST/ NJ Ave (U/S) (11A-11-2U)

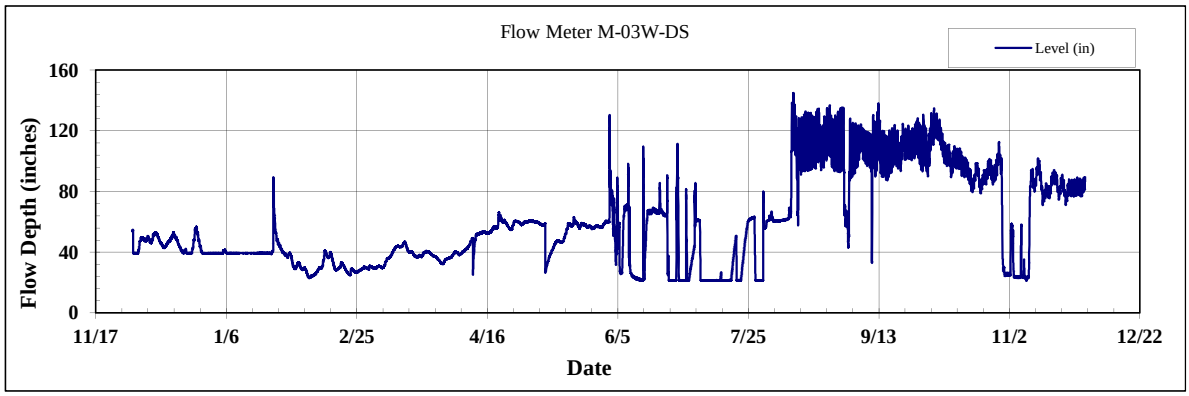


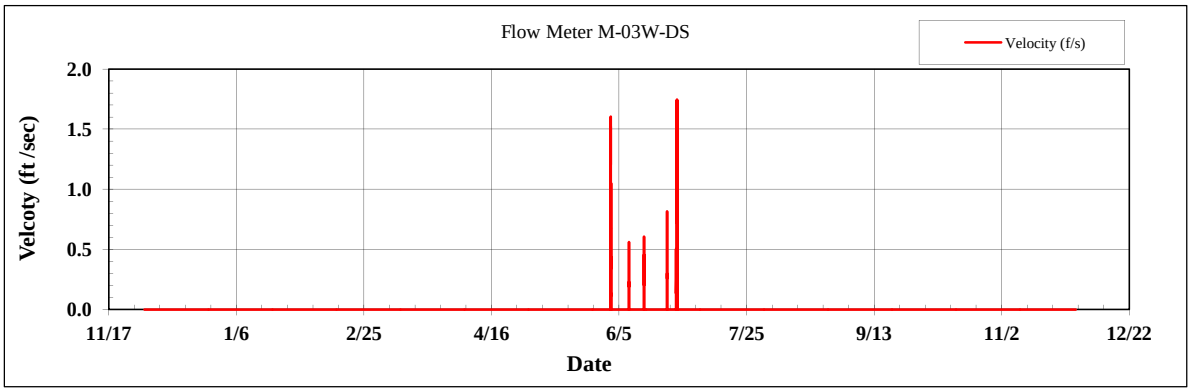


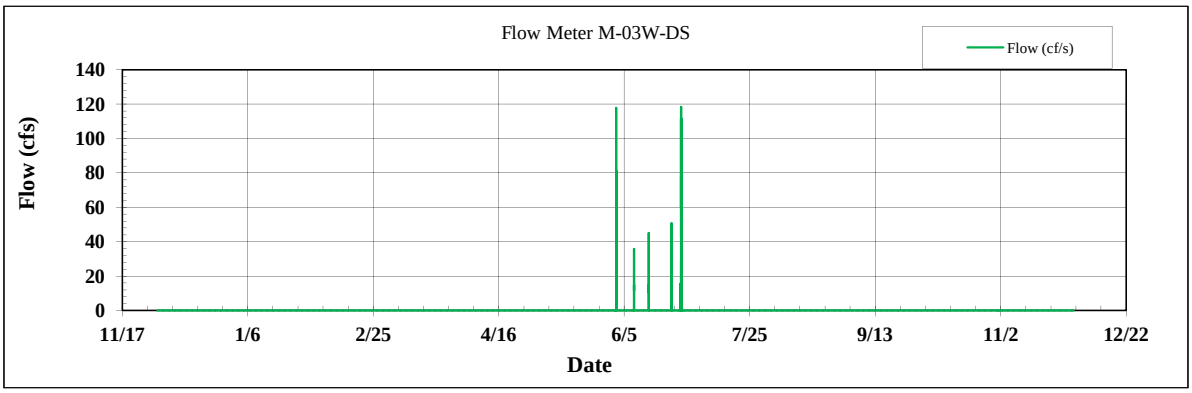


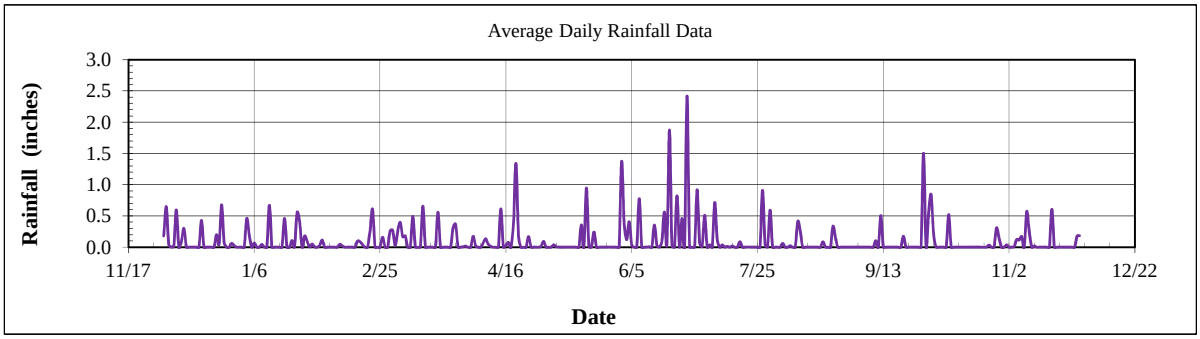


West Channel of BST/ NJ Ave (D/S) (11A-11-2D)

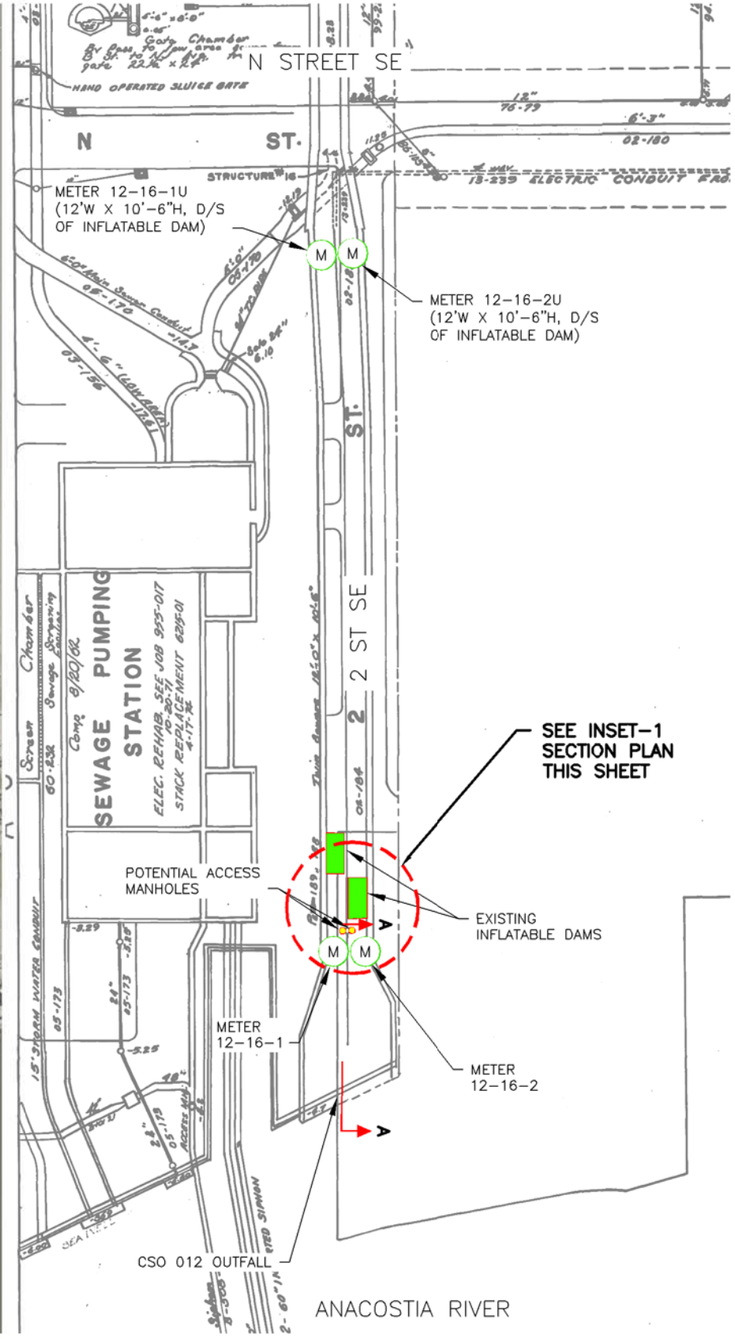




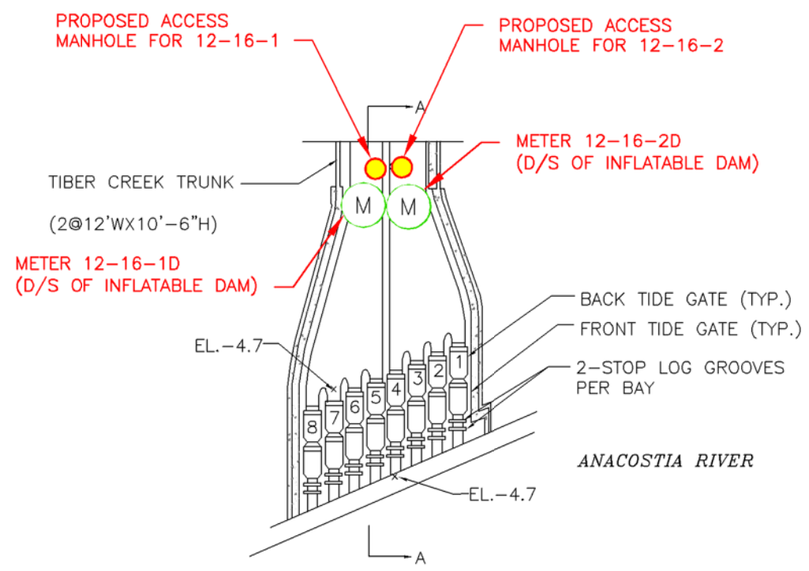




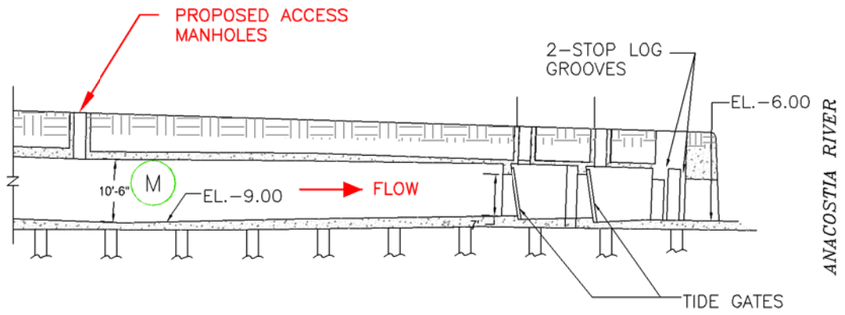
4 – FLOW METERS



FLOW METER LOCATION PLAN
SCALE: NTS



INSET–1 SECTION PLAN
SCALE NTS



TYPICAL SECTION B–B (PROFILE VIEWM PLAN
SCALE NTS

LEGEND

M FLOW METER LOCATION

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
12–16–1U, 12–16–1D, 12–16–2U, 12–16–2D
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 2

LAST SAVED BY: CONSTANT A. NORTEY DATE: 10/27/2014 11:32:43 AM
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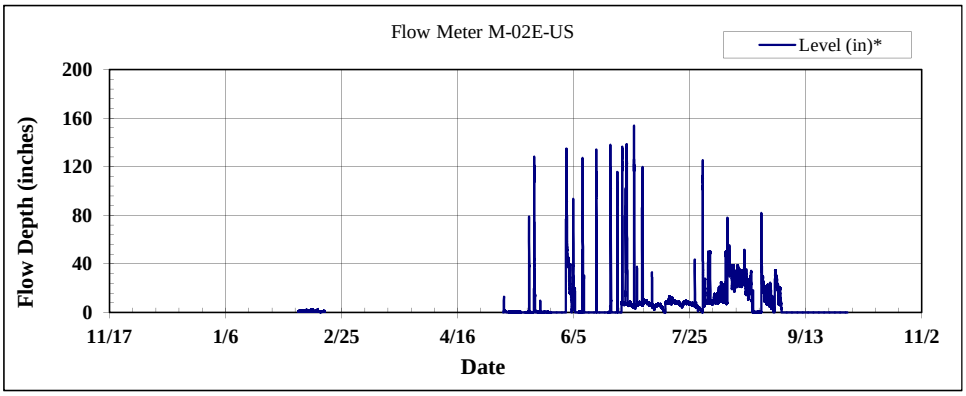
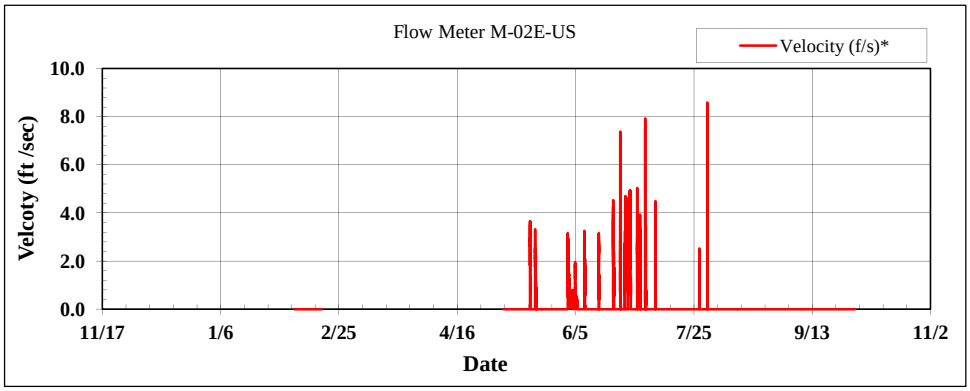
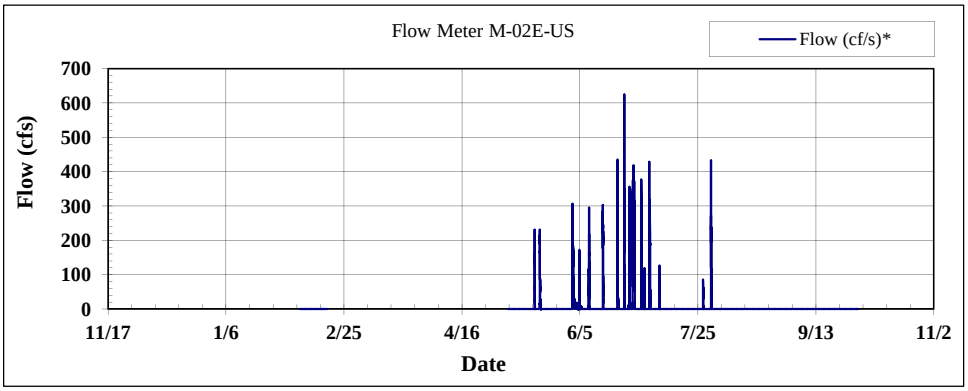
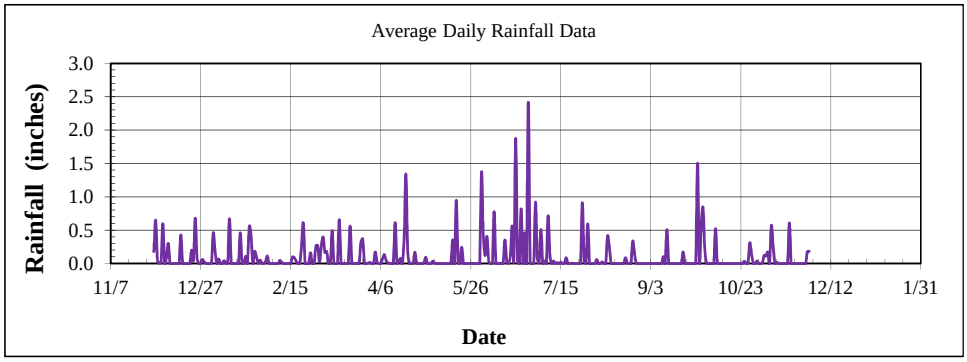
East Channel of Tiber Creek (U/S) (12-16-1U)

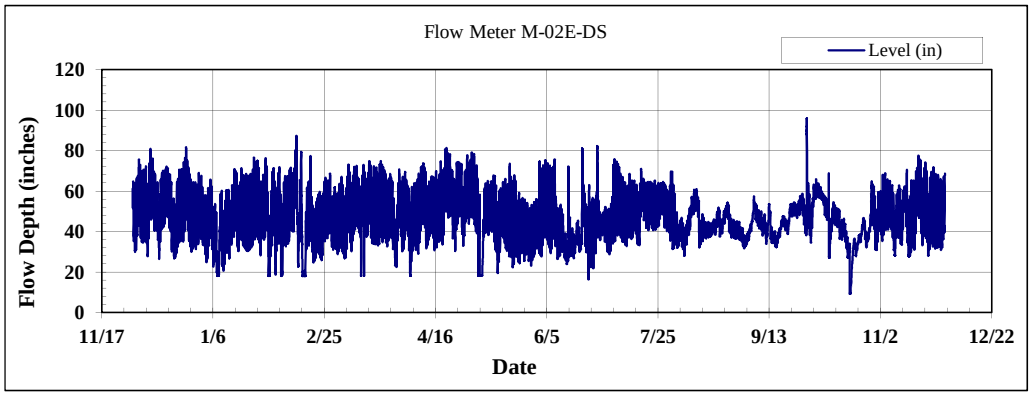


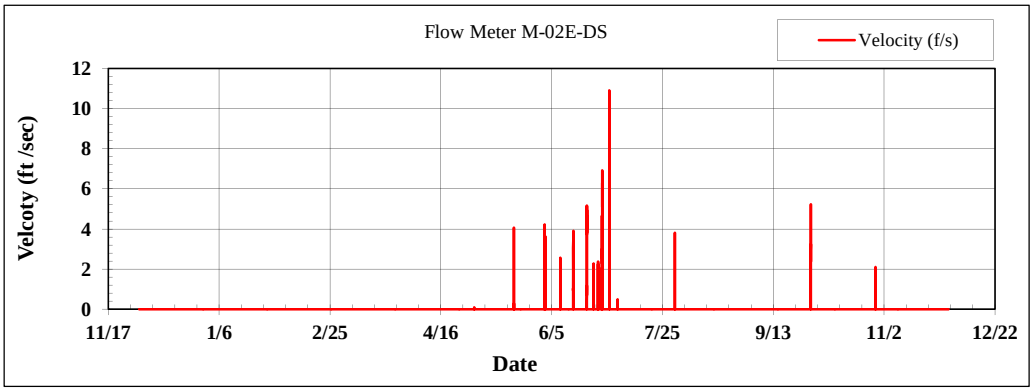


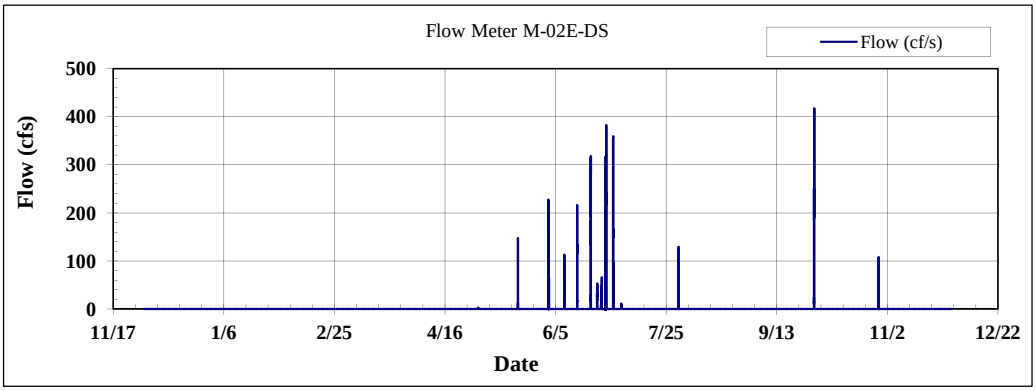


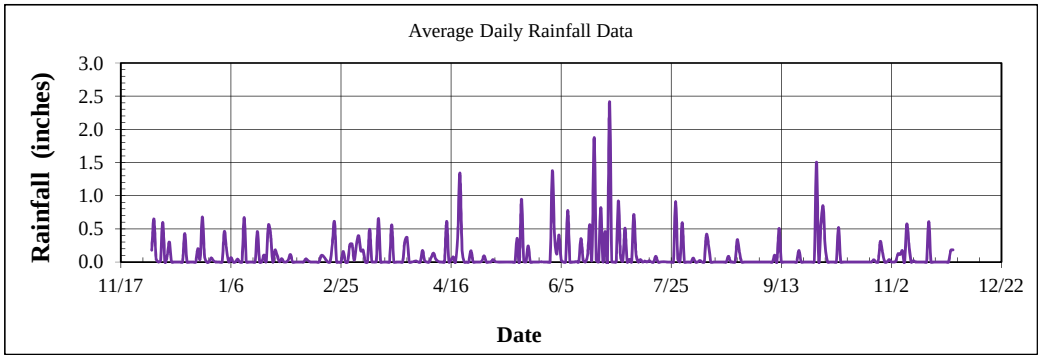


East Channel of Tiber Creek (D/S) (12-16-1D)

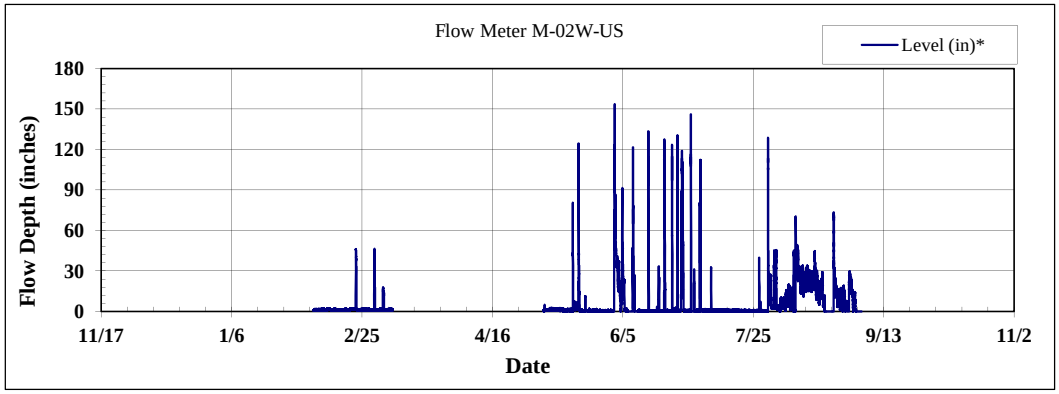


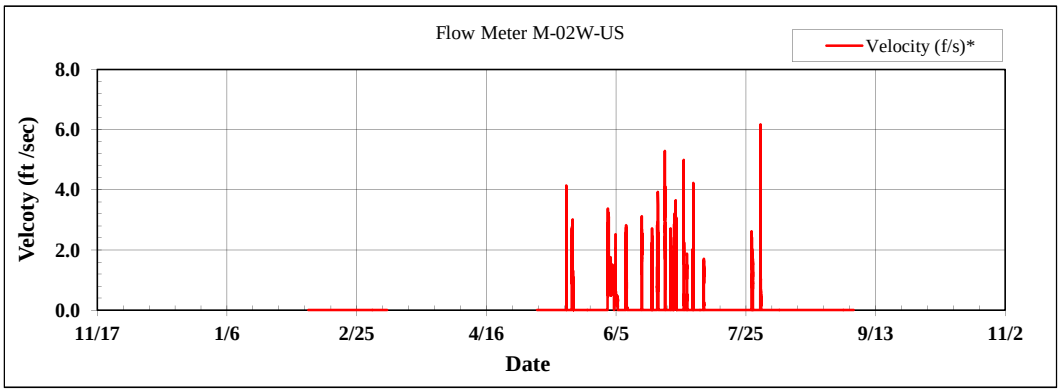


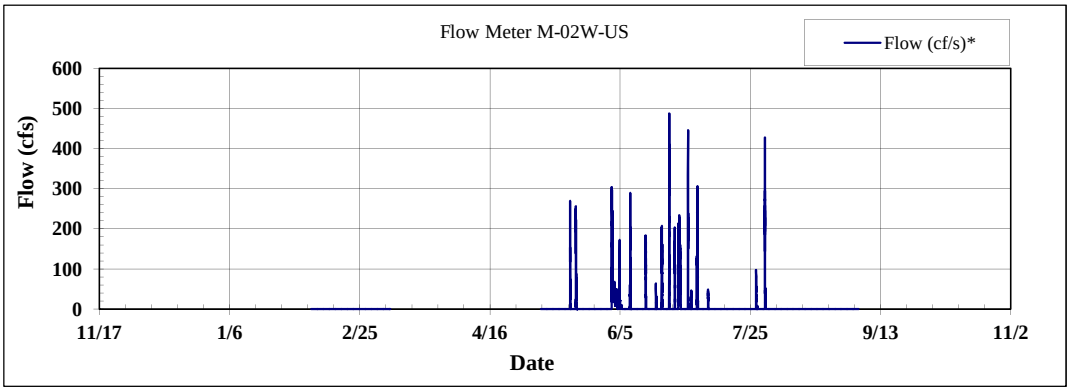


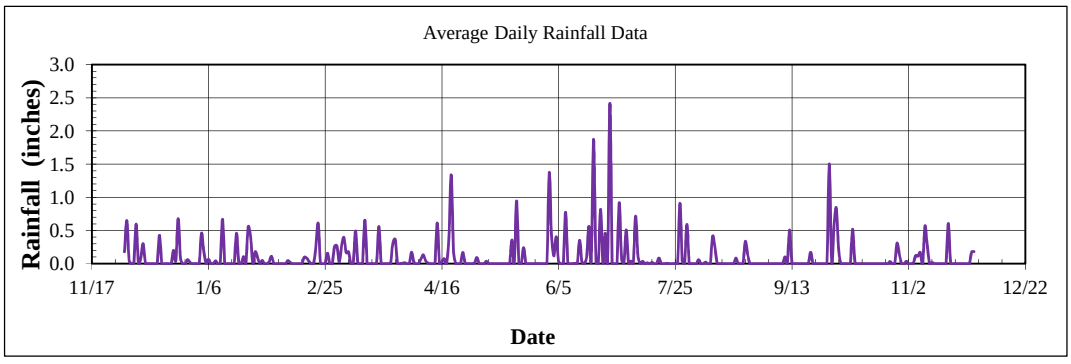


West Channel of Tiber Creek (U/S) (12-16-2U)

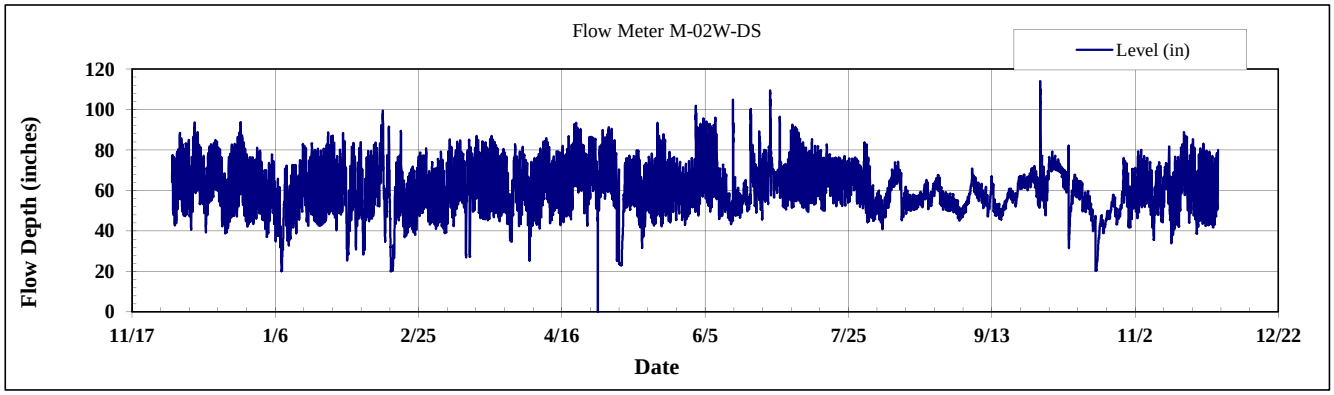


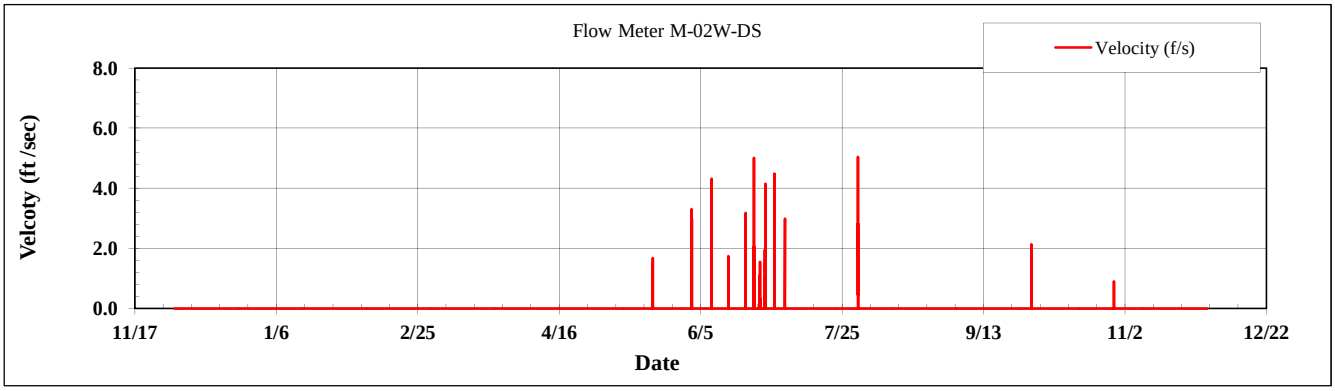


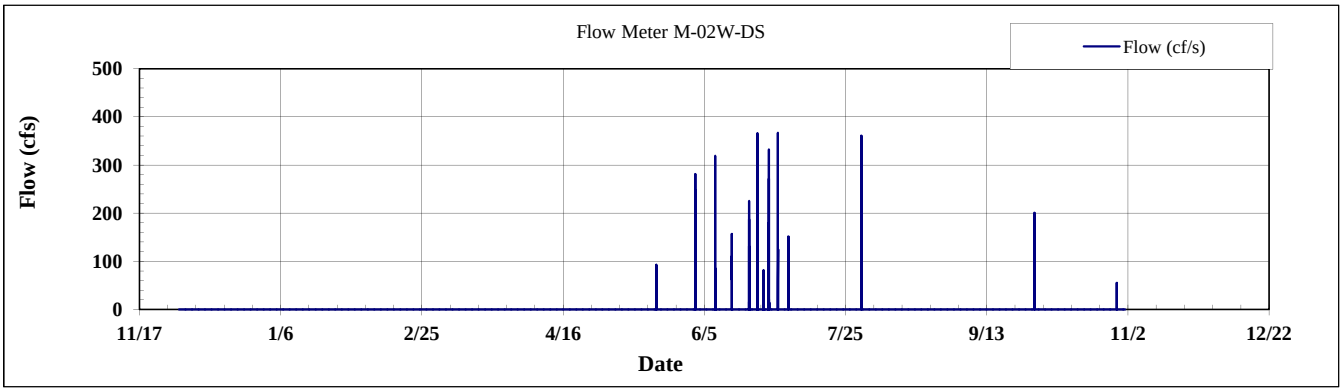


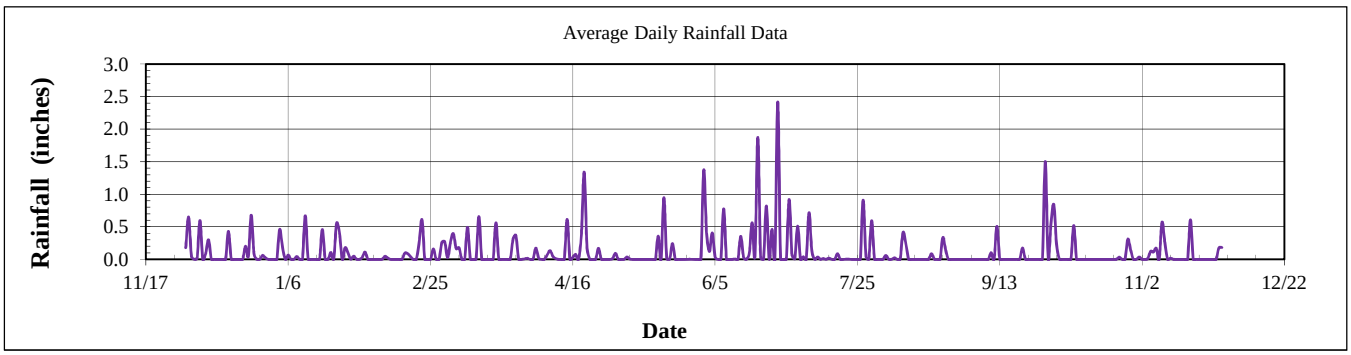


West Channel of Tiber Creek (D/S) (12-16-2D)



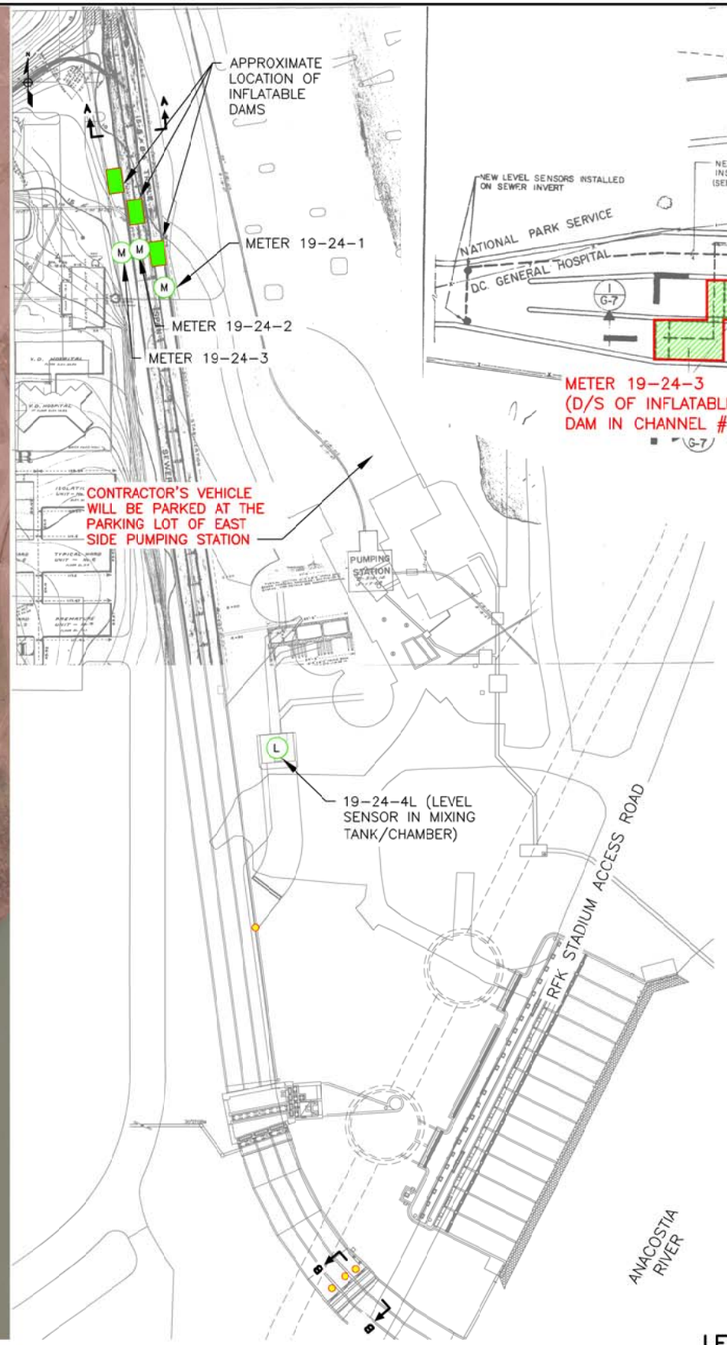


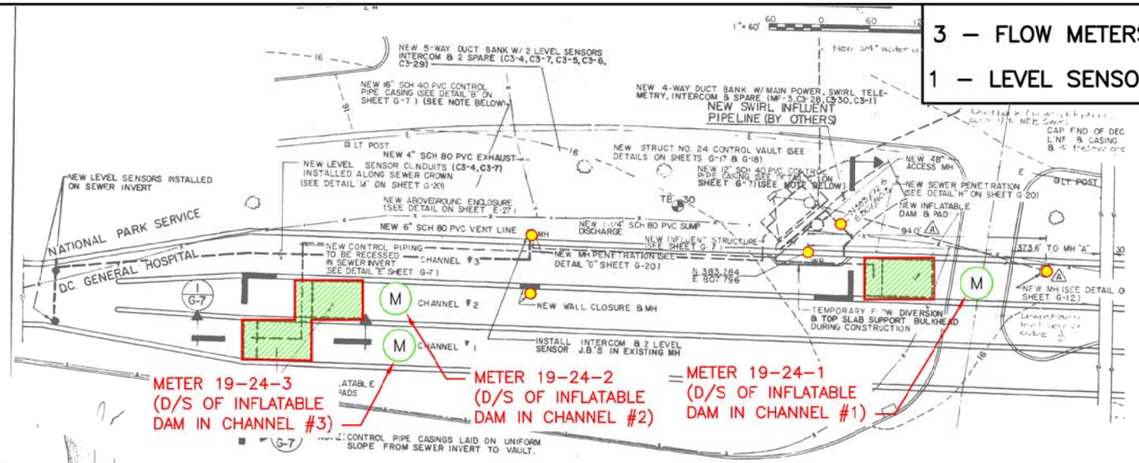




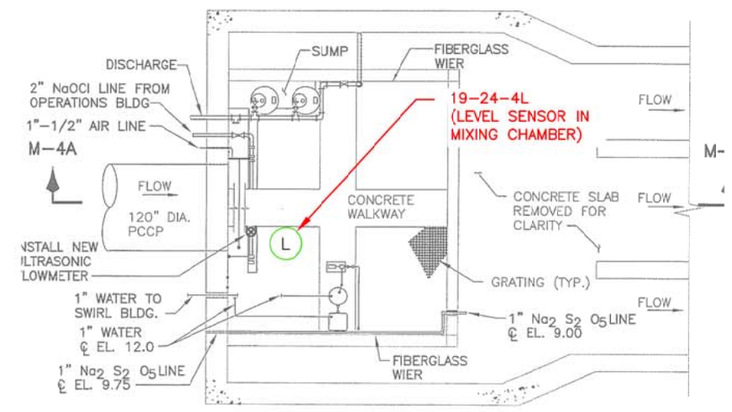
3 – FLOW METERS
1 – LEVEL SENSOR

FLOW METER LOCATION PLAN
SCALE: NTS

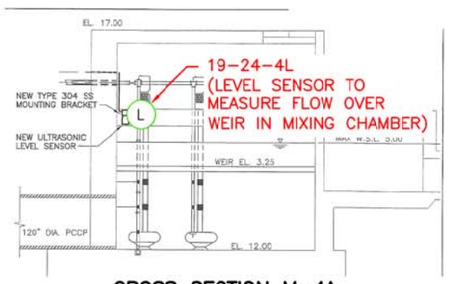




STRUCTURE 24 SITE PLAN
SCALE NTS



MIXING CHAMBER SECTIONAL PLAN
SCALE NTS



CROSS SECTION M–4A
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- (L) LEVEL SENSOR
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
19–24–1_2_3_4L
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 1

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 11/11/2014 3:15:55 PM
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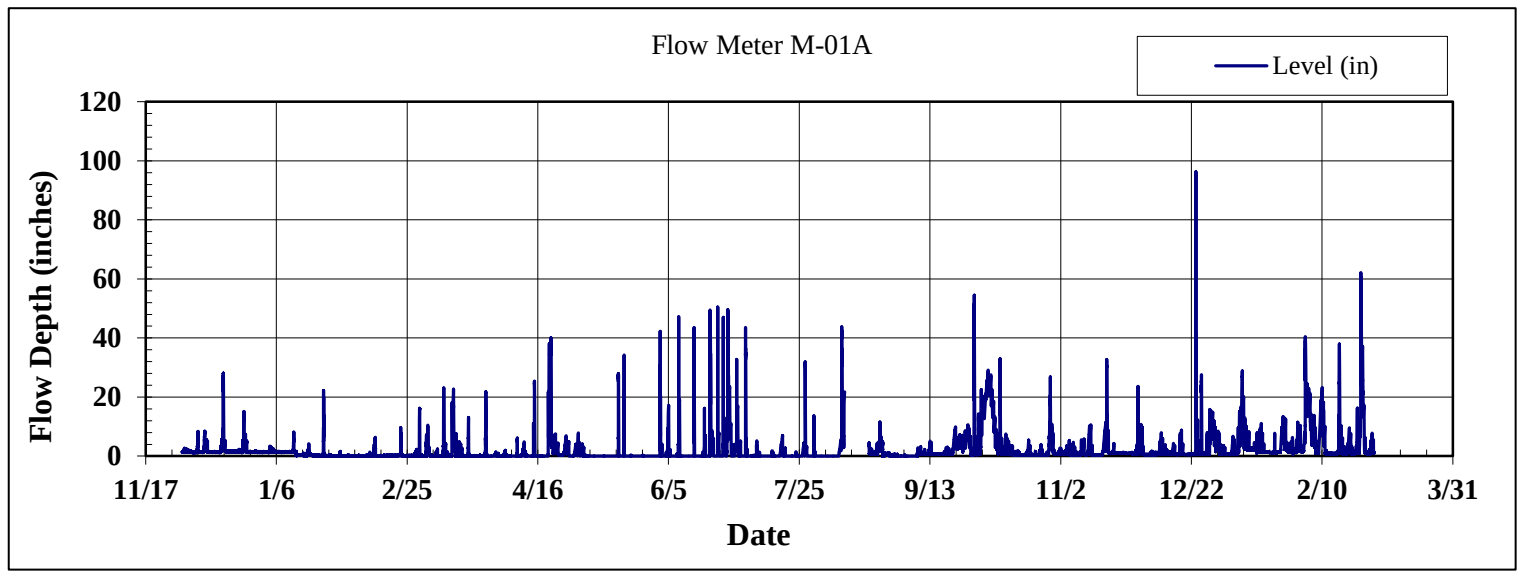
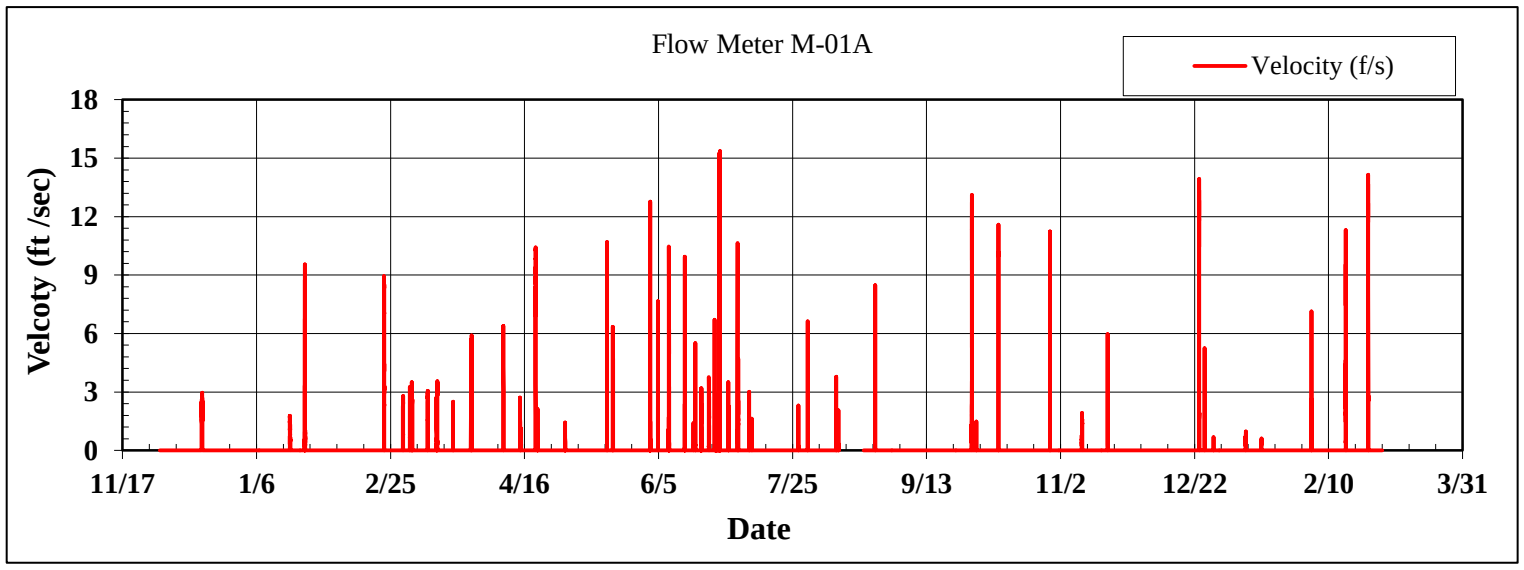
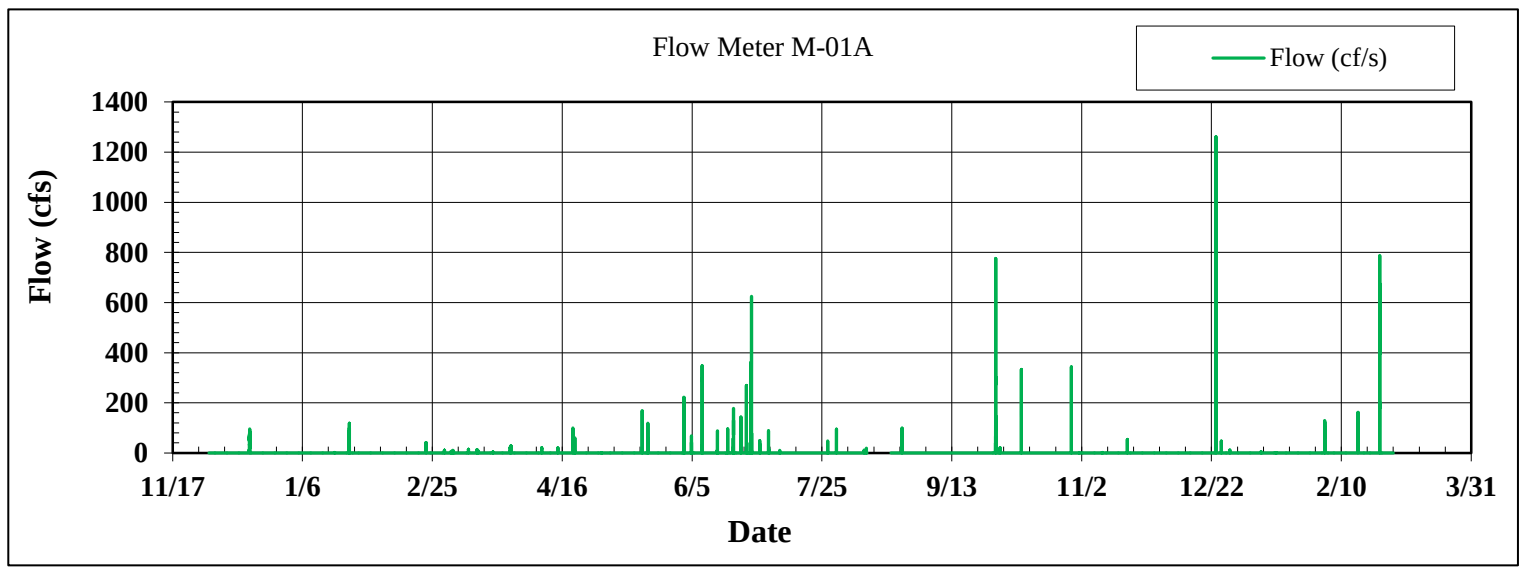
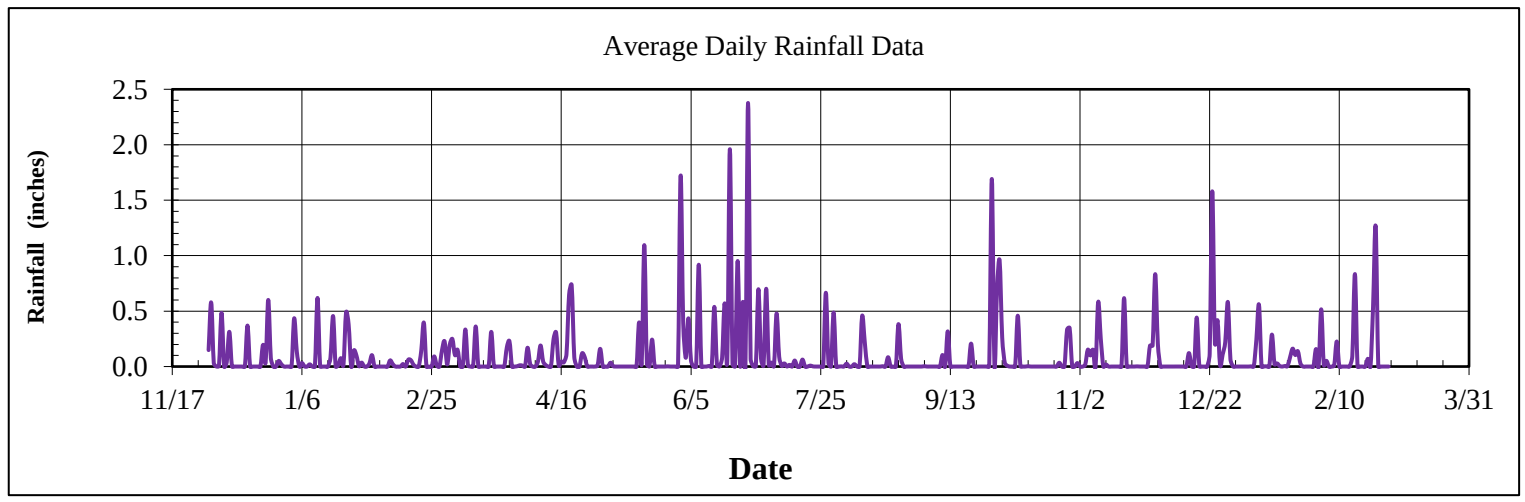
East Channel of NEBTS (19-24-1)

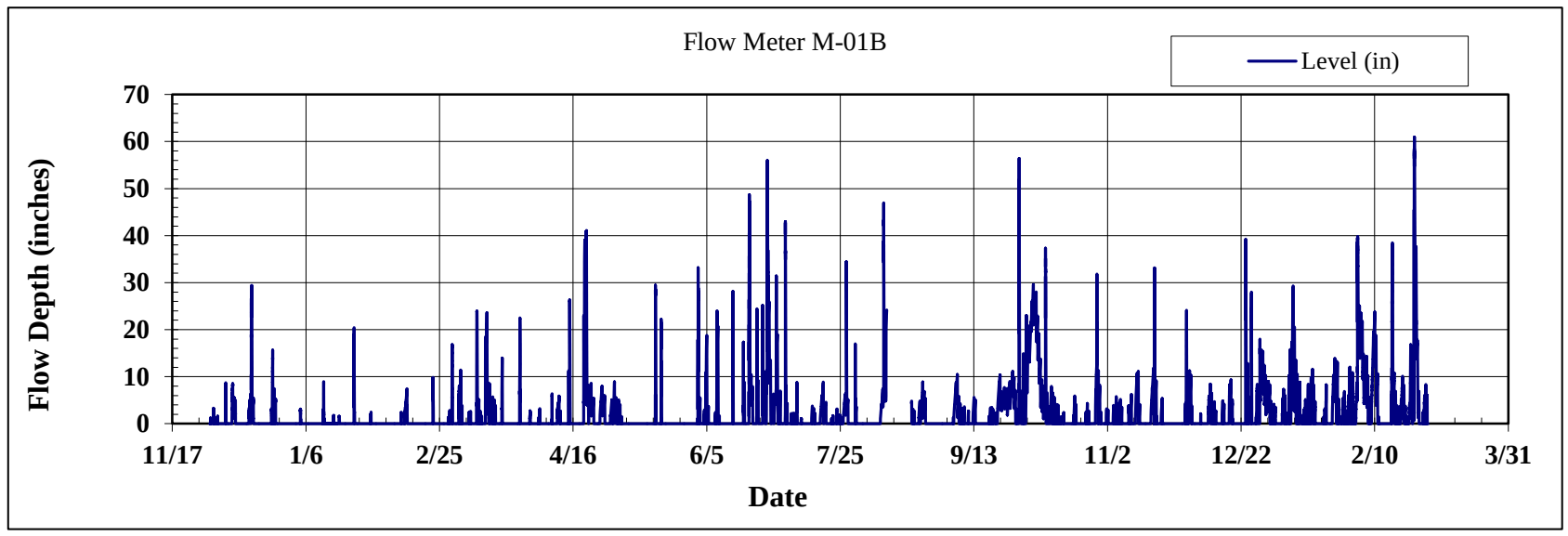


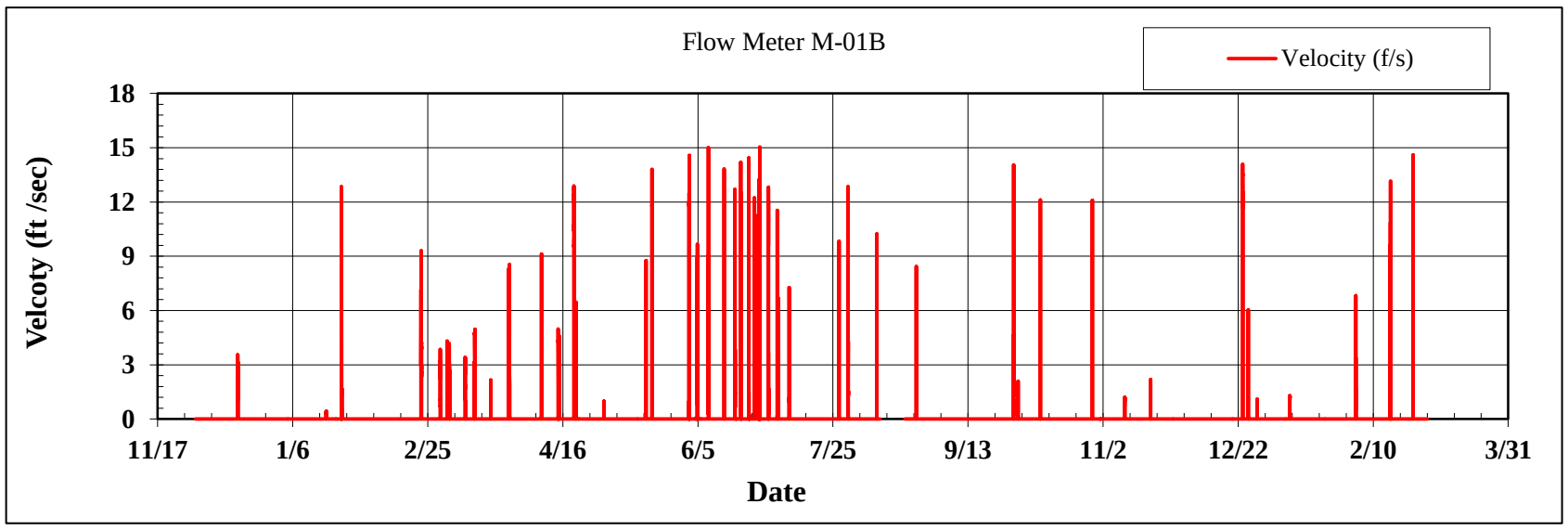


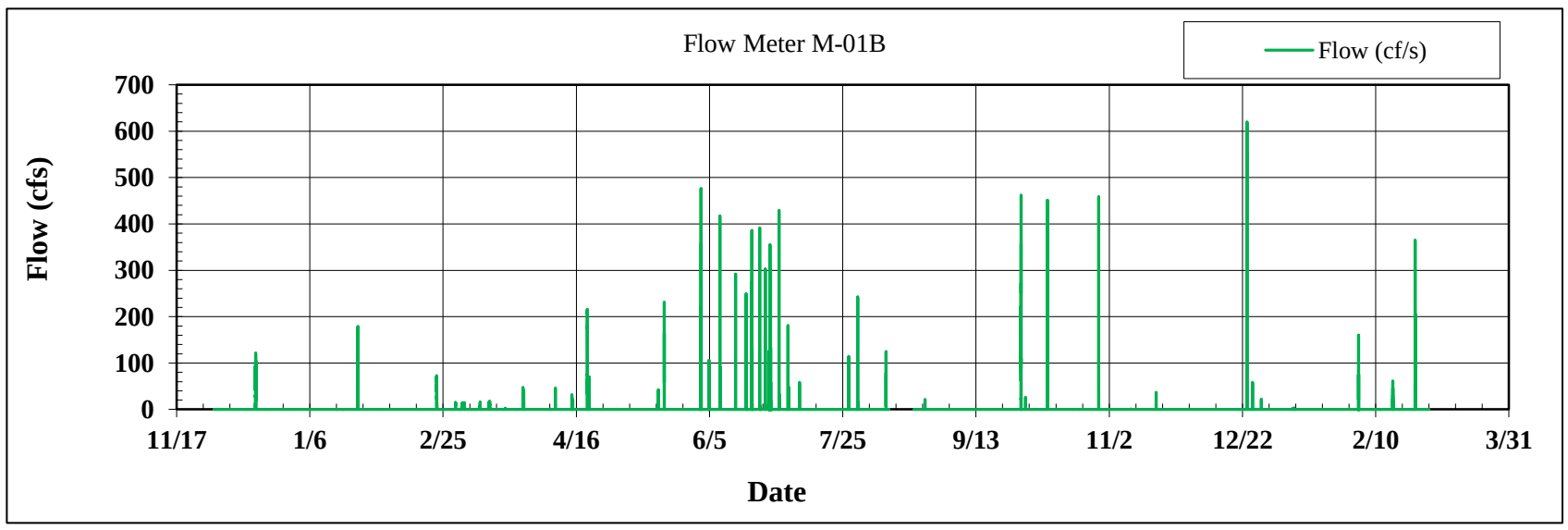


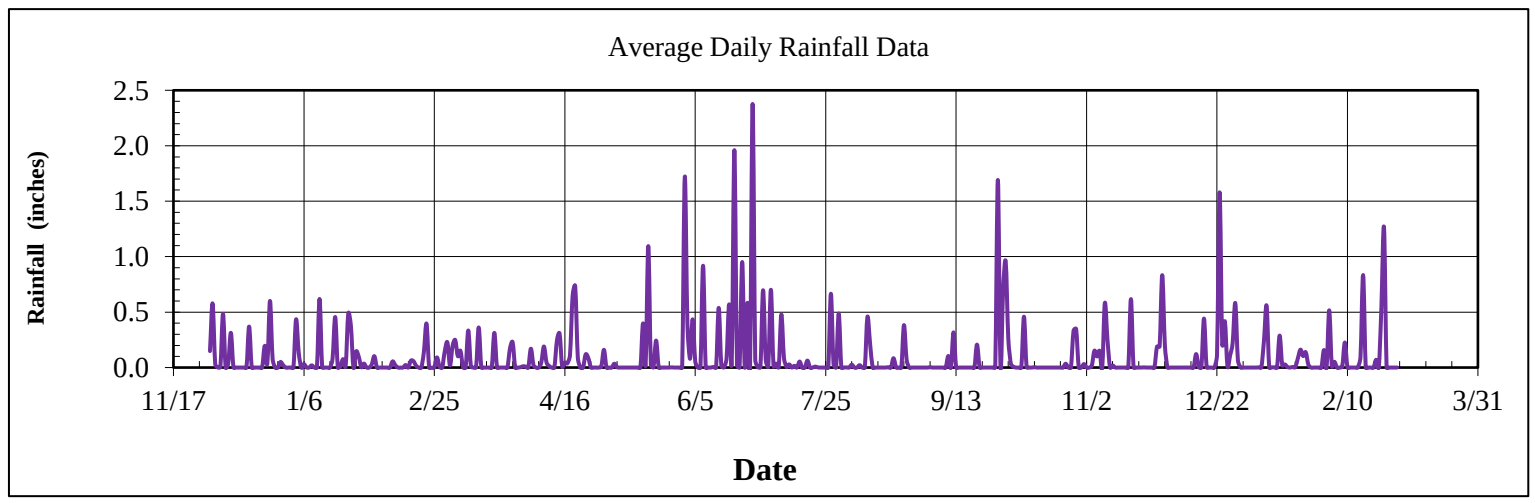


Middle Channelof NEBTS (19-24-2)

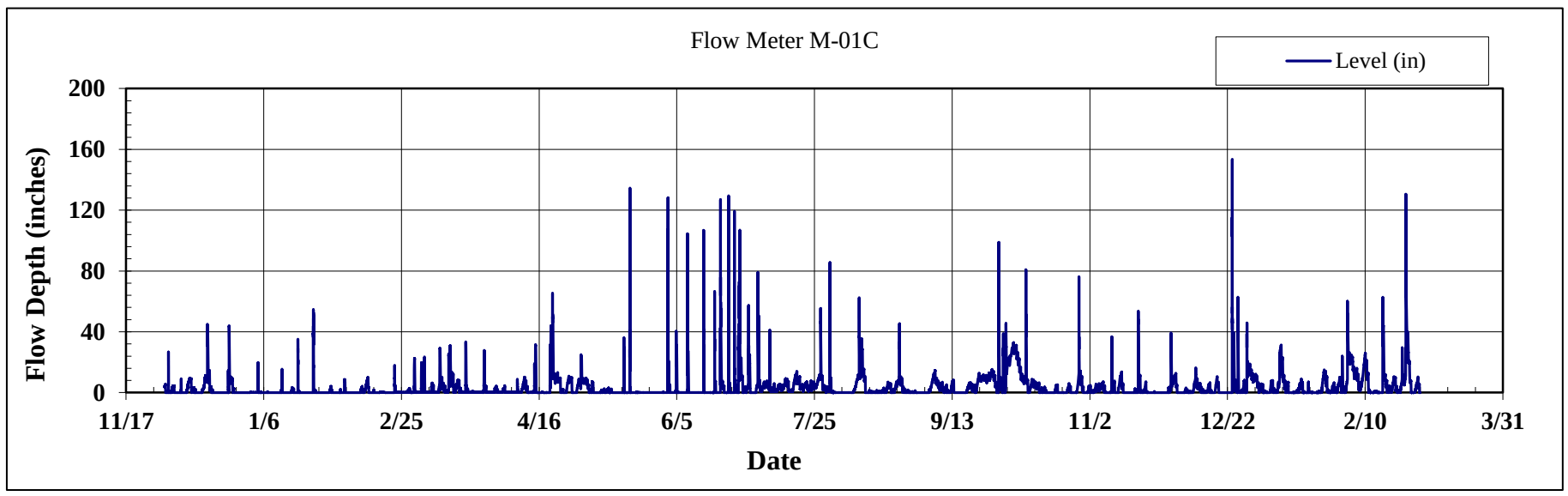


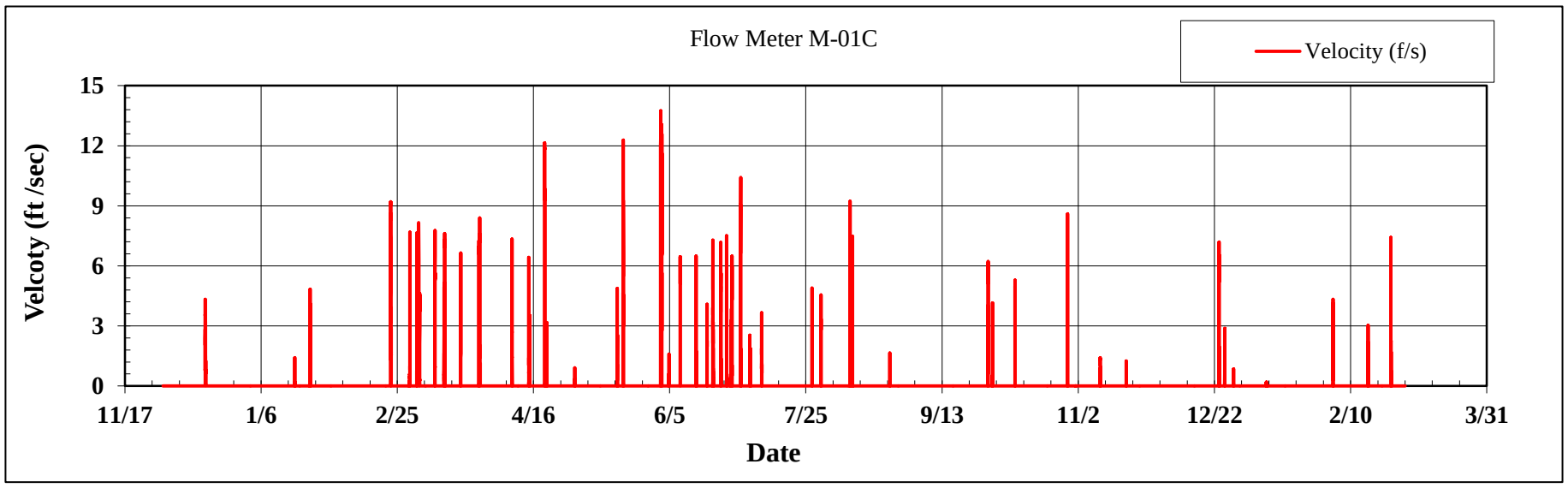


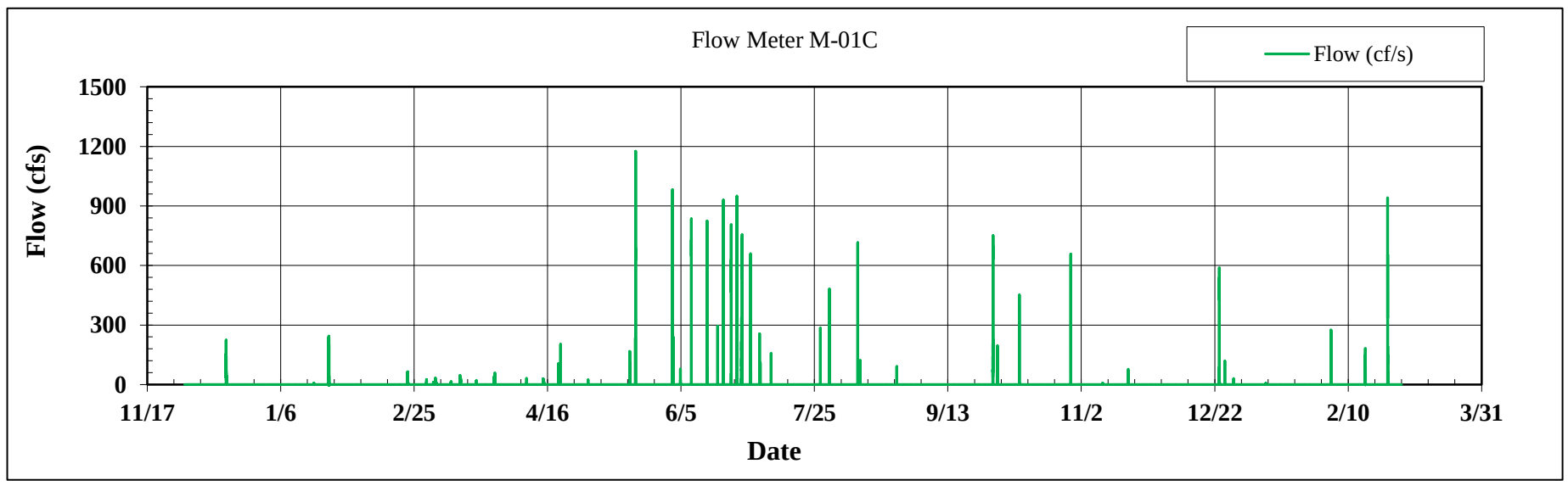


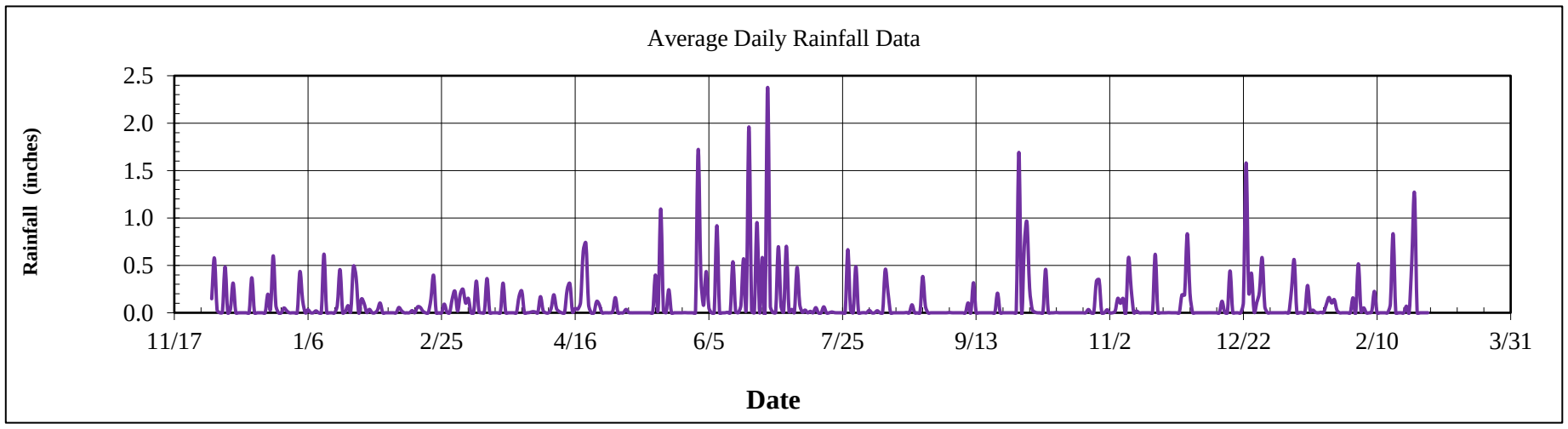


West Channel of NEBTS (19-24-3)

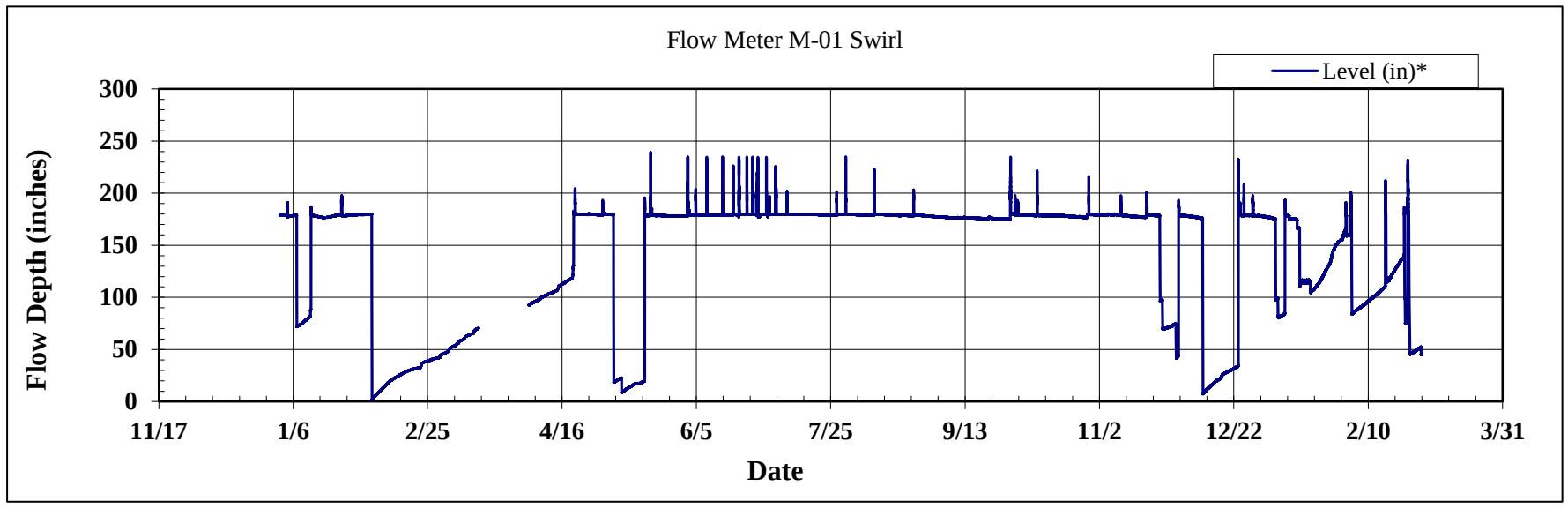


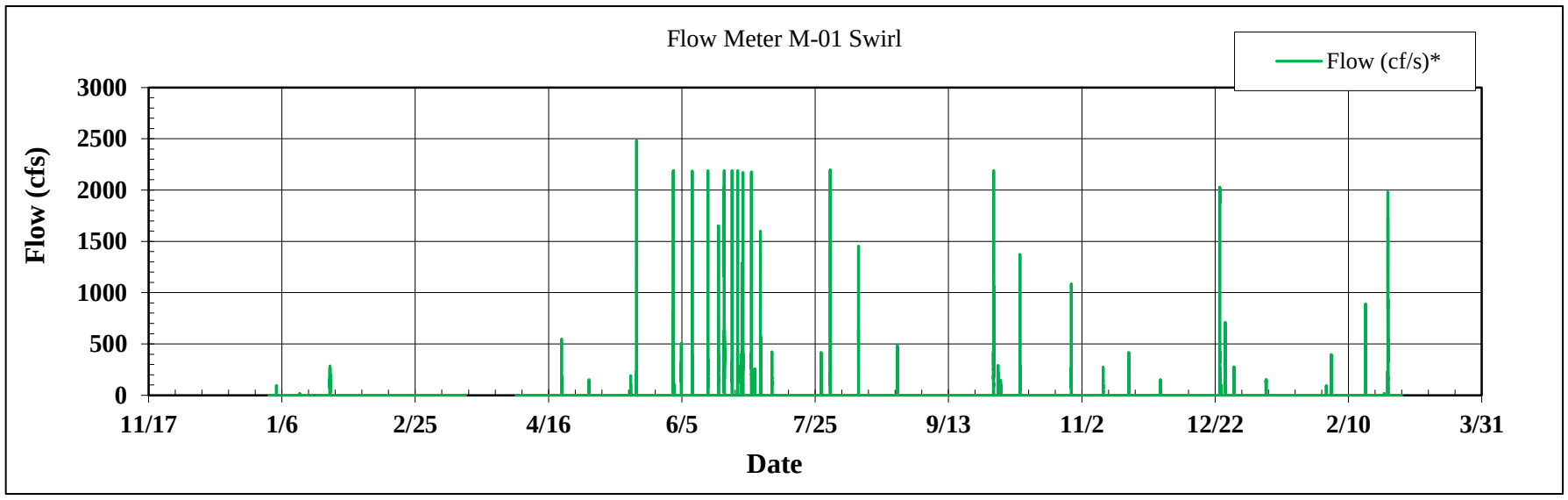


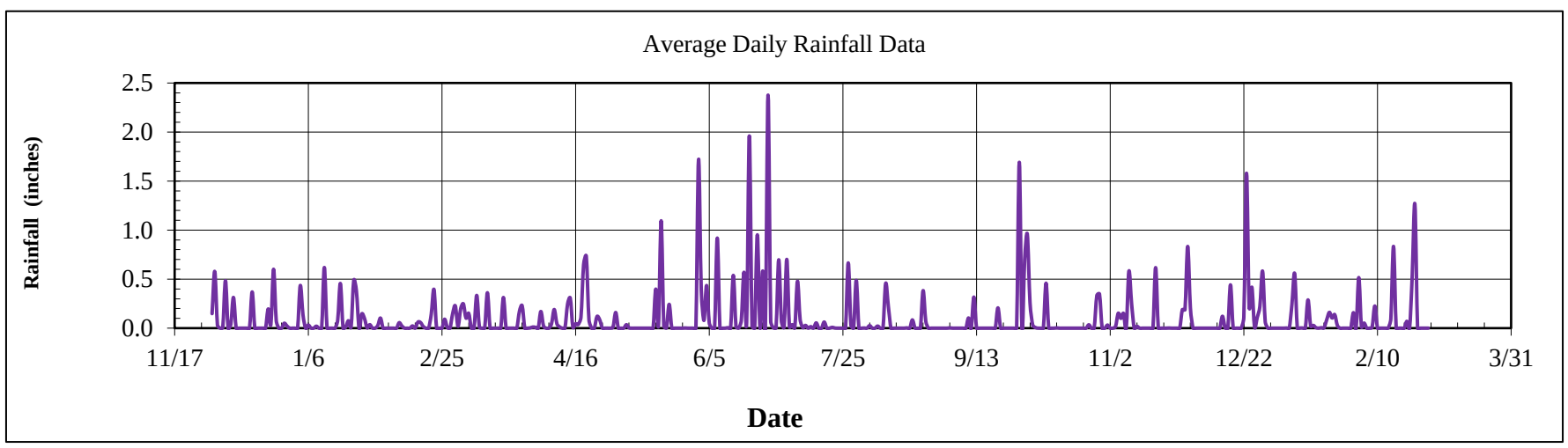




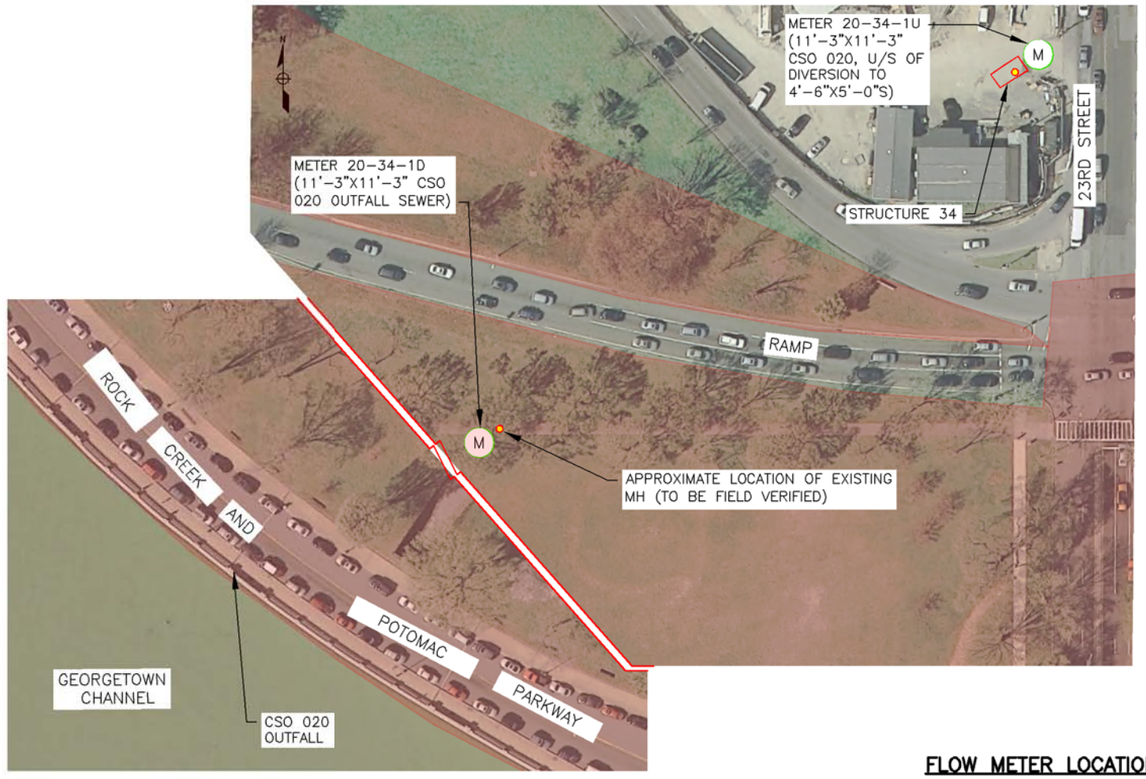
Mixing Chamber @ Swirl Effluent (19-24-4L)

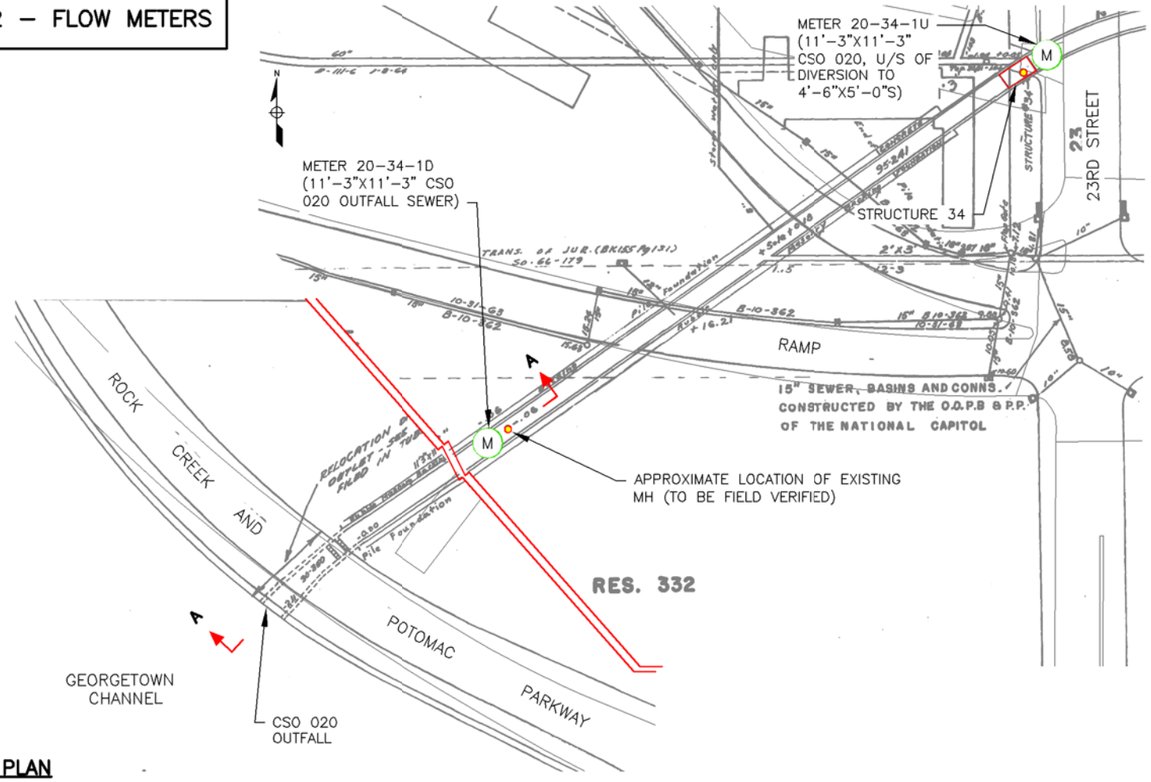




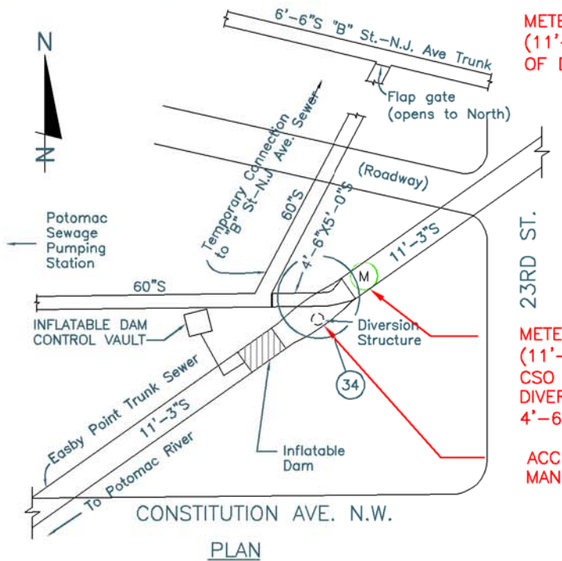


2 – FLOW METERS



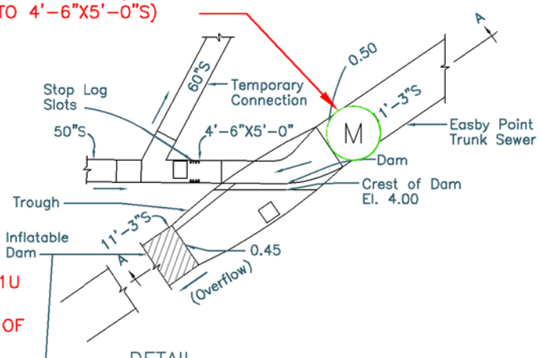


FLOW METER LOCATION PLAN
SCALE: NTS



PLAN

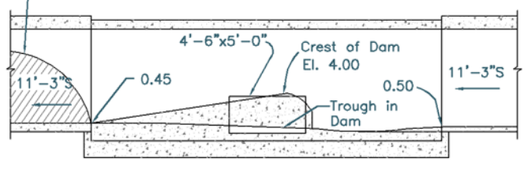
METER 20–34–1U
(11'–3"X11'–3" CSO 020, U/S
OF DIVERSION TO 4'–6"X5'–0"S)



METER 20–34–1U
(11'–3"X11'–3"
CSO 020, U/S OF
DIVERSION TO
4'–6"X5'–0"S)

ACCESS
MANHOLE

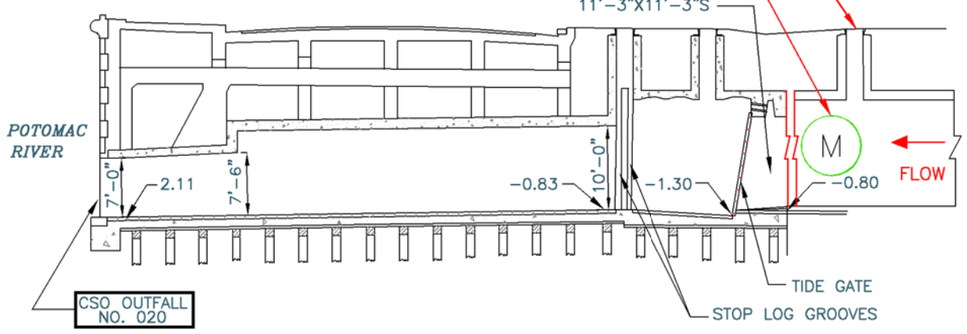
DETAIL



SECTION A–A

STRUCTURE–34 DETAIL
SCALE NTS

APPROXIMATE LOCATION OF EXISTING MH (TO BE FIELD VERIFIED)
METER 20–34–1D (11'–3"X11'–3"
CSO 020 OUTFALL SEWER)
11'–3"X11'–3"S



SECTION A–A (11'–3" X 11'–3" SEWER PROFILE)
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

20–34–1U AND 20–34–1D
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 9

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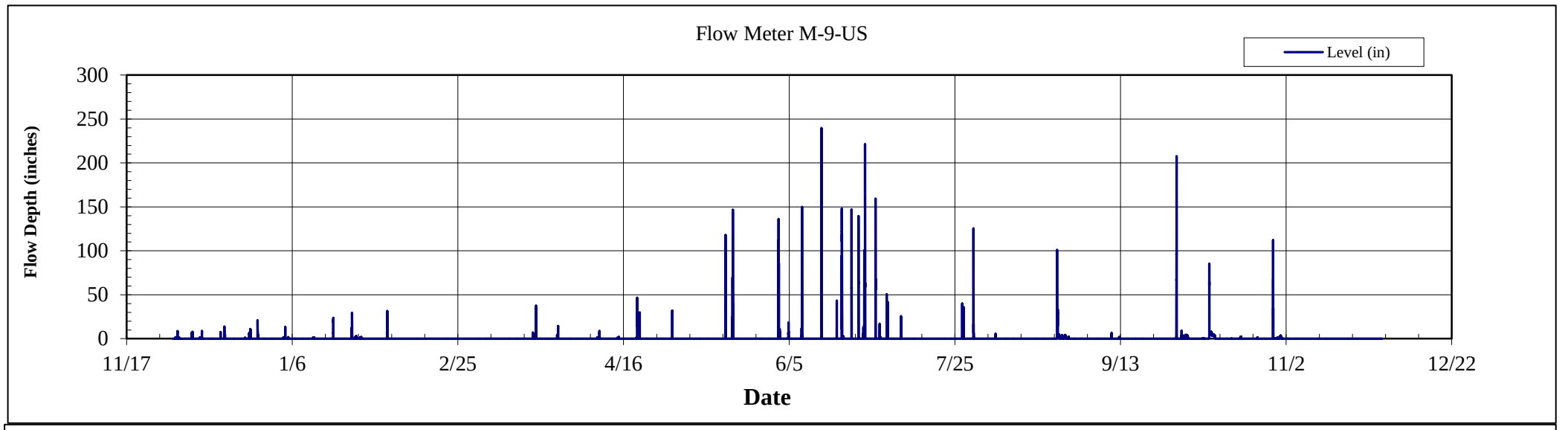
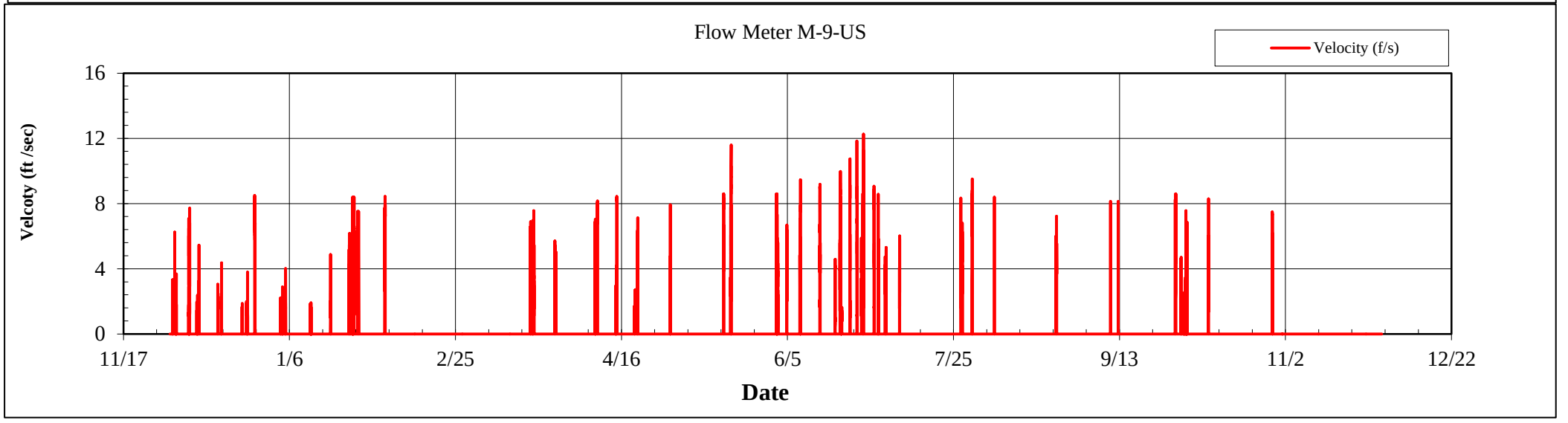
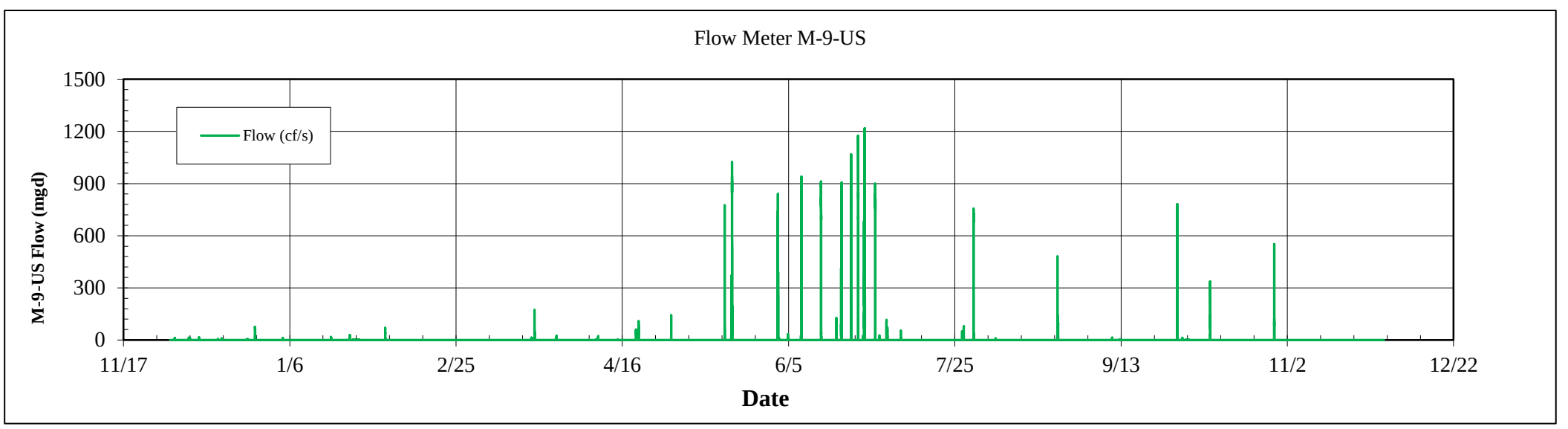
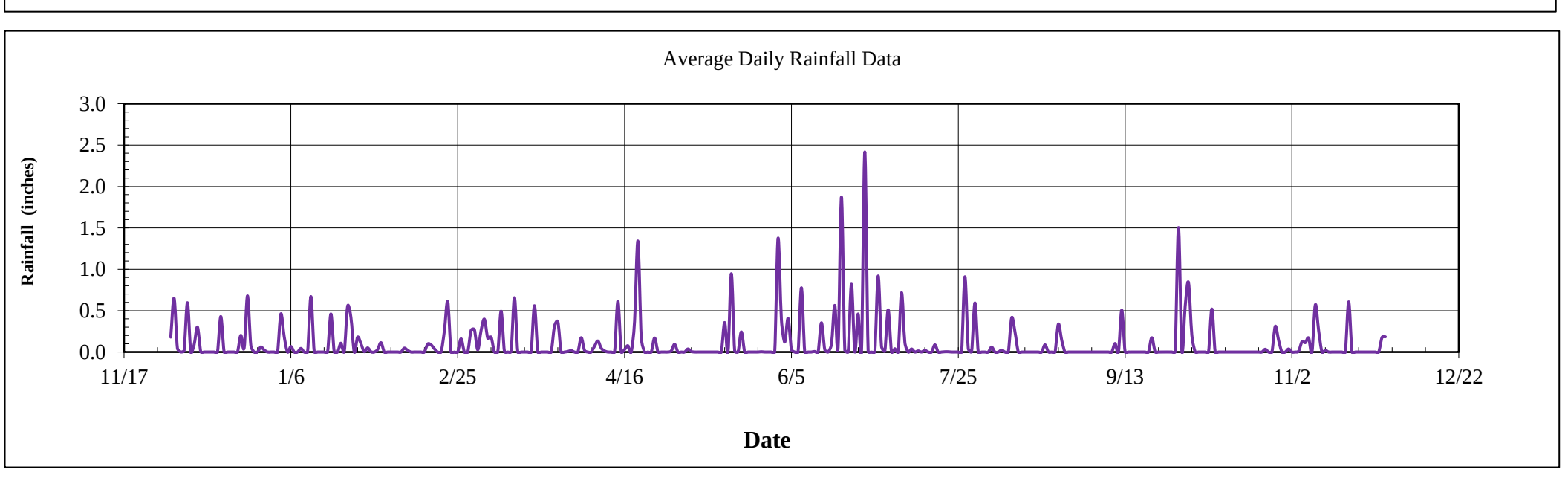
Easby Point Trunk Sewer Diversion to Potomac PS- U/S of STR 34 (20-34-1U)

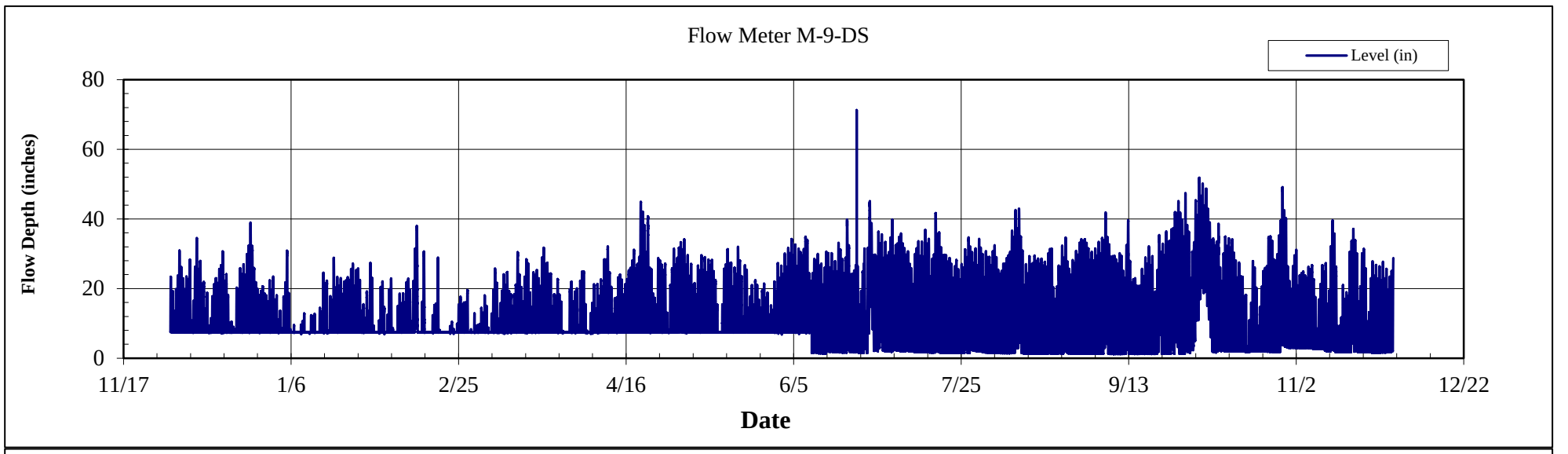


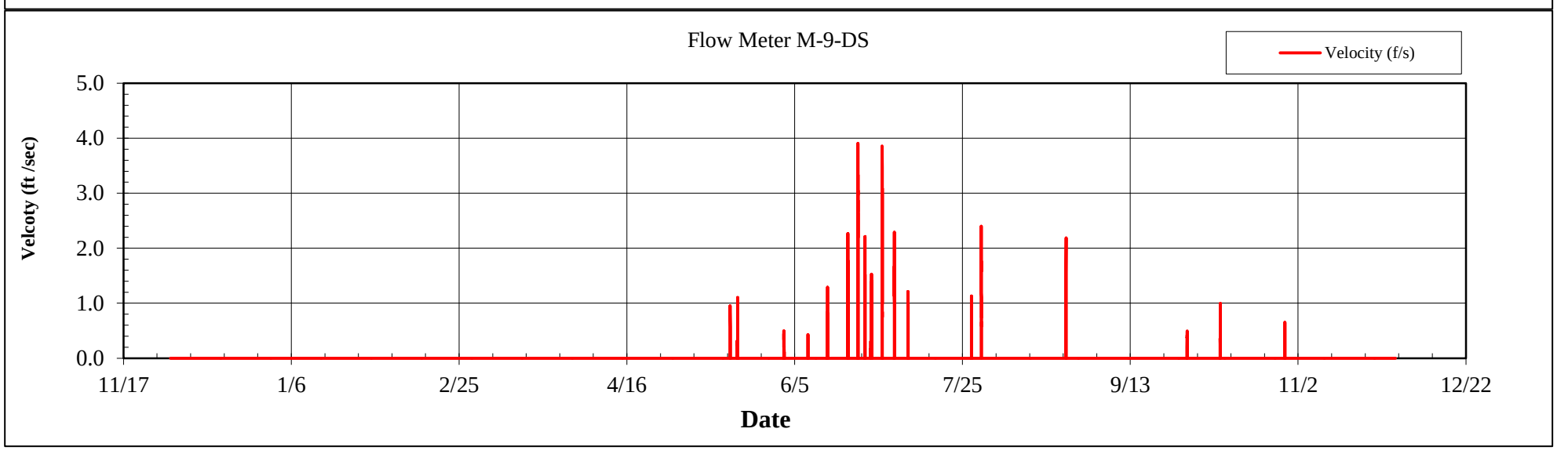


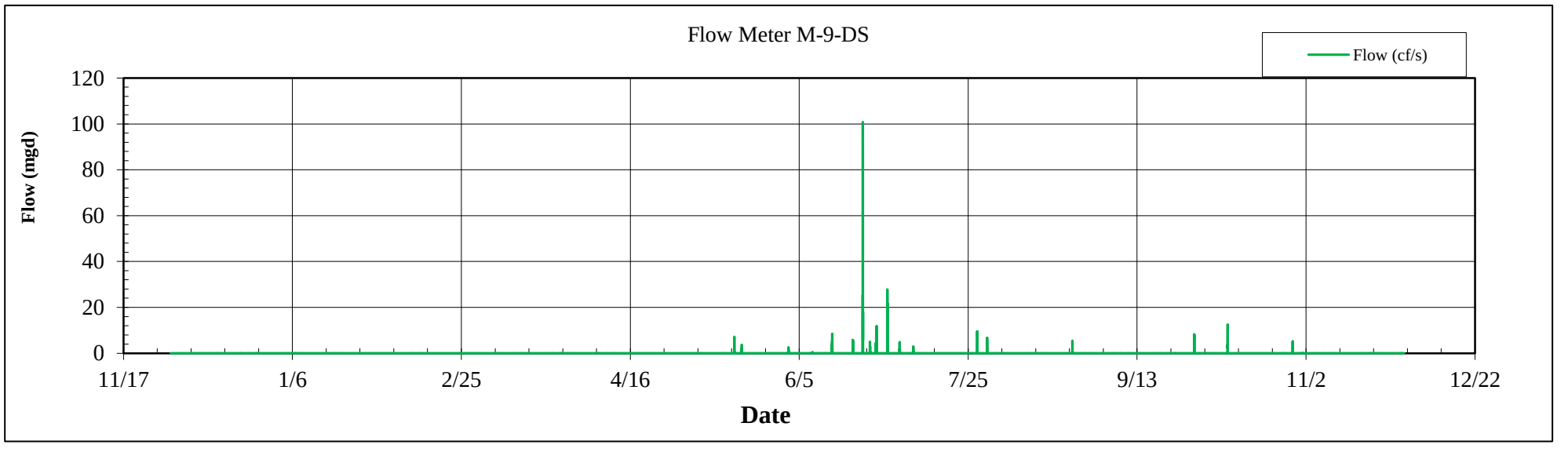


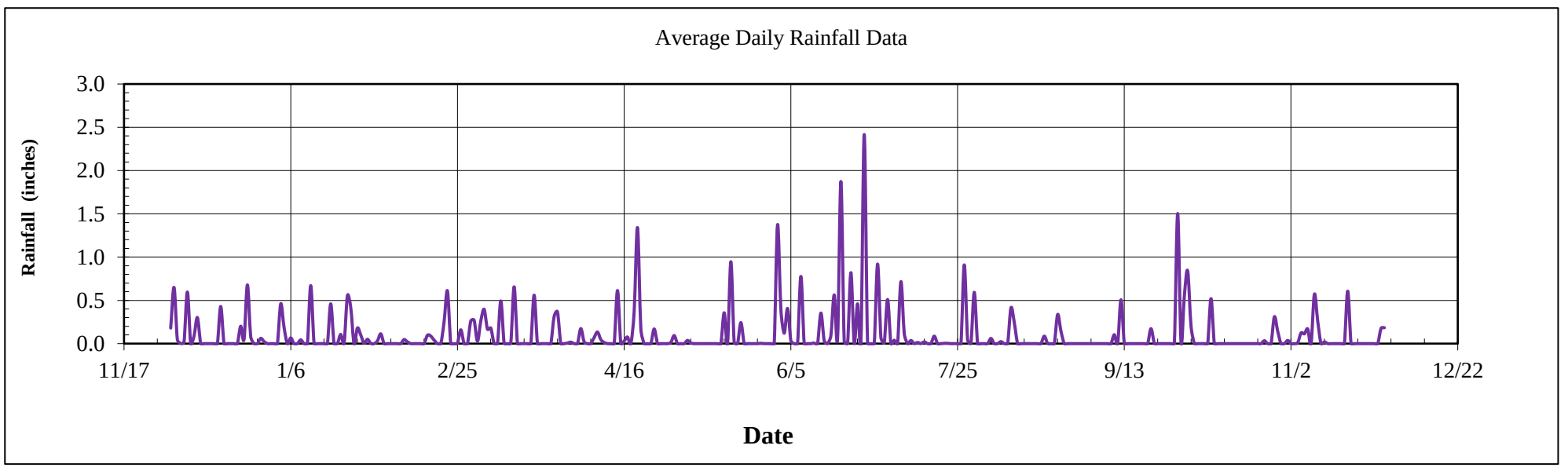


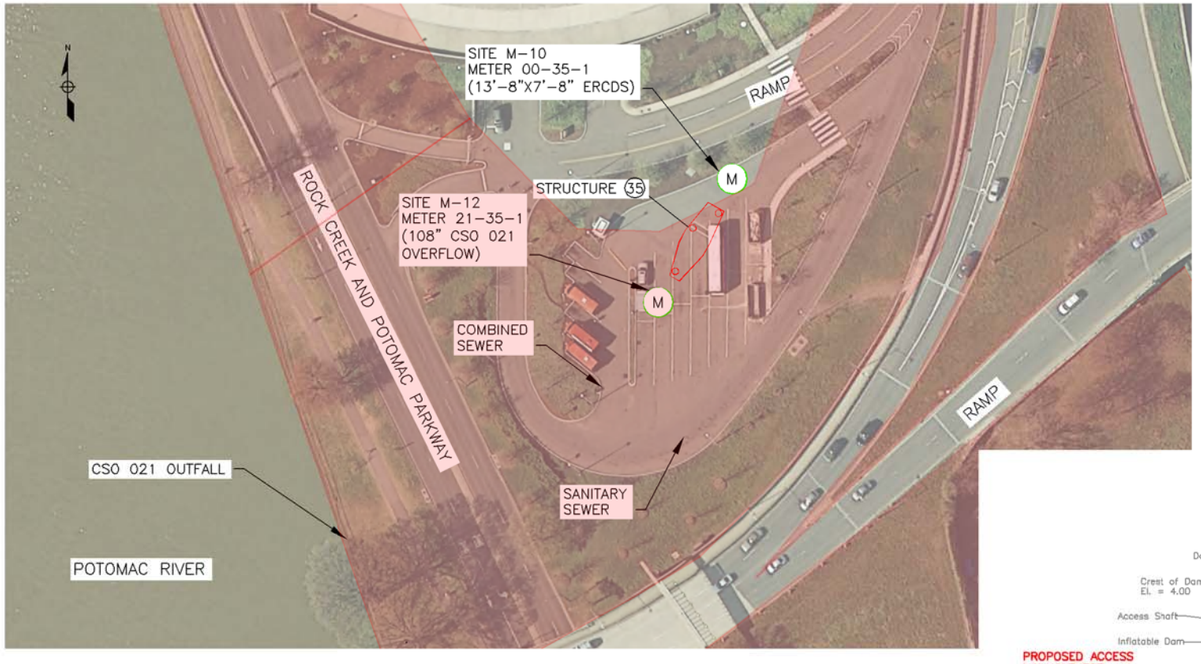
CSO 020 Outfall Sewer- D/S of STR 34 (20-34-1D)

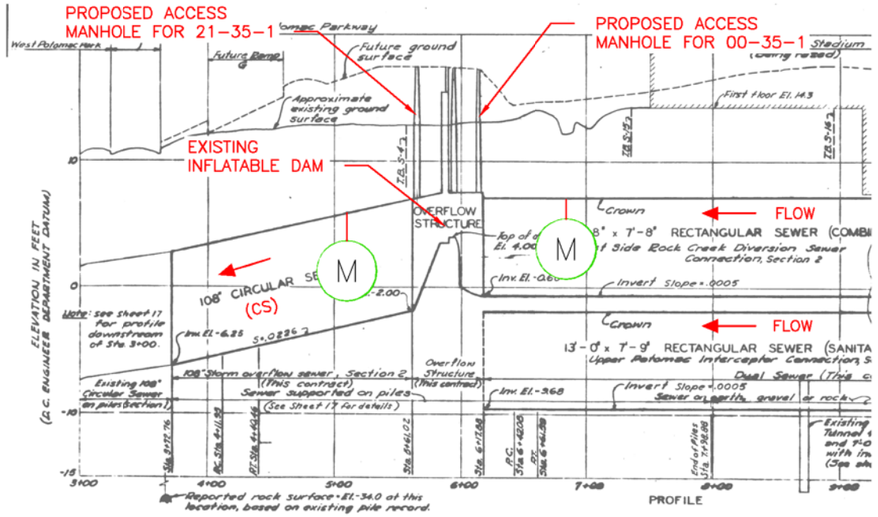










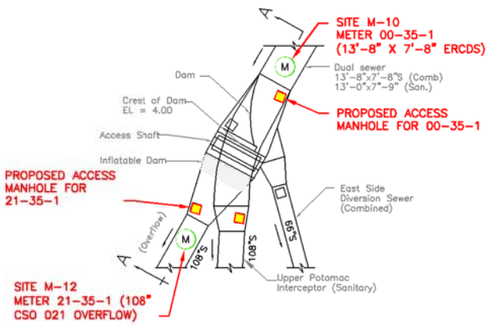


TYPICAL CROSS SECTION A–A (PROFILE VIEW)

SCALE: NTS

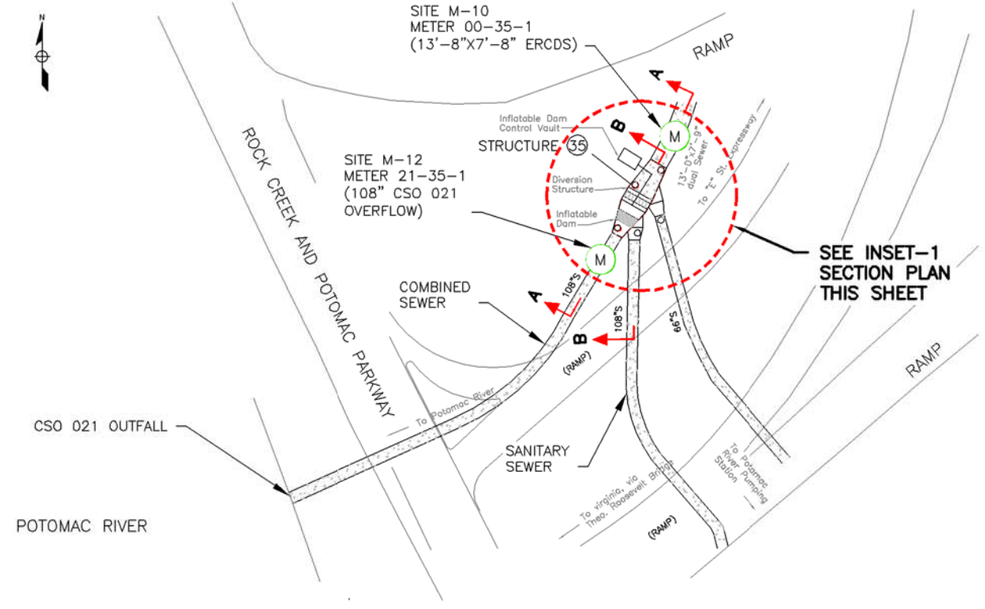
1 – FLOW METER @ M–10

1 – FLOW METER @ M–12



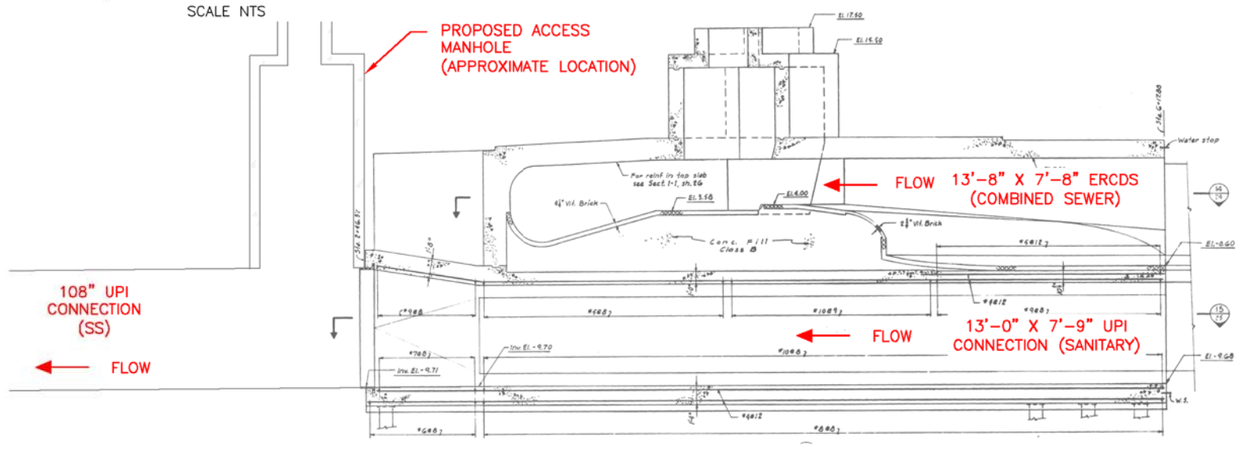
INSET–1 SECTION PLAN

SCALE NTS



FLOW METER LOCATION PLAN

SCALE: NTS



TYPICAL CROSS SECTION B–B (PROFILE VIEW)

SCALE: NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
21–35–1 AND 00–35–1
METER LOCATIONS AND TYPICAL CROSS SECTIONS

DATE: OCTOBER 2014 | SITE 10 AND 12

LAST SAVED BY: CONSTANT A. NORTEY DATE: 10/27/2014 2:15:47 PM
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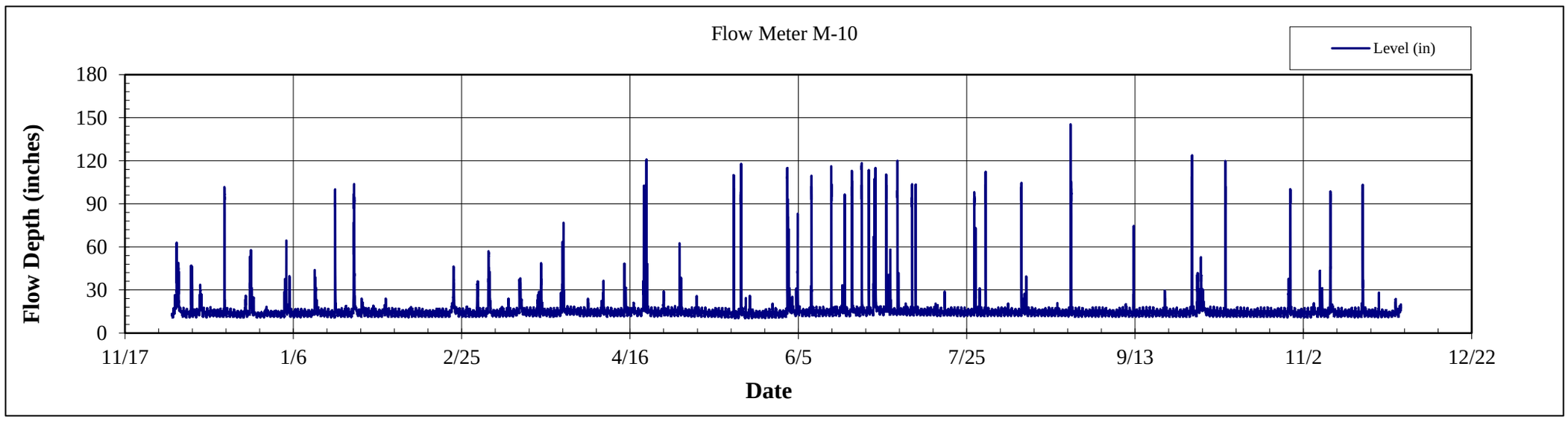
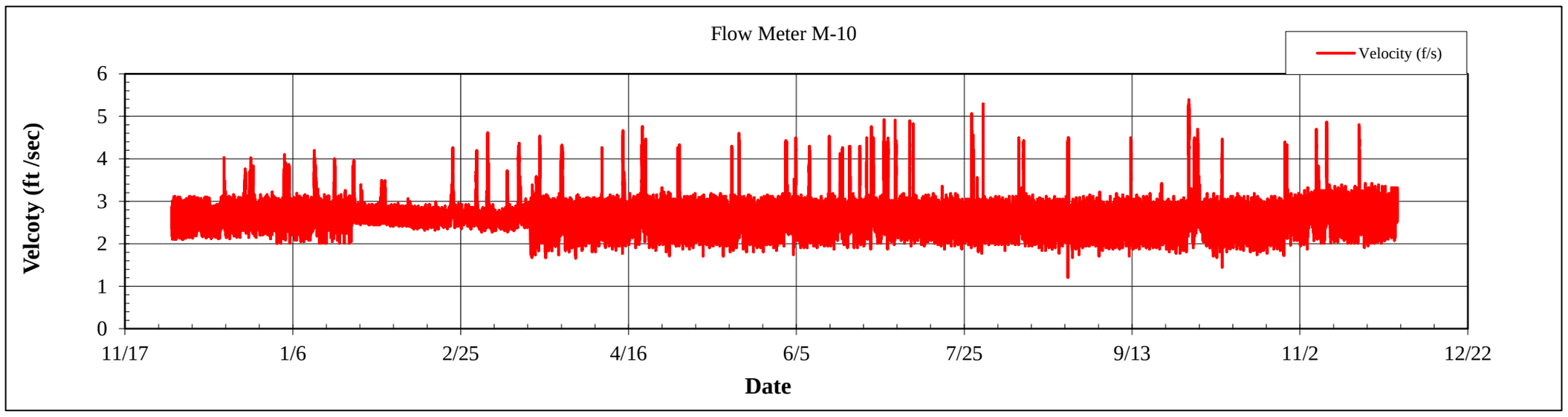
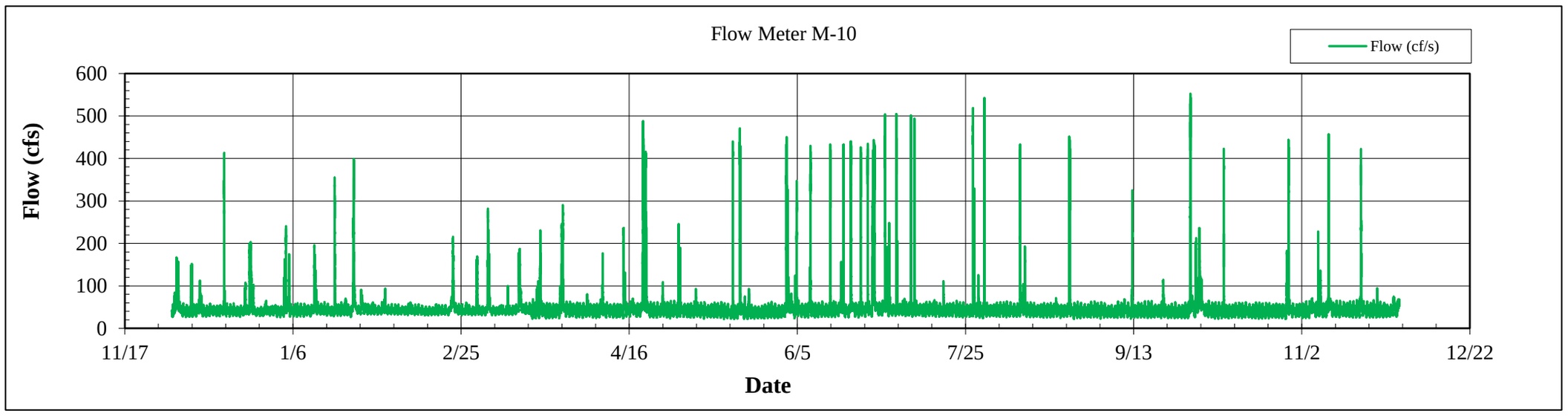
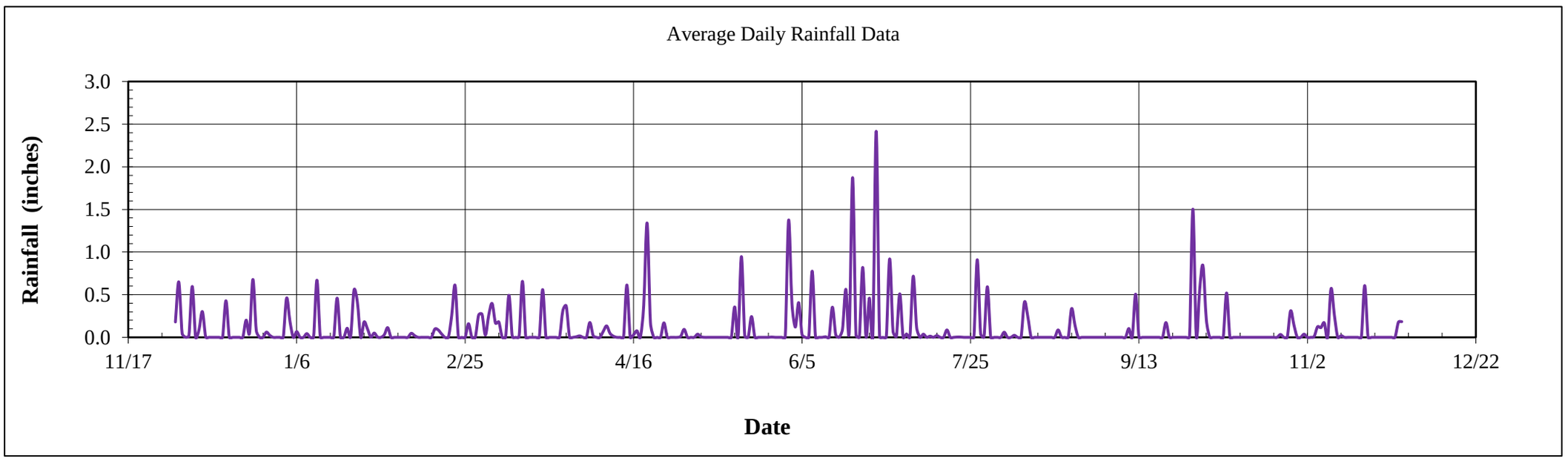
ERCDS Flows- U/S of STR 35 (00-35-1)

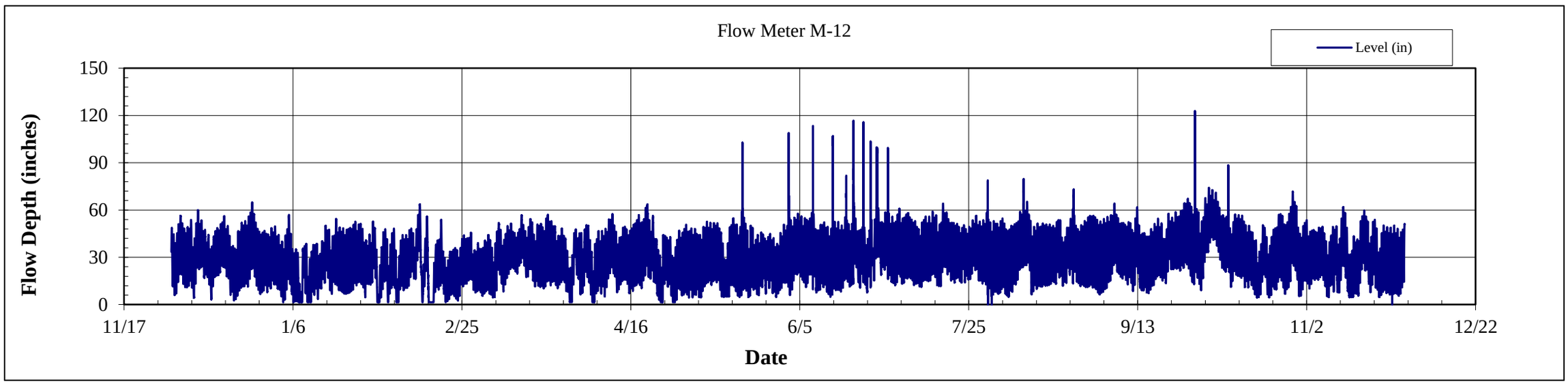


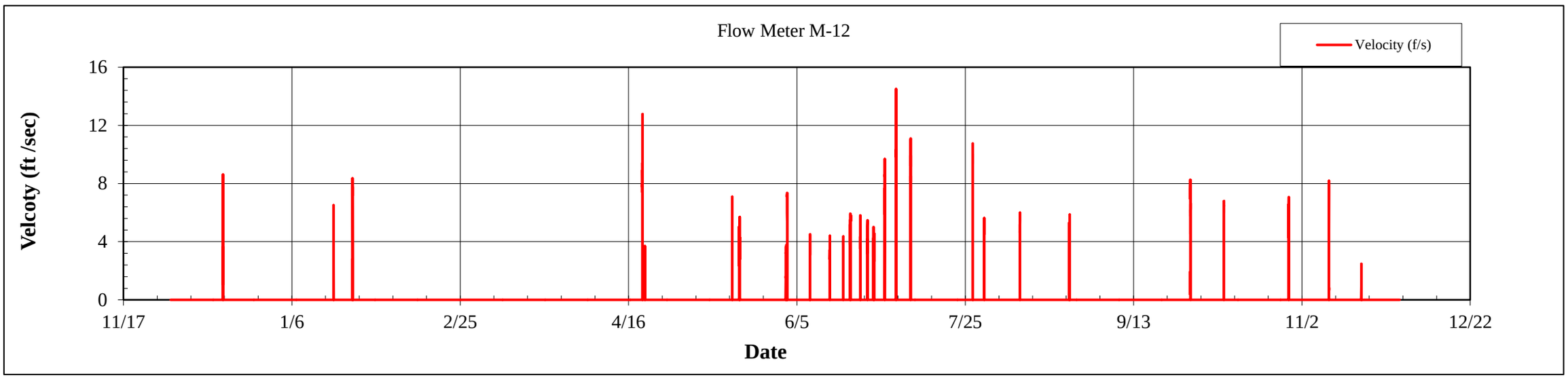


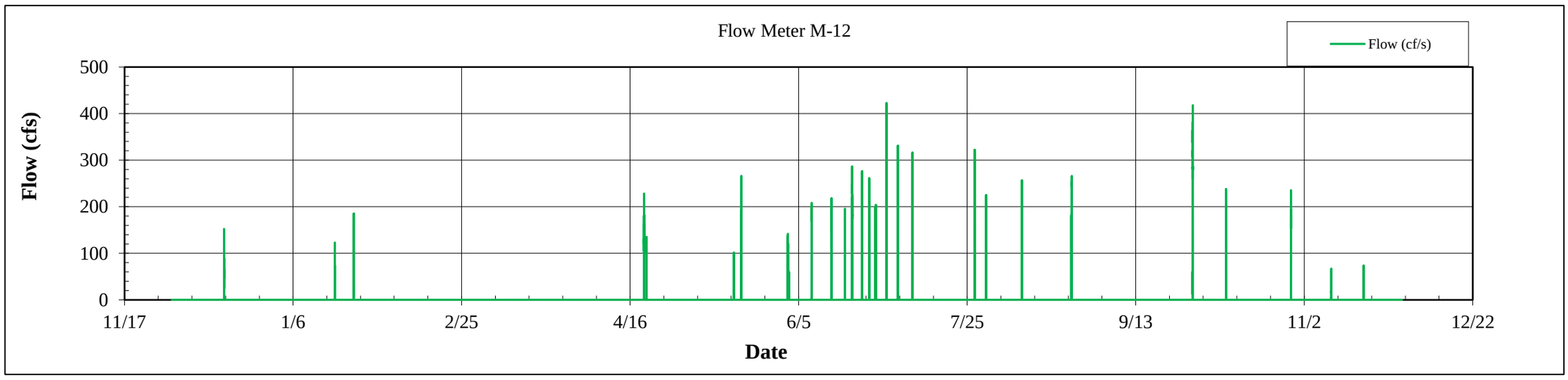


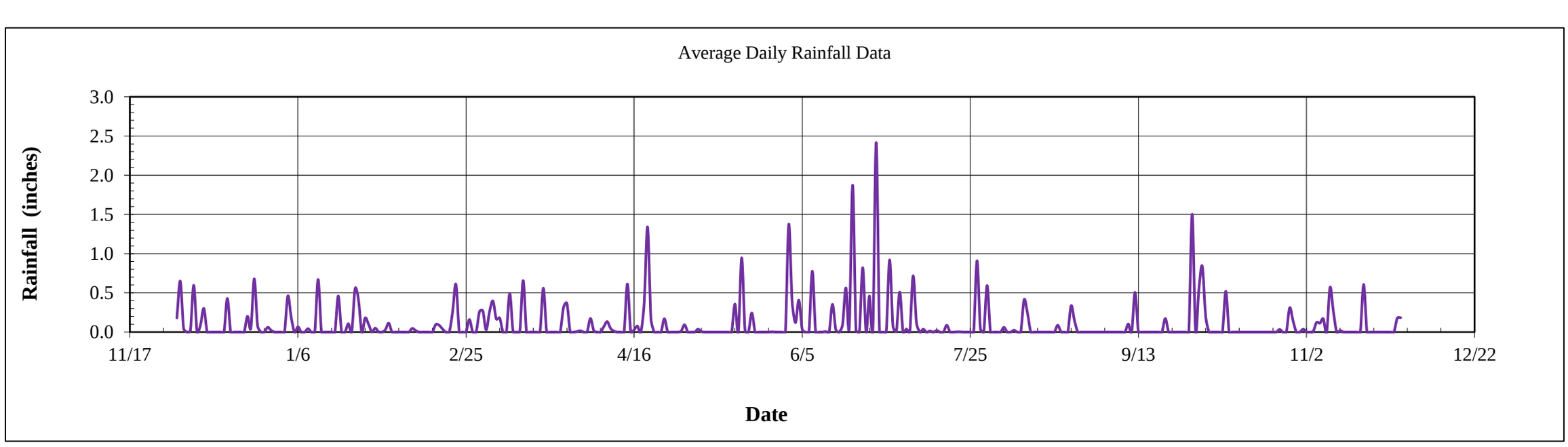


CSO 021 Overflows (21-35-1)

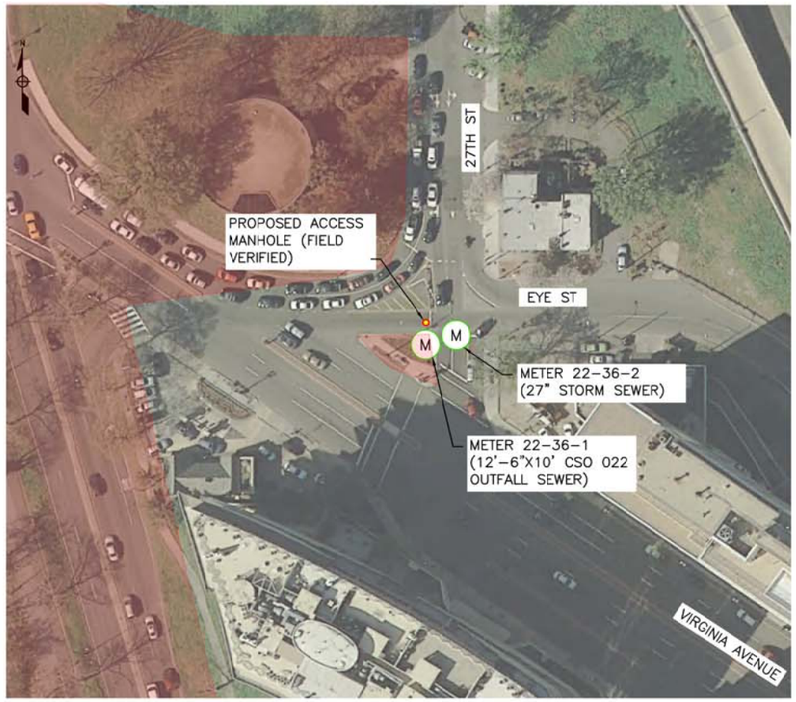






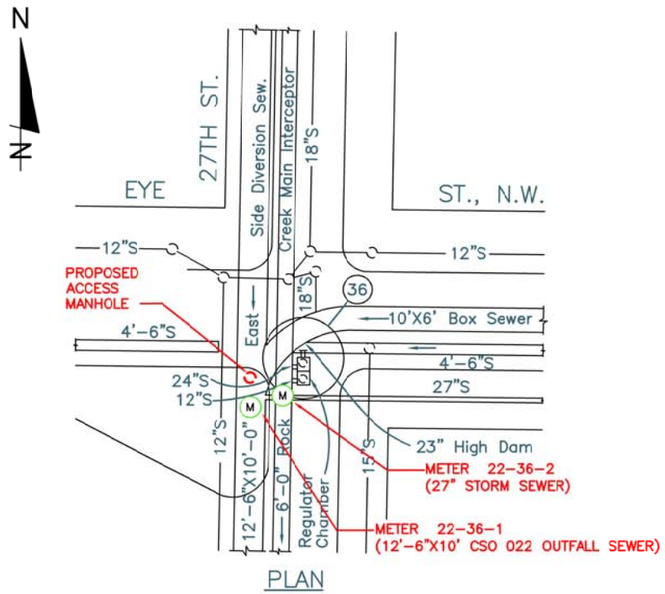


2 – FLOW METERS

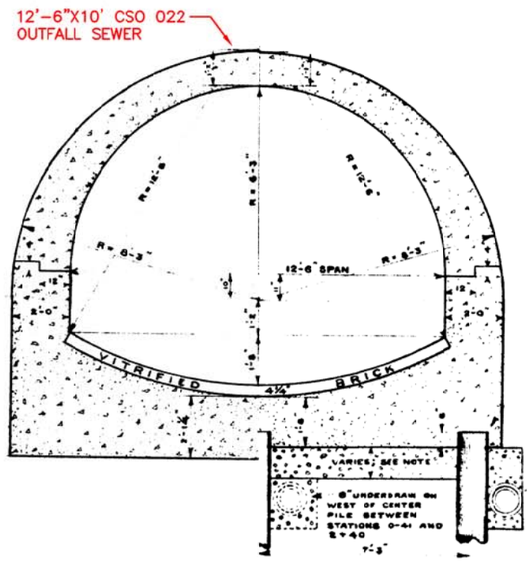


FLOW METER LOCATION PLAN

SCALE: NTS

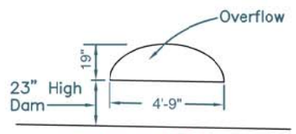


PLAN

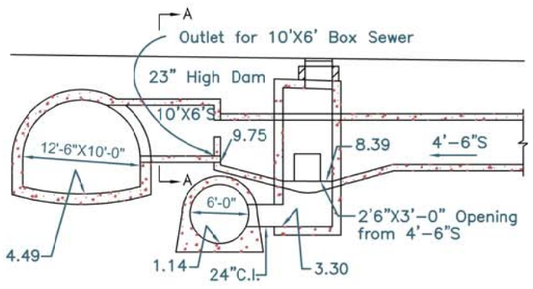


TYPICAL CROSS SECTION A–A

SCALE NTS



SECTION A–A



DETAIL

STRUCTURE – 36 DETAIL

SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

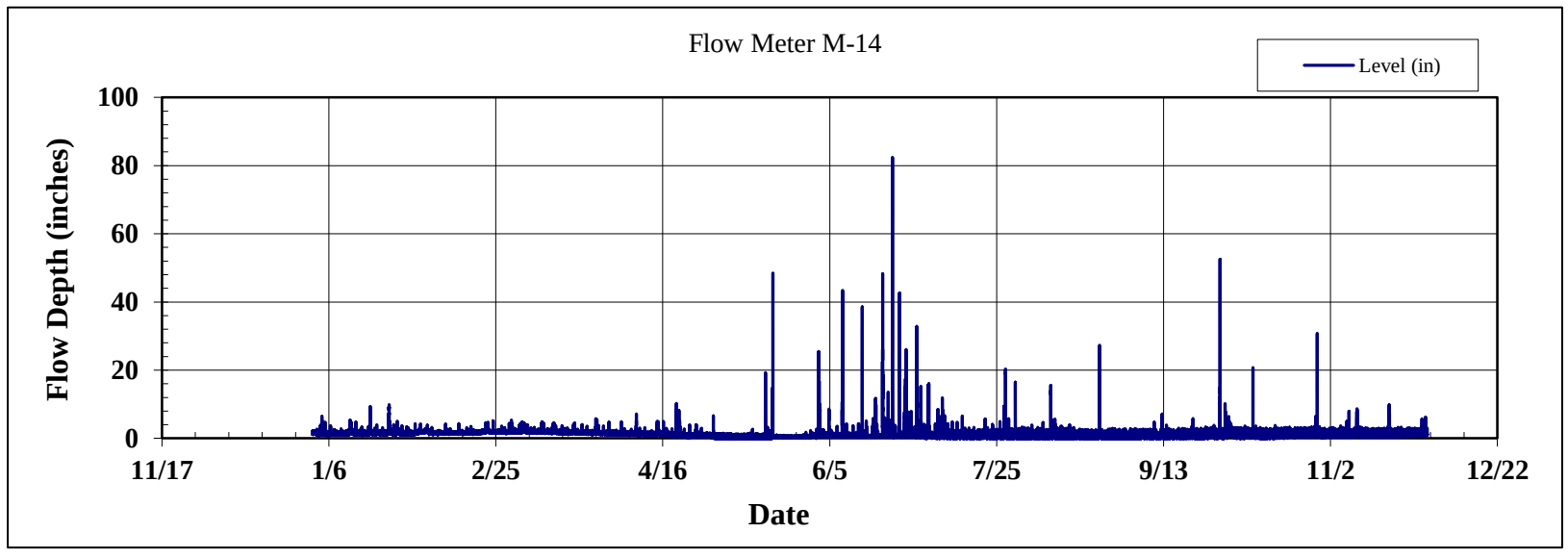
22–36–1_2

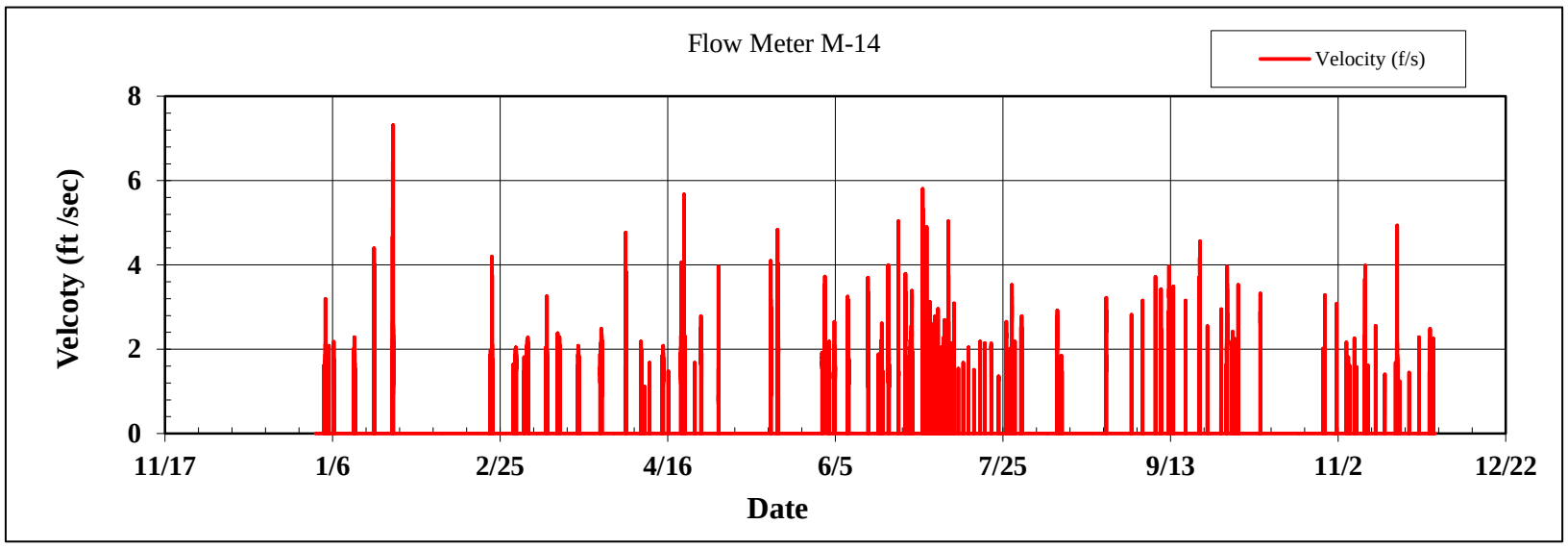
METER LOCATION AND TYPICAL CROSS SECTION

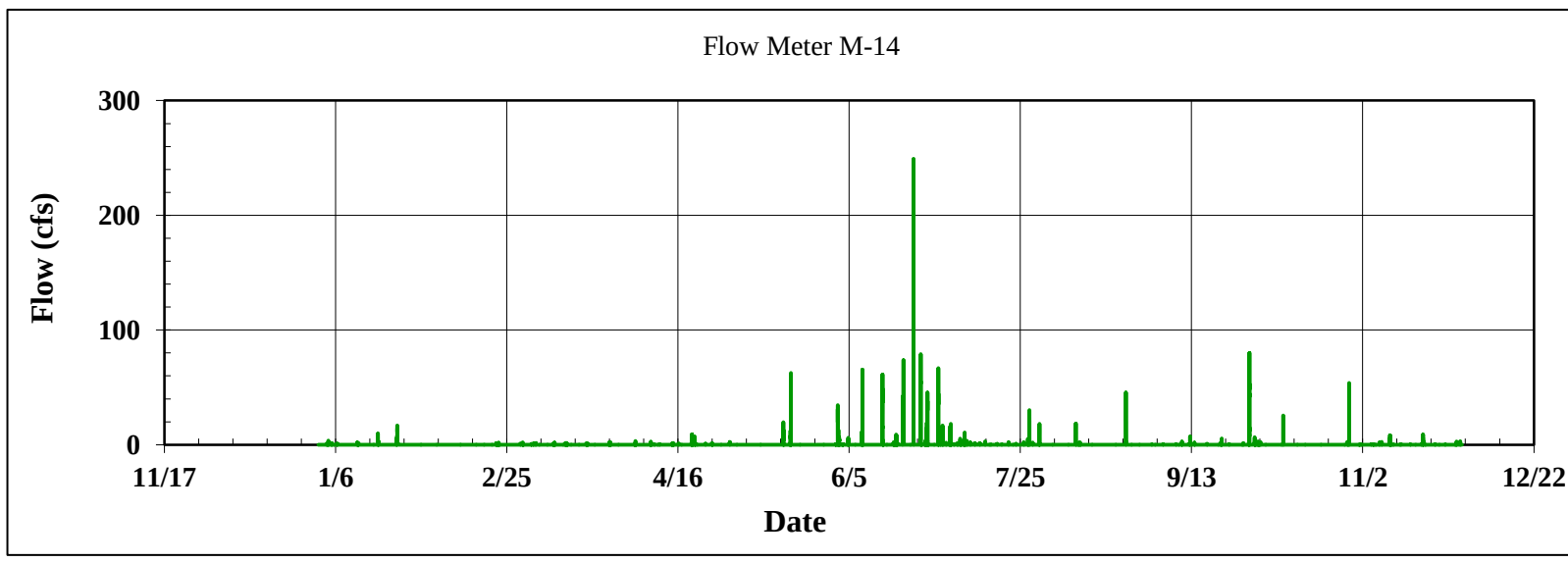
DATE: OCTOBER 2014 | SITE 14

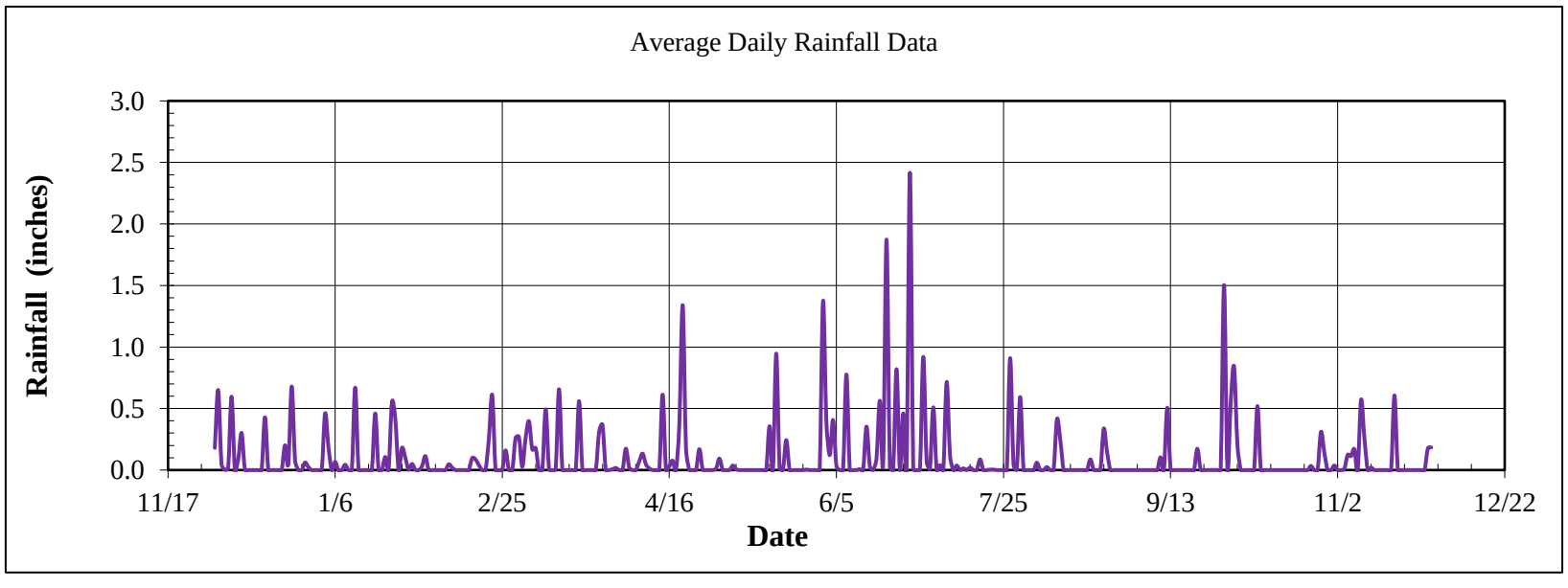
LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 6/16/2015 4:15:17 PM
DRAWING ID: L:\LTCP\DOM\FLOW METER – EXHIBITS\EXHIBITS–FIGURES\14_22–36–1_2.DWG

Outfall Sewer- D/S of 27" Storm Connection (22-36-1)

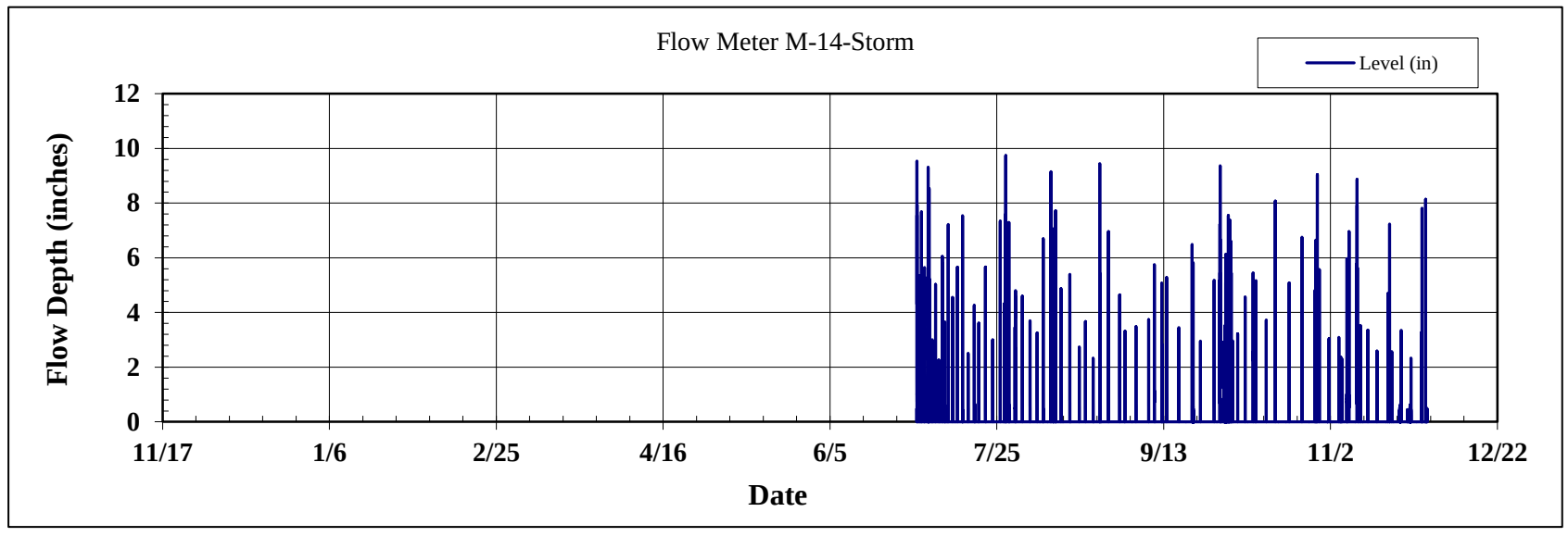


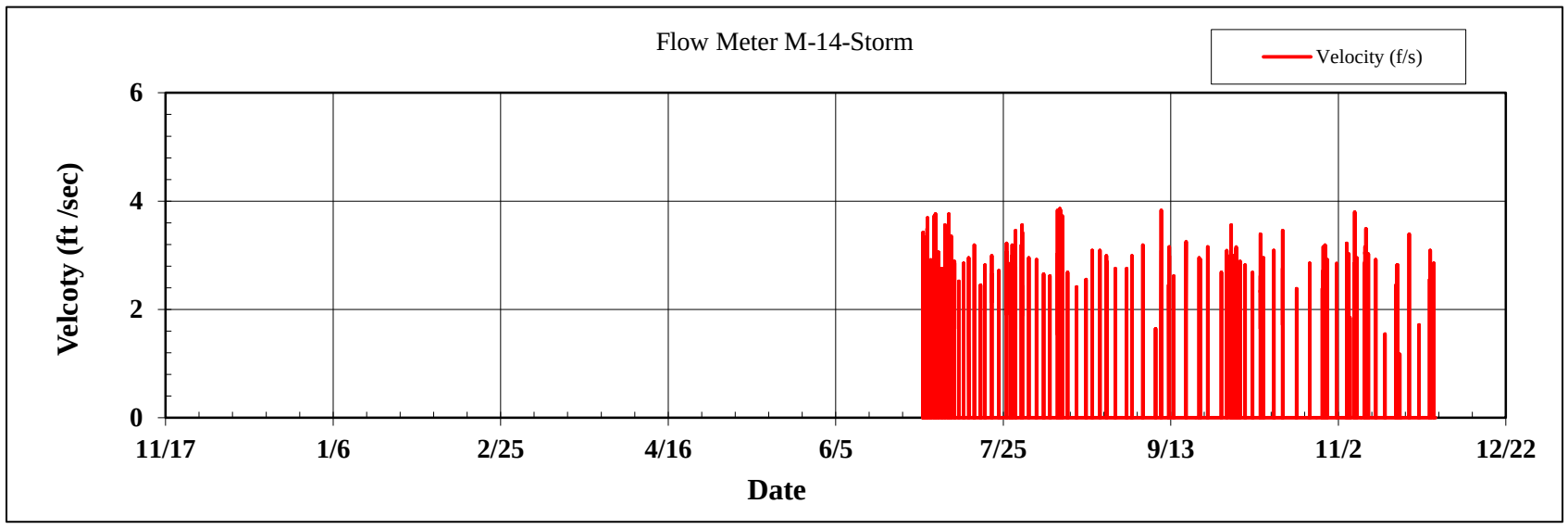


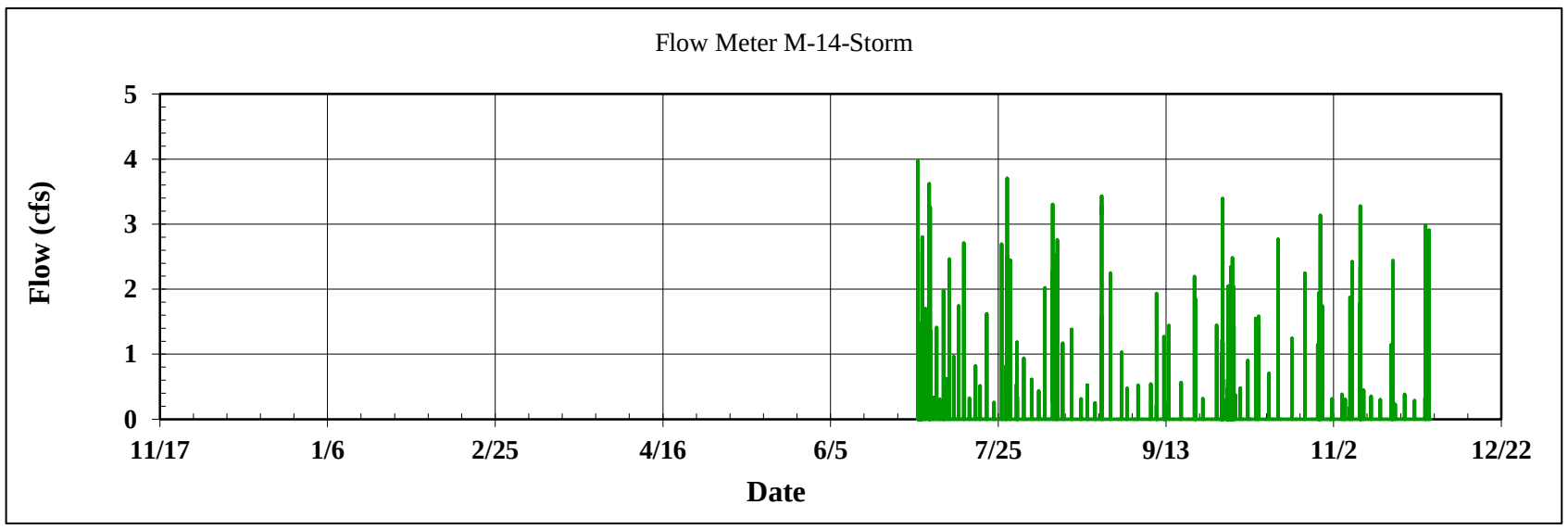


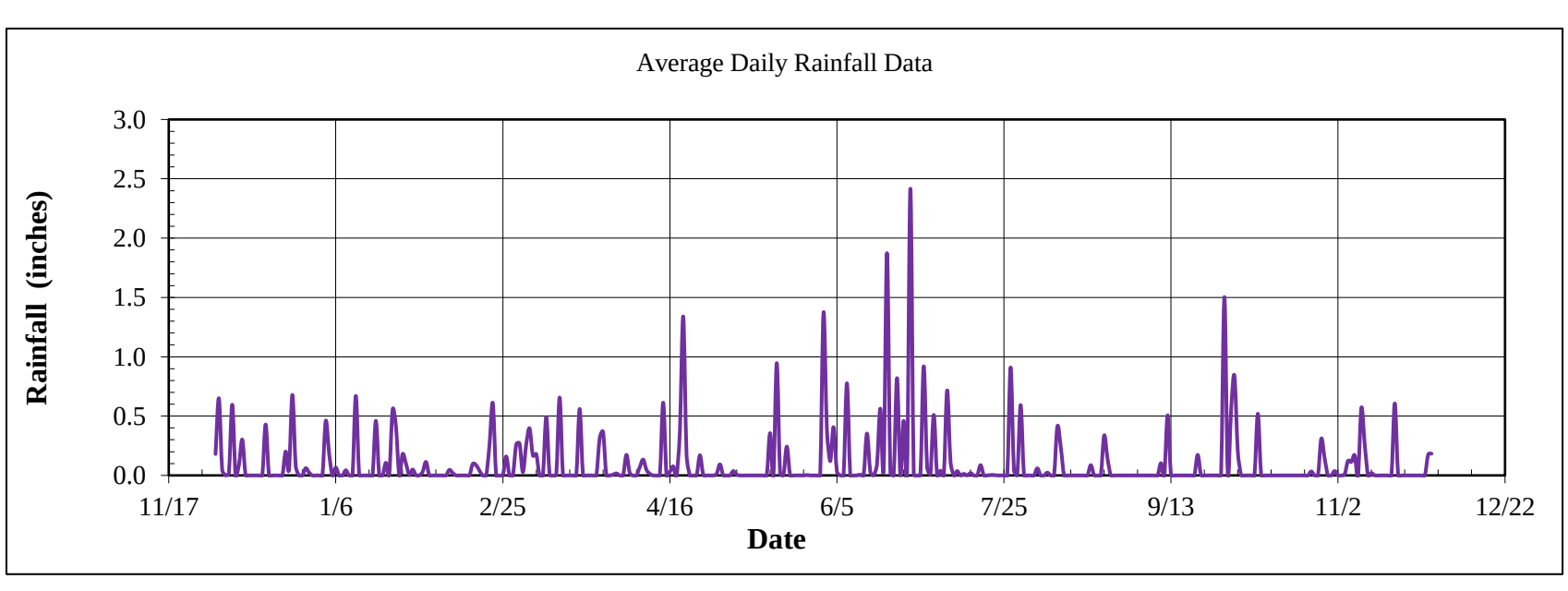


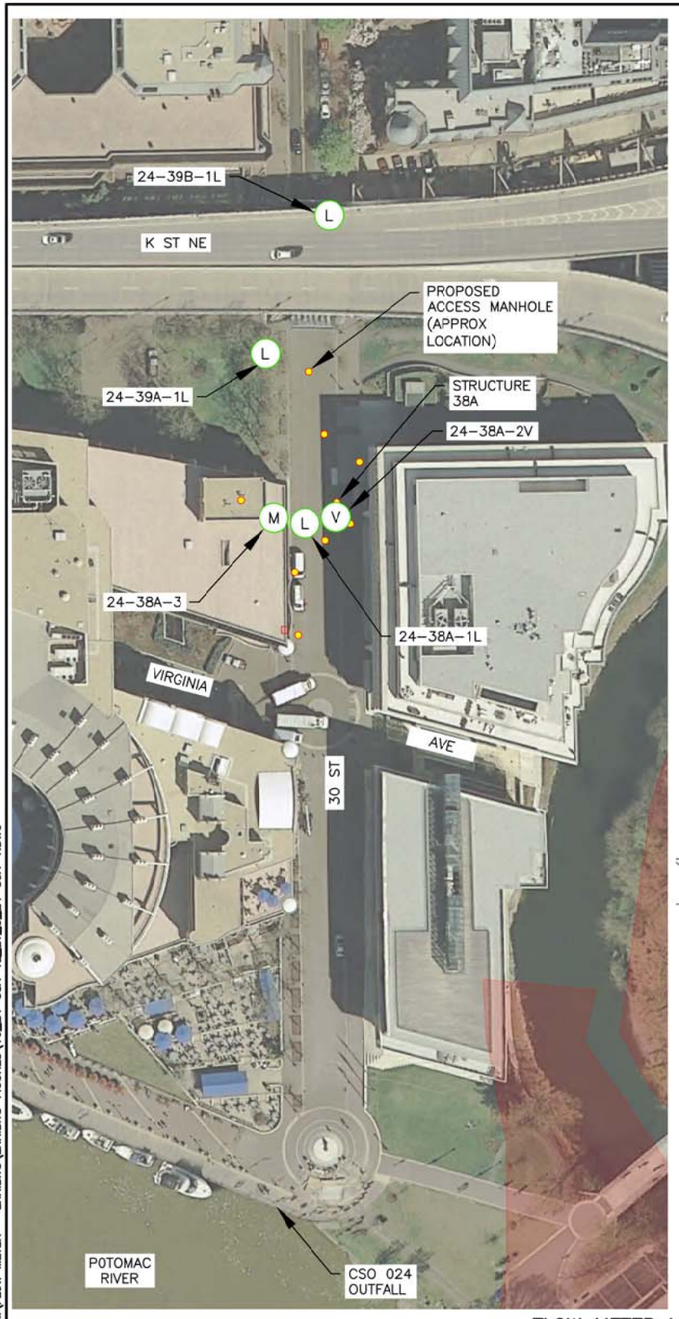
27" Storm Connection D/S of STR 36 (22-36-2)



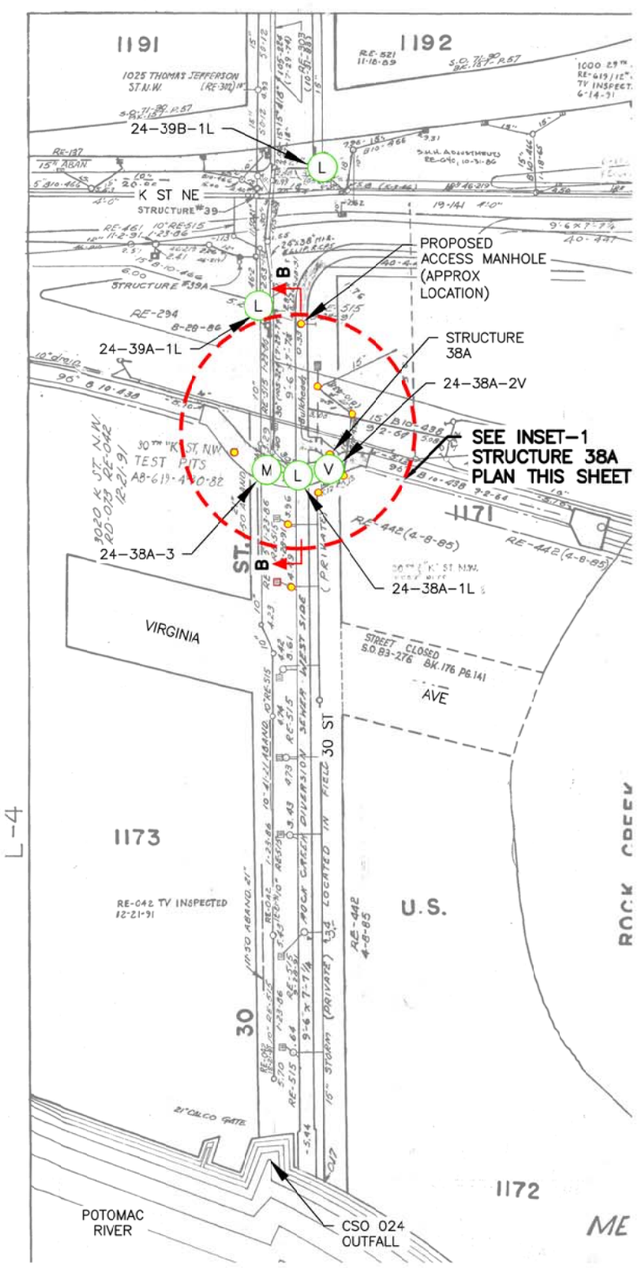


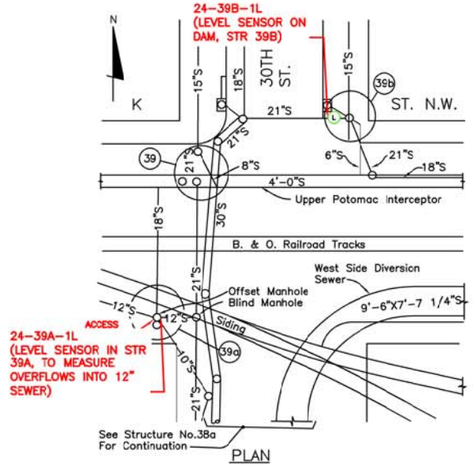


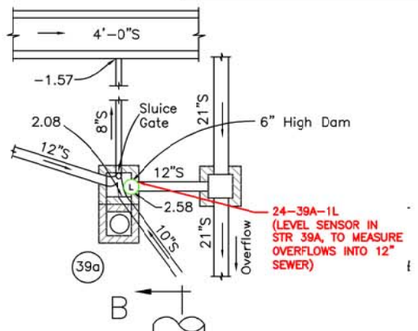




FLOW METER LOCATION PLAN
SCALE: NTS

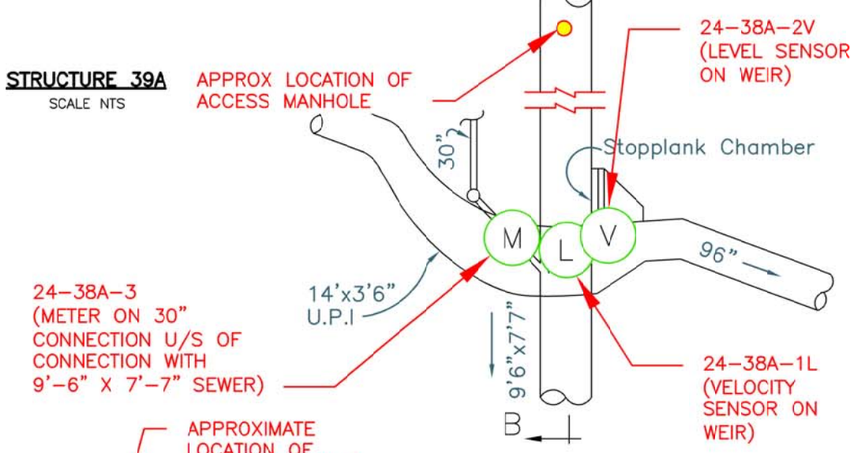


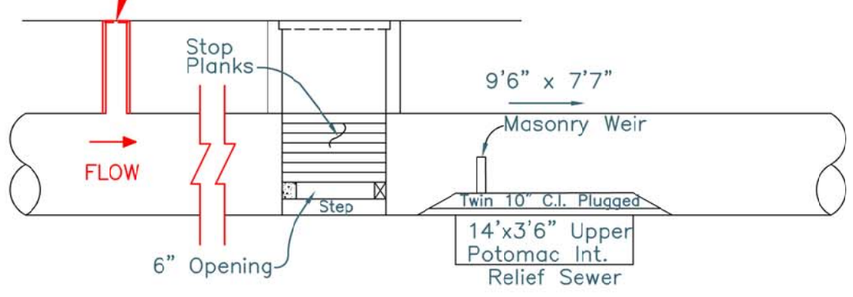




2 – FLOW METERS
3 – LEVEL SENSORS
1 – VELOCITY SENSOR

STRUCTURE 39A
SCALE NTS





INSET–1 STRUCTURE 38A PLAN
SCALE NTS

CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- (L) LEVEL SENSOR LOCATION
- (V) VELOCITY SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
24–38A–1L, 24–38A–2V, 24–38A–3
24–39A–1L,24–39B–1L

DATE: OCTOBER 2014,REV. 7/15 | SITE 16

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 7/30/2015 3:28:53 PM
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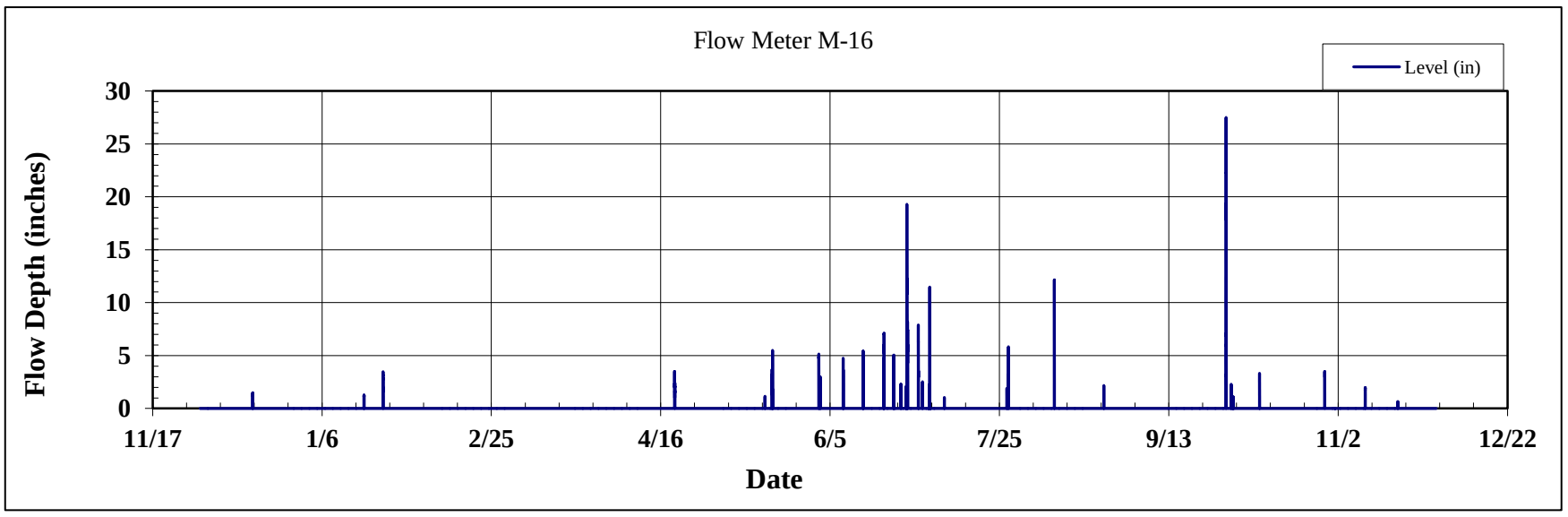
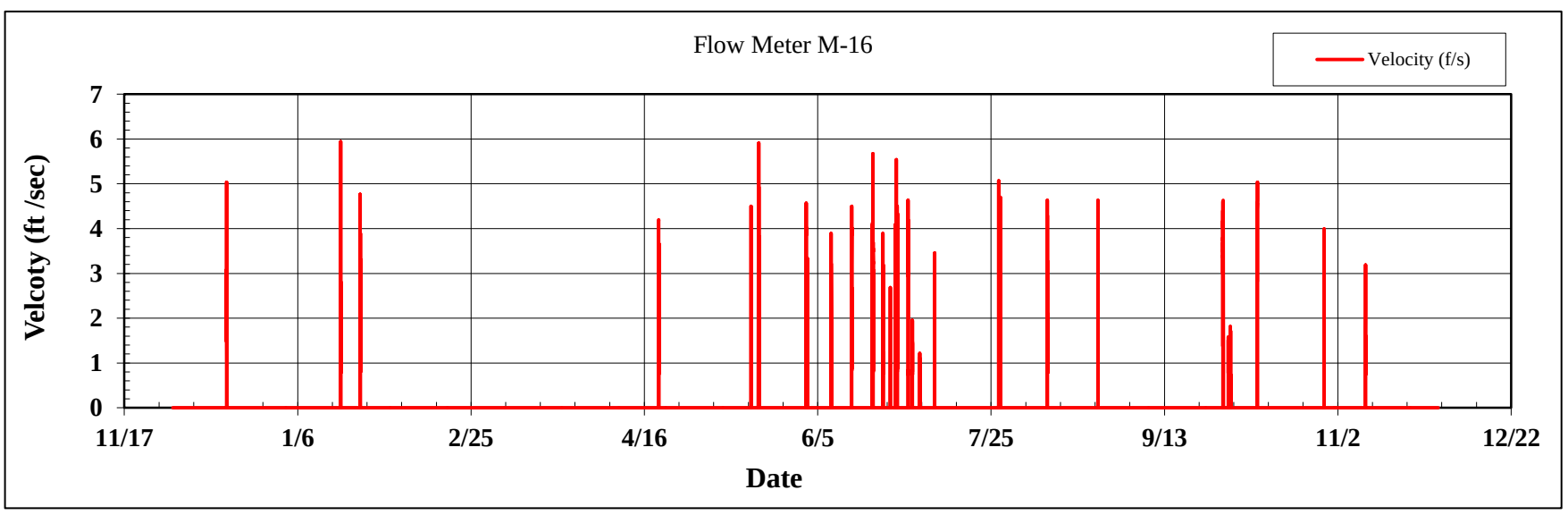
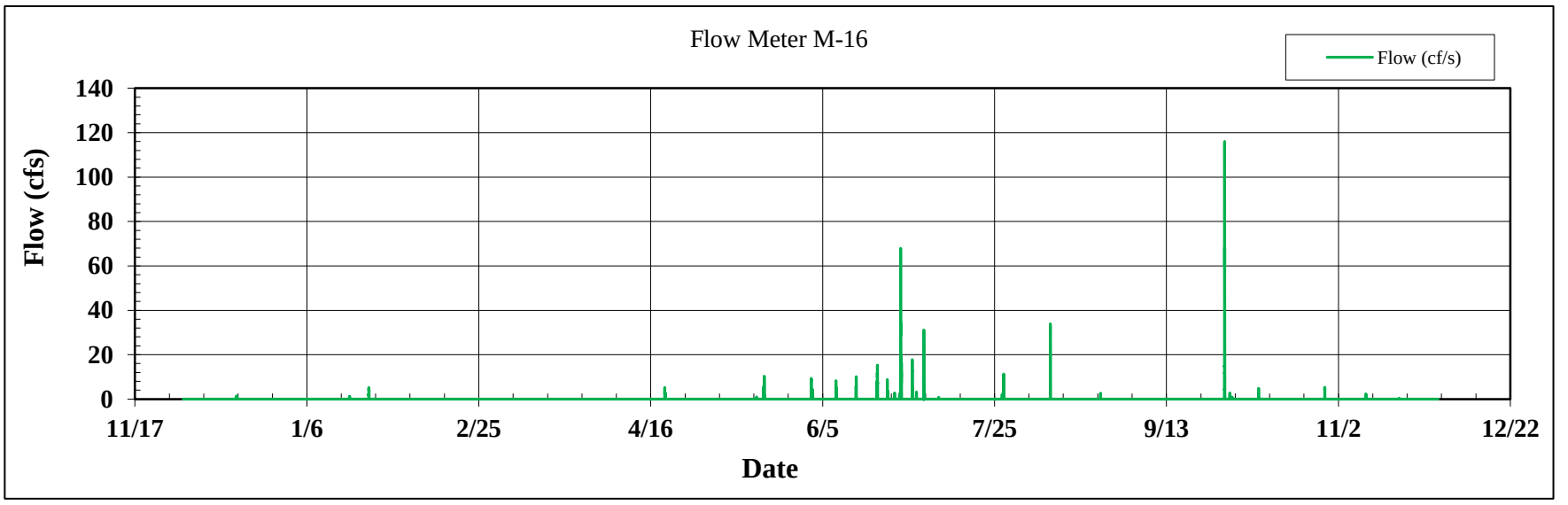
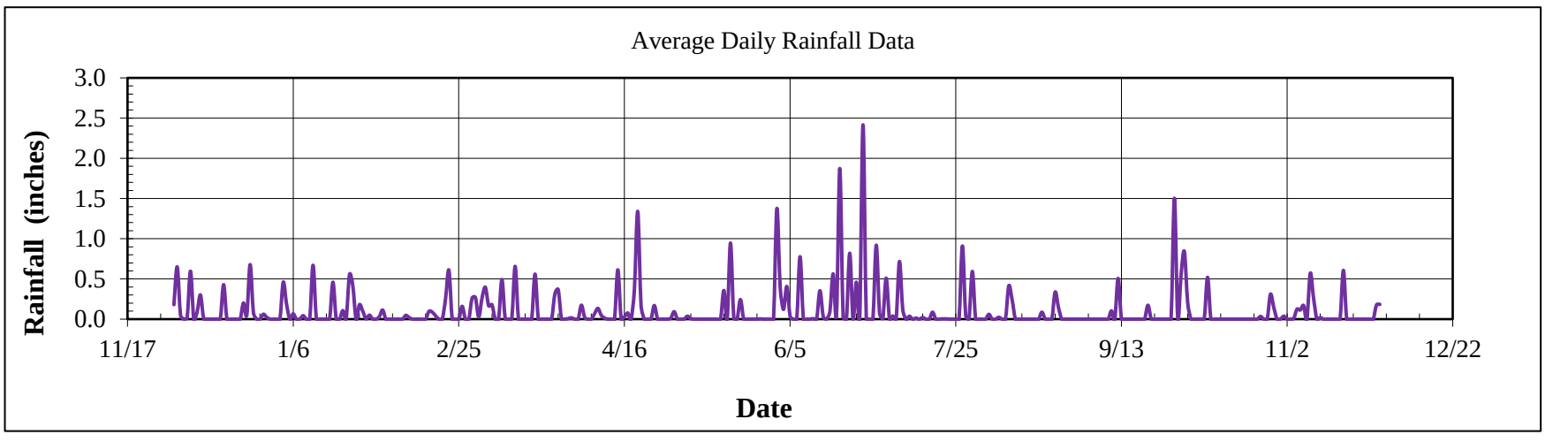
CSO 024- D/S of STR 38A (24-38a-1L, 24-38a-2V)

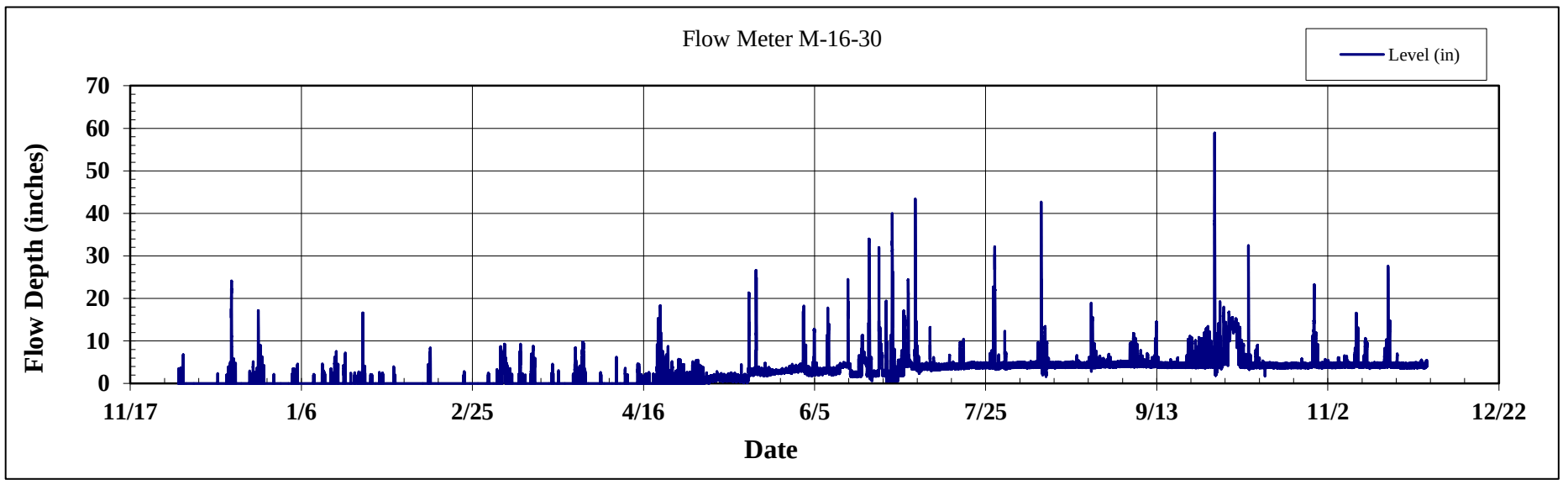


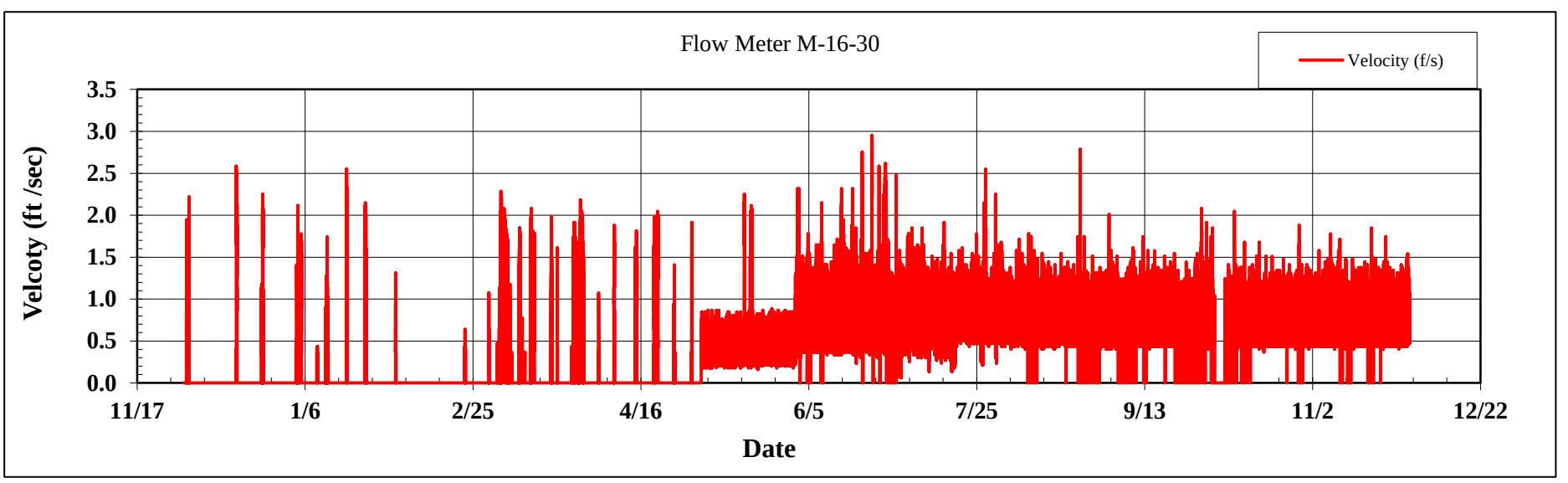


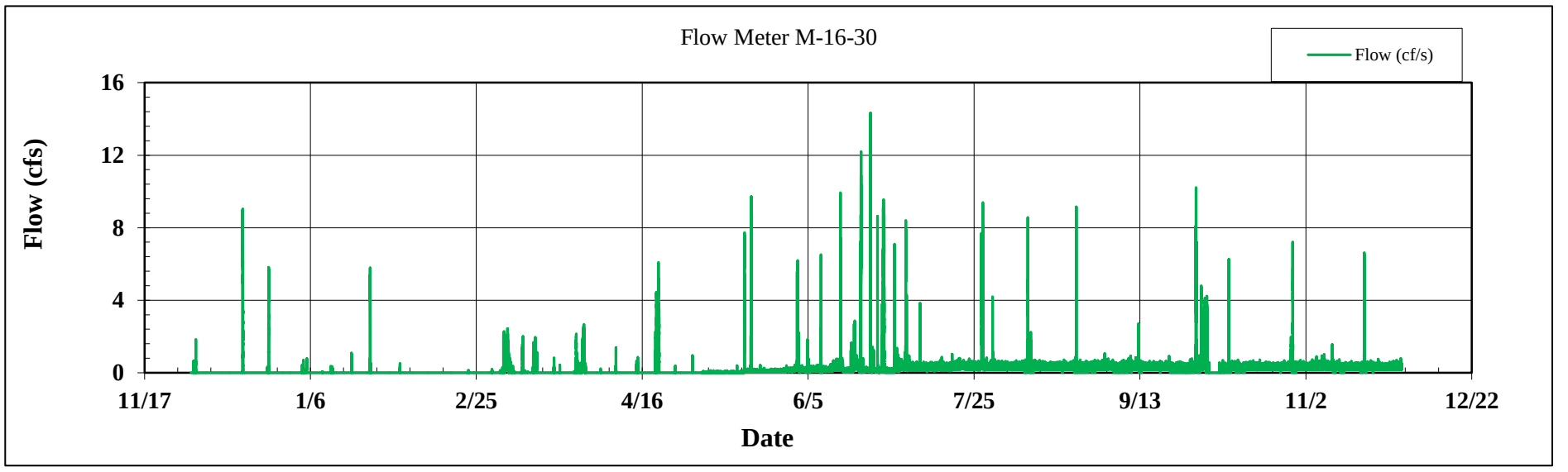


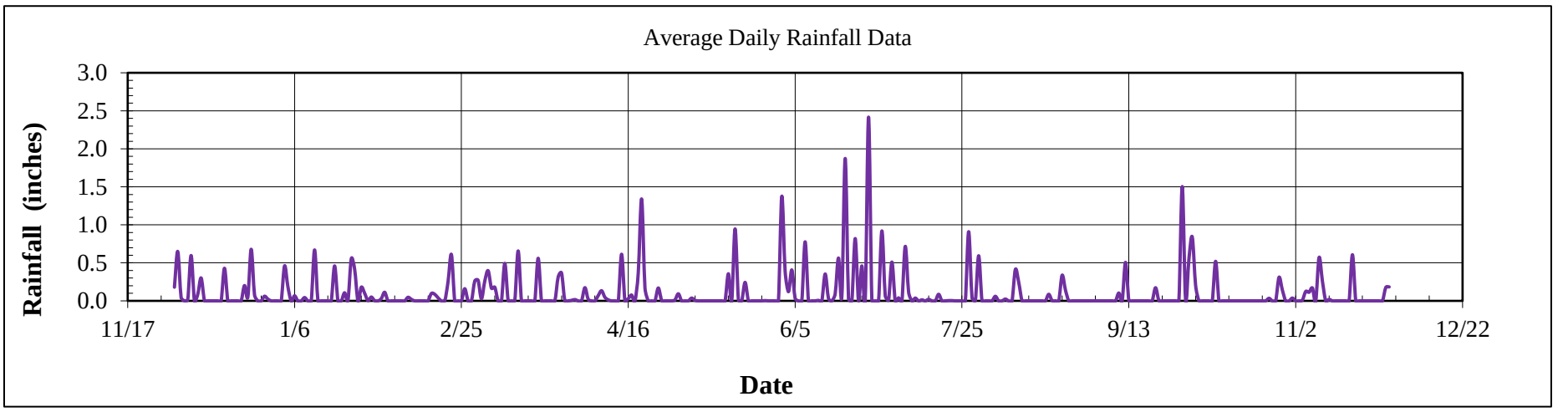


30" Connection to CSO 024- D/S of STR 38A (24-38a-3)

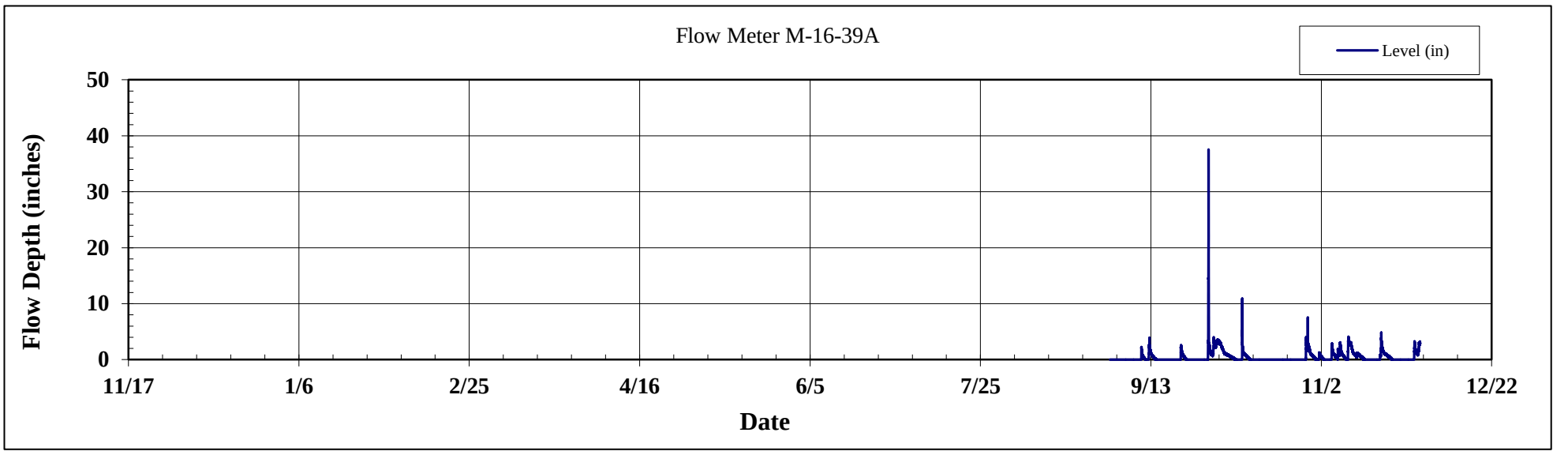


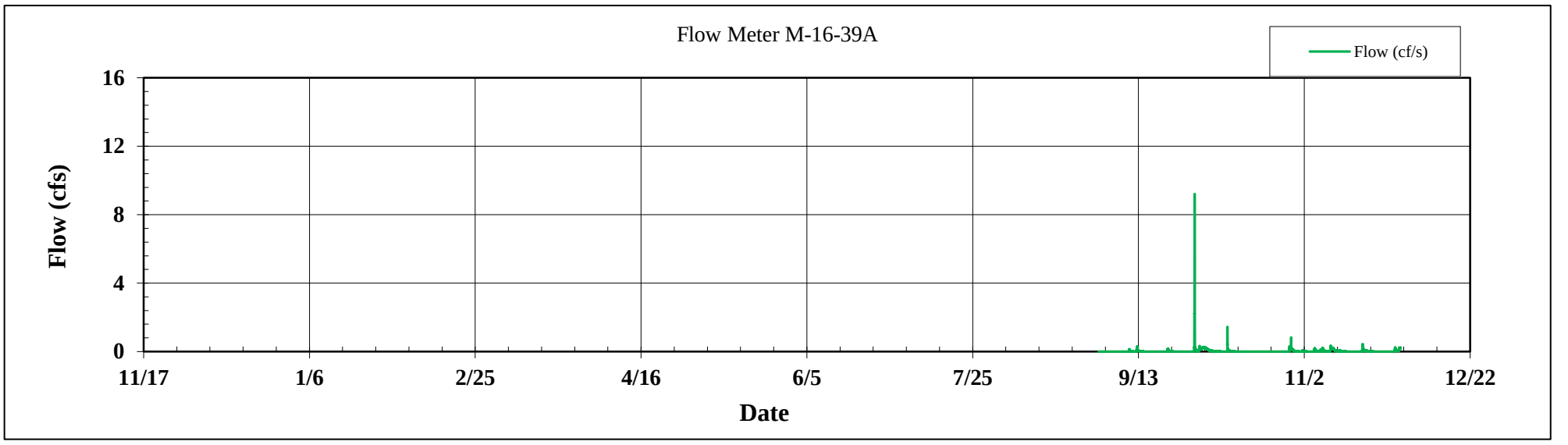


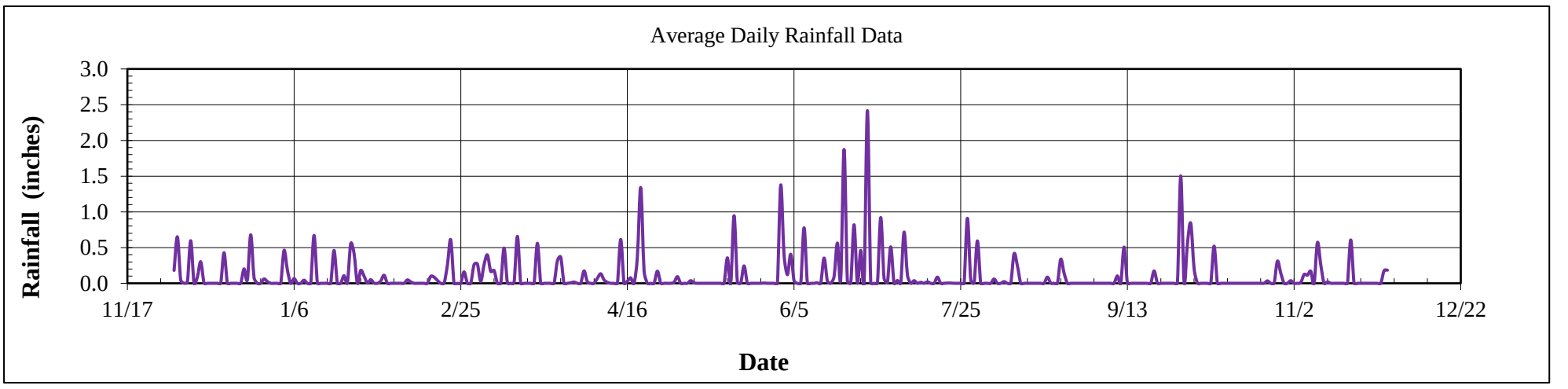




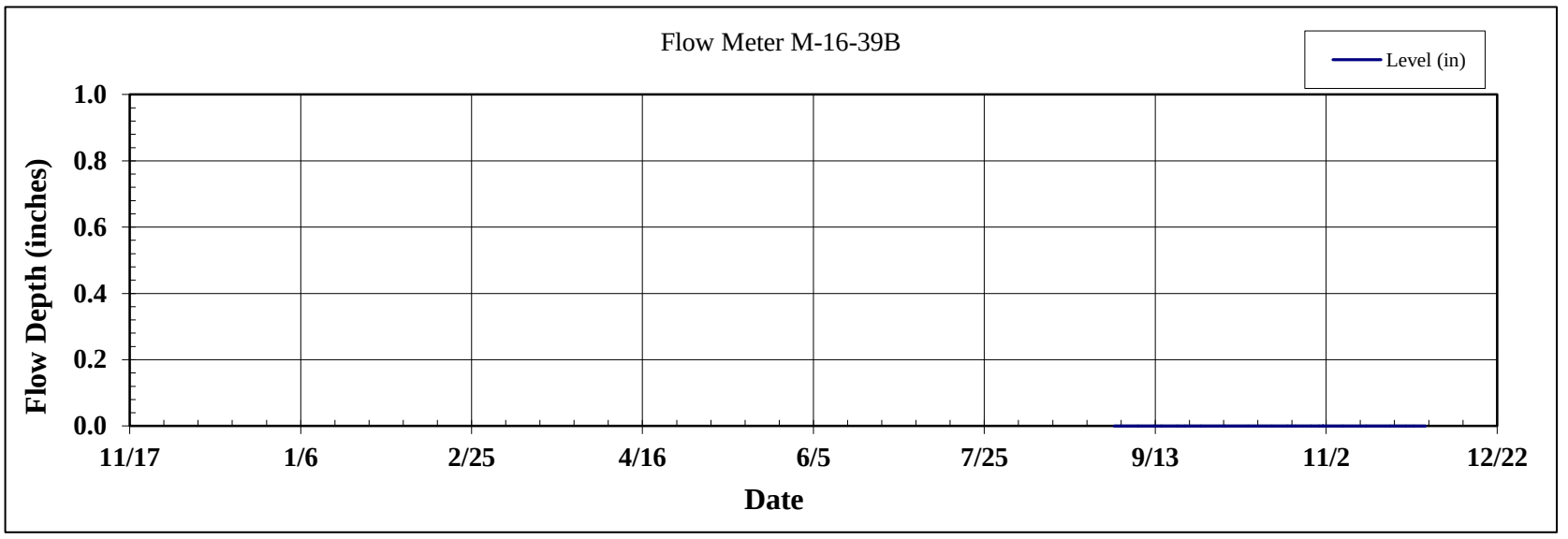
12" Overflow to CSO 024- D/S of STR 39A (24-39a-1L)

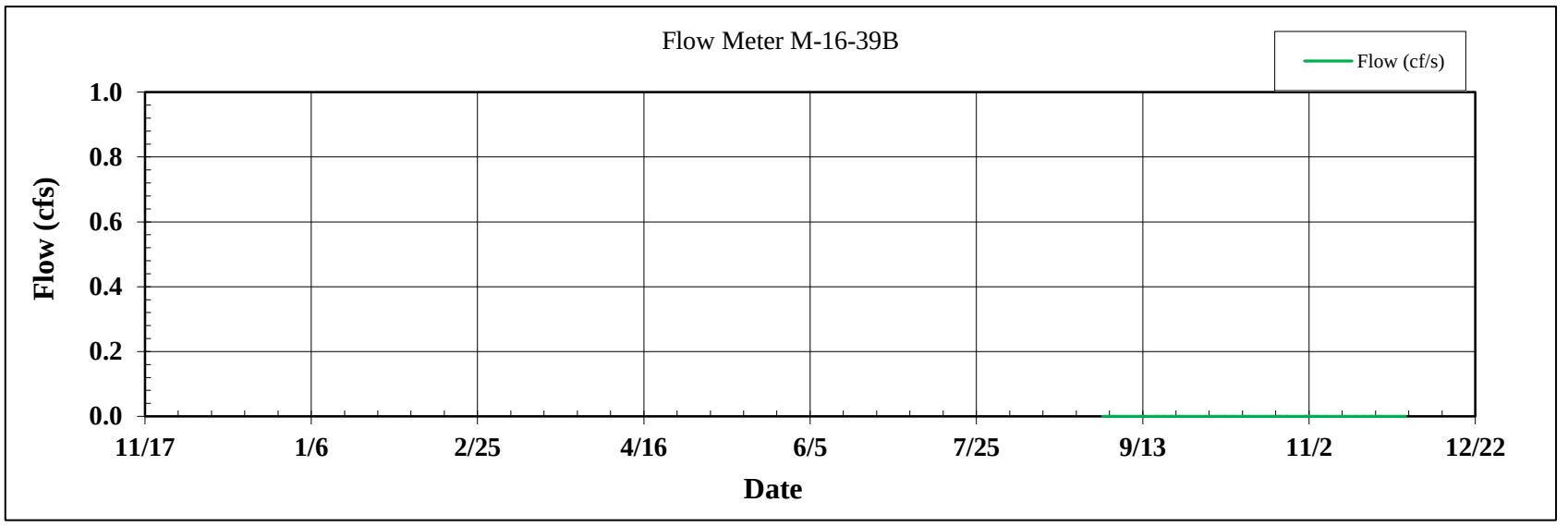


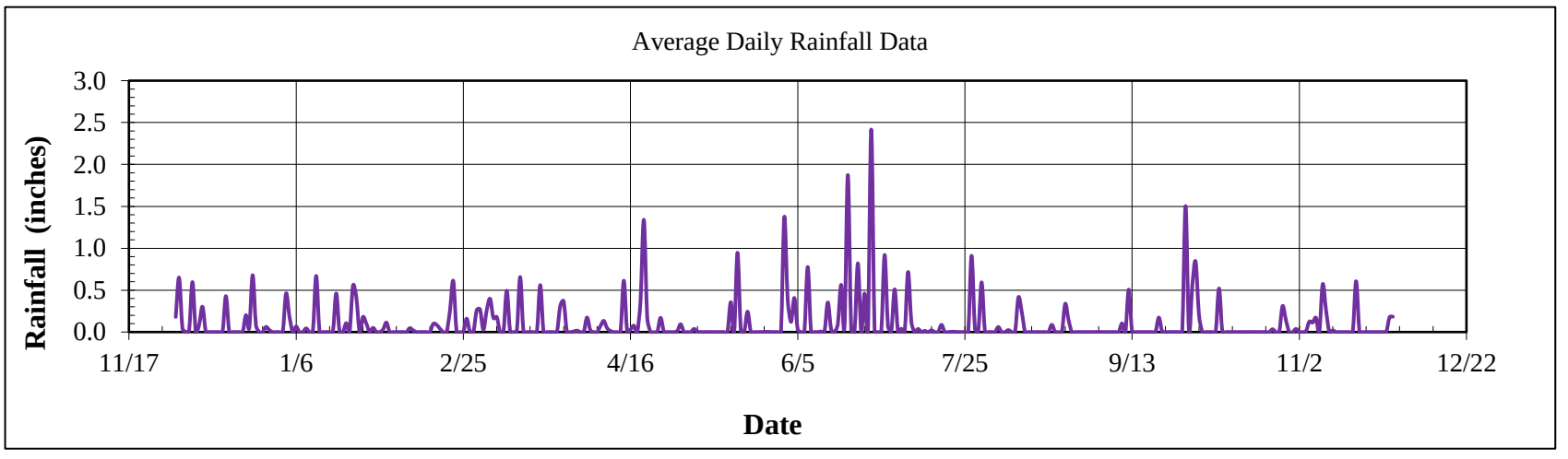




21" Overflow to CSO 024- D/S of STR 39b (24-39b-1L)

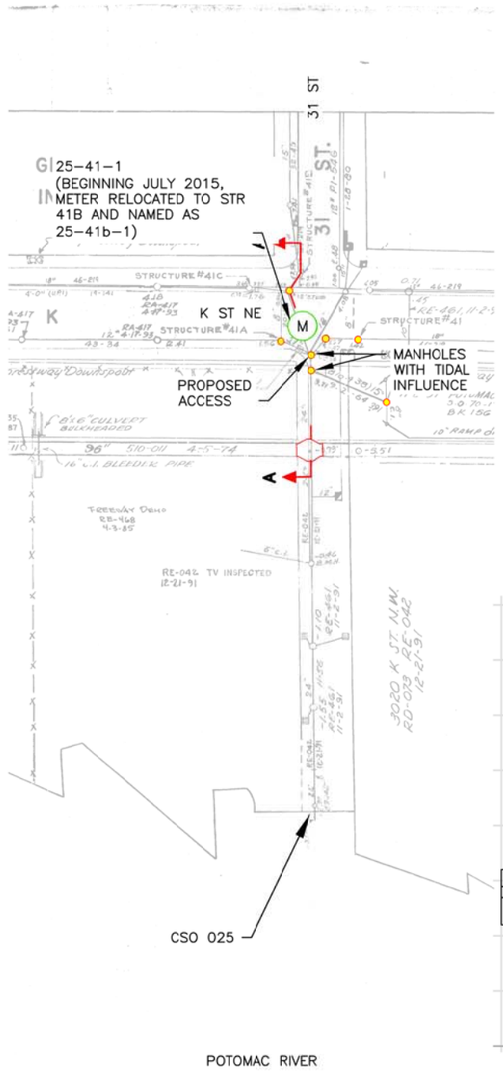


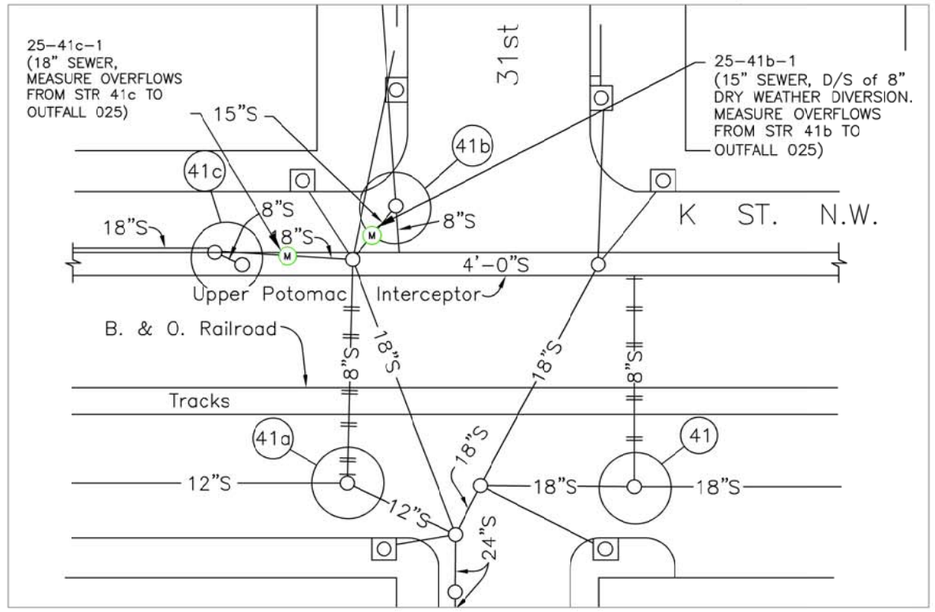


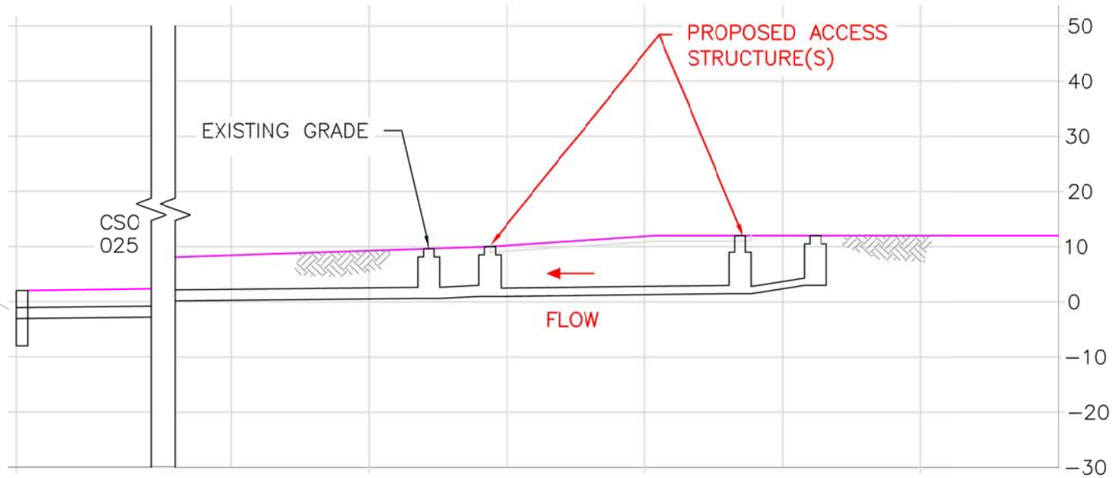


2 – FLOW METERS

FLOW METER LOCATION PLAN
SCALE: NTS







CROSS SECTION A–A (SEWER PROFILE)
SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

25–41b–1 & 25–41c–1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014,Rev 7/'15 | SITE 18

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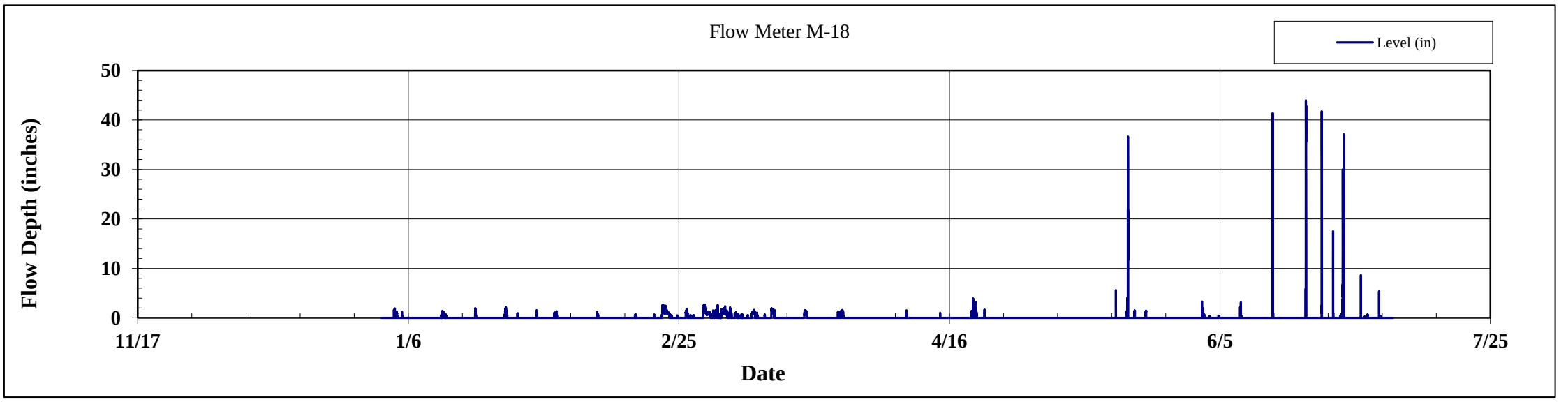
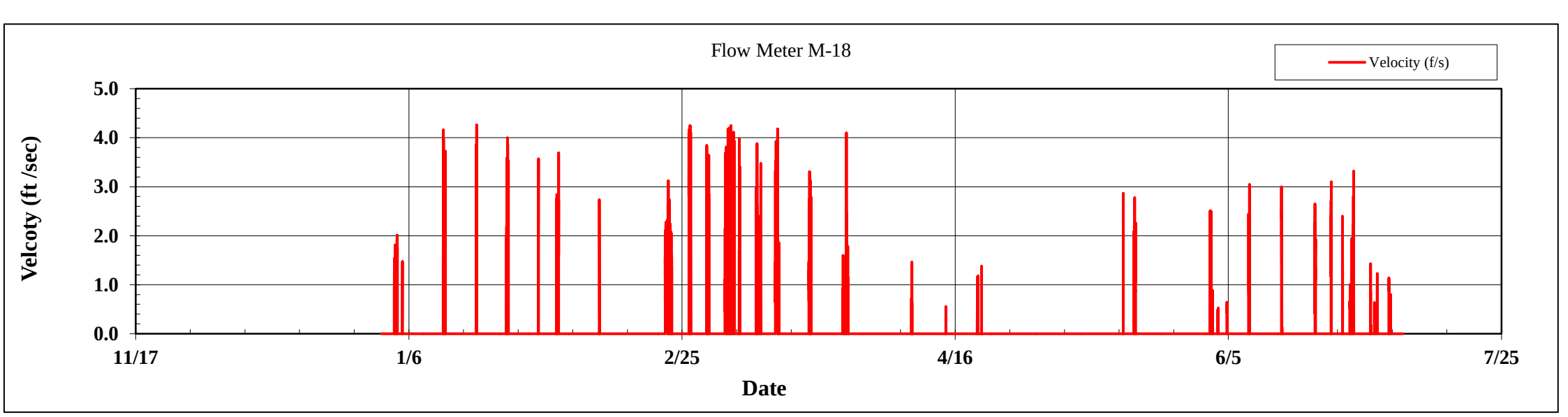
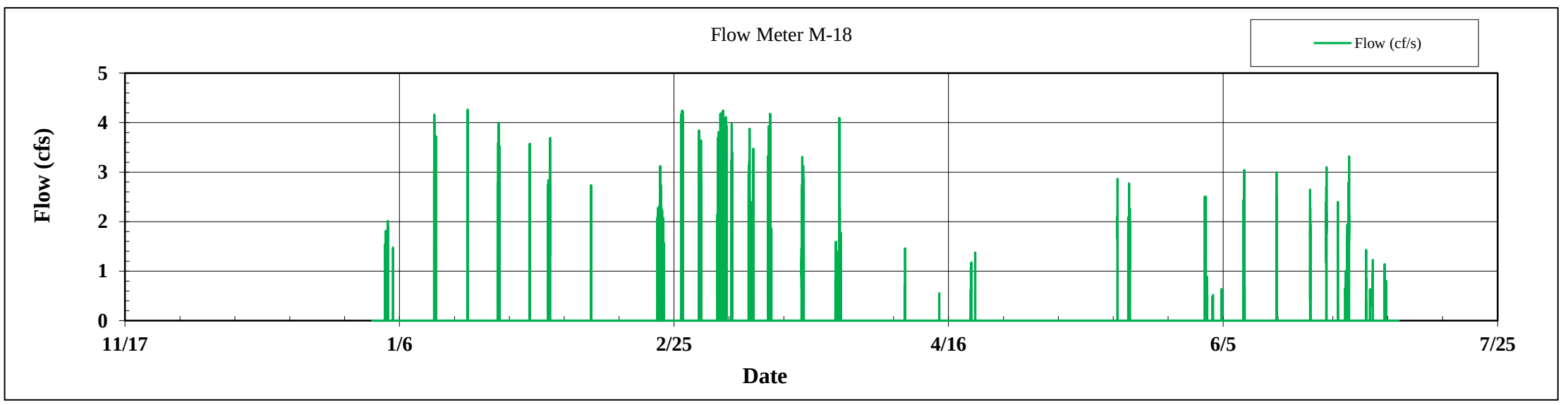
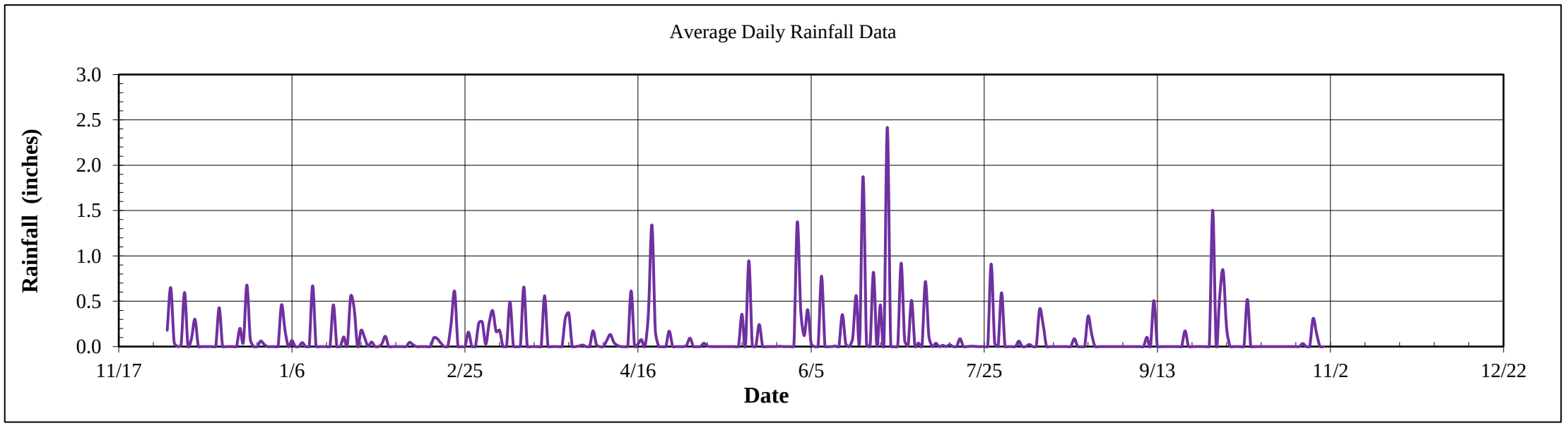
CSO 025 Outfall Sewer- D/S of STR 41 (25-41-1)

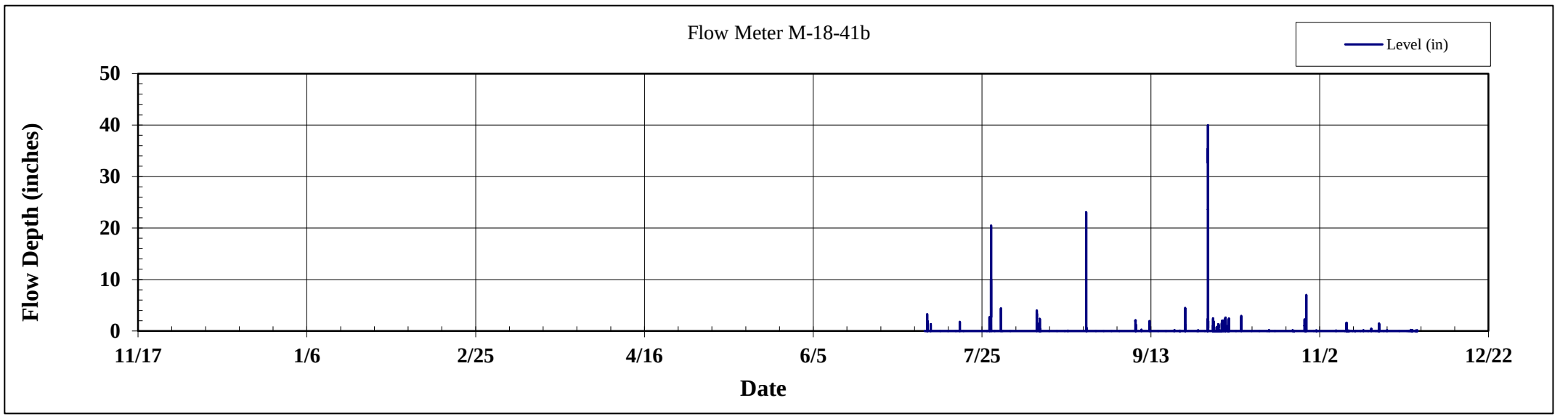


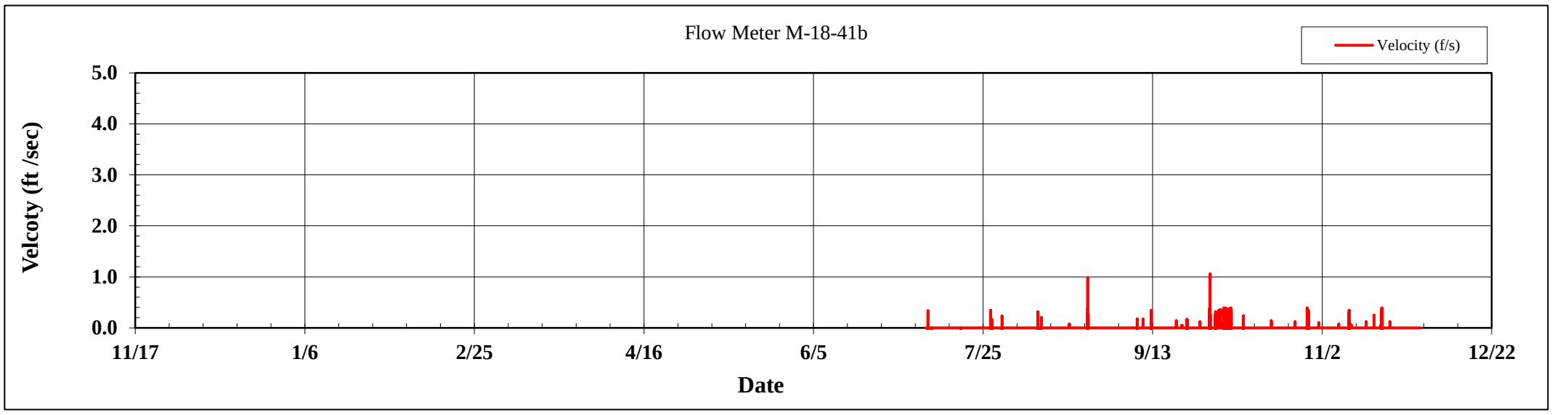


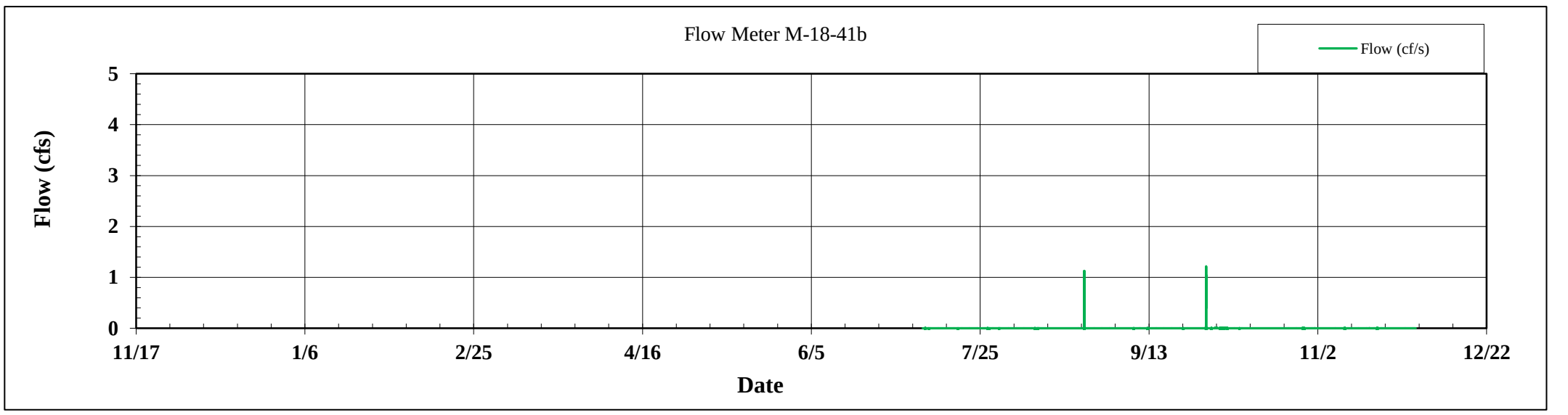


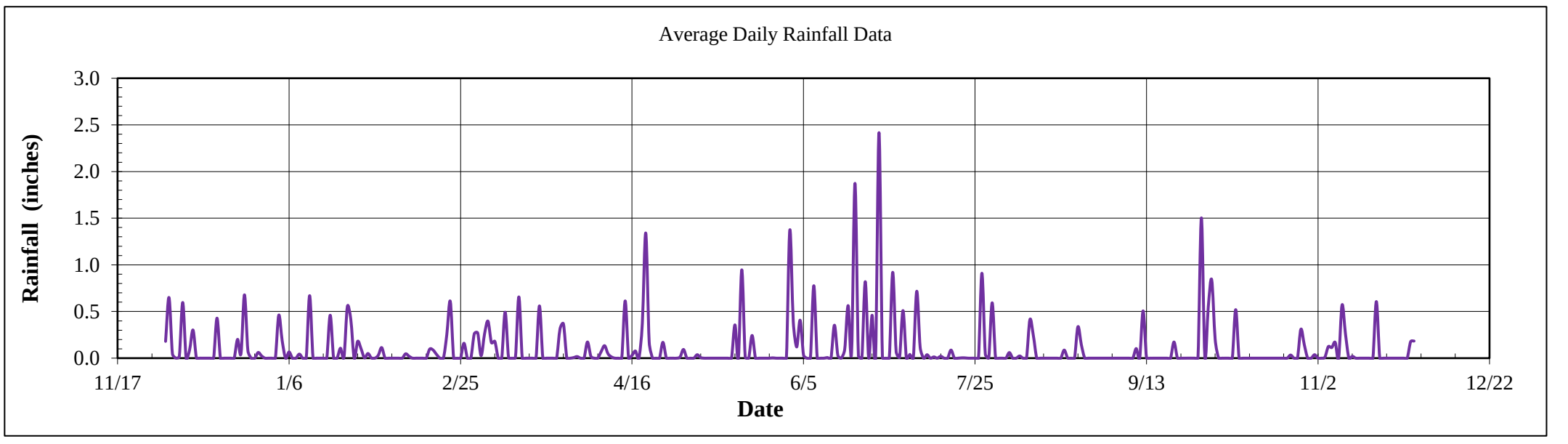


CSO 025 Outfall Sewer- Overflows from STR 41b (25-41b-1)

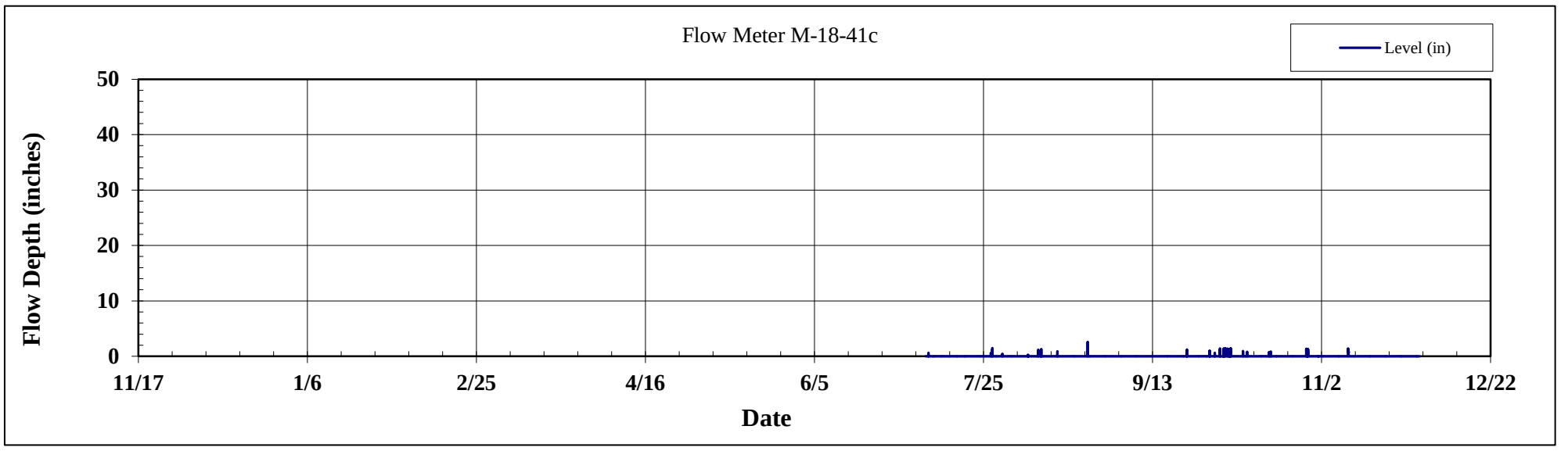


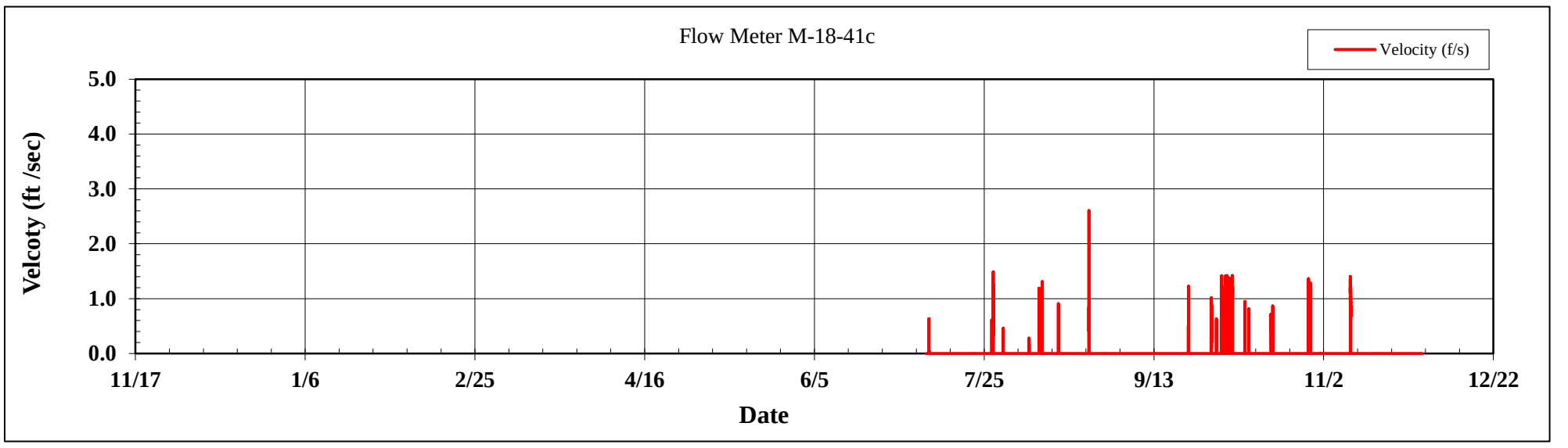


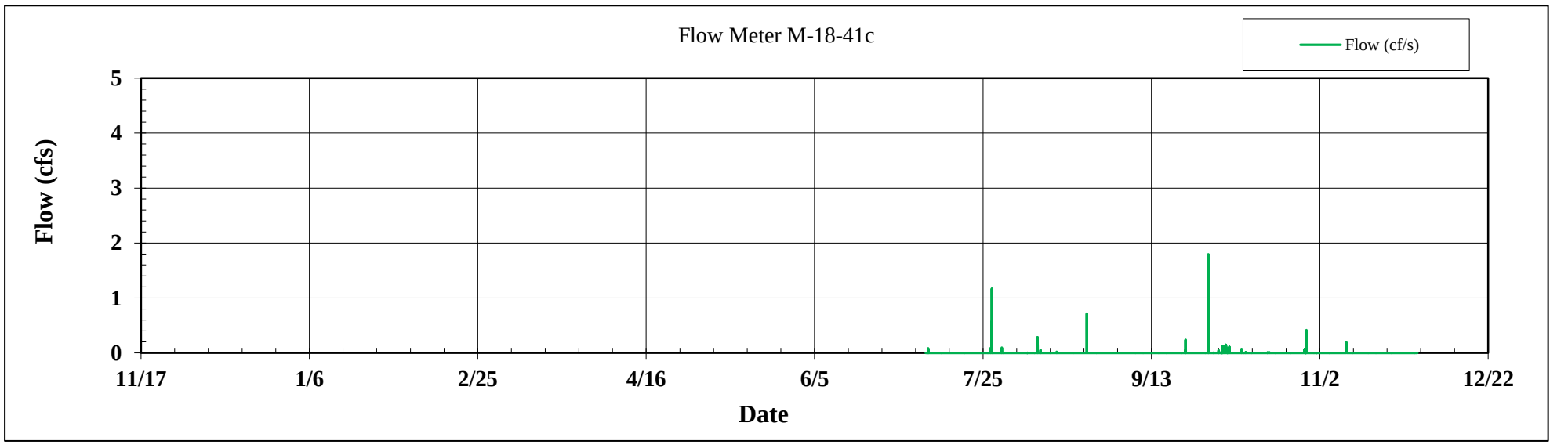


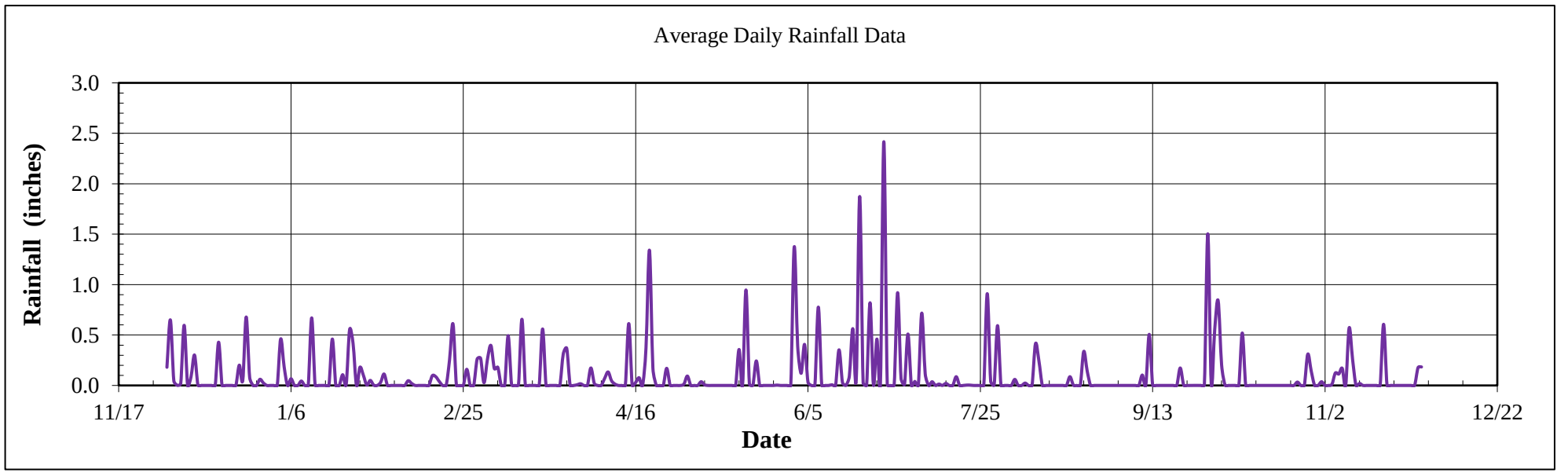


CSO 025 Outfall Sewer- Overflows from STR 41c (25-41c-1)

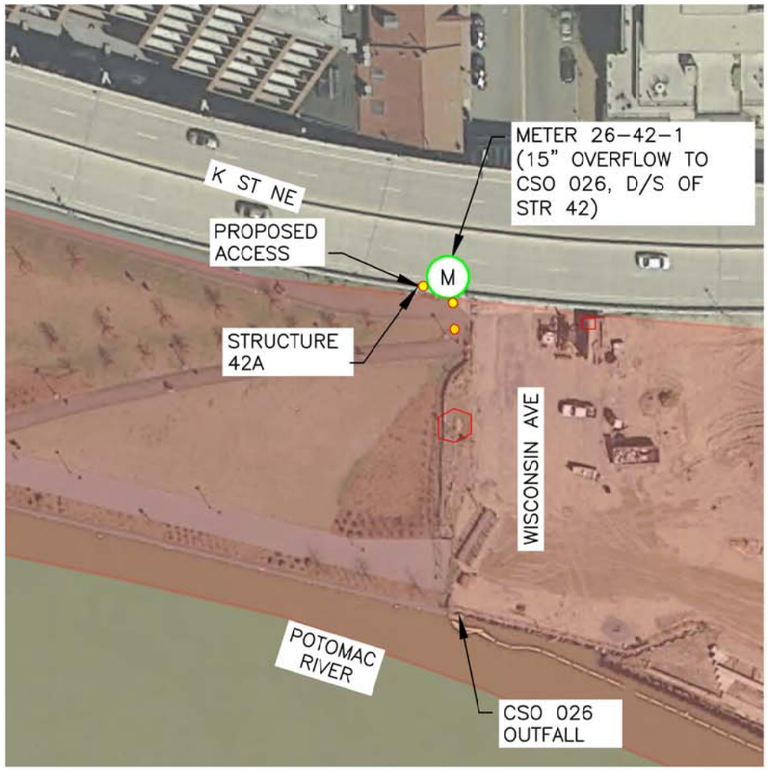




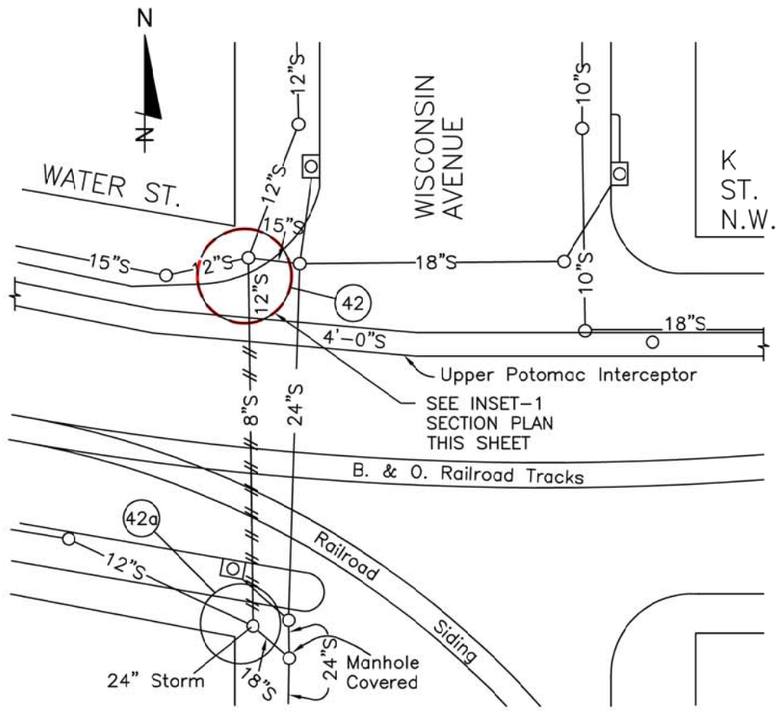


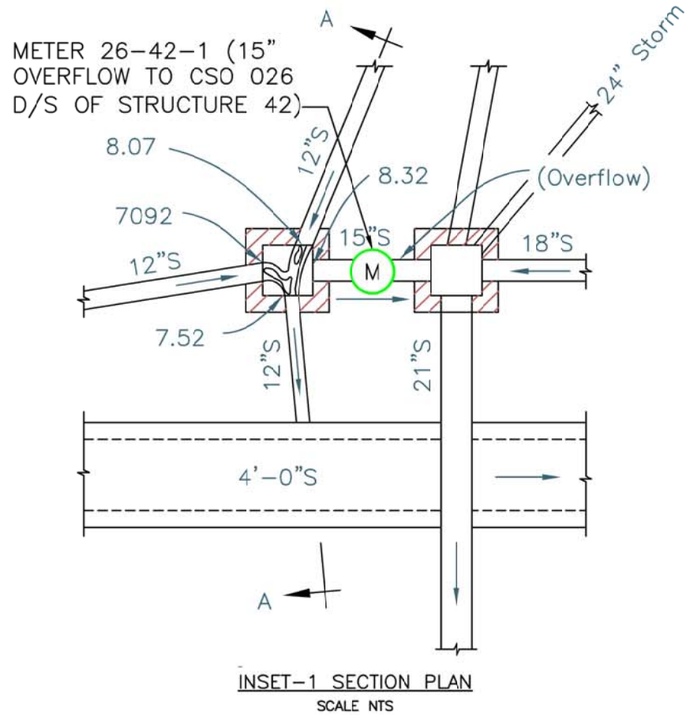


1 – FLOW METER

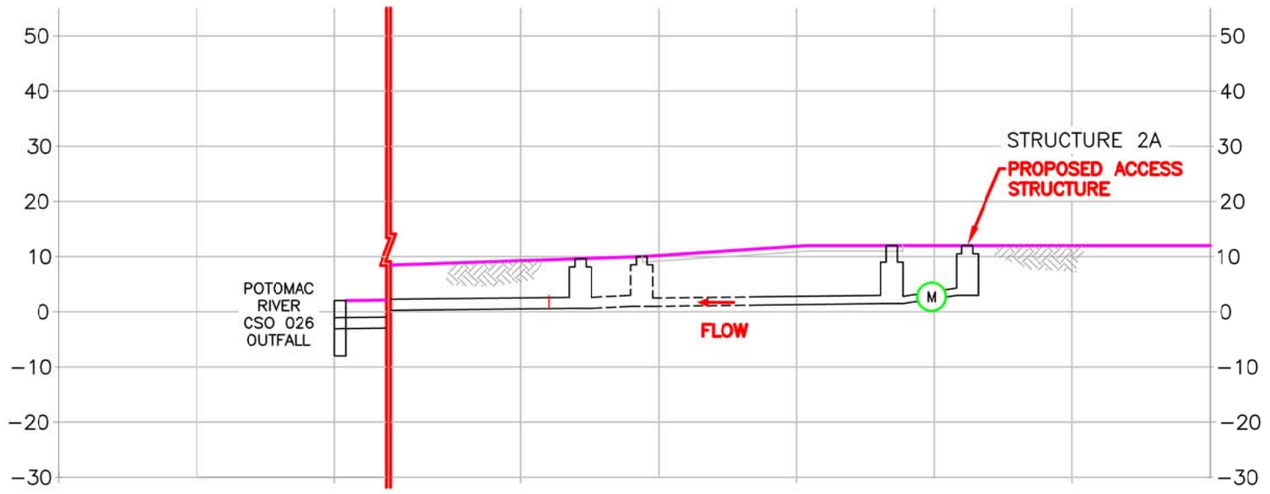


FLOW METER LOCATION PLAN
SCALE: NTS

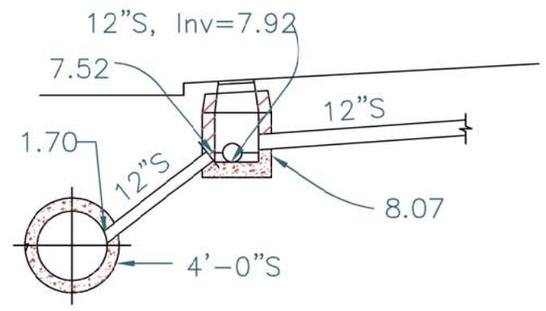




INSET–1 SECTION PLAN
SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS



SECTION A–A

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
26–42–1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 19

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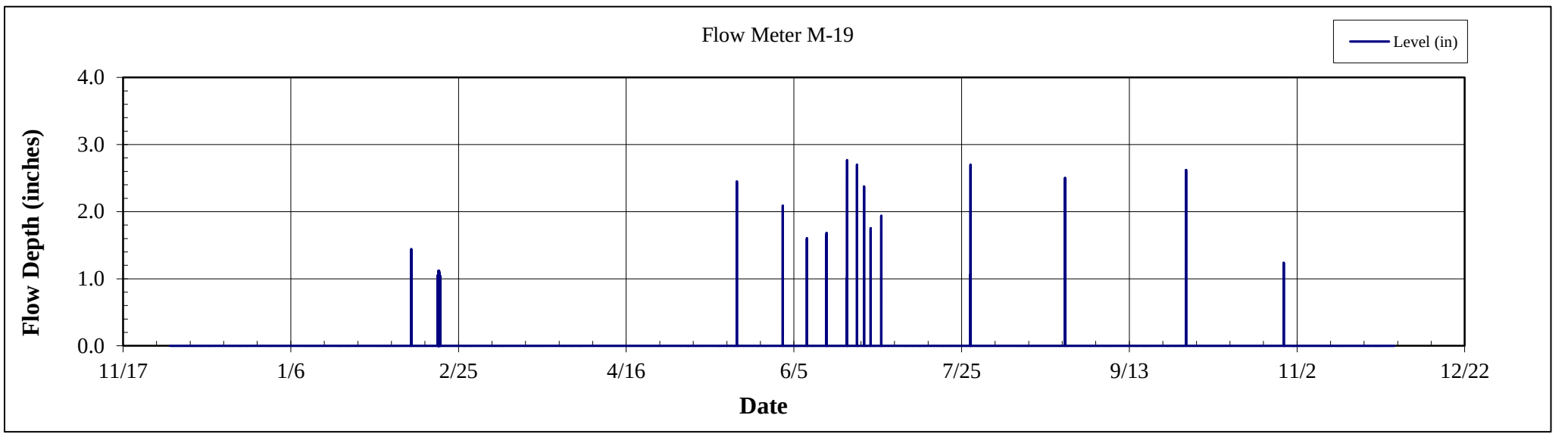
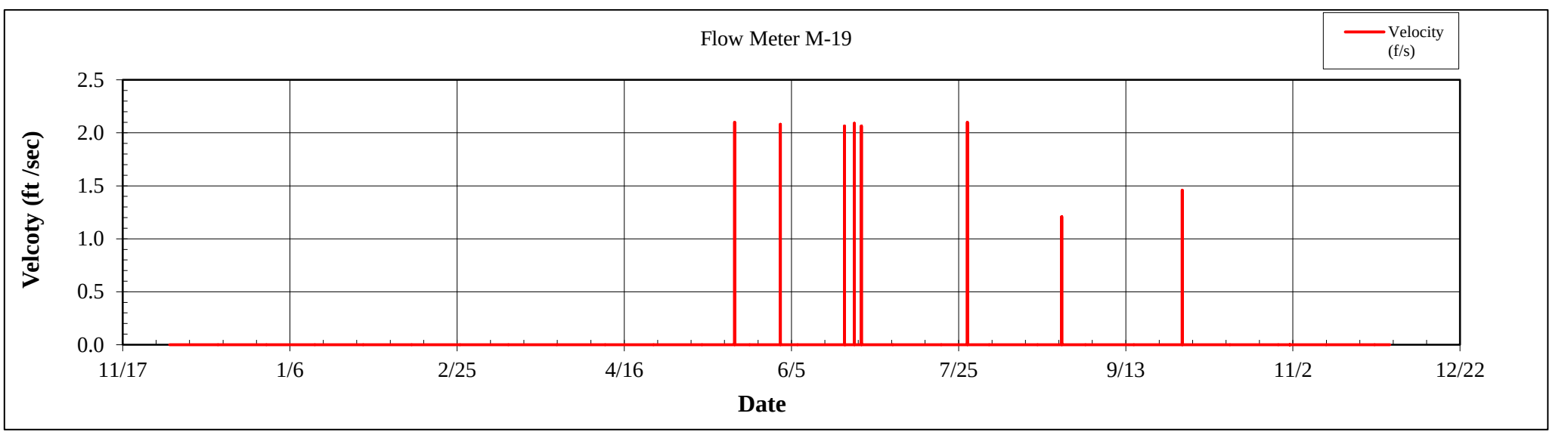
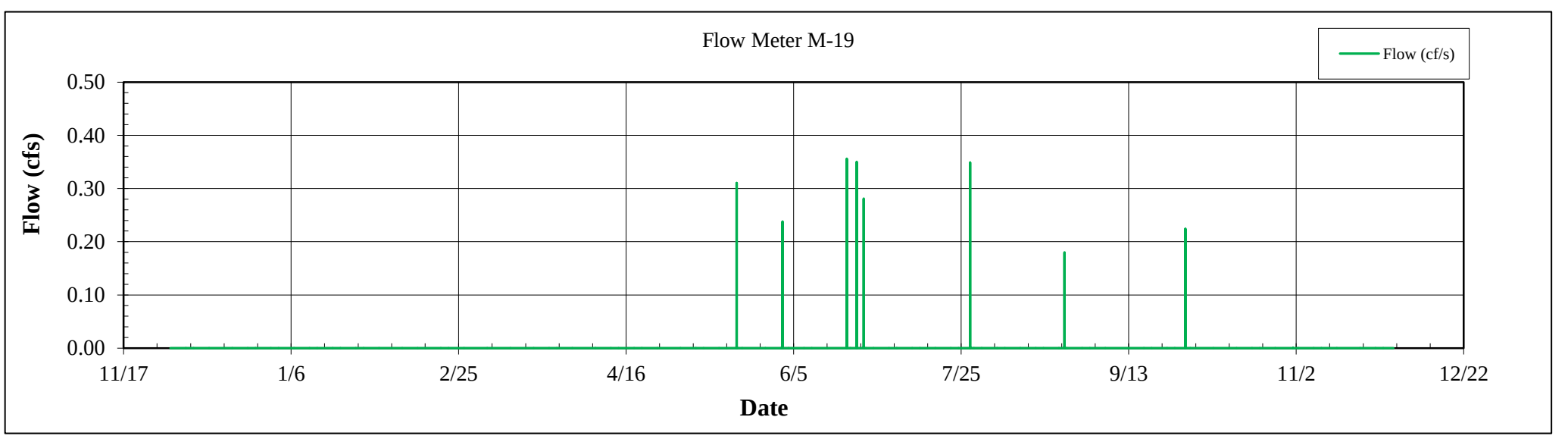
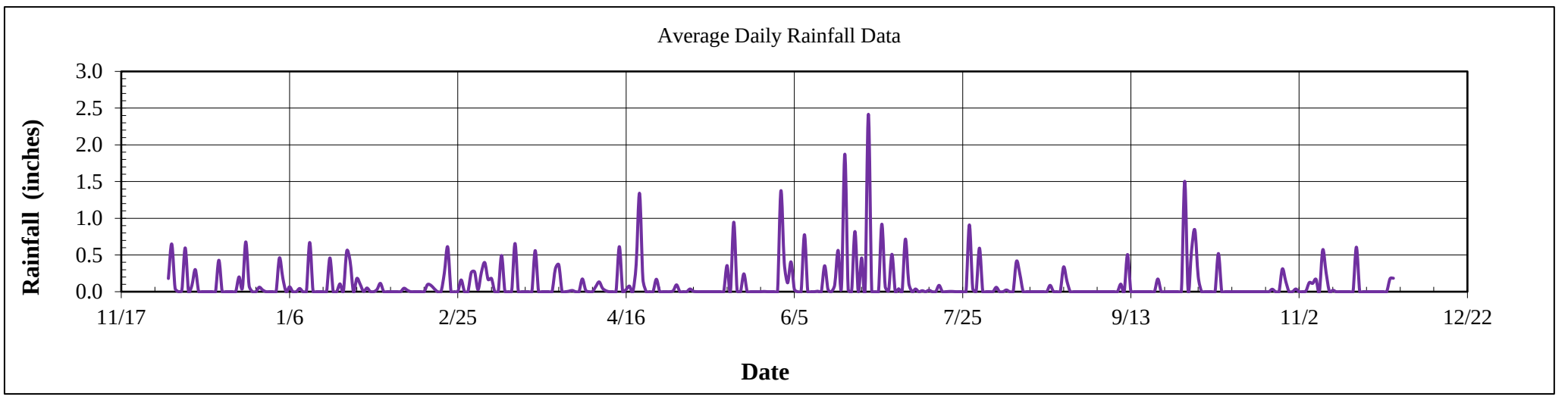
DRAWING ID: L:\LTCP\PCM\FLOW METER – EXHIBITS\EXHIBITS–FIGURES\19_26–42A–1.DWG

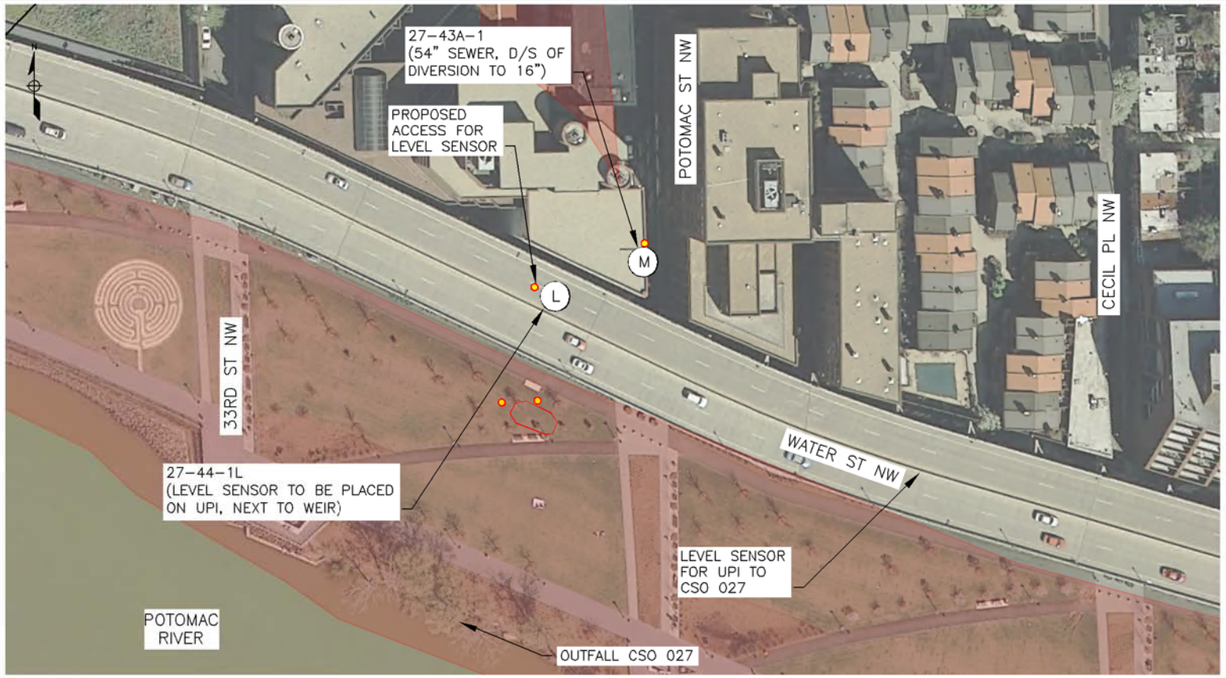
CSO 026 Overflow-D/S OF STR 42 (26-42-1)

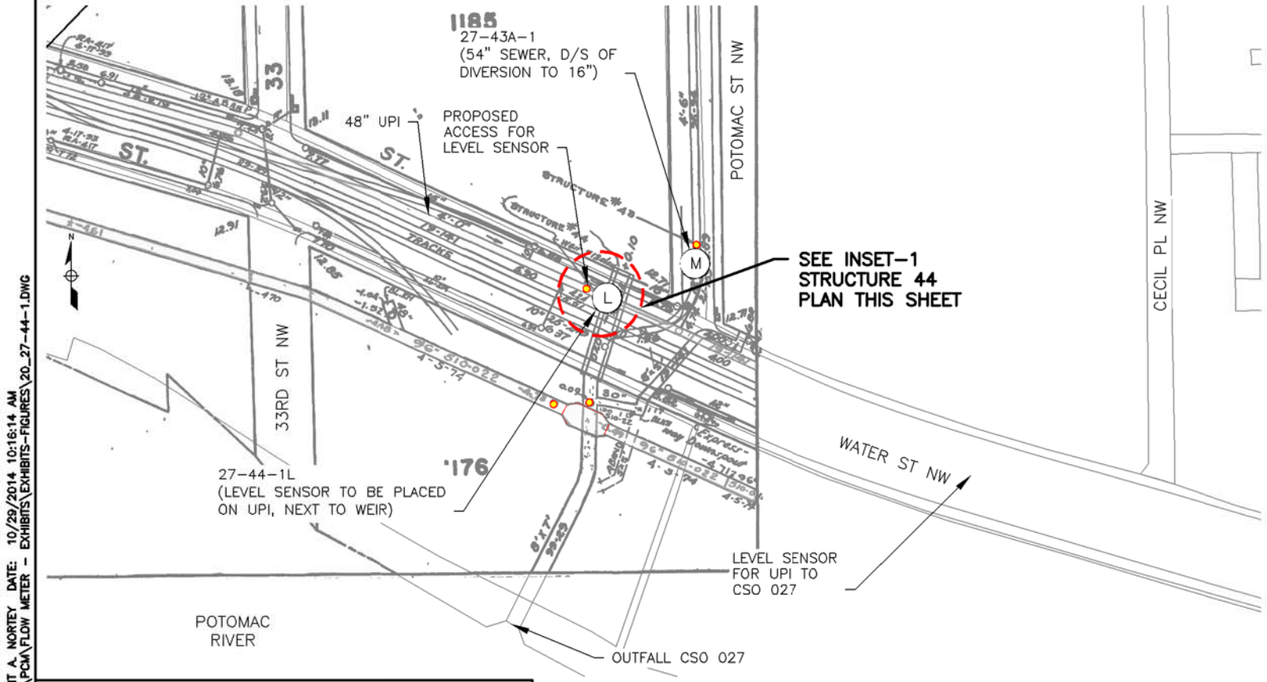








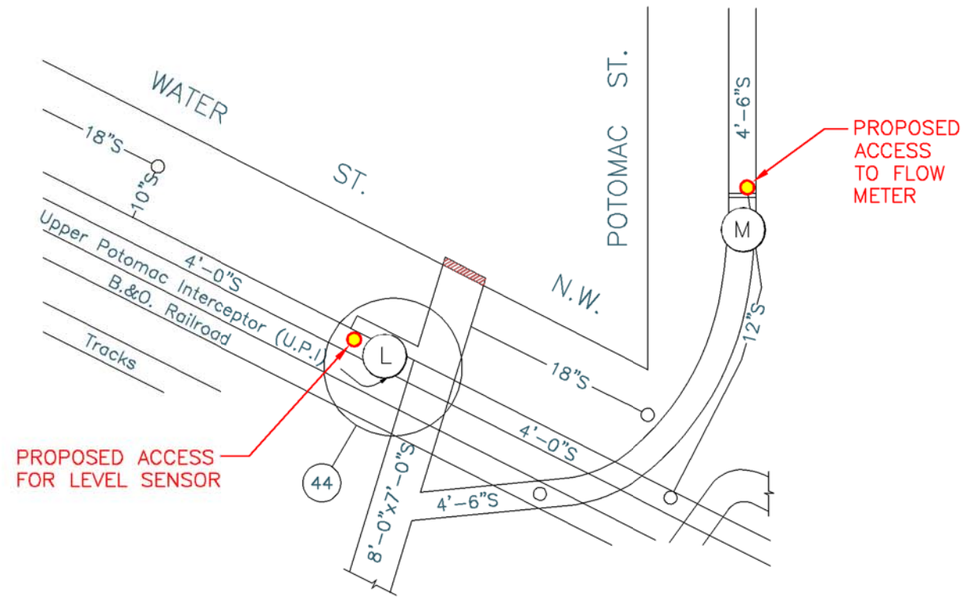




LEVEL SENSOR LOCATION PLAN

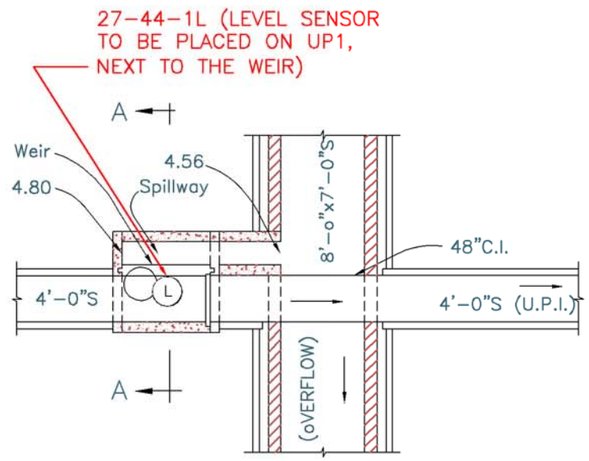
SCALE: NTS

1 – FLOW METER
1 – LEVEL SENSOR



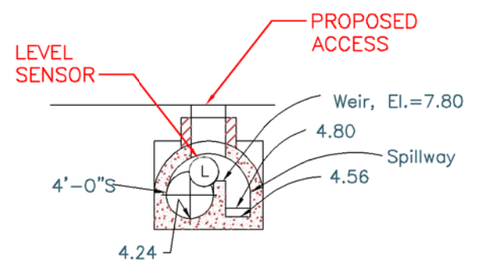
INSET-1 STRUCTURE 44 PLAN

SCALE NTS



STRUCTURE 44 DETAIL

SCALE NTS



SECTION A-A

SCALE NTS

LEGEND

- (M) LEVEL SENSOR LOCATION
- (L) LEVEL SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

27-43A-1 AND 27-44-1L

LEVEL SENSOR LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 20

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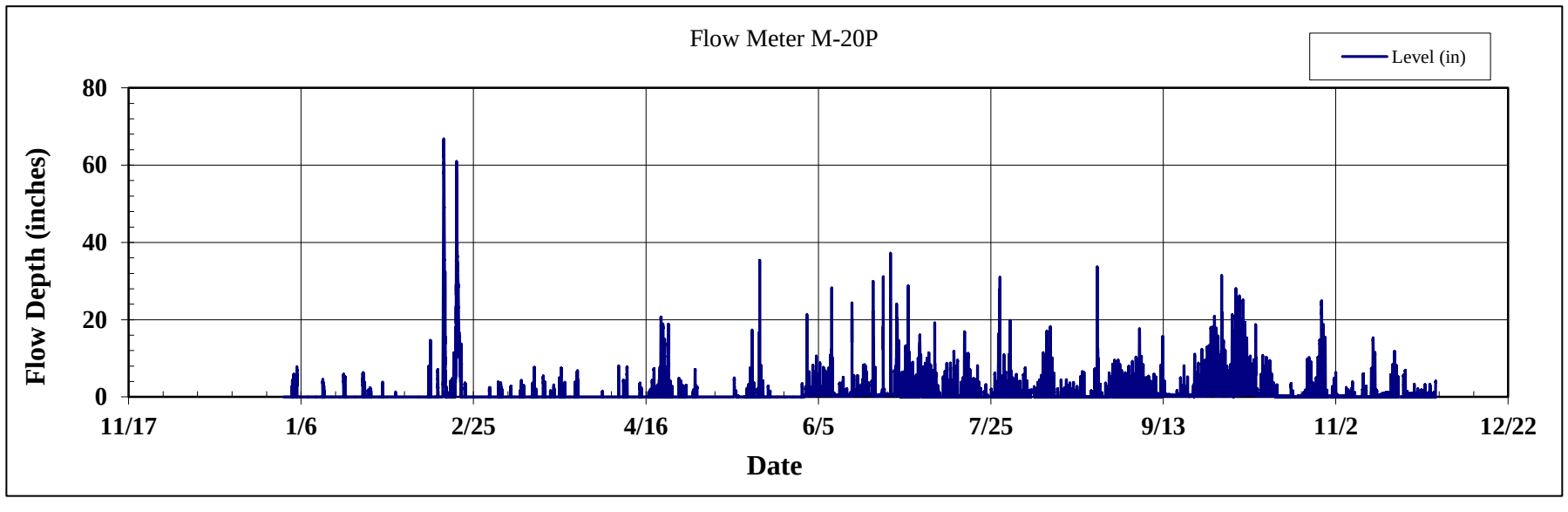
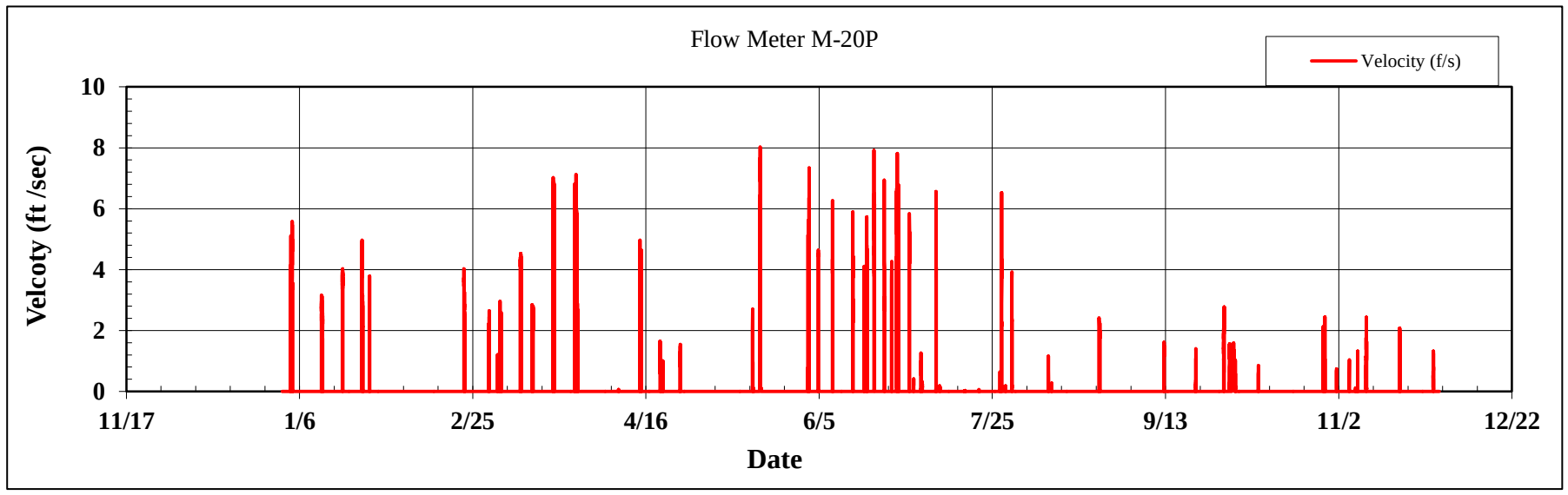
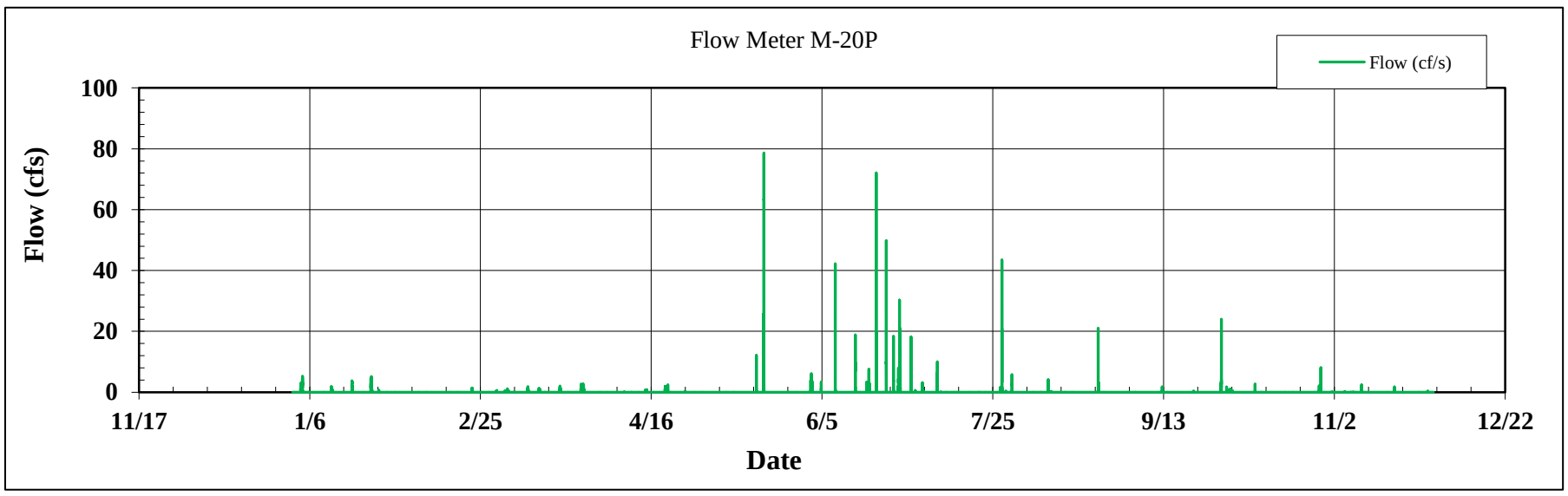
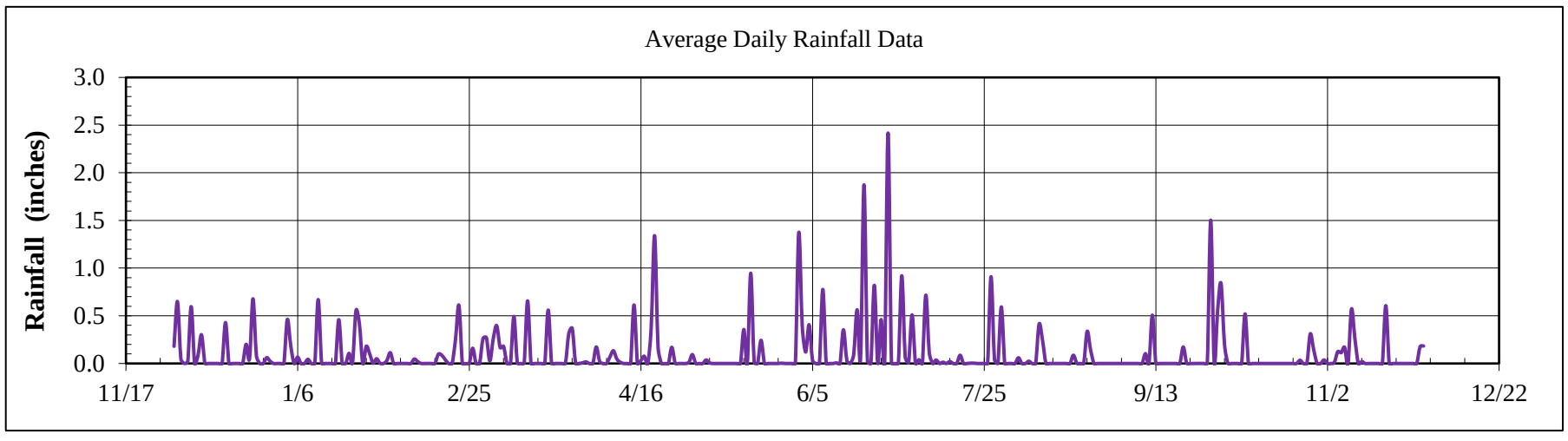
Overflow to CSO 027- D/S OF STR 43a (27-43a-1)

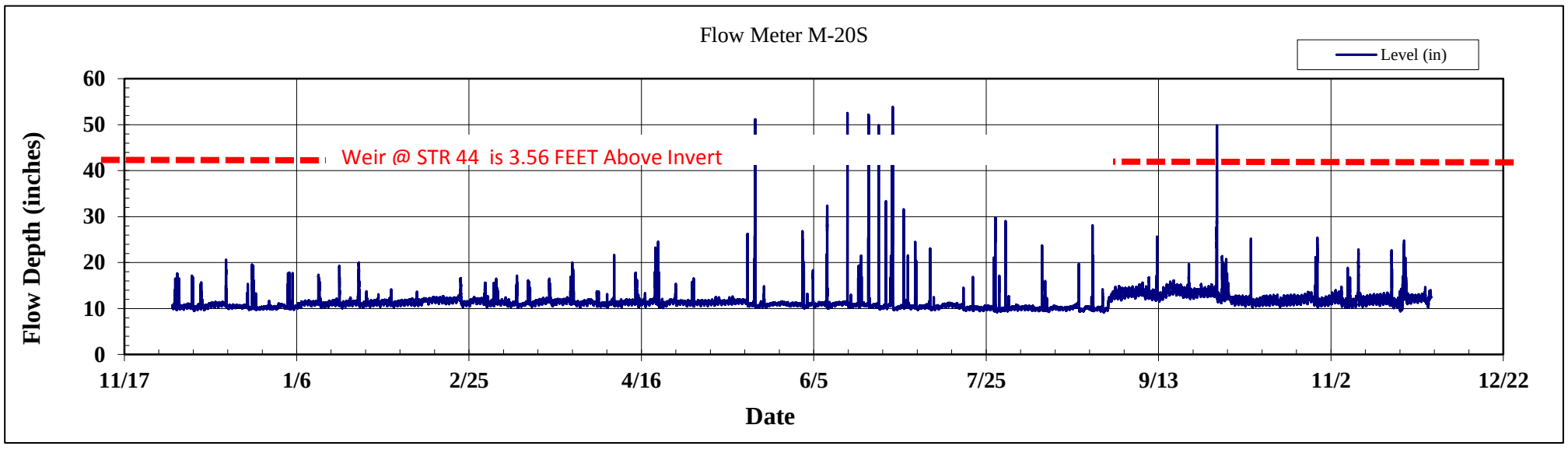


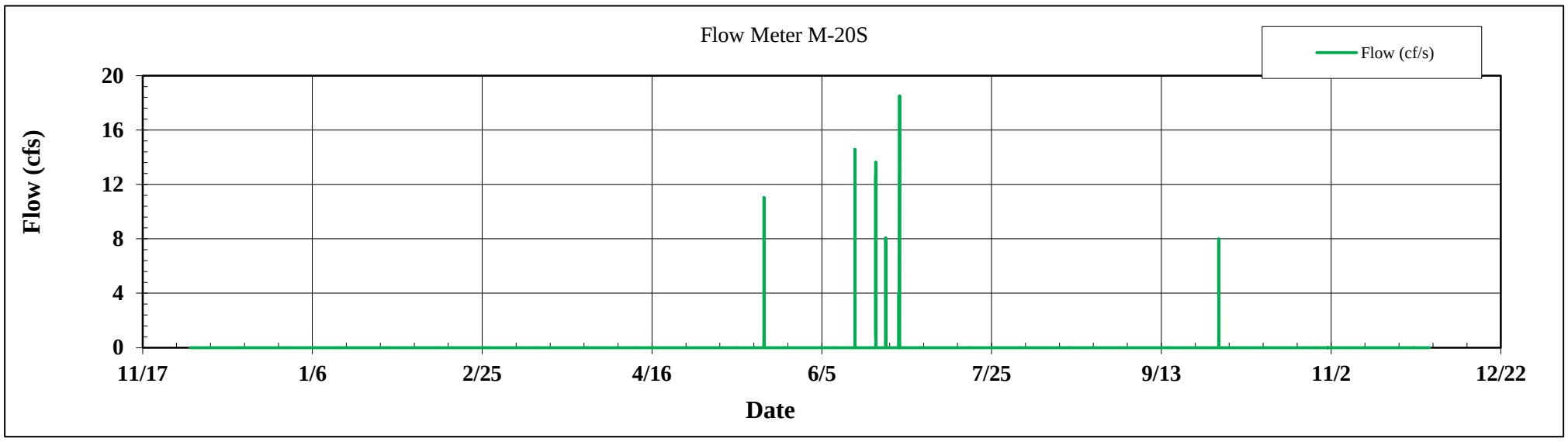


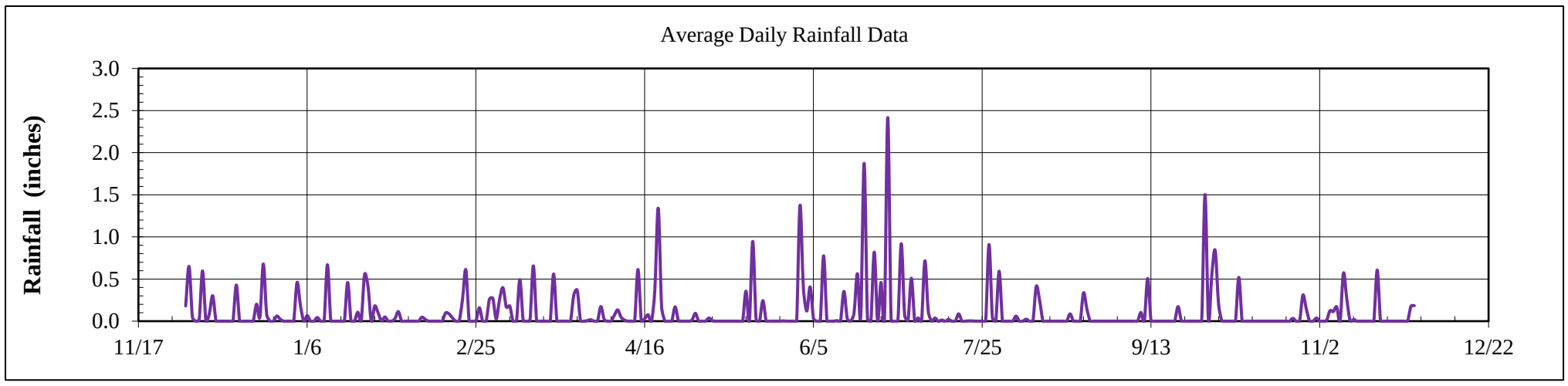




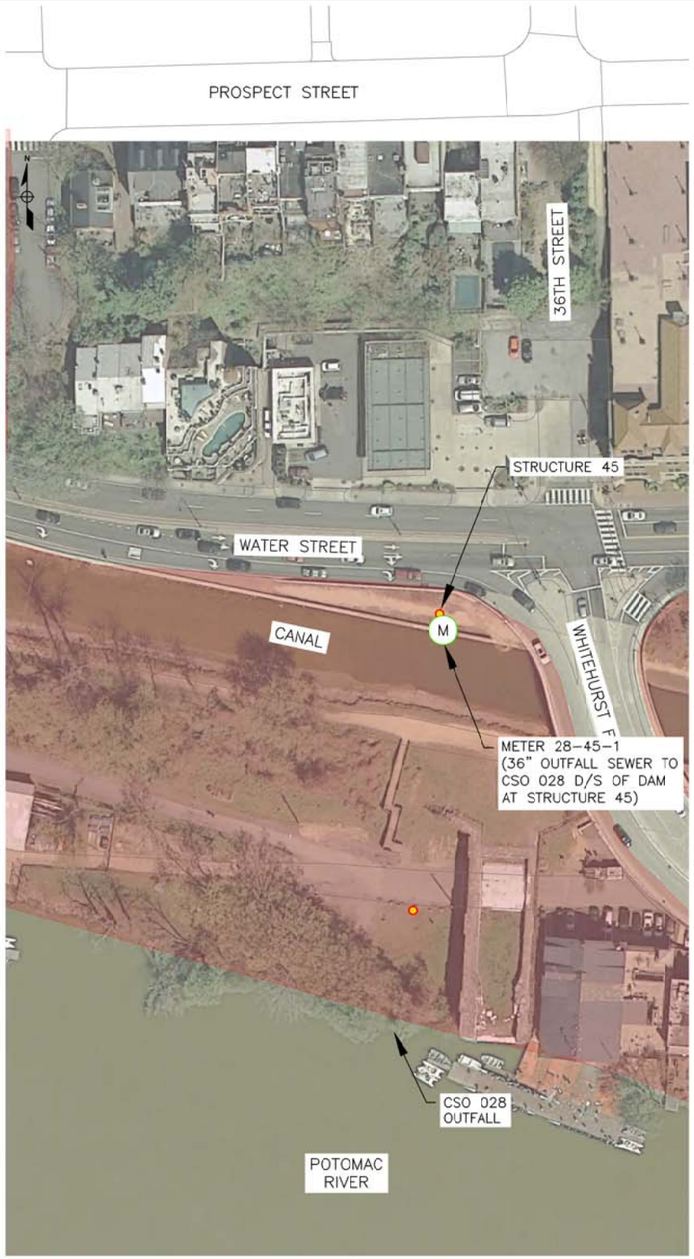
UPI Flow to CSO 027- STR 44 (27-44-1L)





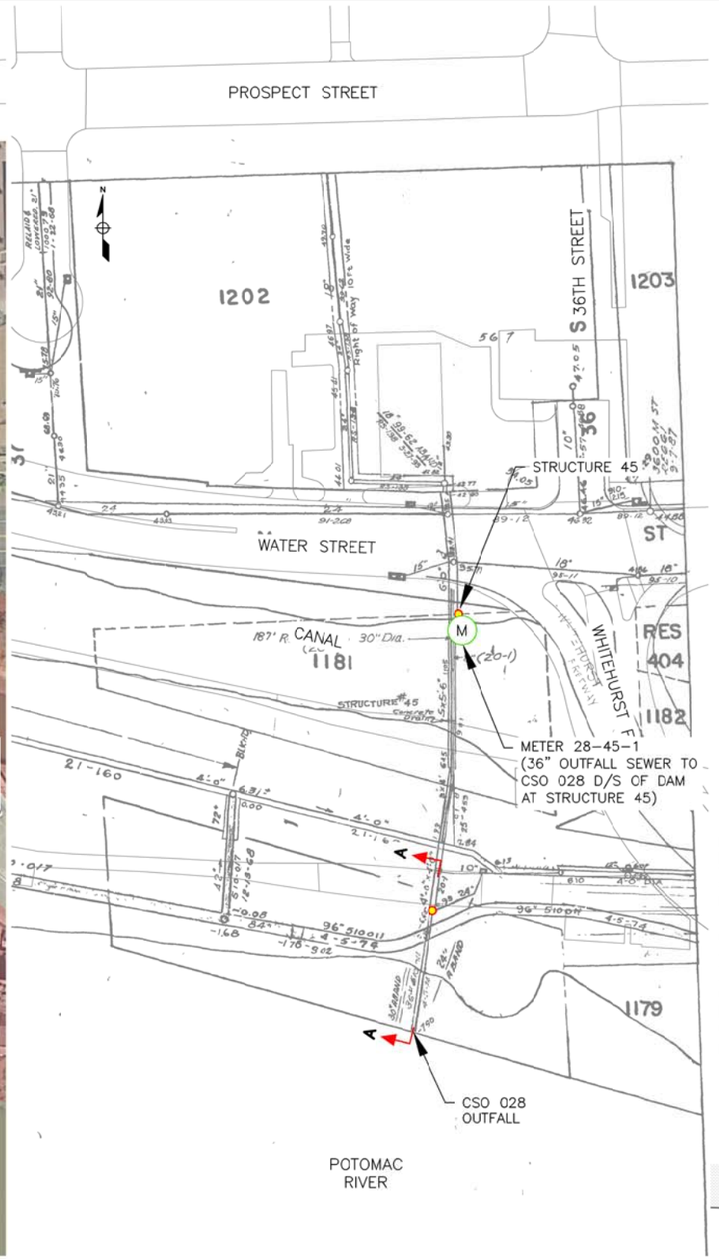


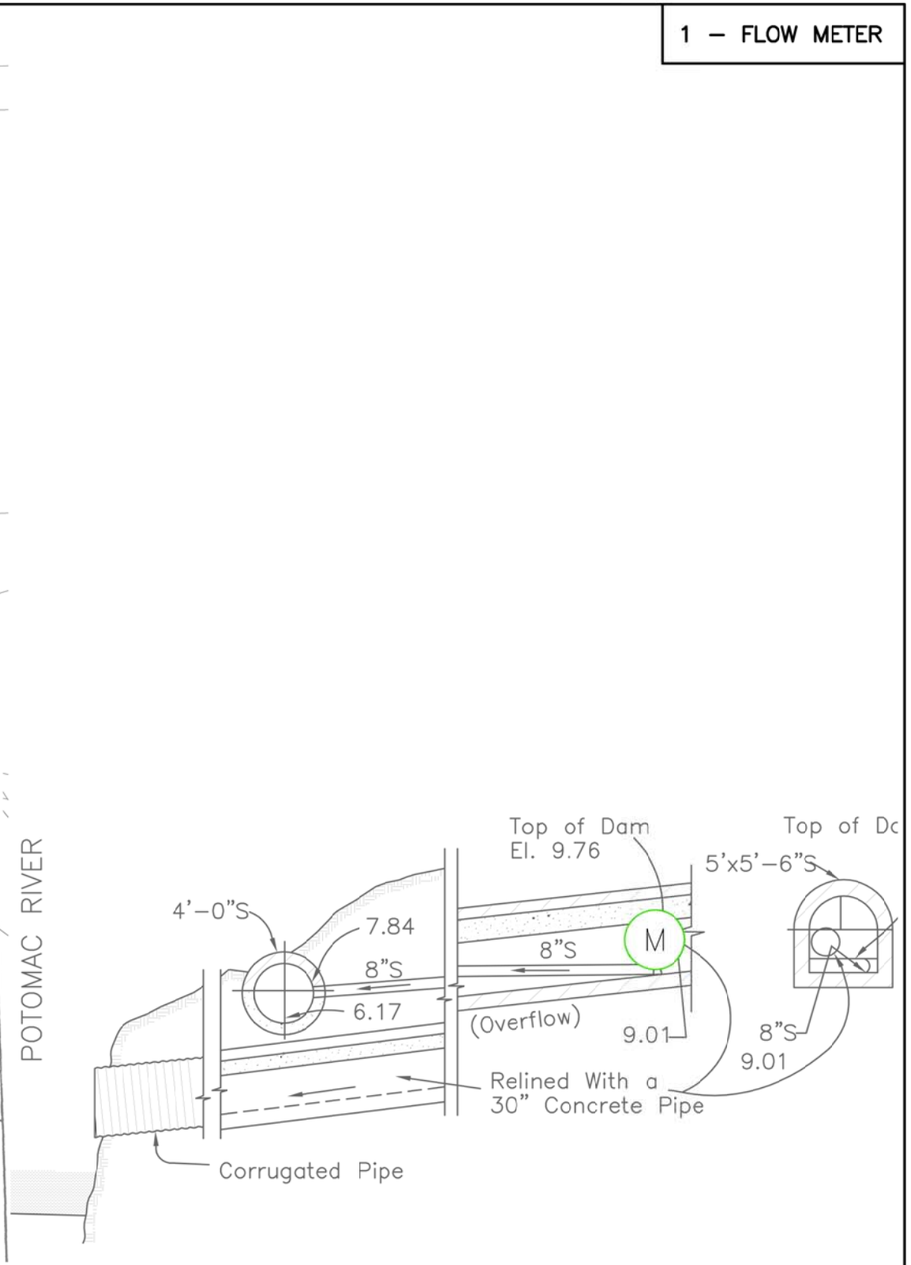
1 – FLOW METER



FLOW METER LOCATION PLAN

SCALE: NTS





CROSS SECTION A–A (PROFILE)

SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

28–45–1

METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 23

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 11/11/2014 3:43:05 PM
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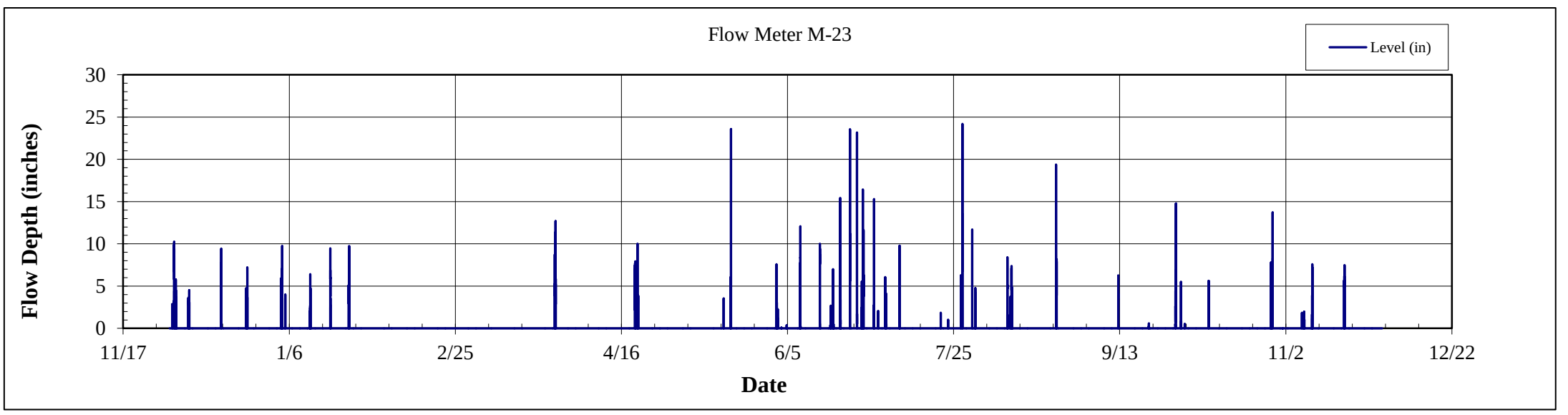
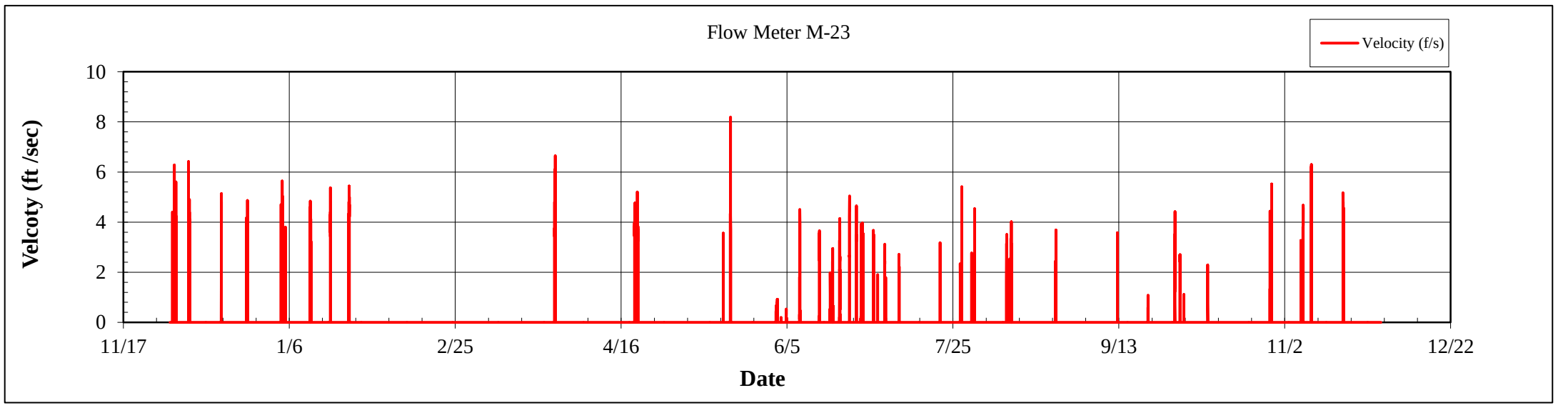
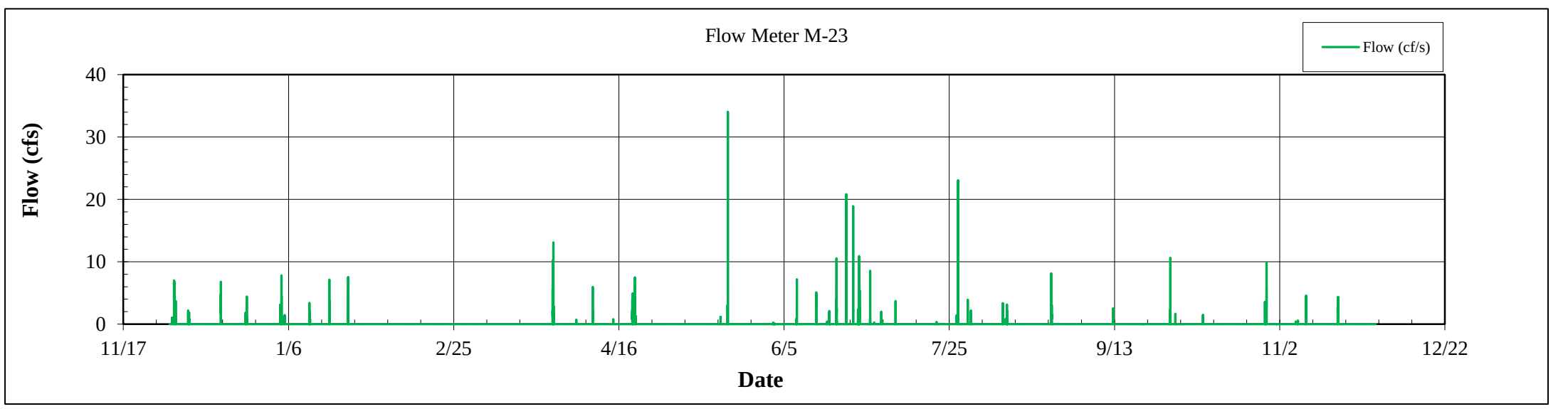
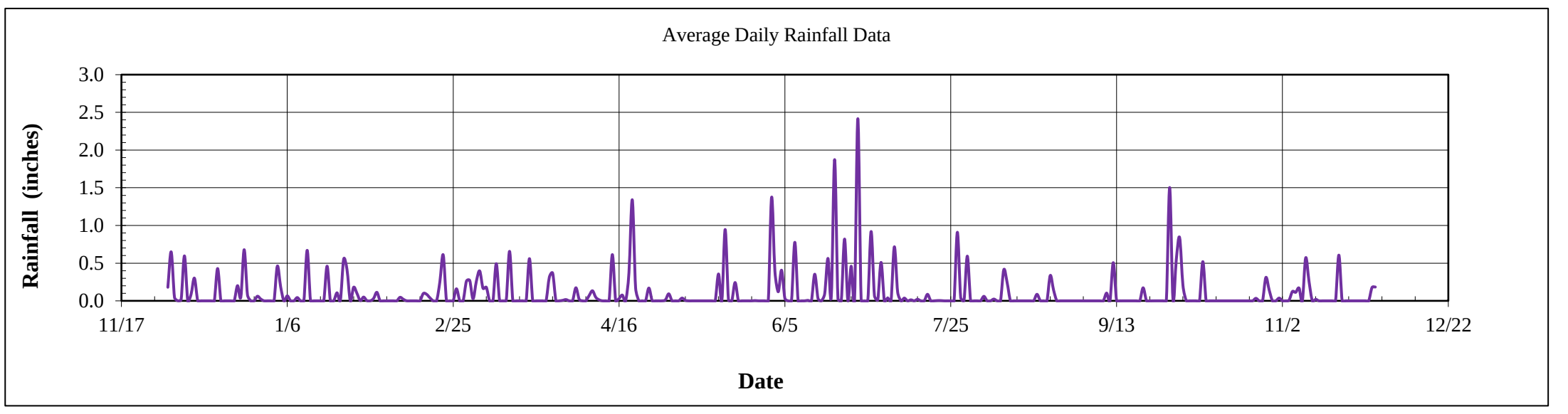
CSO 028 Overflow (D/S OF STR 45)

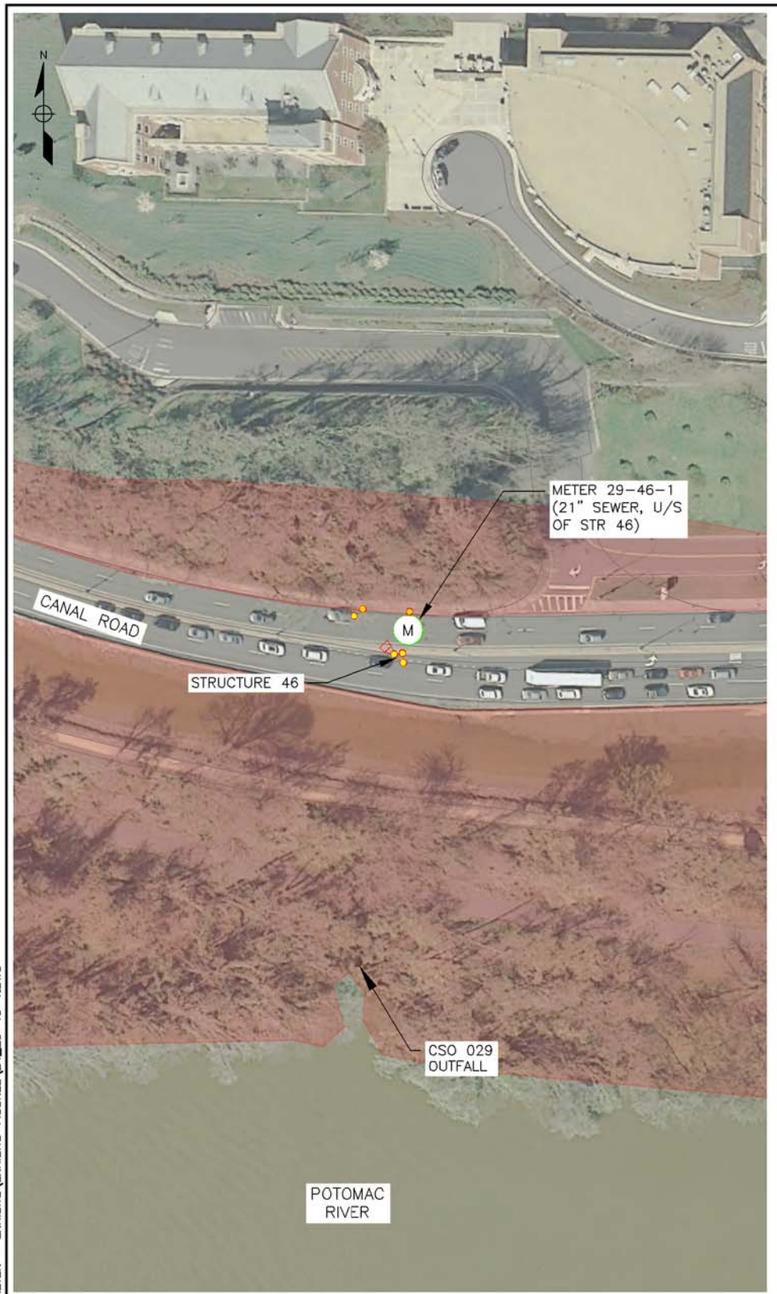








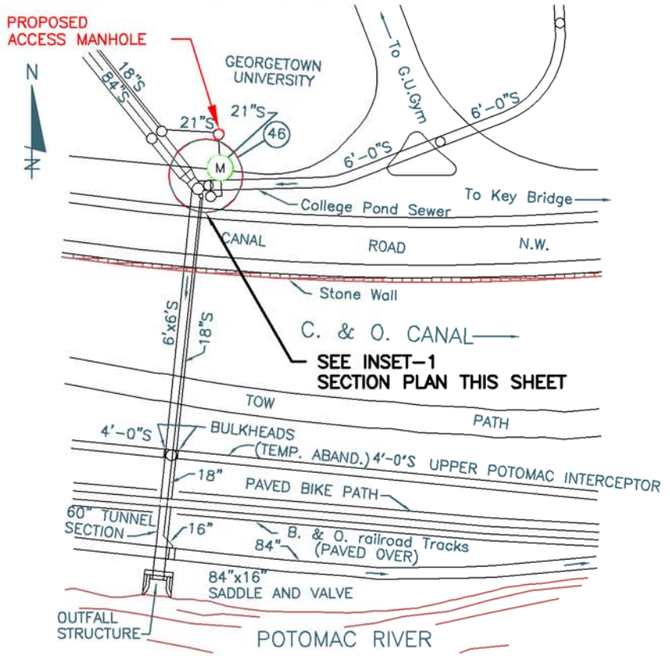
1 – FLOW METER



STRUCTURE NO. 46, College Pond Sewer, Canal Road about 1,000 ft. East of Foxhall Road, N.W. This structure has a slot–type regulator. The Storm Overflow is formed by a depressed slot and a masonry dam. A 6–ft. Combined Sewer enters the Diversion Chamber, and there is a slot in the invert which collects the Dry–Weather Flow into a sump–like structure, and the flow is then conveyed through an 18–in. intercepting connection to the Upper Potomac Interceptor Relief Sewer. The Upper Potomac Interceptor is temporarily abandoned.

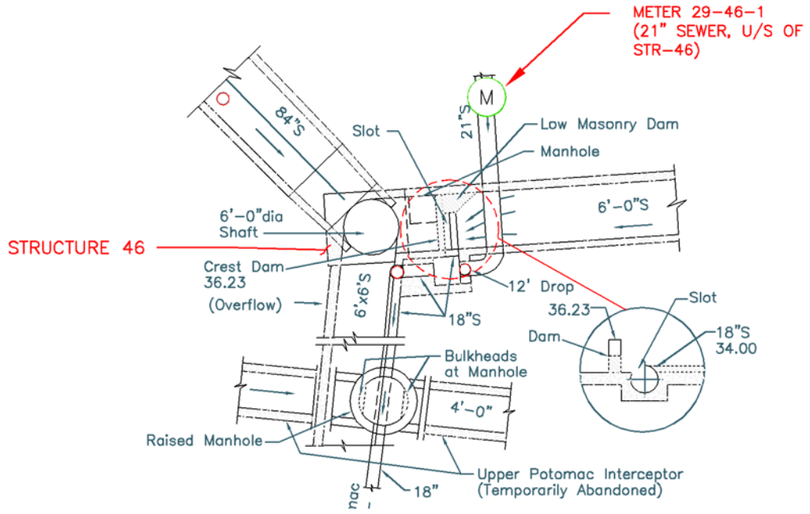
The 6–ft. by 6–ft. Overflow line discharges to the Potomac River.

There is an Outlet Structure and Gate at the outlet.



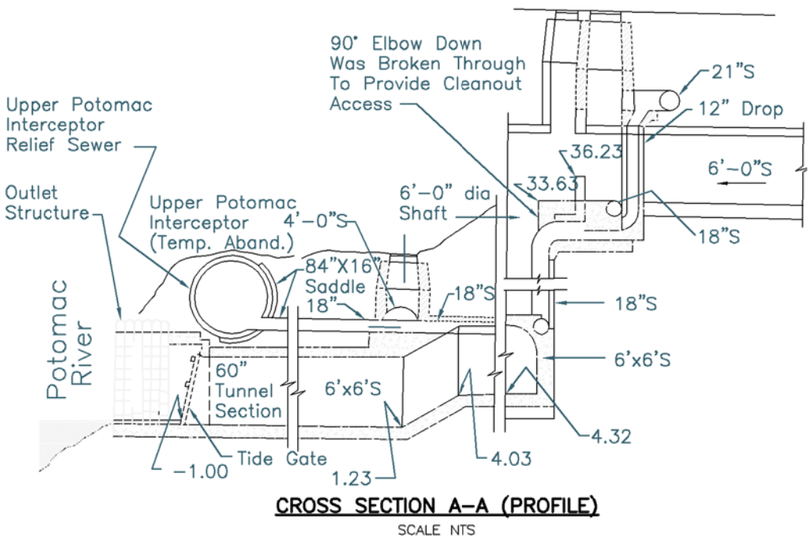
FLOW METER LOCATION PLAN

SCALE: NTS



INSET–1 SECTION PLAN

SCALE NTS



CROSS SECTION A–A (PROFILE)

SCALE NTS

LAST SAVED BY: CONSTANT A. NORTEY DATE: 10/29/2014 10:35:38 AM
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DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

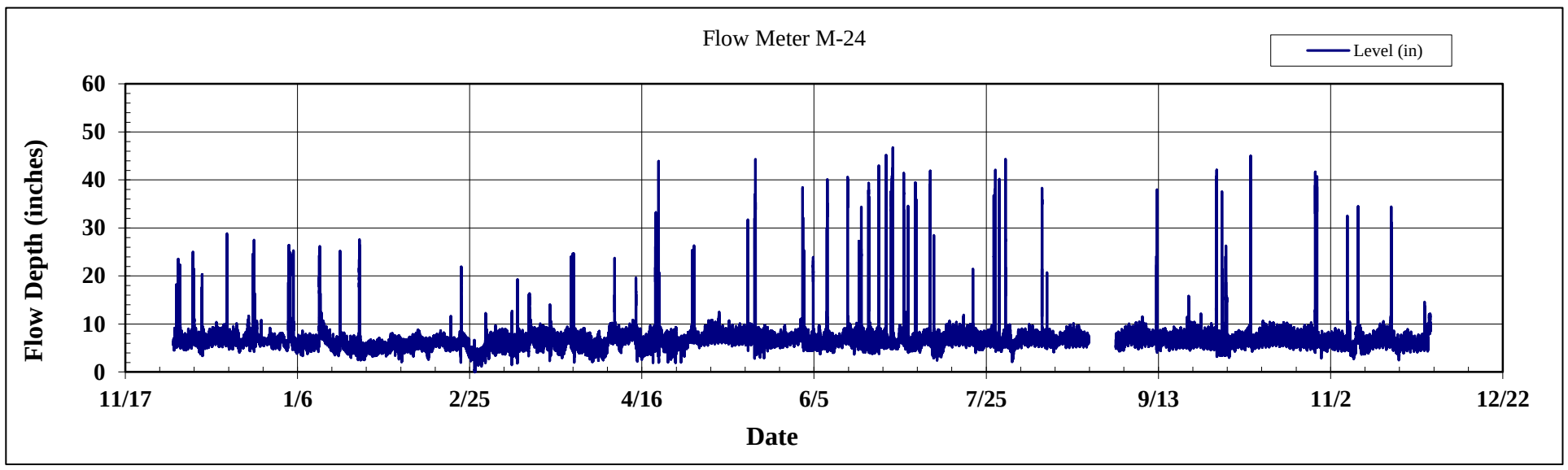
LEGEND

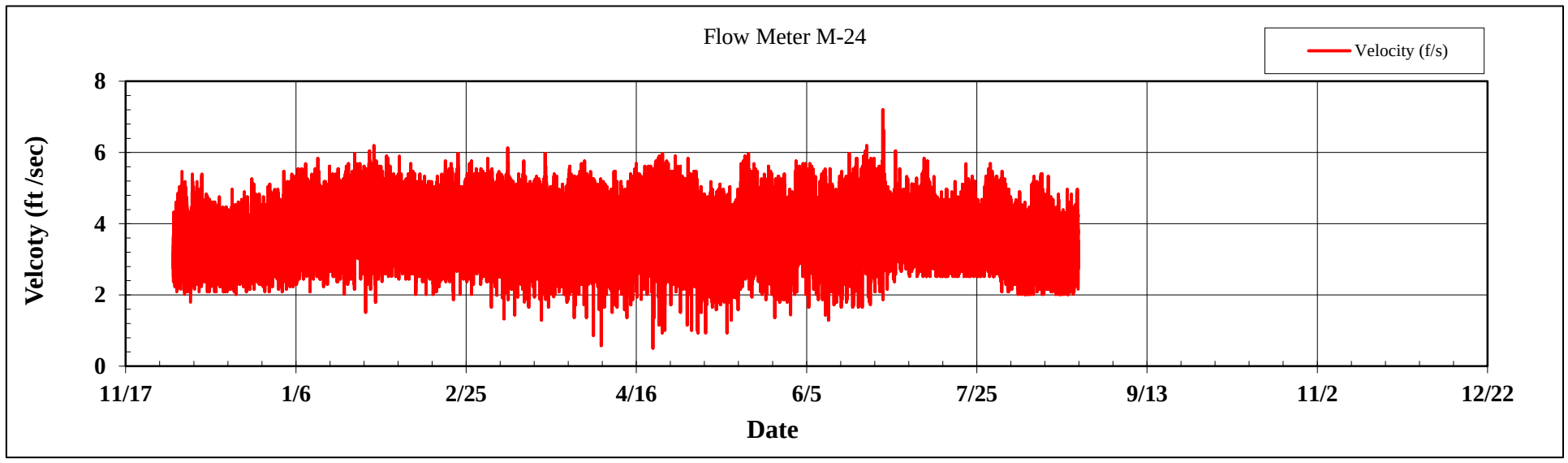
- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

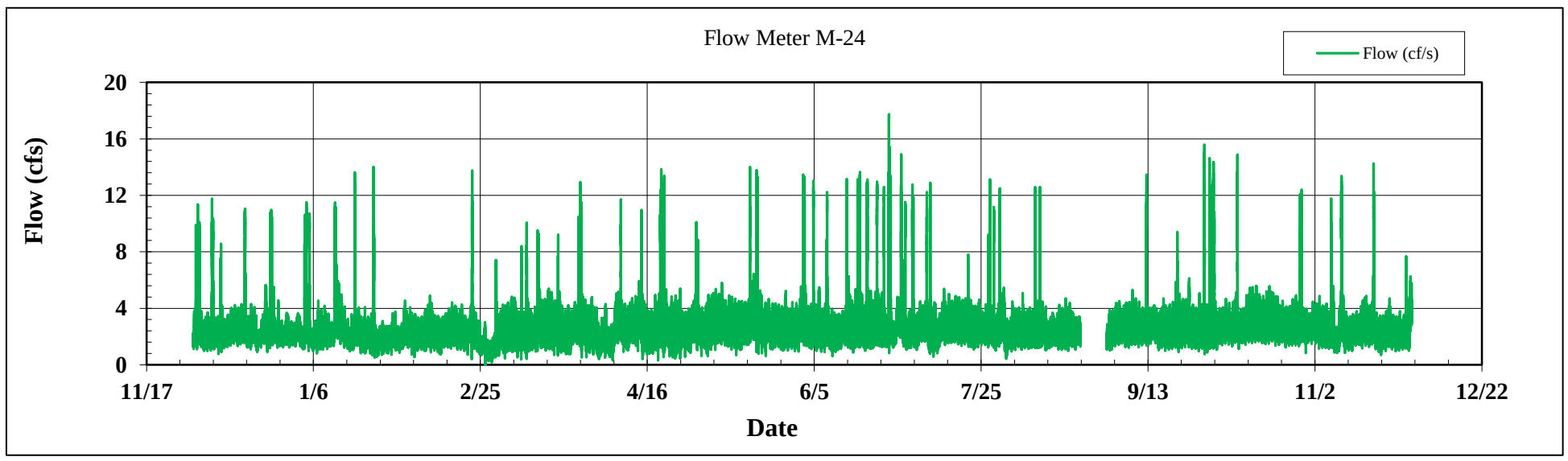
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29–46–1
METER LOCATION AND TYPICAL CROSS SECTION

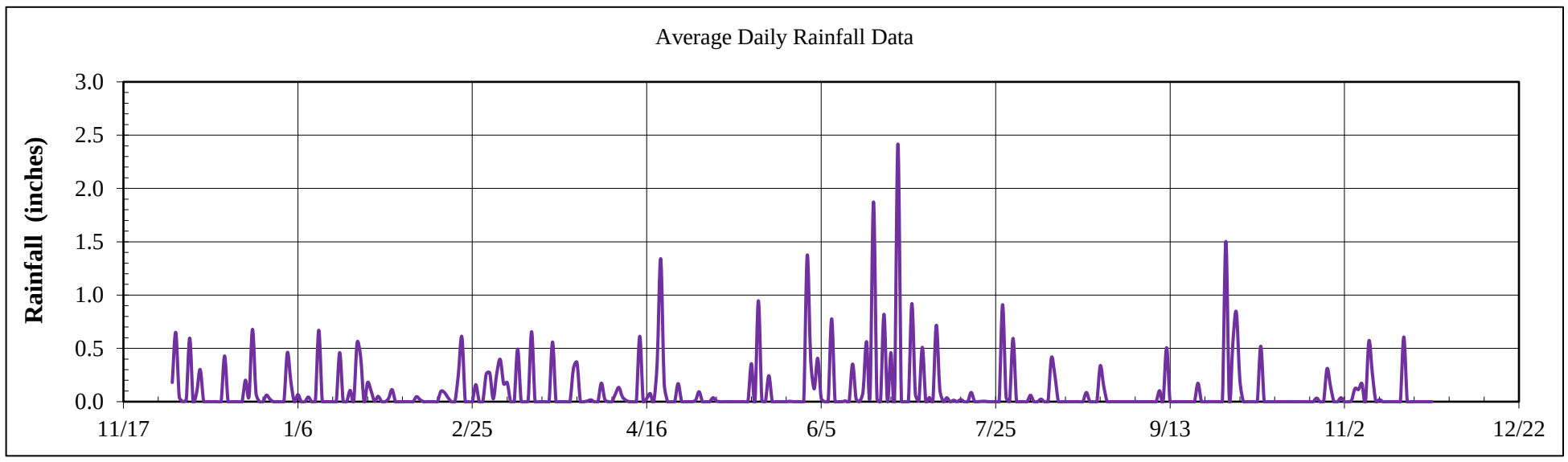
DATE: OCTOBER 2014 | SITE 24

Georgetown Flows to UPIRS- 21" SS Near STR 46 (29-46-1)

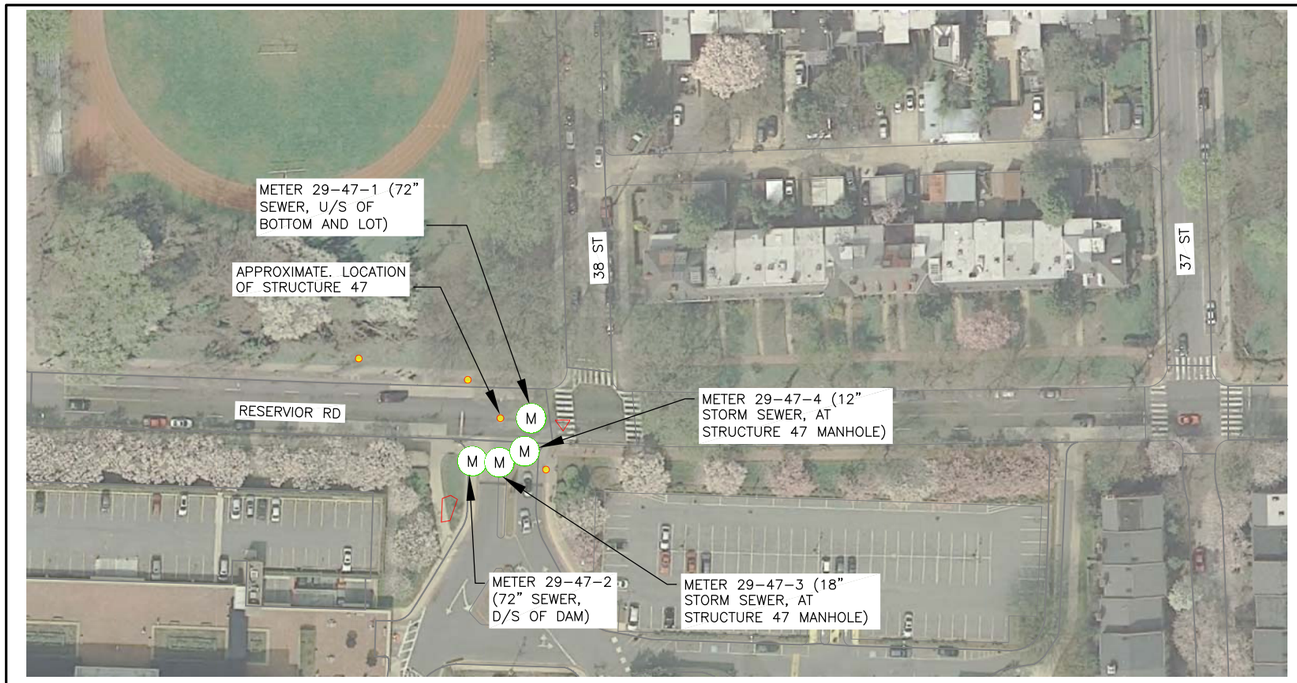


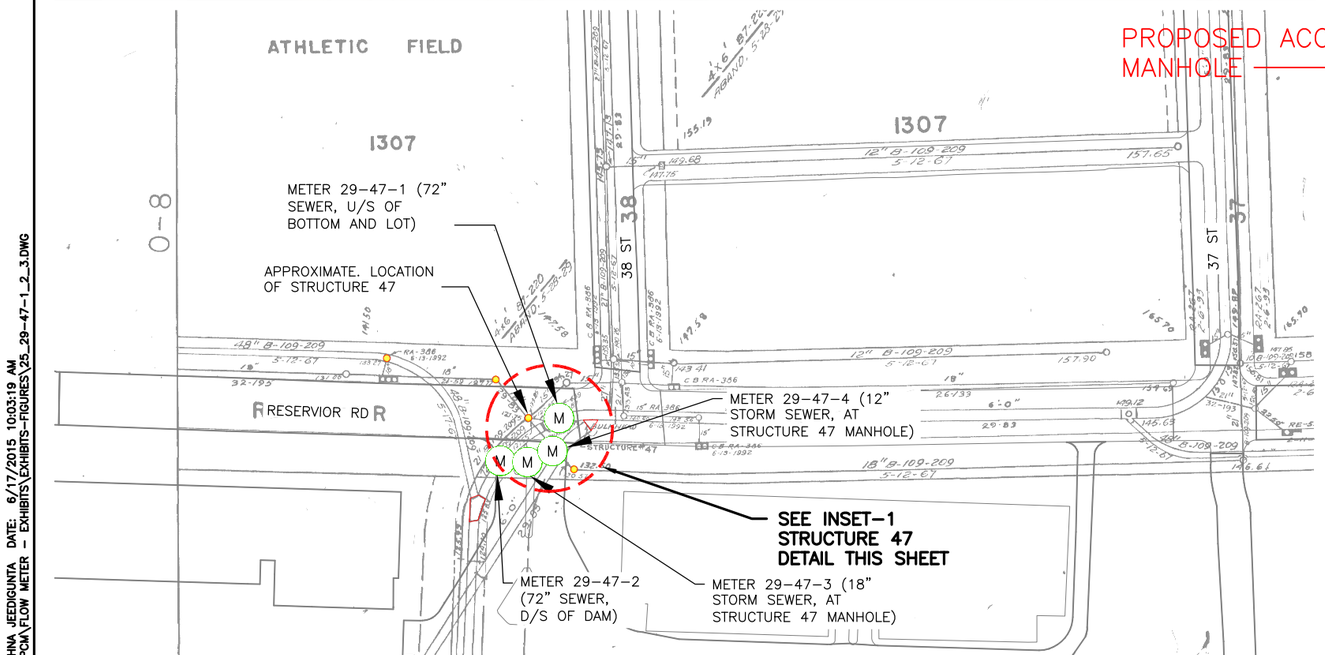




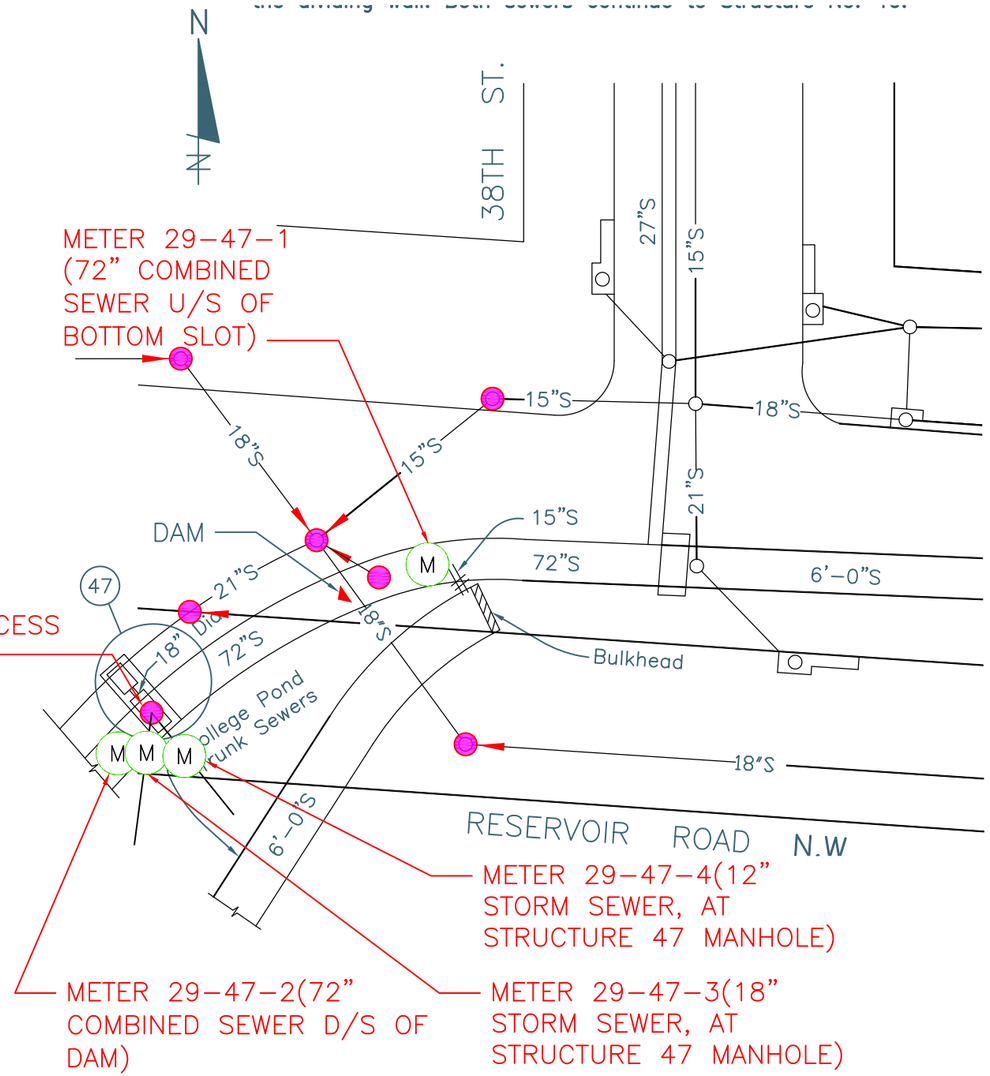


4 – FLOW METERS





FLOW METER LOCATION PLAN
SCALE: NTS



INSET–1 STRUCTURE 47 DETAIL
SCALE NTS

LEGEND

M FLOW METER LOCATION

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29–47–1_2_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 25

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 6/17/2015 10:03:19 AM
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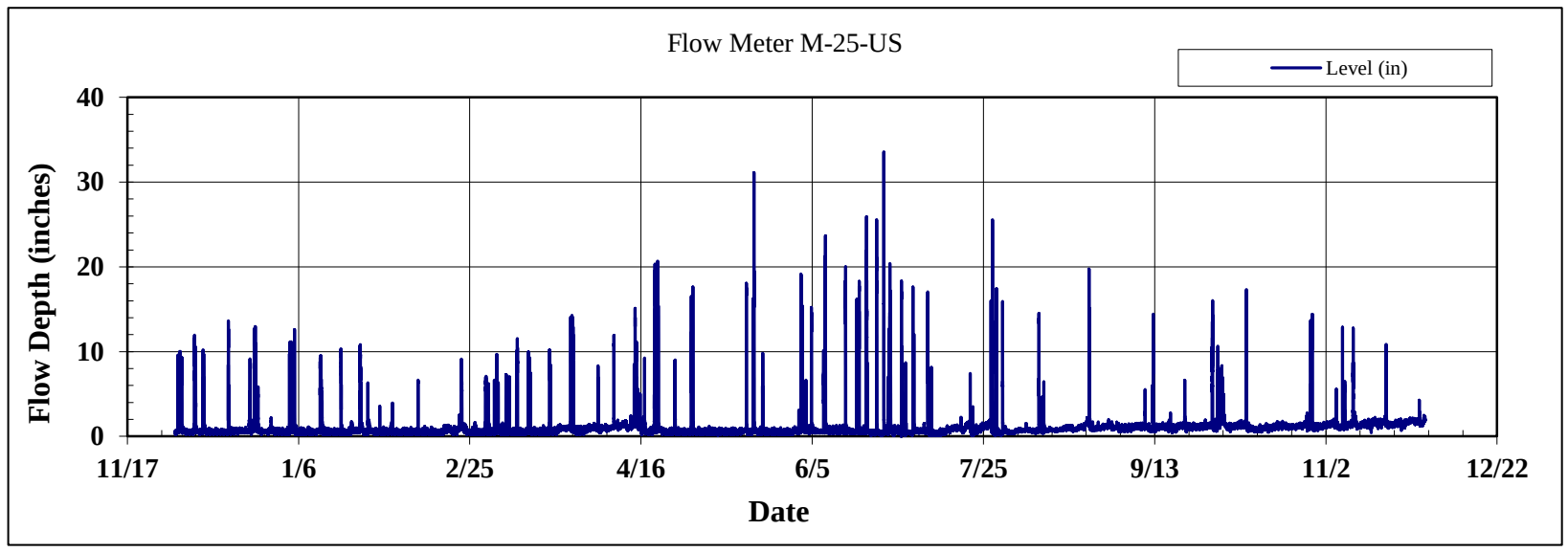
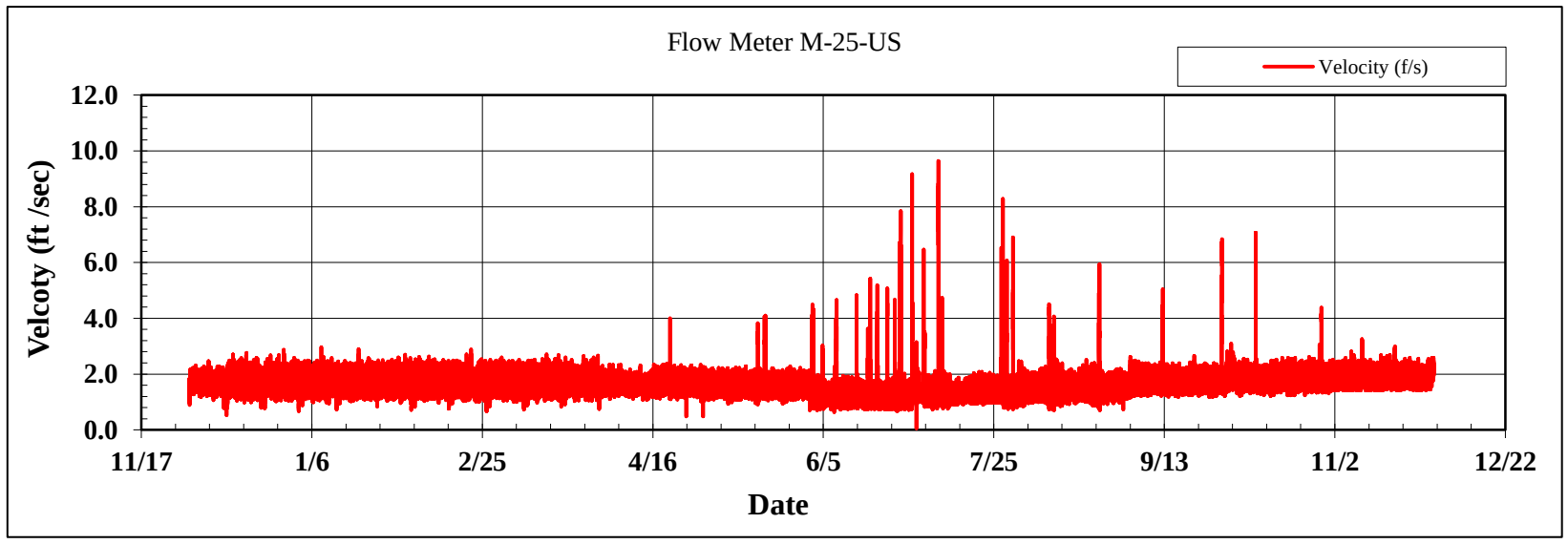
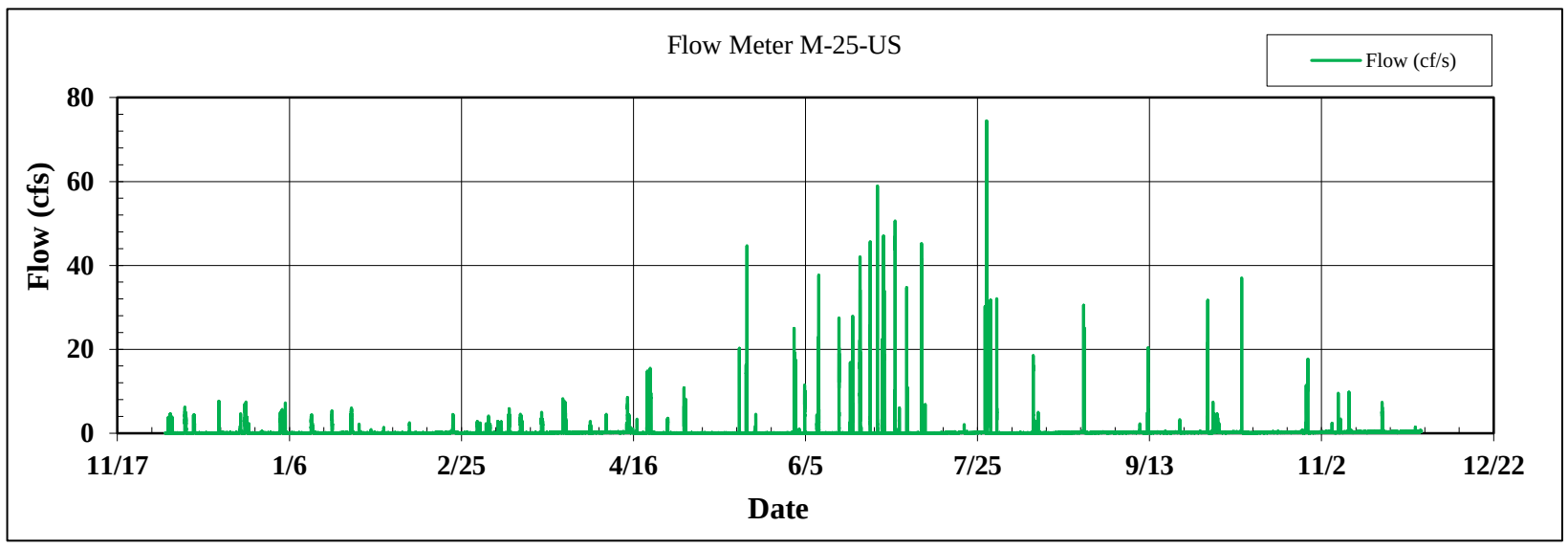
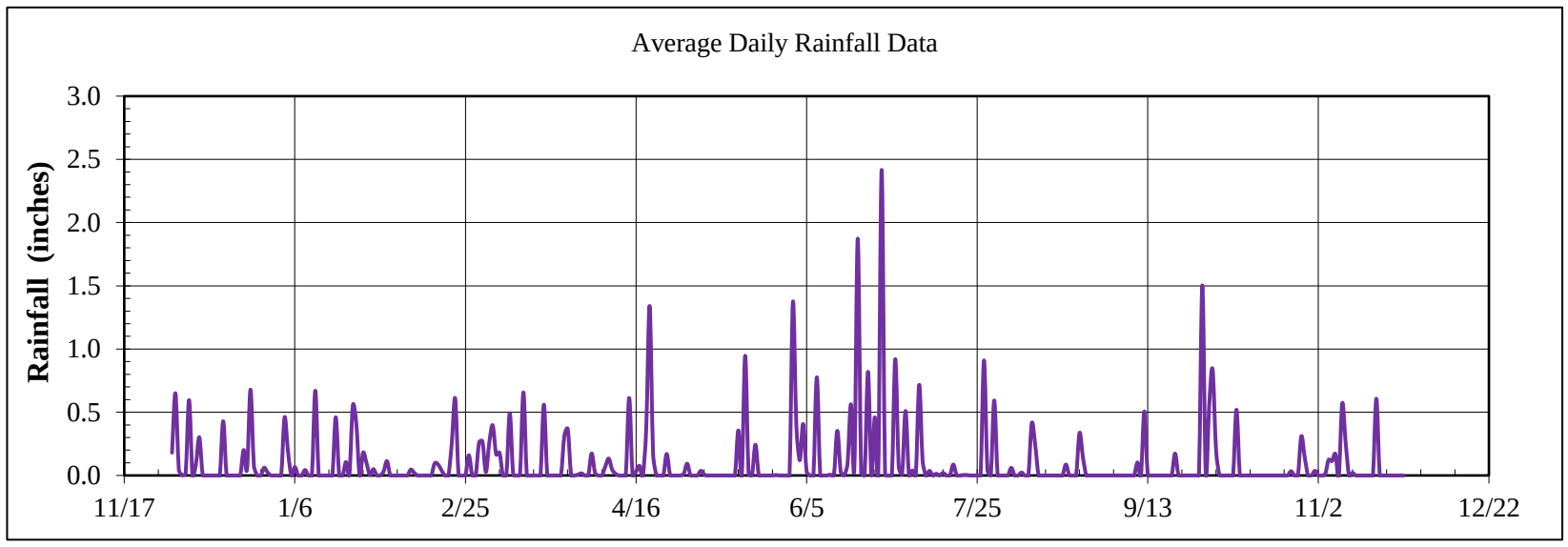
College Pond Sewer Flows- U/S of STR 47 (29-47-1)

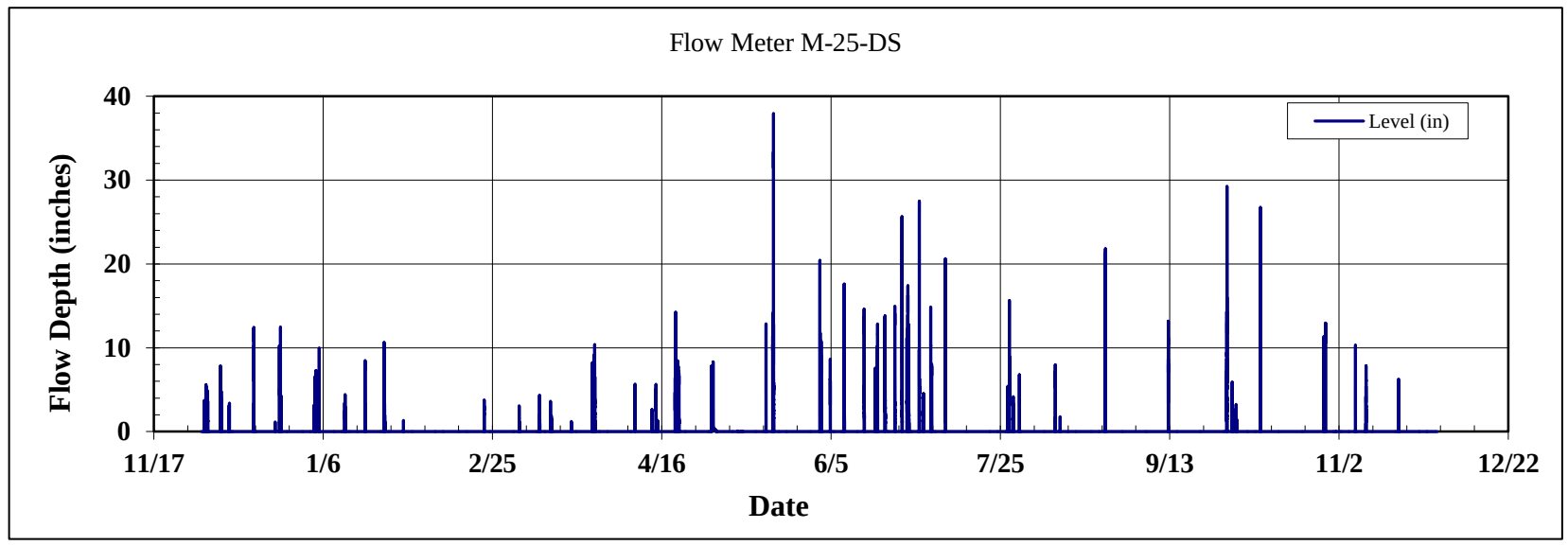


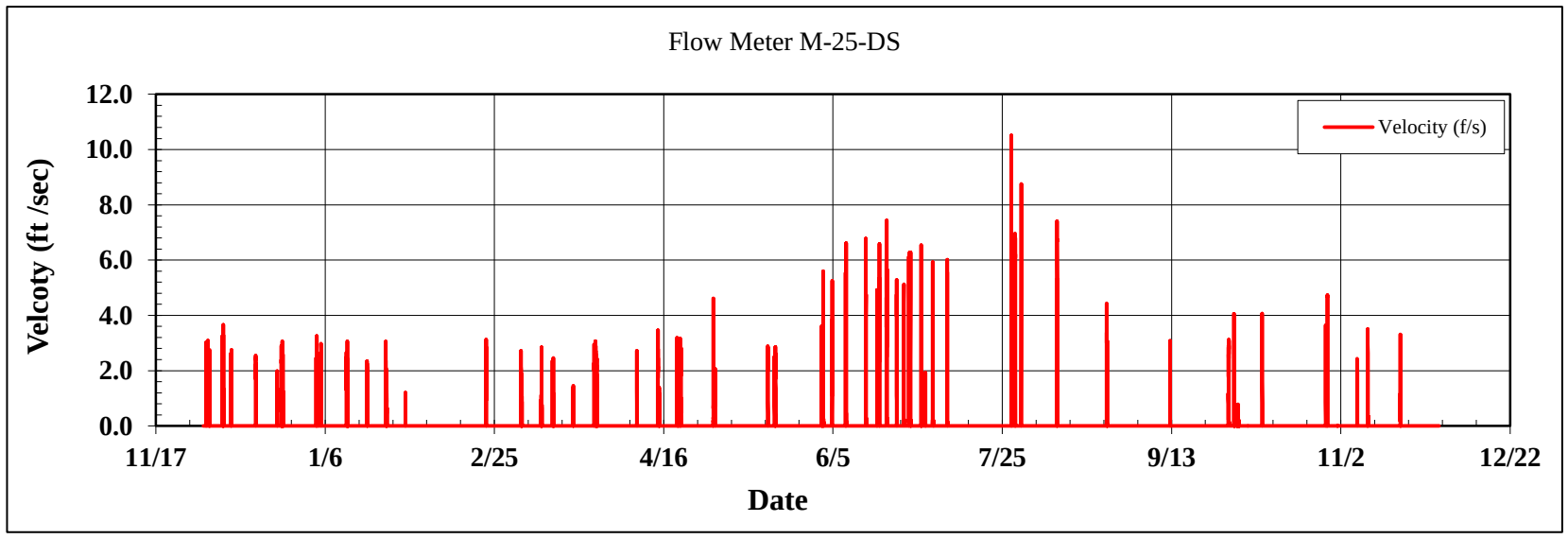


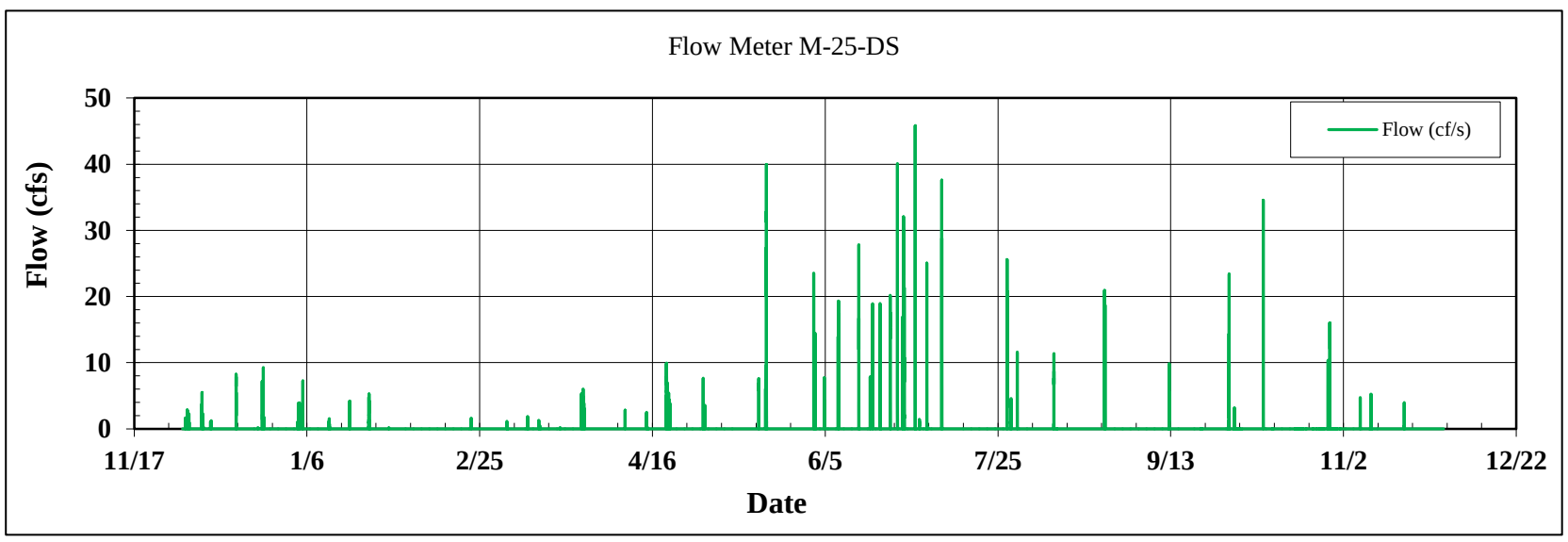


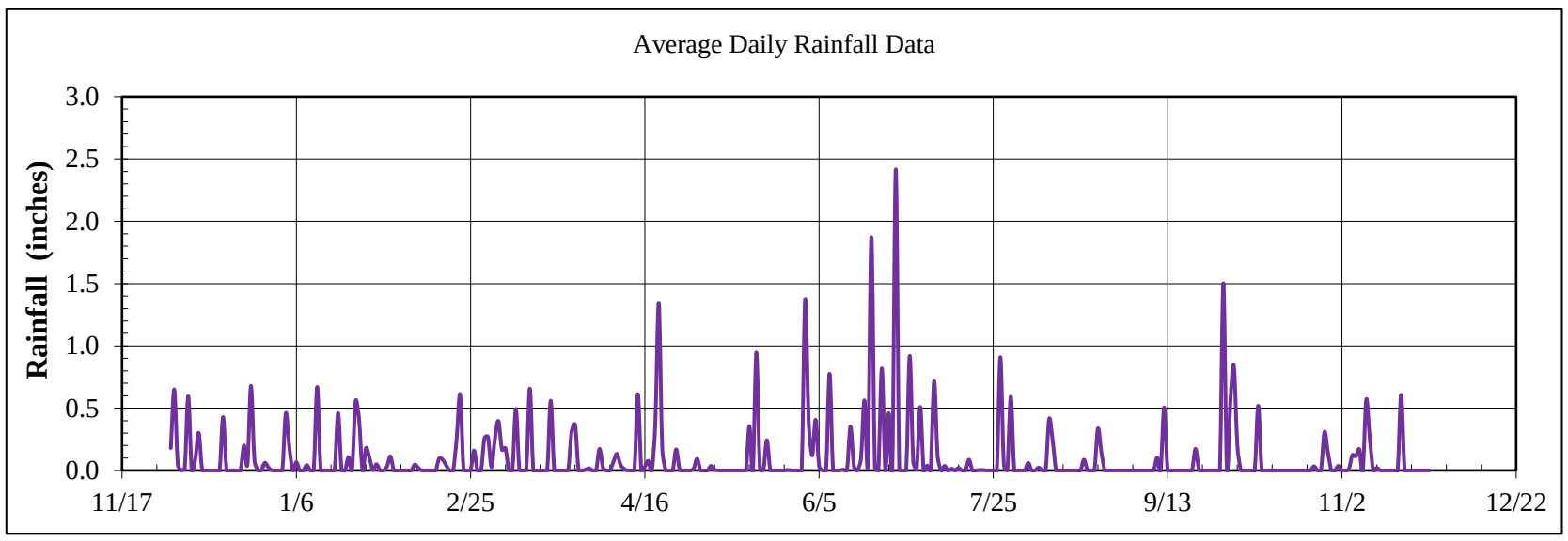


CSO 029 Overflow- D/S of STR 47 (29-47-2)

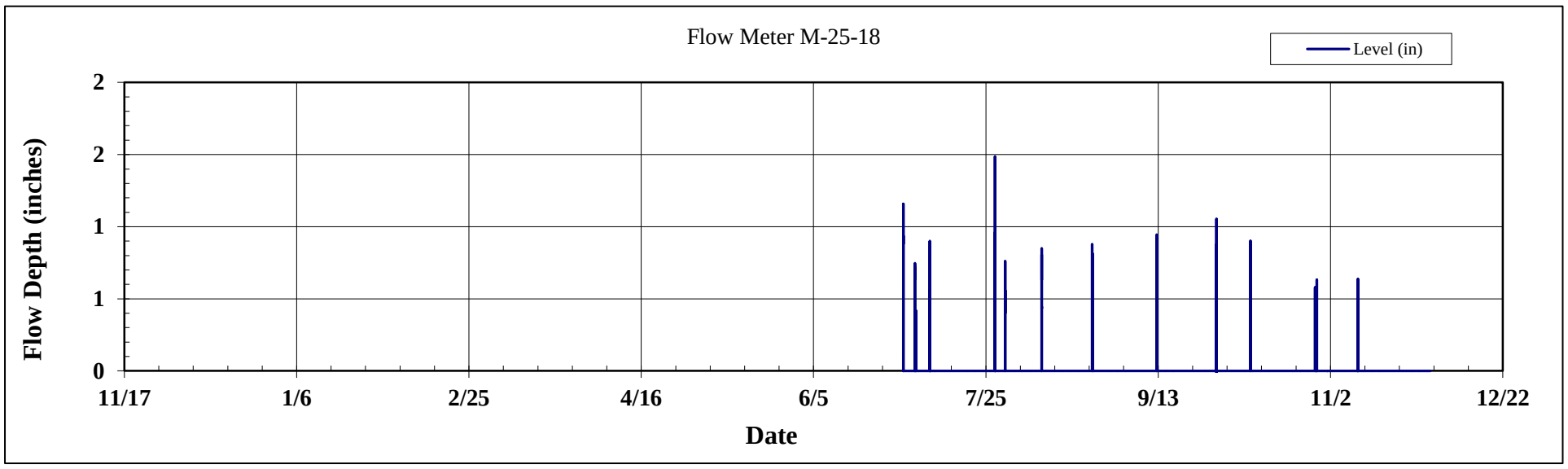


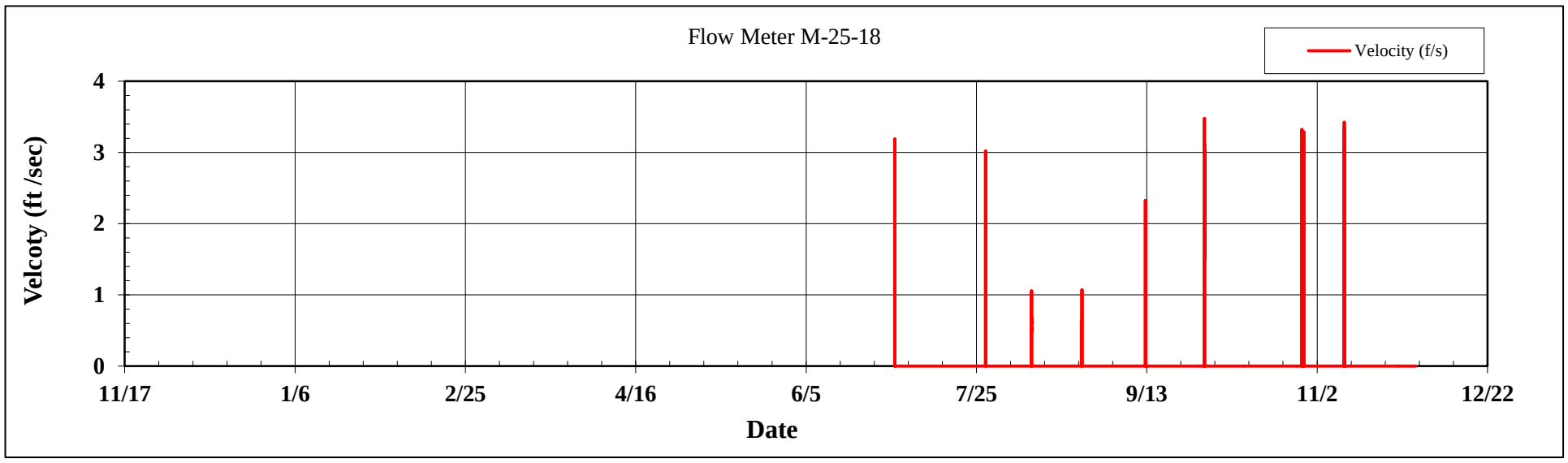


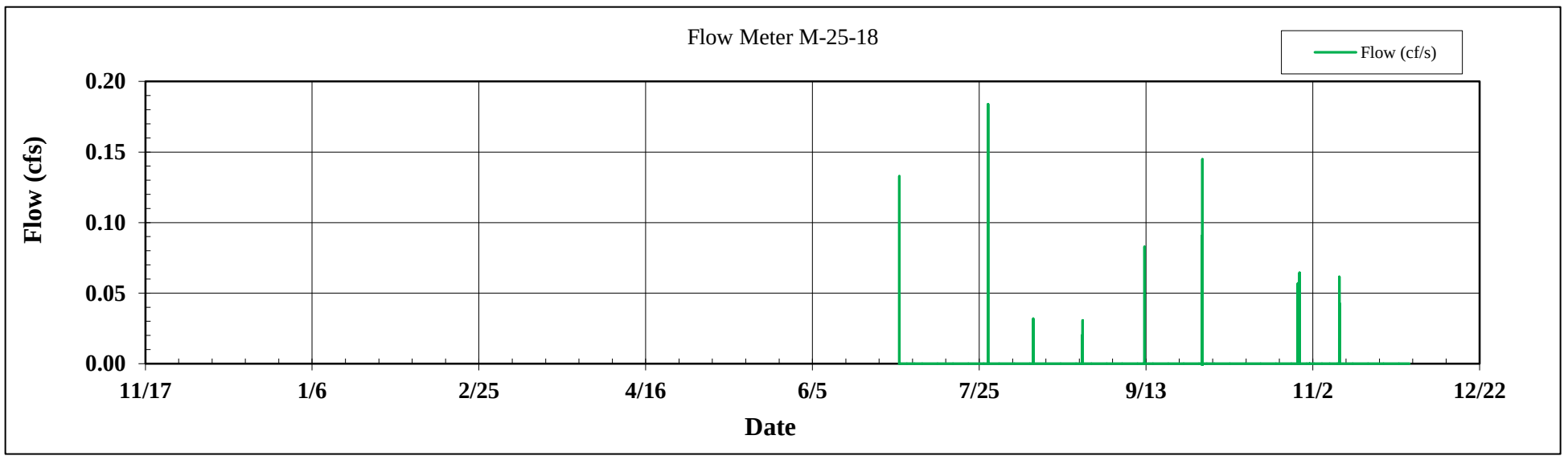


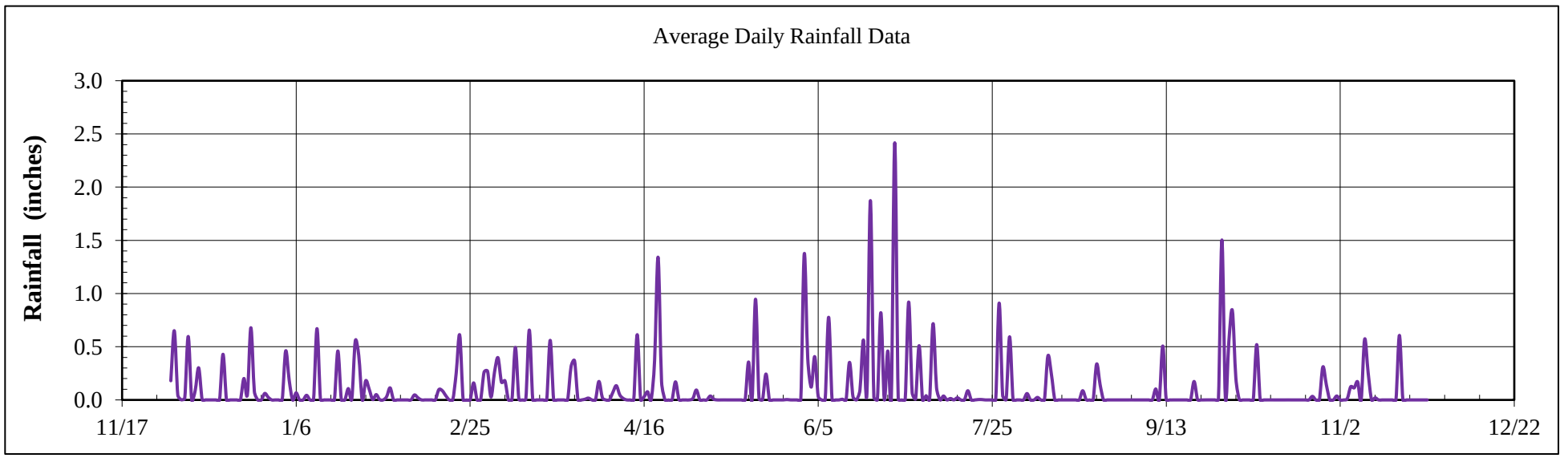


18" Storm Drain at STR 47 (29-47-3)

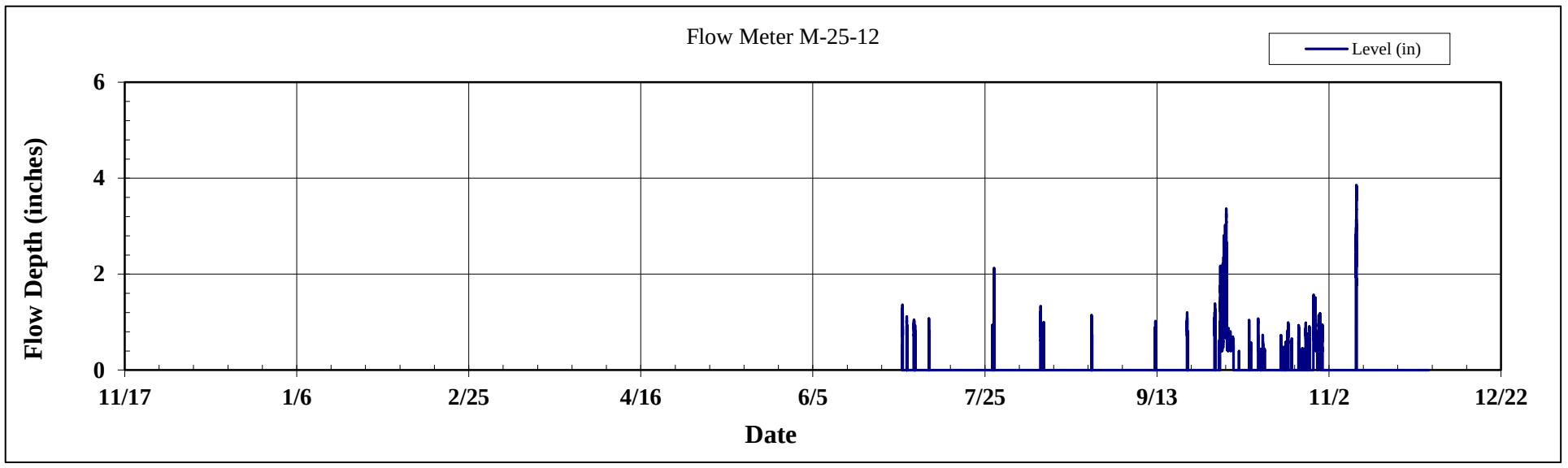


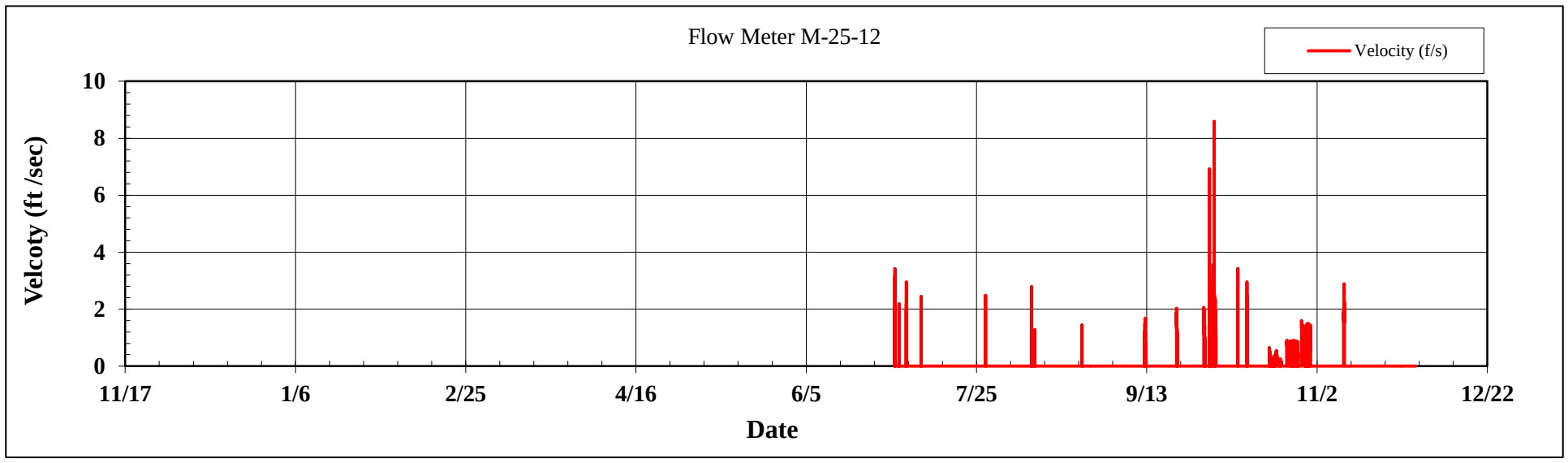


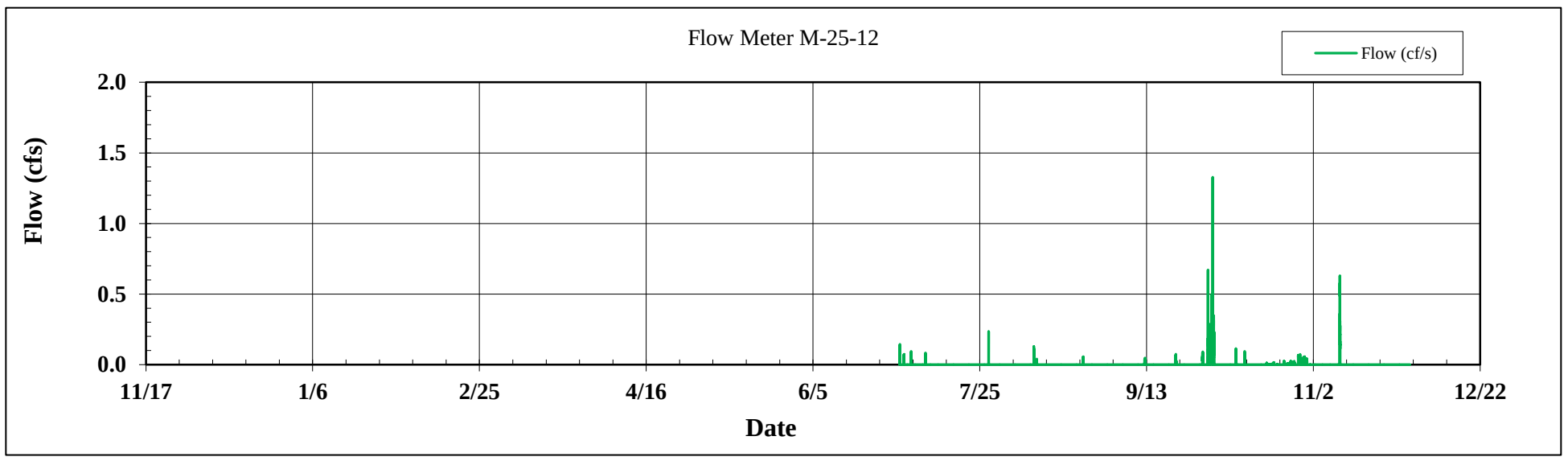


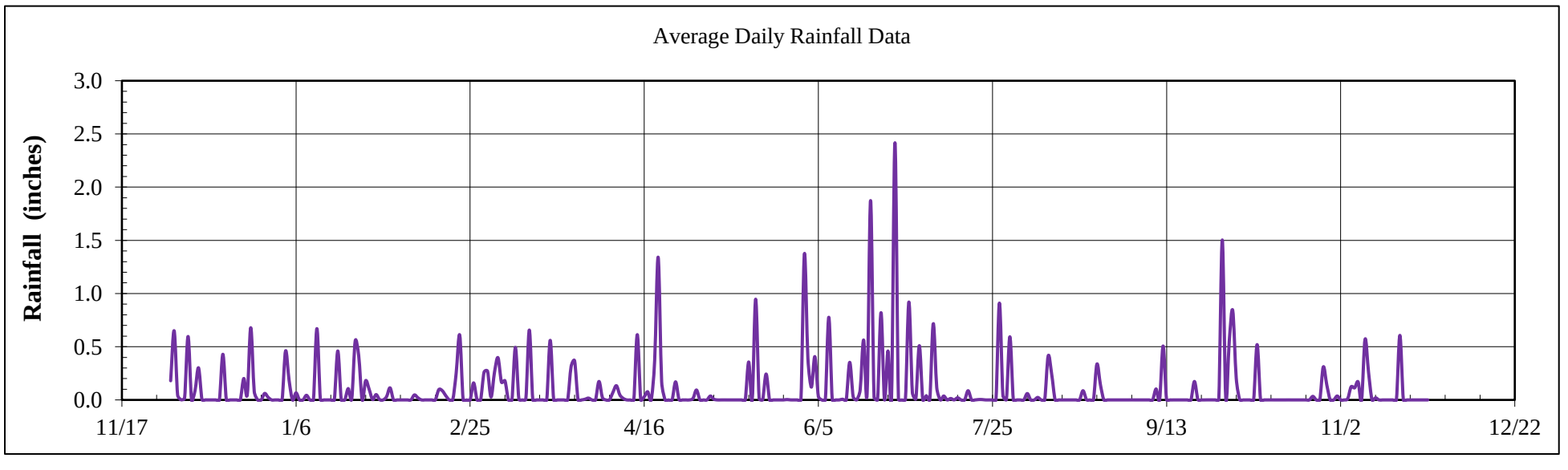


12" Storm Drain at STR 47 (29-47-4)



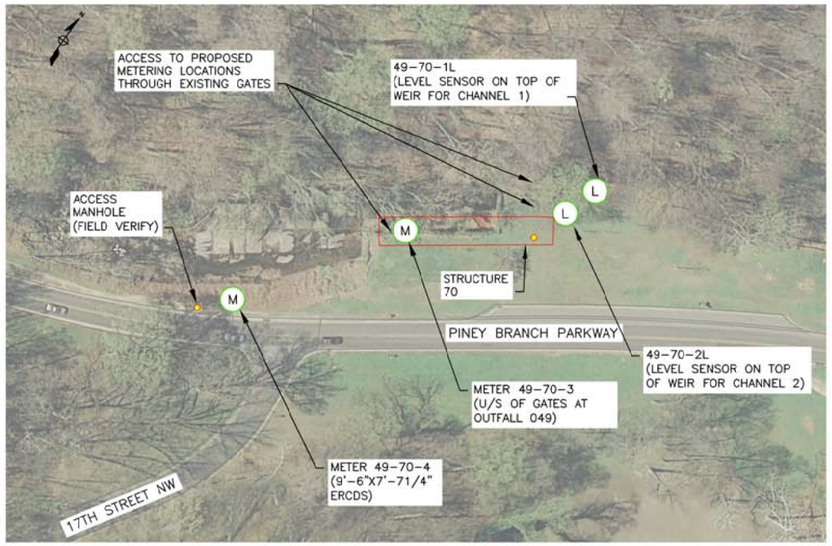


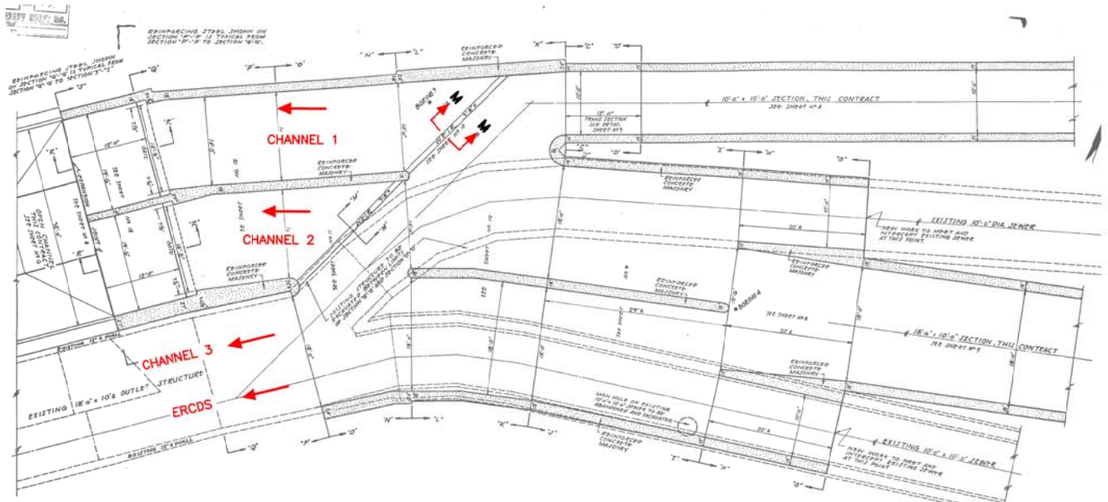




2 – FLOW METERS

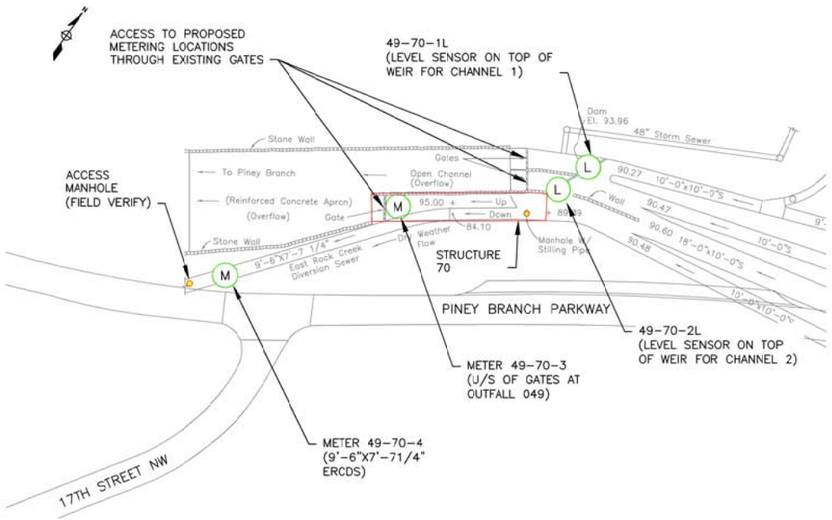
2 – LEVEL SENSORS





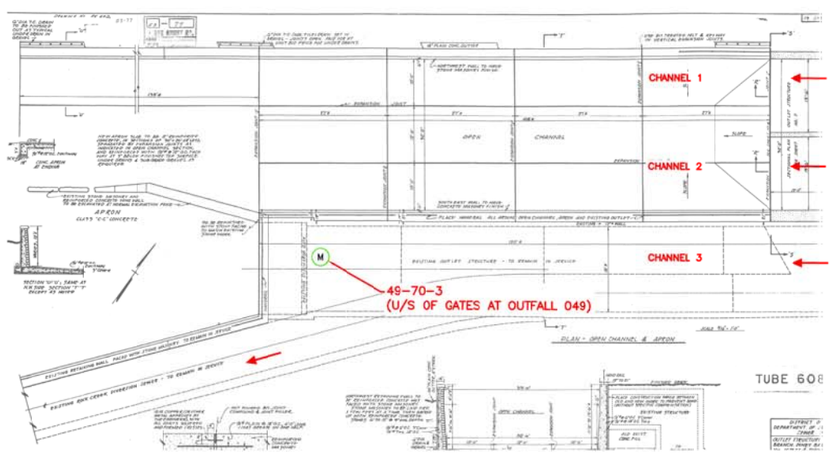
SECTIONAL PLAN

SCALE NTS



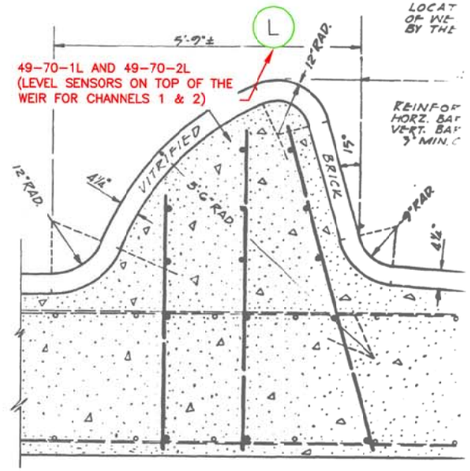
FLOW METER LOCATION PLAN

SCALE: NTS



SECTIONAL PLAN

SCALE NTS



TYPICAL WEIR SECTION M–M

SCALE NTS

LEGEND

(M) FLOW METER LOCATION

(L) LEVEL SENSOR LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
49–70–1L_2L_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 28

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 11/13/2014 10:18:48 AM
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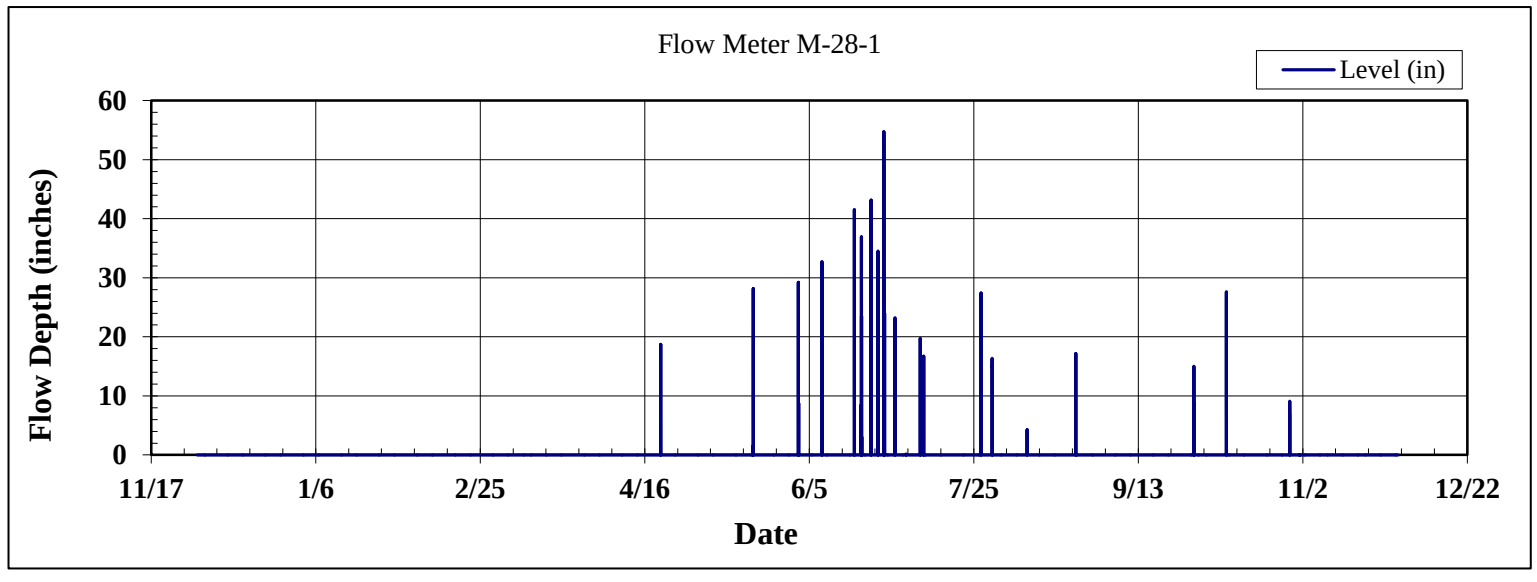
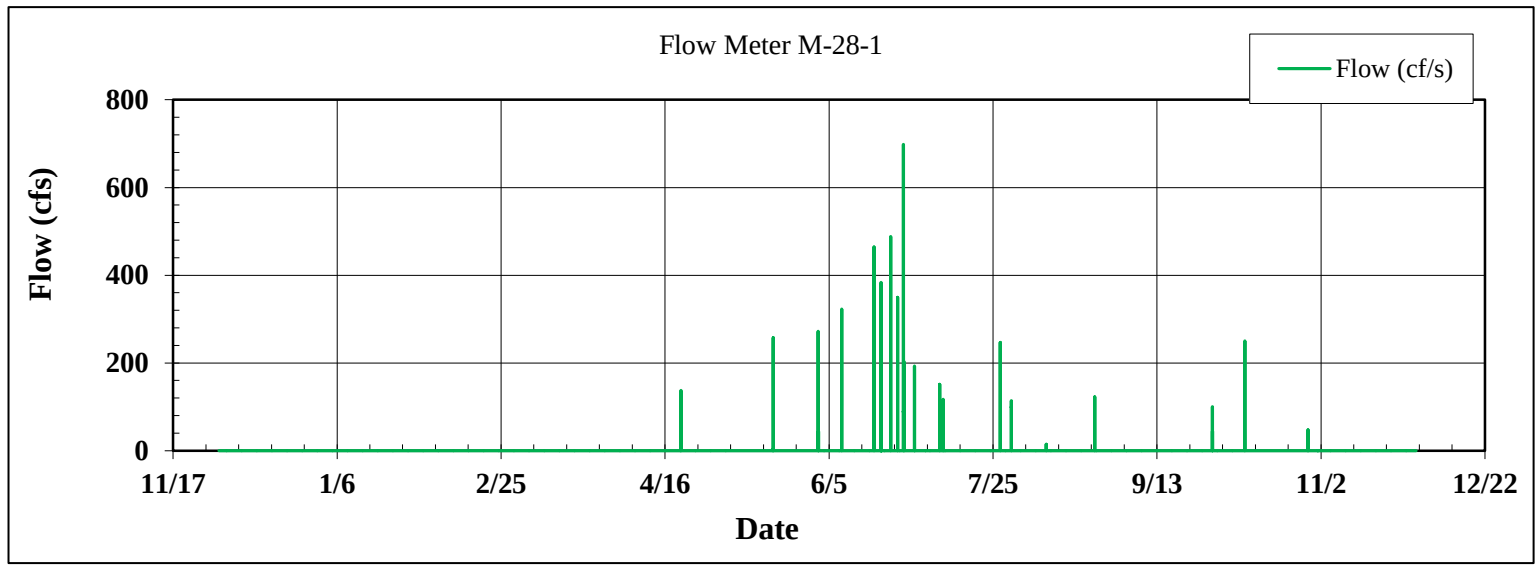
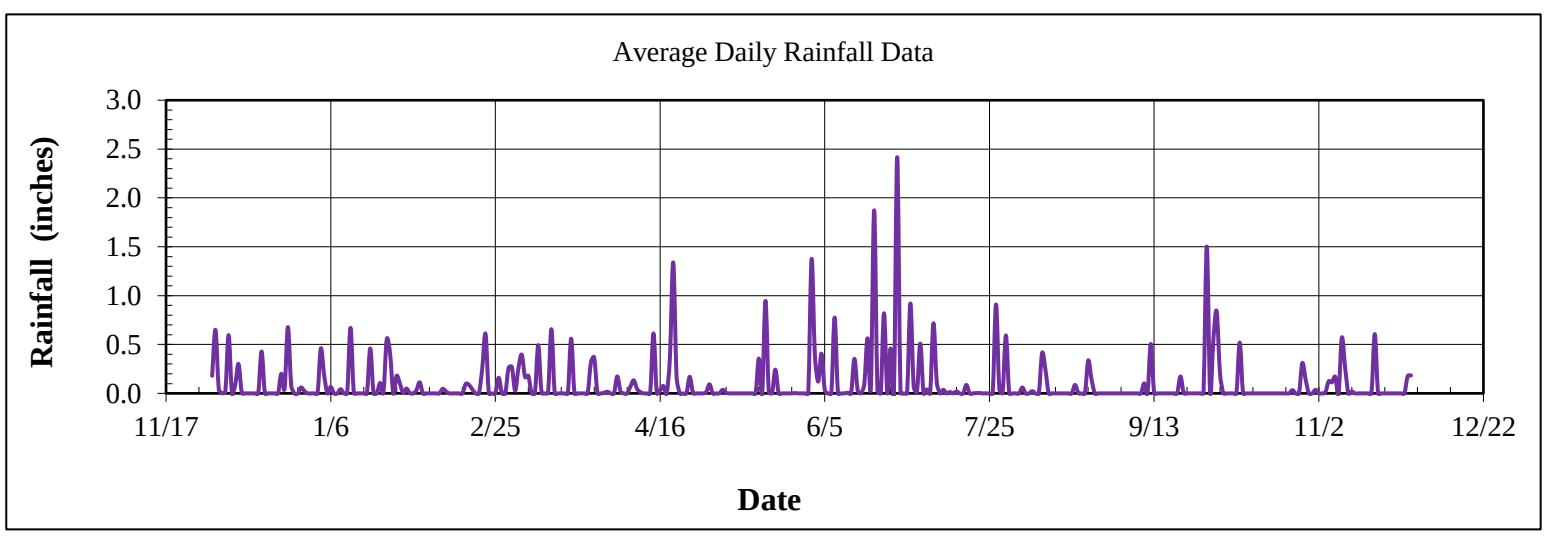
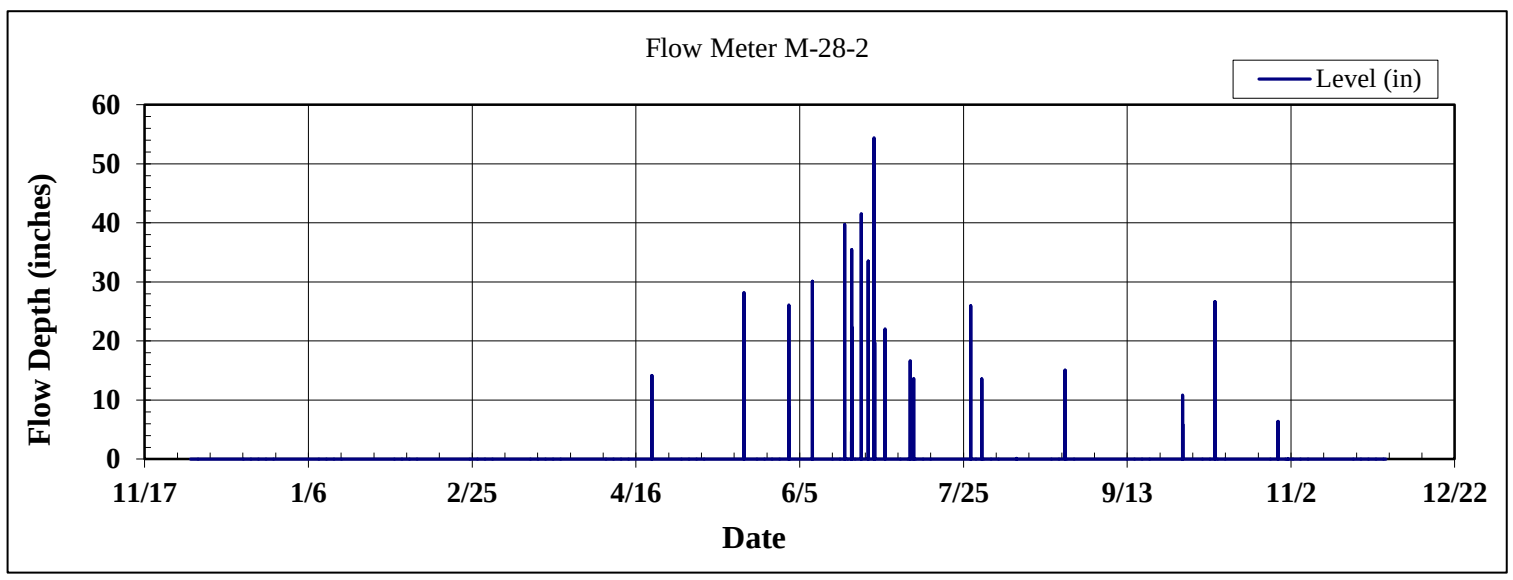
CSO 049 Overflow West Channel (49-70-1L)

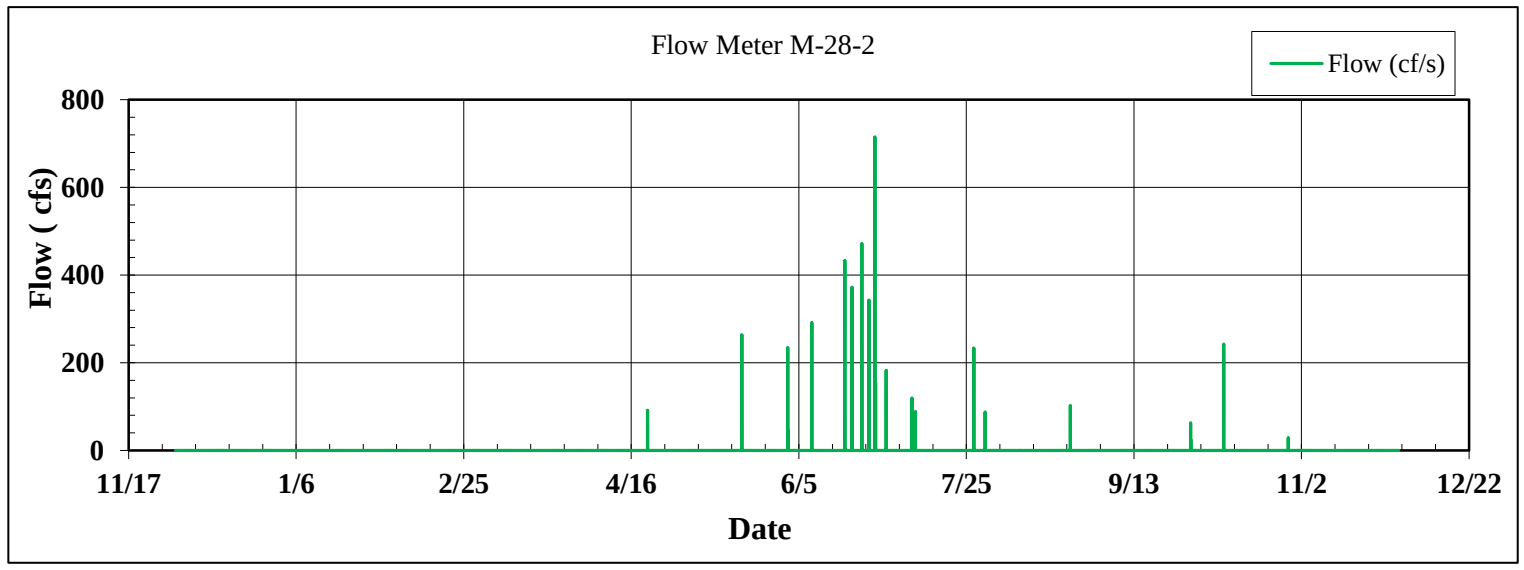


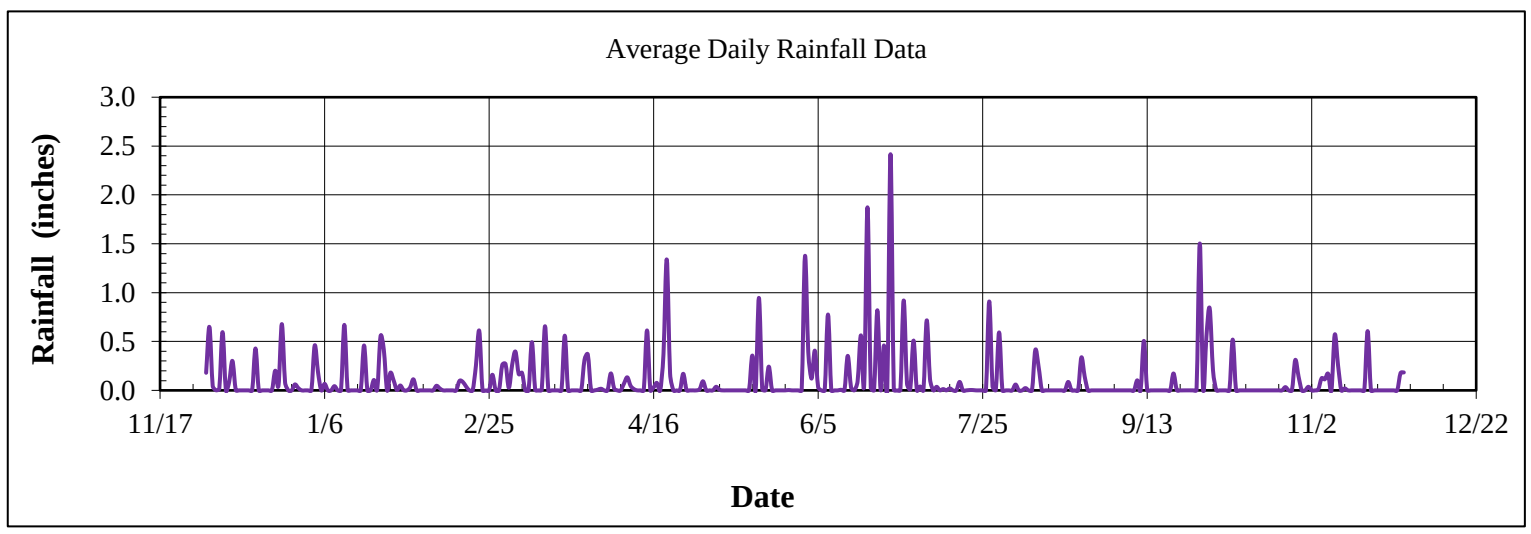




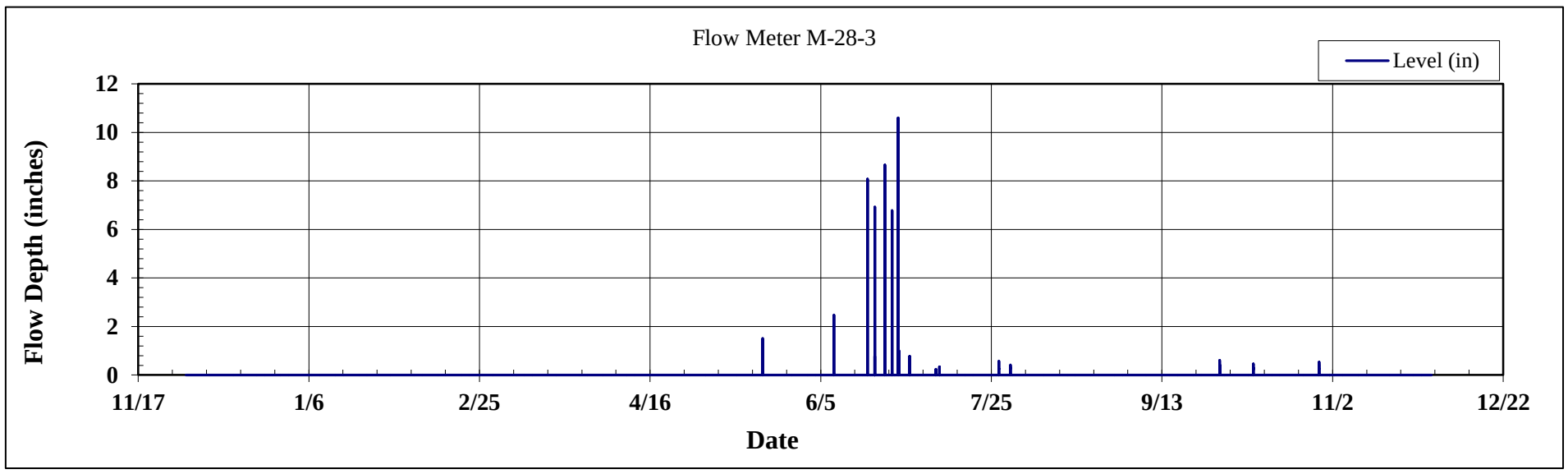
CSO 049 Overflow Middle Channel (49-70-2L)

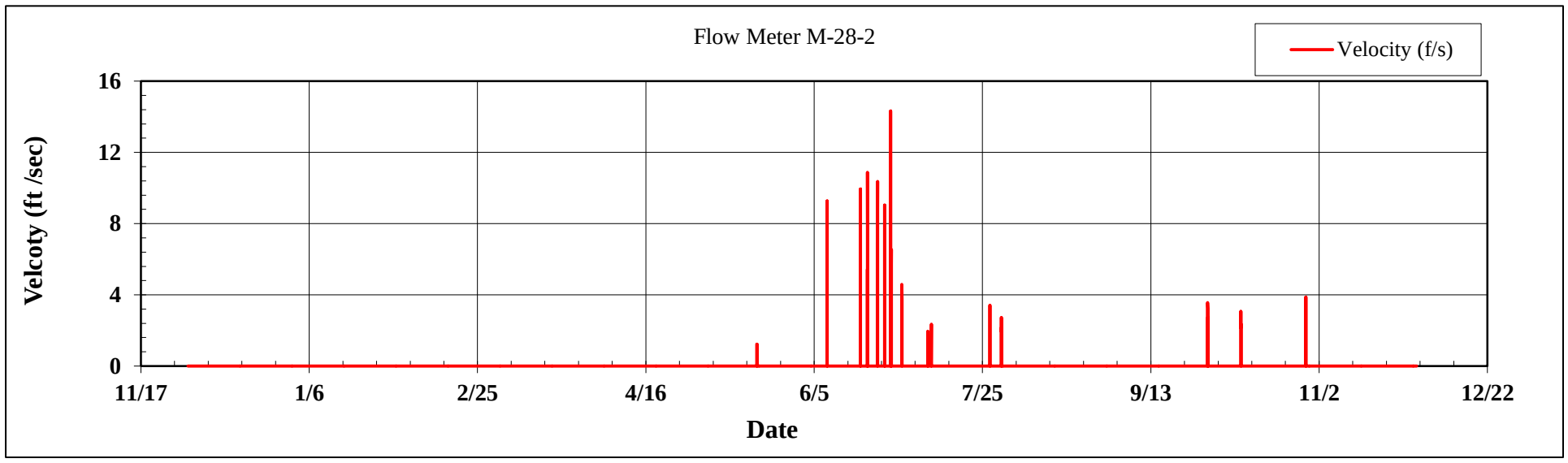


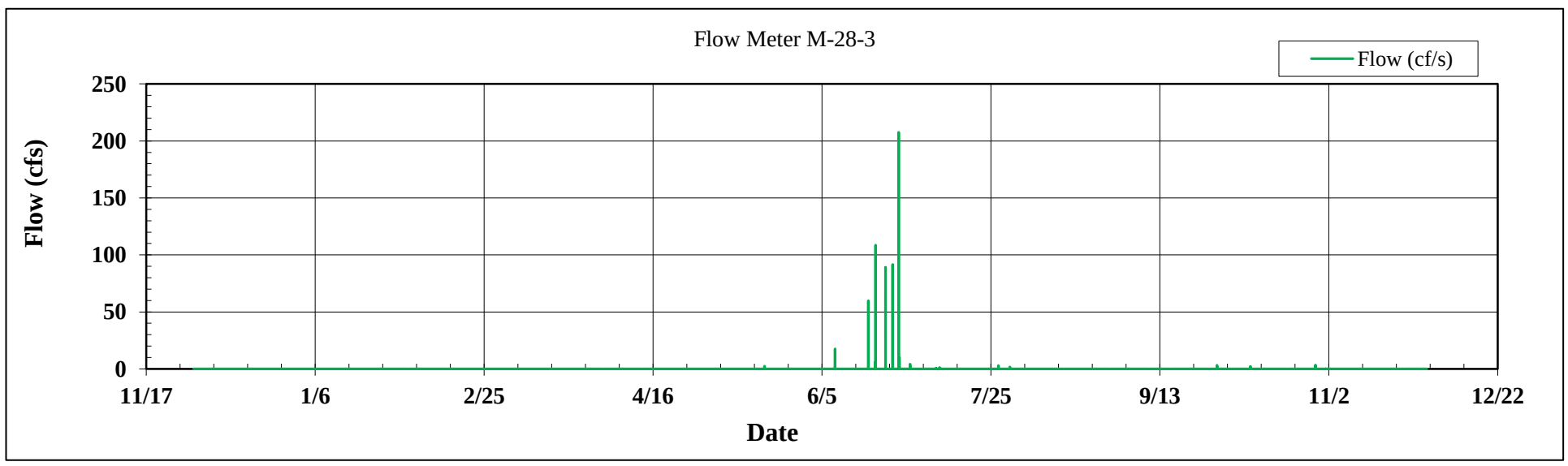


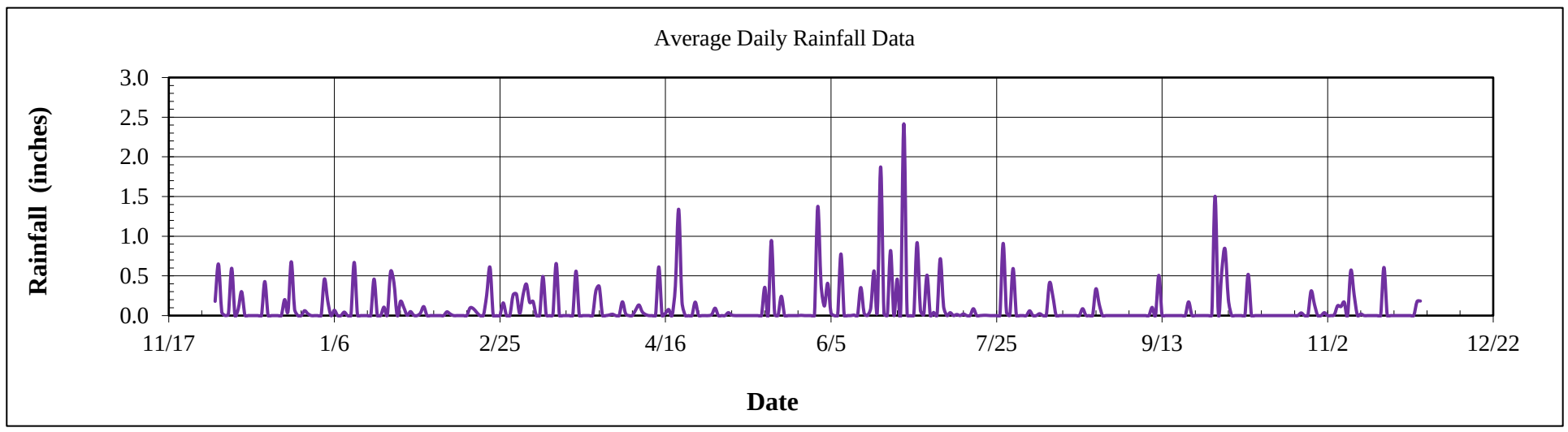


CSO 049 Overflow East Channel (49-70-3)

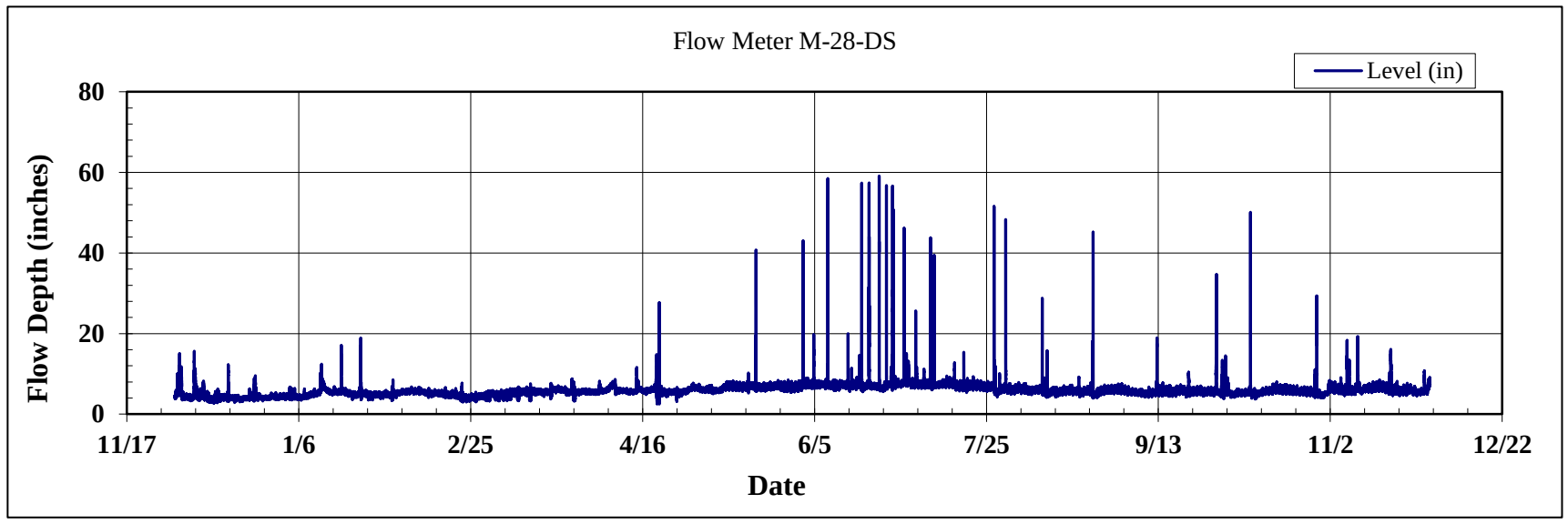


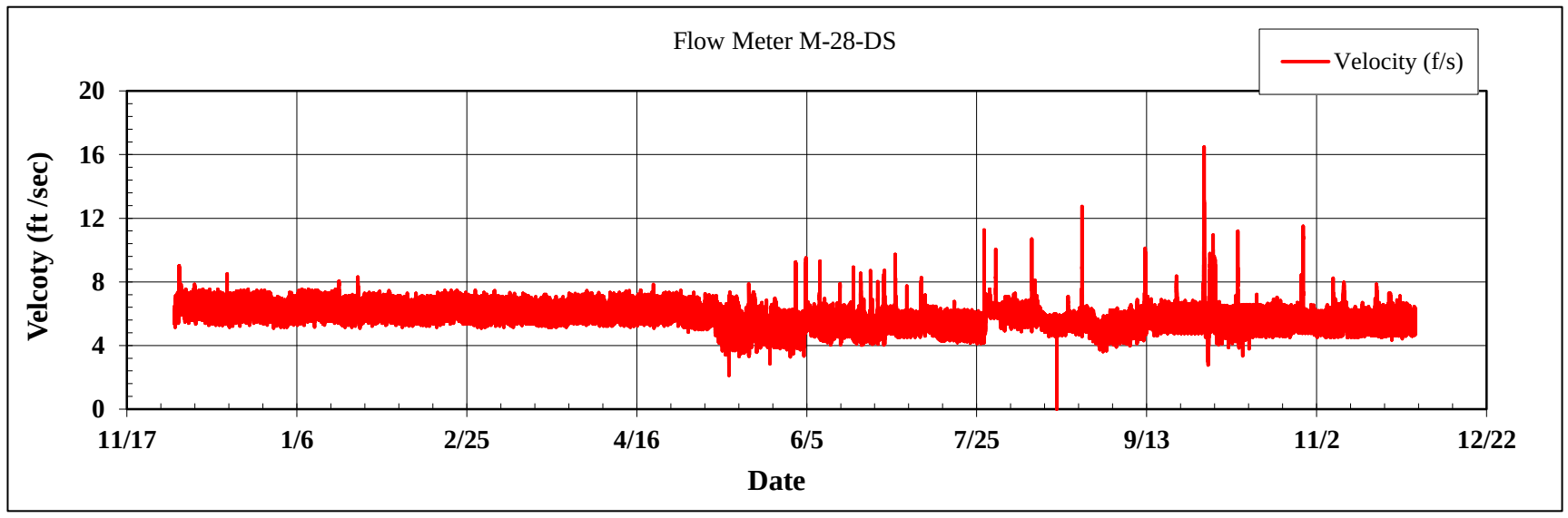


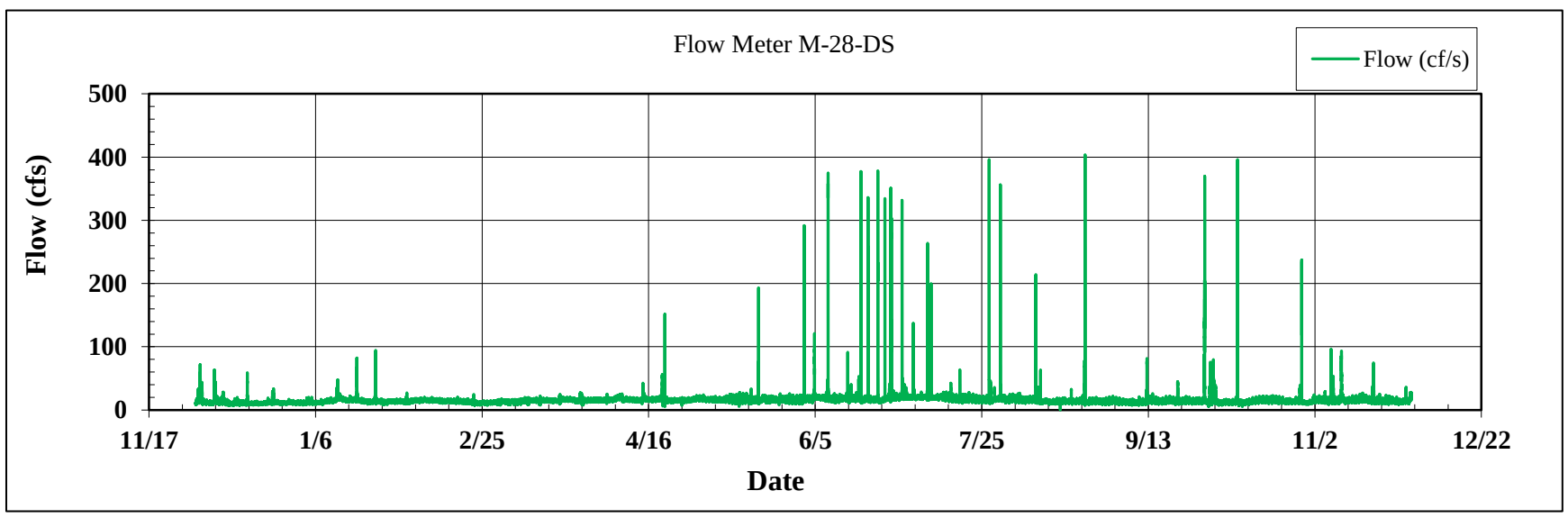


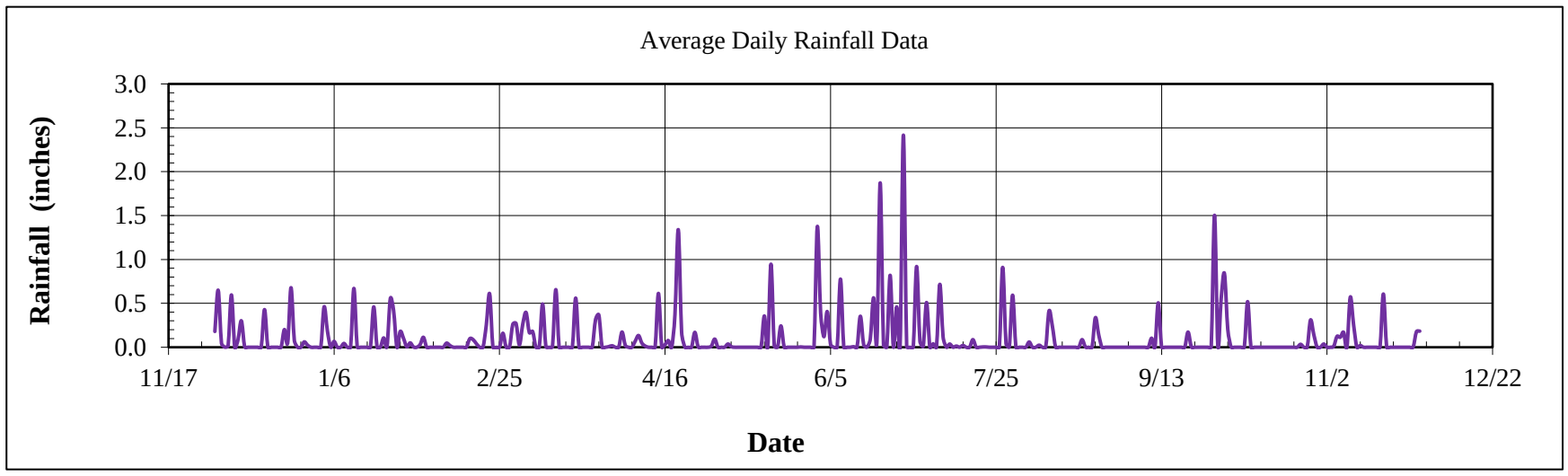


Dry Weather Diversion to ERCDS (49-70-4)





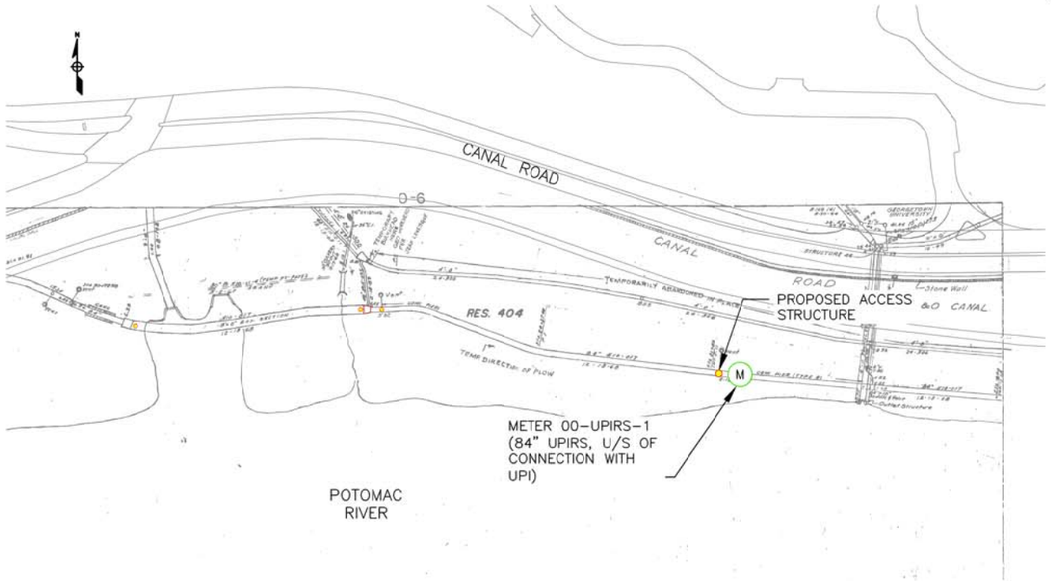




1 – FLOW METER

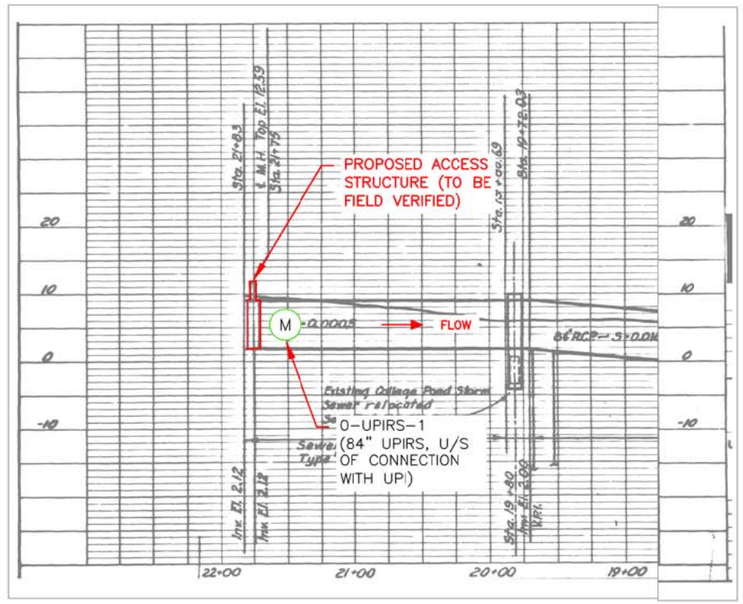
FLOW METER LOCATION PLAN

SCALE: NTS



FLOW METER LOCATION PLAN

SCALE: NTS



SEWER PROFILE

SCALE NTS

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

00-UPIRS-1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 26

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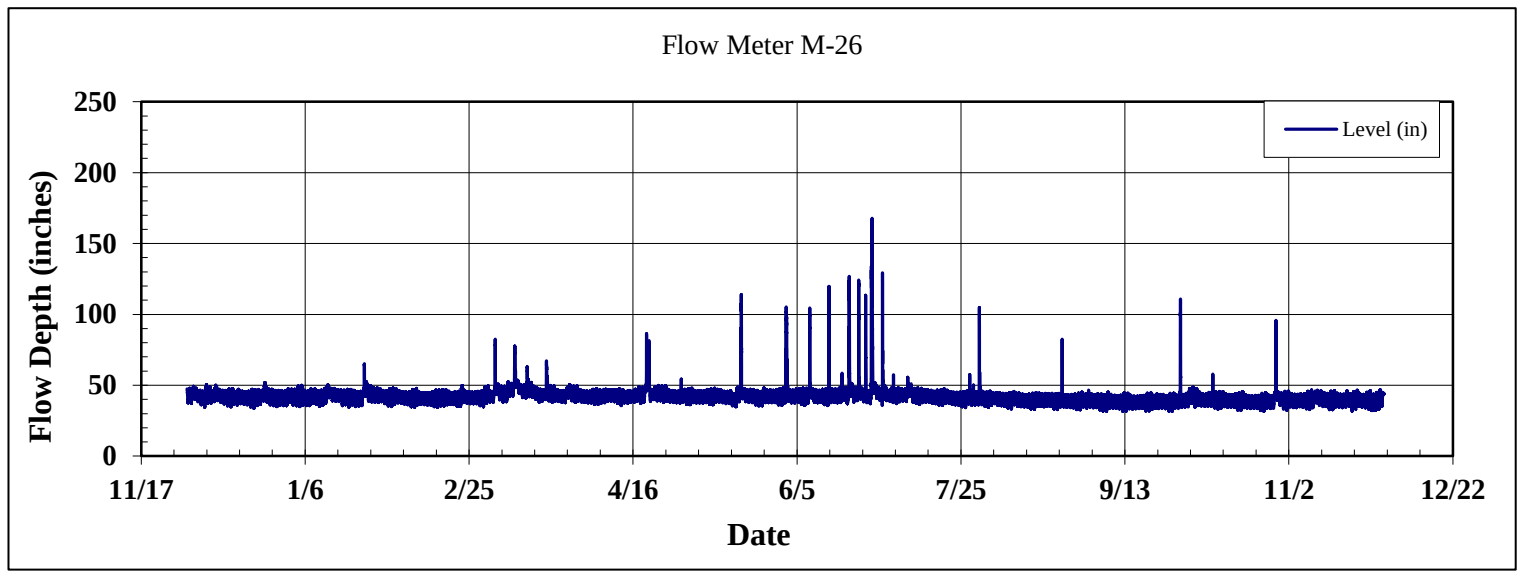
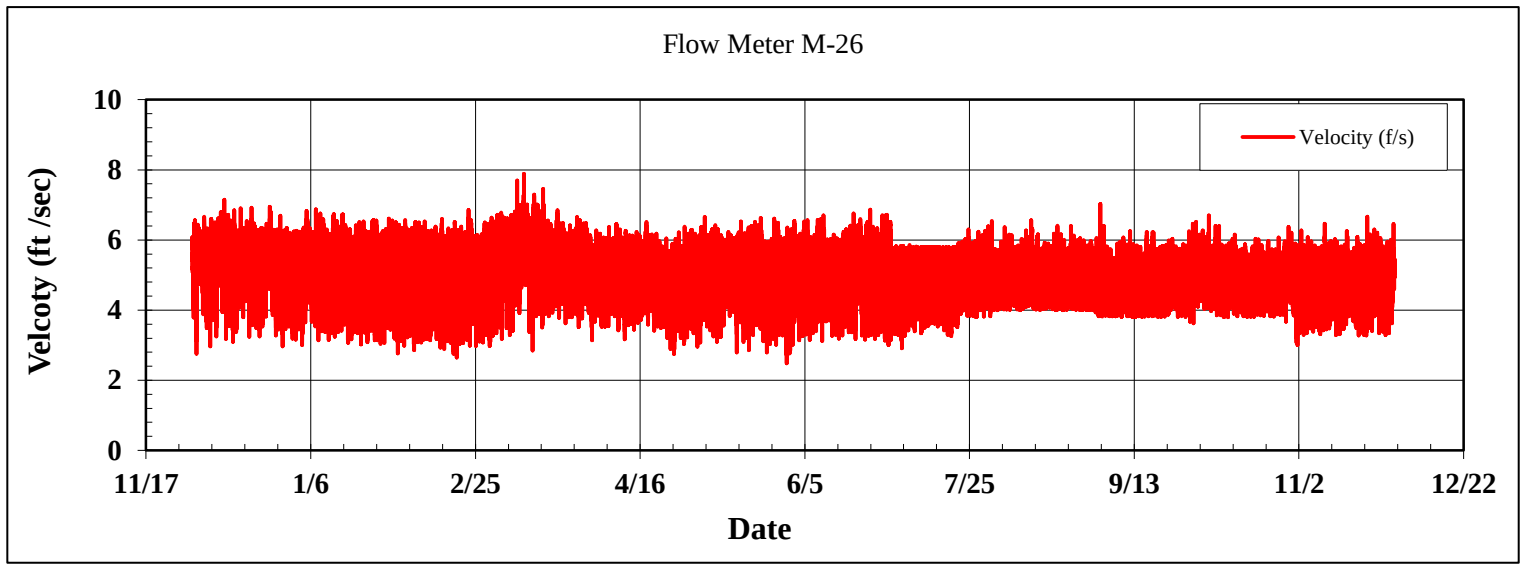
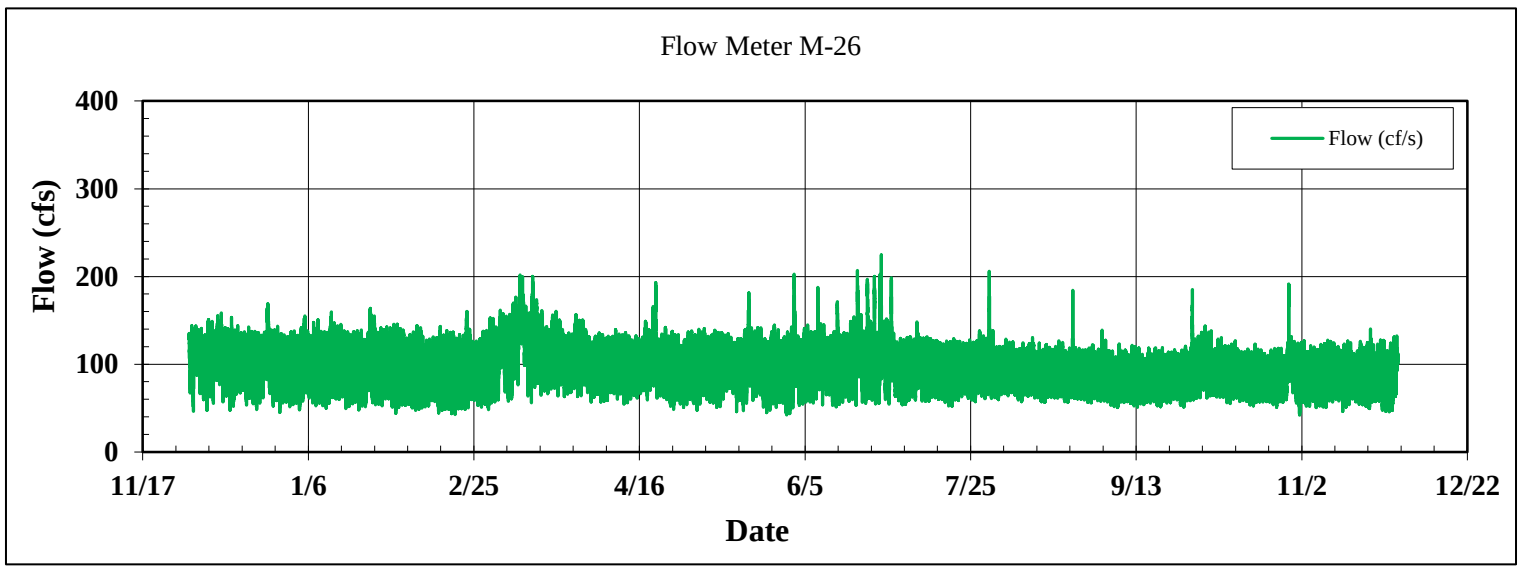
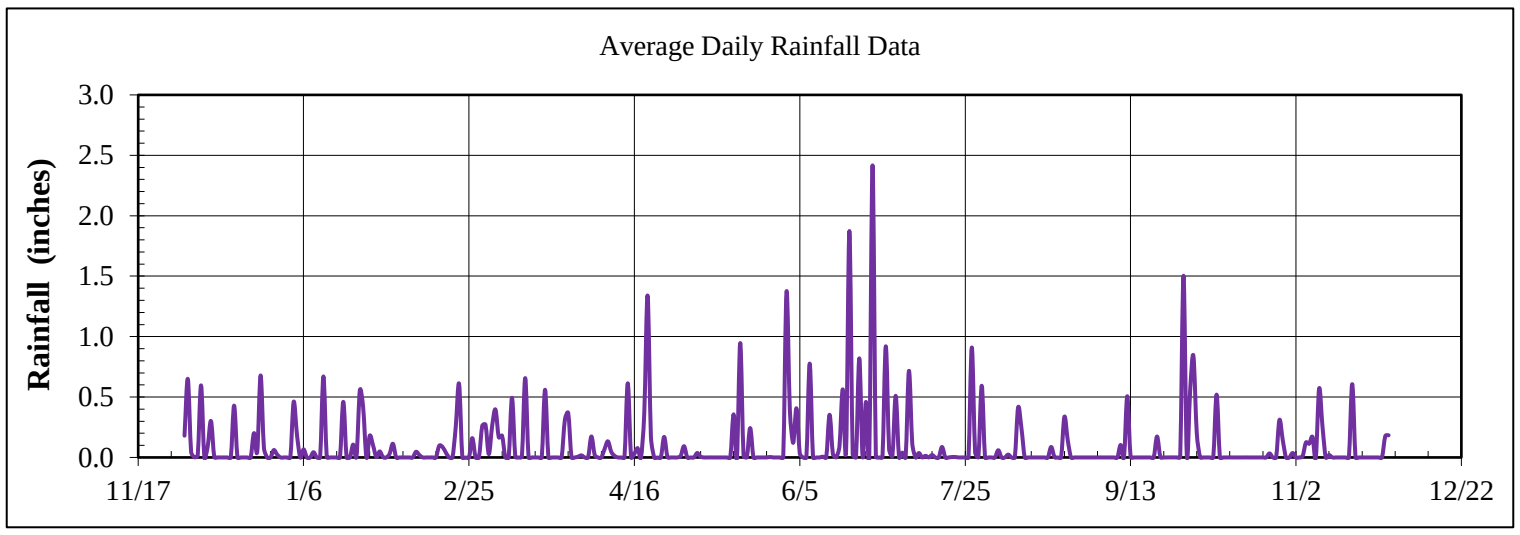
UPIRS Flows from Boundary (00-UPIRS-1)

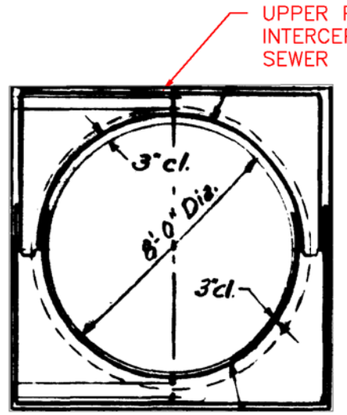




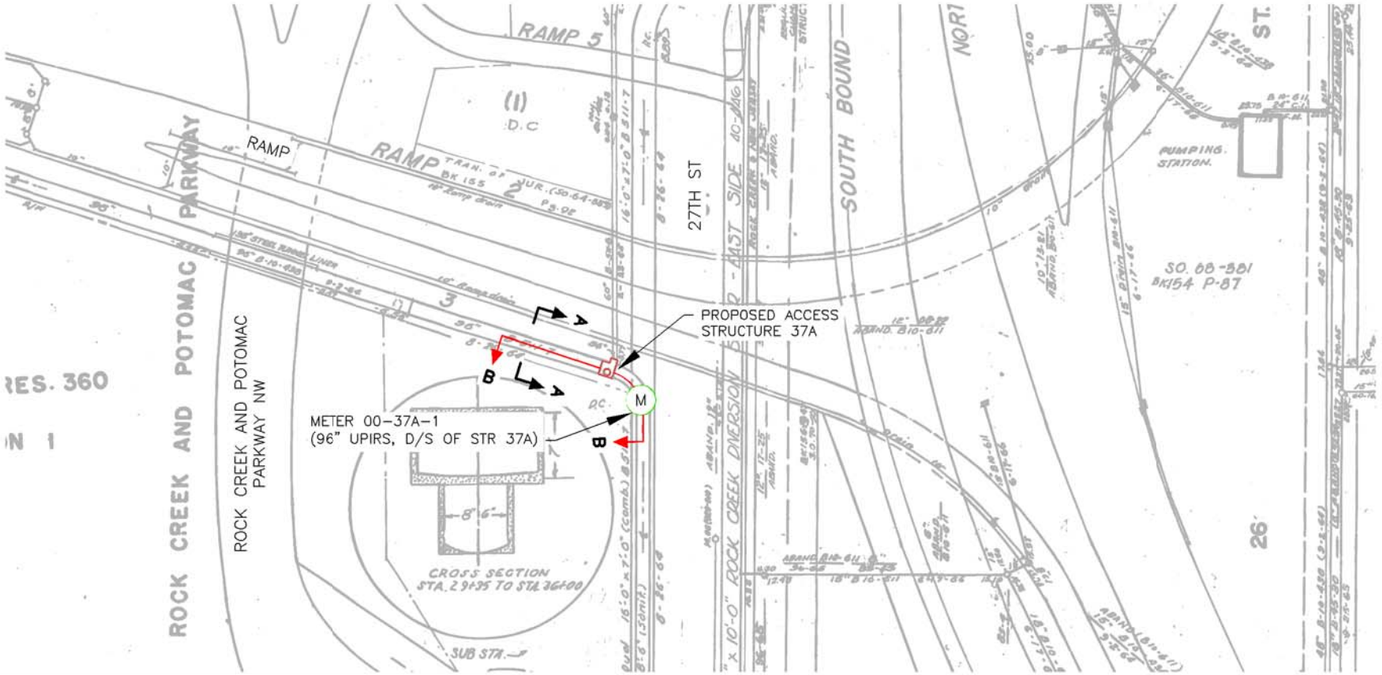




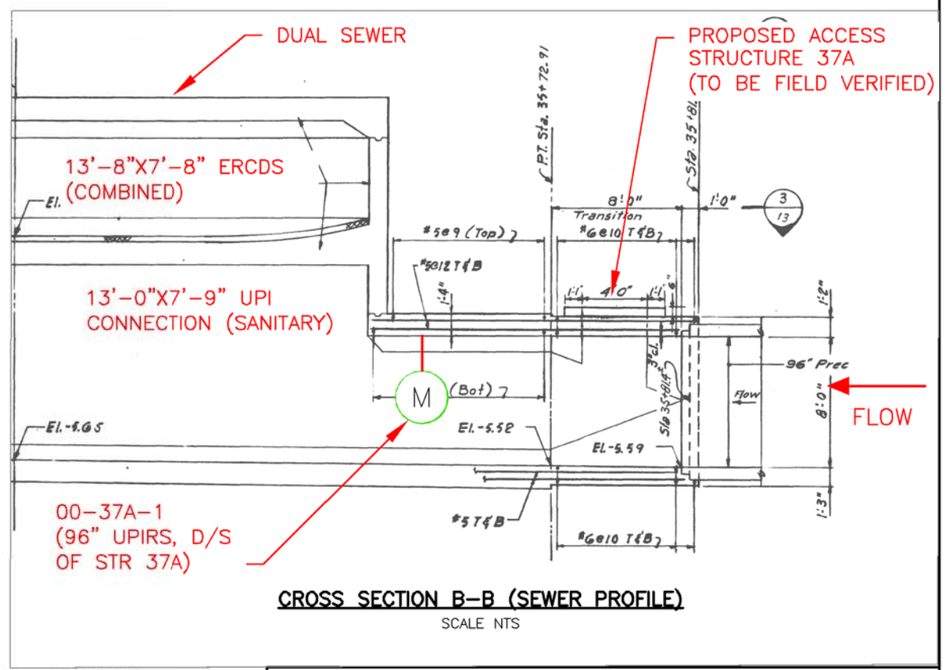
1 – FLOW METER



TYPICAL CROSS SECTION A–A
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND

- M — FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00–37A–1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 15

LAST SAVED BY: CONSTANT A. MORTEY DATE: 10/27/2014 3:43:39 PM
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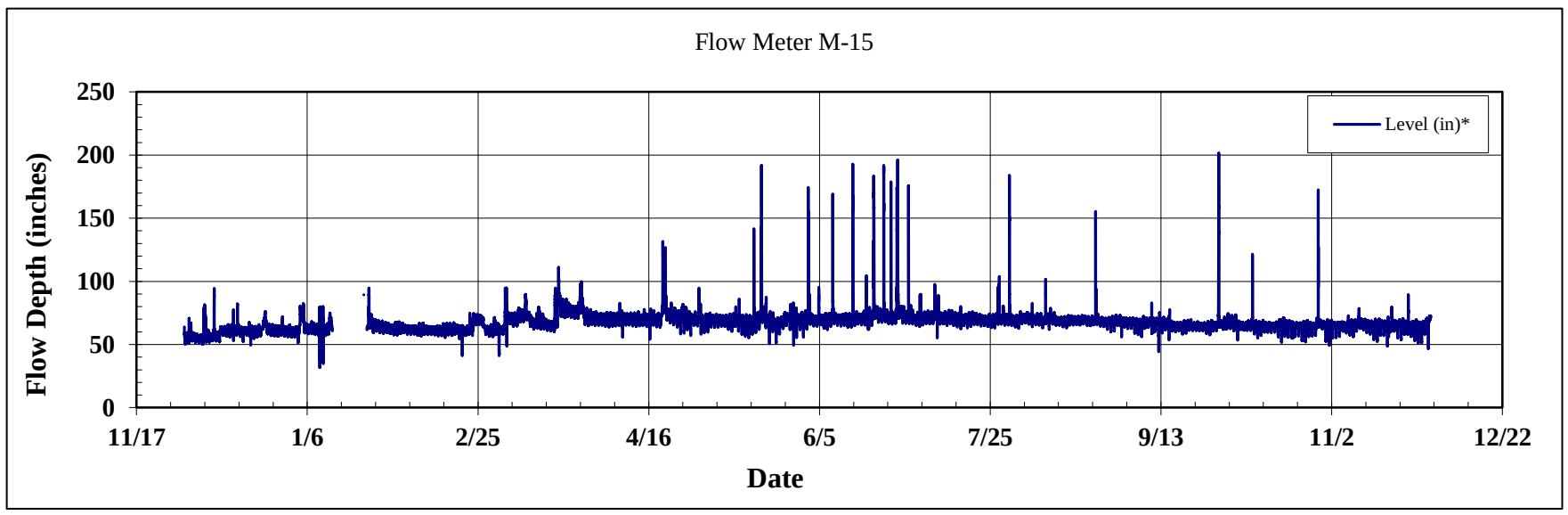
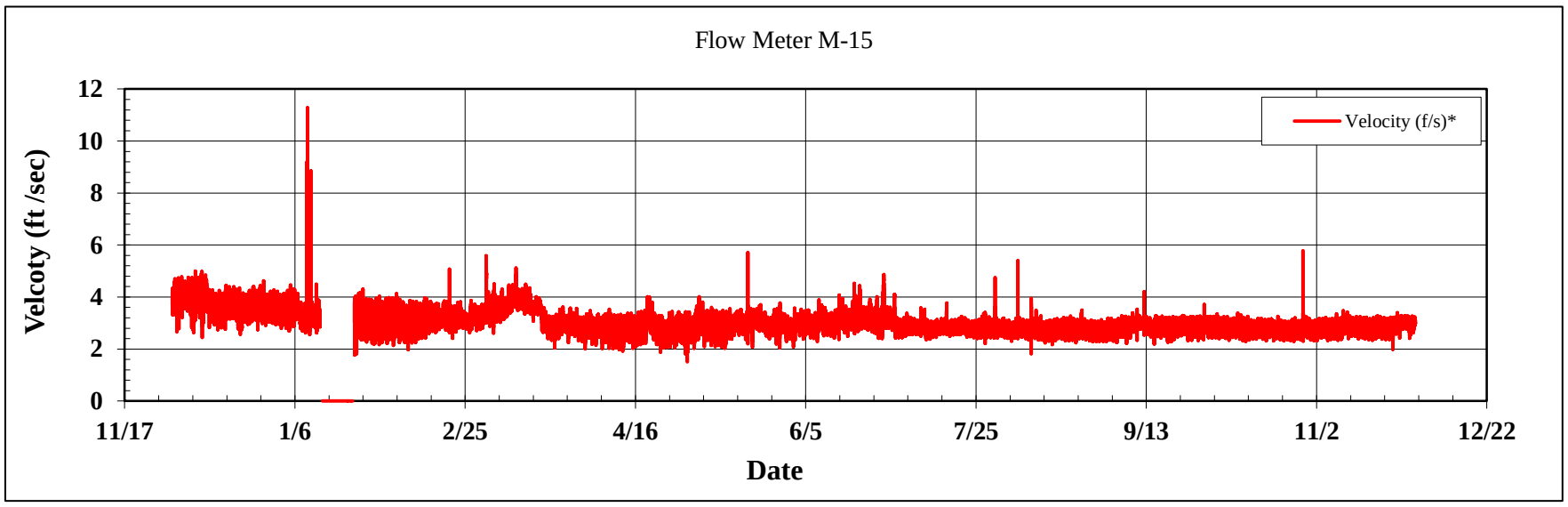
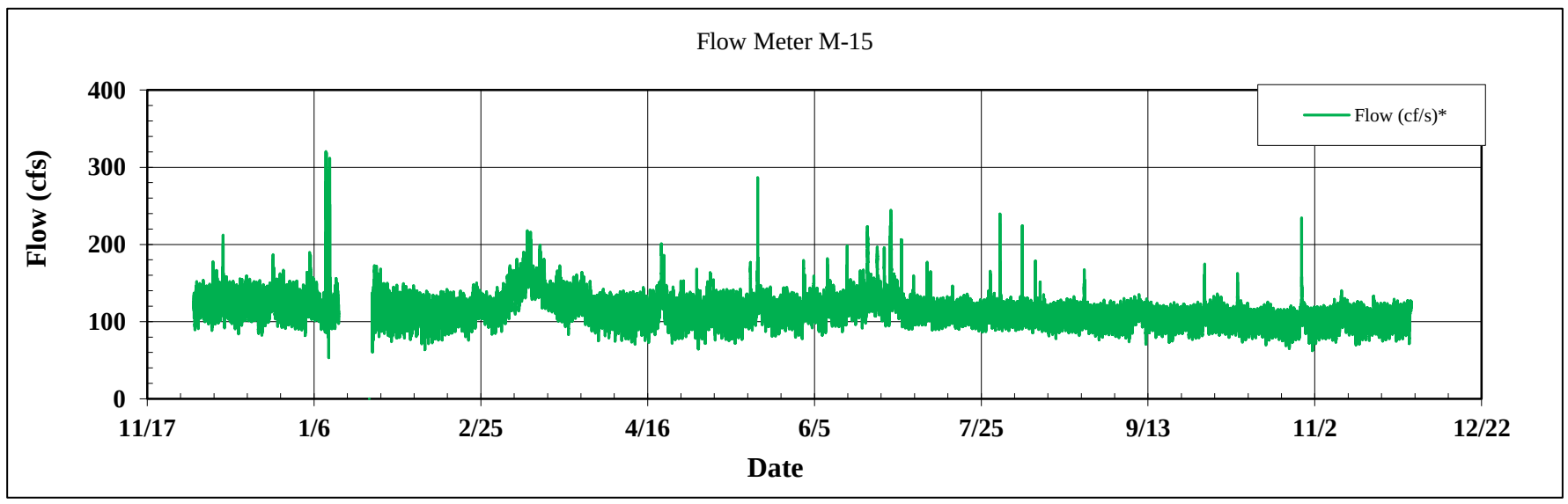
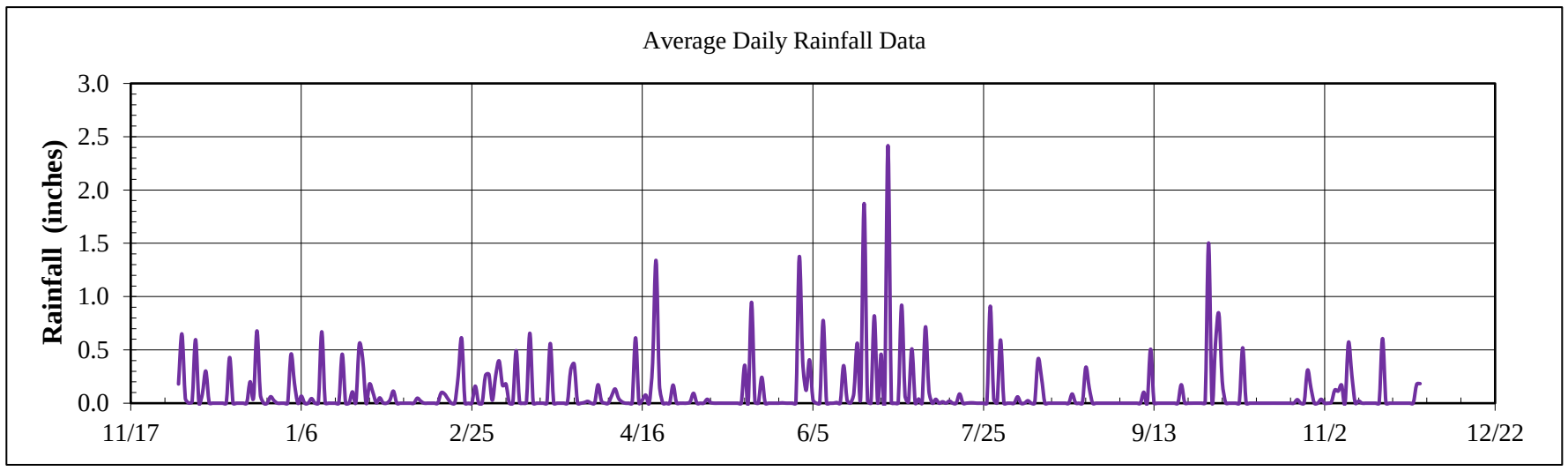
UPIRS Flows to UPI-D/S of STR 37A (00-37A-1)

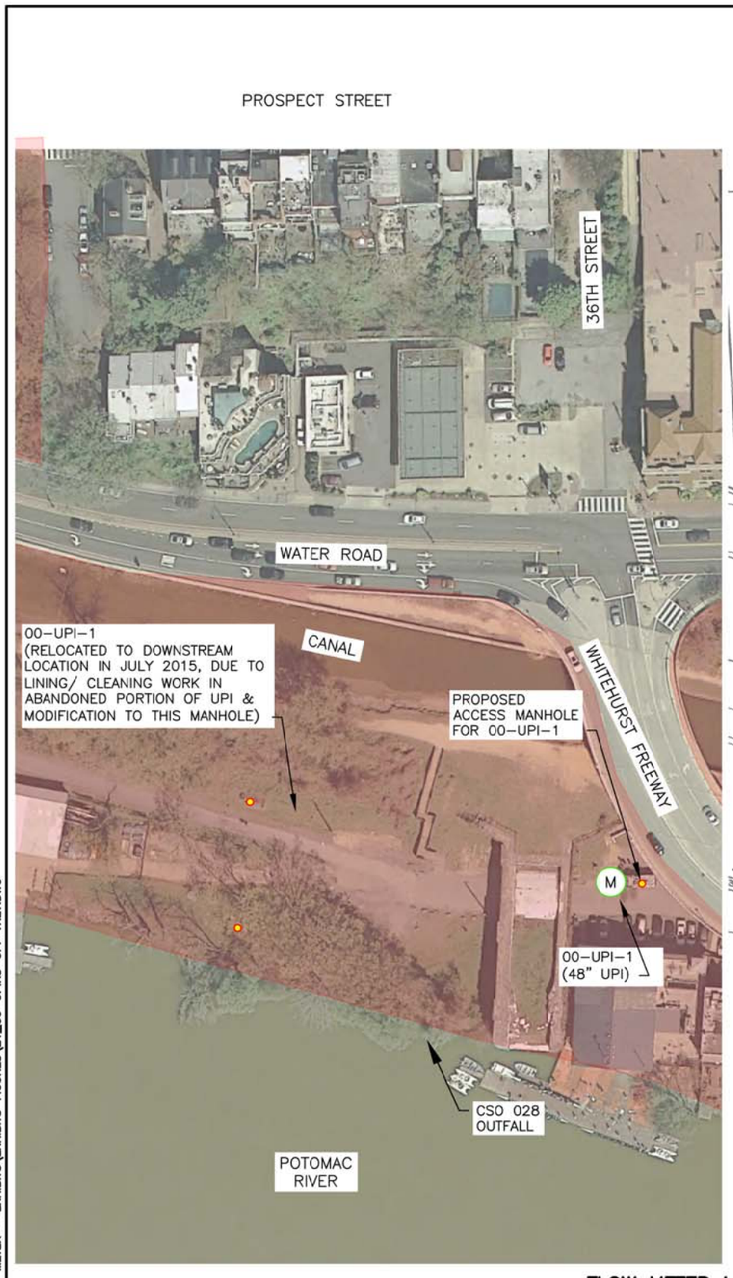


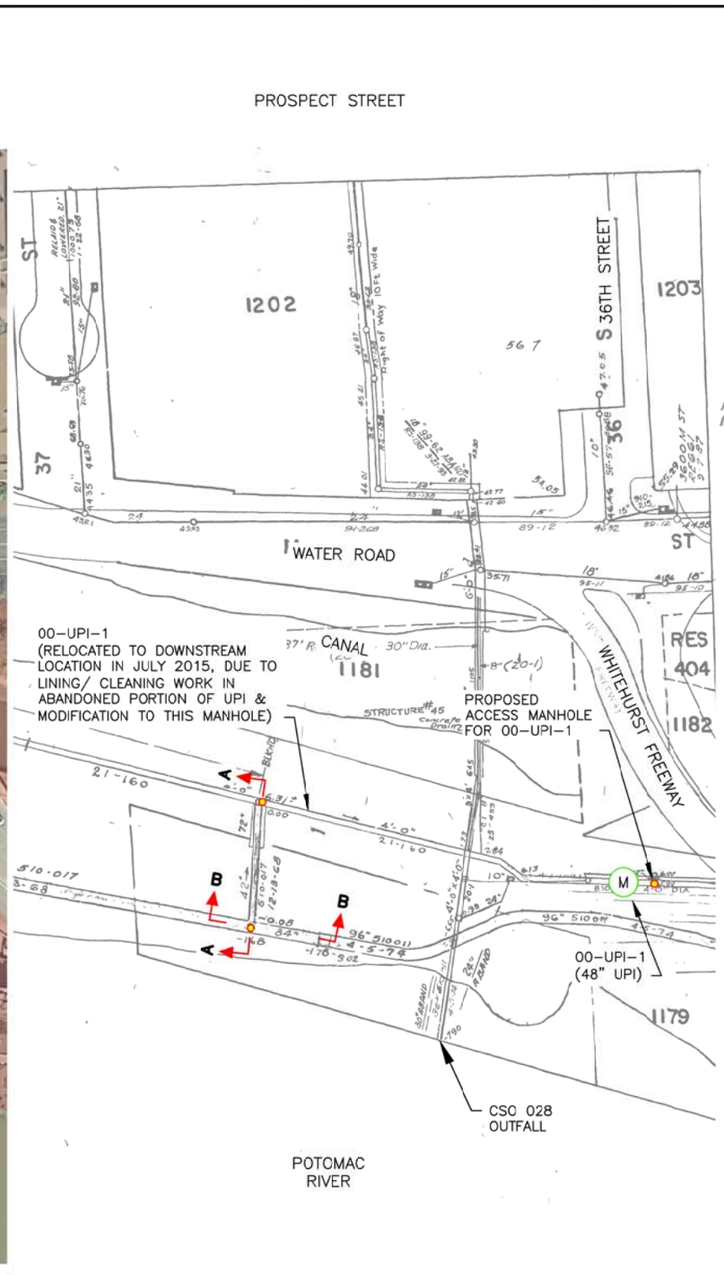




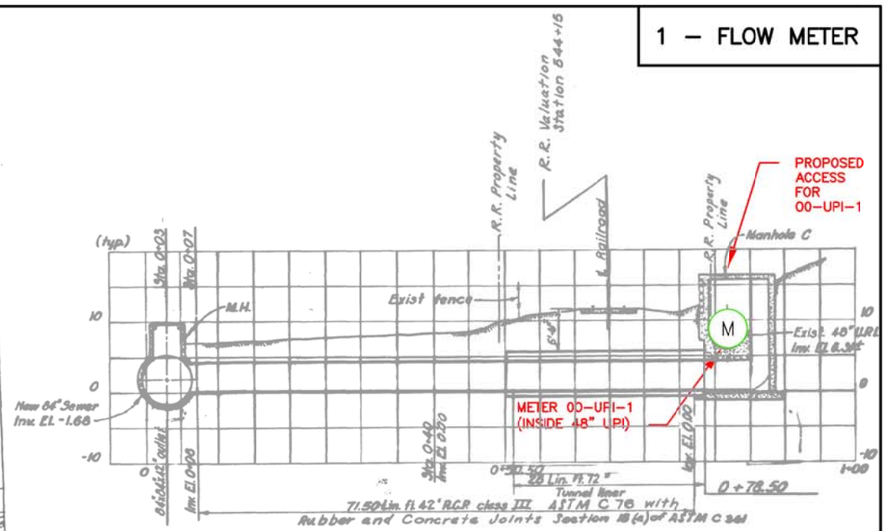


1 – FLOW METER

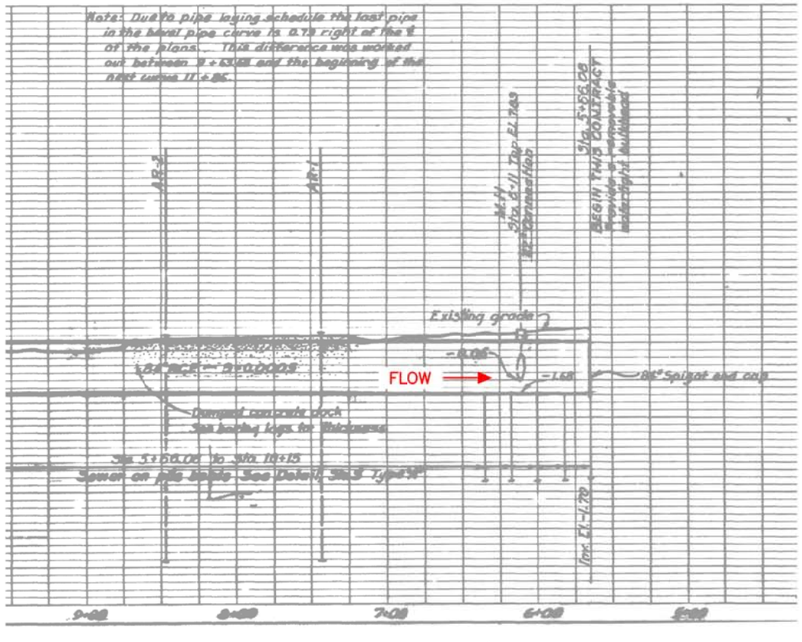




FLOW METER LOCATION PLAN
SCALE: NTS



CROSS SECTION A–A (PROFILE)
SCALE NTS



CROSS SECTION B–B (PROFILE)
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00–UPI–1
METER LOCATIONS AND TYPICAL CROSS SECTION

DATE: JULY 2015	SITE 21

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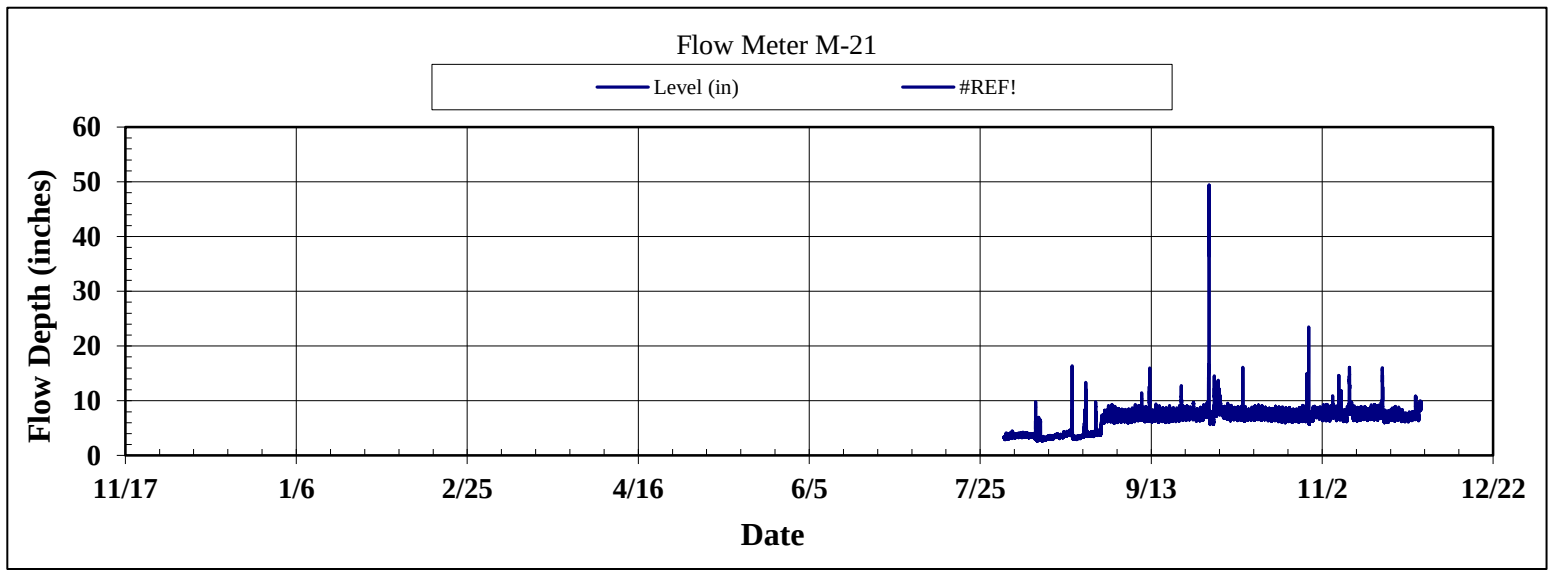
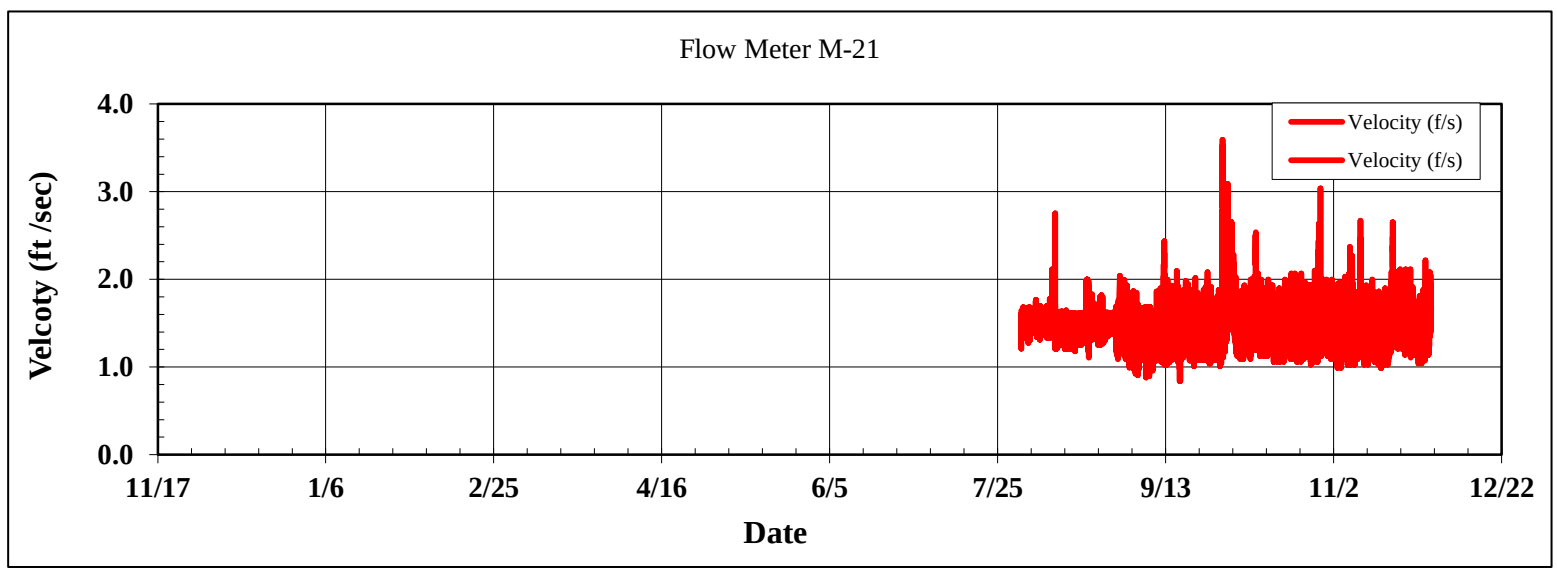
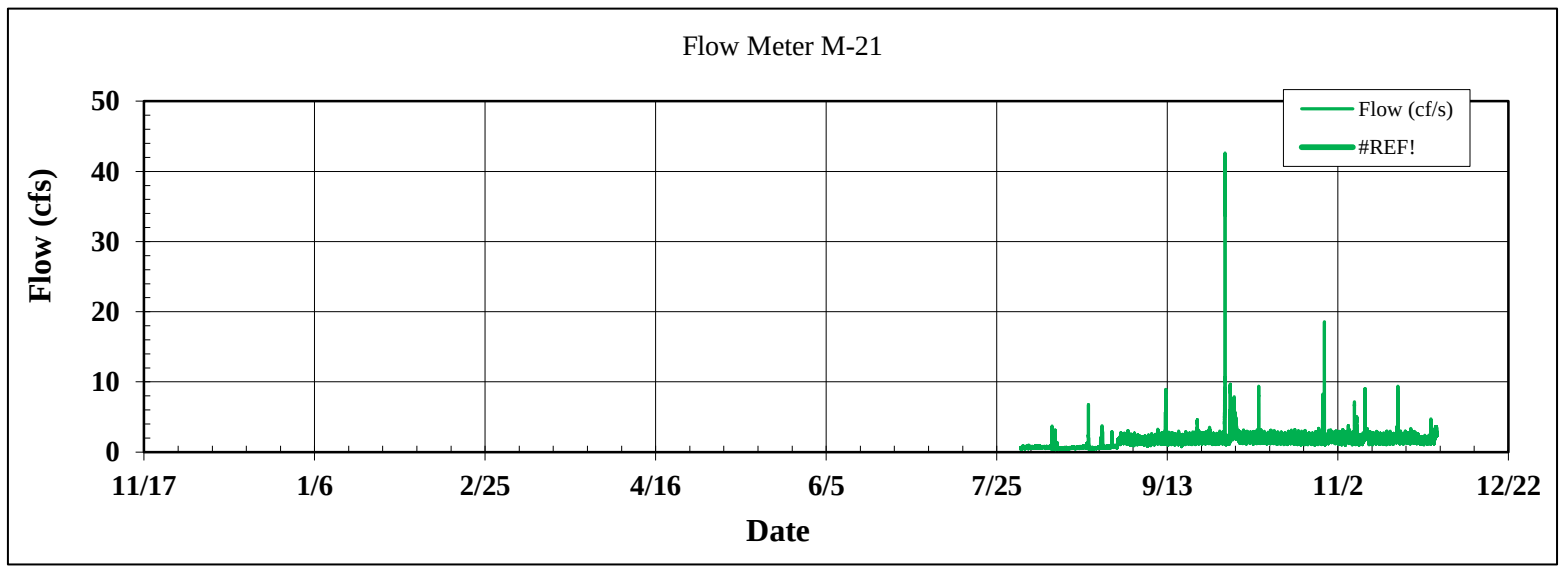
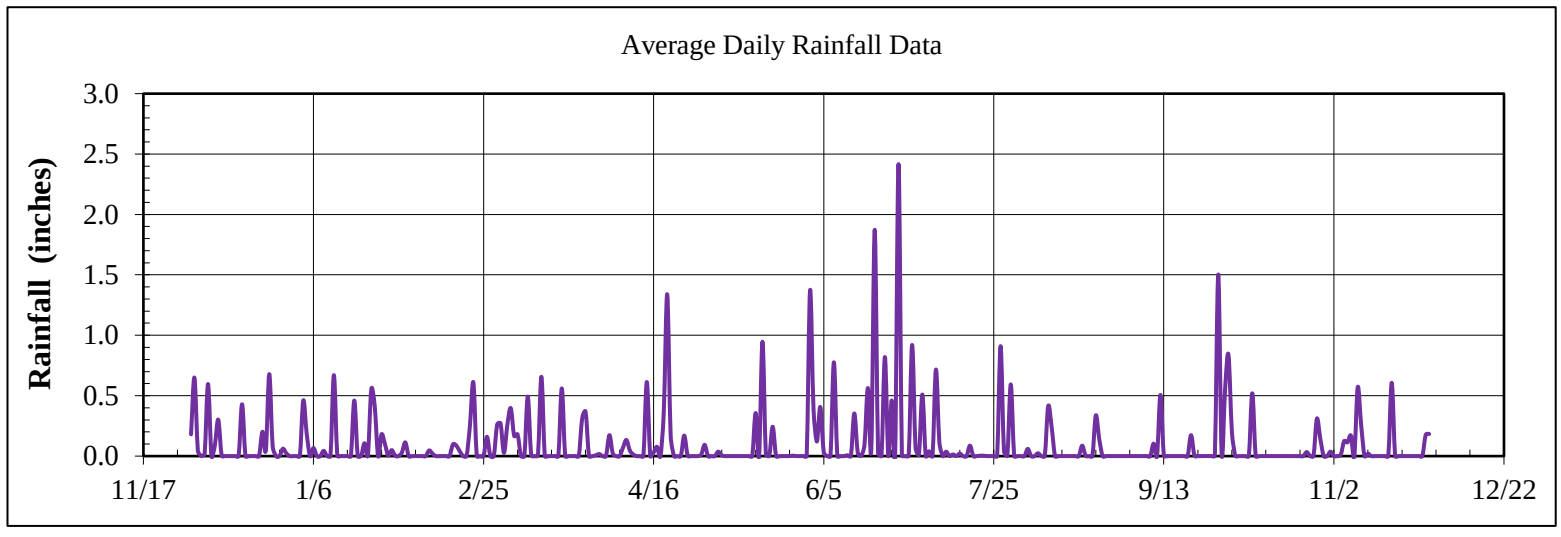
UPIRS Flows to UPI- D/S of 6' Connection (00-UPI-1)









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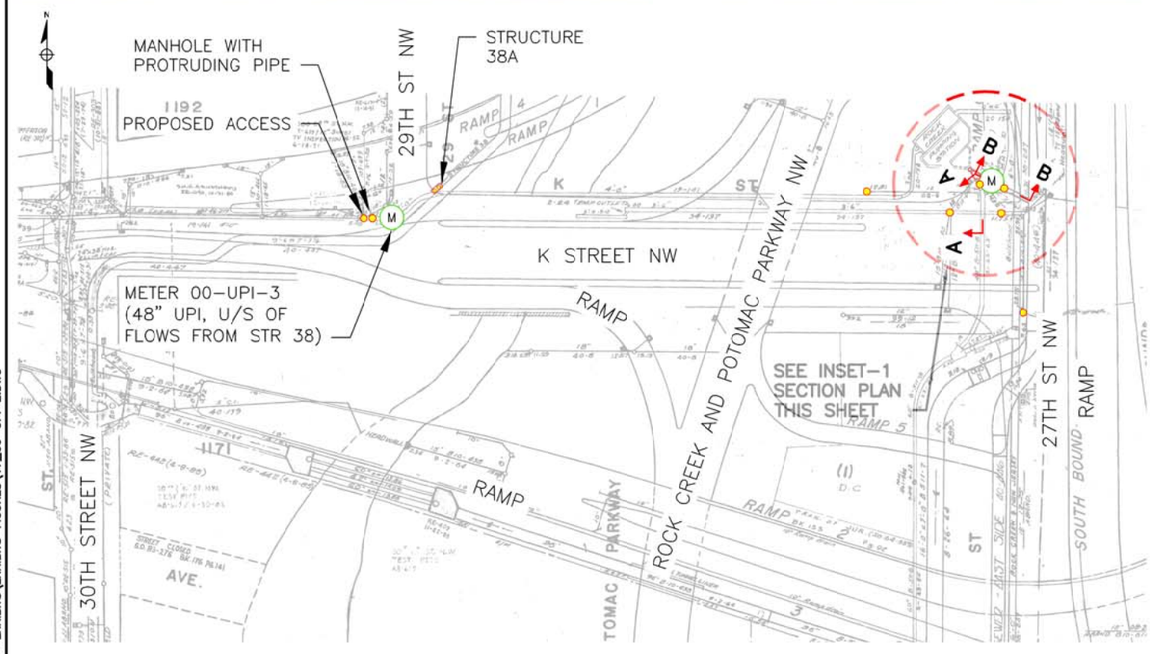

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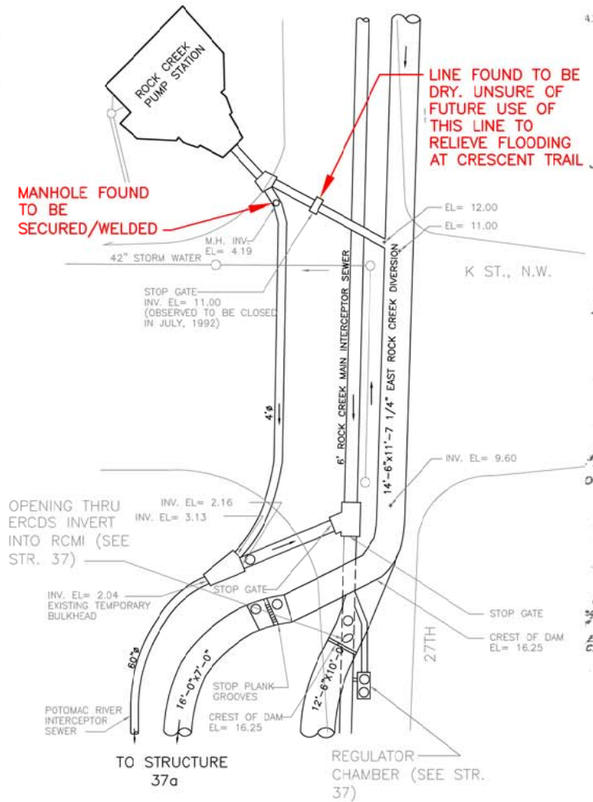

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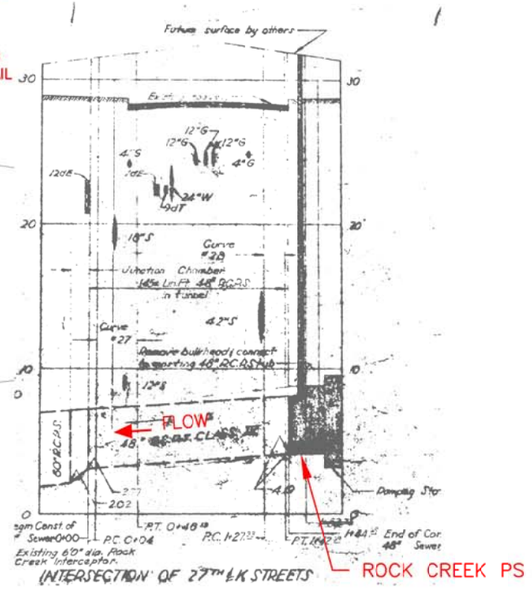

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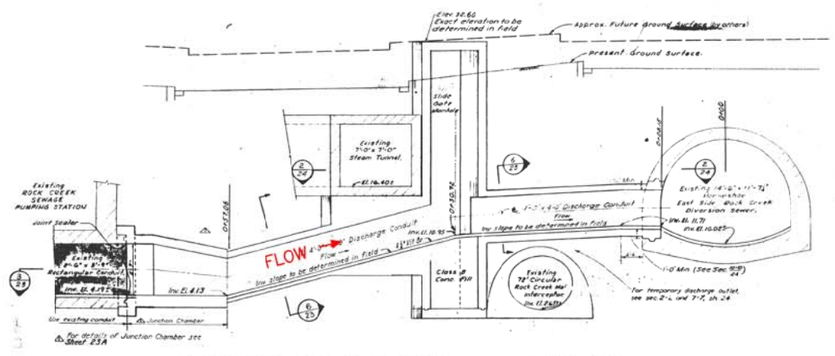

CROSS SECTION B-B (PROFILE FOR 00-UPI-3)
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

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00-UPI-2
METER LOCATION AND TYPICAL CROSS SECTION

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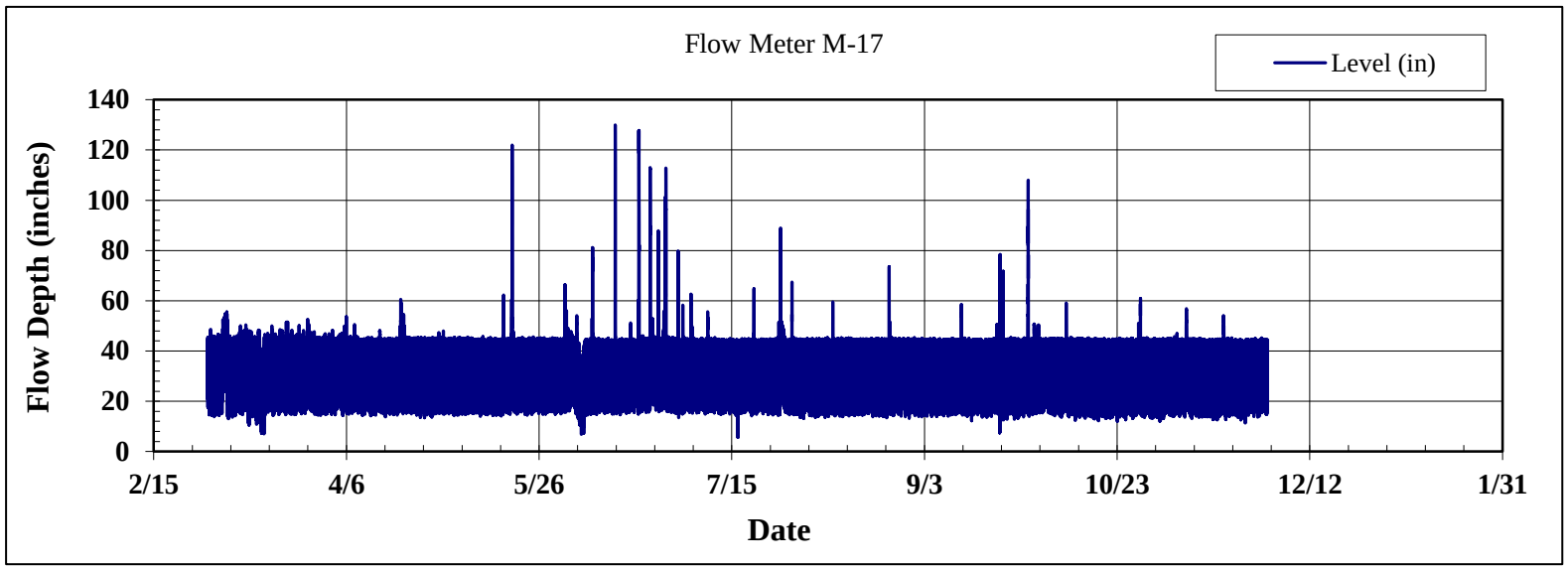

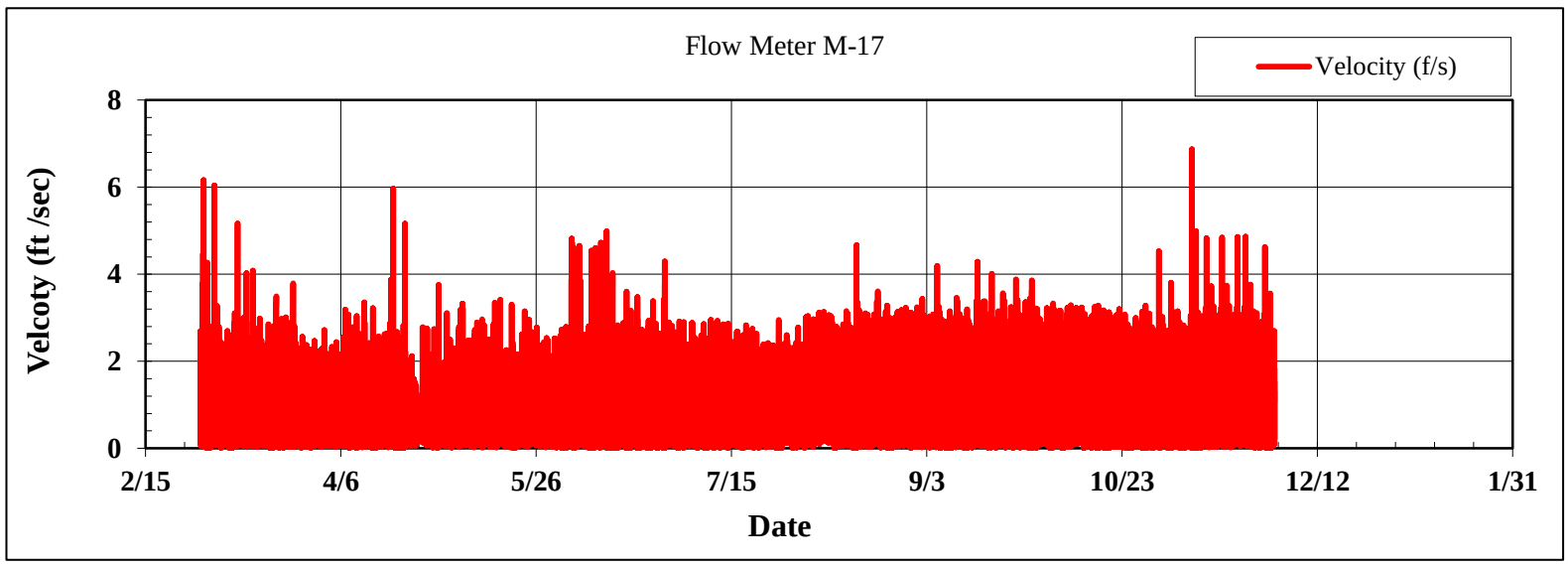

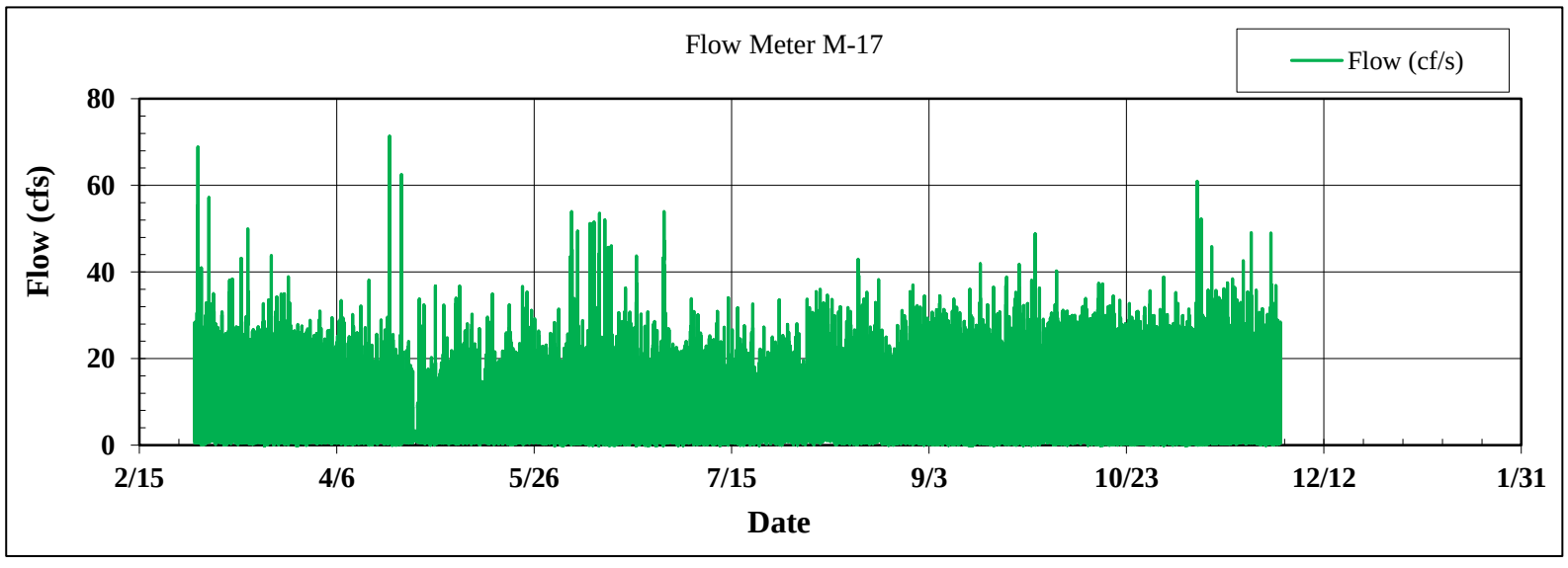

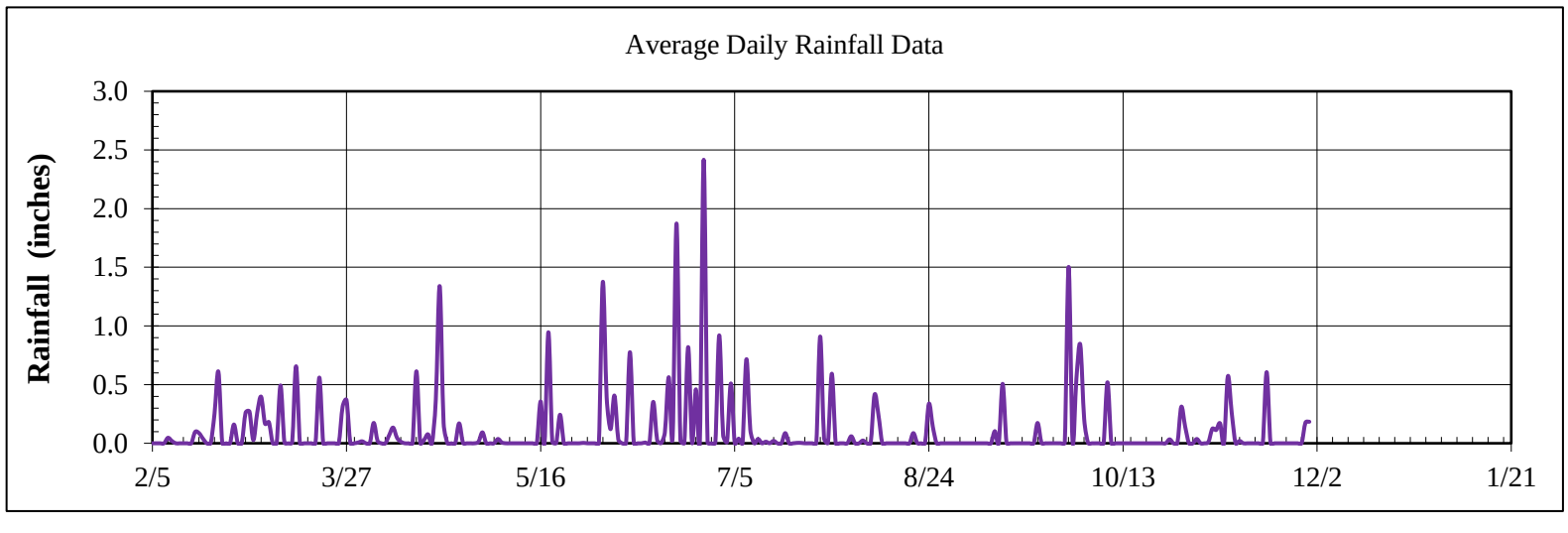

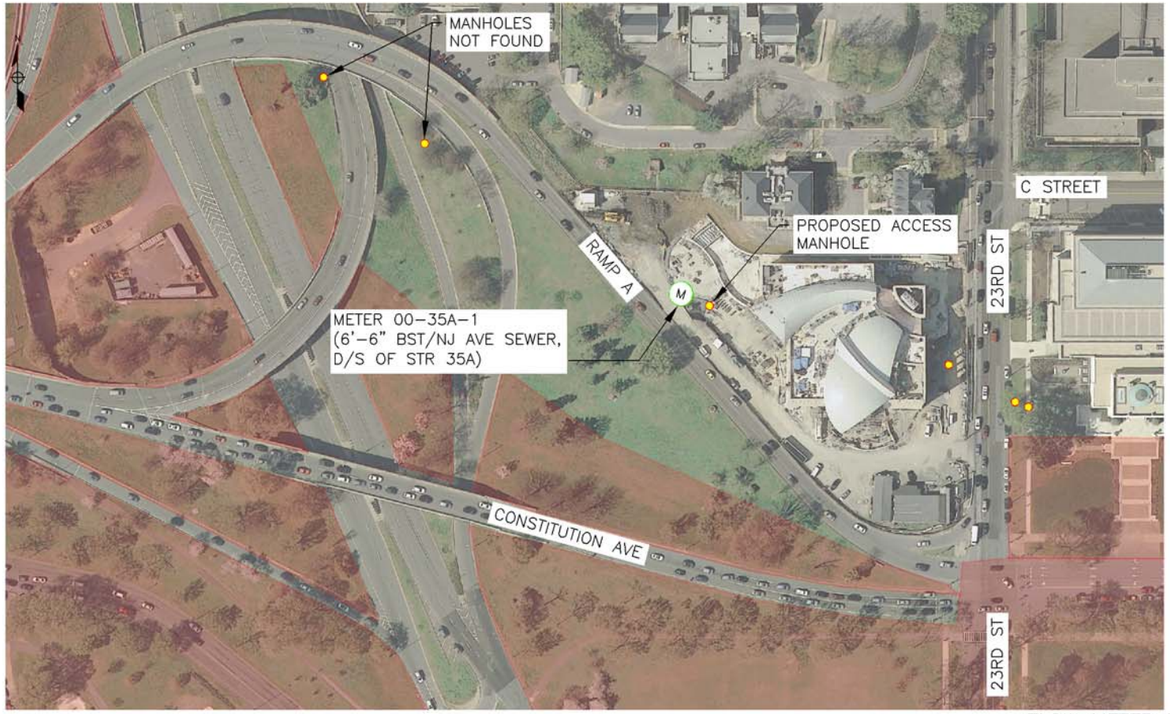

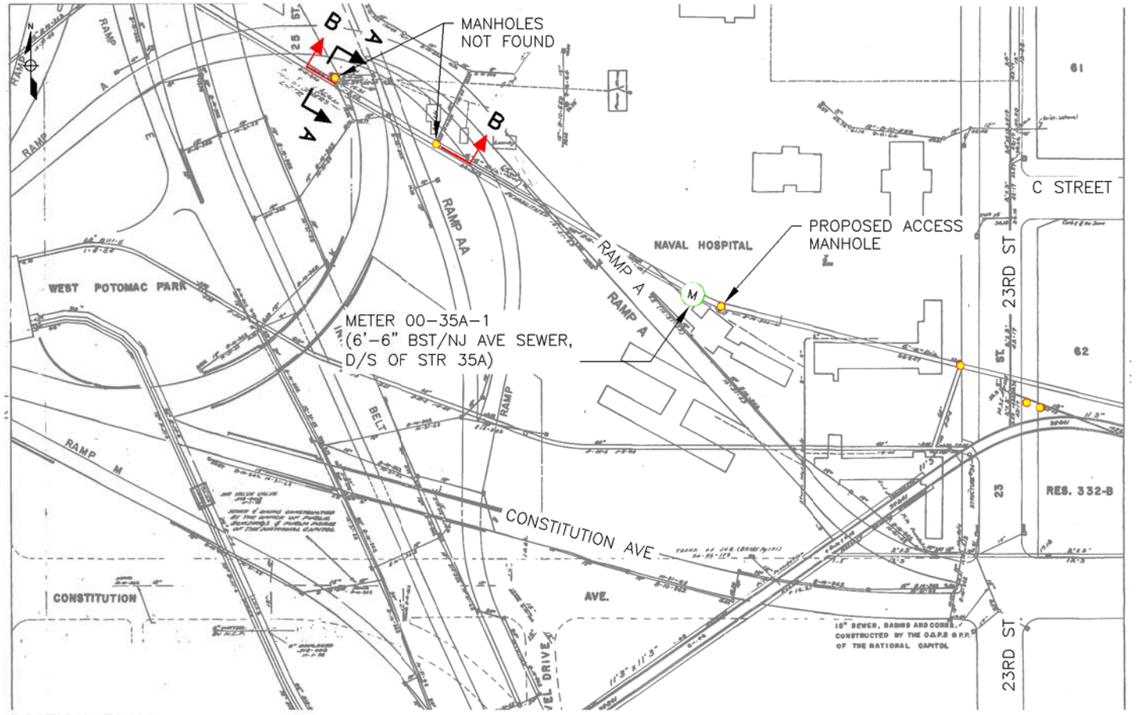

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SCALE: NTS

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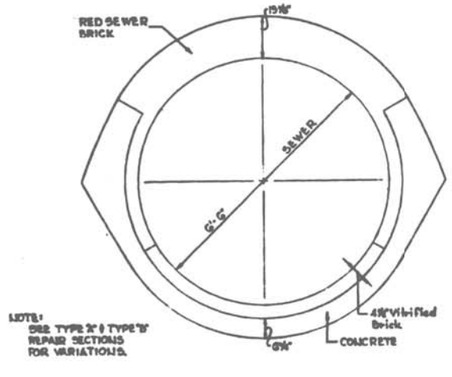

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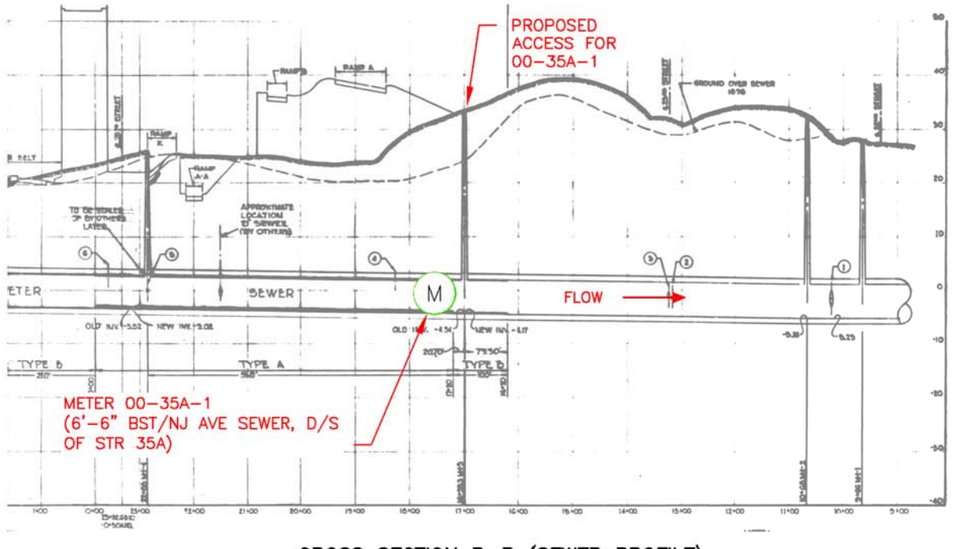

CROSS SECTION B–B (SEWER PROFILE)

SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
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00–35A–1

METER LOCATION AND TYPICAL CROSS SECTION

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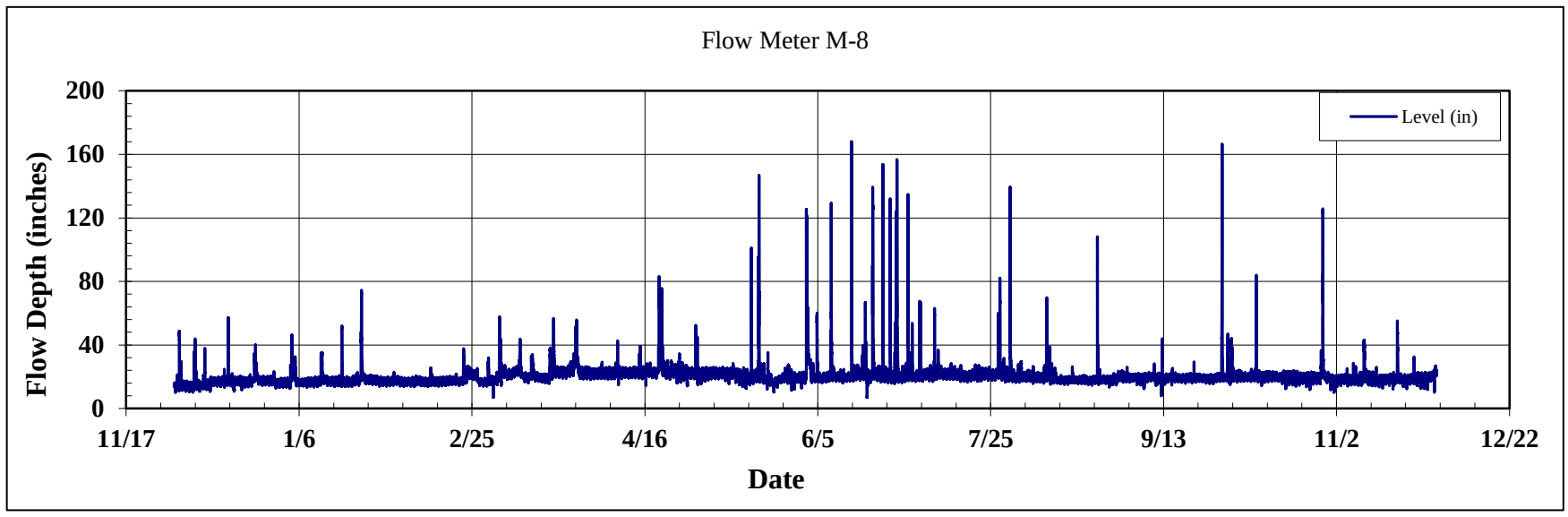

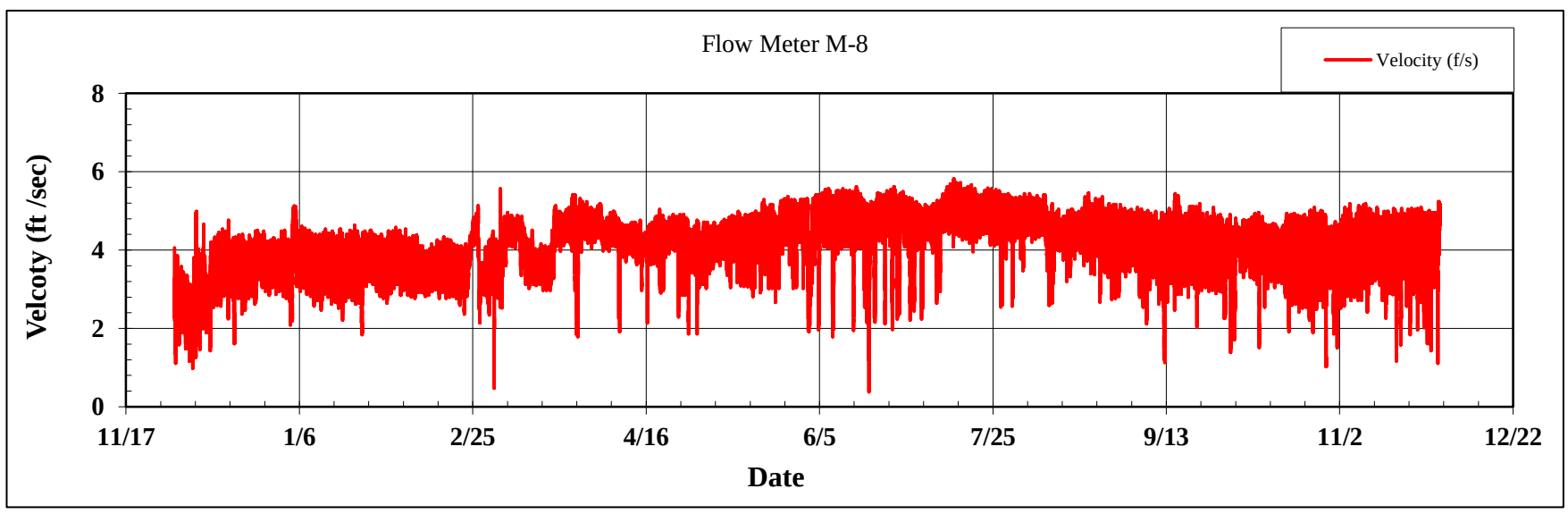

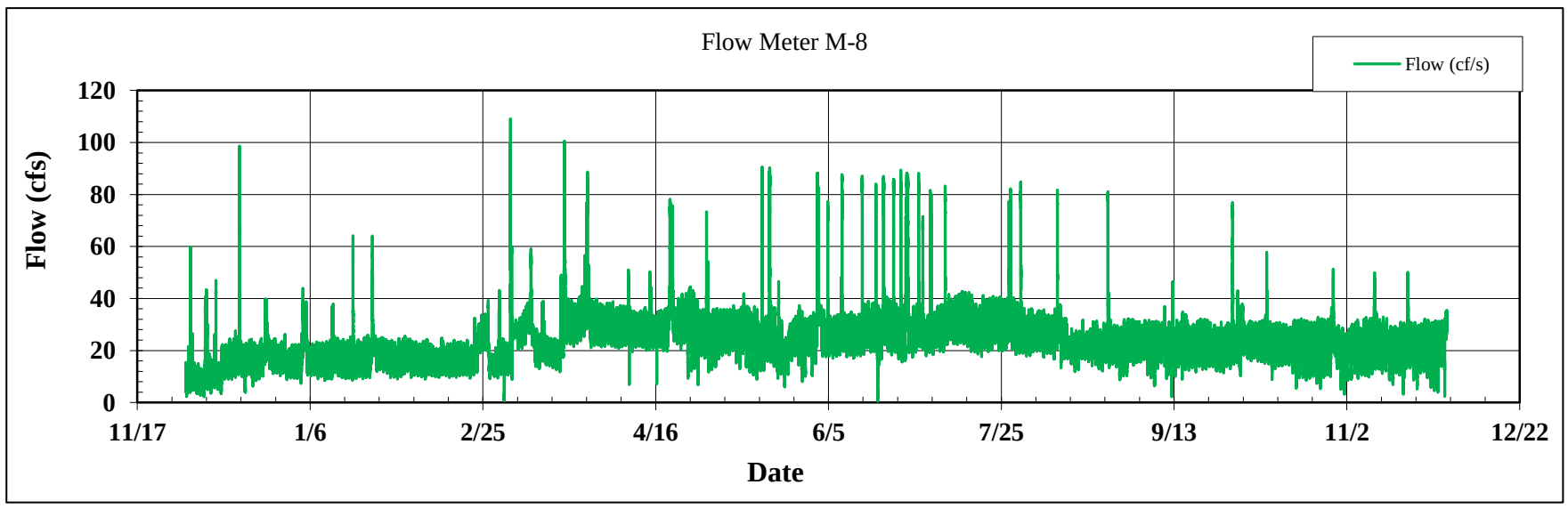

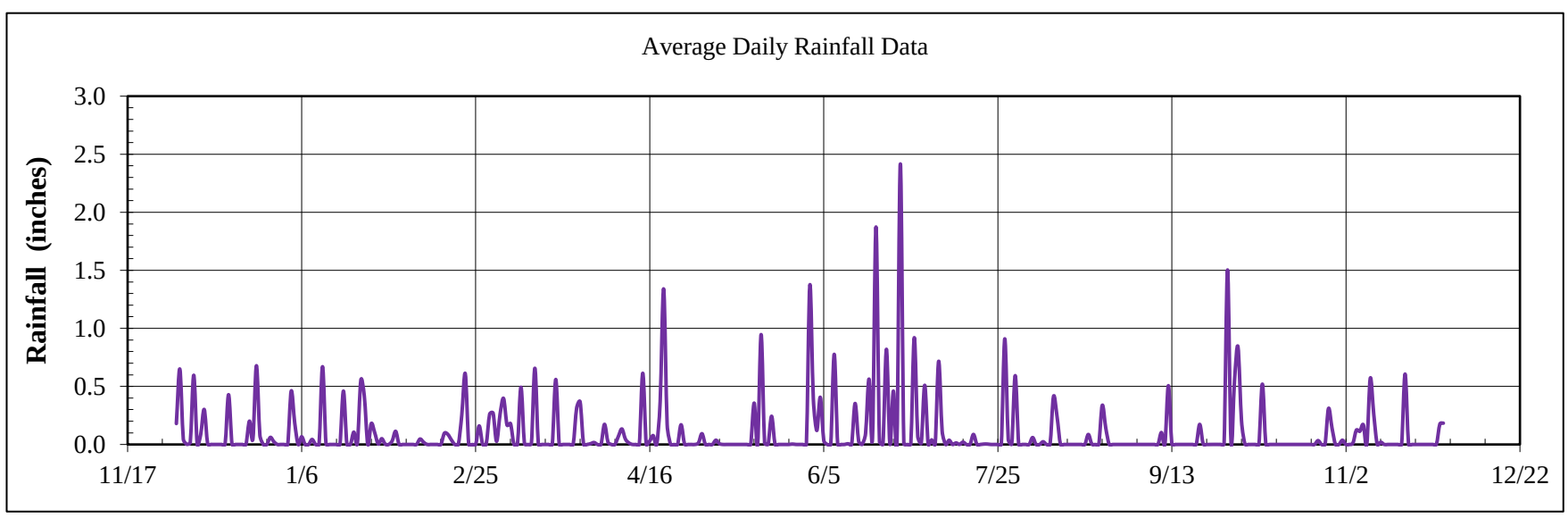

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FLOW METER LOCATION PLAN
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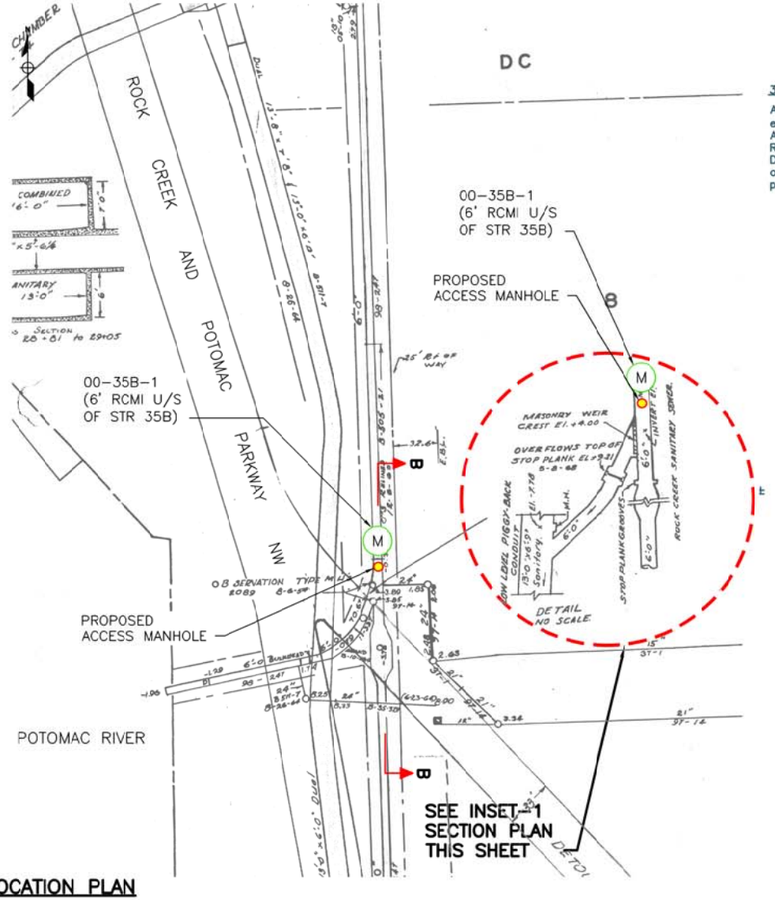

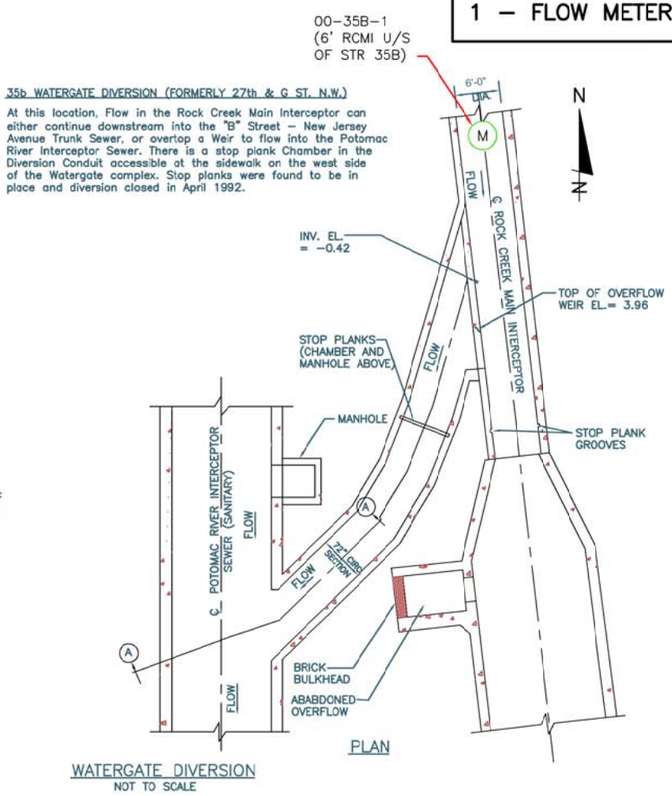

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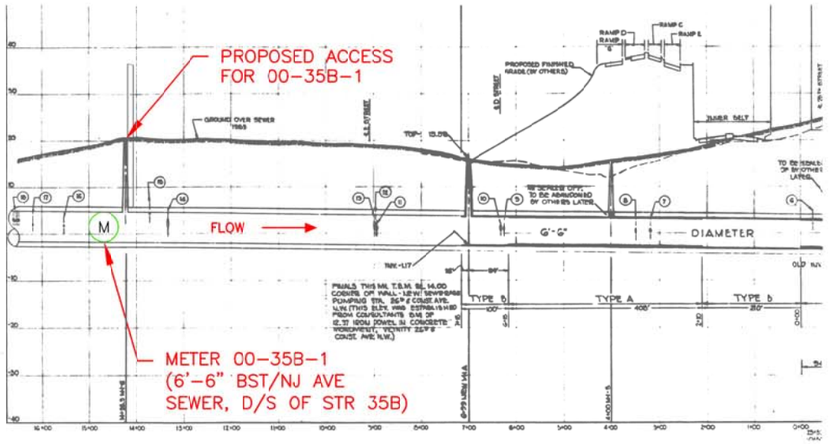

CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND
- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
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00–35B–1
METER LOCATION AND TYPICAL CROSS SECTION

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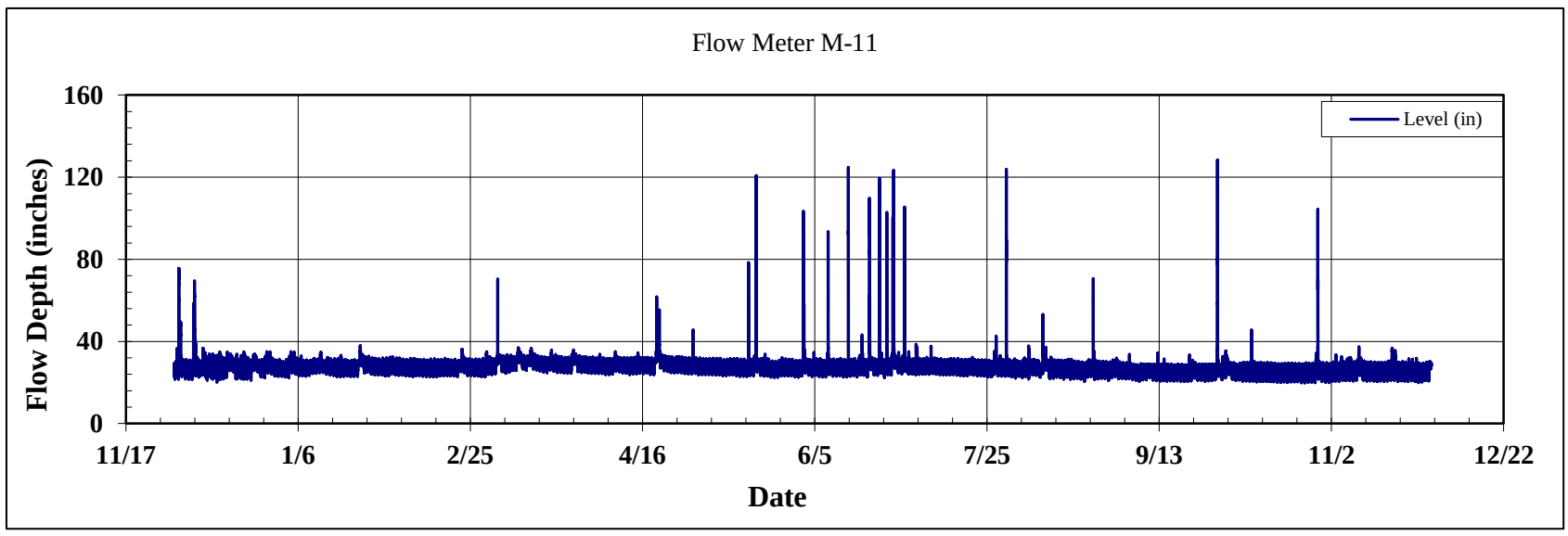

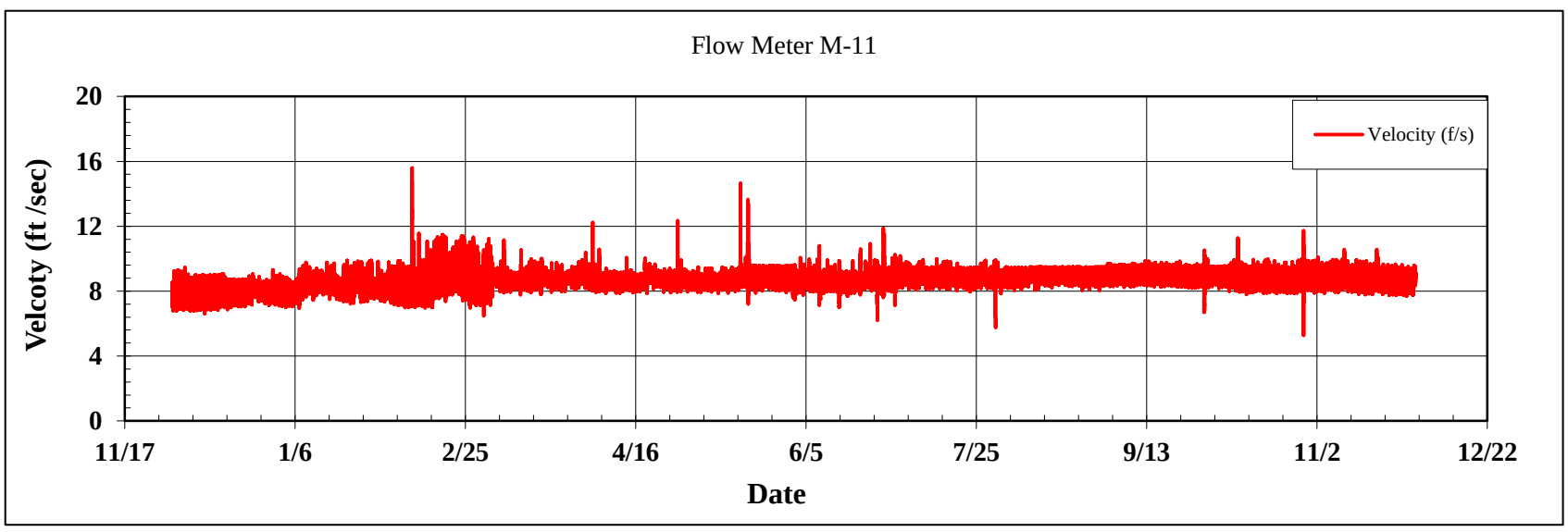

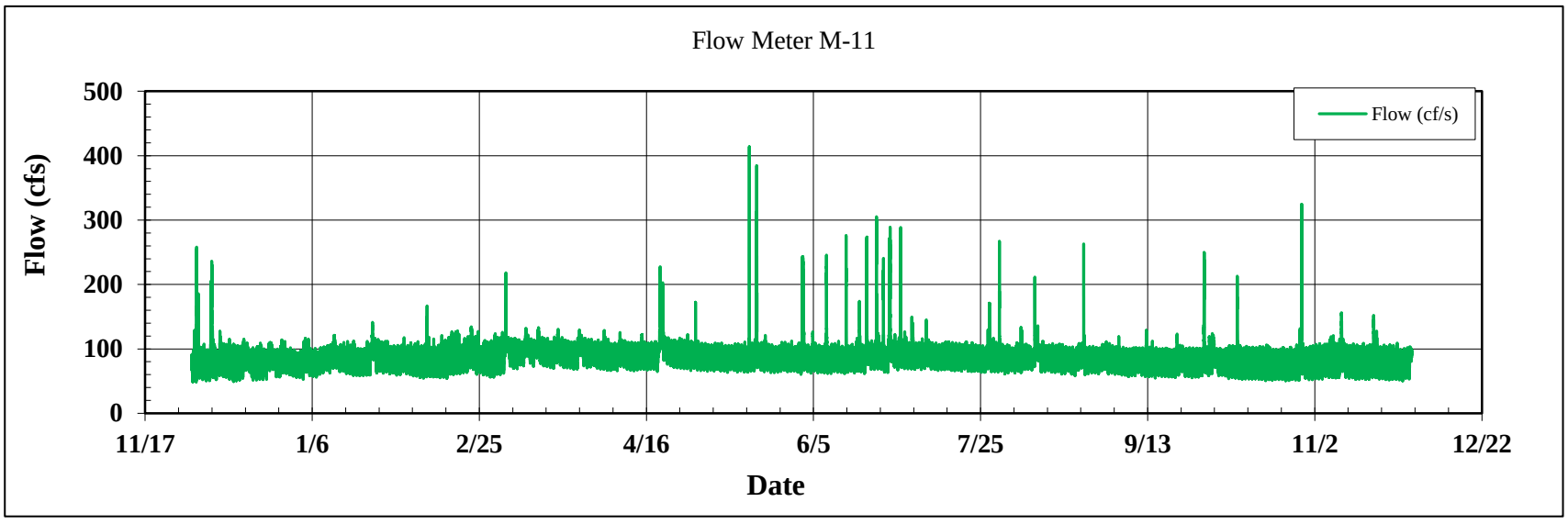

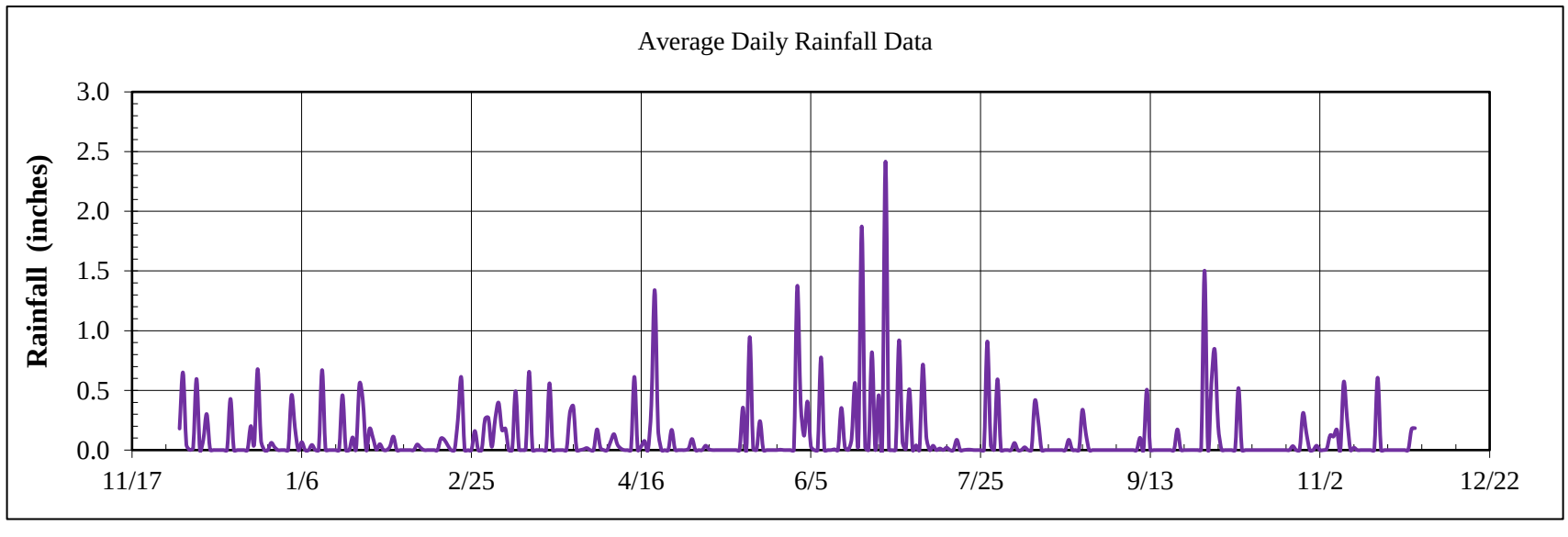

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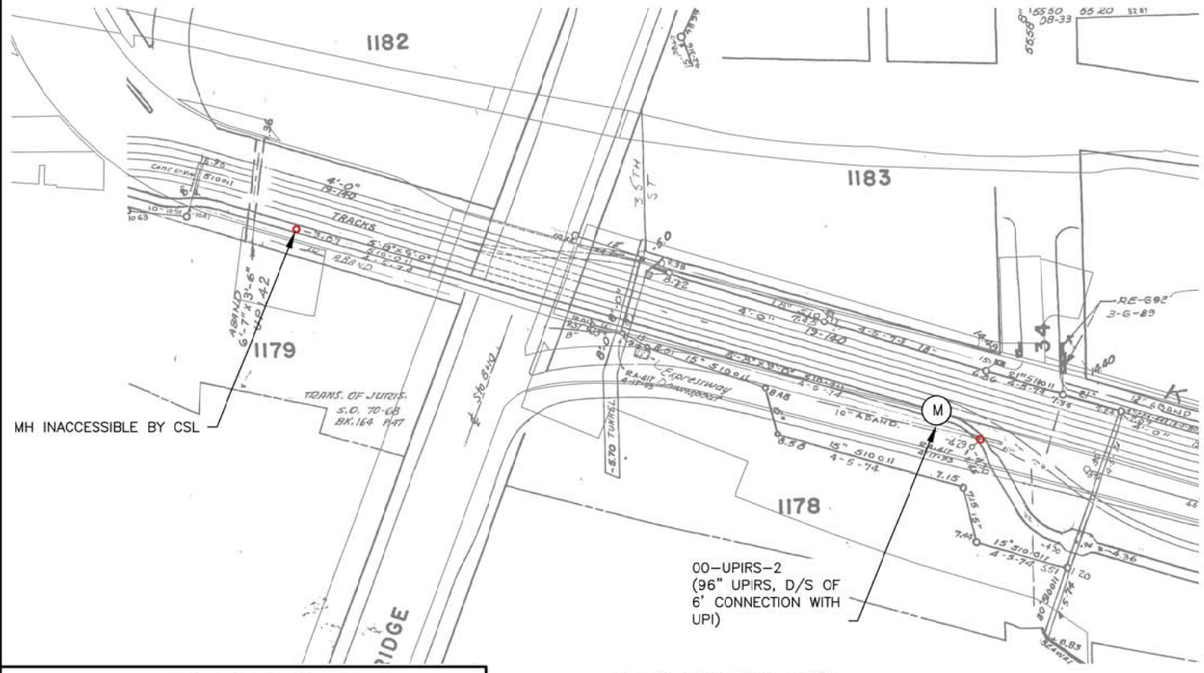

METER LOCATION PLAN

SCALE: NTS

LEGEND

(M) LEVEL SENSOR LOCATION

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FLOW MONITORING MAPS

00–UPIRS–2

METER LOCATION MAP

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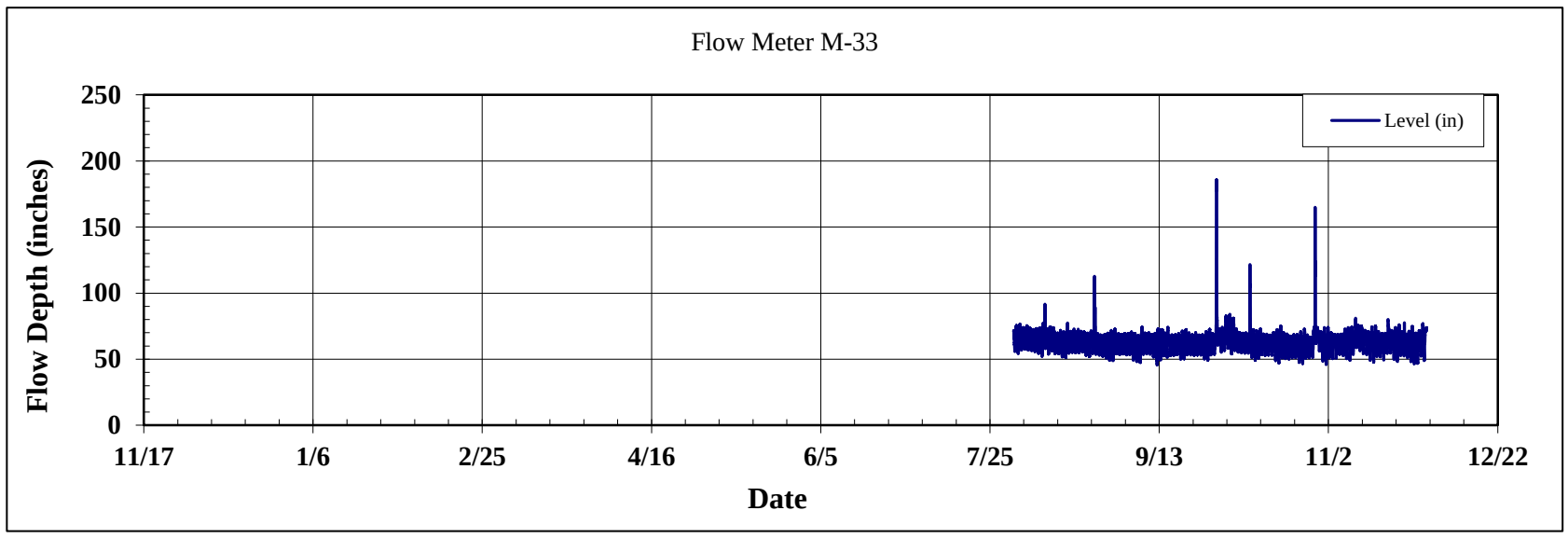
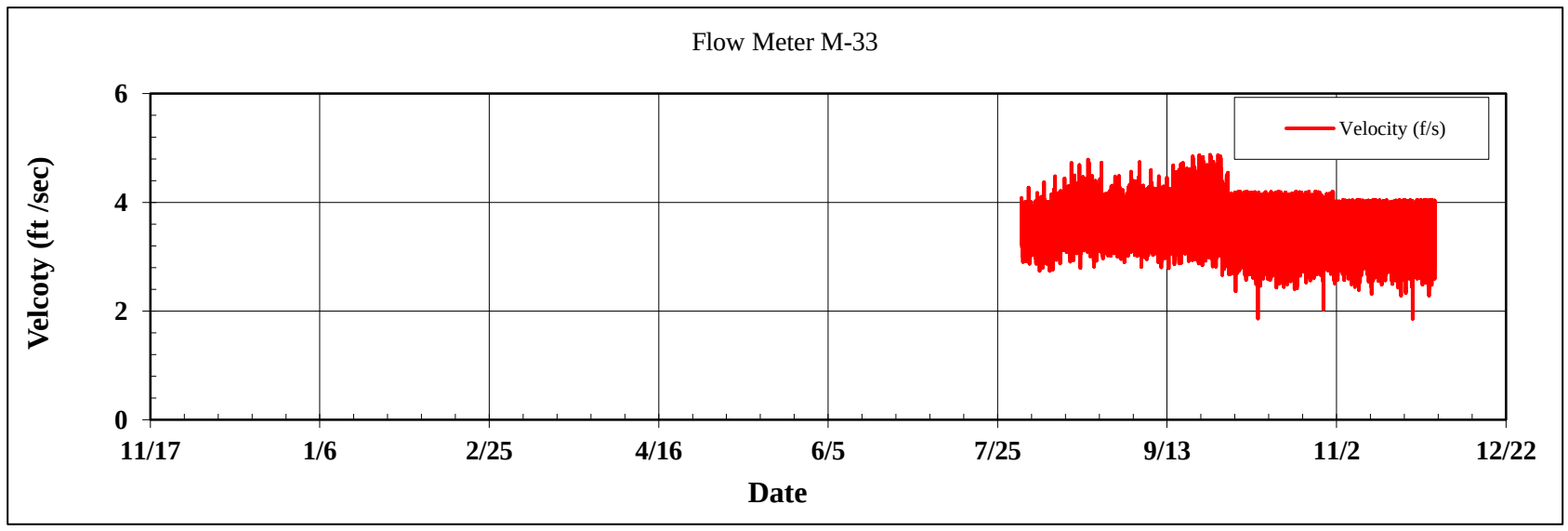
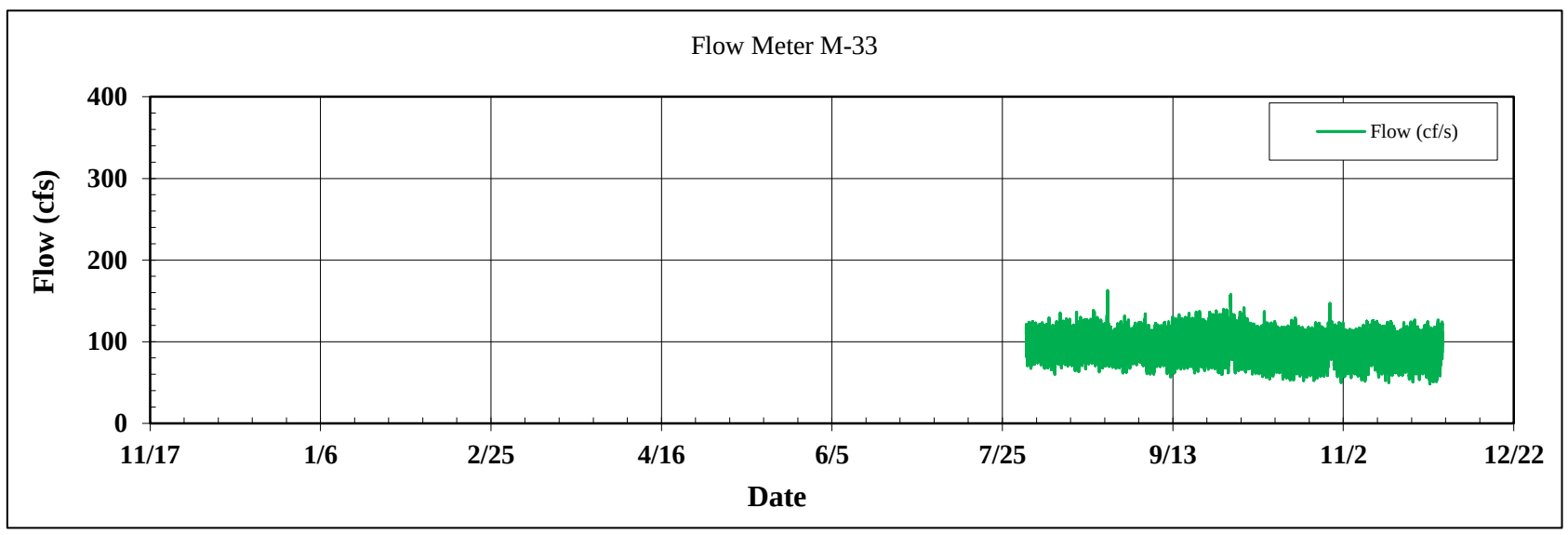
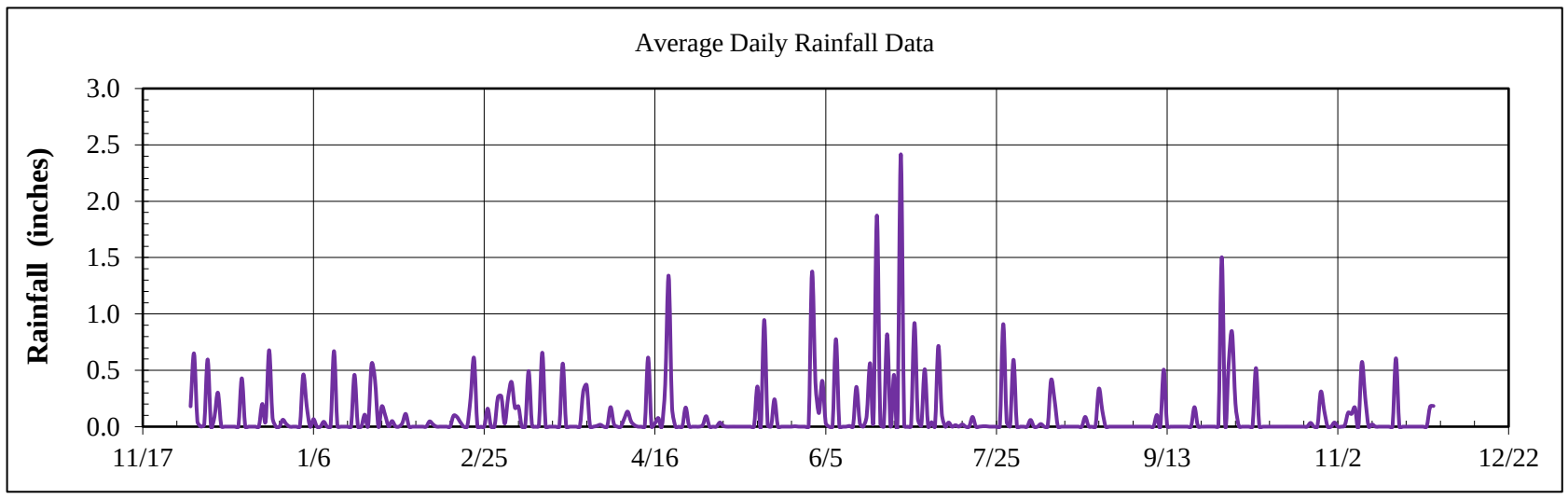




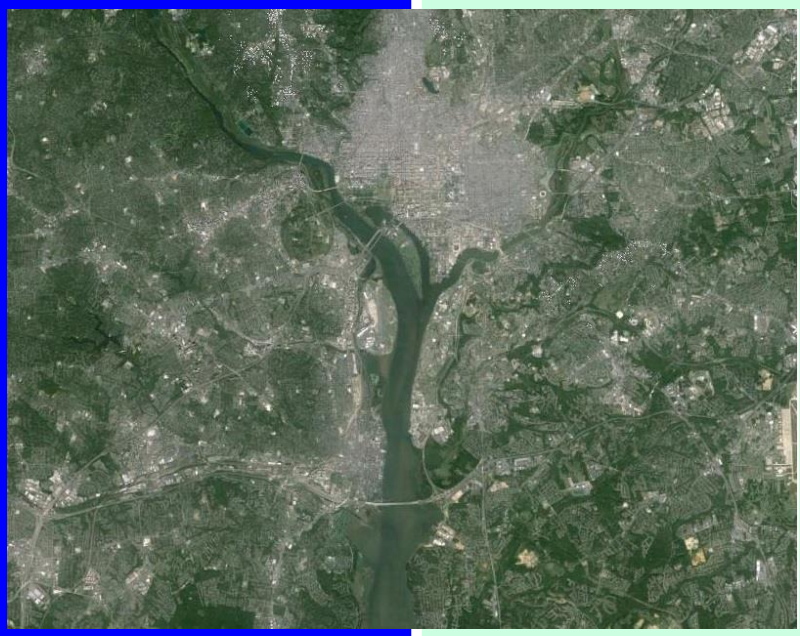




Appendix D Data Report for Receiving Water Quality Monitoring

Final Report

DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY, COMBINED SEWER SYSTEM LONG TERM CONTROL PLAN, PHASE I IMPLEMENTATION, DATA REPORT FOR RECEIVING WATER MONITORING



June 2016

Prepared by:

VERSAR

District of Columbia Water and Sewer Authority
Combined Sewer System Long Term Control Plan
Phase I Implementation Data Report
for Receiving Water Monitoring

Prepared for

Metropolitan Washington Council of Governments
777 North Capitol Street, N.E., Suite 300
Washington D.C. 20001

and

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Washington, D.C. 20032

Prepared by

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Under the Supervision of:

William Burton, Program Manager

June 2016

FOREWORD

This report was prepared by Versar, Inc., for the Metropolitan Washington Council of Governments (MWCOG) and the District of Columbia Water and Sewer Authority (DC Water) under MWCOG contract number 15-004. This study was conducted under the direction of William Burton with assistance from the project manager, David Wong and field coordinators Colby Hause and Chester Lindley. Danielle Zaveta provided database support while field collections were taken by Versar staff including, Ryan Corbin, Katherine Dillow, Neal Eshleman, Raymond Mao (summer intern), Pooja Potti, Daniel Spradlin, Charles Tonkin, and Alex Vanko.

VERSAR

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1.0 PURPOSE AND BACKGROUND

The District of Columbia Water and Sewer Authority has a National Pollutant Discharge Elimination System Permit (NPDES) for the Advanced Wastewater Treatment Plant at Blue Plains and the combined sewer system. The permit required DC Water to conduct Phase I post construction monitoring after the inflatable dams were replaced and the pumping station rehabilitations were completed. The purpose of the monitoring program was to examine the impact of the completed combined sewer overflow control projects on the receiving water quality. The Phase I work began in December of 2014 and was completed in February 2016.

The NPDES permit specified the scope of the Phase I post construction monitoring program, which included rainfall, CSO flow, and in-stream receiving water monitoring. DC Water conducted the rainfall monitoring and CSO flow monitoring and sampling. The work conducted by Versar Inc., included all labor, equipment, materials and services to conduct in-stream receiving water quality monitoring and storm event sampling as described in section 2.0 below.

Versar met with MWCOG and DC Water staff at the initiation of the project to confirm logistics and sampling timing, and to share contact information for initiating each sampling event. Versar also participated periodically in conference calls and face-to-face meetings with MWCOG and DC Water to coordinate each sampling event.

2.0 SUMMARY OF MONITORING PROGRAM

Versar, Inc., was responsible for the tasks detailed below:

- Meeting with MWCOG and DC Water staff directly and on periodic conference calls throughout the project period.
- Installing continuous Dissolved Oxygen monitors at six (6) locations, collecting and recording measurements as listed in Table 2-1.
- Collecting and analyzing grab samples for twelve (12) water quality parameters at thirteen (13) permanent locations and two (2) temporary locations.
- Following approved procedures for all aspects of sample collection, quality control sampling, labeling, preservation, chain of custody and analytic methods in accordance with 40 CFR Part 136.
- Preparing and following the Sample Procedure and Quality Control document, also known as a Quality Assurance Project Plan (QAPP).

- Obtaining the permits and resources necessary to conduct the project work.
- Submitting data, invoices, and status reports on a monthly basis.

Table 2-1. Continuous Dissolved Oxygen Monitoring Stations

Tributary	In-situ Meter Location	Coordinates	Comments
Anacostia River	1. Bladensburg, MD	38°56'2.79"N 76°56'21.15"W	Upstream of CSO area; Fixed elevation
	2. Pennsylvania Avenue Bridge (Seafarer's Yacht Club)	38°52'43.66"N 76°58'22.72"W	After Northeast Boundary CSO discharge; Fixed elevation
	3. South Capitol Street Bridge	38°52'6.11"N 77° 0'18.29"W	Downstream of CSO area; Fixed elevation
Potomac River	4. Chain Bridge	38°54'49.21"N 77° 6'8.96"W	Upstream of CSO area; Float Buoy
	5. 14th Street Bridge	38°52'37.18"N 77° 2'27.34"W	Downstream of CSO area; Fixed Elevation
	6. Woodrow Wilson Bridge	38°48'24.46"N 77° 2'1.37"W	Boundary condition; Float Buoy

2.1 DISSOLVED OXYGEN (DO) AND TEMPERATURE MONITORING

Six (6) Yellow Spring Instrument EXO2 sondes (Figure 2-1) were deployed at the locations presented in Table 2-1 (Figure 2-2) in protective PVC tubes (Figure 2-3). D.O. meters were set-up to collect data at minimum 30-minute intervals for 12 continuous months. Meters were suspended approximately 1 meter below the mean low water (MLW) line at fixed elevation locations and 1.5 meters below the surface on floating buoys. PME MiniDOT loggers were used as a back-up to the EXO2 sondes in the case of malfunction or removal for maintenance (Figure 2-4). Maps and images of these locations can be found in the Sample Procedure and Quality Control Document in Appendix D.

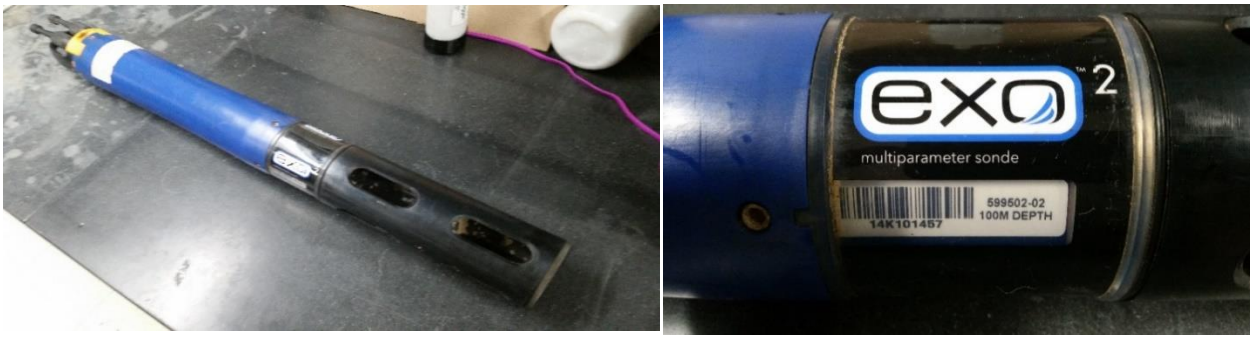

Figure 2-1. YSI EXO2 Multi-parameter sondes used in the primary collection of dissolved oxygen and temperature at the six monitoring locations in the Potomac and Anacostia River.

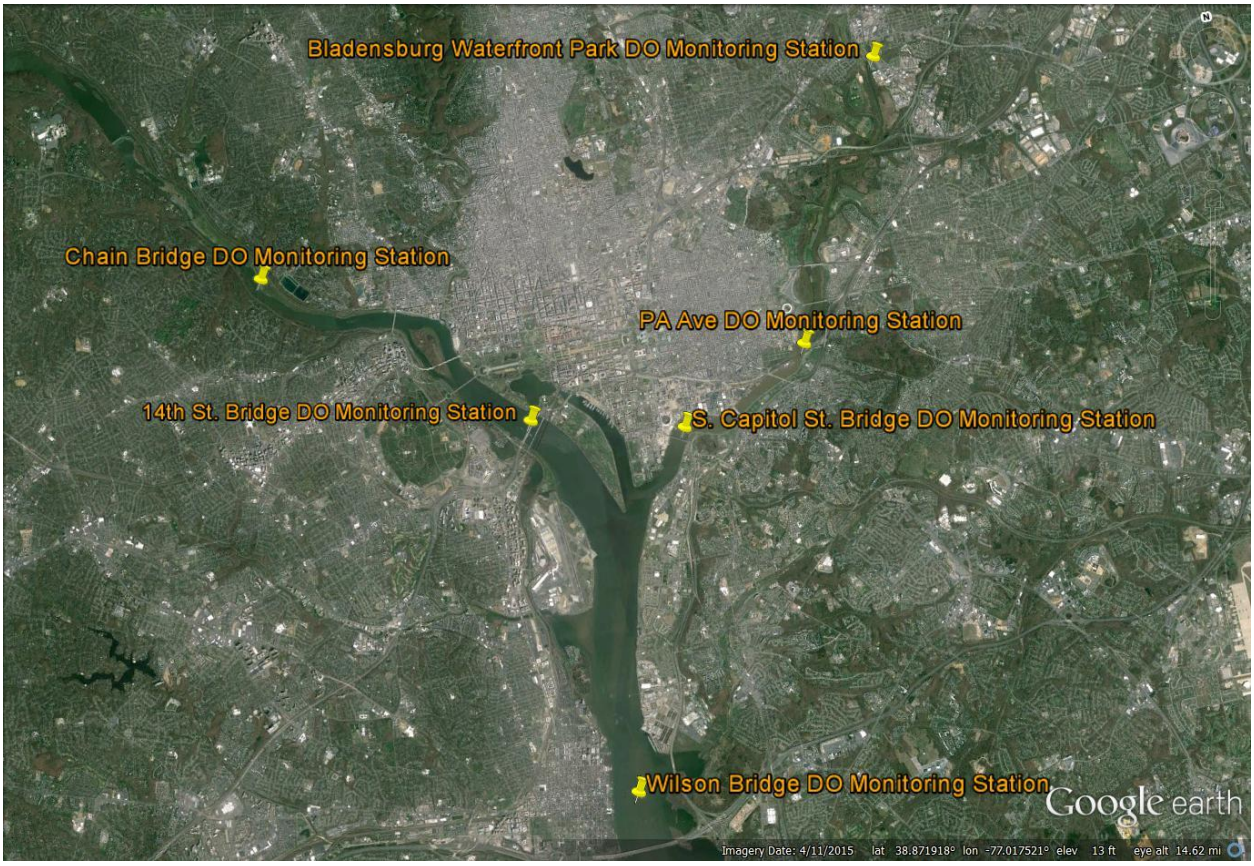

Figure 2-2. Location of dissolved oxygen and temperature monitoring stations in the Potomac and Anacostia Rivers

Figure 2-3. Protective PVC housing and signs for the dissolved oxygen monitoring stations

Figure 2-4. PME MiniDOT Loggers were used as a back-up to the YSI EXO2 multi-parameter sondes during maintenance and periods of heavy icing.

Water quality meters were first deployed on December 10, 2014 and then checked on a bi-weekly basis for fouling and damage. Approximately once a month units were downloaded and checked to ensure probes were reading accurately using a side by side comparison with a laboratory calibrated instrument. During the monitoring period a number of the stations experienced probe malfunctions due to a factory software issue and were temporarily replaced using PME MiniDOT loggers. A period of heavy icing also occurred between January and March of 2015. During that time, the YSI EXO2 units were removed from the PVC tubes and replaced with the more rugged MiniDOT loggers to minimize equipment and data loss. Most stations experienced short periods of data loss due to these probe malfunctions and environmental issues. Each period of data loss was tracked and the DO monitoring stations were additionally deployed for the appropriate time period.

EXO2 loggers were again deployed in the spring of 2015 and were used for continuous monitoring until the fall of 2015. During the spring of 2015, high flows in the Potomac River damaged the moored anchor system of the Chain Bridge DO monitoring station, resulting in a period of data loss. At the end of November 2015, all EXO2 units were removed and replaced with PME MiniDOT loggers for the duration of the monitoring period to prevent equipment loss due to icing and shortened battery life due to cooling water temperatures. Heavy icing in early January 2016 precluded the scheduled end of the DO monitoring period. The loggers continued to record DO until the end of the month when conditions permitted their retrieval. All but one station, Potomac Chain Bridge, were retrieved and downloaded. Three additional attempts were made to locate the Chain Bridge logger but it was determined that ice flows likely swept away the mooring causing the loss of the unit. Water quality data from the U.S. Geological Survey (USGS) gauge at Little Falls (#01646500) was reviewed and compared to the data collected at the Chain Bridge DO monitoring station and was determined to be comparable. This data was used to supplement the data gap in the spring of 2015 and at the end of the monitoring period.

2.2 SURFACE WATER SAMPLING AND ANALYSIS

2.2.1 Routine Sampling

Surface water was sampled for seventy-one (71) events at thirteen (13) permanent locations (Table 2-2) from December 18, 2015 through January 7, 2016. Generally, samples were collected in a pattern of twice in one week, then once in the next week, then twice in the next week, then once in the next week. DC Water wanted the ability to look at the projected weather each week and plan the sampling days accordingly with a goal of collecting samples on both dry and wet weather days. The goal was to capture at least four (4) separate storms over the duration of the one-year routine monitoring schedule. During the monitoring period heavy icing on the river prevented sampling between January 7-18, 2015, February 11-March 10, 2015, and again at the conclusion of the project in January 2016.

Table 2-2. Receiving Water Quality Monitoring Stations- Regular and Wet Weather			
Tributary	**Station Number**	**Description**	**Coordinates**
Anacostia	1	Bladensburg Waterfront Park	38°56'2.68"N 76°56'21.16"W
	1U	Bladensburg WP (Upstream) (Temporary)	See Section 4.4
	1D	Bladensburg WP (Downstream) (Temporary)	See Section 4.4
	2	Benning Road Bridge	38°53'48.93"N 76°57'43.86"W
	3	PA Ave / Seafarers Yacht Club	38°52'36.38"N 76°58'41.11"W
	4	South Capitol St Bridge	38°52'7.27"N 77° 0'19.45"W
	5	Haines Point	38°51'16.51"N 77° 1'14.40"W
Potomac	6	Three Sisters	38°54'11.00"N 77° 4'51.83"W
	7	Upstream of Rock Creek	38°53'57.38"N 77° 3'33.04"W
	8	14th St Bridge	38°52'37.98"N 77° 2'29.87"W
	9	Woodrow Wilson Bridge	38°47'46.22"N 77° 1'53.03"W
Rock Creek	10	Boundary Bridge	38°59'11.63"N 7° 3'11.17"W
	11	Tilden St / Pierce's Mill	38°56'27.05"N 77° 3'3.86"W
	12	Porter St	38°56'3.19"N 7° 2'55.97"W
	13	PA Ave/Thompson's Boat House	38°54'13.33"N 77° 3'24.29"W

Between January 1 and January 22, 2015, sampling and analysis was conducted at two (2) temporary sampling locations (#1U and #1D) to assess the potential impacts of dredging activity at Bladensburg Park and other downstream Anacostia sample locations. Versar conducted sampling and analysis for three (3) events during this dredging project.

Specific methods used for water collection and analysis can be found in the Sample Procedure and Quality Control Document in Appendix D. Field data and laboratory results can be found in the Station Data Summaries in Appendix A.

2.2.2 Wet Weather Sampling

Versar sampled for four (4) Wet Weather Events at thirteen (13) permanent locations during the thirteen (13) months of this sampling program. These Wet Weather sampling events were conducted on days directed by MWCOG and DC Water on the dates specified in Table 2-3. For each Wet Weather Sampling Event, Versar sampled for forty-eight (48) hours with samples collected at approximately eight (8) hour intervals for a total of six (6) rounds of sampling for each event. Wet Weather Sampling Event #2 had a total of seven (7) rounds of sampling due to delays in the timing of the rain event. The four (4) Wet Weather Sampling Events were conducted at the same locations and analyzed for the same parameters listed in Table 2-2. Field data and laboratory results can be found in the Station Data Summaries in Appendix A.

Table 2-3. List of storm event sample dates and number of rounds sampled during each storm

Storm Event Number	Dates of Sampling	Rounds Sampled
1	4/19/15 to 4/21/15	6
2	5/31/15 to 6/2/15	7
3	6/27/15 to 6/28/15	6
4	10/1/15 to 10/3/15	6

2.2.3 Station Descriptions

2.2.3.1 Anacostia River

Sampling in the Anacostia River was conducted in tidal waters between its confluence with the Potomac River at Haines Point upstream to Bladensburg, covering approximately 7.7 river miles. Figure 2-5 illustrates the relative distribution of the routine sampling stations in the Anacostia River.

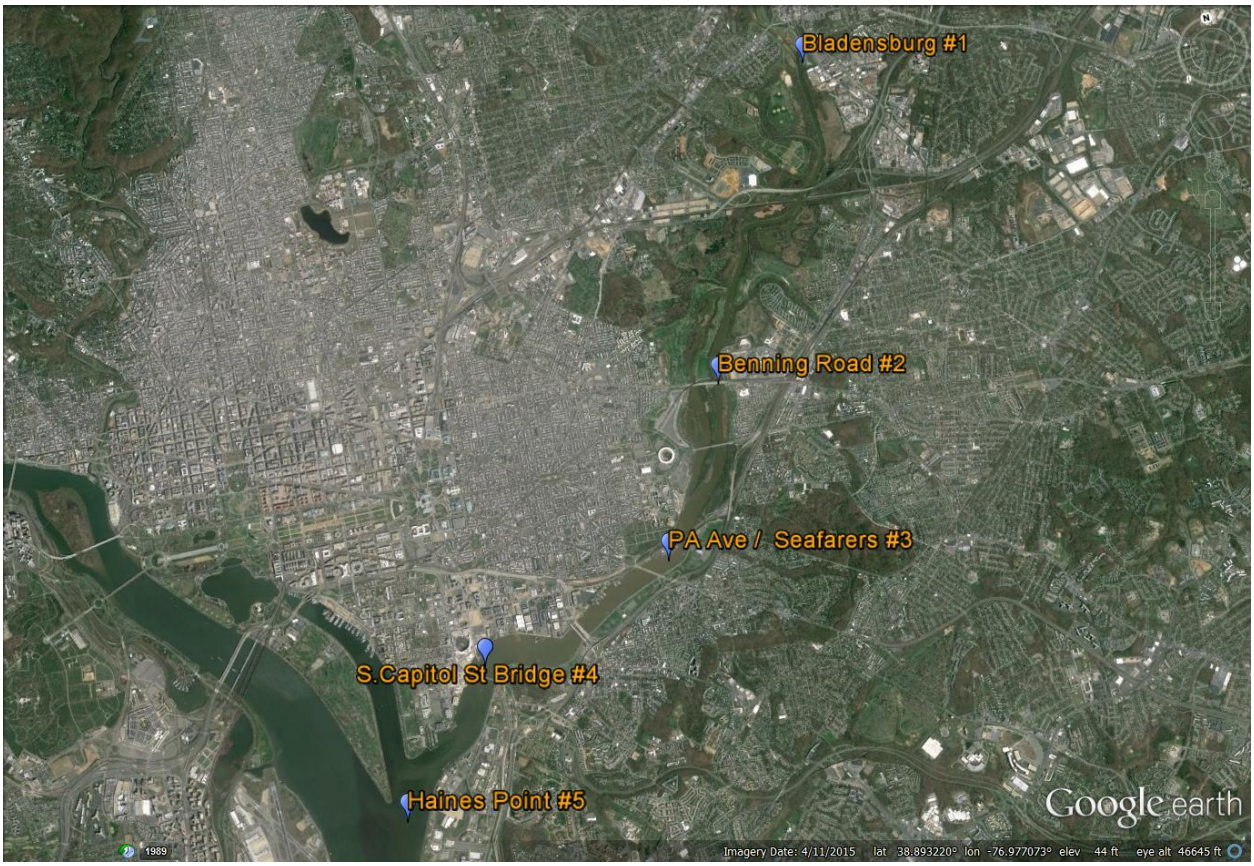

Figure 2-5. Location of water quality monitoring stations in the Anacostia River Watershed.

Bladensburg Waterfront Park (Station 1). The uppermost station on the Anacostia River was located at Bladensburg Waterfront Park (Figure 2-6). The site, managed by the Maryland-National Capital Park and Planning Commission and operated by Prince George's Department of Parks and Recreations, is located at 4601 Annapolis Road in Bladensburg, MD. Permission was obtained from the Park Manager to install a long-term DO monitoring station as well as conduct routine sampling from their docks. Sampling was conducted approximately ¾ mile below the confluence of the Northeast and Northwest Branch at the headwaters of the Anacostia River.

Figure 2-6. Bladensburg Waterfront Park. Continuous dissolved oxygen monitoring and weekly routine sampling was conducted off the docks at Bladensburg Waterfront Park. (Image courtesy of Google Maps.)

Benning Road Bridge (Station 2). The Benning Road Bridge Station was located on the down river side of Benning Road where it passes over the main channel of the Anacostia River. It was located to the east of Kingman Lake (Figure 2-7). Samples were taken from the concrete bridge using a niskin bottle approximately 20 feet above the river's surface.

Figure 2-7. Benning Road Bridge. Samples were collected next to the wooden channel marker in the lower right corner of the image. (Image courtesy of Google Maps.)

Pennsylvania Ave. Bridge / Seafarers Yacht Club (Station 3). This station was located just upstream of the Pennsylvania Ave. Bridge and just downstream of the Seafarers Yacht Club (Figure 2-8), about 150 yards downstream of the CSX railroad bridge. Samples were collected by boat using a niskin bottle. A long term DO Monitoring station was affixed to the CSX bridge piling on the east side of the channel.

Figure 2-8. Pennsylvania Avenue / Seafarers Yacht Club. Samples were collected mid-river directly in front of the white boathouse. The long-term dissolved oxygen monitoring station was located about 300 yards up from this location on the CSX railroad bridge. (Image courtesy of Google Maps.)

South Capitol St. Bridge (Station 4). The Capitol St. Bridge sampling station was located about 100 yards up river of the bridge (Figure 2-9). Samples were collected in the center of the channel by boat using a niskin bottle. A long term DO monitoring station was affixed to the outside of the east channel pilings.

Haines Point (Station 5). The Haines Point station was located just inside the confluence of the Anacostia River and Potomac River (Figure 2-10). Samples were collected center-channel, about 200 yards off of Haines Point, by boat using a niskin bottle.

Figure 2-9. South Capital St. Bridge. Samples were collected mid-channel in front of National's Stadium by boat using a niskin bottle. The long term DO monitoring station was located on the bridge, affixed to the outside of the east channel pilings. (Image courtesy of Google Maps.)

Figure 2-10. View of the Haines Point Sampling location. Samples were collected in the center channel by boat using a niskin bottle. (Image courtesy of Google Maps.)

2.2.3.2 Potomac River

Sampling in the Potomac River was conducted in tidal waters between the Woodrow Wilson Bridge and Three Sisters islands, covering approximately 8.6 river miles. Figure 2-11 illustrates the relative distribution of the routine sampling stations in the Potomac River.

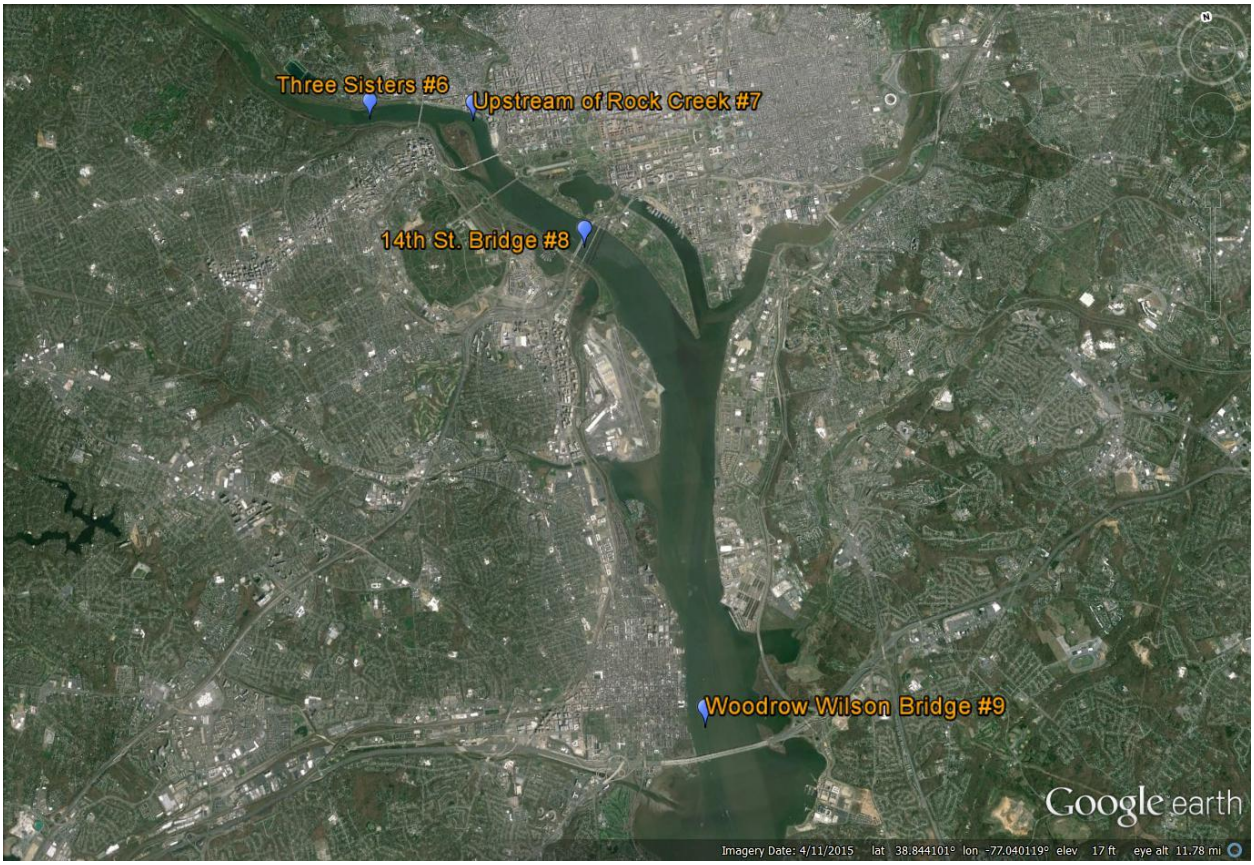

Figure 2-11. Location of water quality monitoring stations in the Potomac River

Three Sisters (Station 6). The Three Sisters is a group of small rock islands located on the Potomac River just upriver from the Georgetown Waterfront and the Key Bridge (Figure 2-12). The area is characterized by deep swift waters and is a popular recreational destination for boaters during most of the year. Samples were collected by boat using a niskin bottle in the west side channel.

Upstream of Rock Creek (Station 7). This station was located just upriver from the confluence of Rock Creek and the Potomac River (Figure 2-13). Samples were taken in the center channel in front of Thompson's Boat House in view of the Georgetown waterfront. Samples were collected by boat using a niskin bottle.

Figure 2-12. Three Sister Island – Station 6. Samples were collected on the left side of the river, across from the rock islands. Samples were collected using a niskin bottle. (Image courtesy of the Potomac Boat Club.)

Figure 2-13. Potomac River at Thompson's Boat House where Rock Creek enters the river. Samples were taken just upstream of this location by boat using a niskin bottle.

14th Street Bridge (Station 8). This station was located in the center channel of the Potomac River at the 14th Street Bridge (left) and I-395 (right) facing east (Figure 2-14). Samples were collected by boat using a niskin bottle in the main channel just south of the bridge. A long-term dissolved oxygen monitoring station was attached below the 14th Street Bridge.

Figure 2-14. View of the center channel of the Potomac River at the 14th Street Bridge (left) and I-395 (right) facing east. Samples were taken between the bridge and I-395 by boat using a niskin bottle. The long-term dissolved oxygen monitoring station was affixed below the 14th Street Bridge. (Image courtesy of Google Maps.)

Woodrow Wilson Bridge (Station 9). This station was located just north of the Woodrow Wilson Bridge in the center of the main channel, about 150 yards downriver of the Torpedo Factory in Old Alexandria and adjacent to a red navigational buoy in the "No Wake" zone. The DO monitoring station was located just north of the sampling station and was attached to the Red "4" navigational buoy with permission from the U.S. Coast Guard (Figure 2-15). Samples were collected by boat using a niskin bottle.

Figure 2-15. Woodrow Wilson Bridge dissolved oxygen monitoring station located just north of Old Town Alexandria on the Potomac River.

2.2.3.3 Rock Creek

Sampling in Rock Creek was primarily conducted in non-tidal waters (Stations 10, 11, and 12) from its confluence with the Potomac at the Georgetown waterfront approximately 8.8 miles upstream to the Maryland/DC border at Boundary Bridge. Figure 2-16 illustrates the relative distribution of the routine sampling stations in the Rock Creek Watershed.

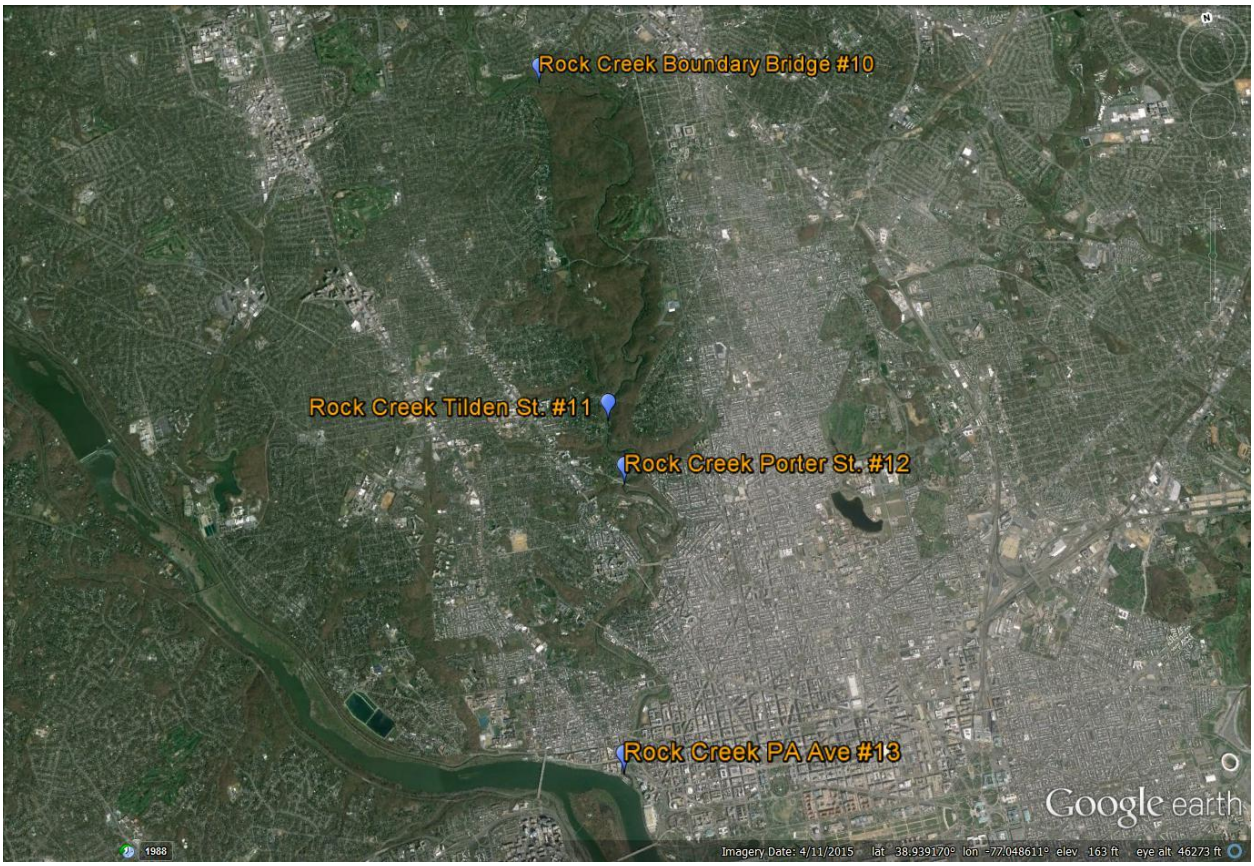

Figure 2-16. Locations of water quality monitoring stations in the Rock Creek Watershed

Boundary Bridge (Station 10). This station is located at the MD-DC line on Beach Drive and is located within the property of Rock Creek National Park (Figure 2-17). Access to the bridge was accomplished via a foot path from a nearby parking lot.

Tilden St. (Pierce's Mill) (Station 11). Sampling was just up river from Pierce's Mill on the east side of the creek (Figure 2-18). A public parking lot provided easy access to the creek. Samples were taken by hand by wading to the center of the creek.

Figure 2-17. Boundary Bridge. Sampling was conducted from the center of the bridge using a niskin bottle. (Image courtesy of Flick'r.com.)

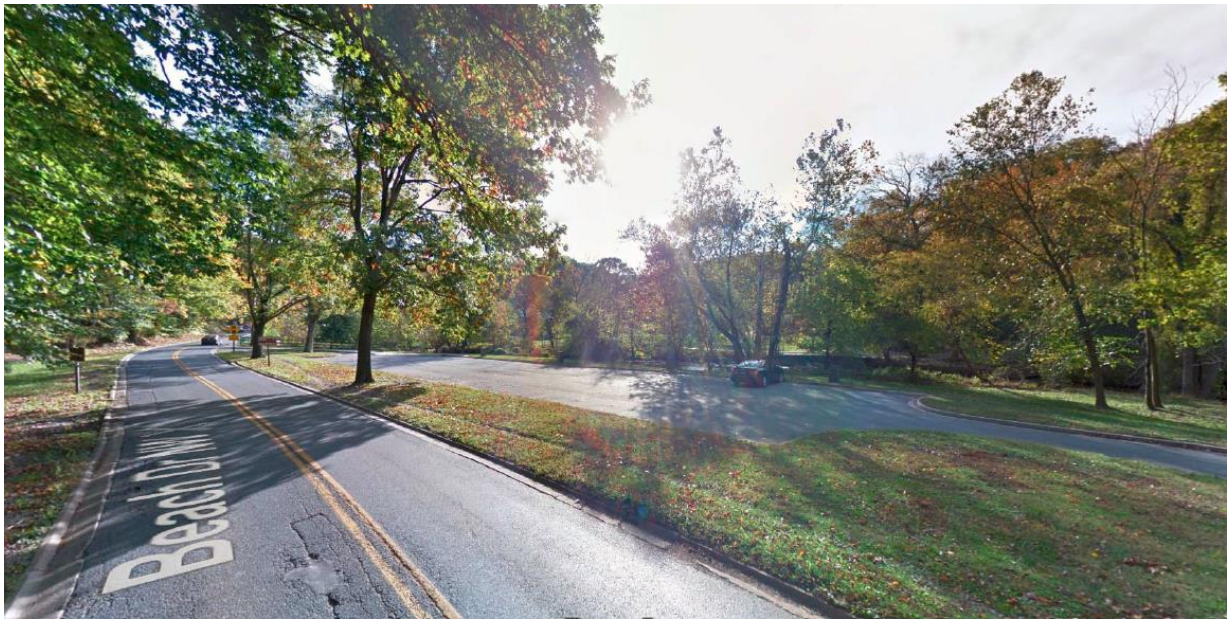

Figure 2-18. A view of the Rock Creek and the public parking lot off of Beach Drive at Tilden Street. Sampling was conducted just beyond the location of the parked car. (Image courtesy of Google Maps.)

Porter Street (Station 12). Samples from this station were taken off the Klingle St. foot bridge along Rock Creek Park Trail (Figure 2-19). Sampling was conducted off this bridge about 150 yards downstream of Porter Street below the Klingle St. overpass.

Figure 2-19. Klingle St. foot-bridge along Rock Creek Park Trail. Sampling was conducted off the center of the bridge using a niskin bottle. (Image courtesy of Google Maps.)

Pennsylvania Avenue / Thompson's Boat House (Station 13). The original location of Station 13 was on the bridge on Rock Creek Parkway that passes over the creek at the entrance to the C&O canal (Figure 2-20). The first three trips were sampled from that location. Due to parking and safety concerns crossing Rock Creek Parkway, the station was moved to the foot bridge that leads from the parking lot to the waterfront at Thompson's Boat House for trips 4 through 71.

Figure 2-20. Pennsylvania Avenue / Thompson's Boat House sampling station near the confluence of Rock Creek and the Potomac River. Sampling was conducted off the center of the foot bridge using a niskin bottle. (Image courtesy of Google Maps.)

2.2.4 Sampling Parameters and Analysis

Samples were analyzed for the twelve (12) parameters noted in Table 2-4. The specific analytical test method used and the associated schedule for all of the bacteriological testing is specified in the updated Sample Procedure and Quality Control document in Appendix D. Laboratory results can be found in the Station Data Summaries in Appendix A.

Table 2-4. List of parameters measured by sampling location

Parameters for Anacostia and Potomac River Locations (all Stations - #1 to 9)	Parameters for Rock Creek Locations	
	At DC/MD Boundary, Tilden Street, Porter Street Locations (#10, 11 & 12)	At Penn Ave. Location (#13)
Laboratory parameters MPN Fecal Coliforms (EC-Med) (SM 9221 E-06) MPN Fecal Coliforms (A1) (SM 9221 E-06) *Escherichia coli* Quantitray (SM 9223 B-04) *Escherichia coli* (SM 9221F) CBOD5 (total) Total suspended solids Chlorophyll-a	**Laboratory parameters** MPN Fecal Coliforms (EC-Med) (SM 9221 E-06 MPN Fecal Coliforms (A1) (SM 9221 E-06) *Escherichia coli* Quantitray (SM 9223 B-04) *Escherichia coli* (SM 9221F)	**Laboratory parameters** MPN Fecal Coliforms (EC-Med) (SM 9221 E-06) MPN Fecal Coliforms (A1) (SM 9221 E-06) *Escherichia coli* Quantitray (SM 9223 B-04) *Escherichia coli*(SM 9221F) CBOD5 (total) Total suspended solids
Field parameters Temperature pH Conductivity Dissolved Oxygen Secchi Depth (Except for Station #2)	**Field parameters** Temperature pH Conductivity Dissolved Oxygen	**Field parameters** Temperature pH Conductivity Dissolved Oxygen

2.3 PERMITS / PERMISSIONS

Sampling permits were required to sample within the boundaries of Rock Creek National Park. Permits were obtained for the 2014, 2015, and 2016 calendar years and are provided in Appendix B. Additional permission was required from the District of Columbia's Harbor Patrol Unit and United States Coastguard to mount the DO monitoring stations at various locations within the district waters.

3.0 PROGRAM MODIFICATIONS

3.1 *E. COLI* AND FECAL MONITORING

At the initiation of the project, two methods were used for the analysis of *E. coli* and Fecal Coliform bacteria. *E. coli* was initially analyzed using the Enzyme Substrate Well test (Quantitray; Standard method 9223B-2004) while Fecal Coliform was analyzed using the Multiple Tube Fermentation, A1 Media test (Standard method 9223B-2004). After the initial results were provided by Martel Laboratories and reviewed by DC Water, it was determined that Fecal

Coliform and *E. Coli* were not yielding comparable results. After multiple discussions and a face-to-face meetings between Versar, Martel Laboratories, DC Water, and MWCOG, two alternative methods were added in an attempt to obtain comparable results. Standard method 9222 C, E-2006 (Multiple Tube Fermentation; EC-Medium) was added for Fecal Coliform testing and standard method 9221F-2006 (Multiple Tube Fermentation; EC-Mug) was added for *E. coli* testing. These methods were used for receiving water monitoring conducted in 2000. Martel Laboratories was also authorized to obtain re-certification for *E. coli* analysis of non-potable water under standard method 9221F-2006 (Multiple Tube Fermentation; EC-Mug). Initially, samples from four trips were tested and compared. After results proved to be inconclusive, an additional 22 routine monitoring trips were authorized to be sampled using all four methods of analysis. Three of the four wet weather events were also monitored using all four methods. On July 9, 2015, after additional analysis, DC Water directed Versar and Martel Laboratories to cease using the Enzyme Substrate Well test (Quantitray; Standard method 9223B-2004) for *E. coli* and the Multiple Tube Fermentation, A1 Media test (Standard method 9223B-2004) for Fecal Coliform. All subsequent trips after that date used standard method 9221F-2006 (Multiple Tube Fermentation; EC-Mug) for *E. coli* and Standard method 9222 C, E-2006 (Multiple Tube Fermentation; EC-Medium) for Fecal Coliform. **A table tracking these changes can be found in the Sample Procedure and Quality Control document (Appendix D, Table 7)**

3.2 BACTERIAL REPORTING LIMITS AND EXTENDED DILUTIONS

Seasonal and environmental changes resulted in instances when the resulting bacterial counts exceeded the standard reporting limits of the tests-conducted with a single dilution-as set forth in the original scope of work. To ensure actual counts were obtained, Martel Laboratories was instructed to conduct extended and extra-extended dilutions for the various bacteria tests during wet weather events. These reporting limits were changed on May 28, 2015 at the instruction of DC Water and are summarized in Table 3-1.

Table 3-1. Modifications to Bacteria Reporting Limits

Analysis	Method	Initial Reporting Limits, MPN/ 100 ml	Expanded Reporting Limits, MPN/ 100 ml
Fecal	9221 E (A1 Med)	2-16,000	2- 160,000
	9221 E (EC Med)	2-16,000	2- 160,000
E.Coli	9221 F (EC Mug)	2-16,000	2- 160,000
	9223 B (Quantitray)	2-2.4 Million	2- 2.4 Million (No Change)

In addition to Storm Event sampling, the new reporting limits and extended dilutions were also applicable during high water discharges, observations of fish kills, other point-source

discharges, or physical observations that field crews felt may have resulted in high bacteria levels in the stream. Extended dilutions were also required if more than 0.5 inches of rain was reported at Washington Reagan National Airport in the 24-hours prior to routine sampling.

3.3 DISSOLVED OXYGEN MONITORING STATION – BENNING ROAD

The original description of work required a dissolved oxygen monitoring station to be installed at Benning Road. Initial site investigations determined that installing and maintaining the monitoring station was not feasible due to river access issues. After consulting with DC Water and the Metropolitan Washington Council of Governments, the DO monitoring station was moved to the Bladensburg Waterfront Park (Station #1) location.

3.4 MAINTENANCE DREDGING IMPACTS AT BLADENSBURG

After sampling was initiated in December 2014, maintenance dredging operations began at Bladensburg Waterfront Park. On December 16, 2014, dredging operations damaged the submerged pile to which the DO monitoring station was attached. The unit was removed and inspected and then moved to another submerged pile for the duration of the monitoring, approximately 30 feet away (Figure 3-1).

Water quality testing was also briefly impacted during the dredging operations. Initially, it was unclear what impacts the dredging would have on the water chemistry at the site. Due to those concerns, two temporary stations were added at the Bladensburg location. To assess the potential impact, water chemistry samples were collected from a station positioned upstream of the dredge (#1U – Bladensburg Upstream) and a station positioned downstream (#1D – Bladensburg Downstream) of the dredge (Figure 3-2). A total of three routine sampling trips between January 5 to 22, 2015 were monitored to determine the impacts of dredging activities. A table tracking these sampling events can be found in the Sample Procedure and Quality Control document in Appendix D.

Figure 3-1. The initial placement of the dissolved oxygen monitoring station prior to being damaged by the dredge on December 16, 2014 and the final location of the monitoring station.

Figure 3-2. The temporarily monitoring stations (#1U – Bladensburg Upstream and #1D – Bladensburg Downstream) during maintenance dredging operations at Bladensburg Waterfront Park in January 2015.

In November 2015, maintenance dredging resumed but additional water chemistry was not monitored under the direction of DC Water. Technicians did monitor and note the dredge location during this period which ended in late December 2015 (Figure 3-3).

Figure 3-3. Approximate dredge locations in reference to the fixed routine monitoring station location during maintenance dredging operations at Bladensburg Waterfront Park from November 16, 2015 until December 19, 2015.

3.5 SECCHI DISK READINGS

Secchi disk readings were initially required at Benning Road (Station #2) but it was later determined that reliable and accurate readings could not be obtained while sampling from the bridge. After consultation with DC Water and the Metropolitan Washington Council of Governments, the secchi disc requirement was removed for Station 2.

APPENDIX A
STATION DATA SUMMARIES FOR ROUTINE AND WET WEATHER EVENTS

Routine Sampling Data Summary

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-B-120814-R Anacostia Bladensburg	01	12/8/2014	>=1600		8500		7	<2	<6	4.75	7.23	0.288	12.66	0.6
Anacostia Bladensburg	01-B-120814-R Anacostia Bladensburg-D	01-D	12/8/2014								4.75	7.11	0.288	11.87	
Anacostia Benning Road	02-B-120814-R Anacostia Benning Road	02	12/8/2014	920		1120		23	<2	6	6.5	7.41	0.275	10.3	0.4
Anacostia PA Ave Seafarers	03-B-120814-R Anacostia PA Ave Seafarers	03	12/8/2014	540		4100		19	<2	<6	6.33	7.4	0.319	10.19	0.35
Anacostia Capitol St. Bridge	04-B-120814-R Anacostia Capitol St. Bridge	04	12/8/2014	>=1600		3000		8	4	8	6.31	7.23	0.34	9.22	0.6
Anacostia Haines Point	05-B-120814-R Anacostia Haines Point	05	12/8/2014	920		285		4	<2	<6	5.67	7.4	0.384	11.23	1.3
Potomac Three Sisters Island	06-B-120814-R Potomac Three Sisters Island	06	12/8/2014	79		53		23	<2	<6	5.3	7.71	0.366	12.35	0.65
Potomac Upstream of Rock Creek	07-B-120814-R Potomac Upstream of Rock Creek	07	12/8/2014	49		53		17	<2	10	5.4	7.97	0.37	14.14	0.9
Potomac 14th St. Bridge	08-B-120814-R Potomac 14th St. Bridge	08	12/8/2014	46		47		9	<2	9	5.57	7.73	0.378	12.04	1.5
Potomac Wilson Bridge	09-B-120814-R Potomac Wilson Bridge	09	12/8/2014	220		137		13	<2	<6	5.32	7.68	0.388	11.8	0.95
Rock Creek Boundary Bridge	10-L-120814-R Rock Creek Boundary Bridge	10	12/8/2014	350		225					4.77	7.03	0.34	12.2	
Rock Creek Tilden St	11-L-120814-R Rock Creek Tilden St	11	12/8/2014	240		235					4.94	7.47	0.283	12.8	
Rock Creek Porter St	12-L-120814-R Rock Creek Porter St	12	12/8/2014	540		613					4.91	7.45	0.289	13.26	
Rock Creek PA Ave	13-L-120814-R Rock Creek PA Ave	13	12/8/2014	350		579		6	5		4.95	7.33	0.277	12.88	
	BE-120814-R Boat Equipment Blank		12/8/2014	<2		<1		<1	4	<6					
Anacostia Bladensburg	01-L-121114-R Anacostia Bladensburg	01	12/11/2014	330		4100		4	<4	<6	4.9	7.55	0.377	12.41	0.95
Anacostia Bladensburg	01-L-121114-R Anacostia Bladensburg-D	01-D	12/11/2014	700											
Anacostia Benning Road	02-L-121114-R Anacostia Benning Road	02	12/11/2014	920		2000		19	<4	<6	5.45	7.5	0.266	12.3	
Anacostia Benning Road	02-L-121114-R Anacostia Benning Road-D	02-D	12/11/2014			980					5.45	7.5	0.266	11.06	
Anacostia PA Ave Seafarers	03-B-121114-R Anacostia PA Ave Seafarers	03	12/11/2014	240		770		15	<4	<6	5.02	7.33	0.288	11.12	0.4
Anacostia PA Ave Seafarers	03-B-121114-R Anacostia PA Ave Seafarers-D	03-D	12/11/2014					13							
Anacostia Capitol St. Bridge	04-B-121114-R Anacostia Capitol St. Bridge	04	12/11/2014	230		2000		10	<4	<6	5.57	7.38	0.322	10.27	0.4
Anacostia Capitol St. Bridge	04-B-121114-R Anacostia Capitol St. Bridge-D	04-D	12/11/2014						4						
Anacostia Haines Point	05-B-121114-R Anacostia Haines Point	05	12/11/2014	240		238		10	<4	11	4.55	7.78	0.301	12.88	0.5
Potomac Three Sisters Island	06-B-121114-R Potomac Three Sisters Island	06	12/11/2014	350		488		21	<4	12	4.32	7.79	0.278	13.71	0.5
Potomac Upstream of Rock Creek	07-B-121114-R Potomac Upstream of Rock Creek	07	12/11/2014	540		411		19	<4	10	4.33	7.79	0.28	13.64	0.5
Potomac 14th St. Bridge	08-B-121114-R Potomac 14th St. Bridge	08	12/11/2014	540		272		14	<4	7	4.54	7.76	0.283	13.46	
Potomac Wilson Bridge	09-B-121114-R Potomac Wilson Bridge	09	12/11/2014	240		261		9	<4	<6	4.49	7.84	0.316	13.05	0.6
Rock Creek Boundary Bridge	10-L-121114-R Rock Creek Boundary Bridge	10	12/11/2014	240		186					4.56	7.63	0.355	11.96	
Rock Creek Tilden St	11-L-121114-R Rock Creek Tilden St	11	12/11/2014	240		201					4.38	7.62	0.357	12.65	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Porter St	12-L-121114-R Rock Creek Porter St	12	12/11/2014	240		186					4.33	7.68	0.367	13.11	
Rock Creek PA Ave	13-L-121114-R Rock Creek PA Ave	13	12/11/2014	240		228		3	<4		4.31	7.69	0.366	12.82	
	BE-121114-R Boat Equipment Blank		12/11/2014	<2		<1		<1	7	6					
	LE-121114-R Land Equipment Blank		12/11/2014	<2		<1		<1	<4	<6					
Anacostia Bladensburg	01-L-121514-R Anacostia Bladensburg	01	12/15/2014	310		276		4	<4	6	5.63	7.76	0.408	11.54	
Anacostia Benning Road	02-L-121514-R Anacostia Benning Road	02	12/15/2014	79		153		17	8	13	5.18	7.64	0.331	10.47	
Anacostia PA Ave Seafarers	03-B-121514-R Anacostia PA Ave Seafarers	03	12/15/2014	130		148		18	<4	16	4.96	7.2	0.317	10.32	0.4
Anacostia PA Ave Seafarers	03-B-121514-R Anacostia PA Ave Seafarers-D	03-D	12/15/2014								4.96	7.2	0.311	10.25	
Anacostia Capitol St. Bridge	04-B-121514-R Anacostia Capitol St. Bridge	04	12/15/2014	220		238		8	<4	<6	5.11	7.38	0.308	10.53	0.51
Anacostia Haines Point	05-B-121514-R Anacostia Haines Point	05	12/15/2014	33		28		3	<4	<6	4.19	7.87	0.289	13.68	1
Anacostia Haines Point	05-B-121514-R Anacostia Haines Point-D	05-D	12/15/2014							<6					
Potomac Three Sisters Island	06-B-121514-R Potomac Three Sisters Island	06	12/15/2014	46		19		4	<4	<6	4.66	8	0.285	13.4	1.25
Potomac Upstream of Rock Creek	07-B-121514-R Potomac Upstream of Rock Creek	07	12/15/2014	17		27		4	<4	10	4.55	7.98	0.284	13.42	1.3
Potomac 14th St. Bridge	08-B-121514-R Potomac 14th St. Bridge	08	12/15/2014	110		28		3	<4	<6	4.18	7.95	0.286	13.68	1.15
Potomac Wilson Bridge	09-B-121514-R Potomac Wilson Bridge	09	12/15/2014	79		78		4	<4	<6	4.12	7.95	0.292	13.55	1.05
Rock Creek Boundary Bridge	10-L-121514-R Rock Creek Boundary Bridge	10	12/15/2014	70		79					5.27	7.64	0.422	11.91	
Rock Creek Tilden St	11-L-121514-R Rock Creek Tilden St	11	12/15/2014	130		81					5.12	7.65	0.437	12.45	
Rock Creek Porter St	12-L-121514-R Rock Creek Porter St	12	12/15/2014	49		49					5.21	7.77	0.45	13.04	
Rock Creek PA Ave	13-L-121514-R Rock Creek PA Ave	13	12/15/2014	130		82		1	<4		5.42	7.78	0.46	12.68	
	BE-121514-R Boat Equipment Blank		12/15/2014	<2		<1		<1	<4	<6					
	BF-121514-R Boat Field Blank		12/15/2014	<2		<1		<1	<4	<6					
	LE-121514-R Land Equipment Blank		12/15/2014	<2		<1		<1	<4	<6					
	LF-121514-R Land Field Blank		12/15/2014	<2		<1		<1	<4	<6					
Anacostia Bladensburg	01-L-122214-R Anacostia Bladensburg	01	12/22/2014	330		308		1	<4	11	3.45	7.69	0.417	13.08	1.55
Anacostia Benning Road	02-L-122214-R Anacostia Benning Road	02	12/22/2014	240		308		12	<4	14	3.91	7.84	0.387		
Anacostia Benning Road	02-L-122214-R Anacostia Benning Road-D	02-D	12/22/2014	240											
Anacostia PA Ave Seafarers	03-B-122214-R Anacostia PA Ave Seafarers	03	12/22/2014	110		435		13	<4	9	4.26	7.33	0.359	9.6	0.5
Anacostia PA Ave Seafarers	03-B-122214-R Anacostia PA Ave Seafarers-D	03-D	12/22/2014			687									
Anacostia Capitol St. Bridge	04-B-122214-R Anacostia Capitol St. Bridge	04	12/22/2014	240		222		5	<4	<6	4.46	7.44	0.338	10.56	0.8
Anacostia Capitol St. Bridge	04-B-122214-R Anacostia Capitol St. Bridge-D	04-D	12/22/2014												
Anacostia Haines Point	05-B-122214-R Anacostia Haines Point	05	12/22/2014	33		29		1	<4	<6	3.97	7.91	0.333	13.17	1.6
Anacostia Haines Point	05-B-122214-R Anacostia Haines Point-D	05-D	12/22/2014					2							

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Three Sisters Island	06-B-122214-R Potomac Three Sisters Island	06	12/22/2014	11		3		<1	<4	<6	3.18	8.07	0.345	13.81	2.4
Potomac Upstream of Rock Creek	07-B-122214-R Potomac Upstream of Rock Creek	07	12/22/2014	2		<1		<1	<4	<6	3.3	8.15	0.344	14.06	1.7
Potomac 14th St. Bridge	08-B-122214-R Potomac 14th St. Bridge	08	12/22/2014	8		5		<1	<4	<6	3.46	8.16	0.341	13.94	2.6
Potomac Wilson Bridge	09-B-122214-R Potomac Wilson Bridge	09	12/22/2014	13		15		9	<4	<6	4.09	7.9	0.335	13.12	0.9
Rock Creek Boundary Bridge	10-L-122214-R Rock Creek Boundary Bridge	10	12/22/2014	79		74									
Rock Creek Tilden St	11-L-122214-R Rock Creek Tilden St	11	12/22/2014	350		488									
Rock Creek Porter St	12-L-122214-R Rock Creek Porter St	12	12/22/2014	110		157									
Rock Creek PA Ave	13-L-122214-R Rock Creek PA Ave	13	12/22/2014	110		192		1	<4		3.07	7.36	0.478	12.98	
	BE-122214-R Boat Equipment Blank		12/22/2014	<2		<1		<1	20	<6					
	LE-122214-R Land Equipment Blank		12/22/2014	<2		<1		<1	<4	<6					
Anacostia Bladensburg	01-L-122914-R Anacostia Bladensburg	01	12/29/2014	790		1553		2	<4	<6	7.32	7.48	0.379	11.31	1.48
Anacostia Benning Road	02-L-122914-R Anacostia Benning Road	02	12/29/2014	240		345		24	<4	7	7.07	7.48	0.31	9.85	
Anacostia PA Ave Seafarers	03-B-122914-R Anacostia PA Ave Seafarers	03	12/29/2014	79		201		24	<4	8	7.16	7.15	0.305	9.41	0.35
Anacostia PA Ave Seafarers	03-B-122914-R Anacostia PA Ave Seafarers-D	03-D	12/29/2014	130											
Anacostia Capitol St. Bridge	04-B-122914-R Anacostia Capitol St. Bridge	04	12/29/2014	130		201		16	<4	<6	7.1	7.08	0.282	9.06	0.35
Anacostia Capitol St. Bridge	04-B-122914-R Anacostia Capitol St. Bridge-D	04-D	12/29/2014			236									
Anacostia Haines Point	05-B-122914-R Anacostia Haines Point	05	12/29/2014	170		166		6	<4	<6	5.7	7.59	0.322	12.04	0.95
Potomac Three Sisters Island	06-B-122914-R Potomac Three Sisters Island	06	12/29/2014	11		21		4	<4	<6	5.58	8.04	0.35	13.04	1.35
Potomac Three Sisters Island	06-B-122914-R Potomac Three Sisters Island-D	06-D	12/29/2014							<6	5.58	8.06	0.35	13.06	
Potomac Upstream of Rock Creek	07-B-122914-R Potomac Upstream of Rock Creek	07	12/29/2014	27		20		4	<4	<6	5.55	8.07	0.348	13.01	1.6
Potomac 14th St. Bridge	08-B-122914-R Potomac 14th St. Bridge	08	12/29/2014	49		37		4	<4	<6	5.3	7.96	0.346	13.23	1.6
Potomac Wilson Bridge	09-B-122914-R Potomac Wilson Bridge	09	12/29/2014	170		201		9	<4	<6	5.59	7.78	0.324	12.79	1.05
Rock Creek Boundary Bridge	10-L-122914-R Rock Creek Boundary Bridge	10	12/29/2014	130		411					6.73	7.47	0.38	11.64	
Rock Creek Tilden St	11-L-122914-R Rock Creek Tilden St	11	12/29/2014	540		308					6.62	7.57	0.386	12.24	
Rock Creek Porter St	12-L-122914-R Rock Creek Porter St	12	12/29/2014	350		166					6.63	7.66	0.393	12.62	
Rock Creek PA Ave	13-L-122914-R Rock Creek PA Ave	13	12/29/2014	31		155		3	82		6.62	7.68	0.415	12.31	
	BE-122914-R Boat Equipment Blank		12/29/2014	<2		<1		<1	35	<6					
	LE-122914-R Land Equipment Blank		12/29/2014	<2		<1		<1	<4	<6					
Anacostia Bladensburg (Downstream)	1D-L-010515-R Anacostia Bladensburg (Downstream)	1D	1/5/2015	240		770		13	<2	6	5	7.71	0.232	14.34	0.4
Anacostia Bladensburg (Upstream)	1U-L-010515-R Anacostia Bladensburg (Upstream)	1U	1/5/2015	1300		727		12	<2	24	6.21	7.69	0.236	13.58	0.4
Anacostia Benning Road	02-L-010515-R Anacostia Benning Road	02	1/5/2015	920		1300		26	<2	23	6.13	7.62	0.225	12.2	
Anacostia PA Ave Seafarers	03-B-010515-R Anacostia PA Ave Seafarers	03	1/5/2015	1600		2420		22	<2	16	5.05	7.11	0.282	11.61	0.3

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Capitol St. Bridge	04-B-010515-R Anacostia Capitol St. Bridge	04	1/5/2015	490		548		8	<2	<6	5.17	7.2	0.324	10.2	0.7
Anacostia Haines Point	05-B-010515-R Anacostia Haines Point	05	1/5/2015	350		260		5	<2	<6	4.08	7.8	0.318	12.5	0.8
Potomac Three Sisters Island	06-B-010515-R Potomac Three Sisters Island	06	1/5/2015	240		238		13	<2	11	4.39	7.88	0.301	13.16	0.45
Potomac Three Sisters Island	06-B-010515-R Potomac Three Sisters Island-D	06-D	1/5/2015					12							
Potomac Upstream of Rock Creek	07-B-010515-R Potomac Upstream of Rock Creek	07	1/5/2015	240		210		10	<2	9	4.37	7.95	0.305	13.18	0.6
Potomac Upstream of Rock Creek	07-B-010515-R Potomac Upstream of Rock Creek-D	07-D	1/5/2015								4.37	8.01	0.308	13.28	
Potomac 14th St. Bridge	08-B-010515-R Potomac 14th St. Bridge	08	1/5/2015	49		140		6	<2	7	4.17	8.13	0.312	13.4	0.85
Potomac Wilson Bridge	09-B-010515-R Potomac Wilson Bridge	09	1/5/2015	130		80		7	<2	<6	3.74	8.04	0.33	13.09	1.32
Rock Creek Boundary Bridge	10-L-010515-R Rock Creek Boundary Bridge	10	1/5/2015	920		1046					5.23	7.2	0.259	12.28	
Rock Creek Tilden St	11-L-010515-R Rock Creek Tilden St	11	1/5/2015	1600		770					5.2	7.58	0.265	12.94	
Rock Creek Porter St	12-L-010515-R Rock Creek Porter St	12	1/5/2015	540		548					5.28	7.68	0.269	13.33	
Rock Creek PA Ave	13-L-010515-R Rock Creek PA Ave	13	1/5/2015	540		1414		17	<2		5.32	7.71	0.271	13.04	
	BF-010515-R Boat Field Blank		1/5/2015	<2		<1		<1	<2	<6					
	LE-010515-R Land Equipment Blank		1/5/2015	<2		<1		<1	<2	<6					
	LF-010515-R Land Field Blank		1/5/2015	<2		<1		<1	<2	<6					
	BE-010515-R Boat Equipment Blank		1/5/2015	<2		<1		<1	2	<6					
Anacostia Bladensburg (Downstream)	1D-L-012015-R Anacostia Bladensburg (Downstream)	1D	1/20/2015	350		4100		8	<2	12	4.81	7.35	0.799	13.21	0.45
Anacostia Bladensburg (Upstream)	1U-L-012015-R Anacostia Bladensburg (Upstream)	1U	1/20/2015	1700		1414		11	<2	8	4.04	7.26	0.785	13.71	0.55
Anacostia Benning Road	02-L-012015-R Anacostia Benning Road	02	1/20/2015	240		1414		34	<4	<6	2.7	7.23	0.957	12.13	
Anacostia PA Ave Seafarers	03-B-012015-R Anacostia PA Ave Seafarers	03	1/20/2015	920		1733		35	<4	<6	2.35	7.64	1.315	12.47	0.15
Anacostia Capitol St. Bridge	04-B-012015-R Anacostia Capitol St. Bridge	04	1/20/2015	170		980		6	<2	<6	1.18	7.81	0.827	13.84	0.85
Anacostia Capitol St. Bridge	04-B-012015-R Anacostia Capitol St. Bridge-D	04-D	1/20/2015	540											
Anacostia Haines Point	05-B-012015-R Anacostia Haines Point	05	1/20/2015	350		248		3	<2	<6	1.35	8.03	0.539	14.65	1.6
Anacostia Haines Point	05-B-012015-R Anacostia Haines Point-D	05-D	1/20/2015			308			<2						
Potomac Three Sisters Island	06-B-012015-R Potomac Three Sisters Island	06	1/20/2015	<2		1		1	<2	<6	1.18	8.17	0.355	14.96	3.75
Potomac Upstream of Rock Creek	07-B-012015-R Potomac Upstream of Rock Creek	07	1/20/2015	<2		3		1	<2	<6	1.11	8.17	0.357	15.11	3.95
Potomac Upstream of Rock Creek	07-B-012015-R Potomac Upstream of Rock Creek-D	07-D	1/20/2015							14					
Potomac 14th St. Bridge	08-B-012015-R Potomac 14th St. Bridge	08	1/20/2015	17		31		1	<2	<6	1.32	8.26	0.369	15.37	3.45
Potomac 14th St. Bridge	08-B-012015-R Potomac 14th St. Bridge-D	08-D	1/20/2015								1.32	8.27	0.369	15.45	
Potomac Wilson Bridge	09-B-012015-R Potomac Wilson Bridge	09	1/20/2015	110		157		9	<2	<6	1.45	7.97	0.484	14.74	1.25
Potomac Wilson Bridge	09-B-012015-R Potomac Wilson Bridge-D	09-D	1/20/2015								1.45	7.97	0.485	14.73	
Rock Creek Boundary Bridge	10-L-012015-R Rock Creek Boundary Bridge	10	1/20/2015	240		139					2.8	6.87	0.764	13.09	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-012015-R Rock Creek Boundary Bridge-D	10-D	1/20/2015								2.8	6.88	0.762	13.1	
Rock Creek Tilden St	11-L-012015-R Rock Creek Tilden St	11	1/20/2015	49		299					2.56	7.41	1.037	13.99	
Rock Creek Porter St	12-L-012015-R Rock Creek Porter St	12	1/20/2015	46		249					2.6	7.31	1.067	14.18	
Rock Creek PA Ave	13-L-012015-R Rock Creek PA Ave	13	1/20/2015	920		3000		2	<2		2.59	7.34	1.117	13.52	
	BE-012015-R Boat Equipment Blank		1/20/2015	<2		<1		<1	<2	<6					
	LE-012015-R Land Equipment Blank		1/20/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg (Downstream)	1D-L-012215-R Anacostia Bladensburg (Downstream)	1D	1/22/2015	240	920	1046	920	3	<4	<6	4.19	7.48	1.219	12.79	
Anacostia Bladensburg (Upstream)	1U-L-012215-R Anacostia Bladensburg (Upstream)	1U	1/22/2015	700	790	1300	790	3	<4	<6	3.58	7.46	1.39	12.97	0.85
Anacostia Benning Road	02-L-012215-R Anacostia Benning Road	02	1/22/2015	540	920	727	920	25	<4	<6	2.97	7.43	1	11.75	
Anacostia PA Ave Seafarers	03-B-012215-R Anacostia PA Ave Seafarers	03	1/22/2015	540	920	980	920	16	<4	<6	2.13	7.52	1.103	12.28	0.3
Anacostia Capitol St. Bridge	04-B-012215-R Anacostia Capitol St. Bridge	04	1/22/2015	330	330	365	220	5	<4	<6	1.62	7.67	0.622	13.82	0.8
Anacostia Haines Point	05-B-012215-R Anacostia Haines Point	05	1/22/2015	170	79	210	79	2	<4	<6	1.74	7.85	0.438	14.26	1.9
Anacostia Haines Point	05-B-012215-R Anacostia Haines Point-D	05-D	1/22/2015	49	110		110								
Potomac Three Sisters Island	06-B-012215-R Potomac Three Sisters Island	06	1/22/2015	2	5	2	5	<1	<4	<6	1.41	8.16	0.364	14.78	3
Potomac Three Sisters Island	06-B-012215-R Potomac Three Sisters Island-D	06-D	1/22/2015		4	4	4		<4						
Potomac Upstream of Rock Creek	07-B-012215-R Potomac Upstream of Rock Creek	07	1/22/2015	2	5	5	5	<1	<4	<6	1.51	8.22	0.362	14.88	3.4
Potomac Upstream of Rock Creek	07-B-012215-R Potomac Upstream of Rock Creek-D	07-D	1/22/2015					<1							
Potomac 14th St. Bridge	08-B-012215-R Potomac 14th St. Bridge	08	1/22/2015	2	5	13	5	<1	<4	<6	1.55	8.17	0.364	14.72	2.25
Potomac Wilson Bridge	09-B-012215-R Potomac Wilson Bridge	09	1/22/2015	49	140	72	140	5	<4	<6					
Rock Creek Boundary Bridge	10-L-012215-R Rock Creek Boundary Bridge	10	1/22/2015	540	1600	1046	1600				3.04	7.25	1.796	12.96	
Rock Creek Boundary Bridge	10-L-012215-R Rock Creek Boundary Bridge-D	10-D	1/22/2015								3.04	7.25	1.796	12.96	
Rock Creek Tilden St	11-L-012215-R Rock Creek Tilden St	11	1/22/2015	130	130	187	130				2.84	7.45	1.119	13.83	
Rock Creek Porter St	12-L-012215-R Rock Creek Porter St	12	1/22/2015	350	240	260	240				2.99	7.68	1.318	14.31	
Rock Creek PA Ave	13-L-012215-R Rock Creek PA Ave	13	1/22/2015	>=1600	>=1600	12000	>=1600				3.08	7.61	1.721	13.65	
	BE-012215-R Boat Equipment Blank		1/22/2015	<2		<1		<1	<4	<6					
	LE-012215-R Land Equipment Blank		1/22/2015	<2		<1		<1	<4	<6					
Anacostia Bladensburg (Upstream)	1U-L-012615-R Anacostia Bladensburg (Upstream)	1U	1/26/2015	490	1300	980	1300	8	<2	10	4.55	7.53	0.662	12.24	0.5
Anacostia Benning Road	02-L-012615-R Anacostia Benning Road	02	1/26/2015	350	350	921	350	43	<2	22	3.61	7.58	0.579	12.14	
Anacostia PA Ave Seafarers	03-B-012615-R Anacostia PA Ave Seafarers	03	1/26/2015	920	350	1203	350	40	<2	15	3.66	7.48	0.599	12.64	0.24
Anacostia Capitol St. Bridge	04-B-012615-R Anacostia Capitol St. Bridge	04	1/26/2015	700	490	5200	490	48	<2	<6	3.28	7.45	0.737	12.48	0.18
Anacostia Haines Point	05-B-012615-R Anacostia Haines Point	05	1/26/2015	540	350	816	350	17	<2	7	2.68	7.78	0.499	13.86	0.48
Potomac Three Sisters Island	06-B-012615-R Potomac Three Sisters Island	06	1/26/2015	240	79	199	79	12	<2	8	2.84	7.83	0.358	14.15	0.62

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Upstream of Rock Creek	07-B-012615-R Potomac Upstream of Rock Creek	07	1/26/2015	46	130	201	130	11	<2	9	2.83	7.86	0.35	14.07	0.6
Potomac 14th St. Bridge	08-B-012615-R Potomac 14th St. Bridge	08	1/26/2015	170	70	365	70	12	<2	<6	2.56	7.86	0.352	14.34	0.5
Potomac 14th St. Bridge	08-B-012615-R Potomac 14th St. Bridge-D	08-D	1/26/2015							7					
Potomac Wilson Bridge	09-B-012615-R Potomac Wilson Bridge	09	1/26/2015	920	540	1414	540	20	<2	<6	2.86	7.84	0.47	13.74	0.5
Rock Creek Boundary Bridge	10-L-012615-R Rock Creek Boundary Bridge	10	1/26/2015	240	130	285	130				4.01	7.36	0.612	12.28	
Rock Creek Tilden St	11-L-012615-R Rock Creek Tilden St-D	11-D	1/26/2015	240	540	613	540				3.96	7.46	0.818	12.93	
Rock Creek Porter St	11-L-012615-R Rock Creek Tilden St-D	11-D	1/26/2015								3.96	7.44	0.819	13.01	
Rock Creek Porter St	12-L-012615-R Rock Creek Porter St	12	1/26/2015	240	350	649	350				3.98	7.52	0.865	13.35	
Rock Creek PA Ave	13-L-012615-R Rock Creek PA Ave	13	1/26/2015	330	170	687	170	10	<2		4.04	7.58	0.983	13.08	
	BE-012615-R Boat Equipment Blank		1/26/2015	<2		<1		<1	<2	<6					
	BF-012615-R Boat Field Blank		1/26/2015	<2		<1		<1	<2	<6					
	LE-012615-R Land Equipment Blank		1/26/2015	<2		1		<1	<2	<6					
	LF-012615-R Land Field Blank		1/26/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg (Upstream)	1U-B-012715-R Anacostia Bladensburg (Upstream)	1U	1/27/2015	1100	1700	2420	1700	14	<2	<6	2.41	7.85	1.702	13.2	0.4
Anacostia Benning Road	02-B-012715-R Anacostia Benning Road	02	1/27/2015	920	>=1600	1733	>=1600	14	4	<6	3.32	7.48	0.97	12.37	
Anacostia PA Ave Seafarers	03-B-012715-R Anacostia PA Ave Seafarers	03	1/27/2015	540	920	1046	920	23	<2	<6	3.36	7.4	0.827	12.17	0.3
Anacostia Capitol St. Bridge	04-B-012715-R Anacostia Capitol St. Bridge	04	1/27/2015	490	3500	866	3500	42	<2	<6	2.9	7.25	0.707	12.12	0.2
Anacostia Haines Point	05-B-012715-R Anacostia Haines Point	05	1/27/2015	140	170	435	130	11	<2	<6	2.38	7.61	0.465	13.6	0.55
Potomac Three Sisters Island	06-B-012715-R Potomac Three Sisters Island	06	1/27/2015	130	110	173	110	8	<2	10	2.02	7.81	0.379	14.27	0.9
Potomac Three Sisters Island	06-B-012715-R Potomac Three Sisters Island-D	06-D	1/27/2015	49	79		49								
Potomac Upstream of Rock Creek	07-B-012715-R Potomac Upstream of Rock Creek	07	1/27/2015	110	170	148	110	8	<2	7	2.12	7.7	0.387	14.08	0.8
Potomac Upstream of Rock Creek	07-B-012715-R Potomac Upstream of Rock Creek-D	07-D	1/27/2015		79	192	79	7							
Potomac 14th St. Bridge	08-B-012715-R Potomac 14th St. Bridge	08	1/27/2015	170	79	150	49	7	<2	7	2.28	7.77	0.401	14.11	0.7
Potomac 14th St. Bridge	08-B-012715-R Potomac 14th St. Bridge-D	08-D	1/27/2015						<2						
Potomac Wilson Bridge	09-B-012715-R Potomac Wilson Bridge	09	1/27/2015	540	110	365	110	15	<2	7	2.3	7.69	0.399	13.66	0.5
Rock Creek Boundary Bridge	10-L-012715-R Rock Creek Boundary Bridge	10	1/27/2015	350	540	517	540				2.67	7.44	2.608	13.12	
Rock Creek Porter St	11-L-012715-R Rock Creek Tilden St	11	1/27/2015	540	920	1046	920				2.85	7.62	2.027	13.71	
Rock Creek Porter St	12-L-012715-R Rock Creek Porter St	12	1/27/2015	920	1600	980	350				2.86	7.65	2.177	14.25	
Rock Creek Porter St	12-L-012715-R Rock Creek Porter St-D	12-D	1/27/2015								2.86	7.63	2.178	14.19	
Rock Creek PA Ave	13-L-012715-R Rock Creek PA Ave	13	1/27/2015	790	1100	866	1100	7	<2		2.77	7.83	1.94	13.24	
Rock Creek PA Ave	13-L-012715-R Rock Creek PA Ave-D	13-D	1/27/2015								2.77	7.79	1.944	13.27	
	BE-012715-R Boat Equipment Blank		1/27/2015	<2		1		<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-020315-R Anacostia Bladensburg	01	2/3/2015	790	3500	1553	3500	13	<2	13	0.63	7.49	1.624	13.93	0.5
Anacostia Bladensburg	01-L-020315-R Anacostia Bladensburg-D	01-D	2/3/2015								0.63	7.47	1.626	13.89	
Anacostia Benning Road	02-L-020315-R Anacostia Benning Road	02	2/3/2015	540	540	1414	540	11	2	10	1.72	7.48	1.611	13.82	
Anacostia PA Ave Seafarers	03-B-020315-R Anacostia PA Ave Seafarers	03	2/3/2015	350	130	222	130	11	<2	17	0.24	6.69	1.831	13.3	0.55
Anacostia Capitol St. Bridge	04-B-020315-R Anacostia Capitol St. Bridge	04	2/3/2015	460	230	219	230	10	<2	<6	0.99	7.31	0.907	13.45	0.45
Anacostia Haines Point	05-B-020315-R Anacostia Haines Point	05	2/3/2015	49	49	28	49	5	<2	<6	0.17	7.61	0.443	14.4	1
Potomac Three Sisters Island	06-B-020315-R Potomac Three Sisters Island	06	2/3/2015	4	8	4	8	4	<2	7	0.92	8.03	0.356	14.87	1.5
Potomac Upstream of Rock Creek	07-B-020315-R Potomac Upstream of Rock Creek	07	2/3/2015	7	5	10	<2	3	<2	<6	0.89	7.99	0.355	14.7	1.6
Potomac Upstream of Rock Creek	07-B-020315-R Potomac Upstream of Rock Creek-D	07-D	2/3/2015	5		10									
Potomac 14th St. Bridge	08-B-020315-R Potomac 14th St. Bridge	08	2/3/2015	13	33	24	17	3	<2	7	0.78	8.01	0.379	14.84	1.7
Potomac 14th St. Bridge	08-B-020315-R Potomac 14th St. Bridge-D	08-D	2/3/2015	17		12									
Potomac Wilson Bridge	09-B-020315-R Potomac Wilson Bridge	09	2/3/2015												
Rock Creek Tilden St	10-L-020315-R Rock Creek Tilden St	11	2/3/2015	920	350	1300	350				1.31	6.43	1.488	13.46	
Rock Creek Tilden St	11-L-020315-R Rock Creek Tilden St	11	2/3/2015	540	920	2420	920				1.25	7.03	1.875	14.3	
Rock Creek Porter St	12-L-020315-R Rock Creek Porter St	12	2/3/2015	920	920	1553	920				1.4	7.4	1.948	14.64	
Rock Creek PA Ave	13-L-020315-R Rock Creek PA Ave	13	2/3/2015	790	1300	613	1300	11	<2		1.21	7.49	2.267	14.39	
	BE-020315-R Boat Equipment Blank		2/3/2015	<2		<1		<1	<2	<6					
	LE-020315-R Land Equipment Blank		2/3/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-020515-R Anacostia Bladensburg	01	2/5/2015	230		866		15	<2	<6	2.93	7.57	1.152	13.04	0.5
Anacostia Benning Road	02-L-020515-R Anacostia Benning Road	02	2/5/2015	140		517		12	<2	<6	2.24	7.54	1.568	13	
Anacostia Benning Road	02-L-020515-R Anacostia Benning Road-D	02-D	2/5/2015								2.24	7.51	1.567	12.98	
Anacostia PA Ave Seafarers	03-B-020515-R Anacostia PA Ave Seafarers	03	2/5/2015	170		91		12	<2	<6	1.8	7.53	1.529	13.4	0.6
Anacostia Capitol St. Bridge	04-B-020515-R Anacostia Capitol St. Bridge	04	2/5/2015	33		105		6	<2	<6	1.31	7.7	0.891	13.94	0.65
Anacostia Haines Point	05-B-020515-R Anacostia Haines Point	05	2/5/2015	49		40		7	<2	<6	1.13	7.8	0.523	14.55	1.1
Potomac Three Sisters Island	06-B-020515-R Potomac Three Sisters Island	06	2/5/2015	2		3		4	<2	9	2.06	8.22	0.366	14.59	1.6
Potomac Upstream of Rock Creek	07-B-020515-R Potomac Upstream of Rock Creek	07	2/5/2015	<2		4		3	<2	<6	1.76	8.19	0.365	14.74	1.6
Potomac 14th St. Bridge	08-B-020515-R Potomac 14th St. Bridge	08	2/5/2015	<2		3		3	<2	<6	1.59	8.23	0.369	15.18	1.1
Potomac 14th St. Bridge	08-B-020515-R Potomac 14th St. Bridge-D	08-D	2/5/2015						<2						
Potomac Wilson Bridge	09-B-020515-R Potomac Wilson Bridge	09	2/5/2015	33	23	23	23	8	<2	7	1.46	7.97	0.425	14.9	1.2
Potomac Wilson Bridge	09-B-020515-R Potomac Wilson Bridge-D	09-D	2/5/2015					9		8					
Rock Creek Boundary Bridge	10-L-020515-R Rock Creek Boundary Bridge	10	2/5/2015	79		86					2.86	7.46	0.865	13.25	
Rock Creek Tilden St	11-L-020515-R Rock Creek Tilden St	11	2/5/2015	33		138					2.29	7.63	0.945	13.9	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Porter St	12-L-020515-R Rock Creek Porter St	12	2/5/2015	23		118					2.24	7.75	0.957	14.29	
Rock Creek PA Ave	13-L-020515-R Rock Creek PA Ave	13	2/5/2015	33		141		3	<2		2.11	7.75	0.98	13.8	
	BE-020515-R Boat Equipment Blank		2/5/2015	<2		<1		<1	<2	<6					
	BF-020515-R Boat Field Blank		2/5/2015	<2		<1		<1	<2	<6					
	LE-020515-R Land Equipment Blank		2/5/2015	<2		<1		<1	<2	<6					
	LF-020515-R Land Field Blank		2/5/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-020915-R Anacostia Bladensburg	01	2/9/2015	790		2420		3	<2	<6	3.82	7.5	0.746	12.69	1.4
Anacostia Benning Road	02-L-020915-R Anacostia Benning Road	02	2/9/2015	79		68		10	<2	<6	2.33	7.46	1.376	12.78	
Anacostia PA Ave Seafarers	03-B-020915-R Anacostia PA Ave Seafarers	03	2/9/2015	79		54		8	<2	<6	1.9	7.65	1.145	13.57	0.6
Anacostia PA Ave Seafarers	03-B-020915-R Anacostia PA Ave Seafarers-D	03-D	2/9/2015								1.9	7.6	1.148	13.39	
Anacostia Capitol St. Bridge	04-B-020915-R Anacostia Capitol St. Bridge	04	2/9/2015	70		72		4	<2	<6	1.43	7.91	0.63	14.5	1.2
Anacostia Haines Point	05-B-020915-R Anacostia Haines Point	05	2/9/2015	130		71		2	<2	7	1.24	8.24	0.4	15.6	1.8
Potomac Three Sisters Island	06-B-020915-R Potomac Three Sisters Island	06	2/9/2015	2		<1		3	<2	9	1.5	8.28	0.361	14.89	2.2
Potomac Upstream of Rock Creek	07-B-020915-R Potomac Upstream of Rock Creek	07	2/9/2015	5		2		2	<2	10	1.33	8.28	0.364	15.26	2.4
Potomac 14th St. Bridge	08-B-020915-R Potomac 14th St. Bridge	08	2/9/2015	2		1		2	<2	10	1.29	8.32	0.37	15.67	2.4
Potomac 14th St. Bridge	08-B-020915-R Potomac 14th St. Bridge-D	08-D	2/9/2015	2											
Potomac Wilson Bridge	09-B-020915-R Potomac Wilson Bridge	09	2/9/2015	49		24		4	<2	<6	2.38	7.98	0.431	15.03	1.4
Potomac Wilson Bridge	09-B-020915-R Potomac Wilson Bridge-D	09-D	2/9/2015			31									
Rock Creek Boundary Bridge	10-L-020915-R Rock Creek Boundary Bridge	10	2/9/2015	130		48					3.84	7.01	0.767	12.48	
Rock Creek Tilden St	11-L-020915-R Rock Creek Tilden St	11	2/9/2015	33		101					3.43	7.36	0.79	13.16	
Rock Creek Porter St	12-L-020915-R Rock Creek Porter St	12	2/9/2015	33		62					3.44	7.5	8.05	13.45	
Rock Creek PA Ave	13-L-020915-R Rock Creek PA Ave	13	2/9/2015	79		105		2	<2		3.4	7.52	0.817	12.99	
	BE-020915-R Boat Equipment Blank		2/9/2015	<2		<1		<1	<2	<6					
	LE-020915-R Land Equipment Blank		2/9/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-031215-R Anacostia Bladensburg	01	3/12/2015	430	230	579	230	16	<4	<6	6.41	7.46	0.839	12.38	0.2
Anacostia Bladensburg	01-L-031215-R Anacostia Bladensburg-D	01-D	3/12/2015							14					
Anacostia Benning Road	02-L-031215-R Anacostia Benning Road	02	3/12/2015	>=1600	920	1553	920	35	<4	8	6.49	7.45	0.916	11.65	
Anacostia PA Ave Seafarers	03-B-031215-R Anacostia PA Ave Seafarers	03	3/12/2015	1600	540	1986	540	54	<4	11	5.59	7.25	0.922	12.13	0.2
Anacostia Capitol St. Bridge	04-B-031215-R Anacostia Capitol St. Bridge	04	3/12/2015	1700	2400	980	790	22	<4	6	5.17	7.31	1.092	12.65	0.3
Anacostia Capitol St. Bridge	04-B-031215-R Anacostia Capitol St. Bridge-D	04-D	3/12/2015								5.17	7.29	1.082	12.7	
Anacostia Haines Point	05-B-031215-R Anacostia Haines Point	05	3/12/2015	540	540	435	220	55	<4	21	3.92	7.43	0.268	14.27	0.3
Anacostia Haines Point	05-B-031215-R Anacostia Haines Point-D	05-D	3/12/2015								3.92	7.42	0.267	14.47	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Three Sisters Island	06-B-031215-R Potomac Three Sisters Island	06	3/12/2015	540	170	649	170		<4	24	4.17	7.65	0.248	14.52	0.15
Potomac Upstream of Rock Creek	07-B-031215-R Potomac Upstream of Rock Creek	07	3/12/2015	540	540	488	540	80	<4	16	4.06	7.65	0.249	14.38	0.15
Potomac 14th St. Bridge	08-B-031215-R Potomac 14th St. Bridge	08	3/12/2015	350	540	548	220	55	<4	21	4	7.6	0.255	14.52	0.3
Potomac Wilson Bridge	09-B-031215-R Potomac Wilson Bridge	09	3/12/2015	350	170	365	170	38	<4	15	3.94	7.51	0.281	14.32	0.3
Potomac Wilson Bridge	09-B-031215-R Potomac Wilson Bridge-D	09-D	3/12/2015	220	220			44							
Rock Creek Boundary Bridge	10-L-031215-R Rock Creek Boundary Bridge	10	3/12/2015	130	33	173	33				3.82	6.68	0.852	12.67	
Rock Creek Boundary Bridge	10-L-031215-R Rock Creek Boundary Bridge-D	10-D	3/12/2015			219	33								
Rock Creek Tilden St	11-L-031215-R Rock Creek Tilden St	11	3/12/2015	350	79	210	79				4.57	7.12	0.893	13.14	
Rock Creek Porter St	12-L-031215-R Rock Creek Porter St	12	3/12/2015	240	170	186	170				4.75	7.35	0.901	13.64	
Rock Creek PA Ave	13-L-031215-R Rock Creek PA Ave	13	3/12/2015	130	230	248	230	33	<4		5.07	7.46	0.93	13	
Rock Creek PA Ave	13-L-031215-R Rock Creek PA Ave-D	13-D	3/12/2015						<4						
	BE-031215-R Boat Equipment Blank		3/12/2015	<2		<1		<1	<4	<6					
	LE-031215-R Land Equipment Blank		3/12/2015	<2		<1		<1	<4	6					
Anacostia Bladensburg	01-L-031615-R Anacostia Bladensburg	01	3/16/2015	330	700	1203	700	7	<2	<6	7.27	7.62	0.782	11.84	0.7
Anacostia Benning Road	02-L-031615-R Anacostia Benning Road	02	3/16/2015	790	330	727	330	22	<2	<6	8.06	7.62	0.774	11.69	
Anacostia PA Ave Seafarers	03-B-031615-R Anacostia PA Ave Seafarers	03	3/16/2015	540	540	816	540	36	<2	<6	7.65	7.4	0.747	10.8	0.3
Anacostia Capitol St. Bridge	04-B-031615-R Anacostia Capitol St. Bridge	04	3/16/2015	1300	490	921	490	21	<2	<6	7.82	7.47	0.861	11.05	0.3
Anacostia Haines Point	05-B-031615-R Anacostia Haines Point	05	3/16/2015	79	70	126	49	17	<2	<6	6.52	7.48	0.424	12.76	0.4
Potomac Three Sisters Island	06-B-031615-R Potomac Three Sisters Island	06	3/16/2015	130	49	53	33	47	<2	16	6.58	7.62	0.231	13.58	0.3
Potomac Three Sisters Island	06-B-031615-R Potomac Three Sisters Island-D	06-D	3/16/2015								6.58	7.61	0.231	13.62	
Potomac Upstream of Rock Creek	07-B-031615-R Potomac Upstream of Rock Creek	07	3/16/2015	70	33	57	23	40	<2	11	6.49	7.63	0.231	13.61	0.3
Potomac 14th St. Bridge	08-B-031615-R Potomac 14th St. Bridge	08	3/16/2015	130	46	63	46	35	<2	16	6.34	7.58	0.231	13.6	0.3
Potomac Wilson Bridge	09-B-031615-R Potomac Wilson Bridge	09	3/16/2015	240	240	122	130	38	<2	11	6.38	7.55	0.255	13.35	0.3
Rock Creek Boundary Bridge	10-L-031615-R Rock Creek Boundary Bridge	10	3/16/2015	79	350	124	350					7.28	0.621	12.49	
Rock Creek Tilden St	11-L-031615-R Rock Creek Tilden St	11	3/16/2015	130	350	172	350					7.35	0.705	12.38	
Rock Creek Porter St	12-L-031615-R Rock Creek Porter St	12	3/16/2015	240	130	308	130					7.52	0.712	12.64	
Rock Creek PA Ave	13-L-031615-R Rock Creek PA Ave	13	3/16/2015	170	230	185	230	12	<2		6.29	7.72	0.727	12.5	
	BE-031615-R Boat Equipment Blank		3/16/2015	<2		<1		<1	<2	<6					
	BF-031615-R Boat Field Blank		3/16/2015	<2		<1		<1	<2	<6					
	LE-031615-R Land Equipment Blank		3/16/2015	<2		<1		<1	<2	<6					
	LF-031615-R Land Field Blank		3/16/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-031915-R Anacostia Bladensburg	01	3/19/2015	940	490	921	330	3	<2	<6	6.69	7.66	0.768	11.7	0.5

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-031915-R Anacostia Bladensburg-D	01-D	3/19/2015					2							
Anacostia Benning Road	02-L-031915-R Anacostia Benning Road	02	3/19/2015	490	170	228	110	20	<2	<6	8.63	7.61	0.824	10.91	
Anacostia Benning Road	02-L-031915-R Anacostia Benning Road-D	02-D	3/19/2015							<6					
Anacostia PA Ave Seafarers	03-B-031915-R Anacostia PA Ave Seafarers	03	3/19/2015	49	70	116	49	26	<2	<6	8.35	7.77	0.773	10.37	0.375
Anacostia Capitol St. Bridge	04-B-031915-R Anacostia Capitol St. Bridge	04	3/19/2015	79	49	52	49	12	<2	<6	8	7.61	0.552	11.52	0.55
Anacostia Haines Point	05-B-031915-R Anacostia Haines Point	05	3/19/2015	17	350	26	33	8	<2	<6	7.87	7.59	0.286	12.6	1.12
Potomac Three Sisters Island	06-B-031915-R Potomac Three Sisters Island	06	3/19/2015	13	130	9	13	19	<2	<6	7.38	7.74	0.241	13.28	0.68
Potomac Upstream of Rock Creek	07-B-031915-R Potomac Upstream of Rock Creek	07	3/19/2015	49	33	22	11	16	<2	<6	7.36	7.7	0.241	13.24	0.79
Potomac Upstream of Rock Creek	07-B-031915-R Potomac Upstream of Rock Creek-D	07-D	3/19/2015								7.36	7.67	0.241	13.3	
Potomac 14th St. Bridge	08-B-031915-R Potomac 14th St. Bridge	08	3/19/2015	8	350	12	26	27	<2	<6	7.53	7.66	0.242	13.11	0.7
Potomac Wilson Bridge	09-B-031915-R Potomac Wilson Bridge	09	3/19/2015	33	240	47	130	13	<2	<6	7.93	7.65	0.256	12.73	0.95
Rock Creek Boundary Bridge	10-L-031915-R Rock Creek Boundary Bridge	10	3/19/2015	49	79	130	79				5.41	7.44	0.66	12.43	
Rock Creek Boundary Bridge	10-L-031915-R Rock Creek Boundary Bridge-D	10-D	3/19/2015	79	33										
Rock Creek Tilden St	11-L-031915-R Rock Creek Tilden St	11	3/19/2015	49	23	51	23				5.48	7.72	0.667	13.44	
Rock Creek Tilden St	11-L-031915-R Rock Creek Tilden St-D	11-D	3/19/2015			39	23								
Rock Creek Porter St	12-L-031915-R Rock Creek Porter St	12	3/19/2015	46	23	68	23				5.55	7.93	0.673	14.02	
Rock Creek PA Ave	13-L-031915-R Rock Creek PA Ave	13	3/19/2015	49	33	135	33	4	<2		5.75	7.88	0.671	13.51	
Rock Creek PA Ave	13-L-031915-R Rock Creek PA Ave-D	13-D	3/19/2015						<2						
	BE-031915-R Boat Equipment Blank		3/19/2015	<2		<1		<1	<2	<6					
	LE-031915-R Land Equipment Blank		3/19/2015	<2		1		<1	<2	<6					
Anacostia Bladensburg	01-L-032315-R Anacostia Bladensburg	01	3/23/2015	1300	490	1203	490	4	<2	18	7.94	7.64	0.784	11.15	1.15
Anacostia Benning Road	02-L-032315-R Anacostia Benning Road	02	3/23/2015	330	230	461	230	77	<2	50	7.92	7.66	0.829	11.81	
Anacostia PA Ave Seafarers	03-B-032315-R Anacostia PA Ave Seafarers	03	3/23/2015	540	130	231	79	17	<2	10	8.07	7.27		10.24	0.4
Anacostia Capitol St. Bridge	04-B-032315-R Anacostia Capitol St. Bridge	04	3/23/2015	94	33	56	33	8	<2	<6	8.11	7.33	0.544	11	1
Anacostia Haines Point	05-B-032315-R Anacostia Haines Point	05	3/23/2015	13	23	17	13	5	<2	12	8.08	7.51	0.311	12.38	1.4
Potomac Three Sisters Island	06-B-032315-R Potomac Three Sisters Island	06	3/23/2015	8	8	4	8	13	<2	<6	8	7.66	0.28	12.83	0.9
Potomac Upstream of Rock Creek	07-B-032315-R Potomac Upstream of Rock Creek	07	3/23/2015	13	13	5	13	8	<2	<6	8.26	7.6	0.279	12.65	1.1
Potomac 14th St. Bridge	08-B-032315-R Potomac 14th St. Bridge	08	3/23/2015	5	8	7	8	6	<2	26	8.74	7.66	0.28	12.4	1.3
Potomac 14th St. Bridge	08-B-032315-R Potomac 14th St. Bridge-D	08-D	3/23/2015								8.74	7.68	0.28	12.45	
Potomac Wilson Bridge	09-B-032315-R Potomac Wilson Bridge	09	3/23/2015	49	49	60	49	8	<2	7	8.05	7.49	0.3	12.27	0.9
Potomac Wilson Bridge	09-B-032315-R Potomac Wilson Bridge-D	09-D	3/23/2015								8.05	7.54	0.3	12.37	
Rock Creek Boundary Bridge	10-L-032315-R Rock Creek Boundary Bridge	10	3/23/2015	49	240	82	240				6.64	6.99	0.694	12.15	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Tilden St	11-L-032315-R Rock Creek Tilden St	11	3/23/2015	94	49	65	33				6.5	7.65	0.734	13.67	
Rock Creek Tilden St	11-L-032315-R Rock Creek Tilden St-D	11-D	3/23/2015	49	23										
Rock Creek Porter St	12-L-032315-R Rock Creek Porter St	12	3/23/2015	79	130	57	79				6.74	8.06	0.747	13.98	
Rock Creek Porter St	12-L-032315-R Rock Creek Porter St-D	12-D	3/23/2015			58	49								
Rock Creek PA Ave	13-L-032315-R Rock Creek PA Ave	13	3/23/2015	330	130	238	130	3	<2		6.7	7.91	0.783	12.85	
	BE-032315-R Boat Equipment Blank		3/23/2015	<2		<1		<1	<2	<6					
	LE-032315-R Land Equipment Blank		3/23/2015	<2		<1		<1	<2	8					
Anacostia Bladensburg	01-L-032615-R Anacostia Bladensburg	01	3/26/2015	330	330	687	170	2	<2	9	7.95	7.81	0.697	11.71	1.65
Anacostia Bladensburg	01-L-032615-R Anacostia Bladensburg-D	01-D	3/26/2015						<2						
Anacostia Benning Road	02-L-032615-R Anacostia Benning Road	02	3/26/2015	33	33	78	33	17	<2	10	8.83	7.56	0.827	10.39	
Anacostia Benning Road	02-L-032615-R Anacostia Benning Road-D	02-D	3/26/2015					18							
Anacostia PA Ave Seafarers	03-B-032615-R Anacostia PA Ave Seafarers	03	3/26/2015	49	33	59	33	19	<2	11	8.57	7.38	0.847	10.49	0.51
Anacostia PA Ave Seafarers	03-B-032615-R Anacostia PA Ave Seafarers-D	03-D	3/26/2015							11					
Anacostia Capitol St. Bridge	04-B-032615-R Anacostia Capitol St. Bridge	04	3/26/2015	79	46	66	23	7	<2	7	8.49	7.45	0.591	10.75	0.89
Anacostia Haines Point	05-B-032615-R Anacostia Haines Point	05	3/26/2015	14	<2	4	<2	5	<2	<6	7.9	7.67	0.269	12.71	1.55
Potomac Three Sisters Island	06-B-032615-R Potomac Three Sisters Island	06	3/26/2015	7	8	5	2	9	<2	8	8	7.78	0.269	12.74	1.25
Potomac Upstream of Rock Creek	07-B-032615-R Potomac Upstream of Rock Creek	07	3/26/2015	<2	2	6	2	7	<2	<6	8.07	7.77	0.268	12.63	1.2
Potomac 14th St. Bridge	08-B-032615-R Potomac 14th St. Bridge	08	3/26/2015	7	<2	3	<2	5	<2	<6	8.17	7.78	0.269	12.59	1.25
Potomac Wilson Bridge	09-B-032615-R Potomac Wilson Bridge	09	3/26/2015	70	130	47	22	6	<2	9	7.89	7.72	0.283	12.58	1.3
Rock Creek Boundary Bridge	10-L-032615-R Rock Creek Boundary Bridge	10	3/26/2015	240	79	199	79				7.61	7.7	0.673	12.16	
Rock Creek Boundary Bridge	10-L-032615-R Rock Creek Boundary Bridge-D	10-D	3/26/2015								7.61	7.79	0.673	12.2	
Rock Creek Tilden St	11-L-032615-R Rock Creek Tilden St	11	3/26/2015	240	350	194	350				7.41	7.95	0.691	13.27	
Rock Creek Porter St	12-L-032615-R Rock Creek Porter St	12	3/26/2015	350	130	260	79				7.45	8.04	0.702	13.17	
Rock Creek PA Ave	13-L-032615-R Rock Creek PA Ave	13	3/26/2015	230	700	649	700	2	<2		7.61	7.94	0.709	12.57	
	BE-032615-R Boat Equipment Blank		3/26/2015	<2		<1		<1	<2	<6					
	BF-032615-R Boat Field Blank		3/26/2015	<2		<1		<1	<2	<6					
	LE-032615-R Land Equipment Blank		3/26/2015	<2		<1		<1	<2	<6					
	LF-032615-R Land Field Blank		3/26/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-033015-R Anacostia Bladensburg	01	3/30/2015	790	490	866	490	3	<2	<6	6.84	7.86	0.632	12.23	0.9
Anacostia Benning Road	02-L-033015-R Anacostia Benning Road	02	3/30/2015	490	230	613	230	25	<2	9	7.34	7.73	0.618	11	
Anacostia PA Ave Seafarers	03-B-033015-R Anacostia PA Ave Seafarers	03	3/30/2015	130	140	411	140	27	<2	12	7.69	7.32	0.603	9.86	0.25
Anacostia Capitol St. Bridge	04-B-033015-R Anacostia Capitol St. Bridge	04	3/30/2015	330	310	272	310	12	<2	18	8.4	7.48	0.563	10.6	0.65

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-033015-R Anacostia Haines Point	05	3/30/2015	350	350	135	350	4	<2	18	6.75	7.72	0.291	12.77	1.1
Potomac Three Sisters Island	06-B-033015-R Potomac Three Sisters Island	06	3/30/2015	8	5	3	5	8	<2	<6	7.75	7.84	0.285	12.57	1.1
Potomac Upstream of Rock Creek	07-B-033015-R Potomac Upstream of Rock Creek	07	3/30/2015	2	5	2	5	8	<2	<6	7.93	7.86	0.284	12.55	1.1
Potomac 14th St. Bridge	08-B-033015-R Potomac 14th St. Bridge	08	3/30/2015	2	5	5	2	6	<2	6	7.59	7.85	0.288	12.71	1
Potomac Wilson Bridge	09-B-033015-R Potomac Wilson Bridge	09	3/30/2015	130	70	61	70	6	<2	8	7.09	7.68	0.305	12.45	1.1
Rock Creek Boundary Bridge	10-L-033015-R Rock Creek Boundary Bridge	10	3/30/2015	170	170	74	110				6.93	7.41	0.634	12.05	
Rock Creek Tilden St	11-L-033015-R Rock Creek Tilden St	11	3/30/2015	350	240	345	240				6.66	7.8	0.629	13.44	
Rock Creek Tilden St	11-L-033015-R Rock Creek Tilden St-D	11-D	3/30/2015								6.66	7.85	0.629	13.21	
Rock Creek Porter St	12-L-033015-R Rock Creek Porter St	12	3/30/2015	540	79	248	79				6.65	8.06	0.638	13.38	
Rock Creek Porter St	12-L-033015-R Rock Creek Porter St-D	12-D	3/30/2015	79	350										
Rock Creek PA Ave	13-L-033015-R Rock Creek PA Ave	13	3/30/2015	490	220	291	130	4	<2		6.66	8.08	0.622	13.15	
Rock Creek PA Ave	13-L-033015-R Rock Creek PA Ave-D	13-D	3/30/2015			190	230								
	BE-033015-R Boat Equipment Blank		3/30/2015	<2		<1		<1	<2	<6					
	LE-033015-R Land Equipment Blank		3/30/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-040615-R Anacostia Bladensburg	01	4/6/2015	1300	230	411	230	5	<2	<6	12.12	7.95	0.627	11.34	1.1
Anacostia Bladensburg	01-L-040615-R Anacostia Bladensburg-D	01-D	4/6/2015			548	280								
Anacostia Benning Road	02-L-040615-R Anacostia Benning Road	02	4/6/2015	33	79	73	79	25	<2	7	13.65	7.79	0.684	8.48	
Anacostia PA Ave Seafarers	03-B-040615-R Anacostia PA Ave Seafarers	03	4/6/2015	170	110	76	79	16	<2	7	12.26	7.63	0.629	9.24	0.7
Anacostia PA Ave Seafarers	03-B-040615-R Anacostia PA Ave Seafarers-D	03-D	4/6/2015					15							
Anacostia Capitol St. Bridge	04-B-040615-R Anacostia Capitol St. Bridge	04	4/6/2015	22	130	26	27	7	<2	8	12.01	7.66	0.425	10.34	1
Anacostia Capitol St. Bridge	04-B-040615-R Anacostia Capitol St. Bridge-D	04-D	4/6/2015							7					
Anacostia Haines Point	05-B-040615-R Anacostia Haines Point	05	4/6/2015	22	23	23	23	8	<2	7	12.62	7.79	0.333	10.7	1.3
Potomac Three Sisters Island	06-B-040615-R Potomac Three Sisters Island	06	4/6/2015	<2	<2	3	<2	5	<2	7	13.02	8.06	0.305	10.9	1.7
Potomac Upstream of Rock Creek	07-B-040615-R Potomac Upstream of Rock Creek	07	4/6/2015	2	<2	1	<2	4	<2	7	12.91	8.07	0.305	11.07	2.1
Potomac 14th St. Bridge	08-B-040615-R Potomac 14th St. Bridge	08	4/6/2015	2	2	1	2	6	<2	8	12.74	8.15	0.305	11.73	1.8
Potomac Wilson Bridge	09-B-040615-R Potomac Wilson Bridge	09	4/6/2015	79	33	40	33	11	<2	8	12.53	7.72	0.338	10.58	1.1
Rock Creek Boundary Bridge	10-L-040615-R Rock Creek Boundary Bridge	10	4/6/2015	49	79	88	79				10.78	7.58	0.637	11.41	
Rock Creek Tilden St	11-L-040615-R Rock Creek Tilden St	11	4/6/2015	49	49	77	33				10.46	7.87	0.665	12.45	
Rock Creek Porter St	12-L-040615-R Rock Creek Porter St	12	4/6/2015	79	79	50	33				10.81	8.2	0.678	12.98	
Rock Creek Porter St	12-L-040615-R Rock Creek Porter St-D	12-D	4/6/2015								10.81	8.23	0.68	13.29	
Rock Creek PA Ave	13-L-040615-R Rock Creek PA Ave	13	4/6/2015	33	49	52	49	2	<2		10.99	8	0.677	11.44	
Rock Creek PA Ave	13-L-040615-R Rock Creek PA Ave-D	13-D	4/6/2015	49	79						10.99	8	0.677	11.45	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
	BE-040615-R Boat Equipment Blank		4/6/2015	<2		<1		<1	<2	<6					
	LE-040615-R Land Equipment Blank		4/6/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-040915-R Anacostia Bladensburg	01	4/9/2015	790	2200	3100	2200	32	2	10	9.82	7.85	0.436	10.75	0.25
Anacostia Bladensburg	01-L-040915-R Anacostia Bladensburg-D	01-D	4/9/2015								9.82	7.67	0.436	10.62	
Anacostia Benning Road	02-L-040915-R Anacostia Benning Road	02	4/9/2015	700	3500	2420	3500	50	5	14	11.07	7.7	0.398	9.5	
Anacostia PA Ave Seafarers	03-B-040915-R Anacostia PA Ave Seafarers	03	4/9/2015	1600	>=1600	1414	>=1600	57	3	11	11.9	7.64	0.472	8.79	0.2
Anacostia Capitol St. Bridge	04-B-040915-R Anacostia Capitol St. Bridge	04	4/9/2015	79	230	308	230	12	4	<6	13.48	7.61	0.571	8.29	0.75
Anacostia Haines Point	05-B-040915-R Anacostia Haines Point	05	4/9/2015	33	170	50	130	9	<2	10	13.68	7.93	0.349	9.78	1.1
Potomac Three Sisters Island	06-B-040915-R Potomac Three Sisters Island	06	4/9/2015	33	79	29	27	8	<2	10	13.33	7.88	0.314	10.76	1.15
Potomac Upstream of Rock Creek	07-B-040915-R Potomac Upstream of Rock Creek	07	4/9/2015	49	13	39	13	7	10	12	13.42	7.91	0.311	10.65	1.2
Potomac 14th St. Bridge	08-B-040915-R Potomac 14th St. Bridge	08	4/9/2015	31	79	68	79	9	7	11	13.86	8.06	0.308	10.55	1.05
Potomac Wilson Bridge	09-B-040915-R Potomac Wilson Bridge	09	4/9/2015	46	49	51	49	13	4	11	13.35	7.79	0.347	10	0.95
Rock Creek Boundary Bridge	10-L-040915-R Rock Creek Boundary Bridge	10	4/9/2015	920	920	1120	540				10.53	7.46	0.29	10.35	
Rock Creek Tilden St	11-L-040915-R Rock Creek Tilden St	11	4/9/2015	1600	1600	1986	1600				10.4	7.93	0.24	11.2	
Rock Creek Porter St	12-L-040915-R Rock Creek Porter St	12	4/9/2015	1600	1600	5200	1600				10.37	8	0.24	11.43	
Rock Creek PA Ave	13-L-040915-R Rock Creek PA Ave	13	4/9/2015	1300	5400	1986	3500	20	4		10.43	7.87	0.422	10.97	
	BE-040915-R Boat Equipment Blank		4/9/2015	<2		<1		<1	<2	<6					
	BF-040915-R Boat Field Blank		4/9/2015	<2		<1		<1	<2	<6					
	LE-040915-R Land Equipment Blank		4/9/2015	<2		<1		<1	<2	<6					
	LF-040915-R Land Field Blank		4/9/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-041315-R Anacostia Bladensburg	01	4/13/2015	460	130	517	130	4	<2	16	14.03	7.99	0.548	10.59	1.75
Anacostia Bladensburg	01-L-041315-R Anacostia Bladensburg-D	01-D	4/13/2015	490	130										
Anacostia Benning Road	02-L-041315-R Anacostia Benning Road	02	4/13/2015	310	330	579	330	29	<2	18	14.62	7.9	0.569	9.15	
Anacostia Benning Road	02-L-041315-R Anacostia Benning Road-D	02-D	4/13/2015			461	230				14.62	7.7	0.568	9.03	
Anacostia PA Ave Seafarers	03-B-041315-R Anacostia PA Ave Seafarers	03	4/13/2015	70	130	140	79	30	<2	7	13.31	7.38	0.513	7.64	0.35
Anacostia PA Ave Seafarers	03-B-041315-R Anacostia PA Ave Seafarers-D	03-D	4/13/2015						<2						
Anacostia Capitol St. Bridge	04-B-041315-R Anacostia Capitol St. Bridge	04	4/13/2015	220	230	192	130	11	<2	9	13.85	7.42	0.474	7.67	0.55
Anacostia Capitol St. Bridge	04-B-041315-R Anacostia Capitol St. Bridge-D	04-D	4/13/2015					11							
Anacostia Haines Point	05-B-041315-R Anacostia Haines Point	05	4/13/2015	79	49	105	49	5	<2	12	13.35	7.73	0.352	10.19	1.2
Potomac Three Sisters Island	06-B-041315-R Potomac Three Sisters Island	06	4/13/2015	13	4	10	4	25	<2	13	14.14	7.91	0.308	11	1
Potomac Upstream of Rock Creek	07-B-041315-R Potomac Upstream of Rock Creek	07	4/13/2015	8	9	9	9	8	<2	15	14.44	7.93	0.31	10.83	1
Potomac 14th St. Bridge	08-B-041315-R Potomac 14th St. Bridge	08	4/13/2015	13	11	11	11	7	<2	9	15.16	8.1	0.315	10.53	1.15

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Wilson Bridge	09-B-041315-R Potomac Wilson Bridge	09	4/13/2015	49	11	14	8	10	<2	10	13.68	7.92	0.321	10.89	1.1
Rock Creek Boundary Bridge	10-L-041315-R Rock Creek Boundary Bridge	10	4/13/2015	49	240	91	130				12.9	7.88	0.571	10.61	
Rock Creek Tilden St	11-L-041315-R Rock Creek Tilden St	11	4/13/2015	240	130	129	130				12.8	8.08	0.58	11.77	
Rock Creek Porter St	12-L-041315-R Rock Creek Porter St	12	4/13/2015	220	350	102	130				13.05	8.28	0.591	12.68	
Rock Creek PA Ave	13-L-041315-R Rock Creek PA Ave	13	4/13/2015	130	79	49	79	3	<2		13.02	8.08	0.589	11.37	
	BE-041315-R Boat Equipment Blank		4/13/2015	<2		<1		<1	<2	<6					
	LE-041315-R Land Equipment Blank		4/13/2015	2		3		<1	<2	<6					
Anacostia Bladensburg	01-L-042315-R Anacostia Bladensburg	01	4/23/2015	490	330	1120	330	6	19	<6	13.05	7.53	0.488	9.73	1
Anacostia Benning Road	02-L-042315-R Anacostia Benning Road	02	4/23/2015	230	210	238	110	24	20	9	15.47	7.1	0.393	7.63	
Anacostia PA Ave Seafarers	03-B-042315-R Anacostia PA Ave Seafarers	03	4/23/2015	330	170	488	130	37	15	7	16.19	6.87	0.386	4.76	0.3
Anacostia PA Ave Seafarers	03-B-042315-R Anacostia PA Ave Seafarers-D	03-D	4/23/2015								16.19	6.82	0.386	4.73	0.3
Anacostia Capitol St. Bridge	04-B-042315-R Anacostia Capitol St. Bridge	04	4/23/2015	1300	330	727	170	15	12	<6	16.95	6.93	0.348	5.69	0.4
Anacostia Haines Point	05-B-042315-R Anacostia Haines Point	05	4/23/2015	350	170	345	110	52	16	8	14.22	7.35	0.205	10.41	0.5
Anacostia Haines Point	05-B-042315-R Anacostia Haines Point-D	05-D	4/23/2015							13					
Potomac Three Sisters Island	06-B-042315-R Potomac Three Sisters Island	06	4/23/2015	240	1600	548	1600	90	11	16	14.03	7.4	0.194	10.8	0.2
Potomac Upstream of Rock Creek	07-B-042315-R Potomac Upstream of Rock Creek	07	4/23/2015	240	350	276	350	52	12	11	13.98	7.38	0.195	10.7	0.2
Potomac 14th St. Bridge	08-B-042315-R Potomac 14th St. Bridge	08	4/23/2015	240	350	308	170	39	13	8	14.04	7.42	0.197	10.71	0.3
Potomac Wilson Bridge	09-B-042315-R Potomac Wilson Bridge	09	4/23/2015	130	350	158	170	28	16	<6	14.38	7.34	0.208	10.14	0.5
Rock Creek Boundary Bridge	10-L-042315-R Rock Creek Boundary Bridge	10	4/23/2015	110	79	210	79				13.8	8.9	0.475	9.96	
Rock Creek Tilden St	11-L-042315-R Rock Creek Tilden St	11	4/23/2015	330	230	276	230				13.51	7.84	0.485	10.49	
Rock Creek Porter St	12-L-042315-R Rock Creek Porter St	12	4/23/2015	230	230	291	49				13.08	7.24	0.499	10.7	
Rock Creek PA Ave	13-L-042315-R Rock Creek PA Ave	13	4/23/2015	490	230	326	230	4	12		12.73	7.43	0.503	10.24	
	BE-042315-R Boat Equipment Blank		4/23/2015	<2		<1		<1	14	<6					
	LE-042315-R Land Equipment Blank		4/23/2015	2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-042715-R Anacostia Bladensburg	01	4/27/2015	220	460	461	460	11	12	9	12.91	7.63	0.497	9.21	0.85
Anacostia Benning Road	02-L-042715-R Anacostia Benning Road	02	4/27/2015	130	490	291	330	22	10	<6	14.17	7.69	0.546	9.37	
Anacostia Benning Road	02-L-042715-R Anacostia Benning Road-D	02-D	4/27/2015	230	170										
Anacostia PA Ave Seafarers	03-B-042715-R Anacostia PA Ave Seafarers	03	4/27/2015	79	230	115	130	17	11	<6	13.82	7.14	0.521	6.05	0.5
Anacostia PA Ave Seafarers	03-B-042715-R Anacostia PA Ave Seafarers-D	03-D	4/27/2015			166	170								
Anacostia Capitol St. Bridge	04-B-042715-R Anacostia Capitol St. Bridge	04	4/27/2015	110	490	206	170	11	10	<6	14.44	7.15	0.339	6.12	0.65
Anacostia Capitol St. Bridge	04-B-042715-R Anacostia Capitol St. Bridge-D	04-D	4/27/2015						12		14.44	7.11	0.343	5.95	
Anacostia Haines Point	05-B-042715-R Anacostia Haines Point	05	4/27/2015	130	130	105	130	6	11	9	13.81	7.26	0.251	9.1	1.25

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-042715-R Anacostia Haines Point-D	05-D	4/27/2015					6			13.81	7.28	0.252	9.12	
Potomac Three Sisters Island	06-B-042715-R Potomac Three Sisters Island	06	4/27/2015	23	33	25	33	15	12	<6	12.23	7.61	0.221	11.17	0.7
Potomac Upstream of Rock Creek	07-B-042715-R Potomac Upstream of Rock Creek	07	4/27/2015	49	23	23	23	14	12	6	12.36	7.62	0.22	11.07	0.85
Potomac 14th St. Bridge	08-B-042715-R Potomac 14th St. Bridge	08	4/27/2015	33	79	18	79	13	11	<6	12.81	7.63	0.22	10.88	0.9
Potomac Wilson Bridge	09-B-042715-R Potomac Wilson Bridge	09	4/27/2015	79	33	58	33	9	4	18	12.51	7.47	0.223	10.61	0.85
Rock Creek Boundary Bridge	10-L-042715-R Rock Creek Boundary Bridge	10	4/27/2015	130	130	128	130				12.94	7.38	0.486	10.22	
Rock Creek Tilden St	11-L-042715-R Rock Creek Tilden St	11	4/27/2015	350	130	201	130				12.37	7.79	0.484	11.03	
Rock Creek Porter St	12-L-042715-R Rock Creek Porter St	12	4/27/2015	110	170	140	170				12.68	7.79	0.495	11.12	
Rock Creek PA Ave	13-L-042715-R Rock Creek PA Ave	13	4/27/2015	170	33	104	33	2	12		13.26	7.85	0.513	10.57	
	BE-042715-R Boat Equipment Blank		4/27/2015	<2		<1		<1	10	<6					
	BF-042715-R Boat Field Blank		4/27/2015	<2		<1		<1	6	<6					
	LE-042715-R Land Equipment Blank		4/27/2015	<2		<1		<1	14	<6					
	LF-042715-R Land Field Blank		4/27/2015	<2		<1		<1	22	<6					
Anacostia Bladensburg	01-L-050415-R Anacostia Bladensburg	01	5/4/2015	130	230	167	230	10	<2	13	20.04	7.48	0.546	7.62	0.95
Anacostia Benning Road	02-L-050415-R Anacostia Benning Road	02	5/4/2015	49	130	81	49	18	<2	<6	19.05	7.27	0.561	3.4	
Anacostia PA Ave Seafarers	03-B-050415-R Anacostia PA Ave Seafarers	03	5/4/2015	2200	700	980	330	10	<2	<6	17.73	6.14	0.518	5.06	0.8
Anacostia PA Ave Seafarers	03-B-050415-R Anacostia PA Ave Seafarers-D	03-D	5/4/2015	2200	9200										
Anacostia Capitol St. Bridge	04-B-050415-R Anacostia Capitol St. Bridge	04	5/4/2015	310	230	155	33	5	<2	6	17.43	6.88	0.417	7.86	1.5
Anacostia Capitol St. Bridge	04-B-050415-R Anacostia Capitol St. Bridge-D	04-D	5/4/2015			77	49								
Anacostia Haines Point	05-B-050415-R Anacostia Haines Point	05	5/4/2015	13	8	12	8	4	<2	<6	17.65	7.23	0.378	9.17	1.6
Potomac Three Sisters Island	06-B-050415-R Potomac Three Sisters Island	06	5/4/2015	17	11	8	11	11	<2	<6	18.71	7.43	0.383	9.23	1.1
Potomac Three Sisters Island	06-B-050415-R Potomac Three Sisters Island-D	06-D	5/4/2015							<6	18.71	7.48	0.383	9.3	1.2
Potomac Upstream of Rock Creek	07-B-050415-R Potomac Upstream of Rock Creek	07	5/4/2015	8	13	5	8	6	<2	<6	19.04	7.48	0.381	9.11	1.3
Potomac 14th St. Bridge	08-B-050415-R Potomac 14th St. Bridge	08	5/4/2015	13	23	13	23	5	<2	<6	18.88	7.51	0.378	9.24	1.2
Potomac Wilson Bridge	09-B-050415-R Potomac Wilson Bridge	09	5/4/2015	23	2	10	2	6	<2	7	17.72	7.36	0.374	9.34	1.7
Rock Creek Boundary Bridge	10-L-050415-R Rock Creek Boundary Bridge	10	5/4/2015	170	79	172	79				16.81	7.54	0.55	8.98	
Rock Creek Tilden St	11-L-050415-R Rock Creek Tilden St	11	5/4/2015	110	70	127	70				16.37	7.67	0.573	9.87	
Rock Creek Porter St	12-L-050415-R Rock Creek Porter St	12	5/4/2015	130	79	111	79				16.78	7.78	0.59	10.23	
Rock Creek PA Ave	13-L-050415-R Rock Creek PA Ave	13	5/4/2015	140	110	77	110	2	<2		16.64	7.71	0.598	9.04	
	BE-050415-R Boat Equipment Blank		5/4/2015	<2		<1		<1	<2	<6					
	LE-050415-R Land Equipment Blank		5/4/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-050715-R Anacostia Bladensburg	01	5/7/2015	490	1100	326	700	7	4	10	21.58	7.23	0.532		0.85

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Benning Road	02-L-050715-R Anacostia Benning Road	02	5/7/2015	460	790	517	490	10	3	8	22.86	6.92	0.55	3.03	
Anacostia PA Ave Seafarers	03-B-050715-R Anacostia PA Ave Seafarers	03	5/7/2015	110	230	613	230	16	<2	8	20.6	7.27	0.548	5.74	0.75
Anacostia Capitol St. Bridge	04-B-050715-R Anacostia Capitol St. Bridge	04	5/7/2015	14	23	39	23	4	<2	16	20.68	7.44	0.472	8.84	1.3
Anacostia Haines Point	05-B-050715-R Anacostia Haines Point	05	5/7/2015	31	8	17	5	5	<2	12	20.75	7.66	0.397	8.81	1.35
Anacostia Haines Point	05-B-050715-R Anacostia Haines Point-D	05-D	5/7/2015						<2						
Potomac Three Sisters Island	06-B-050715-R Potomac Three Sisters Island	06	5/7/2015	33	110	28	110	5	<2	<6	21.53	7.57	0.411	7.92	1.45
Potomac Three Sisters Island	06-B-050715-R Potomac Three Sisters Island-D	06-D	5/7/2015					5							
Potomac Upstream of Rock Creek	07-B-050715-R Potomac Upstream of Rock Creek	07	5/7/2015	23	49	27	22	4	<2	<6	21.81	7.56	0.4	8.01	1.45
Potomac Upstream of Rock Creek	07-B-050715-R Potomac Upstream of Rock Creek-D	07-D	5/7/2015								21.81	7.54	0.4	8.02	
Potomac 14th St. Bridge	08-B-050715-R Potomac 14th St. Bridge	08	5/7/2015	23	11	19	7	4	<2	27	21.34	7.68	0.399	8.81	1.85
Potomac Wilson Bridge	09-B-050715-R Potomac Wilson Bridge	09	5/7/2015	79	140	121	63	9	<2	16	20.88	7.7	0.41	9.59	1.1
Rock Creek Boundary Bridge	10-L-050715-R Rock Creek Boundary Bridge	10	5/7/2015	920	920	770	920				19.4	7.4	0.576	8.05	
Rock Creek Tilden St	11-L-050715-R Rock Creek Tilden St	11	5/7/2015	350	350	121	170				18.99	7.72	0.589	9.53	
Rock Creek Porter St	12-L-050715-R Rock Creek Porter St	12	5/7/2015	110	130	157	49				19.53	7.44	0.603	9.78	
Rock Creek PA Ave	13-L-050715-R Rock Creek PA Ave	13	5/7/2015	330	170	250	170	2	<2		19.36	7.22	0.606	8.51	
	BE-050715-R Boat Equipment Blank		5/7/2015	<2		<1		<1	<2	<6					
	LE-050715-R Land Equipment Blank		5/7/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-051115-R Anacostia Bladensburg	01	5/11/2015	490	460	157	210	12	<2	19	23.21	7.29	0.553	6.64	0.65
Anacostia Benning Road	02-L-051115-R Anacostia Benning Road	02	5/11/2015	70	130	79	49	11	<2	<6	24.26	7.07	0.58	2.23	
Anacostia PA Ave Seafarers	03-B-051115-R Anacostia PA Ave Seafarers	03	5/11/2015	79	79	40	79	15	<2	10	24.02	6.9	0.636	2.91	0.65
Anacostia Capitol St. Bridge	04-B-051115-R Anacostia Capitol St. Bridge	04	5/11/2015	170	490	76	490	10	<2	<6	23.37	7.09	0.544	5.17	0.8
Anacostia Capitol St. Bridge	04-B-051115-R Anacostia Capitol St. Bridge-D	04-D	5/11/2015	130	49										
Anacostia Haines Point	05-B-051115-R Anacostia Haines Point	05	5/11/2015	31	26	15	26	5	<2	15	23.07	7.85	0.404	9.01	1.35
Anacostia Haines Point	05-B-051115-R Anacostia Haines Point-D	05-D	5/11/2015			26	17								
Potomac Three Sisters Island	06-B-051115-R Potomac Three Sisters Island	06	5/11/2015	8	8	5	8	6	<2	<6	23.66	7.69	0.397	7.7	1.3
Potomac Upstream of Rock Creek	07-B-051115-R Potomac Upstream of Rock Creek	07	5/11/2015	17	7	5	7	6	<2	<6	23.61	7.66	0.399	8.14	1.45
Potomac Upstream of Rock Creek	07-B-051115-R Potomac Upstream of Rock Creek-D	07-D	5/11/2015							<6	23.61	7.67	0.399	8.15	
Potomac 14th St. Bridge	08-B-051115-R Potomac 14th St. Bridge	08	5/11/2015	33	22	8	14	6	<2	13	23.1	7.74	0.407	8.28	1.2
Potomac 14th St. Bridge	08-B-051115-R Potomac 14th St. Bridge-D	08-D	5/11/2015								23.1	7.74	0.407	8.29	
Potomac Wilson Bridge	09-B-051115-R Potomac Wilson Bridge	09	5/11/2015	23	22	12	17	6	<2	21	22.87	7.74	0.405	8.68	1.15
Rock Creek Boundary Bridge	10-L-051115-R Rock Creek Boundary Bridge	10	5/11/2015	1600	>=1600	2420	>=1600				20.62	7.46	0.584	7.38	
Rock Creek Tilden St	11-L-051115-R Rock Creek Tilden St	11	5/11/2015	350	240	228	240				20.85	7.79	0.568	8.59	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Porter St	12-L-051115-R Rock Creek Porter St	12	5/11/2015	110	79	166	49				28.7	7.87	0.631	8.78	
Rock Creek PA Ave	13-L-051115-R Rock Creek PA Ave	13	5/11/2015	490	490	248	220	5	<2		21.41	7.68	0.611	7.86	
	BE-051115-R Boat Equipment Blank		5/11/2015	<2		<1		<1	<2	<6					
	BF-051115-R Boat Field Blank		5/11/2015	<2		<1		<1	<2	<6					
	LE-051115-R Land Equipment Blank		5/11/2015	<2		<1		<1	<2	<6					
	LF-051115-R Land Field Blank		5/11/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-051815-R Anacostia Bladensburg	01	5/18/2015	35000	35000	13100	4000	8	2	14	24.31	6.73	0.525	1.81	0.7
Anacostia Benning Road	02-L-051815-R Anacostia Benning Road	02	5/18/2015	7900	3300	6300	1700	9	<2	26	24.4	6.83	0.572	1.79	
Anacostia PA Ave Seafarers	03-B-051815-R Anacostia PA Ave Seafarers	03	5/18/2015	1700	3300	3000	790	13	<2	42	23.9	7.13	0.542	3.19	0.65
Anacostia Capitol St. Bridge	04-B-051815-R Anacostia Capitol St. Bridge	04	5/18/2015	2300	2300	1300	1300	9	<2	30	23.7	7.35	0.473	5.73	0.95
Anacostia Haines Point	05-B-051815-R Anacostia Haines Point	05	5/18/2015	130	240	140	79	8	<2	41	23.15	7.76	0.419	7.55	1.15
Anacostia Haines Point	05-B-051815-R Anacostia Haines Point-D	05-D	5/18/2015	350	540										
Potomac Three Sisters Island	06-B-051815-R Potomac Three Sisters Island	06	5/18/2015	240	240	308	240	7	<2	25	24.12	7.99	0.415	7.69	1.15
Potomac Three Sisters Island	06-B-051815-R Potomac Three Sisters Island-D	06-D	5/18/2015			242	170		<2						
Potomac Upstream of Rock Creek	07-B-051815-R Potomac Upstream of Rock Creek	07	5/18/2015	540	540	345	540	7	<2	29	24.19	8.1	0.406	8.1	1.15
Potomac Upstream of Rock Creek	07-B-051815-R Potomac Upstream of Rock Creek-D	07-D	5/18/2015					7							
Potomac 14th St. Bridge	08-B-051815-R Potomac 14th St. Bridge	08	5/18/2015	130	350	435	350	6	<2	29	23.9	7.84	0.398	7.2	1.2
Potomac Wilson Bridge	09-B-051815-R Potomac Wilson Bridge	09	5/18/2015	350	350	272	350	9	<2	38	23.54	8.06	0.414	8.7	1
Rock Creek Boundary Bridge	10-L-051815-R Rock Creek Boundary Bridge	10	5/18/2015	9200	16000	6300	9200				21.48	7.32	0.495	6.96	
Rock Creek Boundary Bridge	10-L-051815-R Rock Creek Boundary Bridge-D	10-D	5/18/2015								21.48	7.31	0.495	6.97	
Rock Creek Tilden St	11-L-051815-R Rock Creek Tilden St	11	5/18/2015	1600	>=1600	1414	1600				21.38	7.5	0.485	8.1	
Rock Creek Porter St	12-L-051815-R Rock Creek Porter St	12	5/18/2015	1600	>=1600	1203	1600				21.58	7.56	0.537	8.52	
Rock Creek PA Ave	13-L-051815-R Rock Creek PA Ave	13	5/18/2015	3500	2200	921	940	5	<2		22.07	7.4	0.428	7.45	
	BE-051815-R Boat Equipment Blank		5/18/2015	<2		<1		<1	<2	<6					
	LE-051815-R Land Equipment Blank		5/18/2015	<2		1		<1	<2	<6					
Anacostia Bladensburg	01-L-052115-R Anacostia Bladensburg	01	5/21/2015	1100	1100	866	1100	10	3	10	18.33	7.22	0.462	6.27	0.6
Anacostia Benning Road	02-L-052115-R Anacostia Benning Road	02	5/21/2015	490	330	488	170	9	2	7	22.08	6.87	0.335	2.06	
Anacostia PA Ave Seafarers	03-B-052115-R Anacostia PA Ave Seafarers	03	5/21/2015	220	790	816	790	9	<2	7	23.35	7.14	0.484	1.19	0.6
Anacostia Capitol St. Bridge	04-B-052115-R Anacostia Capitol St. Bridge	04	5/21/2015	130	790	488	490	10	<2	11	23.86	7.02	0.505	2.29	0.75
Anacostia Haines Point	05-B-052115-R Anacostia Haines Point	05	5/21/2015	350	240	192	130	13	<2	24	24.01	7.3	0.417	6.08	0.55
Potomac Three Sisters Island	06-B-052115-R Potomac Three Sisters Island	06	5/21/2015	350	350	93	40	11	<2	43	23.51	7.88	0.418	7.47	0.8
Potomac Upstream of Rock Creek	07-B-052115-R Potomac Upstream of Rock Creek	07	5/21/2015	130	110	88	70	10	<2	38	23.57	7.79	0.416	7.38	0.8

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac 14th St. Bridge	08-B-052115-R Potomac 14th St. Bridge	08	5/21/2015	170	110	77	49	11	<2	35	24.54	7.96	0.418	7.33	0.65
Potomac 14th St. Bridge	08-B-052115-R Potomac 14th St. Bridge-D	08-D	5/21/2015							34					
Potomac Wilson Bridge	09-B-052115-R Potomac Wilson Bridge	09	5/21/2015	79	22	86	14	15	<2	29	23.29	7.29	0.428	6.21	0.6
Rock Creek Boundary Bridge	10-L-052115-R Rock Creek Boundary Bridge	10	5/21/2015	330	790	345	490				18.49	7.44	0.418	7.66	
Rock Creek Tilden St	11-L-052115-R Rock Creek Tilden St	11	5/21/2015	920	540	411	130				18.22	7.62	0.436	8.63	
Rock Creek Tilden St	11-L-052115-R Rock Creek Tilden St-D	11-D	5/21/2015								18.22	7.66	0.436	8.61	
Rock Creek Porter St	12-L-052115-R Rock Creek Porter St	12	5/21/2015	350	1600	326	130				18.13	7.72	0.449	9.09	
Rock Creek PA Ave	13-L-052115-R Rock Creek PA Ave	13	5/21/2015	790	700	411	330	6	<2		18.52	7.65	0.437	8.49	
	BE-052115-R Boat Equipment Blank		5/21/2015	<2		<1		<1	<2	<6					
	LE-052115-R Land Equipment Blank		5/21/2015	<2		28		<1	<2	<6					
Anacostia Bladensburg	01-L-052615-R Anacostia Bladensburg	01	5/26/2015	430	330	161	110	12	3	42	25.3	7.5	0.536	7.52	0.7
Anacostia Benning Road	02-L-052615-R Anacostia Benning Road	02	5/26/2015	79	70	47	49	10	<2	8	25.9	7.58	0.459	7.45	
Anacostia PA Ave Seafarers	03-B-052615-R Anacostia PA Ave Seafarers	03	5/26/2015	68	79	68	79	10	<2	<6	23	7.16	0.446	2.52	0.55
Anacostia Capitol St. Bridge	04-B-052615-R Anacostia Capitol St. Bridge	04	5/26/2015	49	22	55	14	10	<2	13	23.2	7.32	0.39	3.59	0.7
Anacostia Haines Point	05-B-052615-R Anacostia Haines Point	05	5/26/2015	49	33	20	33	9	<2	32	22.4	8.35	0.336	9	0.8
Potomac Three Sisters Island	06-B-052615-R Potomac Three Sisters Island	06	5/26/2015	33	49	14	14	8	<2	38	23.8	8.58	0.328	8.25	0.7
Potomac Three Sisters Island	06-B-052615-R Potomac Three Sisters Island-D	06-D	5/26/2015	23	8										
Potomac Upstream of Rock Creek	07-B-052615-R Potomac Upstream of Rock Creek	07	5/26/2015	31	23	12	23	7	3	50	24.5	8.74	0.331	9.51	1.1
Potomac Upstream of Rock Creek	07-B-052615-R Potomac Upstream of Rock Creek-D	07-D	5/26/2015			10	8		2						
Potomac 14th St. Bridge	08-B-052615-R Potomac 14th St. Bridge	08	5/26/2015	23	8	12	8	7	<2	40	23.6	8.7	0.334	9.24	0.85
Potomac 14th St. Bridge	08-B-052615-R Potomac 14th St. Bridge-D	08-D	5/26/2015					7							
Potomac Wilson Bridge	09-B-052615-R Potomac Wilson Bridge	09	5/26/2015	79	49	67	49	9	<2	38	22.5	8.37	0.379	9.63	0.75
Rock Creek Boundary Bridge	10-L-052615-R Rock Creek Boundary Bridge	10	5/26/2015	330	330	365	330				20.47	6.89	0.523	7.61	
Rock Creek Tilden St	11-L-052615-R Rock Creek Tilden St	11	5/26/2015	240	240	199	41				20.9	7.83	0.537	8.8	
Rock Creek Porter St	12-L-052615-R Rock Creek Porter St	12	5/26/2015	240	240	141	130				21.4	7.91	0.552	9.06	
Rock Creek Porter St	12-L-052615-R Rock Creek Porter St-D	12-D	5/26/2015								21.4	7.92	0.552	9.07	
Rock Creek PA Ave	13-L-052615-R Rock Creek PA Ave	13	5/26/2015	330	460	276	460	4	<2		21.8	7.24	0.521	8.18	
Rock Creek PA Ave	13-L-052615-R Rock Creek PA Ave-D	13-D	5/26/2015								21.8	7.42	0.522	8.06	
	BE-052615-R Boat Equipment Blank		5/26/2015	<2		<1		<1	<2	<6					
	BF-052615-R Boat Field Blank		5/26/2015	<2		<1		<1	<2	<6					
	LE-052615-R Land Equipment Blank		5/26/2015	<2		<1		<1	<2	<6					
	LF-052615-R Land Field Blank		5/26/2015	<2		<1		<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-060815-R Anacostia Bladensburg	01	6/8/2015	460	790	488	230	10	<2	12	22.6	7.39	0.461	6.45	0.7
Anacostia Bladensburg	01-L-060815-R Anacostia Bladensburg-D	01-D	6/8/2015								22.6	7.35	0.461	6.42	
Anacostia Benning Road	02-L-060815-R Anacostia Benning Road	02	6/8/2015	330	490	199	490	11	<2	6	24	7.32	0.348	4.33	
Anacostia PA Ave Seafarers	03-B-060815-R Anacostia PA Ave Seafarers	03	6/8/2015	330	330	240	230	16	<2	8	21.7	7.03	0.356	2.71	0.4
Anacostia Capitol St. Bridge	04-B-060815-R Anacostia Capitol St. Bridge	04	6/8/2015	2400	790	921	790	12	<2	14	21.8	7.32	0.317	2.93	0.6
Anacostia Haines Point	05-B-060815-R Anacostia Haines Point	05	6/8/2015	240	170	104	170	18	<2	36	21.7	8.02	0.346	8.12	0.8
Potomac Three Sisters Island	06-B-060815-R Potomac Three Sisters Island	06	6/8/2015	79	46	13	46	9	<2	42	23.9	8.59	0.34	10.14	0.7
Potomac Upstream of Rock Creek	07-B-060815-R Potomac Upstream of Rock Creek	07	6/8/2015	49	17	17	11	10	<2	48	23.4	8.49	0.34	9.43	0.7
Potomac Upstream of Rock Creek	07-B-060815-R Potomac Upstream of Rock Creek-D	07-D	6/8/2015	46	27										
Potomac 14th St. Bridge	08-B-060815-R Potomac 14th St. Bridge	08	6/8/2015	23	33	15	23	9	<2	47	22.9	8.4	0.345	10.03	0.7
Potomac 14th St. Bridge	08-B-060815-R Potomac 14th St. Bridge-D	08-D	6/8/2015			29	13								
Potomac Wilson Bridge	09-B-060815-R Potomac Wilson Bridge	09	6/8/2015	240	130	61	79	17	<2	36	22	7.86	0.349	8.06	0.65
Rock Creek Boundary Bridge	10-L-060815-R Rock Creek Boundary Bridge	10	6/8/2015	1100	280	308	170				20.1	7.42	0.472	7.55	
Rock Creek Tilden St	11-L-060815-R Rock Creek Tilden St	11	6/8/2015	240	130	219	130				20	7.78	0.494	8.74	
Rock Creek Porter St	12-L-060815-R Rock Creek Porter St	12	6/8/2015	920	350	154	350				20.5	7.88	0.51	9.06	
Rock Creek PA Ave	13-L-060815-R Rock Creek PA Ave	13	6/8/2015	230	330	435	330	6	<2		21.1	7.87	0.468	8.49	
	BE-060815-R Boat Equipment Blank		6/8/2015	<2		<1		<1	<2	6					
	LE-060815-R Land Equipment Blank		6/8/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-061515-R Anacostia Bladensburg	01	6/15/2015	5400	9200	4100	5400	28	2	43	25.3	7.32	0.34	6.39	0.3
Anacostia Benning Road	02-L-061515-R Anacostia Benning Road	02	6/15/2015	790	5400	1300	3500	23	<2	36	27.5	7.38	0.429	4.95	
Anacostia Benning Road	02-L-061515-R Anacostia Benning Road-D	02-D	6/15/2015								27.5	7.32	0.429	5.29	
Anacostia PA Ave Seafarers	03-B-061515-R Anacostia PA Ave Seafarers	03	6/15/2015	3500	16000	6300	1700	12	<2	28	28.2	7.13	0.339	1.93	0.7
Anacostia PA Ave Seafarers	03-B-061515-R Anacostia PA Ave Seafarers-D	03-D	6/15/2015								28.2	7.08	0.337	1.82	
Anacostia Capitol St. Bridge	04-B-061515-R Anacostia Capitol St. Bridge	04	6/15/2015	16000	16000	11000	5400	10	<2	34	27.9	7.45	0.312	4.09	0.9
Anacostia Haines Point	05-B-061515-R Anacostia Haines Point	05	6/15/2015	540	350	326	170	8	<2	25	27.9	7.74	0.325	5.28	1.1
Potomac Three Sisters Island	06-B-061515-R Potomac Three Sisters Island	06	6/15/2015	920	>=1600	461	>=1600	15	<2	30	28.9	8.17	0.306	6.57	0.6
Potomac Three Sisters Island	06-B-061515-R Potomac Three Sisters Island-D	06-D	6/15/2015							26					
Potomac Upstream of Rock Creek	07-B-061515-R Potomac Upstream of Rock Creek	07	6/15/2015	1600	920	579	540	10	<2	43	29.3	8.38	0.308	6.83	0.8
Potomac 14th St. Bridge	08-B-061515-R Potomac 14th St. Bridge	08	6/15/2015	350	1600	816	350	7	<2	37	29	8.38	0.316	6.94	1.1
Potomac 14th St. Bridge	08-B-061515-R Potomac 14th St. Bridge-D	08-D	6/15/2015						<2						
Potomac Wilson Bridge	09-B-061515-R Potomac Wilson Bridge	09	6/15/2015	23	49	26	49	7	<2	25	28.3	7.81	0.351	6.12	1.2
Potomac Wilson Bridge	09-B-061515-R Potomac Wilson Bridge-D	09-D	6/15/2015					7							

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-061515-R Rock Creek Boundary Bridge	10	6/15/2015	16000	16000	15800	9200				24.5	7.32	0.437	5.2	
Rock Creek Tilden St	11-L-061515-R Rock Creek Tilden St	11	6/15/2015	920	540	1203	540				24.6	7.77	0.54	7.73	
Rock Creek Porter St	12-L-061515-R Rock Creek Porter St	12	6/15/2015	1600	1600	1733	1600				24.7	7.85	0.542	8	
Rock Creek PA Ave	13-L-061515-R Rock Creek PA Ave	13	6/15/2015	1300	9200	3100	2400	10	<2		25.5	7.78	0.515	7.27	
	BE-061515-R Boat Equipment Blank		6/15/2015	<2		<1		<1	<2	<6					
	LE-061515-R Land Equipment Blank		6/15/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-061815-R Anacostia Bladensburg	01	6/18/2015	>=16000	>=16000	16100	9200	15	5	8	25.1	7.54	0.305	7.72	0.5
Anacostia Benning Road	02-L-061815-R Anacostia Benning Road	02	6/18/2015	700	1300	649	790	9	10	21	28.1	7.23	0.387	4	
Anacostia PA Ave Seafarers	03-B-061815-R Anacostia PA Ave Seafarers	03	6/18/2015	1700	2200	2420	700	9	11	26	28.1	7.19	0.352	2	0.8
Anacostia Capitol St. Bridge	04-B-061815-R Anacostia Capitol St. Bridge	04	6/18/2015	49	79	82	79	8	4	17	28.3	7.39	0.323	3.05	0.8
Anacostia Haines Point	05-B-061815-R Anacostia Haines Point	05	6/18/2015	33	23	23	23	7	4	20	28.4	7.66	0.333	5.351	1
Potomac Three Sisters Island	06-B-061815-R Potomac Three Sisters Island	06	6/18/2015	31	49	26	22	7	10	42	28.8	8.35	0.331	7.73	0.8
Potomac Upstream of Rock Creek	07-B-061815-R Potomac Upstream of Rock Creek	07	6/18/2015	70	79	40	23	7	<2	33	29.3	8.42	0.329	7.76	1
Potomac 14th St. Bridge	08-B-061815-R Potomac 14th St. Bridge	08	6/18/2015	11	23	9	23	7	<2	27	28.9	8.18	0.334	7.25	1
Potomac 14th St. Bridge	08-B-061815-R Potomac 14th St. Bridge-D	08-D	6/18/2015	23	8										
Potomac Wilson Bridge	09-B-061815-R Potomac Wilson Bridge	09	6/18/2015	22	8	11	8	8	2	21	28.2	7.61	0.352	5.84	1
Potomac Wilson Bridge	09-B-061815-R Potomac Wilson Bridge-D	09-D	6/18/2015			12	11			20					
Rock Creek Boundary Bridge	10-L-061815-R Rock Creek Boundary Bridge	10	6/18/2015	>=16000	>=16000	23300	>=16000				22.8	7.82	0.37	6.44	
Rock Creek Tilden St	11-L-061815-R Rock Creek Tilden St	11	6/18/2015	16000	>=16000	11000	>=16000				23.1	7.76	0.466	8.21	
Rock Creek Porter St	12-L-061815-R Rock Creek Porter St	12	6/18/2015	16000	>=16000	9700	16000				23.3	7.82	0.469	8.57	
Rock Creek PA Ave	13-L-061815-R Rock Creek PA Ave	13	6/18/2015	9200	16000	4100	16000	21	3		23.7	7.72	0.409	7.69	
	BE-061815-R Boat Equipment Blank		6/18/2015	<2		<1		<1	<2	<6					
	BF-061815-R Boat Field Blank		6/18/2015	<2		<1		<1	<2	<6					
	LE-061815-R Land Equipment Blank		6/18/2015	<2		3		<1	<2	<6					
	LF-061815-R Land Field Blank		6/18/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-062215-R Anacostia Bladensburg	01	6/22/2015	790	2400	1046	1300	9	<2	11	24.3	7.38	0.29	6.48	0.4
Anacostia Bladensburg	01-L-062215-R Anacostia Bladensburg-D	01-D	6/22/2015							9					
Anacostia Benning Road	02-L-062215-R Anacostia Benning Road	02	6/22/2015	3500	1700	1414	1300	33	<2	28	27.8	7.45	0.224	4.88	
Anacostia PA Ave Seafarers	03-B-062215-R Anacostia PA Ave Seafarers	03	6/22/2015	1300	1300	1553	790	55	2	11	25.8	7	0.21	3.4	0.1
Anacostia Capitol St. Bridge	04-B-062215-R Anacostia Capitol St. Bridge	04	6/22/2015	790	2200	816	470	19	<2	28	27.9	7.48	0.254	6	0.25
Anacostia Capitol St. Bridge	04-B-062215-R Anacostia Capitol St. Bridge-D	04-D	6/22/2015								27.9	7.48	0.256	5.98	
Anacostia Haines Point	05-B-062215-R Anacostia Haines Point	05	6/22/2015	540	350	261	350	14	<2	24	27.6	7.71	0.288	6.66	0.5

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-062215-R Anacostia Haines Point-D	05-D	6/22/2015								27.6	7.71	0.288	6.71	
Potomac Three Sisters Island	06-B-062215-R Potomac Three Sisters Island	06	6/22/2015	540	920	130	350	30	<2	14	27.9	7.95	0.277	7.78	0.3
Potomac Upstream of Rock Creek	07-B-062215-R Potomac Upstream of Rock Creek	07	6/22/2015	170	350	96	110	14	<2	20	28.4	8.02	0.314	7.77	0.65
Potomac 14th St. Bridge	08-B-062215-R Potomac 14th St. Bridge	08	6/22/2015	540	130	173	79	11	<2	25	28.9	8.1	0.315	8.16	0.8
Potomac Wilson Bridge	09-B-062215-R Potomac Wilson Bridge	09	6/22/2015	540	920	225	540	14	<2	30	28.2	7.91	0.297	7.22	0.55
Potomac Wilson Bridge	09-B-062215-R Potomac Wilson Bridge-D	09-D	6/22/2015	350	>=16000										
Rock Creek Boundary Bridge	10-L-062215-R Rock Creek Boundary Bridge	10	6/22/2015	1300	2200	1203	2200				24.8	7.5	0.328	7.09	
Rock Creek Boundary Bridge	10-L-062215-R Rock Creek Boundary Bridge-D	10-D	6/22/2015			1203	1300								
Rock Creek Tilden St	11-L-062215-R Rock Creek Tilden St	11	6/22/2015	920	920	866	540				24.6	7.81	0.34	8.15	
Rock Creek Porter St	12-L-062215-R Rock Creek Porter St	12	6/22/2015	1600	920	613	220				24.8	7.88	0.347	8.45	
Rock Creek PA Ave	13-L-062215-R Rock Creek PA Ave	13	6/22/2015	2200	3500	866	1300	19	<2		24.9	7.84	0.345	7.9	
Rock Creek PA Ave	13-L-062215-R Rock Creek PA Ave-D	13-D	6/22/2015						<2						
	BE-062215-R Boat Equipment Blank		6/22/2015	<2		<1		<1	3	<6					
	LE-062215-R Land Equipment Blank		6/22/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-070715-R Anacostia Bladensburg	01	7/7/2015	24000	7900	5290	3300	30	<2	10	26	7.51	0.199	7.7	0.2
Anacostia Benning Road	02-L-070715-R Anacostia Benning Road	02	7/7/2015	13000	7900	5380	4900	41	2	19	28.4	7.53	0.288	5.82	
Anacostia PA Ave Seafarers	03-B-070715-R Anacostia PA Ave Seafarers	03	7/7/2015	4900	17000	4260	3300	60	<2	18	25.6	7.29	0.305	4.36	0.2
Anacostia Capitol St. Bridge	04-B-070715-R Anacostia Capitol St. Bridge	04	7/7/2015	790	3300	613	1700	10	<2	12	25.9	7.09	0.305	2.07	0.7
Anacostia Haines Point	05-B-070715-R Anacostia Haines Point	05	7/7/2015	79	79	56	49	13	<2	12	25	7.85	0.277	7.51	0.85
Potomac Three Sisters Island	06-B-070715-R Potomac Three Sisters Island	06	7/7/2015	49	79	45	33	8	<2	15	26.1	8.24	0.285	8.55	1.1
Potomac Three Sisters Island	06-B-070715-R Potomac Three Sisters Island-D	06-D	7/7/2015								26.1	8.25	0.285	8.1	
Potomac Upstream of Rock Creek	07-B-070715-R Potomac Upstream of Rock Creek	07	7/7/2015	33	240	27	130	6	<2	17	25.7	8.24	0.284	8.36	1.1
Potomac 14th St. Bridge	08-B-070715-R Potomac 14th St. Bridge	08	7/7/2015	130	170	49	110	7	<2	12	26.2	8.22	0.284	8.21	0.9
Potomac Wilson Bridge	09-B-070715-R Potomac Wilson Bridge	09	7/7/2015	49	49	38	49	10	<2	13	25.3	7.81	0.278	7.93	0.95
Rock Creek Boundary Bridge	10-L-070715-R Rock Creek Boundary Bridge	10	7/7/2015	1700	5400	2790	2400				23.6	7.4	0.311	7.11	
Rock Creek Tilden St	11-L-070715-R Rock Creek Tilden St	11	7/7/2015	240	>=1600	548	1600				23.5	7.78	0.385	8.31	
Rock Creek Porter St	12-L-070715-R Rock Creek Porter St	12	7/7/2015	240	540	579	540				23.9	7.9	0.388	8.66	
Rock Creek PA Ave	13-L-070715-R Rock Creek PA Ave	13	7/7/2015	1100	790	613	790	10	<2		24	7.86	0.377	8.09	
	BE-070715-R Boat Equipment Blank		7/7/2015	<2		<1		<1	<2	<6					
	LE-070715-R Land Equipment Blank		7/7/2015	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-070915-R Anacostia Bladensburg	01	7/9/2015		7000		3300	22	2	27	25.4	7.42	0.327	6.76	0.5
Anacostia Bladensburg	01-L-070915-R Anacostia Bladensburg-D	01-D	7/9/2015					21							

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Benning Road	02-L-070915-R Anacostia Benning Road	02	7/9/2015		1700		1300	31	2	17	27.7	7.38	0.306	5.61	
Anacostia Benning Road	02-L-070915-R Anacostia Benning Road-D	02-D	7/9/2015							31					
Anacostia PA Ave Seafarers	03-B-070915-R Anacostia PA Ave Seafarers	03	7/9/2015		11000		7900	27	<2	15	26.3	7.35	0.264	2.71	0.3
Anacostia Capitol St. Bridge	04-B-070915-R Anacostia Capitol St. Bridge	04	7/9/2015		700		110	14	<2	15	26.7	7.13	0.3	2.1	0.4
Anacostia Haines Point	05-B-070915-R Anacostia Haines Point	05	7/9/2015		220		140	9	<2	19	26.5	7.43	0.295	6.03	0.7
Potomac Three Sisters Island	06-B-070915-R Potomac Three Sisters Island	06	7/9/2015		3500		1700	33	<2	16	26.6	7.89	0.272	7.92	0.2
Potomac Upstream of Rock Creek	07-B-070915-R Potomac Upstream of Rock Creek	07	7/9/2015		9200		940	21	<2	16	26.8	7.93	0.289	7.82	0.45
Potomac Upstream of Rock Creek	07-B-070915-R Potomac Upstream of Rock Creek-D	07-D	7/9/2015								26.8	8	0.288	7.85	
Potomac 14th St. Bridge	08-B-070915-R Potomac 14th St. Bridge	08	7/9/2015		1700		700	18	<2	18	26.7	8	0.295	7.71	0.55
Potomac Wilson Bridge	09-B-070915-R Potomac Wilson Bridge	09	7/9/2015		490		330	6	<2	20	26.8	7.87	0.296	7.44	0.85
Rock Creek Boundary Bridge	10-L-070915-R Rock Creek Boundary Bridge	10	7/9/2015		790		280				24	7.41	0.419	7.05	
Rock Creek Boundary Bridge	10-L-070915-R Rock Creek Boundary Bridge-D	10-D	7/9/2015		490										
Rock Creek Tilden St	11-L-070915-R Rock Creek Tilden St	11	7/9/2015		1100		1100				24.2	7.75	0.41	8.04	
Rock Creek Tilden St	11-L-070915-R Rock Creek Tilden St-D	11-D	7/9/2015				1300								
Rock Creek Porter St	12-L-070915-R Rock Creek Porter St	12	7/9/2015		790		490				24.3	7.87	0.417	8.44	
Rock Creek PA Ave	13-L-070915-R Rock Creek PA Ave	13	7/9/2015		24000		7900	5	<2		24.8	7.73	0.377	7.66	
Rock Creek PA Ave	13-L-070915-R Rock Creek PA Ave-D	13-D	7/9/2015						<2						
	BE-070915-R Boat Equipment Blank		7/9/2015		<1		<1	<1	<2	<6					
	BF-070915-R Boat Field Blank		7/9/2015		<1		<1	<1	<2	<6					
	LE-070915-R Land Equipment Blank		7/9/2015		1		<1	<1	<2	<6					
	LF-070915-R Land Field Blank		7/9/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-071315-R Anacostia Bladensburg	01	7/13/2015		790		490	27	17	267	24.9	7.7	0.476	7.58	0.4
Anacostia Benning Road	02-L-071315-R Anacostia Benning Road	02	7/13/2015		490		330	25	<2	25	26.6	7.7	0.382	3.55	
Anacostia PA Ave Seafarers	03-B-071315-R Anacostia PA Ave Seafarers	03	7/13/2015		79		79	14	<2	19	27.91	7.14	0.332	1.11	0.55
Anacostia Capitol St. Bridge	04-B-071315-R Anacostia Capitol St. Bridge	04	7/13/2015		230		230	13	3	20	27.72	7.31	0.306	2.54	0.55
Anacostia Haines Point	05-B-071315-R Anacostia Haines Point	05	7/13/2015		49		49	11	<2	22	27.34	7.79	0.309	6.45	0.7
Potomac Three Sisters Island	06-B-071315-R Potomac Three Sisters Island	06	7/13/2015		33		23	7	<2	19	27.5	8.49	0.309	7.62	1
Potomac Upstream of Rock Creek	07-B-071315-R Potomac Upstream of Rock Creek	07	7/13/2015		130		79	9	<2	21	27.28	8.53	0.327	7.61	0.85
Potomac 14th St. Bridge	08-B-071315-R Potomac 14th St. Bridge	08	7/13/2015		33		33	12	<2	27	27.63	8.59	0.312	8.08	0.8
Potomac 14th St. Bridge	08-B-071315-R Potomac 14th St. Bridge-D	08-D	7/13/2015								27.63	8.63	0.312	8.1	
Potomac Wilson Bridge	09-B-071315-R Potomac Wilson Bridge	09	7/13/2015		17		5	11	<2	21	27.35	7.92	0.322	7.32	0.85
Potomac Wilson Bridge	09-B-071315-R Potomac Wilson Bridge-D	09-D	7/13/2015								27.35	8.03	0.32	7.36	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-071315-R Rock Creek Boundary Bridge	10	7/13/2015		350		170				22.8	7.86	0.491	7.45	
Rock Creek Tilden St	11-L-071315-R Rock Creek Tilden St	11	7/13/2015		350		350				22.8	7.92	0.515	8.31	
Rock Creek Tilden St	11-L-071315-R Rock Creek Tilden St-D	11-D	7/13/2015		540										
Rock Creek Porter St	12-L-071315-R Rock Creek Porter St	12	7/13/2015		350		170				22.8	7.94	0.532	8.57	
Rock Creek Porter St	12-L-071315-R Rock Creek Porter St-D	12-D	7/13/2015				540								
Rock Creek PA Ave	13-L-071315-R Rock Creek PA Ave	13	7/13/2015		330		230	3	<2		24	7.88	0.499	7.72	
	BE-071315-R Boat Equipment Blank		7/13/2015		<1		<1	<1	<2	<6					
	LE-071315-R Land Equipment Blank		7/13/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-072015-R Anacostia Bladensburg	01	7/20/2015		1100		220	9	<2	27	29.4	7.36	0.483	5.85	0.8
Anacostia Bladensburg	01-L-072015-R Anacostia Bladensburg-D	01-D	7/20/2015						<2						
Anacostia Benning Road	02-L-072015-R Anacostia Benning Road	02	7/20/2015		130		49	18	<2	50	29.7	7.6	0.385	4.75	
Anacostia Benning Road	02-L-072015-R Anacostia Benning Road-D	02-D	7/20/2015					19							
Anacostia PA Ave Seafarers	03-B-072015-R Anacostia PA Ave Seafarers	03	7/20/2015		79		79	30	2	35	28.7	7.01	0.406	2.93	0.3
Anacostia PA Ave Seafarers	03-B-072015-R Anacostia PA Ave Seafarers-D	03-D	7/20/2015							34					
Anacostia Capitol St. Bridge	04-B-072015-R Anacostia Capitol St. Bridge	04	7/20/2015		70		70	12	<2	39	28.5	7.29	0.34	4.78	0.5
Anacostia Haines Point	05-B-072015-R Anacostia Haines Point	05	7/20/2015		5		5	10	<2	18	27.5	7.8	0.318	6.72	0.8
Potomac Three Sisters Island	06-B-072015-R Potomac Three Sisters Island	06	7/20/2015		11		7	5	<2	11	28.9	8.23	0.313	6.94	1.1
Potomac Upstream of Rock Creek	07-B-072015-R Potomac Upstream of Rock Creek	07	7/20/2015		11		5	7	<2	14	28.6	8.21	0.316	7.91	1.1
Potomac 14th St. Bridge	08-B-072015-R Potomac 14th St. Bridge	08	7/20/2015		8		8	6	<2	14	27.9	8.16	0.323	7.53	1.1
Potomac Wilson Bridge	09-B-072015-R Potomac Wilson Bridge	09	7/20/2015		8		5	10	<2	19	27.9	7.86	0.327	7.24	0.8
Rock Creek Boundary Bridge	10-L-072015-R Rock Creek Boundary Bridge	10	7/20/2015		330		330				24.9	7.9	0.52	6.85	
Rock Creek Boundary Bridge	10-L-072015-R Rock Creek Boundary Bridge-D	10-D	7/20/2015								24.9	7.7	0.52	6.81	
Rock Creek Tilden St	11-L-072015-R Rock Creek Tilden St	11	7/20/2015		350		350				25.1	7.8	0.562	7.92	
Rock Creek Porter St	12-L-072015-R Rock Creek Porter St	12	7/20/2015		240		79				25.4	8.02	0.579	8.84	
Rock Creek PA Ave	13-L-072015-R Rock Creek PA Ave	13	7/20/2015		5400		5400	4	<2		27.1	8.01	0.457	7.33	
	BE-072015-R Boat Equipment Blank		7/20/2015		1		<1	<1	<2	<6					
	LE-072015-R Land Equipment Blank		7/20/2015		1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-072315-R Anacostia Bladensburg	01	7/23/2015		130		79	11	<2	25	27.3	7.59	0.492	7.47	0.55
Anacostia Benning Road	02-L-072315-R Anacostia Benning Road	02	7/23/2015		14		9	33	<2	52	28.3	7.54	0.448	4.34	
Anacostia PA Ave Seafarers	03-B-072315-R Anacostia PA Ave Seafarers	03	7/23/2015		23		13	28	<2	36	28	7.07	0.432	3.41	0.3
Anacostia Capitol St. Bridge	04-B-072315-R Anacostia Capitol St. Bridge	04	7/23/2015		70		21	18	<2	24	28.3	7.28	0.346	4.28	0.45
Anacostia Haines Point	05-B-072315-R Anacostia Haines Point	05	7/23/2015		<2		<2	5	<2	14	28.7	7	0.317	5.93	1.15

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Three Sisters Island	06-B-072315-R Potomac Three Sisters Island	06	7/23/2015		4		2	7	<2	9	28.9	8.31	0.335	7.54	1.2
Potomac Upstream of Rock Creek	07-B-072315-R Potomac Upstream of Rock Creek	07	7/23/2015		11		11	8	<2	12	29.4	8.31	0.337	6.66	1.05
Potomac 14th St. Bridge	08-B-072315-R Potomac 14th St. Bridge	08	7/23/2015		7		5	9	<2	14	29	8.11	0.333	6.41	0.9
Potomac Wilson Bridge	09-B-072315-R Potomac Wilson Bridge	09	7/23/2015		8		8	10	<2	19	28	7.7	0.339	6.38	0.95
Rock Creek Boundary Bridge	10-L-072315-R Rock Creek Boundary Bridge	10	7/23/2015		700		700				22.9	7.43	0.534	6.99	
Rock Creek Tilden St	11-L-072315-R Rock Creek Tilden St	11	7/23/2015		350		350				22.7	7.71	0.577	8.06	
Rock Creek Tilden St	11-L-072315-R Rock Creek Tilden St-D	11-D	7/23/2015								22.7	7.75	0.577	8.05	
Rock Creek Porter St	12-L-072315-R Rock Creek Porter St	12	7/23/2015		540		350				22.8	7.86	0.593	8.74	
Rock Creek Porter St	12-L-072315-R Rock Creek Porter St-D	12-D	7/23/2015		540										
Rock Creek PA Ave	13-L-072315-R Rock Creek PA Ave	13	7/23/2015		2200		2200	2	<2		24.6	7.85	0.507	7.54	
Rock Creek PA Ave	13-L-072315-R Rock Creek PA Ave-D	13-D	7/23/2051				1400								
	BE-072315-R Boat Equipment Blank		7/23/2015					<1	<2	<6					
	BF-072315-R Boat Field Blank		7/23/2015		<1		<1	<1	<2	<6					
	LE-072315-R Land Equipment Blank		7/23/2015		<1		<1	<1	<2	<6					
	LF-072315-R Land Field Blank		7/23/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-072715-R Anacostia Bladensburg	01	7/27/2015		>=1600		>=1600	25	3	30	27.2	7.51	0.303	6.67	0.35
Anacostia Bladensburg	01-L-072715-R Anacostia Bladensburg-D	01-D	7/27/2015				>=1600								
Anacostia Benning Road	02-L-072715-R Anacostia Benning Road	02	7/27/2015		5400		1400	19	<2	30	28.1	7.65	0.506	5.87	
Anacostia Benning Road	02-L-072715-R Anacostia Benning Road-D	02-D	7/27/2015						<2						
Anacostia PA Ave Seafarers	03-B-072715-R Anacostia PA Ave Seafarers	03	7/27/2015		5400		2400	29	2	44		7.14	0.466		0.4
Anacostia PA Ave Seafarers	03-B-072715-R Anacostia PA Ave Seafarers-D	03-D	7/27/2015					39							
Anacostia Capitol St. Bridge	04-B-072715-R Anacostia Capitol St. Bridge	04	7/27/2015		490		130	15	<2	41	29	7.37	0.366	5.24	0.5
Anacostia Capitol St. Bridge	04-B-072715-R Anacostia Capitol St. Bridge-D	04-D	7/27/2015							39					
Anacostia Haines Point	05-B-072715-R Anacostia Haines Point	05	7/27/2015		21		17	8	<2	21	28.5	7.74	0.334	6.31	0.7
Potomac Three Sisters Island	06-B-072715-R Potomac Three Sisters Island	06	7/27/2015		8		5	4	<2	8	29.2	8.5	0.36	7.31	1.45
Potomac Upstream of Rock Creek	07-B-072715-R Potomac Upstream of Rock Creek	07	7/27/2015		7		5	3	<2	10	29.2	8.51	0.333	6.88	1.4
Potomac 14th St. Bridge	08-B-072715-R Potomac 14th St. Bridge	08	7/27/2015		>=1600		1600	6	<2	19	28.5	8.36	0.334	7	1
Potomac Wilson Bridge	09-B-072715-R Potomac Wilson Bridge	09	7/27/2015		34		27	7	<2	19	28	7.81	0.398	6.98	1
Rock Creek Boundary Bridge	10-L-072715-R Rock Creek Boundary Bridge	10	7/27/2015		>=16000		16000				23.6	7.66	0.369	6.95	
Rock Creek Tilden St	11-L-072715-R Rock Creek Tilden St	11	7/27/2015		>=16000		>=16000				23.8	7.65	0.354	7.96	
Rock Creek Porter St	12-L-072715-R Rock Creek Porter St	12	7/27/2015		>=16000		>=16000				23.8	7.64	0.294	8.27	
Rock Creek Porter St	12-L-072715-R Rock Creek Porter St-D	12-D	7/27/2015								23.8	7.57	0.295	8.27	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek PA Ave	13-L-072715-R Rock Creek PA Ave	13	7/27/2015		>=16000		16000	57	5		24.3	7.68	0.389	7.54	
Rock Creek PA Ave	13-L-072715-R Rock Creek PA Ave-D	13-D	7/27/2015		>=16000										
Rock Creek PA Ave	13-L-072715-R Rock Creek PA Ave-D	13-D	7/27/2015								24.3	7.61	0.391	7.53	
	BE-072715-R Boat Equipment Blank		7/27/2015		<1		<1	<1	<2	<6					
	LE-072715-R Land Equipment Blank		7/27/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-080315-R Anacostia Bladensburg	01	8/3/2015		330		330	9	<2	32	28.1	7.54	0.427	5.01	1.1
Anacostia Bladensburg	01-L-080315-R Anacostia Bladensburg-D	01-D	8/3/2015								28.1	7.34	0.43	5.21	
Anacostia Benning Road	02-L-080315-R Anacostia Benning Road	02	8/3/2015		490		220	24	<2	56	28.4	7.53	0.357	2.87	
Anacostia PA Ave Seafarers	03-B-080315-R Anacostia PA Ave Seafarers	03	8/3/2015		1700		1100	33	3	40	28.6	7.64	0.385	3.23	0.3
Anacostia Capitol St. Bridge	04-B-080315-R Anacostia Capitol St. Bridge	04	8/3/2015		110		79	14	<2	34	28.6	7.77	0.371	4.25	0.5
Anacostia Haines Point	05-B-080315-R Anacostia Haines Point	05	8/3/2015		17		7	8	<2	17	28.4	7.77	0.362	5.91	0.8
Potomac Three Sisters Island	06-B-080315-R Potomac Three Sisters Island	06	8/3/2015		49		7	4	<2	16	30.2	8.58	0.346	8.66	1.1
Potomac Upstream of Rock Creek	07-B-080315-R Potomac Upstream of Rock Creek	07	8/3/2015		33		17	5	<2	15	29.8	8.29	0.351	8.2	1.05
Potomac 14th St. Bridge	08-B-080315-R Potomac 14th St. Bridge	08	8/3/2015		23		23	8	<2	13	29.2	7.91	0.348	6.6	0.85
Potomac Wilson Bridge	09-B-080315-R Potomac Wilson Bridge	09	8/3/2015		8		8	12	<2	29	28.5	7.82	0.365	6.5	0.8
Rock Creek Boundary Bridge	10-L-080315-R Rock Creek Boundary Bridge	10	8/3/2015		490		490				23.2	7.33	0.55	6.3	
Rock Creek Tilden St	11-L-080315-R Rock Creek Tilden St	11	8/3/2015		540		350				23.1	7.69	0.56	7.38	
Rock Creek Porter St	12-L-080315-R Rock Creek Porter St	12	8/3/2015		540		540				23.6	7.85	0.57	5.59	
Rock Creek PA Ave	13-L-080315-R Rock Creek PA Ave	13	8/3/2015		330		130	5	<2		28.7	8.16	0.349	5.12	
	BE-080315-R Boat Equipment Blank		8/3/2015		1		<1	<1	<2	<6					
	LE-080315-R Land Equipment Blank		8/3/2015		1		<1	<1	<2	9					
Anacostia Bladensburg	01-L-081015-R Anacostia Bladensburg	01	8/10/2015		>=16000		>=16000	22	2	27	24.4	7.69	0.456	5.66	0.5
Anacostia Bladensburg	01-L-081015-R Anacostia Bladensburg-D	01-D	8/10/2015		>=16000										
Anacostia Benning Road	02-L-081015-R Anacostia Benning Road	02	8/10/2015		700		700	22	<2	43	25.2	7.48	0.472	4.89	
Anacostia Benning Road	02-L-081015-R Anacostia Benning Road-D	02-D	8/10/2015				790				25.2	7.47	0.472	4.9	
Anacostia PA Ave Seafarers	03-B-081015-R Anacostia PA Ave Seafarers	03	8/10/2015		5400		1300	25	<2	43	27.3	7.29	0.374	3.5	0.5
Anacostia PA Ave Seafarers	03-B-081015-R Anacostia PA Ave Seafarers-D	03-D	8/10/2015					27							
Anacostia Capitol St. Bridge	04-B-081015-R Anacostia Capitol St. Bridge	04	8/10/2015		5400		5400	18	<2	39	27.5	7.4	0.362	5.13	0.6
Anacostia Capitol St. Bridge	04-B-081015-R Anacostia Capitol St. Bridge-D	04-D	8/10/2015						<2						
Anacostia Haines Point	05-B-081015-R Anacostia Haines Point	05	8/10/2015		22		22	13	<2	27	27.2	7.58	0.357	5.68	0.7
Potomac Three Sisters Island	06-B-081015-R Potomac Three Sisters Island	06	8/10/2015		46		17	7	<2	21	27.4	8.19	0.372	8.01	1.1
Potomac Upstream of Rock Creek	07-B-081015-R Potomac Upstream of Rock Creek	07	8/10/2015		33		33	5	<2	28	27.3	8.25	0.368	8.82	0.8

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac 14th St. Bridge	08-B-081015-R Potomac 14th St. Bridge	08	8/10/2015		49		17	11	<2	37	27.3	8.02	0.356	7.54	0.7
Potomac Wilson Bridge	09-B-081015-R Potomac Wilson Bridge	09	8/10/2015		8		5	13	<2	25	26.8	7.41	0.39	6.21	0.7
Rock Creek Boundary Bridge	10-L-081015-R Rock Creek Boundary Bridge	10	8/10/2015		9200		1700				22.8	7.85	0.495	7.1	
Rock Creek Tilden St	11-L-081015-R Rock Creek Tilden St	11	8/10/2015		16000		9200				22.8	8.04	0.41	8.03	
Rock Creek Porter St	12-L-081015-R Rock Creek Porter St	12	8/10/2015		9200		5400				22.7	7.84	0.464	8.5	
Rock Creek PA Ave	13-L-081015-R Rock Creek PA Ave	13	8/10/2015		16000		16000	35	<2		22.9	7.92	0.397	7.82	
	BE-081015-R Boat Equipment Blank		8/10/2015		<1		<1	<1	<2	<6					
	BF-081015-R Boat Field Blank		8/10/2015		<1		<1	<1	<2	<6					
	LE-081015-R Land Equipment Blank		8/10/2015		<1		<1	<1	<2	<6					
	LF-081015-R Land Field Blank		8/10/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-081315-R Anacostia Bladensburg	01	8/13/2015		790		490	8	3	14	25.9	7.71	0.356	4.82	0.6
Anacostia Benning Road	02-L-081315-R Anacostia Benning Road	02	8/13/2015		230		230	24	<2	31	26.1	7.7	0.376	4.89	
Anacostia PA Ave Seafarers	03-B-081315-R Anacostia PA Ave Seafarers	03	8/13/2015		330		210	19	2	30	26.6	6.98	0.389	3.31	0.4
Anacostia PA Ave Seafarers	03-B-081315-R Anacostia PA Ave Seafarers-D	03-D	8/13/2015								26.6	6.95	0.389	3.35	
Anacostia Capitol St. Bridge	04-B-081315-R Anacostia Capitol St. Bridge	04	8/13/2015		260		70	12	<2	25	26.9	7.06	0.358	4.29	0.6
Anacostia Haines Point	05-B-081315-R Anacostia Haines Point	05	8/13/2015		49		49	9	<2	18	26.6	7.4	0.37	6.25	0.85
Anacostia Haines Point	05-B-081315-R Anacostia Haines Point-D	05-D	8/13/2015							15					
Potomac Three Sisters Island	06-B-081315-R Potomac Three Sisters Island	06	8/13/2015		33		17	6	<2	<6	27	8.02	0.381	7.9	1.05
Potomac Upstream of Rock Creek	07-B-081315-R Potomac Upstream of Rock Creek	07	8/13/2015		49		22	7	<2	9	26.7	7.74	0.373	6.98	0.95
Potomac 14th St. Bridge	08-B-081315-R Potomac 14th St. Bridge	08	8/13/2015		49		13	7	<2	15	26.7	7.56	0.363	6.03	0.85
Potomac Wilson Bridge	09-B-081315-R Potomac Wilson Bridge	09	8/13/2015		23		13	9	<2	12	26.4	7.37	0.382	6.36	0.8
Rock Creek Boundary Bridge	10-L-081315-R Rock Creek Boundary Bridge	10	8/13/2015		490		110				22	7.37	0.465	6.42	
Rock Creek Tilden St	11-L-081315-R Rock Creek Tilden St	11	8/13/2015		540		540				21.9	7.62	0.504	7.73	
Rock Creek Porter St	12-L-081315-R Rock Creek Porter St	12	8/13/2015		350		350				21.9	7.8	0.507	8.3	
Rock Creek PA Ave	13-L-081315-R Rock Creek PA Ave	13	8/13/2015		490		17	2	<2		23.8	7.93	0.416	7.42	
	BE-081315-R Boat Equipment Blank		8/13/2015		2		<1	<1	<2	<6					
	LE-081315-R Land Equipment Blank		8/13/2015		4		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-081715-R Anacostia Bladensburg	01	8/17/2015		220		170	9	2	27	28.5	8.04	0.495	7.63	0.7
Anacostia Benning Road	02-L-081715-R Anacostia Benning Road	02	8/17/2015		79		17	20	3	64	27.9	7.99	0.419	5.55	
Anacostia Benning Road	02-L-081715-R Anacostia Benning Road-D	02-D	8/17/2015		79										
Anacostia PA Ave Seafarers	03-B-081715-R Anacostia PA Ave Seafarers	03	8/17/2015		1400		49	25	<2	36	27.7	7.03	0.383	5.26	0.4
Anacostia PA Ave Seafarers	03-B-081715-R Anacostia PA Ave Seafarers-D	03-D	8/17/2015				79								

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Capitol St. Bridge	04-B-081715-R Anacostia Capitol St. Bridge	04	8/17/2015		79		33	14	<2	32	27.4	7.24	0.368	6.53	0.7
Anacostia Capitol St. Bridge	04-B-081715-R Anacostia Capitol St. Bridge-D	04-D	8/17/2015						<2		27.4	7.25	0.369	6.54	
Anacostia Haines Point	05-B-081715-R Anacostia Haines Point	05	8/17/2015		23		23	13	<2	23	27	7.32	0.388	6.88	0.85
Anacostia Haines Point	05-B-081715-R Anacostia Haines Point-D	05-D	8/17/2015					11			27	7.32	0.388	6.92	
Potomac Three Sisters Island	06-B-081715-R Potomac Three Sisters Island	06	8/17/2015		11		5	3	<2	11	28.4	8.11	0.379	7.83	1.7
Potomac Upstream of Rock Creek	07-B-081715-R Potomac Upstream of Rock Creek	07	8/17/2015		17		8	4	<2	13	28.2	8.13	0.38	8.62	1.2
Potomac 14th St. Bridge	08-B-081715-R Potomac 14th St. Bridge	08	8/17/2015		13		13	11	<2	20	27.3	7.69	0.383	7.33	0.85
Potomac Wilson Bridge	09-B-081715-R Potomac Wilson Bridge	09	8/17/2015		23		13	14	<2	25	27.2	7.39	0.396	7.69	0.75
Rock Creek Boundary Bridge	10-L-081715-R Rock Creek Boundary Bridge	10	8/17/2015		330		170				23	8.6	0.657	6.9	
Rock Creek Tilden St	11-L-081715-R Rock Creek Tilden St	11	8/17/2015		220		170				23.2	8.5	0.712	7.78	
Rock Creek Porter St	12-L-081715-R Rock Creek Porter St	12	8/17/2015		540		540				23.4	8.31	0.679	7.95	
Rock Creek PA Ave	13-L-081715-R Rock Creek PA Ave	13	8/17/2015		140		33	3	<2		28.1	8.68	0.394	7.95	
	BE-081715-R Boat Equipment Blank		8/17/2015		<1		<1	<1	<2	<6					
	LE-081715-R Land Equipment Blank		8/17/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-082415-R Anacostia Bladensburg	01	8/24/2015		490		330	9	<2	14	27.1	7.92	0.462	8.32	0.8
Anacostia Benning Road	02-L-082415-R Anacostia Benning Road	02	8/24/2015		94		94	20	3	49	27.4	7.79	0.477	5.23	
Anacostia PA Ave Seafarers	03-B-082415-R Anacostia PA Ave Seafarers	03	8/24/2015		230		130	26	<2	26	27	6.83	0.419	3.92	0.5
Anacostia PA Ave Seafarers	03-B-082415-R Anacostia PA Ave Seafarers-D	03-D	8/24/2015		110										
Anacostia Capitol St. Bridge	04-B-082415-R Anacostia Capitol St. Bridge	04	8/24/2015		170		170	14	<2	28	27.5	7.03	0.384	5.06	0.55
Anacostia Capitol St. Bridge	04-B-082415-R Anacostia Capitol St. Bridge-D	04-D	8/24/2015				170								
Anacostia Haines Point	05-B-082415-R Anacostia Haines Point	05	8/24/2015		70		46	11	<2	18	27.1	7.49	0.379	6.04	0.7
Potomac Three Sisters Island	06-B-082415-R Potomac Three Sisters Island	06	8/24/2015		49		22	3	<2	<6	27.6	8.23	0.372	7.88	1.6
Potomac Three Sisters Island	06-B-082415-R Potomac Three Sisters Island-D	06-D	8/24/2015							<6	27.6	8.23	0.373	7.86	
Potomac Upstream of Rock Creek	07-B-082415-R Potomac Upstream of Rock Creek	07	8/24/2015		110		79	4	<2	<6	27.4	8.25	0.373	8	1.7
Potomac 14th St. Bridge	08-B-082415-R Potomac 14th St. Bridge	08	8/24/2015		23		8	10	<2	<6	27	7.97	0.395	7.33	0.9
Potomac Wilson Bridge	09-B-082415-R Potomac Wilson Bridge	09	8/24/2015		23		13	8	<2	17	27.1	7.55	0.398	6.84	1.1
Rock Creek Boundary Bridge	10-L-082415-R Rock Creek Boundary Bridge	10	8/24/2015		490		490				21.7	7.64	0.691	6.45	
Rock Creek Tilden St	11-L-082415-R Rock Creek Tilden St	11	8/24/2015		130		79				21.8	7.82	0.661	7.55	
Rock Creek Porter St	12-L-082415-R Rock Creek Porter St	12	8/24/2015		350		350				22.1	7.87	0.675	8.37	
Rock Creek PA Ave	13-L-082415-R Rock Creek PA Ave	13	8/24/2015		130		130	2	<2		23.9	8.02	0.557	8.38	
	BE-082415-R Boat Equipment Blank		8/24/2015		<1		<1	<1	<2	<6					
	BF-082415-R Boat Field Blank		8/24/2015		<1		<1	<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
	LE-082415-R Land Equipment Blank		8/24/2015		<1		<1	<1	<2	<6					
	LF-082415-R Land Field Blank		8/24/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-082715-R Anacostia Bladensburg	01	8/27/2015		490		490	12	<2	11	23.8	7.9	0.386	4.75	0.6
Anacostia Benning Road	02-L-082715-R Anacostia Benning Road	02	8/27/2015		210		130	23	2	33	25.1	8.1	0.451	5.13	
Anacostia PA Ave Seafarers	03-B-082715-R Anacostia PA Ave Seafarers	03	8/27/2015		630		170	18	<2	22	26.6	7.34	0.416	3.32	0.6
Anacostia Capitol St. Bridge	04-B-082715-R Anacostia Capitol St. Bridge	04	8/27/2015		230		170	11	<2	21	26.9	7.35	0.387	4.33	0.8
Anacostia Haines Point	05-B-082715-R Anacostia Haines Point	05	8/27/2015		49		49	7	<2	18	26.4	7.61	0.384	6.9	1.1
Anacostia Haines Point	05-B-082715-R Anacostia Haines Point-D	05-D	8/27/2015					7							
Potomac Three Sisters Island	06-B-082715-R Potomac Three Sisters Island	06	8/27/2015		23		13	8	<2	15	26.7	8.17	0.365	7.93	1.1
Potomac Three Sisters Island	06-B-082715-R Potomac Three Sisters Island-D	06-D	8/27/2015						<2						
Potomac Upstream of Rock Creek	07-B-082715-R Potomac Upstream of Rock Creek	07	8/27/2015		>=1600		>=1600	7	<2	7	26.7	7.96	0.363	7.04	1.4
Potomac Upstream of Rock Creek	07-B-082715-R Potomac Upstream of Rock Creek-D	07-D	8/27/2015								26.7	8.07	0.363	7.13	
Potomac 14th St. Bridge	08-B-082715-R Potomac 14th St. Bridge	08	8/27/2015		220		110	7	<2	<6	26.6	7.8	0.373	6.85	1.2
Potomac Wilson Bridge	09-B-082715-R Potomac Wilson Bridge	09	8/27/2015		22		22	12	<2	15	26.3	7.55	0.408	6.81	1
Rock Creek Boundary Bridge	10-L-082715-R Rock Creek Boundary Bridge	10	8/27/2015		2200		790				20.4	8.06	0.58	6.71	
Rock Creek Tilden St	11-L-082715-R Rock Creek Tilden St	11	8/27/2015		350		350				20.2	7.97	0.575	7.47	
Rock Creek Porter St	12-L-082715-R Rock Creek Porter St	12	8/27/2015		540		540				20.6	7.97	0.593	8.96	
Rock Creek PA Ave	13-L-082715-R Rock Creek PA Ave	13	8/27/2015		220		220	2	<2		22.7	7.95	0.554	7.57	
	BE-082715-R Boat Equipment Blank		8/27/2015		<1		<1	<1	<2	<6					
	LE-082715-R Land Equipment Blank		8/27/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-083115-R Anacostia Bladensburg	01	8/31/2015		790		790	15	4	91	26.3	7.88	0.461	8.13	0.6
Anacostia Benning Road	02-L-083115-R Anacostia Benning Road	02	8/31/2015		170		170	25	<2	27	26.3	7.72	0.419	3.25	
Anacostia PA Ave Seafarers	03-B-083115-R Anacostia PA Ave Seafarers	03	8/31/2015		170		79	24	<2	23	26.6	7.21	0.417	3.73	0.5
Anacostia Capitol St. Bridge	04-B-083115-R Anacostia Capitol St. Bridge	04	8/31/2015		17		17	13	<2	24	26.5	7.35	0.402	4.83	0.6
Anacostia Capitol St. Bridge	04-B-083115-R Anacostia Capitol St. Bridge-D	04-D	8/31/2015		34		11								
Anacostia Haines Point	05-B-083115-R Anacostia Haines Point	05	8/31/2015		31		31	11	<2	11	26.2	7.39	0.429	6.41	0.85
Anacostia Haines Point	05-B-083115-R Anacostia Haines Point-D	05-D	8/31/2015				11								
Potomac Three Sisters Island	06-B-083115-R Potomac Three Sisters Island	06	8/31/2015		13		8	5	<2	<6	27	8.37	0.391	8.56	1.15
Potomac Upstream of Rock Creek	07-B-083115-R Potomac Upstream of Rock Creek	07	8/31/2015		46		46	3	<2	10	26.8	8.27	0.39	8.55	1.05
Potomac 14th St. Bridge	08-B-083115-R Potomac 14th St. Bridge	08	8/31/2015		130		130	7	<2	14	26.5	7.84	0.385	6.83	1
Potomac 14th St. Bridge	08-B-083115-R Potomac 14th St. Bridge-D	08-D	8/31/2015								26.5	7.83	0.385	6.86	
Potomac Wilson Bridge	09-B-083115-R Potomac Wilson Bridge	09	8/31/2015		23		13	11	<2	14	26.3	7.49	0.426	6.5	0.8

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Wilson Bridge	09-B-083115-R Potomac Wilson Bridge-D	09-D	8/31/2015								26.3	7.49	0.426	6.54	
Rock Creek Boundary Bridge	10-L-083115-R Rock Creek Boundary Bridge	10	8/31/2015		490		490				22.4	7.76	0.742	6.42	
Rock Creek Tilden St	11-L-083115-R Rock Creek Tilden St	11	8/31/2015		540		540				22.7	7.89	0.702	7.64	
Rock Creek Porter St	12-L-083115-R Rock Creek Porter St	12	8/31/2015		350		170				22.8	7.95	0.691	8.33	
Rock Creek PA Ave	13-L-083115-R Rock Creek PA Ave	13	8/31/2015		490		140	3	<2		26.1	8.25	0.404	8.02	
	BE-083115-R Boat Equipment Blank		8/31/2015		<1		<1	<1	<2	<6					
	LE-083115-R Land Equipment Blank		8/31/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-090815-R Anacostia Bladensburg	01	9/8/2015		330		230	12	<2	31	27.9	8.06	0.584	7.31	0.7
Anacostia Benning Road	02-L-090815-R Anacostia Benning Road	02	9/8/2015		230		230	28	<2	49	28.1	8	0.448	6.29	
Anacostia PA Ave Seafarers	03-B-090815-R Anacostia PA Ave Seafarers	03	9/8/2015		79		17	18	<2	39	27.5	7.1	0.436	4.39	0.4
Anacostia Capitol St. Bridge	04-B-090815-R Anacostia Capitol St. Bridge	04	9/8/2015		49		33	13	<2	41	27.9	7.55	0.415	6.12	0.5
Anacostia Haines Point	05-B-090815-R Anacostia Haines Point	05	9/8/2015		49		17	9	<2	28	27.6	7.61	0.406	6.86	0.7
Anacostia Haines Point	05-B-090815-R Anacostia Haines Point-D	05-D	9/8/2015		31										
Potomac Three Sisters Island	06-B-090815-R Potomac Three Sisters Island	06	9/8/2015		11		5	3	<2	<6	29	8.3	0.396	8.45	1.5
Potomac Three Sisters Island	06-B-090815-R Potomac Three Sisters Island-D	06-D	9/8/2015				5		<2						
Potomac Upstream of Rock Creek	07-B-090815-R Potomac Upstream of Rock Creek	07	9/8/2015		11		7	4	<2	11	28.7	8.38	0.391	9.01	1
Potomac Upstream of Rock Creek	07-B-090815-R Potomac Upstream of Rock Creek-D	07-D	9/8/2015					4							
Potomac 14th St. Bridge	08-B-090815-R Potomac 14th St. Bridge	08	9/8/2015		13		5	7	<2	16	28.1	8.02	0.395	7.63	0.9
Potomac Wilson Bridge	09-B-090815-R Potomac Wilson Bridge	09	9/8/2015		23		23	8	<2	27	27.5	7.45	0.441	7.23	0.85
Rock Creek Boundary Bridge	10-L-090815-R Rock Creek Boundary Bridge	10	9/8/2015		310		310				23	7.41	0.828	6.11	
Rock Creek Boundary Bridge	10-L-090815-R Rock Creek Boundary Bridge-D	10-D	9/8/2015								23	7.4	0.828	6.09	
Rock Creek Tilden St	11-L-090815-R Rock Creek Tilden St	11	9/8/2015		920		140				23	7.77	0.834	7.46	
Rock Creek Porter St	12-L-090815-R Rock Creek Porter St	12	9/8/2015		170		170				23.1	7.97	0.833	8	
Rock Creek PA Ave	13-L-090815-R Rock Creek PA Ave	13	9/8/2015		23		23	3	<2		25.6	8.03	0.586	7.37	
	BE-090815-R Boat Equipment Blank		9/8/2015		<1		<1	<1	<2	<6					
	BF-090815-R Boat Field Blank		9/8/2015		<1		<1	<1	<2	<6					
	LE-090815-R Land Equipment Blank		9/8/2015		<1		<1	<1	<2	<6					
	LF-090815-R Land Field Blank		9/8/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-091015-R Anacostia Bladensburg	01	9/10/2015		310		230	9	2	22	28.3	8.51	0.523	4.72	0.6
Anacostia Benning Road	02-L-091015-R Anacostia Benning Road	02	9/10/2015		79		49	25	<2	24	28.2	8.45	0.458	3.92	
Anacostia PA Ave Seafarers	03-B-091015-R Anacostia PA Ave Seafarers	03	9/10/2015		130		79	24	<2	38	28.1	7.13	0.417	4.41	0.45
Anacostia Capitol St. Bridge	04-B-091015-R Anacostia Capitol St. Bridge	04	9/10/2015		130		79	12	<2	57	28.2	7.24	0.409	5.72	0.7

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-091015-R Anacostia Haines Point	05	9/10/2015		13		8	5	<2	14	27.8	7.37	0.41	6.38	1
Potomac Three Sisters Island	06-B-091015-R Potomac Three Sisters Island	06	9/10/2015		5		2	3	<2	9	28.8	8.29	0.394	7.86	1.3
Potomac Upstream of Rock Creek	07-B-091015-R Potomac Upstream of Rock Creek	07	9/10/2015		8		5	3	<2	11	28.7	8.31	0.395	8.43	1.3
Potomac 14th St. Bridge	08-B-091015-R Potomac 14th St. Bridge	08	9/10/2015		2		2	5	<2	16	28.5	8	0.394	7.79	1
Potomac 14th St. Bridge	08-B-091015-R Potomac 14th St. Bridge-D	08-D	9/10/2015							30					
Potomac Wilson Bridge	09-B-091015-R Potomac Wilson Bridge	09	9/10/2015		8		8	9	<2	27	27.9	7.3	0.45	6.69	0.85
Rock Creek Boundary Bridge	10-L-091015-R Rock Creek Boundary Bridge	10	9/10/2015		700		700				24.4	8.4	0.871	5.78	
Rock Creek Tilden St	11-L-091015-R Rock Creek Tilden St	11	9/10/2015		170		170				24.5	8.3	0.852	6.88	
Rock Creek Tilden St	11-L-091015-R Rock Creek Tilden St-D	11-D	9/10/2015								24.5	8.2	0.852	6.88	
Rock Creek Porter St	12-L-091015-R Rock Creek Porter St	12	9/10/2015		920		920				24.6	8.73	0.84	7.44	
Rock Creek Porter St	12-L-091015-R Rock Creek Porter St-D	12-D	9/10/2015								24.6	8.46	0.84	7.44	
Rock Creek PA Ave	13-L-091015-R Rock Creek PA Ave	13	9/10/2015		700		700	3	<2		26.6	8.6	0.582	7.05	
	BE-091015-R Boat Equipment Blank		9/10/2015		<1		<1	<1	<2	<6					
	LE-091015-R Land Equipment Blank		9/10/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-091415-R Anacostia Bladensburg	01	9/14/2015		9200		1700	19	<2	14	21.1	8.25	0.298	6.29	0.5
Anacostia Benning Road	02-L-091415-R Anacostia Benning Road	02	9/14/2015		490		330	16	<2	24	22.8	7.86	0.447	3.39	
Anacostia PA Ave Seafarers	03-B-091415-R Anacostia PA Ave Seafarers	03	9/14/2015		790		130	22	<2	21	24.1	7.33	0.443	3.63	0.5
Anacostia Capitol St. Bridge	04-B-091415-R Anacostia Capitol St. Bridge	04	9/14/2015		110		27	14	<2	17	25.4	7.2	0.414	4.04	0.7
Anacostia Haines Point	05-B-091415-R Anacostia Haines Point	05	9/14/2015		33		33	10	<2	8	24.3	7.4	0.423	6.31	1.1
Potomac Three Sisters Island	06-B-091415-R Potomac Three Sisters Island	06	9/14/2015		130		49	6	<2	8	24	7.89	0.387	7.95	1.4
Potomac Three Sisters Island	06-B-091415-R Potomac Three Sisters Island-D	06-D	9/14/2015		170										
Potomac Upstream of Rock Creek	07-B-091415-R Potomac Upstream of Rock Creek	07	9/14/2015		540		170	7	<2	7	24.5	7.7	0.372	7.05	1.2
Potomac Upstream of Rock Creek	07-B-091415-R Potomac Upstream of Rock Creek-D	07-D	9/14/2015				920		<2						
Potomac 14th St. Bridge	08-B-091415-R Potomac 14th St. Bridge	08	9/14/2015		>=1600		94	7	<2	11	25.1	7.56	0.396	6.06	1.1
Potomac 14th St. Bridge	08-B-091415-R Potomac 14th St. Bridge-D	08-D	9/14/2015					8							
Potomac Wilson Bridge	09-B-091415-R Potomac Wilson Bridge	09	9/14/2015		79		49	13	<2	14	24.2	7.36	0.449	6.39	1.1
Rock Creek Boundary Bridge	10-L-091415-R Rock Creek Boundary Bridge	10	9/14/2015		3500		3500				17.6	8.16	0.395	5.67	
Rock Creek Tilden St	11-L-091415-R Rock Creek Tilden St	11	9/14/2015		1600		1600				17.8	8.09	0.515	7.85	
Rock Creek Porter St	12-L-091415-R Rock Creek Porter St	12	9/14/2015		540		540				18	8.03	0.487	8.66	
Rock Creek Porter St	12-L-091415-R Rock Creek Porter St-D	12-D	9/14/2015								18	7.95	0.487	8.68	
Rock Creek PA Ave	13-L-091415-R Rock Creek PA Ave	13	9/14/2015		700		490	5	<2		23.6	8.1	0.375	7.08	
Rock Creek PA Ave	13-L-091415-R Rock Creek PA Ave-D	13-D	9/14/2015								23.6	8.09	0.376	7.14	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
	BE-091415-R Boat Equipment Blank		9/14/2015		<1		<1	<1	<2	10					
	LE-091415-R Land Equipment Blank		9/14/2015		1		1	<1	5	<6					
Anacostia Bladensburg	01-L-092115-R Anacostia Bladensburg	01	9/21/2015		790		790	18	<2	24	22.9	8.12	0.48	6.02	0.5
Anacostia Bladensburg	01-L-092115-R Anacostia Bladensburg-D	01-D	9/21/2015								22.9	8.11	0.479	6.01	
Anacostia Benning Road	02-L-092115-R Anacostia Benning Road	02	9/21/2015		92		61	27	<2	32	23.4	8.33	0.403	5.05	
Anacostia PA Ave Seafarers	03-B-092115-R Anacostia PA Ave Seafarers	03	9/21/2015		130		79	21	<2	26	23.6	7.09	0.407	4.71	0.45
Anacostia Capitol St. Bridge	04-B-092115-R Anacostia Capitol St. Bridge	04	9/21/2015		1400		310	16	<2	18	24.6	7.2	0.417	5.6	0.55
Anacostia Haines Point	05-B-092115-R Anacostia Haines Point	05	9/21/2015		49		49	11	<2	16	23.8	7.62	0.41	7.46	0.8
Potomac Three Sisters Island	06-B-092115-R Potomac Three Sisters Island	06	9/21/2015		4		2	4	<2	<6	24.1	8.16	0.383	8.04	1.6
Potomac Upstream of Rock Creek	07-B-092115-R Potomac Upstream of Rock Creek	07	9/21/2015		33		8	4	<2	<6	24.1	8.11	0.387	7.79	1.4
Potomac Upstream of Rock Creek	07-B-092115-R Potomac Upstream of Rock Creek-D	07-D	9/21/2015		33										
Potomac 14th St. Bridge	08-B-092115-R Potomac 14th St. Bridge	08	9/21/2015		17		2	11	<2	15	23.7	8.04	0.395	8.08	0.9
Potomac 14th St. Bridge	08-B-092115-R Potomac 14th St. Bridge-D	08-D	9/21/2015				8								
Potomac Wilson Bridge	09-B-092115-R Potomac Wilson Bridge	09	9/21/2015		31		23	9	<2	13	23.9	7.45	0.436	7.39	0.9
Rock Creek Boundary Bridge	10-L-092115-R Rock Creek Boundary Bridge	10	9/21/2015		2400		280				19.6	7.77	0.821	6.51	
Rock Creek Tilden St	11-L-092115-R Rock Creek Tilden St	11	9/21/2015		350		170				19.8	7.96	0.755	7.81	
Rock Creek Porter St	12-L-092115-R Rock Creek Porter St	12	9/21/2015		170		170				19.3	8.18	0.753	8.54	
Rock Creek PA Ave	13-L-092115-R Rock Creek PA Ave	13	9/21/2015		790		490	4	<2		23.3	8.36	0.197	8.04	
	BE-092115-R Boat Equipment Blank		9/21/2015		<1		<1	<1	<2	<6					
	BF-092115-R Boat Field Blank		9/21/2015		<1		<1	<1	<2	<6					
	LE-092115-R Land Equipment Blank		9/21/2015		>23		>23	<1	<2	<6					
	LF-092115-R Land Field Blank		9/21/2015		<1		<1	<1	<2	7					
Anacostia Bladensburg	01-L-092815-R Anacostia Bladensburg	01	9/28/2015		460		460	6	<2	12	20.7	8.22	0.486	5.72	0.8
Anacostia Benning Road	02-L-092815-R Anacostia Benning Road	02	9/28/2015		130		79	40	<2	28	20.9	8.26	0.41	5.17	
Anacostia Benning Road	02-L-092815-R Anacostia Benning Road-D	02-D	9/28/2015								20.9	8.11	0.41	5.13	
Anacostia PA Ave Seafarers	03-B-092815-R Anacostia PA Ave Seafarers	03	9/28/2015		490		330	16	<2	15	21.2	7.46	0.409	5.37	0.45
Anacostia Capitol St. Bridge	04-B-092815-R Anacostia Capitol St. Bridge	04	9/28/2015		79		79	8	<2	16	21.6	7.55	0.406	6.85	0.7
Anacostia Haines Point	05-B-092815-R Anacostia Haines Point	05	9/28/2015		130		130	7	<2	17	21.4	7.49	0.425	7.36	1
Potomac Three Sisters Island	06-B-092815-R Potomac Three Sisters Island	06	9/28/2015		22		11	2	<2	<6	21.4	8.06	0.398	8.73	2
Potomac Upstream of Rock Creek	07-B-092815-R Potomac Upstream of Rock Creek	07	9/28/2015		23		8	4	<2	12	21.6	7.97	0.395	8.53	1.3
Potomac 14th St. Bridge	08-B-092815-R Potomac 14th St. Bridge	08	9/28/2015		5		5	5	<2	10	21.8	7.81	0.389	7.77	1.15
Potomac 14th St. Bridge	08-B-092815-R Potomac 14th St. Bridge-D	08-D	9/28/2015						<2						

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac Wilson Bridge	09-B-092815-R Potomac Wilson Bridge	09	9/28/2015		33		33	8	<2	9	21.4	7.59	0.45	7.58	0.85
Potomac Wilson Bridge	09-B-092815-R Potomac Wilson Bridge-D	09-D	9/28/2015					9		11					
Rock Creek Boundary Bridge	10-L-092815-R Rock Creek Boundary Bridge	10	9/28/2015		790		790				18.8	8.46	0.81	7.17	
Rock Creek Tilden St	11-L-092815-R Rock Creek Tilden St	11	9/28/2015		920		280				19.1	8.2	0.834	8.82	
Rock Creek Porter St	12-L-092815-R Rock Creek Porter St	12	9/28/2015		170		170				18.9	8.14	0.422	9.06	
Rock Creek PA Ave	13-L-092815-R Rock Creek PA Ave	13	9/28/2015		110		110	4	<2		20.6	8.25	0.442	8.81	
	BE-092815-R Boat Equipment Blank		9/28/2015		1		<1	<1	<2	<6					
	LE-092815-R Land Equipment Blank		9/28/2015		5		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-100515-R Anacostia Bladensburg	01	10/5/2015		3300		2300	7	<2	<6	15	8.13	0.324	9.12	0.8
Anacostia Benning Road	02-L-100515-R Anacostia Benning Road	02	10/5/2015		490		460	22	<2	<6	14.7	8.15	0.247	7.65	
Anacostia PA Ave Seafarers	03-B-100515-R Anacostia PA Ave Seafarers	03	10/5/2015		490		490	21	<2	<6	14.4	7.5	0.239	7.68	0.3
Anacostia PA Ave Seafarers	03-B-100515-R Anacostia PA Ave Seafarers-D	03-D	10/5/2015								14.4	7.48	0.239	7.67	
Anacostia Capitol St. Bridge	04-B-100515-R Anacostia Capitol St. Bridge	04	10/5/2015		790		790	15	<2	<6	16	7.38	0.226	6.78	0.35
Anacostia Haines Point	05-B-100515-R Anacostia Haines Point	05	10/5/2015		490		490	11	<2	<6	16.4	7.5	0.305	8.99	0.7
Potomac Three Sisters Island	06-B-100515-R Potomac Three Sisters Island	06	10/5/2015		700		700	36	<2	7	15.1	7.64	0.342	10.38	0.3
Potomac Upstream of Rock Creek	07-B-100515-R Potomac Upstream of Rock Creek	07	10/5/2015		1300		1300	18	<2	14	15.4	7.56	0.341	10.35	0.5
Potomac 14th St. Bridge	08-B-100515-R Potomac 14th St. Bridge	08	10/5/2015		1400		1400	18	<2	7	15.5	7.55	0.336	10.11	0.45
Potomac 14th St. Bridge	08-B-100515-R Potomac 14th St. Bridge-D	08-D	10/5/2015		1100										
Potomac Wilson Bridge	09-B-100515-R Potomac Wilson Bridge	09	10/5/2015		490		490	15	<2	<6	16.3	7.58	0.312	9.25	0.7
Potomac Wilson Bridge	09-B-100515-R Potomac Wilson Bridge-D	09-D	10/5/2015				330								
Rock Creek Boundary Bridge	10-L-100515-R Rock Creek Boundary Bridge	10	10/5/2015		230		230				15	7.94	0.381	9.36	
Rock Creek Tilden St	11-L-100515-R Rock Creek Tilden St	11	10/5/2015		230		230				14.1	7.81	0.362	10.12	
Rock Creek Porter St	12-L-100515-R Rock Creek Porter St	12	10/5/2015		330		330				14.1	7.86	0.369	10.44	
Rock Creek PA Ave	13-L-100515-R Rock Creek PA Ave	13	10/5/2015		680		400	1	<2		14	7.8		10.51	
	BE-100515-R Boat Equipment Blank		10/5/2015		7		2	<1	<2	<6					
	LE-100515-R Land Equipment Blank		10/5/2015		5		7	<1	<2	<6					
Anacostia Bladensburg	01-L-100815-R Anacostia Bladensburg	01	10/8/2015		5400		5400	5	<2	<6	18.9	8.45	0.418	7.68	0.8
Anacostia Benning Road	02-L-100815-R Anacostia Benning Road	02	10/8/2015		790		220	15	<2	<6	17.5	8.56	0.323	5.6	
Anacostia PA Ave Seafarers	03-B-100815-R Anacostia PA Ave Seafarers	03	10/8/2015		460		460	22	<2	<6	17	7.41	0.268	5.13	0.4
Anacostia Capitol St. Bridge	04-B-100815-R Anacostia Capitol St. Bridge	04	10/8/2015		1700		1100	12	<2	6	17.2	7.32	0.246	6.06	0.5
Anacostia Capitol St. Bridge	04-B-100815-R Anacostia Capitol St. Bridge-D	04-D	10/8/2015								17.2	7.24	0.246	5.82	
Anacostia Haines Point	05-B-100815-R Anacostia Haines Point	05	10/8/2015		540		350	9	<2	<6	16.9	7.28	0.279	7.81	0.8

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-100815-R Anacostia Haines Point-D	05-D	10/8/2015								16.9	7.28	0.279	7.79	
Potomac Three Sisters Island	06-B-100815-R Potomac Three Sisters Island	06	10/8/2015												
Potomac Upstream of Rock Creek	07-B-100815-R Potomac Upstream of Rock Creek	07	10/8/2015		350		350	23	<2	<6	18.6	8.9	0.268	10.07	0.6
Potomac 14th St. Bridge	08-B-100815-R Potomac 14th St. Bridge	08	10/8/2015		350		350	28	<2	6	16.6	7.75	0.268	10.07	0.6
Potomac Wilson Bridge	09-B-100815-R Potomac Wilson Bridge	09	10/8/2015		540		540	19	<2	<6	16.2	7.52	0.29	9.95	0.6
Potomac Wilson Bridge	09-B-100815-R Potomac Wilson Bridge-D	09-D	10/8/2015		540				<2						
Rock Creek Boundary Bridge	10-L-100815-R Rock Creek Boundary Bridge	10	10/8/2015		140		110				15.4	9.1	0.501	8.5	
Rock Creek Boundary Bridge	10-L-100815-R Rock Creek Boundary Bridge-D	10-D	10/8/2015				490								
Rock Creek Tilden St	11-L-100815-R Rock Creek Tilden St	11	10/8/2015		49		49				15.7	8.97	0.486	9.27	
Rock Creek Porter St	12-L-100815-R Rock Creek Porter St	12	10/8/2015		79		79				15.7	8.7	0.505	9.8	
Rock Creek PA Ave	13-L-100815-R Rock Creek PA Ave	13	10/8/2015		140		70	2	<2		16.8	8.68	0.462	9.04	
Rock Creek PA Ave	13-L-100815-R Rock Creek PA Ave-D	13-D	10/8/2015					1							
	BE-100815-R Boat Equipment Blank		10/8/2015		9		<1	<1	<2	<6					
	BF-100815-R Boat Field Blank		10/8/2015		<1		<1	<1	<2	<6					
	LE-100815-R Land Equipment Blank		10/8/2015		5		1	<1	<2	<6					
	LF-100815-R Land Field Blank		10/8/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-101315-R Anacostia Bladensburg	01	10/13/2015		330		330	10	<2	9	18.6	8.28	0.385	8.38	0.8
Anacostia Benning Road	02-L-101315-R Anacostia Benning Road	02	10/13/2015		170		110	15	<2	8	18.7	8.1	0.311	3.67	
Anacostia PA Ave Seafarers	03-B-101315-R Anacostia PA Ave Seafarers	03	10/13/2015		490		220	14	<2	11	18.5	7.07	0.293	4.02	0.6
Anacostia Capitol St. Bridge	04-B-101315-R Anacostia Capitol St. Bridge	04	10/13/2015		130		79	10	<2	10	18.1	7.27	0.274	6.37	0.7
Anacostia Haines Point	05-B-101315-R Anacostia Haines Point	05	10/13/2015		130		79	10	<2	<6	18.1	7.37	0.282	8.51	0.9
Potomac Three Sisters Island	06-B-101315-R Potomac Three Sisters Island	06	10/13/2015		170		170	7	<2	<6	17.8	7.99	0.264	9.42	1.1
Potomac Three Sisters Island	06-B-101315-R Potomac Three Sisters Island-D	06-D	10/13/2015								17.8	7.95	0.264	9.44	
Potomac Upstream of Rock Creek	07-B-101315-R Potomac Upstream of Rock Creek	07	10/13/2015		280		170	6	<2	<6	18.2	7.95	0.264	9.46	1.1
Potomac 14th St. Bridge	08-B-101315-R Potomac 14th St. Bridge	08	10/13/2015		49		33	8	<2	<6	17.8	7.85	0.263	9.16	1.1
Potomac Wilson Bridge	09-B-101315-R Potomac Wilson Bridge	09	10/13/2015		240		240	9	<2	<6	18.3	7.56	0.283	8.47	0.9
Rock Creek Boundary Bridge	10-L-101315-R Rock Creek Boundary Bridge	10	10/13/2015		230		230				14.7	8.11	0.482	8.2	
Rock Creek Tilden St	11-L-101315-R Rock Creek Tilden St	11	10/13/2015		920		350				15.3	7.95	0.459	9.14	
Rock Creek Porter St	12-L-101315-R Rock Creek Porter St	12	10/13/2015		110		70				15.2	7.9	0.468	9.89	
Rock Creek PA Ave	13-L-101315-R Rock Creek PA Ave	13	10/13/2015		170		170	3	<2		17.6	8.29	0.307	9.23	
	BE-101315-R Boat Equipment Blank		10/13/2015		<1		<1	<1	<2	<6					
	LE-101315-R Land Equipment Blank		10/13/2015		1		1	<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-101915-R Anacostia Bladensburg	01	10/19/2015		230		230	7	<2	9	11.6	8.49	0.465	10.71	0.8
Anacostia Bladensburg	01-L-101915-R Anacostia Bladensburg-D	01-D	10/19/2015					9							
Anacostia Benning Road	02-L-101915-R Anacostia Benning Road	02	10/19/2015		94		46	14	<2	27	14	8.22	0.35	6.2	
Anacostia Benning Road	02-L-101915-R Anacostia Benning Road-D	02-D	10/19/2015							20					
Anacostia PA Ave Seafarers	03-B-101915-R Anacostia PA Ave Seafarers	03	10/19/2015		330		130	20	<2	28	13.9	6.99	0.34	5.61	0.5
Anacostia Capitol St. Bridge	04-B-101915-R Anacostia Capitol St. Bridge	04	10/19/2015		170		140	13	<2	21	16.1	7.38	0.31	5.66	0.6
Anacostia Haines Point	05-B-101915-R Anacostia Haines Point	05	10/19/2015		170		110	10	<2	12	14.8	7.5	0.299	8.94	1
Potomac Three Sisters Island	06-B-101915-R Potomac Three Sisters Island	06	10/19/2015		33		33	3	<2	<6	14.3	8.19	0.317	10.5	1.9
Potomac Upstream of Rock Creek	07-B-101915-R Potomac Upstream of Rock Creek	07	10/19/2015		130		130	4	<2	<6	14.2	7.96	0.315	10.4	1.4
Potomac Upstream of Rock Creek	07-B-101915-R Potomac Upstream of Rock Creek-D	07-D	10/19/2015								14.2	7.99	0.315	10.42	
Potomac 14th St. Bridge	08-B-101915-R Potomac 14th St. Bridge	08	10/19/2015		110		110	13	<2	<6	14.9	7.96	0.31	9.6	1.1
Potomac Wilson Bridge	09-B-101915-R Potomac Wilson Bridge	09	10/19/2015		170		110	10	<2	8	15	7.27	0.306	9.1	0.9
Rock Creek Boundary Bridge	10-L-101915-R Rock Creek Boundary Bridge	10	10/19/2015		33		33				9	8.1	0.669	9.68	
Rock Creek Boundary Bridge	10-L-101915-R Rock Creek Boundary Bridge-D	10-D	10/19/2015		79										
Rock Creek Tilden St	11-L-101915-R Rock Creek Tilden St	11	10/19/2015		170		70				8.8	8.07	0.652	11.26	
Rock Creek Tilden St	11-L-101915-R Rock Creek Tilden St-D	11-D	10/19/2015				170								
Rock Creek Porter St	12-L-101915-R Rock Creek Porter St	12	10/19/2015		140		94				8.8	8.08	0.674	11.57	
Rock Creek PA Ave	13-L-101915-R Rock Creek PA Ave	13	10/19/2015		79		49	5	<2		12.7	8.34	0.324	10.45	
Rock Creek PA Ave	13-L-101915-R Rock Creek PA Ave-D	13-D	10/19/2015						<2						
	BE-101915-R Boat Equipment Blank		10/19/2015		<1		<1	<1	<2	<6					
	LE-101915-R Land Equipment Blank		10/19/2015		1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-102215-R Anacostia Bladensburg	01	10/22/2015		330		330	8	2	28	13.1	7.78	0.49	8.82	0.85
Anacostia Benning Road	02-L-102215-R Anacostia Benning Road	02	10/22/2015		79		79	18	<2	22	14.5	7.44	0.442	7.47	
Anacostia PA Ave Seafarers	03-B-102215-R Anacostia PA Ave Seafarers	03	10/22/2015		70		70	20	<2	22	14.7	7.53	0.387	7	0.5
Anacostia Capitol St. Bridge	04-B-102215-R Anacostia Capitol St. Bridge	04	10/22/2015		79		79	14	<2	14	15.9	7.55	0.322	6.14	0.65
Anacostia Haines Point	05-B-102215-R Anacostia Haines Point	05	10/22/2015		130		79	8	<2	10	15.2	7.74	0.305	8.58	0.9
Potomac Three Sisters Island	06-B-102215-R Potomac Three Sisters Island	06	10/22/2015		17		17	2	<2	<6	13.9	8.49	0.34	10.97	2.15
Potomac Upstream of Rock Creek	07-B-102215-R Potomac Upstream of Rock Creek	07	10/22/2015		8		8	2	<2	<6	13.7	8.41	0.339	11.21	2.6
Potomac 14th St. Bridge	08-B-102215-R Potomac 14th St. Bridge	08	10/22/2015		49		33	4	<2	<6	13.3	8.31	0.334	10.83	1.75
Potomac 14th St. Bridge	08-B-102215-R Potomac 14th St. Bridge-D	08-D	10/22/2015								13.3	8.32	0.334	10.84	
Potomac Wilson Bridge	09-B-102215-R Potomac Wilson Bridge	09	10/22/2015		49		49	6	<2	<6	15.3	7.77	0.333	9.5	1.15
Potomac Wilson Bridge	09-B-102215-R Potomac Wilson Bridge-D	09-D	10/22/2015								15.3	7.77	0.333	9.5	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-102215-R Rock Creek Boundary Bridge	10	10/22/2015		170		170				10.7	6.61	0.701	9.4	
Rock Creek Tilden St	11-L-102215-R Rock Creek Tilden St	11	10/22/2015		130		79				11	7.17	0.707	10.61	
Rock Creek Tilden St	11-L-102215-R Rock Creek Tilden St-D	11-D	10/22/2015		130										
Rock Creek Porter St	12-L-102215-R Rock Creek Porter St	12	10/22/2015		79		49				11.2	7.44	0.709	10.9	
Rock Creek Porter St	12-L-102215-R Rock Creek Porter St-D	12-D	10/22/2015				49								
Rock Creek PA Ave	13-L-102215-R Rock Creek PA Ave	13	10/22/2015		79		79	1	<2		12.7	7.68	0.588	9.96	
	BE-102215-R Boat Equipment Blank		10/22/2015		<1		<1	<1	<2	<6					
	BF-102215-R Boat Field Blank		10/22/2015		<1		<1	<1	<2	<6					
	LE-102215-R Land Equipment Blank		10/22/2015		<1		<1	<1	<2	<6					
	LF-102215-R Land Field Blank		10/22/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-102615-R Anacostia Bladensburg	01	10/26/2015		460		460	18	<2	58	14.2	8.22	0.476	9.68	0.65
Anacostia Bladensburg	01-L-102615-R Anacostia Bladensburg-D	01-D	10/26/2015						<2						
Anacostia Benning Road	02-L-102615-R Anacostia Benning Road	02	10/26/2015		230		230	23	<2	19	14.6	8.41	0.423	6.9	
Anacostia Benning Road	02-L-102615-R Anacostia Benning Road-D	02-D	10/26/2015					23							
Anacostia PA Ave Seafarers	03-B-102615-R Anacostia PA Ave Seafarers	03	10/26/2015		330		230	31	<2	14	15.2	7.27	0.342	6.02	0.4
Anacostia PA Ave Seafarers	03-B-102615-R Anacostia PA Ave Seafarers-D	03-D	10/26/2015							10					
Anacostia Capitol St. Bridge	04-B-102615-R Anacostia Capitol St. Bridge	04	10/26/2015		1300		330	12	<2	16	15.1	7.03	0.327	7.07	0.6
Anacostia Haines Point	05-B-102615-R Anacostia Haines Point	05	10/26/2015		170		170	10	<2	8	14.7	7.42	0.351	9.51	1.3
Potomac Three Sisters Island	06-B-102615-R Potomac Three Sisters Island	06	10/26/2015		49		14	3	<2	<6	15.1	8.4	0.361	10.49	1.9
Potomac Upstream of Rock Creek	07-B-102615-R Potomac Upstream of Rock Creek	07	10/26/2015		130		130	5	<2	<6	15	8.32	0.355	10.06	1.4
Potomac 14th St. Bridge	08-B-102615-R Potomac 14th St. Bridge	08	10/26/2015		46		17	6	<2	<6	14.7	8.12	0.352	9.86	1.15
Potomac Wilson Bridge	09-B-102615-R Potomac Wilson Bridge	09	10/26/2015		130		130	10	<2	14	15.1	7.2	0.362	9.45	1
Rock Creek Boundary Bridge	10-L-102615-R Rock Creek Boundary Bridge	10	10/26/2015		170		110				12.1	8.16	0.724	8.43	
Rock Creek Tilden St	11-L-102615-R Rock Creek Tilden St	11	10/26/2015		79		79				12.4	8.03	0.731	9.77	
Rock Creek Porter St	12-L-102615-R Rock Creek Porter St	12	10/26/2015		110		70				12	7.98		10.68	
Rock Creek PA Ave	13-L-102615-R Rock Creek PA Ave	13	10/26/2015		79		22	<1	<2		13.5	8.22	0.537	9.66	
	BE-102615-R Boat Equipment Blank		10/26/2015		<1		<1	<1	<2	<6					
	LE-102615-R Land Equipment Blank		10/26/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-110215-R Anacostia Bladensburg	01	11/2/2015		330		330	11	<2	38	14.8	8.13	0.403	9.27	0.6
Anacostia Benning Road	02-L-110215-R Anacostia Benning Road	02	11/2/2015		220		170	17	<2	11	15.2	7.85	0.359	4.35	
Anacostia PA Ave Seafarers	03-B-110215-R Anacostia PA Ave Seafarers	03	11/2/2015		490		220	17	<2	10	15.2	7.1	0.351	4.85	0.35
Anacostia Capitol St. Bridge	04-B-110215-R Anacostia Capitol St. Bridge	04	11/2/2015		700		460	13	<2	9	15.4	6.87	0.351	5.44	0.45

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-110215-R Anacostia Haines Point	05	11/2/2015		130		49	9	<2	<6	14.3	7.21	0.265	9.55	0.6
Potomac Three Sisters Island	06-B-110215-R Potomac Three Sisters Island	06	11/2/2015		230		130	7	<2	<6	13.7	7.82	0.348	10.82	1
Potomac Upstream of Rock Creek	07-B-110215-R Potomac Upstream of Rock Creek	07	11/2/2015		490		330	7	<2	<6	13.6	7.67	0.342	10.8	0.9
Potomac 14th St. Bridge	08-B-110215-R Potomac 14th St. Bridge	08	11/2/2015		110		79	8	<2	<6	14	7.61	0.305	10.48	0.65
Potomac Wilson Bridge	09-B-110215-R Potomac Wilson Bridge	09	11/2/2015		230		130	9	<2	8	14.6	7.34	0.251	9.32	0.7
Rock Creek Boundary Bridge	10-L-110215-R Rock Creek Boundary Bridge	10	11/2/2015		170		170				12.8	7.38	0.5	8.43	
Rock Creek Tilden St	11-L-110215-R Rock Creek Tilden St	11	11/2/2015		110		110				13.2	7.46	0.516	9.52	
Rock Creek Porter St	12-L-110215-R Rock Creek Porter St	12	11/2/2015		33		33				13.2	7.57	0.526	10.08	
Rock Creek Porter St	12-L-110215-R Rock Creek Porter St-D	12-D	11/2/2015		79						13.2	7.6	0.526	10.17	
Rock Creek PA Ave	13-L-110215-R Rock Creek PA Ave	13	11/2/2015		230		79	<1	<2		13.6	7.14	0.494	9.11	
Rock Creek PA Ave	13-L-110215-R Rock Creek PA Ave-D	13-D	11/2/2015				170				13.6	7.67	0.494	9.04	
	BE-110215-R Boat Equipment Blank		11/2/2015		<1		<1	<1	<2	<6					
	LE-110215-R Land Equipment Blank		11/2/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-110515-R Anacostia Bladensburg	01	11/5/2015		2400		2400	23	11	230	15.5	7.71	0.396	7.59	0.5
Anacostia Bladensburg	01-L-110515-R Anacostia Bladensburg-D	01-D	11/5/2015				2400								
Anacostia Benning Road	02-L-110515-R Anacostia Benning Road	02	11/5/2015		460		210	15	<2	16					
Anacostia Benning Road	02-L-110515-R Anacostia Benning Road-D	02-D	11/5/2015						<2						
Anacostia PA Ave Seafarers	03-B-110515-R Anacostia PA Ave Seafarers	03	11/5/2015		31		31	15	<2	15	16	7.7	0.353	4.74	0.6
Anacostia PA Ave Seafarers	03-B-110515-R Anacostia PA Ave Seafarers-D	03-D	11/5/2015					13							
Anacostia Capitol St. Bridge	04-B-110515-R Anacostia Capitol St. Bridge	04	11/5/2015		170		170	9	<2	9	15.9	7.5	0.336	6.38	0.9
Anacostia Capitol St. Bridge	04-B-110515-R Anacostia Capitol St. Bridge-D	04-D	11/5/2015							7					
Anacostia Haines Point	05-B-110515-R Anacostia Haines Point	05	11/5/2015		330		330	5	<2	9	14.2	8.03	0.343	10.4	1.1
Potomac Three Sisters Island	06-B-110515-R Potomac Three Sisters Island	06	11/5/2015		140		79	5	<2	<6	14.2	8.09	0.373	10.76	1.9
Potomac Upstream of Rock Creek	07-B-110515-R Potomac Upstream of Rock Creek	07	11/5/2015		140		26	4	<2	9	14.2	8.01	0.378	10.98	1.8
Potomac 14th St. Bridge	08-B-110515-R Potomac 14th St. Bridge	08	11/5/2015		110		46	7	<2	<6	14.2	8.05	0.372	10.98	1.35
Potomac Wilson Bridge	09-B-110515-R Potomac Wilson Bridge	09	11/5/2015		230		230	6	<2	<6	14.8	7.97	0.348	9.85	1.25
Rock Creek Boundary Bridge	10-L-110515-R Rock Creek Boundary Bridge	10	11/5/2015		330		230				15.1	7.32	0.546	9.74	
Rock Creek Tilden St	11-L-110515-R Rock Creek Tilden St	11	11/5/2015		490		330				14	7.67	0.541	10.09	
Rock Creek Porter St	12-L-110515-R Rock Creek Porter St	12	11/5/2015		170		170				16	7.5	0.535	10.49	
Rock Creek PA Ave	13-L-110515-R Rock Creek PA Ave	13	11/5/2015		2200		1700	2	<2		15.2	7.74	0.508	10.09	
Rock Creek PA Ave	13-L-110515-R Rock Creek PA Ave-D	13-D	11/5/2015		2200						15.2	7.64	0.505	9.94	
	BE-110515-R Boat Equipment Blank		11/5/2015		<1		<1	<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
	BF-110515-R Boat Field Blank		11/5/2015		<1		<1	<1	<2	<6					
	LE-110515-R Land Equipment Blank		11/5/2015		2		1	<1	<2	<6					
	LF-110515-R Land Field Blank		11/5/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-110915-R Anacostia Bladensburg	01	11/9/2015		1300		490	7	<2	15	10.9	7.52	0.401	7.66	0.55
Anacostia Benning Road	02-L-110915-R Anacostia Benning Road	02	11/9/2015		130		130	15	<2	13	14.5	7.99	0.426	4.4	
Anacostia PA Ave Seafarers	03-B-110915-R Anacostia PA Ave Seafarers	03	11/9/2015		110		46	18	<2	<6	14.5	7.29	0.376	3.96	0.7
Anacostia Capitol St. Bridge	04-B-110915-R Anacostia Capitol St. Bridge	04	11/9/2015		790		140	11	<2	8	15.2	7.33	0.343	6.61	0.9
Anacostia Haines Point	05-B-110915-R Anacostia Haines Point	05	11/9/2015		49		49	7	<2	<6	14.6	7.55	0.36	9.18	1.2
Potomac Three Sisters Island	06-B-110915-R Potomac Three Sisters Island	06	11/9/2015		70		70	5	<2	<6	14.6	7.99	0.328	10.46	1.7
Potomac Upstream of Rock Creek	07-B-110915-R Potomac Upstream of Rock Creek	07	11/9/2015		70		49	5	<2	<6	15.3	7.99	0.332	10.62	1.5
Potomac 14th St. Bridge	08-B-110915-R Potomac 14th St. Bridge	08	11/9/2015		79		79	11	<2	<6	15.7	7.79	0.337	9.65	1
Potomac Wilson Bridge	09-B-110915-R Potomac Wilson Bridge	09	11/9/2015		79		33	10	<2	<6	14.5	7.76	0.373	9.45	1.1
Rock Creek Boundary Bridge	10-L-110915-R Rock Creek Boundary Bridge	10	11/9/2015		170		170				10.9	7.69	0.503	8.63	
Rock Creek Tilden St	11-L-110915-R Rock Creek Tilden St	11	11/9/2015		33		33				10.7	7.71	0.555	10.43	
Rock Creek Porter St	12-L-110915-R Rock Creek Porter St	12	11/9/2015		70		70				10.6	7.84	0.558	11.17	
Rock Creek PA Ave	13-L-110915-R Rock Creek PA Ave	13	11/9/2015		230		130	1	<2		10.6	7.91	0.505	10.55	
	BE-110915-R Boat Equipment Blank		11/9/2015		<1		<1	<1	<2	<6					
	LE-110915-R Land Equipment Blank		11/9/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-111615-R Anacostia Bladensburg	01	11/16/2015		790		790	84	<2	19	11.7	8.1	0.413	9.92	0.7
Anacostia Bladensburg	01-L-111615-R Anacostia Bladensburg-D	01-D	11/16/2015		790										
Anacostia Benning Road	02-L-111615-R Anacostia Benning Road	02	11/16/2015		130		79	16	<2	<6	11.2	8.1	0.333	5.86	
Anacostia Benning Road	02-L-111615-R Anacostia Benning Road-D	02-D	11/16/2015				49				11.2	7.93	0.334	5.81	
Anacostia PA Ave Seafarers	03-B-111615-R Anacostia PA Ave Seafarers	03	11/16/2015		220		46	16	<2	<6	11.9	7.78	0.338	7.08	0.7
Anacostia PA Ave Seafarers	03-B-111615-R Anacostia PA Ave Seafarers-D	03-D	11/16/2015						<2						
Anacostia Capitol St. Bridge	04-B-111615-R Anacostia Capitol St. Bridge	04	11/16/2015		330		110	7	<2	<6	12.3	7.04	0.345	7.38	1
Anacostia Capitol St. Bridge	04-B-111615-R Anacostia Capitol St. Bridge-D	04-D	11/16/2015					7							
Anacostia Haines Point	05-B-111615-R Anacostia Haines Point	05	11/16/2015		460		210	7	<2	<6	11.1	7.48	0.319	10.49	1.4
Potomac Three Sisters Island	06-B-111615-R Potomac Three Sisters Island	06	11/16/2015		33		13	3	<2	7	9.9	7.91	0.316	11.37	2.2
Potomac Upstream of Rock Creek	07-B-111615-R Potomac Upstream of Rock Creek	07	11/16/2015		34		17	4	<2	<6	10	8.02	0.318	11.33	1.8
Potomac 14th St. Bridge	08-B-111615-R Potomac 14th St. Bridge	08	11/16/2015		49		33	4	<2	<6	10	7.78	0.318	11.36	1.8
Potomac Wilson Bridge	09-B-111615-R Potomac Wilson Bridge	09	11/16/2015		49		49	9	<2	8	11.7	7.46	0.333	10.22	1.1
Rock Creek Boundary Bridge	10-L-111615-R Rock Creek Boundary Bridge	10	11/16/2015		170		170				8.2	7.81	0.47	10.48	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Tilden St	11-L-111615-R Rock Creek Tilden St	11	11/16/2015		49		49				8.4	7.79	0.481	11.47	
Rock Creek Porter St	12-L-111615-R Rock Creek Porter St	12	11/16/2015		110		110				8.3	7.92	0.495	11.59	
Rock Creek PA Ave	13-L-111615-R Rock Creek PA Ave	13	11/16/2015		130		79	<1	<2		8.8	7.91	0.484	10.82	
	BE-111615-R Boat Equipment Blank		11/16/2015		<1		<1	<1	<2	<6					
	LE-111615-R Land Equipment Blank		11/16/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-111915-R Anacostia Bladensburg	01	11/19/2015		330		330	9	<2	<6	13.5	8.27	0.444	9.12	0.8
Anacostia Benning Road	02-L-111915-R Anacostia Benning Road	02	11/19/2015		49		33	17	<2	13	12.5	6.19	0.353	6.16	
Anacostia PA Ave Seafarers	03-B-111915-R Anacostia PA Ave Seafarers	03	11/19/2015		49		49	17	<2	10	12.3	7.98	0.351	6.52	0.65
Anacostia PA Ave Seafarers	03-B-111915-R Anacostia PA Ave Seafarers-D	03-D	11/19/2015								12.3	7.93	0.35	6.46	
Anacostia Capitol St. Bridge	04-B-111915-R Anacostia Capitol St. Bridge	04	11/19/2015		170		79	9	<2	8	12.2	7.24	0.339	7.74	0.75
Anacostia Haines Point	05-B-111915-R Anacostia Haines Point	05	11/19/2015		49		49	4	<2	6	11.6	7.7	0.33	10.25	1.6
Anacostia Haines Point	05-B-111915-R Anacostia Haines Point-D	05-D	11/19/2015							10					
Potomac Three Sisters Island	06-B-111915-R Potomac Three Sisters Island	06	11/19/2015		8		8	3	<2	<6	11.4	8.21	0.351	11.37	2
Potomac Upstream of Rock Creek	07-B-111915-R Potomac Upstream of Rock Creek	07	11/19/2015		33		17	3	<2	6	11.4	8.35	0.353	11.74	2
Potomac 14th St. Bridge	08-B-111915-R Potomac 14th St. Bridge	08	11/19/2015		33		33	5	<2	<6	11.1	8.25	0.342	11.5	1.5
Potomac Wilson Bridge	09-B-111915-R Potomac Wilson Bridge	09	11/19/2015		23		23	4	<2	<6	11.4	7.89	0.334	11.04	1.5
Rock Creek Boundary Bridge	10-L-111915-R Rock Creek Boundary Bridge	10	11/19/2015		790		790				11.7	7.81	0.511	9.4	
Rock Creek Tilden St	11-L-111915-R Rock Creek Tilden St	11	11/19/2015		79		79				12.1	7.91	0.545	10.13	
Rock Creek Porter St	12-L-111915-R Rock Creek Porter St	12	11/19/2015		33		33				12.1	7.89	0.546	10.48	
Rock Creek PA Ave	13-L-111915-R Rock Creek PA Ave	13	11/19/2015		70		49	2	<2		12.5	8.04	0.525	9.63	
	BE-111915-R Boat Equipment Blank		11/19/2015		<1		<1	<1	<2	<6					
	BF-111915-R Boat Field Blank		11/19/2015		<1		<1	<1	<2	<6					
	LE-111915-R Land Equipment Blank		11/19/2015		<1		<1	<1	<2	<6					
	LF-111915-R Land Field Blank		11/19/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-113015-R Anacostia Bladensburg	01	11/30/2015		790		790	10	<2	<6	9.4	8.14	0.426	9.22	0.7
Anacostia Benning Road	02-L-113015-R Anacostia Benning Road	02	11/30/2015		330		230	16	<2	<6	9.4	8.25	0.383	7.56	
Anacostia Benning Road	02-L-113015-R Anacostia Benning Road-D	02-D	11/30/2015		490										
Anacostia PA Ave Seafarers	03-B-113015-R Anacostia PA Ave Seafarers	03	11/30/2015		130		130	12	<2	<6	9.7	7.27	0.342	8.39	0.55
Anacostia PA Ave Seafarers	03-B-113015-R Anacostia PA Ave Seafarers-D	03-D	11/30/2015				170								
Anacostia Capitol St. Bridge	04-B-113015-R Anacostia Capitol St. Bridge	04	11/30/2015		49		49	5	<2	<6	9.2	7.63	0.332	10.04	1.1
Anacostia Capitol St. Bridge	04-B-113015-R Anacostia Capitol St. Bridge-D	04-D	11/30/2015						<2		9.2	7.65	0.332	10.01	
Anacostia Haines Point	05-B-113015-R Anacostia Haines Point	05	11/30/2015		49		33	6	<2	<6	8.7	7.94	0.322	11.58	1.5

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-113015-R Anacostia Haines Point-D	05-D	11/30/2015					5							
Anacostia Haines Point	05-B-113015-R Anacostia Haines Point-D	05-D	11/30/2015								8.7	7.98	0.322	11.56	
Potomac Three Sisters Island	06-B-113015-R Potomac Three Sisters Island	06	11/30/2015		33		23	3	<2	<6	9.2	8.29	0.31	11.82	2
Potomac Upstream of Rock Creek	07-B-113015-R Potomac Upstream of Rock Creek	07	11/30/2015		79		27	3	<2	<6	9.3	8.28	0.308	11.89	1.7
Potomac 14th St. Bridge	08-B-113015-R Potomac 14th St. Bridge	08	11/30/2015		46		46	4	<2	<6	8.8	8.17	0.319	11.78	1.5
Potomac Wilson Bridge	09-B-113015-R Potomac Wilson Bridge	09	11/30/2015		33		17	8	<2	<6	9.4	7.8	0.358	11.4	1.3
Rock Creek Boundary Bridge	10-L-113015-R Rock Creek Boundary Bridge	10	11/30/2015		790		490				8.9	7.82	0.475	10.12	
Rock Creek Tilden St	11-L-113015-R Rock Creek Tilden St	11	11/30/2015		330		330				8.5	8.07	0.549	11.35	
Rock Creek Porter St	12-L-113015-R Rock Creek Porter St	12	11/30/2015		490		230				8.5	8.09	0.553	11.72	
Rock Creek PA Ave	13-L-113015-R Rock Creek PA Ave	13	11/30/2015		490		490	1	<2		8.7	8.1	0.555	10.73	
	BE-113015-R Boat Equipment Blank		11/30/2015		<1		<1	<1	<2	<6					
	LE-113015-R Land Equipment Blank		11/30/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-120315-R Anacostia Bladensburg	01	12/3/2015		230		230	5	<2	<6	9.6	8.36	0.294	10.73	0.7
Anacostia Benning Road	02-L-120315-R Anacostia Benning Road	02	12/3/2015		790		790	23	2	8	10.3	8.36	0.271	9.24	
Anacostia PA Ave Seafarers	03-B-120315-R Anacostia PA Ave Seafarers	03	12/3/2015		1700		1400	31	<2	10	9.8	7.14	0.255	9.13	0.4
Anacostia PA Ave Seafarers	03-B-120315-R Anacostia PA Ave Seafarers-D	03-D	12/3/2015		5400										
Anacostia Capitol St. Bridge	04-B-120315-R Anacostia Capitol St. Bridge	04	12/3/2015		1400		1100	12	<2	<6	9.5	7.24	0.344	8.66	0.5
Anacostia Capitol St. Bridge	04-B-120315-R Anacostia Capitol St. Bridge-D	04-D	12/3/2015				1700								
Anacostia Haines Point	05-B-120315-R Anacostia Haines Point	05	12/3/2015		5400		3500	3	<2	6	8.9	7.48	0.326	11.09	1.6
Potomac Three Sisters Island	06-B-120315-R Potomac Three Sisters Island	06	12/3/2015		110		110	12	<2	<6	8.3	8.05	0.298	11.96	0.9
Potomac Three Sisters Island	06-B-120315-R Potomac Three Sisters Island-D	06-D	12/3/2015							<6	8.3	8.03	0.298	11.95	
Potomac Upstream of Rock Creek	07-B-120315-R Potomac Upstream of Rock Creek	07	12/3/2015		170		170	8	<2	9	8.4	8.01	0.302	11.87	0.8
Potomac 14th St. Bridge	08-B-120315-R Potomac 14th St. Bridge	08	12/3/2015		49		49	6	<2	8	8.3	7.81	0.315	11.86	0.9
Potomac Wilson Bridge	09-B-120315-R Potomac Wilson Bridge	09	12/3/2015		330		330	5	<2	<6	8.6	7.84	0.297	11.53	0.7
Rock Creek Boundary Bridge	10-L-120315-R Rock Creek Boundary Bridge	10	12/3/2015		3500		3500				9.3	8.22	0.304	10.13	
Rock Creek Tilden St	11-L-120315-R Rock Creek Tilden St	11	12/3/2015		1700		1100				8.8	8.33	0.346	11.23	
Rock Creek Porter St	12-L-120315-R Rock Creek Porter St	12	12/3/2015		490		490				8.8	8.28	0.347	11.7	
Rock Creek PA Ave	13-L-120315-R Rock Creek PA Ave	13	12/3/2015		1100		700	4	<2		8.9	8.36	0.341	11.17	
	BE-120315-R Boat Equipment Blank		12/3/2015		<1		<1	<1	<2	<6					
	LE-120315-R Land Equipment Blank		12/3/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-120715-R Anacostia Bladensburg	01	12/7/2015		490		330	3	<2	<6	6.1	7.89	0.406	11.31	1.85
Anacostia Benning Road	02-L-120715-R Anacostia Benning Road	02	12/7/2015		220		110	15	<2	9	7.2	8.14	0.348	9.53	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia PA Ave Seafarers	03-B-120715-R Anacostia PA Ave Seafarers	03	12/7/2015		330		33	16	<2	9	8.4	7.79	0.293	7.58	0.5
Anacostia Capitol St. Bridge	04-B-120715-R Anacostia Capitol St. Bridge	04	12/7/2015		130		27	6	<2	8	8.7	7.47	0.32	8.72	0.8
Anacostia Haines Point	05-B-120715-R Anacostia Haines Point	05	12/7/2015		49		49	6	<2	<6	7.5	7.54	0.319	11.64	1.2
Anacostia Haines Point	05-B-120715-R Anacostia Haines Point-D	05-D	12/7/2015						<2						
Potomac Three Sisters Island	06-B-120715-R Potomac Three Sisters Island	06	12/7/2015		49		49	12	<2	11	6.6	8.01	0.287	12.81	0.9
Potomac Three Sisters Island	06-B-120715-R Potomac Three Sisters Island-D	06-D	12/7/2015					13							
Potomac Upstream of Rock Creek	07-B-120715-R Potomac Upstream of Rock Creek	07	12/7/2015		33		33	12	<2	6	6.8	8.14	0.29	12.65	1
Potomac Upstream of Rock Creek	07-B-120715-R Potomac Upstream of Rock Creek-D	07-D	12/7/2015								6.8	8.06	0.29	12.73	
Potomac 14th St. Bridge	08-B-120715-R Potomac 14th St. Bridge	08	12/7/2015		79		49	9	<2	<6	6.9	7.75	0.3	12.75	1
Potomac Wilson Bridge	09-B-120715-R Potomac Wilson Bridge	09	12/7/2015		230		230	8	<2	12	6.8	7.66	0.322	12.71	1.1
Rock Creek Boundary Bridge	10-L-120715-R Rock Creek Boundary Bridge	10	12/7/2015		79		79				5	7.68	0.444	11.93	
Rock Creek Tilden St	11-L-120715-R Rock Creek Tilden St	11	12/7/2015		33		23				4.6	7.72	0.457	12.52	
Rock Creek Porter St	12-L-120715-R Rock Creek Porter St	12	12/7/2015		33		33				4.8	7.72	0.47	12.83	
Rock Creek PA Ave	13-L-120715-R Rock Creek PA Ave	13	12/7/2015		22		22	<1	<2		5.4	7.9	0.463	12.27	
	BE-120715-R Boat Equipment Blank		12/7/2015		<1		<1	<1	<2	<6					
	BF-120715-R Boat Field Blank		12/7/2015		<1		<1	<1	<2	10					
	LE-120715-R Land Equipment Blank		12/7/2015		<1		<1	<1	<2	<6					
	LF-120715-R Land Field Blank		12/7/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-121415-R Anacostia Bladensburg	01	12/14/2015		230		230	13	<2	8	11.4	8.29	0.423	9.68	0.5
Anacostia Benning Road	02-L-121415-R Anacostia Benning Road	02	12/14/2015		79		79	17	<2	6	10.2	8.45	0.365	7.5	
Anacostia PA Ave Seafarers	03-B-121415-R Anacostia PA Ave Seafarers	03	12/14/2015		110		110	12	<2	<6	9.5	7.7	0.325	7.66	0.4
Anacostia Capitol St. Bridge	04-B-121415-R Anacostia Capitol St. Bridge	04	12/14/2015		33		33	4	<2	<6	9	7.75	0.302	9.24	0.8
Anacostia Capitol St. Bridge	04-B-121415-R Anacostia Capitol St. Bridge-D	04-D	12/14/2015		49										
Anacostia Haines Point	05-B-121415-R Anacostia Haines Point	05	12/14/2015		31		31	5	<2	<6	8.3	8	0.269	11.78	1.5
Anacostia Haines Point	05-B-121415-R Anacostia Haines Point-D	05-D	12/14/2015				40								
Potomac Three Sisters Island	06-B-121415-R Potomac Three Sisters Island	06	12/14/2015		27		22	3	<2	<6	8.5	8.16	0.26	11.93	1.7
Potomac Upstream of Rock Creek	07-B-121415-R Potomac Upstream of Rock Creek	07	12/14/2015		49		22	3	<2	<6	8.4	8.13	0.259	12.05	1.9
Potomac Upstream of Rock Creek	07-B-121415-R Potomac Upstream of Rock Creek-D	07-D	12/14/2015							<6					
Potomac 14th St. Bridge	08-B-121415-R Potomac 14th St. Bridge	08	12/14/2015		23		23	4	<2	<6	8	8.11	0.256	12.14	1.5
Potomac 14th St. Bridge	08-B-121415-R Potomac 14th St. Bridge-D	08-D	12/14/2015								8	8.1	0.256	12.16	
Potomac Wilson Bridge	09-B-121415-R Potomac Wilson Bridge	09	12/14/2015		49		49	8	<2	<6	8.5	7.88	0.279	11.63	1.1
Potomac Wilson Bridge	09-B-121415-R Potomac Wilson Bridge-D	09-D	12/14/2015								8.5	7.87	0.28	11.7	

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-121415-R Rock Creek Boundary Bridge	10	12/14/2015		230		49				10	7.73	0.501	10.91	
Rock Creek Tilden St	11-L-121415-R Rock Creek Tilden St	11	12/14/2015		23		23				9.9	7.77	0.522	10.86	
Rock Creek Porter St	12-L-121415-R Rock Creek Porter St	12	12/14/2015		23		13				9.9	7.98	0.539	11.4	
Rock Creek PA Ave	13-L-121415-R Rock Creek PA Ave	13	12/14/2015		490		490	<1	<2		10.7	8.06	0.531	10.47	
	BE-121415-R Boat Equipment Blank		12/14/2015		<1		<1	<1	<2	<6					
	LE-121415-R Land Equipment Blank		12/14/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-121715-R Anacostia Bladensburg	01	12/17/2015		170		170	13	<2	<6	11	7.81	0.426	9.18	0.55
Anacostia Benning Road	02-L-121715-R Anacostia Benning Road	02	12/17/2015		79		49	17	<2	<6	10.8	7.86	0.421	7.49	
Anacostia PA Ave Seafarers	03-B-121715-R Anacostia PA Ave Seafarers	03	12/17/2015		79		79	19	<2	6	10.8	9.05	0.379	7.78	0.45
Anacostia Capitol St. Bridge	04-B-121715-R Anacostia Capitol St. Bridge	04	12/17/2015		490		140	5	<2	<6	9.9	8.23	0.321	9.2	0.9
Anacostia Haines Point	05-B-121715-R Anacostia Haines Point	05	12/17/2015		110		33	5	<2	<6	9.8	7.89	0.285	10.81	1.4
Anacostia Haines Point	05-B-121715-R Anacostia Haines Point-D	05-D	12/17/2015				33								
Potomac Three Sisters Island	06-B-121715-R Potomac Three Sisters Island	06	12/17/2015		5		5	2	<2	<6	9.8	7.92	0.294	11.42	2
Potomac Three Sisters Island	06-B-121715-R Potomac Three Sisters Island-D	06-D	12/17/2015		2				<2						
Potomac Upstream of Rock Creek	07-B-121715-R Potomac Upstream of Rock Creek	07	12/17/2015		7		7	2	<2	<6	10.1	7.94	0.291	11.5	1.7
Potomac Upstream of Rock Creek	07-B-121715-R Potomac Upstream of Rock Creek-D	07-D	12/17/2015					3							
Potomac 14th St. Bridge	08-B-121715-R Potomac 14th St. Bridge	08	12/17/2015		23		13	3	<2	<6	10.2	7.92	0.286	10.98	1.35
Potomac Wilson Bridge	09-B-121715-R Potomac Wilson Bridge	09	12/17/2015		23		13	7	<2	<6	9.8	7.7	0.297	10.88	1.3
Rock Creek Boundary Bridge	10-L-121715-R Rock Creek Boundary Bridge	10	12/17/2015		230		230				9.7	7.71	0.523	10.18	
Rock Creek Boundary Bridge	10-L-121715-R Rock Creek Boundary Bridge-D	10-D	12/17/2015								9.7	7.67	0.523	10.18	
Rock Creek Tilden St	11-L-121715-R Rock Creek Tilden St	11	12/17/2015		70		31				9.5	7.85	0.552	10.82	
Rock Creek Porter St	12-L-121715-R Rock Creek Porter St	12	12/17/2015		49		33				9.4	7.76	0.567	11.28	
Rock Creek PA Ave	13-L-121715-R Rock Creek PA Ave	13	12/17/2015		110		79	2	<2		9.6	7.83	0.556	10.26	
	BE-121715-R Boat Equipment Blank		12/17/2015		<1		<1	<1	<2	<6					
	LE-121715-R Land Equipment Blank		12/17/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-122815-R Anacostia Bladensburg	01	12/28/2015		3500		1700	12	<2	6	12.4	7.92	0.302	9.47	0.65
Anacostia Benning Road	02-L-122815-R Anacostia Benning Road	02	12/28/2015		1100		790	37	<2	12	12.6	8.11	0.224	8.76	
Anacostia PA Ave Seafarers	03-B-122815-R Anacostia PA Ave Seafarers	03	12/28/2015		490		490	35	<2	8	13.9	7.25	0.229	6.96	0.25
Anacostia Capitol St. Bridge	04-B-122815-R Anacostia Capitol St. Bridge	04	12/28/2015		700		700	16	<2	6	12.8	7.27	0.247	8.9	0.4
Anacostia Haines Point	05-B-122815-R Anacostia Haines Point	05	12/28/2015		3500		3500	26	<2	9	12	7.4	0.241	10.83	0.35
Potomac Three Sisters Island	06-B-122815-R Potomac Three Sisters Island	06	12/28/2015		330		230	21	<2	7	11.3	7.9	0.29	11.68	0.6
Potomac Upstream of Rock Creek	07-B-122815-R Potomac Upstream of Rock Creek	07	12/28/2015		1300		350	21	<2	7	11.4	7.97	0.287	11.6	0.7

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Potomac 14th St. Bridge	08-B-122815-R Potomac 14th St. Bridge	08	12/28/2015		790		490	20	<2	8	11.7	7.68	0.277	11.39	0.5
Potomac 14th St. Bridge	08-B-122815-R Potomac 14th St. Bridge-D	08-D	12/28/2015							7					
Potomac Wilson Bridge	09-B-122815-R Potomac Wilson Bridge	09	12/28/2015		1100		1100	31	<2	9	12.4	7.8	0.24	10.73	0.35
Rock Creek Boundary Bridge	10-L-122815-R Rock Creek Boundary Bridge	10	12/28/2015		2800		1700				12	8.19	0.302	9.83	
Rock Creek Tilden St	11-L-122815-R Rock Creek Tilden St	11	12/28/2015		2200		1400				12.1	7.97	0.293	10.65	
Rock Creek Porter St	12-L-122815-R Rock Creek Porter St	12	12/28/2015		1700		700				12.1	7.94	0.291	11.03	
Rock Creek Porter St	12-L-122815-R Rock Creek Porter St-D	12-D	12/28/2015								12.1	7.89	0.291	11.04	
Rock Creek PA Ave	13-L-122815-R Rock Creek PA Ave	13	12/28/2015		2400		2400	19	<2		12.1	8.04	0.28	10.55	
Rock Creek PA Ave	13-L-122815-R Rock Creek PA Ave-D	13-D	12/28/2015								12.1	8.02	0.28	10.5	
	BE-122815-R Boat Equipment Blank		12/28/2015		<1		<1	<1	<2	<6					
	BF-122815-R Boat Field Blank		12/28/2015		<1		<1	<1	<2	<6					
	LE-122815-R Land Equipment Blank		12/28/2015		<1		<1	<1	<2	<6					
	LF-122815-R Land Field Blank		12/28/2015		<1		<1	<1	<2	<6					
Anacostia Bladensburg	01-L-010416-R Anacostia Bladensburg	01	1/4/2016		1700		1700	3	<2	<6	5	7.68	0.403	11.53	1.5
Anacostia Benning Road	02-L-010416-R Anacostia Benning Road	02	1/4/2016		330		170	11	<2	<6	5.8	7.68	0.395	10.86	
Anacostia PA Ave Seafarers	03-B-010416-R Anacostia PA Ave Seafarers	03	1/4/2016		230		230	17	<2	6	7.6	7.64	0.319	8.1	0.35
Anacostia Capitol St. Bridge	04-B-010416-R Anacostia Capitol St. Bridge	04	1/4/2016		330		330	12	<2	<6	9	7.77	0.242	8.13	0.6
Anacostia Haines Point	05-B-010416-R Anacostia Haines Point	05	1/4/2016		170		26	7	<2	6	8	7.52	0.234	11.09	0.8
Potomac Three Sisters Island	06-B-010416-R Potomac Three Sisters Island	06	1/4/2016		79		79	15	<2	6	6.6	7.99	0.225	13.1	0.8
Potomac Three Sisters Island	06-B-010416-R Potomac Three Sisters Island-D	06-D	1/4/2016		79										
Potomac Upstream of Rock Creek	07-B-010416-R Potomac Upstream of Rock Creek	07	1/4/2016		79		79	16	<2	12	6.7	7.94	0.224	13.01	0.8
Potomac Upstream of Rock Creek	07-B-010416-R Potomac Upstream of Rock Creek-D	07-D	1/4/2016				33		<2						
Potomac 14th St. Bridge	08-B-010416-R Potomac 14th St. Bridge	08	1/4/2016		46		46	16	<2	7	7	7.81	0.223	12.88	0.8
Potomac 14th St. Bridge	08-B-010416-R Potomac 14th St. Bridge-D	08-D	1/4/2016					25							
Potomac Wilson Bridge	09-B-010416-R Potomac Wilson Bridge	09	1/4/2016		33		33	8	<2	<6	6.8	7.66	0.221	12.71	1
Rock Creek Boundary Bridge	10-L-010416-R Rock Creek Boundary Bridge	10	1/4/2016		790		790				5.9	7.39	0.381	11.84	
Rock Creek Tilden St	11-L-010416-R Rock Creek Tilden St	11	1/4/2016		79		79				4.2	7.33	0.392	12.87	
Rock Creek Porter St	12-L-010416-R Rock Creek Porter St	12	1/4/2016		230		130				4.1	7.38	0.406	13.42	
Rock Creek Porter St	12-L-010416-R Rock Creek Porter St-D	12-D	1/4/2016								4.1	7.37	0.405	13.26	
Rock Creek PA Ave	13-L-010416-R Rock Creek PA Ave	13	1/4/2016		79		79	3	<2		4.5	7.48	0.408	12.86	
Rock Creek PA Ave	13-L-010416-R Rock Creek PA Ave-D	13-D	1/4/2016								4.5	7.55	0.411	12.66	
	BE-010416-R Boat Equipment Blank		1/4/2016		<1		<1	<1	<2	<6					

	Sample ID			Laboratory Data							Field Data				
				MPN/100 mL				mg/L	mg/L	mg/M3					
				SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
	LE-010416-R Land Equipment Blank		1/4/2016		<1		<1	<1	3	<6					
Anacostia Bladensburg	01-L-010716-R Anacostia Bladensburg	01	1/7/2016		940		940	2	<2	<6	1.9	8.35	0.455	13.38	1.2
Anacostia Bladensburg	01-L-010716-R Anacostia Bladensburg-D	01-D	1/7/2016								1.9	8.29	0.459	13.33	
Anacostia Benning Road	02-L-010716-R Anacostia Benning Road	02	1/7/2016		330		330	14	<2	<6	3.3	8.52	0.433	10.46	
Anacostia PA Ave Seafarers	03-B-010716-R Anacostia PA Ave Seafarers	03	1/7/2016		79		79	9	<2	<6	4.5	7.8	0.34	8.98	0.6
Anacostia Capitol St. Bridge	04-B-010716-R Anacostia Capitol St. Bridge	04	1/7/2016		330		330	8	<2	<6	6.3	7.79	0.261	9.33	0.75
Anacostia Haines Point	05-B-010716-R Anacostia Haines Point	05	1/7/2016		23		23	3	<2	<6	4.3	7.77	0.252	13.08	1.75
Potomac Three Sisters Island	06-B-010716-R Potomac Three Sisters Island	06	1/7/2016		22		17	5	<2	<6	3.2	7.81	0.255	14.07	1.65
Potomac Upstream of Rock Creek	07-B-010716-R Potomac Upstream of Rock Creek	07	1/7/2016		22		22	5	<2	<6	3.2	7.75	0.254	14.08	1.65
Potomac Upstream of Rock Creek	07-B-010716-R Potomac Upstream of Rock Creek-D	07-D	1/7/2016		23										
Potomac 14th St. Bridge	08-B-010716-R Potomac 14th St. Bridge	08	1/7/2016		17		11	4	<2	24	3	7.79	0.254	14.2	1.5
Potomac 14th St. Bridge	08-B-010716-R Potomac 14th St. Bridge-D	08-D	1/7/2016				11								
Potomac Wilson Bridge	09-B-010716-R Potomac Wilson Bridge	09	1/7/2016		31		31	10	<2	<6	4	7.71	0.251	13.5	1.4
Rock Creek Boundary Bridge	10-L-010716-R Rock Creek Boundary Bridge	10	1/7/2016		1100		700				1.3	9.29	0.487	13.77	
Rock Creek Tilden St	11-L-010716-R Rock Creek Tilden St	11	1/7/2016		79		79				1.4	8.93	0.492	14.16	
Rock Creek Porter St	12-L-010716-R Rock Creek Porter St	12	1/7/2016		170		170				1.4	8.67	0.506	14.66	
Rock Creek PA Ave	13-L-010716-R Rock Creek PA Ave	13	1/7/2016		110		110	1	<2		1.7	8.46	0.494	14	
	BE-010716-R Boat Equipment Blank		1/7/2016		<1		<1	<1	<2	<6					
	LE-010716-R Land Equipment Blank		1/7/2016		<1		<1	<1	<2	<6					

Wet Weather Sampling Data Summary

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-041915-40.1 Anacostia Bladensburg	01	4/19/2015	40.1	330	130	130	130	6	<2	9	18.4	7.74	0.564	10.3	1
Anacostia Bladensburg	01-L-041915-40.1 Anacostia Bladensburg-D	01-D	4/19/2015	40.1								18.4	7.72	0.564	10.32	
Anacostia Benning Road	02-L-041915-40.1 Anacostia Benning Road	02	4/19/2015	40.1	33	33	36	33	19	<2	10	19.5	7.63	0.584	6.9	
Anacostia PA Ave Seafarers	03-B-041915-40.1 Anacostia PA Ave Seafarers	03	4/19/2015	40.1	49	49	75	33	21	<2	9	19.14	7.34	0.568	5.5	0.5
Anacostia Capitol St. Bridge	04-B-041915-40.1 Anacostia Capitol St. Bridge	04	4/19/2015	40.1	79	79	172	79	13	<2	12	18.05	7.07	0.486	6.22	0.7
Anacostia Haines Point	05-B-041915-40.1 Anacostia Haines Point	05	4/19/2015	40.1	46	49	38	17	6	<2	17	17.77	7.38	0.271	9.44	1.2
Potomac Three Sisters Island	06-B-041915-40.1 Potomac Three Sisters Island	06	4/19/2015	40.1	4	<2	8	<2	26	<2	8	17.26	7.4	0.243	9.85	0.9
Potomac Upstream of Rock Creek	07-B-041915-40.1 Potomac Upstream of Rock Creek	07	4/19/2015	40.1	33	5	5	5	8	<2	7	17.32	7.44	0.243	9.75	1.25
Potomac 14th St. Bridge	08-B-041915-40.1 Potomac 14th St. Bridge	08	4/19/2015	40.1	13	13	6	8	7	<2	13	17.56	7.31	0.244	9.55	1.3
Potomac Wilson Bridge	09-B-041915-40.1 Potomac Wilson Bridge	09	4/19/2015	40.1	17	7	9	7	7	<2	10	17.94	7.36	0.255	9.19	1.1
Rock Creek Boundary Bridge	10-L-041915-40.1 Rock Creek Boundary Bridge	10	4/19/2015	40.1	49	350	70	350				17.87	8.06	0.475	11.06	
Rock Creek Tilden St	11-L-041915-40.1 Rock Creek Tilden St	11	4/19/2015	40.1	49	33	44	33				18.27	8.84	0.423	12.39	
Rock Creek Porter St	12-L-041915-40.1 Rock Creek Porter St	12	4/19/2015	40.1	79	79	236	49				18.12	8.79	0.414	12.29	
Rock Creek PA Ave	13-L-041915-40.1 Rock Creek PA Ave	13	4/19/2015	40.1	330	170	276	170	4	<2		18.29	8.71	0.581	12.59	
Anacostia PA Ave Seafarers	03-B-041915-40.2 Anacostia PA Ave Seafarers	03	4/19/2015	40.2	230	130	135	79	14	<2	17	17.84	7.33	0.491	6.35	
Anacostia PA Ave Seafarers	03-B-041915-40.2 Anacostia PA Ave Seafarers-D	03-D	4/19/2015	40.2						<2						
Anacostia Capitol St. Bridge	04-B-041915-40.2 Anacostia Capitol St. Bridge	04	4/19/2015	40.2	49	33	49	33	8	<2	14	17.43	7.5	0.326	8.87	
Anacostia Capitol St. Bridge	04-B-041915-40.2 Anacostia Capitol St. Bridge-D	04-D	4/19/2015	40.2					8							
Anacostia Haines Point	05-B-041915-40.2 Anacostia Haines Point	05	4/19/2015	40.2	17	49	11	49	5	<2	14	17.46	7.61	0.262	9.43	
Potomac Three Sisters Island	06-B-041915-40.2 Potomac Three Sisters Island	06	4/19/2015	40.2	70	49	52	33	11	<2	11	17.13	7.41	0.243	9.9	
Potomac Upstream of Rock Creek	07-B-041915-40.2 Potomac Upstream of Rock Creek	07	4/19/2015	40.2	13	8	7	8	7	<2	11	17.1	7.57	0.243	9.92	
Potomac 14th St. Bridge	08-B-041915-40.2 Potomac 14th St. Bridge	08	4/19/2015	40.2	2	8	4	8	6	<2	10	17.08	7.34	0.243	9.91	
Potomac Wilson Bridge	09-B-041915-40.2 Potomac Wilson Bridge	09	4/19/2015	40.2	2	5	3	5	9	<2	9	17.8	7.55	0.257	9.34	
Rock Creek Boundary Bridge	10-L-041915-40.2 Rock Creek Boundary Bridge	10	4/19/2015	40.2	33	46	70	46				17.01	7.81	0.403	9.41	
Rock Creek Tilden St	11-L-041915-40.2 Rock Creek Tilden St	11	4/19/2015	40.2	33	70	40	49				17.01	7.64	0.375	8.75	
Rock Creek Porter St	12-L-041915-40.2 Rock Creek Porter St	12	4/19/2015	40.2	23	4	48	4				16.96	7.79	0.557	8.97	
Rock Creek PA Ave	13-L-041915-40.2 Rock Creek PA Ave	13	4/19/2015	40.2	33	79	84	79	3	<2		17.2	8.51	0.891	8.86	
Anacostia Bladensburg	01-L-041915-40.2 Anacostia Bladensburg	01	4/20/2015	40.2	230	490	345	490	21	<2	27	17	8.26	0.546	9.81	
Anacostia Bladensburg	01-L-041915-40.2 Anacostia Bladensburg-D	01-D	4/20/2015	40.2	130	23										
Anacostia Benning Road	02-L-041915-40.2 Anacostia Benning Road	02	4/20/2015	40.2	330	79	73	49	29	<2	16	18.78	7.39	0.582	5.82	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Benning Road	02-L-041915-40.2 Anacostia Benning Road-D	02-D	4/20/2015	40.2			42	350				18.8	7.37	0.582	5.8	
Anacostia Bladensburg	01-L-041915-40.3 Anacostia Bladensburg	01	4/20/2015	40.3	9200	5400	16000	5400	410	2	44	14.19	7.6	0.259	9.61	0.05
Anacostia Benning Road	02-L-041915-40.3 Anacostia Benning Road	02	4/20/2015	40.3	2400	5400	10900	3500	79	3	23	14.9	7.53	0.35	8.21	
Anacostia PA Ave Seafarers	03-B-041915-40.3 Anacostia PA Ave Seafarers	03	4/20/2015	40.3	2200	16000	10800	9200	25	2	8	17.96	7.34	0.53	6.71	
Anacostia PA Ave Seafarers	03-B-041915-40.3 Anacostia PA Ave Seafarers-D	03-D	4/20/2015	40.3								17.56	7.31	0.517	6.66	
Anacostia Capitol St. Bridge	04-B-041915-40.3 Anacostia Capitol St. Bridge	04	4/20/2015	40.3	310	230	727	79	14	<2	10	17.51	7.19	0.486	6.5	
Anacostia Haines Point	05-B-041915-40.3 Anacostia Haines Point	05	4/20/2015	40.3	23	2	5	2	7	<2	9	16.94	7.62	0.243	9.47	
Anacostia Haines Point	05-B-041915-40.3 Anacostia Haines Point-D	05-D	4/20/2015	40.3							10					
Potomac Three Sisters Island	06-B-041915-40.3 Potomac Three Sisters Island	06	4/20/2015	40.3	540	540	1120	540	16	<2	8	16.47	7.56	0.236	9.82	0.5
Potomac Upstream of Rock Creek	07-B-041915-40.3 Potomac Upstream of Rock Creek	07	4/20/2015	40.3	350	540	517	540	13	<2	9	16.77	7.6	0.235	9.52	0.85
Potomac 14th St. Bridge	08-B-041915-40.3 Potomac 14th St. Bridge	08	4/20/2015	40.3	350	130	345	130	5	<2	11	17.07	7.56	0.246	9.36	1.5
Potomac Wilson Bridge	09-B-041915-40.3 Potomac Wilson Bridge	09	4/20/2015	40.3	49	13	58	13	11	<2	9	17.31	7.41	0.259	8.93	0.95
Rock Creek Boundary Bridge	10-L-041915-40.3 Rock Creek Boundary Bridge	10	4/20/2015	40.3	>=1600	>=1600	>=2420	>=1600				13.95	7.58	0.237	8.81	
Rock Creek Tilden St	11-L-041915-40.3 Rock Creek Tilden St	11	4/20/2015	40.3	>=1600	>=1600	>=2420	>=1600				14.22	7.54	0.246	9.95	
Rock Creek Porter St	12-L-041915-40.3 Rock Creek Porter St	12	4/20/2015	40.3	>=1600	>=1600	>=2420	1600				14.25	7.54	0.245	10.24	
Rock Creek PA Ave	13-L-041915-40.3 Rock Creek PA Ave	13	4/20/2015	40.3	9200	3500	9700	3500	530	2		14.61	7.44	0.256	9.61	
Anacostia Bladensburg	01-L-041915-40.4 Anacostia Bladensburg	01	4/20/2015	40.4	1600	90	11000	23	130	6	19	17.95	7.47	0.288	9	0.15
Anacostia Benning Road	02-L-041915-40.4 Anacostia Benning Road	02	4/20/2015	40.4	9200	170	17100	70	100	4	18	16.26	7.38	0.277	8.78	
Anacostia Benning Road	02-L-041915-40.4 Anacostia Benning Road-D	02-D	4/20/2015	40.4	>=16000	3500										
Anacostia PA Ave Seafarers	03-B-041915-40.4 Anacostia PA Ave Seafarers	03	4/20/2015	40.4	3500	33	6100	23	93	2	20	15.95	7.26	0.338	8.2	0.15
Anacostia PA Ave Seafarers	03-B-041915-40.4 Anacostia PA Ave Seafarers-D	03-D	4/20/2015	40.4			9800	1100								
Anacostia Capitol St. Bridge	04-B-041915-40.4 Anacostia Capitol St. Bridge	04	4/20/2015	40.4	3500	49	14600	11	12	<2	9	18.48	7.16	0.52	5.69	0.55
Anacostia Capitol St. Bridge	04-B-041915-40.4 Anacostia Capitol St. Bridge-D	04-D	4/20/2015	40.4						2		18.63	7.1	0.52	5.64	
Anacostia Haines Point	05-B-041915-40.4 Anacostia Haines Point	05	4/20/2015	40.4	49	5	68	2	7	<2	14	17.87	7.34	0.396	7.84	1.15
Anacostia Haines Point	05-B-041915-40.4 Anacostia Haines Point-D	05-D	4/20/2015	40.4					7			17.58	7.33	0.403	7.75	
Potomac Three Sisters Island	06-B-041915-40.4 Potomac Three Sisters Island	06	4/20/2015	40.4	240	7	461	2	28	<2	10	16.84	7.69	0.241	10.13	0.75
Potomac Upstream of Rock Creek	07-B-041915-40.4 Potomac Upstream of Rock Creek	07	4/20/2015	40.4	240	5	461	5	21	<2	10	16.59	7.62	0.24	10.03	0.85
Potomac 14th St. Bridge	08-B-041915-40.4 Potomac 14th St. Bridge	08	4/20/2015	40.4	350	5	770	2	14	<2	12	17.05	7.48	0.238	9.62	0.65
Potomac Wilson Bridge	09-B-041915-40.4 Potomac Wilson Bridge	09	4/20/2015	40.4	23	<2	2	<2	8	<2	12	17.83	7.55	0.245	9.29	1.25
Rock Creek Boundary Bridge	10-L-041915-40.4 Rock Creek Boundary Bridge	10	4/20/2015	40.4	>=1600	220	>=2420	70				15.62	7.41	0.236	8.75	
Rock Creek Tilden St	11-L-041915-40.4 Rock Creek Tilden St	11	4/20/2015	40.4	>=1600	140	>=2420	70				15.88	7.64	0.195	9.74	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Rock Creek Porter St	12-L-041915-40.4 Rock Creek Porter St	12	4/20/2015	40.4	>=1600	350	>=2420	110				17.55	7.6	0.199	10.04	
Rock Creek PA Ave	13-L-041915-40.4 Rock Creek PA Ave	13	4/20/2015	40.4	>=1600	9200	21600	5400	230	7		16.14	7.56	0.197	9.68	
Anacostia PA Ave Seafarers	03-B-041915-40.5 Anacostia PA Ave Seafarers	03	4/20/2015	40.5	3500	9200	17300	2800	44	2	10	17.15	7.28	0.385	7.23	
Anacostia PA Ave Seafarers	03-B-041915-40.5 Anacostia PA Ave Seafarers-D	03-D	4/20/2015	40.5	9200	2200										
Anacostia Capitol St. Bridge	04-B-041915-40.5 Anacostia Capitol St. Bridge	04	4/20/2015	40.5	1300	2800	5200	2800	12	2	10	18.09	7.23	0.473	6.64	
Anacostia Capitol St. Bridge	04-B-041915-40.5 Anacostia Capitol St. Bridge-D	04-D	4/20/2015	40.5			>=2420	1700								
Anacostia Haines Point	05-B-041915-40.5 Anacostia Haines Point	05	4/20/2015	40.5	350	1600	517	920	9	2	11	17.24	7.44	0.274	9.16	
Potomac 14th St. Bridge	08-B-041915-40.5 Potomac 14th St. Bridge	08	4/20/2015	40.5	240	540	276	540	11	<2	8	17.35	7.48	0.241	9.8	
Potomac Wilson Bridge	09-B-041915-40.5 Potomac Wilson Bridge	09	4/20/2015	40.5	130	240	548	240	9	<2	7	17.87	7.38	0.271	8.98	
Rock Creek Boundary Bridge	10-L-041915-40.5 Rock Creek Boundary Bridge	10	4/20/2015	40.5	>=1600	>=1600	>=2420	>=1600				17.67	7.56	0.383	8.39	
Rock Creek Tilden St	11-L-041915-40.5 Rock Creek Tilden St	11	4/20/2015	40.5	>=1600	>=1600	>=2420	>=1600				17.83	7.71	0.254	8.84	
Rock Creek Porter St	12-L-041915-40.5 Rock Creek Porter St	12	4/20/2015	40.5	>=1600	>=1600	>=2420	>=1600				17.72	7.6	0.257	9.25	
Rock Creek PA Ave	13-L-041915-40.5 Rock Creek PA Ave	13	4/20/2015	40.5	>=16000	5400	12200	3500	180	2		17.15	7.61	0.249	8.74	
Anacostia Bladensburg	01-L-041915-40.5 Anacostia Bladensburg	01	4/21/2015	40.5	>=16000	3500	9700	3500	99	4	10	18.23	7.58	0.31	7.81	
Anacostia Benning Road	02-L-041915-40.5 Anacostia Benning Road	02	4/21/2015	40.5	9200	>=16000	7500	>=16000	190	3	27	18.24	7.42	0.308	7.73	
Potomac Three Sisters Island	06-B-041915-40.5 Potomac Three Sisters Island	06	4/21/2015	40.5	350	540	649	540	23	<2	10	17.79	7.5	0.243	9.62	
Potomac Three Sisters Island	06-B-041915-40.5 Potomac Three Sisters Island-D	06-D	4/21/2015	40.5							11	17.79	7.55	0.243	9.7	
Potomac Upstream of Rock Creek	07-B-041915-40.5 Potomac Upstream of Rock Creek	07	4/21/2015	40.5	350	540	770	540	28	<2	9	17.74	7.51	0.242	9.72	
Anacostia Bladensburg	01-L-041915-40.6 Anacostia Bladensburg	01	4/21/2015	40.6	9200	9200	13200	9200	65	3	9	16.46	7.52	0.327	8.27	
Anacostia Benning Road	02-L-041915-40.6 Anacostia Benning Road	02	4/21/2015	40.6	>=16000	16000	6300	16000	97	2	11	17.55	7.41	0.31	6.75	
Anacostia PA Ave Seafarers	03-B-041915-40.6 Anacostia PA Ave Seafarers	03	4/21/2015	40.6	9200	5400	4100	3500	91	5	14	17.82	7.2	0.306	6.84	
Anacostia Capitol St. Bridge	04-B-041915-40.6 Anacostia Capitol St. Bridge	04	4/21/2015	40.6	3500	16000	8600	16000	54	3	13	17.22	7.2	0.355	6.91	
Anacostia Haines Point	05-B-041915-40.6 Anacostia Haines Point	05	4/21/2015	40.6	1600	540	866	540	14	<2	7	17.64	7.21	0.445	6.98	0.55
Anacostia Haines Point	05-B-041915-40.6 Anacostia Haines Point-D	05-D	4/21/2015	40.6						<2						
Potomac Three Sisters Island	06-B-041915-40.6 Potomac Three Sisters Island	06	4/21/2015	40.6	540	350	921	350	45	<2	11	16.93	7.44	0.231	10.01	0.45
Potomac Three Sisters Island	06-B-041915-40.6 Potomac Three Sisters Island-D	06-D	4/21/2015	40.6					44							
Potomac Upstream of Rock Creek	07-B-041915-40.6 Potomac Upstream of Rock Creek	07	4/21/2015	40.6	920	920	649	920	41	<2	11	17.09	7.44	0.236	9.93	0.5
Potomac Upstream of Rock Creek	07-B-041915-40.6 Potomac Upstream of Rock Creek-D	07-D	4/21/2015	40.6								17.09	7.48	0.237	9.93	
Potomac 14th St. Bridge	08-B-041915-40.6 Potomac 14th St. Bridge	08	4/21/2015	40.6	540	350	517	350	25	<2	9	17.45	7.46	0.252	9.65	0.63
Potomac Wilson Bridge	09-B-041915-40.6 Potomac Wilson Bridge	09	4/21/2015	40.6	1600	240	1203	240	12	<2	7	17.19	7.53	0.272	9.06	0.9
Rock Creek Boundary Bridge	10-L-041915-40.6 Rock Creek Boundary Bridge	10	4/21/2015	40.6	>=1600	920	>=2420	920				16.84	7.4	0.449	8.51	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Rock Creek Tilden St	11-L-041915-40.6 Rock Creek Tilden St	11	4/21/2015	40.6	>=1600	1600	>=2420	280				16.68	7.71	0.401	9.41	
Rock Creek Porter St	12-L-041915-40.6 Rock Creek Porter St	12	4/21/2015	40.6	>=1600	>=1600	>=2420	>=1600				16.63	7.7	0.387	9.76	
Rock Creek PA Ave	13-L-041915-40.6 Rock Creek PA Ave	13	4/21/2015	40.6	16000	2800	7500	2800	92	5		16.62	7.65	0.36	9.02	
	BE-041915-40.1 Boat Equipment Blank		4/19/2015	40.1	<2		<1		<1	<2	<6					
	LE-041915-40.1 Land Equipment Blank		4/19/2015	40.1	<2		<1		<1	<2	<6					
	BE-041915-40.2 Boat Equipment Blank		4/19/2015	40.2	<2		<1		<1	<2	<6					
	LE-041915-40.2 Land Equipment Blank		4/19/2015	40.2	<2		<1		<1	<2	<6					
	BE-041915-40.3 Boat Equipment Blank		4/20/2015	40.3	<2		<1		<1	<2	9					
	BF-041915-40.3 Boat Field Blank		4/20/2015	40.3	<2		<1		<1	<2	<6					
	LE-041915-40.3 Land Equipment Blank		4/20/2015	40.3	<2		<1		<1	<2	<6					
	LF-041915-40.3 Land Field Blank		4/20/2015	40.3	<2		<1		<1	<2	<6					
	BE-041915-40.4 Boat Equipment Blank		4/20/2015	40.4	2		<1		<1	<2	<6					
	LE-041915-40.4 Land Equipment Blank		4/20/2015	40.4	5		3		<1	<2	<6					
	BE-041915-40.5 Boat Equipment Blank		4/20/2015	40.5	<2		<1		<1	<2	<6					
	LE-041915-40.5 Land Equipment Blank		4/20/2015	40.5	8		4		<1	<2	<6					
	BE-041915-40.6 Boat Equipment Blank		4/21/2015	40.6	<2		<1		<1	<2	<6					
	BF-041915-40.6 Boat Field Blank		4/21/2015	40.6	<2		<1		<1	<2	<6					
	LE-041915-40.6 Land Equipment Blank		4/21/2015	40.6	13		7		<1	<2	<6					
	LF-041915-40.6 Land Field Blank		4/21/2015	40.6	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-053115-40.1 Anacostia Bladensburg	01	5/31/2015	40.1	790	230	135	230	10	2	30	28.5	7.39	0.404	6.38	0.7
Anacostia Benning Road	02-L-053115-40.1 Anacostia Benning Road	02	5/31/2015	40.1	310	490	172	490	18	<2	19	29	7.73	0.403	7.27	
Anacostia PA Ave Seafarers	03-B-053115-40.1 Anacostia PA Ave Seafarers	03	5/31/2015	40.1	230	49	93	49	14	<2	17	28.2	7.19	0.376	3.09	0.65
Anacostia Capitol St. Bridge	04-B-053115-40.1 Anacostia Capitol St. Bridge	04	5/31/2015	40.1	23	310	122	310	9	<2	16	27.4	7.43	0.293	4.08	0.8
Anacostia Capitol St. Bridge	04-B-053115-40.1 Anacostia Capitol St. Bridge-D	04-D	5/31/2015	40.1	230	49										
Anacostia Haines Point	05-B-053115-40.1 Anacostia Haines Point	05	5/31/2015	40.1	23	17	4	11	7	3	52	26.8	8.34	0.25	8.29	1.05
Anacostia Haines Point	05-B-053115-40.1 Anacostia Haines Point-D	05-D	5/31/2015	40.1			5	4								
Potomac Three Sisters Island	06-B-053115-40.1 Potomac Three Sisters Island	06	5/31/2015	40.1	49	33	11	17	7	3	47	28.7	8.59	0.242	9.08	0.95
Potomac Upstream of Rock Creek	07-B-053115-40.1 Potomac Upstream of Rock Creek	07	5/31/2015	40.1	49	79	15	14	9	4	65	29.3	8.69	0.24	9.38	0.95
Potomac Upstream of Rock Creek	07-B-053115-40.1 Potomac Upstream of Rock Creek-D	07-D	5/31/2015	40.1							64					
Potomac 14th St. Bridge	08-B-053115-40.1 Potomac 14th St. Bridge	08	5/31/2015	40.1	33	17	18	17	8	4	75	28.3	8.55	0.244	8.65	1
Potomac 14th St. Bridge	08-B-053115-40.1 Potomac 14th St. Bridge-D	08-D	5/31/2015	40.1								28.3	8.52	0.244	8.52	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Potomac Wilson Bridge	09-B-053115-40.1 Potomac Wilson Bridge	09	5/31/2015	40.1	33	5	2	2	7	<2	46	26.9	8.1	0.253	7.37	0.95
Potomac Wilson Bridge	09-B-053115-40.1 Potomac Wilson Bridge-D	09-D	5/31/2015	40.1								27	8.14	0.253	7.7	
Rock Creek Boundary Bridge	10-L-053115-40.1 Rock Creek Boundary Bridge	10	5/31/2015	40.1	79	230	135	230				24.9	7.49	0.421	7.15	
Rock Creek Tilden St	11-L-053115-40.1 Rock Creek Tilden St	11	5/31/2015	40.1	490	330	108	79				25.3	7.97	0.438	8.9	
Rock Creek Porter St	12-L-053115-40.1 Rock Creek Porter St	12	5/31/2015	40.1	230	130	128	130				25.6	8.06	0.449	8.71	
Rock Creek PA Ave	13-L-053115-40.1 Rock Creek PA Ave	13	5/31/2015	40.1	230	490	488	170	6	<2		26.3	7.88	0.409	8.08	
Anacostia Bladensburg	01-L-053115-40.2 Anacostia Bladensburg	01	5/31/2015	40.2	210	79	138	27	13	<2	11	28.4	7.52	0.402	6.74	
Anacostia Benning Road	02-L-053115-40.2 Anacostia Benning Road	02	5/31/2015	40.2	130	220	166	110	13	<2	13	26.8	7.51	0.403	6.14	
Anacostia PA Ave Seafarers	03-B-053115-40.2 Anacostia PA Ave Seafarers	03	5/31/2015	40.2	79	49	72	49	14	<2	6	27.5	7.33	0.322	3.07	
Anacostia Capitol St. Bridge	04-B-053115-40.2 Anacostia Capitol St. Bridge	04	5/31/2015	40.2	140	140	38	21	10	<2	19	26.8	7.67	0.272	5.18	
Anacostia Haines Point	05-B-053115-40.2 Anacostia Haines Point	05	5/31/2015	40.2	14	17	6	13	9	6	35	27	8	0.254	6.76	
Anacostia Haines Point	05-B-053115-40.2 Anacostia Haines Point-D	05-D	5/31/2015	40.2	23	23										
Potomac Three Sisters Island	06-B-053115-40.2 Potomac Three Sisters Island	06	5/31/2015	40.2	17	13	9	8	7	<2	38	28.7	8.42	0.239	7	
Potomac Three Sisters Island	06-B-053115-40.2 Potomac Three Sisters Island-D	06-D	5/31/2015	40.2			3	11		<2						
Potomac Upstream of Rock Creek	07-B-053115-40.2 Potomac Upstream of Rock Creek	07	5/31/2015	40.2	49	110	16	110	7	<2	49	28.5	8.6	0.241	8.6	
Potomac Upstream of Rock Creek	07-B-053115-40.2 Potomac Upstream of Rock Creek-D	07-D	5/31/2015	40.2					6							
Potomac 14th St. Bridge	08-B-053115-40.2 Potomac 14th St. Bridge	08	5/31/2015	40.2	23	23	5	8	11	<2	47	28	8.33	0.246	7.57	
Potomac Wilson Bridge	09-B-053115-40.2 Potomac Wilson Bridge	09	5/31/2015	40.2	70	23	11	13	11	<2	26	26.8	7.87	0.267	6.7	
Rock Creek Boundary Bridge	10-L-053115-40.2 Rock Creek Boundary Bridge	10	5/31/2015	40.2	220	170	155	170				24.5	7.44	0.426	6.38	
Rock Creek Boundary Bridge	10-L-053115-40.2 Rock Creek Boundary Bridge-D	10-D	5/31/2015	40.2								24.5	7.43	0.426	6.36	
Rock Creek Tilden St	11-L-053115-40.2 Rock Creek Tilden St	11	5/31/2015	40.2	330	330	249	110				24.8	7.76	0.441	7	
Rock Creek Porter St	12-L-053115-40.2 Rock Creek Porter St	12	5/31/2015	40.2	170	170	172	46				25.2	7.82	0.452	7.34	
Rock Creek PA Ave	13-L-053115-40.2 Rock Creek PA Ave	13	5/31/2015	40.2	790	1300	866	1300	5			25.1	7.79	0.415	6.97	
Anacostia Bladensburg	01-L-053115-40.3 Anacostia Bladensburg	01	6/1/2015	40.3	230	330	68	170	8	3	14	27.5	7.33	0.403	3.58	0.8
Anacostia Benning Road	02-L-053115-40.3 Anacostia Benning Road	02	6/1/2015	40.3	79	49	58	49	9	<2	8	27.1	7.29	0.359	2.22	
Anacostia PA Ave Seafarers	03-B-053115-40.3 Anacostia PA Ave Seafarers	03	6/1/2015	40.3	130	170	35	33	18	<2	11	26.9	7.26	0.308	2.85	0.5
Anacostia Capitol St. Bridge	04-B-053115-40.3 Anacostia Capitol St. Bridge	04	6/1/2015	40.3	110	33	24	33	10	<2	15	26.7	7.53	0.275	4.41	0.7
Anacostia Haines Point	05-B-053115-40.3 Anacostia Haines Point	05	6/1/2015	40.3	33	11	13	11	9	<2	23	26.8	7.86	0.256	5.98	0.85
Potomac Three Sisters Island	06-B-053115-40.3 Potomac Three Sisters Island	06	6/1/2015	40.3	17	23	7	13	6	<2	39	28.5	8.14	0.241	5.9	0.9
Potomac Upstream of Rock Creek	07-B-053115-40.3 Potomac Upstream of Rock Creek	07	6/1/2015	40.3	17	8	7	8	6	<2	50	28.2	8.2	0.241	6.28	0.9
Potomac 14th St. Bridge	08-B-053115-40.3 Potomac 14th St. Bridge	08	6/1/2015	40.3	33	33	10	11	7	<2	53	27.7	7.98	0.247	5.4	0.75

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Potomac 14th St. Bridge	08-B-053115-40.3 Potomac 14th St. Bridge-D	08-D	6/1/2015	40.3							43					
Potomac Wilson Bridge	09-B-053115-40.3 Potomac Wilson Bridge	09	6/1/2015	40.3	13	13	8	13	10	<2	22	26.5	7.7	0.278	5.88	0.85
Rock Creek Boundary Bridge	10-L-053115-40.3 Rock Creek Boundary Bridge	10	6/1/2015	40.3	3300	700	1046	310				23.9	7.38	0.421	5.83	
Rock Creek Tilden St	11-L-053115-40.3 Rock Creek Tilden St	11	6/1/2015	40.3	2200	1400	1553	460				24	7.62	0.439	6.75	
Rock Creek Tilden St	11-L-053115-40.3 Rock Creek Tilden St-D	11-D	6/1/2015	40.3								24	7.61	0.439	6.73	
Rock Creek Porter St	12-L-053115-40.3 Rock Creek Porter St	12	6/1/2015	40.3	7900	17000	7500	1700				23.5	7.69	0.475	7.43	
Rock Creek PA Ave	13-L-053115-40.3 Rock Creek PA Ave	13	6/1/2015	40.3	1400	490	548	490	4	<2		25	7.76	0.403	6.75	
Anacostia Bladensburg	01-L-053115-40.4 Anacostia Bladensburg	01	6/1/2015	40.4	1300	3500	1414	3500	11	17	27	28.9	7.32	0.404	5.91	0.7
Anacostia Benning Road	02-L-053115-40.4 Anacostia Benning Road	02	6/1/2015	40.4	170	220	89	170	18	<2	24	29.4	7.23	0.419	3.02	
Anacostia PA Ave Seafarers	03-B-053115-40.4 Anacostia PA Ave Seafarers	03	6/1/2015	40.4	490	490	135	140	11	<2	10	28.9	7.2	0.384	3.02	0.5
Anacostia Capitol St. Bridge	04-B-053115-40.4 Anacostia Capitol St. Bridge	04	6/1/2015	40.4	79	49	30	33	8	4	15	28.3	7.57	0.29	5.11	0.7
Anacostia Haines Point	05-B-053115-40.4 Anacostia Haines Point	05	6/1/2015	40.4	13	13	5	13	8	3	36	28.5	8.37	0.251	7.28	0.85
Potomac Three Sisters Island	06-B-053115-40.4 Potomac Three Sisters Island	06	6/1/2015	40.4	79	79	19	49	7	2	46	28.6	8.49	0.245	8.84	0.9
Potomac Three Sisters Island	06-B-053115-40.4 Potomac Three Sisters Island-D	06-D	6/1/2015	40.4	46	33										
Potomac Upstream of Rock Creek	07-B-053115-40.4 Potomac Upstream of Rock Creek	07	6/1/2015	40.4	23	33	11	33	7	2	51	29.1	8.58	0.241	9.25	0.85
Potomac Upstream of Rock Creek	07-B-053115-40.4 Potomac Upstream of Rock Creek-D	07-D	6/1/2015	40.4			6	23		4						
Potomac 14th St. Bridge	08-B-053115-40.4 Potomac 14th St. Bridge	08	6/1/2015	40.4	13	8	12	8	7	8	49	29.1	8.65	0.242	9.39	0.8
Potomac 14th St. Bridge	08-B-053115-40.4 Potomac 14th St. Bridge-D	08-D	6/1/2015	40.4					7							
Potomac Wilson Bridge	09-B-053115-40.4 Potomac Wilson Bridge	09	6/1/2015	40.4	23	8	2	5	7	<2	61	27.8	8.2	0.256	7.8	0.9
Rock Creek Boundary Bridge	10-L-053115-40.4 Rock Creek Boundary Bridge	10	6/1/2015	40.4	230	230	238	230				25.1	7.61	0.425	7.1	
Rock Creek Tilden St	11-L-053115-40.4 Rock Creek Tilden St	11	6/1/2015	40.4	2400	1400	1986	170				25.7	7.95	0.436	8.64	
Rock Creek Porter St	12-L-053115-40.4 Rock Creek Porter St	12	6/1/2015	40.4	5400	3500	>=2420	3500				25.6	7.96	0.441	8.38	
Rock Creek Porter St	12-L-053115-40.4 Rock Creek Porter St-D	12-D	6/1/2015	40.4								25.6	7.95	0.441	8.38	
Rock Creek PA Ave	13-L-053115-40.4 Rock Creek PA Ave	13	6/1/2015	40.4	1700	1700	4100	1700	7	<2		26.2	7.86	0.436	7.74	
Rock Creek PA Ave	13-L-053115-40.4 Rock Creek PA Ave-D	13-D	6/1/2015	40.4								26.2	7.81	0.436	7.74	
Anacostia PA Ave Seafarers	03-B-053115-40.5 Anacostia PA Ave Seafarers	03	6/1/2015	40.5	54000	160000	115300	92000	82	5	13	25.8	7.19	0.266	4.35	
Anacostia Capitol St. Bridge	04-B-053115-40.5 Anacostia Capitol St. Bridge	04	6/1/2015	40.5	3300	1700	5200	1100	22	<2	10	27.6	7.42	0.294	4.15	
Anacostia Haines Point	05-B-053115-40.5 Anacostia Haines Point	05	6/1/2015	40.5	46	49	26	33	9	<2	26	27.1	7.72	0.263	5.43	
Potomac Three Sisters Island	06-B-053115-40.5 Potomac Three Sisters Island	06	6/1/2015	40.5	1700	1700	1046	1300	8	<2	35	23.7	7.87	0.245	6.31	
Potomac Upstream of Rock Creek	07-B-053115-40.5 Potomac Upstream of Rock Creek	07	6/1/2015	40.5	790	230	517	230	6	<2	41	28	8.23	0.246	6.85	
Potomac Upstream of Rock Creek	07-B-053115-40.5 Potomac Upstream of Rock Creek-D	07-D	6/1/2015	40.5	230	1300										

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Potomac 14th St. Bridge	08-B-053115-40.5 Potomac 14th St. Bridge	08	6/1/2015	40.5	23	33	23	33	9	<2	51	28.2	8.21	0.243	6.48	
Potomac 14th St. Bridge	08-B-053115-40.5 Potomac 14th St. Bridge-D	08-D	6/1/2015	40.5			25	17								
Potomac Wilson Bridge	09-B-053115-40.5 Potomac Wilson Bridge	09	6/1/2015	40.5	23	5	10	2	8	<2	27	27	7.81	0.273	6.36	
Rock Creek Boundary Bridge	10-L-053115-40.5 Rock Creek Boundary Bridge	10	6/1/2015	40.5	54000	35000	30900	35000				24.1	7.35	0.317	6.06	
Rock Creek Tilden St	11-L-053115-40.5 Rock Creek Tilden St	11	6/1/2015	40.5	24000	35000	25900	35000				24.1	7.62	0.304	7.68	
Rock Creek Porter St	12-L-053115-40.5 Rock Creek Porter St	12	6/1/2015	40.5	54000	35000	17300	35000				24	7.58	0.292	8.14	
Rock Creek PA Ave	13-L-053115-40.5 Rock Creek PA Ave	13	6/1/2015	40.5	54000	92000	40400	22000	180	5		24.2	7.43	0.246	6.9	
Anacostia Bladensburg	01-L-053115-40.5 Anacostia Bladensburg	01	6/2/2015	40.5	54000	35000	24100	11000	140	15	17	23	7.19	0.14	7.08	
Anacostia Bladensburg	01-L-053115-40.5 Anacostia Bladensburg-D	01-D	6/2/2015	40.5								23	7.18	0.139	7.07	
Anacostia Benning Road	02-L-053115-40.5 Anacostia Benning Road	02	6/2/2015	40.5	92000	92000	43500	17000	400	4	28	23.3	7.67	0.151	7.22	
Anacostia Bladensburg	01-L-053115-40.6 Anacostia Bladensburg	01	6/2/2015	40.6	35000	17000	19900	11000	62	3	10	21.8	7.27	0.195	7.53	0.15
Anacostia Benning Road	02-L-053115-40.6 Anacostia Benning Road	02	6/2/2015	40.6	130000	160000	21300	28000	91	3	11	21.5	7.5	0.16	7.73	
Anacostia Benning Road	02-L-053115-40.6 Anacostia Benning Road-D	02-D	6/2/2015	40.6								21.4	7.43	0.158	7.89	
Anacostia PA Ave Seafarers	03-B-053115-40.6 Anacostia PA Ave Seafarers	03	6/2/2015	40.6	35000	92000	17100	92000	96	5	22	23.5	7.29	0.154	5.07	
Anacostia Capitol St. Bridge	04-B-053115-40.6 Anacostia Capitol St. Bridge	04	6/2/2015	40.6	54000	92000	67000	35000	22	4	11	26.6	7.14	0.294	2.1	0.4
Anacostia Haines Point	05-B-053115-40.6 Anacostia Haines Point	05	6/2/2015	40.6	13000	35000	27200	17000	9	2	28	27.1	7.61	0.256	4.61	0.95
Potomac Three Sisters Island	06-B-053115-40.6 Potomac Three Sisters Island	06	6/2/2015	40.6	490	700	488	490	12	<2	36	27.7	8.11	0.242	6.2	1.05
Potomac Upstream of Rock Creek	07-B-053115-40.6 Potomac Upstream of Rock Creek	07	6/2/2015	40.6	460	1100	687	1100	8	<2	42	28	8.14	0.246	6.03	1.05
Potomac 14th St. Bridge	08-B-053115-40.6 Potomac 14th St. Bridge	08	6/2/2015	40.6	24000	35000	9800	13000	8	20	47	27.8	7.84	0.243	4.76	1
Potomac 14th St. Bridge	08-B-053115-40.6 Potomac 14th St. Bridge-D	08-D	6/2/2015	40.6						2						
Potomac Wilson Bridge	09-B-053115-40.6 Potomac Wilson Bridge	09	6/2/2015	40.6	230	1700	613	1100	11	3	56	26.8	7.75	0.267	5.99	1.15
Potomac Wilson Bridge	09-B-053115-40.6 Potomac Wilson Bridge-D	09-D	6/2/2015	40.6					10		23					
Rock Creek Boundary Bridge	10-L-053115-40.6 Rock Creek Boundary Bridge	10	6/2/2015	40.6	22000	92000	37300	17000				23.1	7.18	0.238	5.29	
Rock Creek Tilden St	11-L-053115-40.6 Rock Creek Tilden St	11	6/2/2015	40.6	24000	35000	15800	24000				23	7.55	0.237	7.97	
Rock Creek Porter St	12-L-053115-40.6 Rock Creek Porter St	12	6/2/2015	40.6	22000	54000	34500	24000				23	7.58	0.237	8.4	
Rock Creek PA Ave	13-L-053115-40.6 Rock Creek PA Ave	13	6/2/2015	40.6	35000	92000	33100	35000	61	<2		23.1	7.52	0.262	7.5	
Anacostia Bladensburg	01-L-053115-40.7 Anacostia Bladensburg	01	6/2/2015	40.7	5800	13000	21800	7900	50	4	34	21	7.19	0.206	7.06	0.15
Anacostia Benning Road	02-L-053115-40.7 Anacostia Benning Road	02	6/2/2015	40.7	13000	28000	19900	22000	58	<2	20	21.6	7.22	0.198	5.6	
Anacostia PA Ave Seafarers	03-B-053115-40.7 Anacostia PA Ave Seafarers	03	6/2/2015	40.7	13000	35000	16000	24000	72	3	12	22.2	7.16	0.178	5.44	0.1
Anacostia PA Ave Seafarers	03-B-053115-40.7 Anacostia PA Ave Seafarers-D	03-D	6/2/2015	40.7								22.2	7.13	0.175	5.42	
Anacostia Capitol St. Bridge	04-B-053115-40.7 Anacostia Capitol St. Bridge	04	6/2/2015	40.7	35000	54000	28100	54000	35	3	10	25.3	7.04	0.241	1.16	0.2

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-053115-40.7 Anacostia Haines Point	05	6/2/2015	40.7	35000	54000	60900	35000	13	<2	10	26.4	7.27	0.281	2.05	0.5
Potomac Three Sisters Island	06-B-053115-40.7 Potomac Three Sisters Island	06	6/2/2015	40.7	3300	540	219	220	13	<2	46	27.1	8.19	0.243	6.88	0.75
Potomac Upstream of Rock Creek	07-B-053115-40.7 Potomac Upstream of Rock Creek	07	6/2/2015	40.7	1300	790	517	490	10	<2	37	26.8	8.08	0.244	6.65	0.7
Potomac 14th St. Bridge	08-B-053115-40.7 Potomac 14th St. Bridge	08	6/2/2015	40.7	1100	3300	921	1700	9	<2	37	27.3	7.95	0.244	5.42	0.7
Potomac 14th St. Bridge	08-B-053115-40.7 Potomac 14th St. Bridge-D	08-D	6/2/2015	40.7	1700	3300										
Potomac Wilson Bridge	09-B-053115-40.7 Potomac Wilson Bridge	09	6/2/2015	40.7	4900	2300	1414	1300	9	<2	43	26.5	7.7	0.254	5.16	0.7
Potomac Wilson Bridge	09-B-053115-40.7 Potomac Wilson Bridge-D	09-D	6/2/2015	40.7			2420	2300								
Rock Creek Boundary Bridge	10-L-053115-40.7 Rock Creek Boundary Bridge	10	6/2/2015	40.7	24000	11000	9600	4900				21.8	7.31	0.213	6.31	
Rock Creek Tilden St	11-L-053115-40.7 Rock Creek Tilden St	11	6/2/2015	40.7	35000	54000	11000	13000				21.1	7.64	0.232	8.51	
Rock Creek Porter St	12-L-053115-40.7 Rock Creek Porter St	12	6/2/2015	40.7	54000	35000	9700	4900				22	7.65	0.233	8.52	
Rock Creek PA Ave	13-L-053115-40.7 Rock Creek PA Ave	13	6/2/2015	40.7	24000	35000	8600	3300	32	3		22.3	7.68	0.27	7.69	
	BE-053115-40.1 Boat Equipment Blank		5/31/2015	40.1			<1		<1	<2	29					
	LE-053115-40.1 Land Equipment Blank		5/31/2015	40.1	<2		<1		<1	<2	<6					
	BE-053115-40.2 Boat Equipment Blank		5/31/2015	40.2	<2		<1		<1	<2	<6					
	LE-053115-40.2 Land Equipment Blank		5/31/2015	40.2	<2		<1		<1	<2	<6					
	BE-053115-40.3 Boat Equipment Blank		6/1/2015	40.3	<2		<1		<1	<2	<6					
	BF-053115-40.3 Boat Field Blank		6/1/2015	40.3	<2		<1		<1	<2	<6					
	LE-053115-40.3 Land Equipment Blank		6/1/2015	40.3	<2		<1		<1	<2	15					
	LF-053115-40.3 Land Field Blank		6/1/2015	40.3	<2		<1		<1	<2	<6					
	BE-053115-40.4 Boat Equipment Blank		6/1/2015	40.4	<2		<1		<1	<2	9					
	LE-053115-40.4 Land Equipment Blank		6/1/2015	40.4	<2		<1		<1	<2	<6					
	BE-053115-40.5 Boat Equipment Blank		6/1/2015	40.5	<2		<1		<1	<2	9					
	LE-053115-40.5 Land Equipment Blank		6/1/2015	40.5	<2		<1		<1	<2	<6					
	BE-053115-40.6 Boat Equipment Blank		6/2/2015	40.6	<2		<1		<1	<2	<6					
	BF-053115-40.6 Boat Field Blank		6/2/2015	40.6	<2		<1		<1	<2	<6					
	LE-053115-40.6 Land Equipment Blank		6/2/2015	40.6	<2		<1		<1	2	<6					
	LF-053115-40.6 Land Field Blank		6/2/2015	40.6	<2		<1		<1	<2	<6					
	BE-053115-40.7 Boat Equipment Blank		6/2/2015	40.7	<2		<1		<1	<2	13					
	LE-053115-40.7 Land Equipment Blank		6/2/2015	40.7	<2		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-062715-40.1 Anacostia Bladensburg	01	6/27/2015	40.1	11000	7900	1730	7900	20	<2	<6	23	7.35	0.301	6.77	
Anacostia Bladensburg	01-L-062715-40.1 Anacostia Bladensburg-D	01-D	6/27/2015	40.1							9					

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Benning Road	02-L-062715-40.1 Anacostia Benning Road	02	6/27/2015	40.1	1300	3500	1414	790	15	<2	7	23.8	7.3	0.266	5.1	
Anacostia PA Ave Seafarers	03-B-062715-40.1 Anacostia PA Ave Seafarers	03	6/27/2015	40.1	1400	5400	1986	1100	19	<2	12	25.4	6.96	0.258	2.37	
Anacostia Capitol St. Bridge	04-B-062715-40.1 Anacostia Capitol St. Bridge	04	6/27/2015	40.1	9200	1700	2420	790	7	<8	15	27	7.11	0.251	1.81	
Anacostia Capitol St. Bridge	04-B-062715-40.1 Anacostia Capitol St. Bridge-D	04-D	6/27/2015	40.1								27	7.12	0.251	1.76	
Anacostia Haines Point	05-B-062715-40.1 Anacostia Haines Point	05	6/27/2015	40.1	330	920	206	540	13	<2	13	26.7	7.62	0.316	6.23	
Anacostia Haines Point	05-B-062715-40.1 Anacostia Haines Point-D	05-D	6/27/2015	40.1								26.7	7.63	0.316	6.25	
Potomac Three Sisters Island	06-B-062715-40.1 Potomac Three Sisters Island	06	6/27/2015	40.1	170	33	56	23	12	<2	11	26	8.06	0.329	7.79	
Potomac Upstream of Rock Creek	07-B-062715-40.1 Potomac Upstream of Rock Creek	07	6/27/2015	40.1	230	350	70	170	9	<2	17	26.5	8.01	0.329	7.63	
Potomac 14th St. Bridge	08-B-062715-40.1 Potomac 14th St. Bridge	08	6/27/2015	40.1	490	540	132	350	9	26	18	26.5	7.94	0.332	7.39	
Potomac Wilson Bridge	09-B-062715-40.1 Potomac Wilson Bridge	09	6/27/2015	40.1	33	70	29	70	9	<2	42	27.2	7.77	0.348	6.76	
Potomac Wilson Bridge	09-B-062715-40.1 Potomac Wilson Bridge-D	09-D	6/27/2015	40.1	49	79				<2						
Rock Creek Boundary Bridge	10-L-062715-40.1 Rock Creek Boundary Bridge	10	6/27/2015	40.1	170	1700	1553	700				22.7	7.09	0.297	7.27	
Rock Creek Boundary Bridge	10-L-062715-40.1 Rock Creek Boundary Bridge-D	10-D	6/27/2015	40.1			1986	7900								
Rock Creek Tilden St	11-L-062715-40.1 Rock Creek Tilden St	11	6/27/2015	40.1	3300	1100	1733	1100				22.6	7.21	0.301	8.1	
Rock Creek Porter St	12-L-062715-40.1 Rock Creek Porter St	12	6/27/2015	40.1	700	2300	1120	2300				22.5	7.47	0.309	8.43	
Rock Creek PA Ave	13-L-062715-40.1 Rock Creek PA Ave	13	6/27/2015	40.1	1300	3300	1733	3300	12	<2		23.1	7.57	0.284	7.74	
Rock Creek PA Ave	13-L-062715-40.1 Rock Creek PA Ave-D	13-D	6/27/2015	40.1					13							
Anacostia Bladensburg	01-L-062715-40.2 Anacostia Bladensburg	01	6/27/2015	40.2	28000	35000	9850	7900	37	2	9	21.5	7.48	0.267	7.72	0.3
Anacostia Benning Road	02-L-062715-40.2 Anacostia Benning Road	02	6/27/2015	40.2	4900	7900	3360	4900	29	<2	46	22.4	7.42	0.291	6.51	
Anacostia PA Ave Seafarers	03-B-062715-40.2 Anacostia PA Ave Seafarers	03	6/27/2015	40.2	310	7900	1203	490	25	<2	64	23.8	7.15	0.235	3.03	0.4
Anacostia Capitol St. Bridge	04-B-062715-40.2 Anacostia Capitol St. Bridge	04	6/27/2015	40.2	4600	2800	5040	1400	7	<2	17	26.2	7.12	0.248	1.98	0.82
Anacostia Haines Point	05-B-062715-40.2 Anacostia Haines Point	05	6/27/2015	40.2	790	330	461	330	14	<2	39	26.4	7.47	0.297	4.95	0.8
Potomac Three Sisters Island	06-B-062715-40.2 Potomac Three Sisters Island	06	6/27/2015	40.2	310	220	166	170	11	<2	21	25.7	8.08	0.322	7.81	0.8
Potomac Three Sisters Island	06-B-062715-40.2 Potomac Three Sisters Island-D	06-D	6/27/2015	40.2								25.7	8.08	0.322	7.78	
Potomac Upstream of Rock Creek	07-B-062715-40.2 Potomac Upstream of Rock Creek	07	6/27/2015	40.2	94	170	144	110	12	<2	14	25.8	8.06	0.324	7.75	0.8
Potomac 14th St. Bridge	08-B-062715-40.2 Potomac 14th St. Bridge	08	6/27/2015	40.2	230	110	133	79	12	<2	33	26.1	8	0.327	7.61	0.95
Potomac Wilson Bridge	09-B-062715-40.2 Potomac Wilson Bridge	09	6/27/2015	40.2	330	490	199	490	10	<2	55	26.5	7.71	0.33	6.58	1
Rock Creek Boundary Bridge	10-L-062715-40.2 Rock Creek Boundary Bridge	10	6/27/2015	40.2	11000	3100	9590	2300				21.9	7.4	0.325	7.53	
Rock Creek Tilden St	11-L-062715-40.2 Rock Creek Tilden St	11	6/27/2015	40.2	7000	4900	5280	4900				21.7	7.7	0.293	8.46	
Rock Creek Porter St	12-L-062715-40.2 Rock Creek Porter St	12	6/27/2015	40.2	4900	4900	5120	4900				21.8	7.71	0.283	8.34	
Rock Creek PA Ave	13-L-062715-40.2 Rock Creek PA Ave	13	6/27/2015	40.2	7900	17000	6700	11000	48	<2		21.7	7.66	0.315	8.25	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Bladensburg	01-L-062715-40.3 Anacostia Bladensburg	01	6/27/2015	40.3	22000	24000	20460	24000	420	5	11	21.3	7.24	0.104	7.97	
Anacostia Bladensburg	01-L-062715-40.3 Anacostia Bladensburg-D	01-D	6/27/2015	40.3					440							
Anacostia Benning Road	02-L-062715-40.3 Anacostia Benning Road	02	6/27/2015	40.3	35000	160000	10120	92000	930	18	23	21.6	7.15	0.102	6.76	
Anacostia Benning Road	02-L-062715-40.3 Anacostia Benning Road-D	02-D	6/27/2015	40.3							57					
Anacostia PA Ave Seafarers	03-B-062715-40.3 Anacostia PA Ave Seafarers	03	6/27/2015	40.3	13000	35000	6770	13000	150	3	13	22.1	7.31	0.24	5.9	0.15
Anacostia Capitol St. Bridge	04-B-062715-40.3 Anacostia Capitol St. Bridge	04	6/27/2015	40.3	4900	35000	7710	11000	10	4	12	25.5	7.05	0.247	2.2	0.6
Anacostia Haines Point	05-B-062715-40.3 Anacostia Haines Point	05	6/27/2015	40.3	230	460	365	460	13	<2	21	26.1	7.18	0.289	4.45	0.6
Potomac Three Sisters Island	06-B-062715-40.3 Potomac Three Sisters Island	06	6/27/2015	40.3	4900	4900	4480	2300	46	<2	14	24.3	7.62	0.26	8.13	0.3
Potomac Upstream of Rock Creek	07-B-062715-40.3 Potomac Upstream of Rock Creek	07	6/27/2015	40.3	1300	1700	2420	790	14	<2	19	25	7.97	0.298	7.83	0.7
Potomac Upstream of Rock Creek	07-B-062715-40.3 Potomac Upstream of Rock Creek-D	07-D	6/27/2015	40.3								25	8	0.298	7.88	
Potomac 14th St. Bridge	08-B-062715-40.3 Potomac 14th St. Bridge	08	6/27/2015	40.3	3300	4900	2030	1100	15	<2	34	25.2	7.84	0.312	7.44	0.8
Potomac Wilson Bridge	09-B-062715-40.3 Potomac Wilson Bridge	09	6/27/2015	40.3	54000	3300	4620	3300	19	<2	20	26	7.54	0.329	6.36	0.8
Rock Creek Boundary Bridge	10-L-062715-40.3 Rock Creek Boundary Bridge	10	6/27/2015	40.3	35000	160000	16640	22000				21.6		0.106	7.02	
Rock Creek Boundary Bridge	10-L-062715-40.3 Rock Creek Boundary Bridge-D	10-D	6/27/2015	40.3	160000	160000										
Rock Creek Tilden St	11-L-062715-40.3 Rock Creek Tilden St	11	6/27/2015	40.3	160000	92000	16640	54000				21.8	7.36	0.113	8.39	
Rock Creek Tilden St	11-L-062715-40.3 Rock Creek Tilden St-D	11-D	6/27/2015	40.3			18500	54000								
Rock Creek Porter St	12-L-062715-40.3 Rock Creek Porter St	12	6/27/2015	40.3	92000	160000	19350	35000				21.7	7.34	0.117	8.75	
Rock Creek PA Ave	13-L-062715-40.3 Rock Creek PA Ave	13	6/27/2015	40.3	92000	160000	12100	17000	480	7		21.7	7.32	0.125	8.39	
Rock Creek PA Ave	13-L-062715-40.3 Rock Creek PA Ave-D	13-D	6/27/2015	40.3						8						
Anacostia Bladensburg	01-L-062715-40.4 Anacostia Bladensburg	01	6/28/2015	40.4	24000	13000	12740	13000	130	4	<6	20.7	7.13	0.124	7.6	
Anacostia Benning Road	02-L-062715-40.4 Anacostia Benning Road	02	6/28/2015	40.4	7900	54000	9330	17000	150	3	11	20.9	7.13	0.125	7.24	
Anacostia PA Ave Seafarers	03-B-062715-40.4 Anacostia PA Ave Seafarers	03	6/28/2015	40.4	13000	13000	10120	4900	210	3	12	21.2	7.1	0.124	6.66	
Anacostia Capitol St. Bridge	04-B-062715-40.4 Anacostia Capitol St. Bridge	04	6/28/2015	40.4	13000	54000	51720	54000	99	4	21	21.9	6.94	0.152	4.93	
Anacostia Haines Point	05-B-062715-40.4 Anacostia Haines Point	05	6/28/2015	40.4	13000	7900	5650	4900	24	<2	14	24.2	7.43	0.264	7.26	
Potomac Three Sisters Island	06-B-062715-40.4 Potomac Three Sisters Island	06	6/28/2015	40.4	2300	4600	2130	4600	91	2	13	23.2	7.73	0.26	8.57	
Potomac Upstream of Rock Creek	07-B-062715-40.4 Potomac Upstream of Rock Creek	07	6/28/2015	40.4	4900	3300	1986	2300	74	<2	16	23.2	7.84	0.27	8.42	
Potomac 14th St. Bridge	08-B-062715-40.4 Potomac 14th St. Bridge	08	6/28/2015	40.4	13000	7900	3230	7900	44	<2	10	23.7	7.78	0.254	8	
Potomac 14th St. Bridge	08-B-062715-40.4 Potomac 14th St. Bridge-D	08-D	6/28/2015	40.4								23.6	7.79	0.253	8.01	
Potomac Wilson Bridge	09-B-062715-40.4 Potomac Wilson Bridge	09	6/28/2015	40.4	7900	54000	10140	4700	13	<2	10	25	7.46	0.296	5.97	
Potomac Wilson Bridge	09-B-062715-40.4 Potomac Wilson Bridge-D	09-D	6/28/2015	40.4								25	7.53	0.295	5.96	
Rock Creek Boundary Bridge	10-L-062715-40.4 Rock Creek Boundary Bridge	10	6/28/2015	40.4	7000	22000	16640	11000				21.4	7.17	0.155	6.79	

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Rock Creek Tilden St	11-L-062715-40.4 Rock Creek Tilden St	11	6/28/2015	40.4	28000	35000	17890	24000				21.3	7.32	0.135	8.5	
Rock Creek Tilden St	11-L-062715-40.4 Rock Creek Tilden St-D	11-D	6/28/2015	40.4	35000	17000										
Rock Creek Porter St	12-L-062715-40.4 Rock Creek Porter St	12	6/28/2015	40.4	14000	54000	26130	17000				21.3	7.37	0.138	8.86	
Rock Creek Porter St	12-L-062715-40.4 Rock Creek Porter St-D	12-D	6/28/2015	40.4			24810	17000								
Rock Creek PA Ave	13-L-062715-40.4 Rock Creek PA Ave	13	6/28/2015	40.4	35000	35000	29090	35000	310	5		21.3	7.39	0.13	8.47	
Anacostia Bladensburg	01-L-062715-40.5 Anacostia Bladensburg	01	6/28/2015	40.5	13000	13000	5460	7900	75	3	15	21.2	7.12	0.169	7.94	0.6
Anacostia Bladensburg	01-L-062715-40.5 Anacostia Bladensburg-D	01-D	6/28/2015	40.5						2						
Anacostia Benning Road	02-L-062715-40.5 Anacostia Benning Road	02	6/28/2015	40.5	7900	13000	5040	7900	63	3	15	21.2	7.27	0.181	7.74	
Anacostia Benning Road	02-L-062715-40.5 Anacostia Benning Road-D	02-D	6/28/2015	40.5					74							
Anacostia PA Ave Seafarers	03-B-062715-40.5 Anacostia PA Ave Seafarers	03	6/28/2015	40.5	17000	17000	8820	17000	120	4	17	20.9	7.13	0.139	6.93	0.1
Anacostia PA Ave Seafarers	03-B-062715-40.5 Anacostia PA Ave Seafarers-D	03-D	6/28/2015	40.5							7					
Anacostia Capitol St. Bridge	04-B-062715-40.5 Anacostia Capitol St. Bridge	04	6/28/2015	40.5	24000	13000	10430	7900	120	7	13	21.5	7.17	0.131	6.21	0.1
Anacostia Haines Point	05-B-062715-40.5 Anacostia Haines Point	05	6/28/2015	40.5	35000	11000	10810	4900	51	3	13	23.7	7.18	0.21	4.73	0.2
Potomac Three Sisters Island	06-B-062715-40.5 Potomac Three Sisters Island	06	6/28/2015	40.5	2300	13000	4710	13000	79	2	17	22.7	7.55	0.235	8.47	0.2
Potomac Upstream of Rock Creek	07-B-062715-40.5 Potomac Upstream of Rock Creek	07	6/28/2015	40.5	2300	1300	1986	1300	82	2	19	22.6	7.59	0.232	8.53	0.2
Potomac 14th St. Bridge	08-B-062715-40.5 Potomac 14th St. Bridge	08	6/28/2015	40.5	3300	2300	2410	2300	61	2	19	23	7.59	0.241	8.23	0.2
Potomac Wilson Bridge	09-B-062715-40.5 Potomac Wilson Bridge	09	6/28/2015	40.5	11000	3300	4730	2300	34	2	13	24	7.54	0.241	6.82	0.3
Rock Creek Boundary Bridge	10-L-062715-40.5 Rock Creek Boundary Bridge	10	6/28/2015	40.5	13000	17000	6570	7900				21.3	6.18	0.156	7.47	
Rock Creek Boundary Bridge	10-L-062715-40.5 Rock Creek Boundary Bridge-D	10-D	6/28/2015	40.5								21.3				
Rock Creek Tilden St	11-L-062715-40.5 Rock Creek Tilden St	11	6/28/2015	40.5	22000	14000	7890	3300				21.5	6.6	0.226	8.57	
Rock Creek Porter St	12-L-062715-40.5 Rock Creek Porter St	12	6/28/2015	40.5	24000	24000	9590	13000				21.5	7.11	0.22	8.91	
Rock Creek PA Ave	13-L-062715-40.5 Rock Creek PA Ave	13	6/28/2015	40.5	54000	35000	8650	4900	78	4		21.6	7.38	0.224	8.42	
Anacostia Bladensburg	01-L-062715-40.6 Anacostia Bladensburg	01	6/28/2015	40.6	24000	54000	1830	35000	35	<2	<6	21	7.13	0.218	7.96	
Anacostia Benning Road	02-L-062715-40.6 Anacostia Benning Road	02	6/28/2015	40.6	24000	3300	3990	120	51	<2	18	21.1	7.48	0.194	7.89	
Anacostia PA Ave Seafarers	03-B-062715-40.6 Anacostia PA Ave Seafarers	03	6/28/2015	40.6	24000	3300	5460	1300	83	<2	40	21.7	7.36	0.157	6.19	0.25
Anacostia Capitol St. Bridge	04-B-062715-40.6 Anacostia Capitol St. Bridge	04	6/28/2015	40.6	24000	14000	5280	3300	51	<2	20	23.5	7.39	0.196	5.76	0.2
Anacostia Haines Point	05-B-062715-40.6 Anacostia Haines Point	05	6/28/2015	40.6	24000	13000	2420	2200	34	<2	22	24.1	7.53	0.25	7	0.3
Potomac Three Sisters Island	06-B-062715-40.6 Potomac Three Sisters Island	06	6/28/2015	40.6	24000	14000	1733	3300	88	<2	28	22.7	7.72	0.253	8.81	
Potomac Upstream of Rock Creek	07-B-062715-40.6 Potomac Upstream of Rock Creek	07	6/28/2015	40.6	3500	4600	2420	1300	55	<2	14	22.8	7.74	0.257	8.72	
Potomac 14th St. Bridge	08-B-062715-40.6 Potomac 14th St. Bridge	08	6/28/2015	40.6	13000	2100	1733	1300	54	<2	16	22.9	7.73	0.257	8.57	0.25
Potomac Wilson Bridge	09-B-062715-40.6 Potomac Wilson Bridge	09	6/28/2015	40.6	490	4900	1414	3300	41	<2	12	23.5	7.62	0.253	7.9	0.25

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Rock Creek Boundary Bridge	10-L-062715-40.6 Rock Creek Boundary Bridge	10	6/28/2015	40.6	4900	35000	2950	4600				21.6	7.23	0.215	7.61	
Rock Creek Tilden St	11-L-062715-40.6 Rock Creek Tilden St	11	6/28/2015	40.6	4600	4900	2010	1700				21.6	7.41	0.247	8.5	
Rock Creek Tilden St	11-L-062715-40.6 Rock Creek Tilden St-D	11-D	6/28/2015	40.6								21.6	7.49	0.247	8.51	
Rock Creek Porter St	12-L-062715-40.6 Rock Creek Porter St	12	6/28/2015	40.6	3300	9400	1890	1300				21.6	7.58	0.252	8.86	
Rock Creek Porter St	12-L-062715-40.6 Rock Creek Porter St-D	12-D	6/28/2015	40.6	110	11000										
Rock Creek PA Ave	13-L-062715-40.6 Rock Creek PA Ave	13	6/28/2015	40.6	170	35000	2420	700	75	<2		21.7	7.46	0.263	8.34	
Rock Creek PA Ave	13-L-062715-40.6 Rock Creek PA Ave-D	13-D	6/28/2015	40.6			2110	1300								
	BE-062715-40.1 Boat Equipment Blank		6/27/2015	40.1	<1		<1		<1	<2	<6					
	LE-062715-40.1 Land Equipment Blank		6/27/2015	40.1	<1		1		<1	<2	<6					
	BE-062715-40.2 Boat Equipment Blank		6/27/2015	40.2	<1		<1		<1	<2	16					
	LE-062715-40.2 Land Equipment Blank		6/27/2015	40.2	1		<1		<1	<2	55					
	BE-062715-40.3 Boat Equipment Blank		6/27/2015	40.3	<1		<1		<1	<2	7					
	BF-062715-40.3 Boat Field Blank		6/27/2015	40.3	<1		<1		<1	<2	<6					
	LE-062715-40.3 Land Equipment Blank		6/27/2015	40.3	<1		<1		<1	<2	<6					
	LF-062715-40.3 Land Field Blank		6/27/2015	40.3	<1		<1		<1	<2	<6					
	BE-062715-40.4 Boat Equipment Blank		6/28/2015	40.4	<1		<1		<1	<2	33					
	LE-062715-40.4 Land Equipment Blank		6/28/2015	40.4	<1		<1		<1	<2	38					
	BE-062715-40.5 Boat Equipment Blank		6/28/2015	40.5	<1		<1		<1	<2	<6					
	LE-062715-40.5 Land Equipment Blank		6/28/2015	40.5	<1		<1		<1	<2	<6					
	BE-062715-40.6 Boat Equipment Blank		6/28/2015	40.6	<1		<1		<1	<2	<6					
	BF-062715-40.6 Boat Field Blank		6/28/2015	40.6	<1		<1		<1	<2	6					
	LE-062715-40.6 Land Equipment Blank		6/28/2015	40.6	<1		<1		<1	<2	<6					
	LF-062715-40.6 Land Field Blank		6/28/2015	40.6	<1		<1		<1	<2	<6					
Anacostia Bladensburg	01-L-100115-40.1 Anacostia Bladensburg	01	10/1/2015	40.1		35000		2300	54	<2	8	17.6	8	0.206	8.81	
Anacostia Bladensburg	01-L-100115-40.1 Anacostia Bladensburg-D	01-D	10/1/2015	40.1				1700								
Anacostia Benning Road	02-L-100115-40.1 Anacostia Benning Road	02	10/1/2015	40.1		13000		7900	77	<2	14	18.1	8.03	0.201	7.46	
Anacostia Benning Road	02-L-100115-40.1 Anacostia Benning Road-D	02-D	10/1/2015	40.1						<2						
Anacostia PA Ave Seafarers	03-B-100115-40.1 Anacostia PA Ave Seafarers	03	10/1/2015	40.1		13000		7900	82	<2	13	18.5	7.53	0.215	7.18	
Anacostia PA Ave Seafarers	03-B-100115-40.1 Anacostia PA Ave Seafarers-D	03-D	10/1/2015	40.1					89							
Anacostia Capitol St. Bridge	04-B-100115-40.1 Anacostia Capitol St. Bridge	04	10/1/2015	40.1		92000		54000	31	<2	<6	21.2	8.61	0.24	3.71	
Anacostia Capitol St. Bridge	04-B-100115-40.1 Anacostia Capitol St. Bridge-D	04-D	10/1/2015	40.1							<6					

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Haines Point	05-B-100115-40.1 Anacostia Haines Point	05	10/1/2015	40.1		2200		700	32	<2	<6	21.3	8.27	0.29	6.05	
Potomac Three Sisters Island	06-B-100115-40.1 Potomac Three Sisters Island	06	10/1/2015	40.1		3300		2300	52	<2	30	20.5	8.62	0.195	8.29	
Potomac Upstream of Rock Creek	07-B-100115-40.1 Potomac Upstream of Rock Creek	07	10/1/2015	40.1		3300		1700	48	<2	<6	20.7	8.36	0.197	8.28	
Potomac 14th St. Bridge	08-B-100115-40.1 Potomac 14th St. Bridge	08	10/1/2015	40.1		1100		790	53	<2	15	20.9	8.79	0.198	7.79	
Potomac Wilson Bridge	09-B-100115-40.1 Potomac Wilson Bridge	09	10/1/2015	40.1		460		460	33	<2	26	21.1	7.93	0.315	7.53	
Rock Creek Boundary Bridge	10-L-100115-40.1 Rock Creek Boundary Bridge	10	10/1/2015	40.1		7900		4900				18.3	7.84	0.384	8.12	
Rock Creek Tilden St	11-L-100115-40.1 Rock Creek Tilden St	11	10/1/2015	40.1		4900		1700				18.6	8	0.293	9.05	
Rock Creek Porter St	12-L-100115-40.1 Rock Creek Porter St	12	10/1/2015	40.1		4900		4900				18.6	7.92	0.293	9.45	
Rock Creek Porter St	12-L-100115-40.1 Rock Creek Porter St-D	12-D	10/1/2015	40.1								18.6	7.89	0.293	9.45	
Rock Creek PA Ave	13-L-100115-40.1 Rock Creek PA Ave	13	10/1/2015	40.1		7000		3300	35	2		18.6	7.9	0.261	8.83	
Rock Creek PA Ave	13-L-100115-40.1 Rock Creek PA Ave-D	13-D	10/1/2015	40.1		11000						18.6	7.88	0.262	8.82	
Anacostia Bladensburg	01-L-100115-40.2 Anacostia Bladensburg	01	10/2/2015	40.2		24000		13000	52	<2	7	16.8	8.09	0.206	8.79	
Anacostia Bladensburg	01-L-100115-40.2 Anacostia Bladensburg-D	01-D	10/2/2015	40.2								16.9	8.01	0.206	8.76	
Anacostia Benning Road	02-L-100115-40.2 Anacostia Benning Road	02	10/2/2015	40.2		17000		17000	62	<2	<6	17.3	8.11	0.208	7.75	
Anacostia PA Ave Seafarers	03-B-100115-40.2 Anacostia PA Ave Seafarers	03	10/2/2015	40.2		4900		4900	75	<2	7	18.2	8.43	0.217	6.47	
Anacostia Capitol St. Bridge	04-B-100115-40.2 Anacostia Capitol St. Bridge	04	10/2/2015	40.2		2300		2300	21	<2	7	21	8.6	0.241	4.12	
Anacostia Haines Point	05-B-100115-40.2 Anacostia Haines Point	05	10/2/2015	40.2		1300		1300	16	<2	<6	20.9	8.25	0.28	6.57	
Potomac Three Sisters Island	06-B-100115-40.2 Potomac Three Sisters Island	06	10/2/2015	40.2		3300		3300	42	<2	7	19.9	8.3	0.2	8.75	
Potomac Upstream of Rock Creek	07-B-100115-40.2 Potomac Upstream of Rock Creek	07	10/2/2015	40.2		11000		2100	41	<2	9	20.1	8.55	0.197	8.47	
Potomac 14th St. Bridge	08-B-100115-40.2 Potomac 14th St. Bridge	08	10/2/2015	40.2		1300		1300	38	<2	<6	20.4	8.29	0.198	8.3	
Potomac Wilson Bridge	09-B-100115-40.2 Potomac Wilson Bridge	09	10/2/2015	40.2		790		790	31	<2	<6	20.4	7.45	0.265	7.56	
Rock Creek Boundary Bridge	10-L-100115-40.2 Rock Creek Boundary Bridge	10	10/2/2015	40.2		3500		3500				17.6	7.78	0.316	8.11	
Rock Creek Tilden St	11-L-100115-40.2 Rock Creek Tilden St	11	10/2/2015	40.2		3300		2300				17.6	7.77	0.371	9.11	
Rock Creek Porter St	12-L-100115-40.2 Rock Creek Porter St	12	10/2/2015	40.2		2300		790				17.6	7.82		9.51	
Rock Creek PA Ave	13-L-100115-40.2 Rock Creek PA Ave	13	10/2/2015	40.2		13000		1400	16	<2		13.4	7.72		10.58	
Anacostia Bladensburg	01-L-100115-40.3 Anacostia Bladensburg	01	10/2/2015	40.3		35000		4900	21	<2	10	16.1	8.07	0.219	9.25	0.35
Anacostia Bladensburg	01-L-100115-40.3 Anacostia Bladensburg-D	01-D	10/2/2015	40.3		3300										
Anacostia Benning Road	02-L-100115-40.3 Anacostia Benning Road	02	10/2/2015	40.3		13000		2200	46	<2	10	16.9	7.96	0.216	7.51	
Anacostia Benning Road	02-L-100115-40.3 Anacostia Benning Road-D	02-D	10/2/2015	40.3				7900				16.9	7.86	0.217	7.5	
Anacostia PA Ave Seafarers	03-B-100115-40.3 Anacostia PA Ave Seafarers	03	10/2/2015	40.3		2300		1300	57	<2	13	18.1	8.14	0.214	6.01	0.15
Anacostia PA Ave Seafarers	03-B-100115-40.3 Anacostia PA Ave Seafarers-D	03-D	10/2/2015	40.3						<2						

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm²)	DO (mg/L)	Secchi Depth (m)
Anacostia Capitol St. Bridge	04-B-100115-40.3 Anacostia Capitol St. Bridge	04	10/2/2015	40.3		2300		1300	20	<2	9	20.8	7.13	0.26	4.46	0.3
Anacostia Capitol St. Bridge	04-B-100115-40.3 Anacostia Capitol St. Bridge-D	04-D	10/2/2015	40.3					21							
Anacostia Haines Point	05-B-100115-40.3 Anacostia Haines Point	05	10/2/2015	40.3		790		170	23	<2	6	20.2	7.4	0.252	7.55	0.45
Potomac Three Sisters Island	06-B-100115-40.3 Potomac Three Sisters Island	06	10/2/2015	40.3		1300		1300	38	<2	7	19.4	7.76	0.216	9.26	0.2
Potomac Upstream of Rock Creek	07-B-100115-40.3 Potomac Upstream of Rock Creek	07	10/2/2015	40.3		1700		1100	33	<2	10	19.6	7.79	0.206	8.98	0.3
Potomac 14th St. Bridge	08-B-100115-40.3 Potomac 14th St. Bridge	08	10/2/2015	40.3		490		330	29	<2	7	19.8	7.63	0.2	8.66	0.35
Potomac Wilson Bridge	09-B-100115-40.3 Potomac Wilson Bridge	09	10/2/2015	40.3		330		330	25	<2	12	20.1	7.66	0.328	7.81	0.4
Rock Creek Boundary Bridge	10-L-100115-40.3 Rock Creek Boundary Bridge	10	10/2/2015	40.3		4900		2300				16.6	7.74	0.29	8.51	
Rock Creek Tilden St	11-L-100115-40.3 Rock Creek Tilden St	11	10/2/2015	40.3		7900		4900				16.8	7.8	0.321	9.47	
Rock Creek Porter St	12-L-100115-40.3 Rock Creek Porter St	12	10/2/2015	40.3		13000		7900				16.7	7.89	0.31	9.88	
Rock Creek PA Ave	13-L-100115-40.3 Rock Creek PA Ave	13	10/2/2015	40.3		2300		2300	10	<2		16.9	7.87	0.315	9.21	
Anacostia Bladensburg	01-L-100115-40.4 Anacostia Bladensburg	01	10/2/2015	40.4		4900		2300	28	<2	<6	14.9	8.13	0.209	9.63	
Anacostia Benning Road	02-L-100115-40.4 Anacostia Benning Road	02	10/2/2015	40.4		7900		4900	40	<2	<6	15.4	7.82	0.201	8.73	
Anacostia PA Ave Seafarers	03-B-100115-40.4 Anacostia PA Ave Seafarers	03	10/2/2015	40.4		13000		3300	55	<2	<6	15.9	7.81	0.208	8.67	
Anacostia PA Ave Seafarers	03-B-100115-40.4 Anacostia PA Ave Seafarers-D	03-D	10/2/2015	40.4								15.8	7.79	0.207	8.66	
Anacostia Capitol St. Bridge	04-B-100115-40.4 Anacostia Capitol St. Bridge	04	10/2/2015	40.4		1100		790	26	<2	<6	18.5	7.8	0.225	5.6	
Anacostia Haines Point	05-B-100115-40.4 Anacostia Haines Point	05	10/2/2015	40.4		230		230	22	<2	<6	20.2	7.4	0.265	5.8	
Anacostia Haines Point	05-B-100115-40.4 Anacostia Haines Point-D	05-D	10/2/2015	40.4							<6					
Potomac Three Sisters Island	06-B-100115-40.4 Potomac Three Sisters Island	06	10/2/2015	40.4		1700		1300	35	<2	<6	18.4	7.67	0.266	9.63	
Potomac Upstream of Rock Creek	07-B-100115-40.4 Potomac Upstream of Rock Creek	07	10/2/2015	40.4		1300		790	28	<2	<6	18.7	7.74	0.243	9.47	
Potomac 14th St. Bridge	08-B-100115-40.4 Potomac 14th St. Bridge	08	10/2/2015	40.4		1100		700	29	<2	<6	18.9	7.82	0.223	9.21	
Potomac Wilson Bridge	09-B-100115-40.4 Potomac Wilson Bridge	09	10/2/2015	40.4		330		110	22	<2	<6	19.6	7.52	0.237	7.94	
Rock Creek Boundary Bridge	10-L-100115-40.4 Rock Creek Boundary Bridge	10	10/2/2015	40.4		11000		4900				15.5	7.87	0.163	8.78	
Rock Creek Tilden St	11-L-100115-40.4 Rock Creek Tilden St	11	10/2/2015	40.4		28000		14000				15.6	7.76	0.243	9.9	
Rock Creek Porter St	12-L-100115-40.4 Rock Creek Porter St	12	10/2/2015	40.4		17000		14000				15.6	7.76	0.245	10.29	
Rock Creek PA Ave	13-L-100115-40.4 Rock Creek PA Ave	13	10/2/2015	40.4		14000		11000	86	2		15.5	7.79	0.232	9.83	
Anacostia Bladensburg	01-L-100115-40.5 Anacostia Bladensburg	01	10/3/2015	40.5		7000		1700	28	<2	<6	14.3	8.05	0.229	9.25	
Anacostia Benning Road	02-L-100115-40.5 Anacostia Benning Road	02	10/3/2015	40.5		11000		3300	36	<2	<6	14.8	8.08	0.217	8.9	
Anacostia Benning Road	02-L-100115-40.5 Anacostia Benning Road-D	02-D	10/3/2015	40.5		35000										
Anacostia PA Ave Seafarers	03-B-100115-40.5 Anacostia PA Ave Seafarers	03	10/3/2015	40.5		7000		2200	38	<2	<6	15.6	7.39	0.209	7.9	
Anacostia PA Ave Seafarers	03-B-100115-40.5 Anacostia PA Ave Seafarers-D	03-D	10/3/2015	40.5				7900								

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
Anacostia Capitol St. Bridge	04-B-100115-40.5 Anacostia Capitol St. Bridge	04	10/3/2015	40.5		2200		1700	14	<2	<6	19	7.14	0.242	5.12	
Anacostia Capitol St. Bridge	04-B-100115-40.5 Anacostia Capitol St. Bridge-D	04-D	10/3/2015	40.5						<2						
Anacostia Haines Point	05-B-100115-40.5 Anacostia Haines Point	05	10/3/2015	40.5		790		490	16	<2	<6	19.2	7.29	0.224	7.87	
Anacostia Haines Point	05-B-100115-40.5 Anacostia Haines Point-D	05-D	10/3/2015	40.5					17			19.2	7.29	0.224	7.81	
Potomac Three Sisters Island	06-B-100115-40.5 Potomac Three Sisters Island	06	10/3/2015	40.5		1400		1400	28	<2	<6	17.7	7.79	0.33	9.8	
Potomac Upstream of Rock Creek	07-B-100115-40.5 Potomac Upstream of Rock Creek	07	10/3/2015	40.5		790		790	23	<2	<6	17.9	7.7	0.304	9.67	
Potomac 14th St. Bridge	08-B-100115-40.5 Potomac 14th St. Bridge	08	10/3/2015	40.5		1100		1100	24	<2	<6	18.1	7.64	0.264	9.49	
Potomac Wilson Bridge	09-B-100115-40.5 Potomac Wilson Bridge	09	10/3/2015	40.5		7900		1100	22	<2	<6	19	7.43	0.233	8	
Rock Creek Boundary Bridge	10-L-100115-40.5 Rock Creek Boundary Bridge	10	10/3/2015	40.5		11000		3300				14.7	7.9	0.198	9.1	
Rock Creek Tilden St	11-L-100115-40.5 Rock Creek Tilden St	11	10/3/2015	40.5		13000		4900				14.7	7.81	0.191	10.06	
Rock Creek Porter St	12-L-100115-40.5 Rock Creek Porter St	12	10/3/2015	40.5		35000		7000				14.7	7.8	0.193	10.43	
Rock Creek PA Ave	13-L-100115-40.5 Rock Creek PA Ave	13	10/3/2015	40.5		24000		13000	50	<2		14.9	7.78	0.214	9.92	
Anacostia Bladensburg	01-L-100115-40.6 Anacostia Bladensburg	01	10/3/2015	40.6		14000		1400	17	<2	<6	14.1	8.09	0.229	9.98	0.4
Anacostia Benning Road	02-L-100115-40.6 Anacostia Benning Road	02	10/3/2015	40.6		11000		2300	26	<2	<6	14.6	7.89	0.218	8.56	
Anacostia PA Ave Seafarers	03-B-100115-40.6 Anacostia PA Ave Seafarers	03	10/3/2015	40.6		13000		13000	35	<2	<6	15.2	7.91	0.207	8.1	0.25
Anacostia PA Ave Seafarers	03-B-100115-40.6 Anacostia PA Ave Seafarers-D	03-D	10/3/2015	40.6		2600										
Anacostia Capitol St. Bridge	04-B-100115-40.6 Anacostia Capitol St. Bridge	04	10/3/2015	40.6		2200		940	16	<2	7	18.2	7.44	0.234	5.44	0.4
Anacostia Capitol St. Bridge	04-B-100115-40.6 Anacostia Capitol St. Bridge-D	04-D	10/3/2015	40.6				790								
Anacostia Haines Point	05-B-100115-40.6 Anacostia Haines Point	05	10/3/2015	40.6		330		330	19	<2	<6	18.5	7.54	0.228	8.02	0.4
Potomac Three Sisters Island	06-B-100115-40.6 Potomac Three Sisters Island	06	10/3/2015	40.6		490		330	25	<2	7	17.1	7.85	0.331	9.9	0.5
Potomac Three Sisters Island	06-B-100115-40.6 Potomac Three Sisters Island-D	06-D	10/3/2015	40.6								17.2	7.85	0.331	9.9	
Potomac Upstream of Rock Creek	07-B-100115-40.6 Potomac Upstream of Rock Creek	07	10/3/2015	40.6		1400		700	18	<2	<6	17.3	7.88	0.337	9.76	0.5
Potomac 14th St. Bridge	08-B-100115-40.6 Potomac 14th St. Bridge	08	10/3/2015	40.6		1700		1100	21	<2	<6	17.6	7.8	0.314	9.63	0.45
Potomac Wilson Bridge	09-B-100115-40.6 Potomac Wilson Bridge	09	10/3/2015	40.6		7900		4900	15	<2	<6	18.3	7.59	0.236	7.96	0.4
Rock Creek Boundary Bridge	10-L-100115-40.6 Rock Creek Boundary Bridge	10	10/3/2015	40.6		4900		390				14.2	7.88	0.222	9.36	
Rock Creek Tilden St	11-L-100115-40.6 Rock Creek Tilden St	11	10/3/2015	40.6		2200		1300				14.3	7.87	0.208	10.2	
Rock Creek Porter St	12-L-100115-40.6 Rock Creek Porter St	12	10/3/2015	40.6		13000		7900				14.3	7.81	0.209	10.53	
Rock Creek PA Ave	13-L-100115-40.6 Rock Creek PA Ave	13	10/3/2015	40.6		13000		2200	14	<2		14.4	7.83	0.208	10.06	
	BE-100115-40.1 Boat Equipment Blank		10/1/2015	40.1		<1		<1	<1	<2	9					
	LE-100115-40.1 Land Equipment Blank		10/1/2015	40.1		2		1	<1	<2	<6					
	BE-100115-40.2 Boat Equipment Blank		10/2/2015	40.2		1		1	<1	<2	<6					

Sample ID					Laboratory Data							Field Data				
					MPN/100 mL				mg/L	mg/L	mg/M3					
					SM9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2	Measurements Taken in Field				
	Sample ID	Site#	Sample Date	Sample Round	Fecal C. (A1 Med)	Fecal C. (EC-Med)	*E. Coli* (Quantitray)	*E. Coli* (EC-Mug)	TSS	CBOD5	Chlorophyll-*a*	Temp (°C)	pH	Conductivity (mS/cm^2)	DO (mg/L)	Secchi Depth (m)
	LE-100115-40.2 Land Equipment Blank		10/2/2015	40.2		>23		7	<1	<2	<6					
	BE-100115-40.3 Boat Equipment Blank		10/2/2015	40.3		9		5	<1	<2	<6					
	BF-100115-40.3 Boat Field Blank		10/2/2015	40.3		<1		<1	<1	<2	<6					
	LE-100115-40.3 Land Equipment Blank		10/2/2015	40.3		>23		9	<1	<2	<6					
	LF-100115-40.3 Land Field Blank		10/2/2015	40.3		<1		<1	<1	<2	<6					
	BE-100115-40.4 Boat Equipment Blank		10/2/2015	40.4		2		1	<1	<2	<6					
	LE-100115-40.4 Land Equipment Blank		10/2/2015	40.4		1		<1	<1	<2	<6					
	BE-100115-40.5 Boat Equipment Blank		10/3/2015	40.5		2		1	<1	<2	<6					
	LE-100115-40.5 Land Equipment Blank		10/3/2015	40.5		12		5	<1	<2	<6					
	BE-100115-40.6 Boat Equipment Blank		10/3/2015	40.6		2		1	<1	<2	<6					
	BF-100115-40.6 Boat Field Blank		10/3/2015	40.6		<1		<1	<1	<2	16					
	LE-100115-40.6 Land Equipment Blank		10/3/2015	40.6		<1		<1	<1	<2	<6					
	LF-100115-40.6 Land Field Blank		10/3/2015	40.6		<1		<1	<1	<2	<6					

APPENDIX B
SAMPLING PERMITS
~~(PROVIDED ON CD)~~

SCIENTIFIC RESEARCH AND COLLECTING PERMIT

Grants permission in accordance with the attached general and special conditions

United States Department of the Interior
National Park Service
Rock Creek

Study#: ROCR-00105
Permit#: ROCR-2014-SCI-0029
Start Date: Dec 01, 2014
Expiration Date: Dec 18, 2015
Coop Agreement#:
Optional Park Code:

Name of principal investigator:

Name: Mr David Wong **Phone:**410-740-6082 **Email:**dwong@versar.com

Name of institution represented:
Versar, Inc.

Co-Investigators:

Name: Michael W. Stephens Jr	**Phone:** 410-740-6085	**Email:** mstephens@versar.com
Name: Charles Tonkin	**Phone:** 410-740-6100	**Email:** ctonkin@versar.com
Name: William Burton	**Phone:** 410-740-6086	**Email:** wburton@versar.com
Name: Colby Hause	**Phone:** N/A	**Email:** N/A
Name: Katherine Dillow	**Phone:** 4107406116	**Email:** kdillow@versar.com
Name: Neal Eshelman	**Phone:** 410-740-6092	**Email:** neshelman@versar.com
Name: Pooja Potti	**Phone:** N/A	**Email:** ppotti@versar.com
Name: Ryan Corbin	**Phone:** 410-740-6071	**Email:** rcorbin@versar.com
Name: Daniel Spradlin	**Phone:** N/A	**Email:** dspradlin@versar.com

Study Title:
PHASE I RECEIVING WATER POST CONSTRUCTION MONITORING FOR DC WATER'S LONG TERM CONTROL PLAN

Purpose of study:
The District of Columbia Water and Sewer Authority ("DC Water") has a National Pollutant Discharge System Elimination Permit ("NPDES") for the wastewater treatment plant at Blue Plains and the combined sewer system. The permit requires DC Water to conduct Phase I of post construction monitoring after the inflatable dams have been replaced and the pumping station rehabilitations have been completed. The purpose of the monitoring program is to examine the impact of the completed combined sewer overflow control projects (i.e., Phase I projects) on the receiving water quality. The Phase I work is scheduled to begin in the fall of 2014 and be completed one year thereafter (final dates to be determined in consultation with COG and DC Water).

Subject/Discipline:
Water Quality

Locations authorized:
MD/DC Border
Tilden Street
Porter Street
Pennsylvania Avenue

Transportation method to research site(s):
Vehicle

Collection of the following specimens or materials, quantities, and any limitations on collecting:
Only collection of water samples is permitted. Collection of any macroinvertebrates, herptofauna, or fish is not authorized by this permit. Any fauna inadvertently captured during the collection of water samples will be immediately released at the site of capture.

Name of repository for specimens or sample materials if applicable:

Repository type: Will be destroyed through analysis or discarded after analysis
Objects collected:
Water Samples

Specific conditions or restrictions (also see attached conditions):

19. The park contact for the study will be Bill Yeaman (202-895-6074 or bill_yeaman@nps.gov). The park contact should be notified of any changes that are required for this permit.

20. The study will be conducted only in areas approved by the Rock Creek Park Resource Management Staff. Special care is required to insure that habitat disturbance or collecting does not occur at sensitive sites.

21. Care will be taken to avoid damages to park resources in all aspects of the project. Exploration and access to study sites will emphasize carefully chosen routes that minimize soil disturbance and trampling of vegetation. All activities will be conducted to avoid disturbance of stream banks and spring habitats. Markings of the study area or points will be limited to those specifically approved by the park. Any necessary marking will be done with temporary markers such as surveyor's flagging tape. All approved marking materials will be removed upon project completion. Minimal impact activity is desired

22. The study will be limited to the collection of water samples. Removal or collecting of other resources including vegetation, animals, rocks, soil, historical artifacts, or items not listed in the permit is not authorized.

23. All vehicles used in the study will be operated and parked only in legal paved areas and not on grass, trails, or in natural areas.

24. All instructions of the U.S. Park Police and other National Park Service officials who represent the Park Superintendent will be obeyed. A copy of this permit will be in the possession of study personnel when in the park and will be shared with these officials upon request. If necessary, the U.S. Park police can be reached at 202-426-7716 (Rock Creek Substation) or if contact is not successful, on 202-610-7505 (Regional Police Dispatcher).

25. All personnel participating in the project will be required to exercise all normal and reasonable safety precautions to protect themselves, park visitors, employees, and property. The U.S. Government will not be held responsible nor liable for any injuries, deaths, or damages to property arising from this permitted use of parkland.

26. Researcher must notify the Park Contact (202-895-6074) at least 48 hours prior to each year's initial visit to the park for field work so that s/he can make timely notification to U.S. Park Police and park staffs. If night activities are planned thereafter, the U.S. Park Police should be notified directly in advance of each event by phone on 202-426-7716 (Rock Creek Substation) or, if contact is not successful, on 202-610-7505 (Regional Police Dispatcher)..

27. Project personnel must comply with all NPS and park regulations and closures except as specifically outlined in this permit.

28. The park will receive copies of the final written report including any raw data, GIS maps, as well any other materials or progress reports, etc. generated by the study. This information should be submitted to the Office of Natural Resource Management through the park contact.

29. The Principal Investigator will complete an online Investigator's Annual Report at the end of each calendar year for which the permit is in effect.

Recommended by park staff(name and title):

William Yeaman - Resource Management Specialist

Reviewed by Collections Manager:

Yes ✓ No ____

Approved by park official:

Date Approved:

11.7.14

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

(Principal investigator's signature)

23 OCT 2014
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

GENERAL CONDITIONS
For
SCIENTIFIC RESEARCH AND COLLECTING PERMIT

United States Department of the Interior
National Park Service

1. **Authority** - The permittee is granted privileges covered under this permit subject to the supervision of the superintendent or a designee, and shall comply with all applicable laws and regulations of the National Park System area and other federal and state laws. A National Park Service (NPS) representative may accompany the permittee in the field to ensure compliance with regulations.

2. **Responsibility** - The permittee is responsible for ensuring that all persons working on the project adhere to permit conditions and applicable NPS regulations.

3. **False information** - The permittee is prohibited from giving false information that is used to issue this permit. To do so will be considered a breach of conditions and be grounds for revocation of this permit and other applicable penalties.

4. **Assignment** - This permit may not be transferred or assigned. Additional investigators and field assistants are to be coordinated by the person(s) named in the permit and should carry a copy of the permit while they are working in the park. The principal investigator shall notify the park's Research and Collecting Permit Office when there are desired changes in the approved study protocols or methods, changes in the affiliation or status of the principal investigator, or modification of the name of any project member.

5. **Revocation** - This permit may be terminated for breach of any condition. The permittee may consult with the appropriate NPS Regional Science Advisor to clarify issues resulting in a revoked permit and the potential for reinstatement by the park superintendent or a designee.

6. **Collection of specimens (including materials)** - No specimens (including materials) may be collected unless authorized on the Scientific Research and Collecting permit.

The general conditions for specimen collections are:

- Collection of archeological materials without a valid Federal Archeology Permit is prohibited.
- Collection of federally listed threatened or endangered species without a valid U.S. Fish and Wildlife Service endangered species permit is prohibited.
- Collection methods shall not attract undue attention or cause unapproved damage, depletion, or disturbance to the environment and other park resources, such as historic sites.
- New specimens must be reported to the NPS annually or more frequently if required by the park issuing the permit. Minimum information for annual reporting includes specimen classification, number of specimens collected, location collected, specimen status (e.g., herbarium sheet, preserved in alcohol/formalin, tanned and mounted, dried and boxed, etc.), and current location.

- Collected specimens that are not consumed in analysis or discarded after scientific analysis remain federal property. The NPS reserves the right to designate the repositories of all specimens removed from the park and to approve or restrict reassignment of specimens from one repository to another. Because specimens are Federal property, they shall not be destroyed or discarded without prior NPS authorization.
- Each specimen (or groups of specimens labeled as a group) that is retained permanently must bear NPS labels and must be accessioned and cataloged in the NPS National Catalog. Unless exempted by additional park-specific stipulations, the permittee will complete the labels and catalog records and will provide accession information. It is the permittee's responsibility to contact the park for cataloging instructions and specimen labels as well as instructions on repository designation for the specimens.
- Collected specimens may be used for scientific or educational purposes only, and shall be dedicated to public benefit and be accessible to the public in accordance with NPS policies and procedures.
- Any specimens collected under this permit, any components of any specimens (including but not limited to natural organisms, enzymes or other bioactive molecules, genetic materials, or seeds), and research results derived from collected specimens are to be used for scientific or educational purposes only, and may not be used for commercial or other revenue-generating purposes unless the permittee has entered into a Cooperative Research And Development Agreement (CRADA) or other approved benefit-sharing agreement with the NPS. The sale of collected research specimens or other unauthorized transfers to third parties is prohibited. Furthermore, if the permittee sells or otherwise transfers collected specimens, any components thereof, or any products or research results developed from such specimens or their components without a CRADA or other approved benefit-sharing agreement with NPS, permittee will pay the NPS a royalty rate of twenty percent (20%) of gross revenue from such sales or other revenues. In addition to such royalty, the NPS may seek other damages to which the NPS may be entitled including but not limited to injunctive relief against the permittee.

7. **Reports** - The permittee is required to submit an Investigator's Annual Report and copies of final reports, publications, and other materials resulting from the study. Instructions for how and when to submit an annual report will be provided by NPS staff. Park research coordinators will analyze study proposals to determine whether copies of field notes, databases, maps, photos, and/or other materials may also be requested. The permittee is responsible for the content of reports and data provided to the National Park Service.

8. **Confidentiality** - The permittee agrees to keep the specific location of sensitive park resources confidential. Sensitive resources include threatened species, endangered species, and rare species, archeological sites, caves, fossil sites, minerals, commercially valuable resources, and sacred ceremonial sites.

9. **Methods of travel** - Travel within the park is restricted to only those methods that are available to the general public unless otherwise specified in additional stipulations associated with this permit.

10. **Other permits** - The permittee must obtain all other required permit(s) to conduct the specified project.

11. **Insurance** - If liability insurance is required by the NPS for this project, then documentation must be provided that it has been obtained and is current in all respects before this permit is considered valid.

12. **Mechanized equipment** - No use of mechanized equipment in designated, proposed, or potential wilderness areas is allowed unless authorized by the superintendent or a designee in additional specific conditions associated with this permit.

13. **NPS participation** - The permittee should not anticipate assistance from the NPS unless specific arrangements are made and documented in either an additional stipulation attached to this permit or in other separate written agreements.

14. **Permanent markers and field equipment** - The permittee is required to remove all markers or equipment from the field after the completion of the study or prior to the expiration date of this permit. The superintendent or a designee may modify this requirement through additional park specific conditions that may be attached to this permit. Additional conditions regarding the positioning and identification of markers and field equipment may be issued by staff at individual parks.

15. **Access to park and restricted areas** - Approval for any activity is contingent on the park being open and staffed for required operations. No entry into restricted areas is allowed unless authorized in additional park specific stipulations attached to this permit.

16. **Notification** - The permittee is required to contact the park's Research and Collecting Permit Office (or other offices if indicated in the stipulations associated with this permit) prior to initiating any fieldwork authorized by this permit. Ideally this contact should occur at least one week prior to the initial visit to the park.

17. **Expiration date** - Permits expire on the date listed. Nothing in this permit shall be construed as granting any exclusive research privileges or automatic right to continue, extend, or renew this or any other line of research under new permit(s).

18. **Other stipulations** - This permit includes by reference all stipulations listed in the application materials or in additional attachments to this permit provided by the superintendent or a designee. Breach of any of the terms of this permit will be grounds for revocation of this permit and denial of future permits.

SCIENTIFIC RESEARCH AND COLLECTING PERMIT

Grants permission in accordance with the attached general and special conditions

United States Department of the Interior
National Park Service
Rock Creek

Study#: ROCR-00105
Permit#: ROCR-2014-SCI-0029
Start Date: Dec 01, 2014
Expiration Date: Apr 30, 2016
Coop Agreement#:
Optional Park Code:

Name of principal investigator:

Name:Mr David Wong	Phone:410-740-6082	Email:dwong *a* versar.com

Name of institution represented:
Versar, Inc.

Co-Investigators:

Name: Michael W. Stephens Jr	**Phone:** 410-740-6085	**Email:** mstephens *a* versar.com
Name: Charles Tonkin	**Phone:** 410-740-6100	**Email:** ctonkin *a* versar.com
Name: William Burton	**Phone:** 410-740-6086	**Email:** wburton *a* versar.com
Name: Colby Hause	**Phone:** N/A	**Email:** N/A
Name: Katherine Dillow	**Phone:** 4107406116	**Email:** kdillow *a* versar.com
Name: Neal Eshelman	**Phone:** 410-740-6092	**Email:** neshelman *a* versar.com
Name: Pooja Potti	**Phone:** N/A	**Email:** ppotti *a* versar.com
Name: Ryan Corbin	**Phone:** 410-740-6071	**Email:** rcorbin *a* versar.com
Name: Daniel Spradlin	**Phone:** N/A	**Email:** dspradlin *a* versar.com

Study Title:
PHASE I RECEIVING WATER POST CONSTRUCTION MONITORING FOR DC WATER S LONG TERM CONTROL PLAN

Purpose of study:
The District of Columbia Water and Sewer Authority ("DC Water") has a National Pollutant Discharge System Elimination Permit ("NPDES") for the wastewater treatment plant at Blue Plains and the combined sewer system. The permit requires DC Water to conduct Phase I of post construction monitoring after the inflatable dams have been replaced and the pumping station rehabilitations have been completed. The purpose of the monitoring program is to examine the impact of the completed combined sewer overflow control projects (i.e.. Phase I projects) on the receiving water quality. The Phase I work is scheduled to begin in the fall of 2014 and be completed one year thereafter (final dates to be determined in consultation with COG and DC Water).

Subject/Discipline:
Water Quality

Locations authorized:
MD/DC Border
Tilden Street
Porter Street
Pennsylvania Avenue

Transportation method to research site(s):
Vehicle

Collection of the following specimens or materials, quantities, and any limitations on collecting:
Only collection of water samples is permitted. Collection of any macroinvertebrates, herptofauna, or fish is not authorized by this permit. Any fauna inadvertently captured during the collection of water samples will be immediately released at the site of capture.

Name of repository for specimens or sample materials if applicable:

Repository type: Will be destroyed through analysis or discarded after analysis
Objects collected:
Water Samples

Specific conditions or restrictions (also see attached conditions):

19. The park contact for the study will be Bill Yeaman (202-895-6074 or bill_yeaman@nps.gov). The park contact should be notified of any changes that are required for this permit.

20. The study will be conducted only in areas approved by the Rock Creek Park Resource Management Staff. Special care is required to insure that habitat disturbance or collecting does not occur at sensitive sites.

21. Care will be taken to avoid damages to park resources in all aspects of the project. Exploration and access to study sites will emphasize carefully chosen routes that minimize soil disturbance and trampling of vegetation. All activities will be conducted to avoid disturbance of stream banks and spring habitats. Markings of the study area or points will be limited to those specifically approved by the park. Any necessary marking will be done with temporary markers such as surveyor's flagging tape. All approved marking materials will be removed upon project completion. Minimal impact activity is desired

22. The study will be limited to the collection of water samples. Removal or collecting of other resources including vegetation, animals, rocks, soil, historical artifacts, or items not listed in the permit is not authorized.

23. All vehicles used in the study will be operated and parked only in legal paved areas and not on grass, trails, or in natural areas.

24. All instructions of the U.S. Park Police and other National Park Service officials who represent the Park Superintendent will be obeyed. A copy of this permit will be in the possession of study personnel when in the park and will be shared with these officials upon request. If necessary, the U.S. Park police can be reached at 202-426-7716 (Rock Creek Substation) or if contact is not successful, on 202-610-7505 (Regional Police Dispatcher).

25. All personnel participating in the project will be required to exercise all normal and reasonable safety precautions to protect themselves, park visitors, employees, and property. The U.S. Government will not be held responsible nor liable for any injuries, deaths, or damages to property arising from this permitted use of parkland.

26. Researcher must notify the Park Contact (202-895-6074) at least 48 hours prior to each year's initial visit to the park for field work so that s/he can make timely notification to U.S. Park Police and park staffs. If night activities are planned thereafter, the U.S. Park Police should be notified directly in advance of each event by phone on 202-426-7716 (Rock Creek Substation) or, if contact is not successful, on 202-610-7505 (Regional Police Dispatcher)..

27. Project personnel must comply with all NPS and park regulations and closures except as specifically outlined in this permit.

28. The park will receive copies of the final written report including any raw data, GIS maps, as well any other materials or progress reports, etc. generated by the study. This information should be submitted to the Office of Natural Resource Management through the park contact.

29. The Principal Investigator will complete an online Investigator's Annual Report at the end of each calendar year for which the permit is in effect.

Recommended by park staff(name and title):

William Yeaman - Resource Management Specialist

Reviewed by Collections Manager:

Yes ___ No ✓

Approved by park official:

Date Approved:

11/3/15

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Permit is not valid unless signed and dated by the principal investigator)

(DAVID A. WONG)
(Principal investigator's signature)

28 OCTOBER 2015
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

U.S. Department of Homeland Security

United States Coast Guard

Commander
United States Coast Guard
Fifth Coast Guard District

431 Crawford Street, Rm.100
Portsmouth, Va. 23704-5004
Staff Symbol: dpw
Phone: 757-398-6360
Fax: 757-398-6303
Email: Albert.L.Grimes@uscg.mil

11011
October 22, 2014

Versar Inc.
Attn.: Mr. Michael Stephens
9200 Rumsey Road, Suite 100
Columbia, MD. 21045

Dear Mr. Stephens,

This is in response to your letter of October 14, 2014 requesting permission to place YSI Water Quality Meter on Upper Potomac River Alexandria Channel Buoy 4 (LL 18615).

Permission is granted for you to place your monitors on Upper Potomac River Alexandria Channel Buoy 4 (LL 18615) until December 31, 2015.

The Coast Guard cannot be held liable for any damage or injury incurred while you are conducting your research activities.

Please notify Mr. Albert Grimes of this office 757-398-6360 if there is any change in your work schedule.

Sincerely,

John R. Walters
Chief, Waterways Management Section
U.S. Coast Guard
By direction

Copy: CG Sector Baltimore
CGC JAMES RANKIN (WLM 555)
CG ANT Potomac

Stephens, Michael

From: Lowe, Kyle <Kyle.Lowe@pgparks.com>
Sent: Wednesday, October 22, 2014 2:54 PM
To: Stephens, Michael
Cc: Sandy, Bernadine
Subject: FW: Water Quality Meter
Attachments: 011.JPG; 016.JPG

Michael- you can have permission to affix your water quality meter with the following criteria:

- Please include M-NCPPC Department of Parks in your Liability Insurance policy as additional insured at a minimum of &1,000,000. This will address any concerns related to your staff injurying themselves while installing and monitoring.
- Please send us periodic updates of your findings.

Insurance can be sent via email to myself. By the way, my father-in-law (Dr. Fred Holland)worked for Versar in the 90s...small world.

Thank You- Kyle

Kyle Lowe
Natural and Historical Resources Division
Office-301.627.2270
Cell- 301.538.5267
Kyle.lowe@pgparks.com
'A Proud Tradition of Public Service'

From: Stephens, Michael [mailto:mstephens@versar.com]
Sent: Friday, October 17, 2014 1:36 PM
To: Sandy, Bernadine
Subject: Water Quality Meter

Dear Bernadine,

As we discussed on the phone today, Versar, inc. is contracted by DC Water to monitor dissolved oxygen and bacterial levels in the Anacostia River. The piers at your park make a perfect location for one of our meters and sampling sites. The pier that is most upriver with the large pilings is ideal.

We would drill an eye bolt into the piling and then suspend the water quality meter 3 feet under the surface of the water using high tension cable. We would place it under the dock so that it is unobtrusive and would not attract any attention. The project is scheduled to run for one year, with a start date of December 1st.

I have attached two pictures of the YSI so you can get an idea of their scope and size. They are approximately three feet in length and 5 inches in diameter.

Please let me know if you would like any additional information, or have a different location that you would prefer for the YSI. Our field crew would also be more than happy to come down and show you the exact set up before we installed anything.

Appendix E Data Report for Flow Monitoring

DC CLEAN RIVERS
POST-CONSTRUCTION MONITORING PHASE I
DECEMBER 2014 – F EBRUARY 2016

dc water is life

CSL Services, Inc. *Customized Solutions to your Flow Metering Needs*

CSL Services, Inc.
May 2016

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- B) Monthly Scattergraphs
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- E) Instrumentation / Discussion of Calibration Methods

Introduction

CSL Services was contracted by Greeley & Hansen to install and maintain about 51 flow meters at various locations throughout the Washington DC Combined Sewer System (CSS). Generally, the monitoring was conducted from December 2014 to February 2016, though some meters were added or removed at different dates. The primary objective of this monitoring effort was to directly measure Combined Sewer Overflows at outfall locations along Anacostia, River, Potomac River and Rock Creek. The monitoring of several internal system points and dry weather diversions in the CSS was also included in the scope. Some locations required more than one flow monitor due to the configuration of the sewers. For some outfalls which were influenced by tides, dual meters were installed on the upstream and downstream side of the inflatable dams.

Site Summary

METER: M-01 Swirl

SEWER: NORTHEAST BOUNDARY TRUNK SEWER

OUTFALL: 019

DURATION: 12/1/14 - 3/1/16

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-01 Swirl measured excess flows from the Northeast Boundary Trunk Sewer after treatment at the Swirl facility before entering the Anacostia River through CSO 019.

3. The weir formula was used to calculate a flow rate from these measurements. M-01 Swirl is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	1.9	0
Avg.	143.554	1.957
Max	239.074	1605.769

Site Name/Manhole # M-1 Swirl Primary: [X] Alternate: [ ] Grade: [ ]

Investigation Date: 10/22/14 Time: 11:20 Crew Members: LR/JS

Installation Date: 12/18/14 Time: 11:00 Crew Members: LR/AP

Address/Location: RFK Stadium, by the swirl facility

Latitude: N 38°53.122' Longitude: W 76°58.311

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec

Depth 9'11" in

Turbulence Amplitude:

- ☐ (Less than 0.25")
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height		N/A	
Width			
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ (No evidence visible)
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *In the treatment plant*

- ☐ (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 29'

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

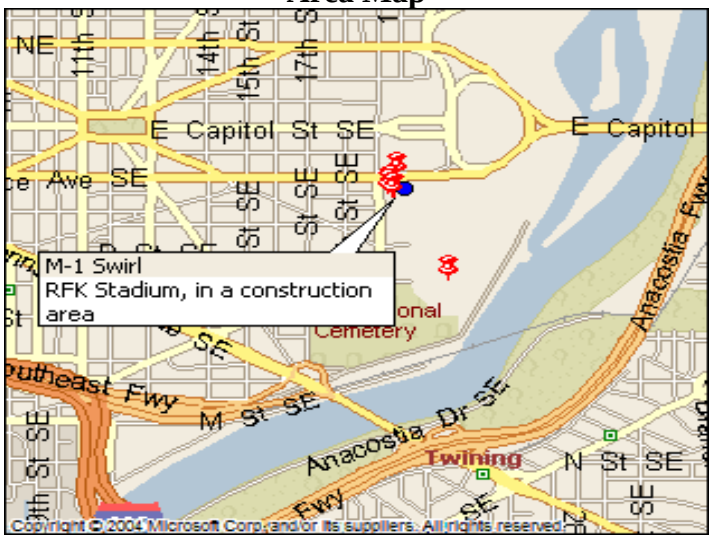
Sensor Configuration:

(Please include Serial Numbers when possible)

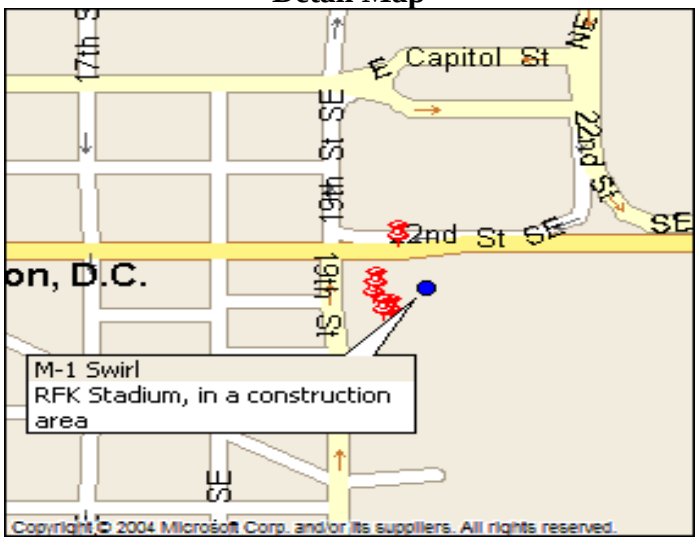
Level	Primary: Flowav
	Redundant:
Velocity	Primary:
	Redundant:
Meter Logger	Telog

Comments: *4'9" from top of weir to the ceiling; 10'11" from top of flow to the landing; 20'1" from bottom of pipe to the landing; 106.5" from landing to XXXX*

Area Map



Detail Map



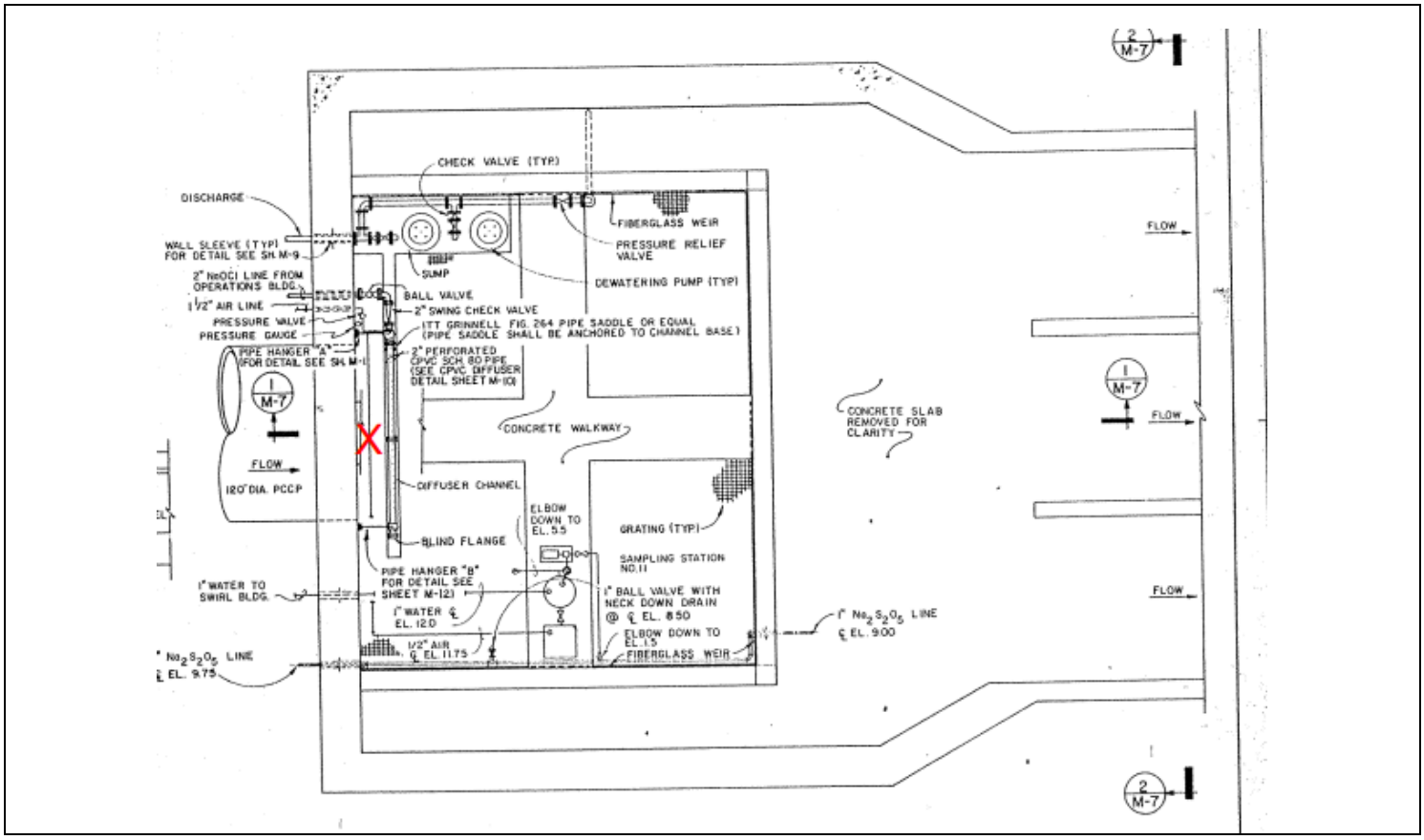
View from top of MH

Site Overview

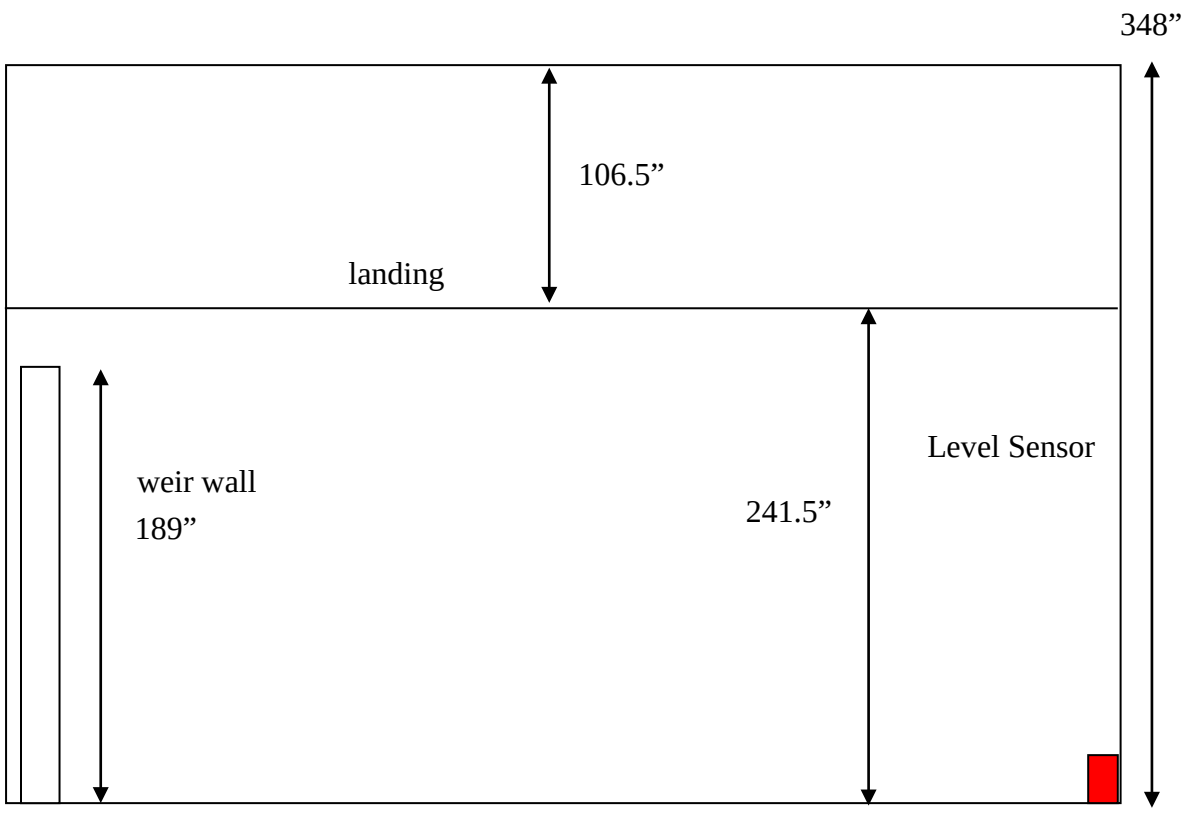
View of flow through influent line

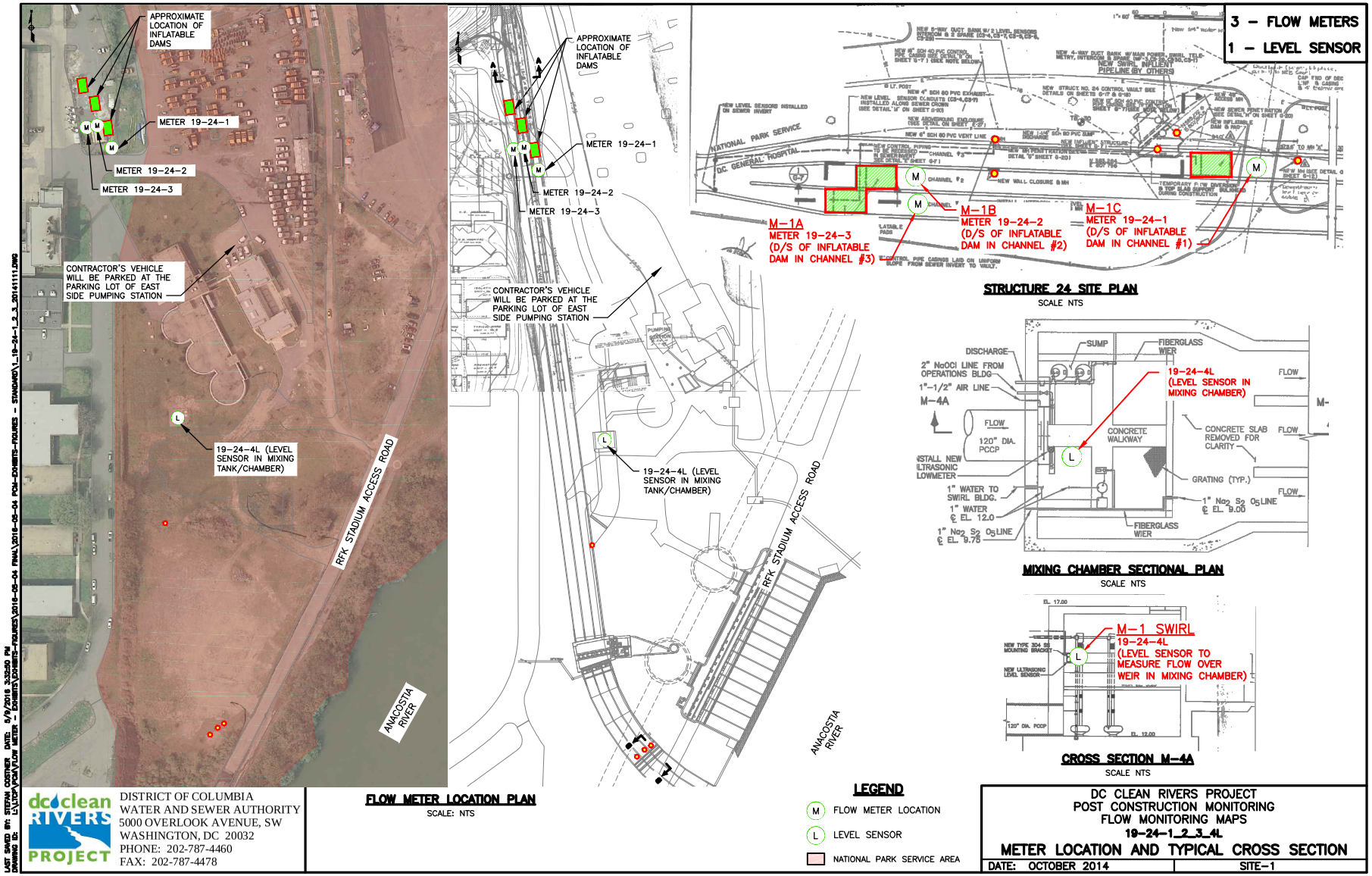
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

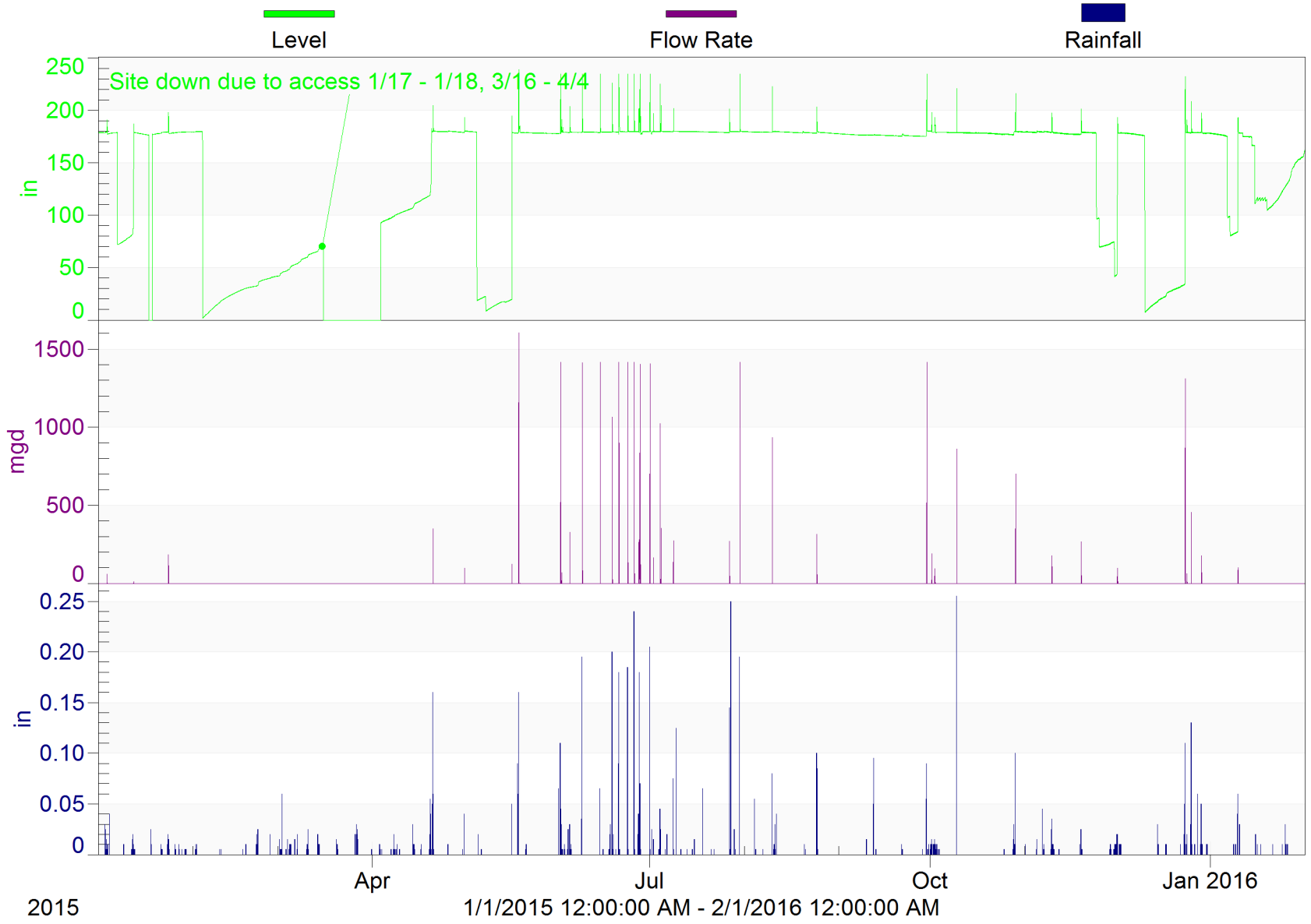


Dimension Structure Detail (pipe profile)




3 – FLOW METERS
1 – LEVEL SENSOR
APPROXIMATE LOCATION OF INFLATABLE DAMS
METER 19-24-1
METER 19-24-2
METER 19-24-3
CONTRACTOR'S VEHICLE WILL BE PARKED AT THE PARKING LOT OF EAST SIDE PUMPING STATION
19-24-4L (LEVEL SENSOR IN MIXING TANK/CHAMBER)
RFK STADIUM ACCESS ROAD
ANACOSTIA RIVER
M-1A
METER 19-24-3
(D/S OF INFLATABLE DAM IN CHANNEL #3)
M-1B
METER 19-24-2
(D/S OF INFLATABLE DAM IN CHANNEL #2)
M-1C
METER 19-24-1
(D/S OF INFLATABLE DAM IN CHANNEL #1)
NATIONAL PARK SERVICE
D.C. GENERAL HOSPITAL
STRUCTURE 24 SITE PLAN
SCALE NTS
DISCHARGE
2" NaOCl LINE FROM OPERATIONS BLDG
1"-1/2" AIR LINE
M-4A
FLOW
120" DIA. PCCP
INSTALL NEW ULTRASONIC LOWMETER
1" WATER TO SWIRL BLDG.
1" WATER ℄ EL. 12.0
1" Na2 S2 O5 LINE ℄ EL. 9.75
SUMP
FIBERGLASS WIER
19-24-4L (LEVEL SENSOR IN MIXING CHAMBER)
CONCRETE WALKWAY
CONCRETE SLAB REMOVED FOR CLARITY
GRATING (TYP.)
1" Na2 S2 O5 LINE ℄ EL. 9.00
MIXING CHAMBER SECTIONAL PLAN
SCALE NTS
M-1 SWIRL
19-24-4L
(LEVEL SENSOR TO MEASURE FLOW OVER WEIR IN MIXING CHAMBER)
NEW TYPE 304 SS MOUNTING BRACKET
NEW ULTRASONIC LEVEL SENSOR
EL. 17.00
EL. 12.00
CROSS SECTION M-4A
SCALE NTS
FLOW METER LOCATION PLAN
SCALE: NTS
LEGEND
FLOW METER LOCATION
LEVEL SENSOR
NATIONAL PARK SERVICE AREA
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
19-24-1_2_3_4L
METER LOCATION AND TYPICAL CROSS SECTION
DATE: OCTOBER 2014
SITE-1
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478
LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:32:50 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\1_19-24-1_2_3_20141111.DWG

M-01 Swirl


Level
Flow Rate
Rainfall
Site down due to access 1/17 - 1/18, 3/16 - 4/4
in
250
200
150
100
50
0
mgd
1500
1000
500
0
in
0.25
0.20
0.15
0.10
0.05
0
Apr
Jul
Oct
Jan 2016
2015
1/1/2015 12:00:00 AM - 2/1/2016 12:00:00 AM

M-01 Swirl

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
12/16/2014	10:30		7			0		GM/ME	Install meter.
12/18/2014	10:57	5.25	5			0		LR/AP	
12/18/2014	12:30	5.08	5			0		LR/AP	
12/22/2014	12:50						6.11	LR/AM	CB telog.
1/7/2015	12:15	71.89	72			0		AP/AM	
2/5/2015	12:20	5.23	5			0	6.07	AP/AM	Add redundant sensor.
4/3/2015	17:30						6.07	AP/AM	CB Telog.
5/14/2015	9:00	17.95	18			0	6.07	LR/DW	CB Telog.
5/14/2015	10:54	16.69	17.25			0		LR/DW	
5/14/2015	10:57	16.77	17.25			0		LR/DW	
5/14/2015	11:00	16.85	17.25			0		LR/DW	
7/23/2015	8:32						6.03	LR/DW	CB Telog.
9/23/2015	10:30		176			0	6.2	LR/JC	CB Telog.
12/14/2015	15:30							LL/MH	CB Telog.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-01A

SEWER: NORTHEAST BOUNDARY TRUNK SEWER

OUTFALL: 019

DURATION: 12/1/14 - 3/1/16

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-01A measured excess flows from the Northeast Boundary Trunk Sewer before entering the Anacostia River through CSO 019 downstream of the inflatable dam Structure 24a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-01A is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	1.842	0.022	0.226
Max	96.221	15.365	814.809

Site Name/Manhole # M-1A Primary: [X] Alternate: [ ]

Investigation Date: 10/22/14 Time: 11:20 Crew Members: LR/JS

Installation Date: 11/14/14 Time: 13:46 Crew Members: LR/SD

Address/Location: Across from RFK Stadium, access road (near swirl facility)

Latitude: N 38°53.179' Longitude: W 76°58.36'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.42 ft/sec

Depth 0.75 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	103"		103"
Width	185"		185"
Material	Concrete/Brick Bottom		Concrete/Brick Bottom
Shape	Chamber		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Need gate key*

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 17'11"

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

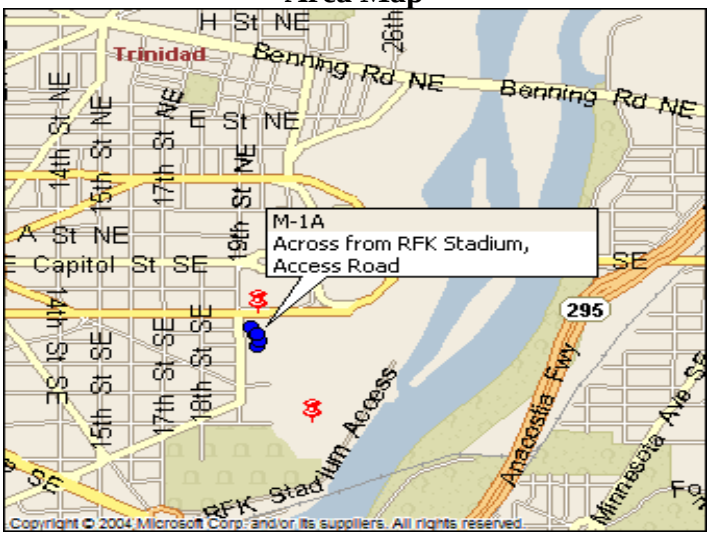
Sensor Configuration:

(Please include Serial Numbers when possible)

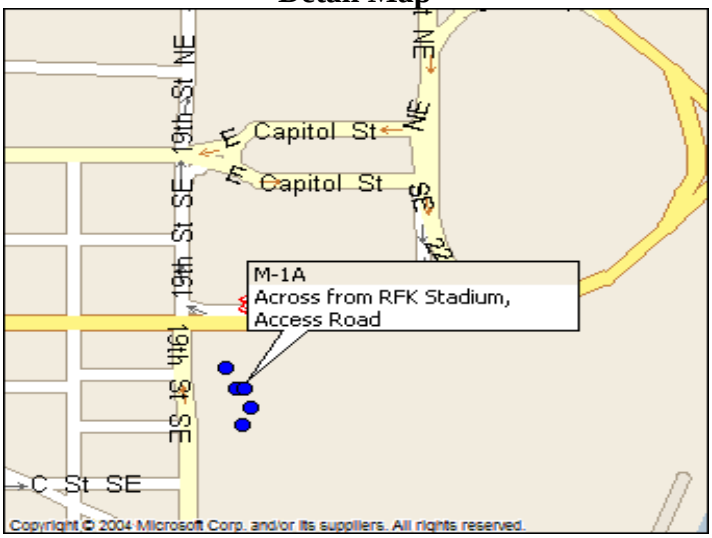
Level	Primary: FL900 A/V
	Redundant:
Velocity	Primary: FL900 A/V
	Redundant:
Meter Logger	Telog

Comments: *M-1A and M-1B meet 13' from the MH*

Area Map



Detail Map



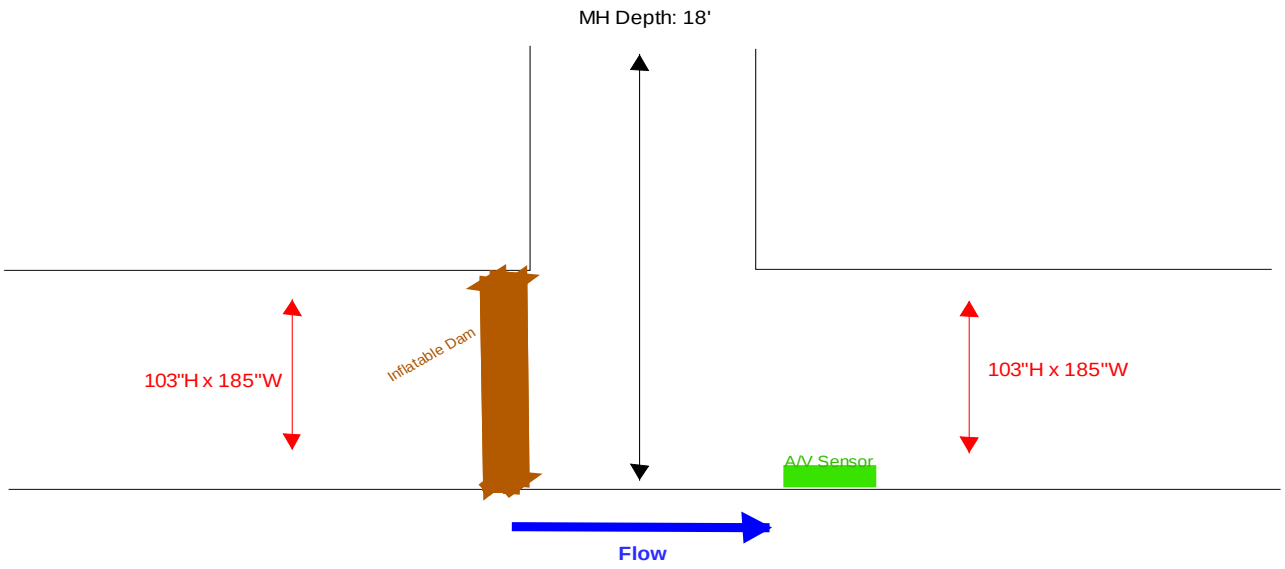
View from top of MH

Site Overview

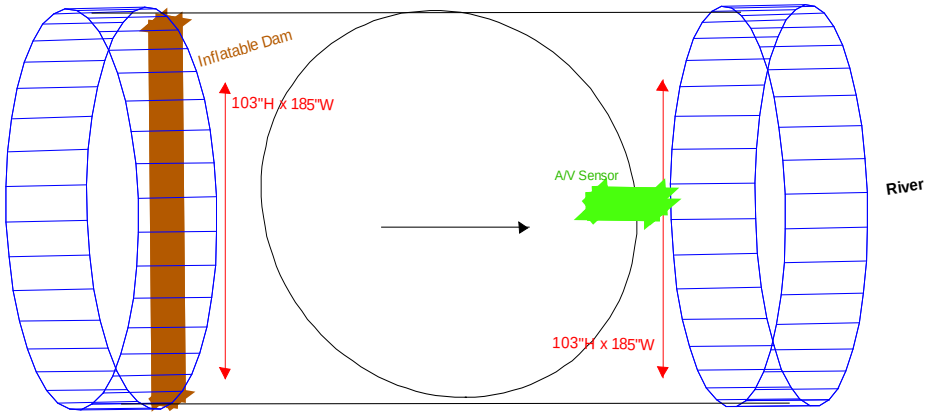
View of flow through influent line

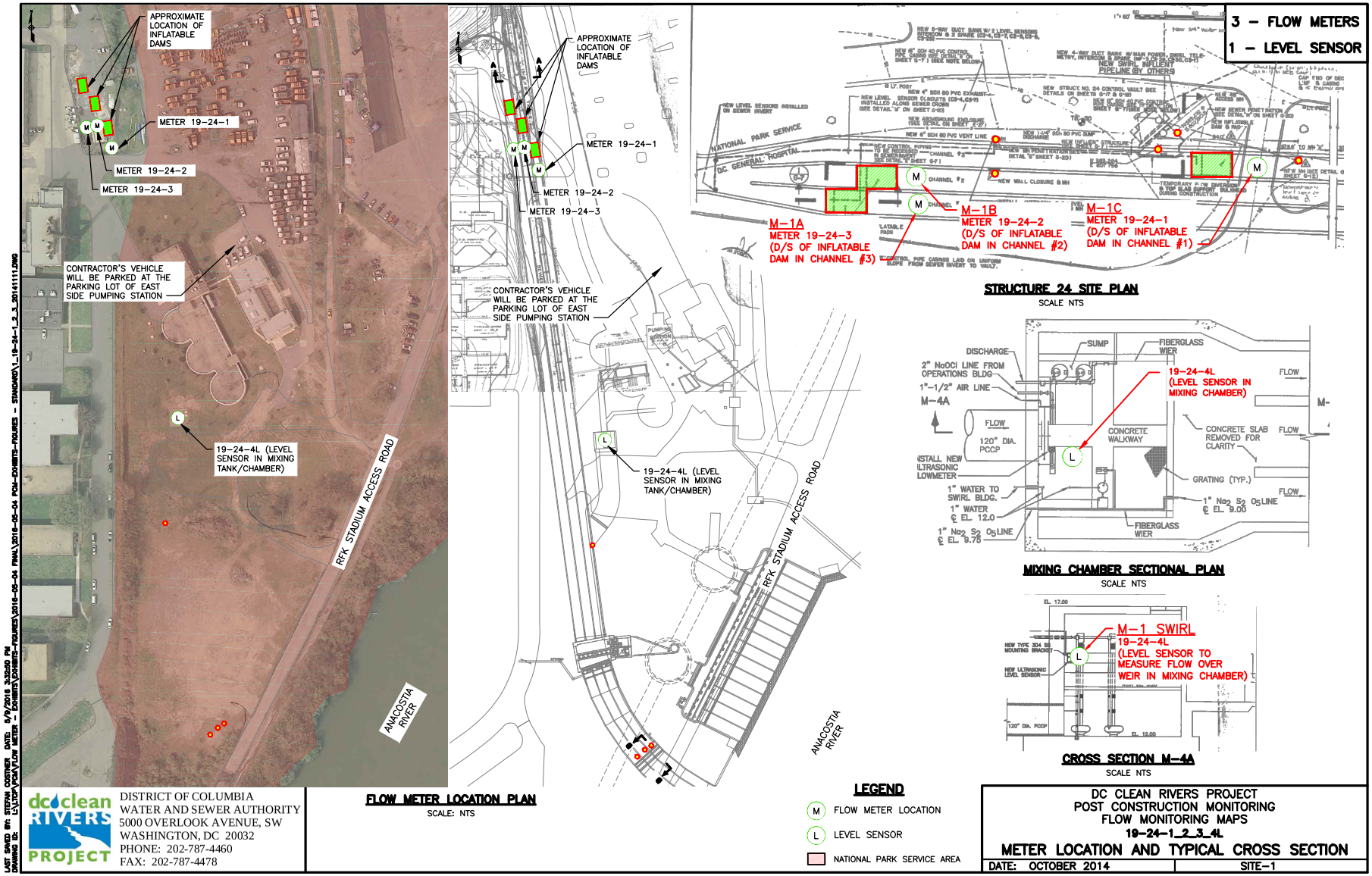
View of flow through effluent line

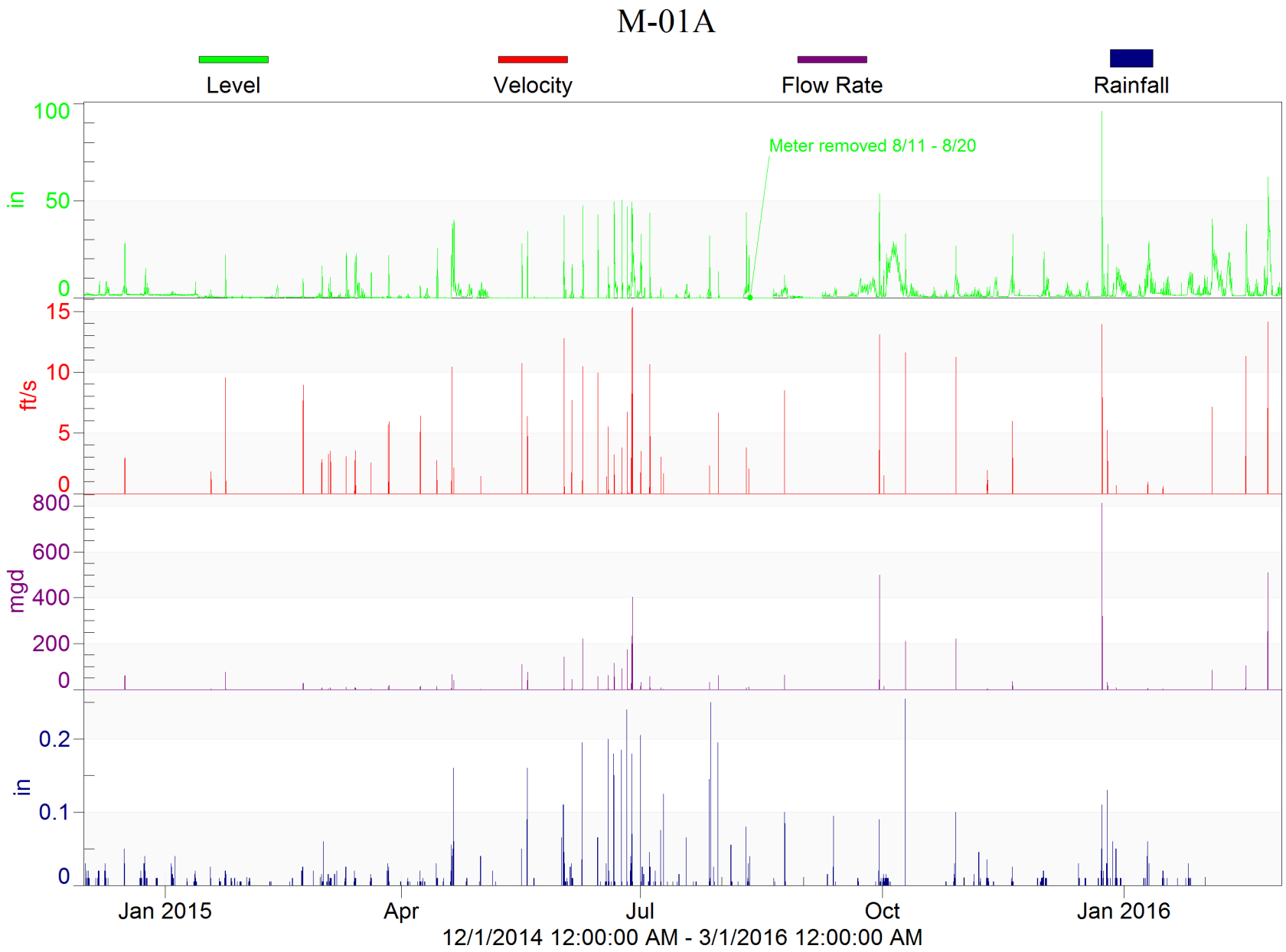
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (pipe profile)

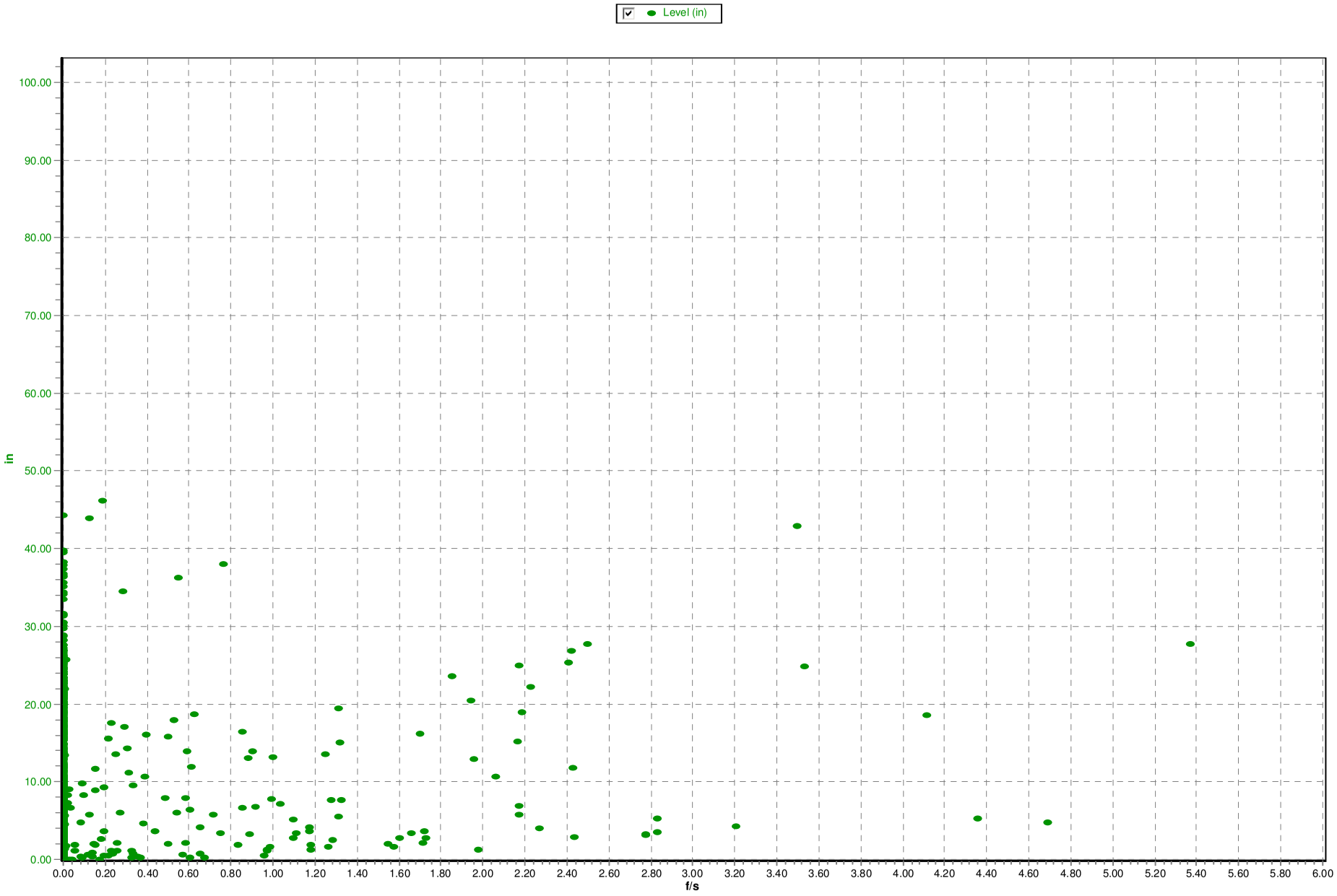



3 – FLOW METERS
1 – LEVEL SENSOR
APPROXIMATE LOCATION OF INFLATABLE DAMS
METER 19–24–1
METER 19–24–2
METER 19–24–3
CONTRACTOR'S VEHICLE WILL BE PARKED AT THE PARKING LOT OF EAST SIDE PUMPING STATION
19–24–4L (LEVEL SENSOR IN MIXING TANK/CHAMBER)
RFK STADIUM ACCESS ROAD
ANACOSTIA RIVER
M–1A
METER 19–24–3
(D/S OF INFLATABLE DAM IN CHANNEL #3)
M–1B
METER 19–24–2
(D/S OF INFLATABLE DAM IN CHANNEL #2)
M–1C
METER 19–24–1
(D/S OF INFLATABLE DAM IN CHANNEL #1)
NATIONAL PARK SERVICE
D.C. GENERAL HOSPITAL
STRUCTURE 24 SITE PLAN
SCALE NTS
DISCHARGE
2" NaOCl LINE FROM OPERATIONS BLDG
1"–1/2" AIR LINE
M–4A
FLOW
120" DIA. PCCP
INSTALL NEW ULTRASONIC LOWMETER
1" WATER TO SWIRL BLDG.
1" WATER ℄ EL. 12.0
1" Na2 S2 O5 LINE ℄ EL. 9.75
SUMP
FIBERGLASS WEIR
19–24–4L (LEVEL SENSOR IN MIXING CHAMBER)
CONCRETE WALKWAY
CONCRETE SLAB REMOVED FOR CLARITY
GRATING (TYP.)
1" Na2 S2 O5 LINE ℄ EL. 9.00
MIXING CHAMBER SECTIONAL PLAN
SCALE NTS
M–1 SWIRL
19–24–4L
(LEVEL SENSOR TO MEASURE FLOW OVER WEIR IN MIXING CHAMBER)
NEW TYPE 304 SS MOUNTING BRACKET
NEW ULTRASONIC LEVEL SENSOR
EL. 17.00
EL. 12.00
CROSS SECTION M–4A
SCALE NTS
FLOW METER LOCATION PLAN
SCALE: NTS
LEGEND
FLOW METER LOCATION
LEVEL SENSOR
NATIONAL PARK SERVICE AREA
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
19–24–1_2_3_4L
METER LOCATION AND TYPICAL CROSS SECTION
DATE: OCTOBER 2014
SITE–1
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478
LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:32:50 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\1_19-24-1_2_3_20141111.DWG


M-01A
Level
Velocity
Flow Rate
Rainfall
Meter removed 8/11 - 8/20
in
100
50
0
ft/s
15
10
5
0
mgd
800
600
400
200
0
in
0.2
0.1
0
Jan 2015
Apr
Jul
Oct
Jan 2016
12/1/2014 12:00:00 AM - 3/1/2016 12:00:00 AM

M-01A - Across from RFK Stadium, access road (near swirl facility)

Pipe Diameter (in): 103 H X 185 W (12/01/14 to 12/01/15)



M-01A

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/19/2015	15:30	0.65	0.5	0	0	0		LR/AP	Install
11/19/2015	15:45	0.81	0.5	0	0	0		LR/AP	
11/19/2015	16:00	0.78	0.5	0	0	0		LR/AP	
12/9/2014	10:47	6.72	5.75	0	0	0	5.42	LR/AM	CB Telog
12/9/2014	10:52	6.43	6	0	0	0		LR/AM	
12/9/2014	10:57	6.38	6	0	0	0		LR/AM	
1/9/2015	12:25	0.27	0.25	0	0	0		LR/PD	Change meter.
1/9/2015	12:30	0.23	0.25	0	0	0		LR/PD	
1/9/2015	12:35	0.23	0.25	0	0	0		LR/PD	
5/14/2015	12:23		0		0	0		LR/DW	CB Telog
7/14/2015	13:15		0		0	0	6.12	LR/DW	CB Telog
7/21/2015	12:01		0		0	0	13.2	LR/DW	CB Meter
8/13/2015	14:30		0		0	0		LR/DW	Meter removed by DC Water.
8/20/2015	14:24		0		0	0		LR/DW	Meter reinstalled.
10/29/2015	13:31		0		0	0		JC/RM	CB Meter
11/19/2015	11:52		3.5		0	0		JC/RM	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-01B

SEWER: NORTHEAST BOUNDARY TRUNK SEWER

OUTFALL: 019

DURATION: 12/1/14 - 3/1/16

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-01B measured excess flows from the Northeast Boundary Trunk Sewer before entering the Anacostia River through CSO 019 downstream of the inflatable dam Structure 24a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-01B is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	1.679	0.028	0.248
Max	56.32	15.038	398.945

Site Name/Manhole # M-1B Primary: [X] Alternate: [ ]

Investigation Date: 10/22/14 Time: 11:20 Crew Members: LR/JS

Installation Date: 11/14/14 Time: 10:37 Crew Members: LR/SD

Address/Location: Access Road behind RFK Stadium (near swirl facility)

Latitude: N 38°53.179' Longitude: W 76°58.36'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity ___ ft/sec

Depth ___ in

Dry Pipe

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Infl. 2	Effluent
Height	103"		103"
Width	185"		185"
Material	Concrete/Brick Bottom		Concrete/Brick Bottom
Shape	Chamber		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Need gate key*

- ☐ (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 17' 11"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

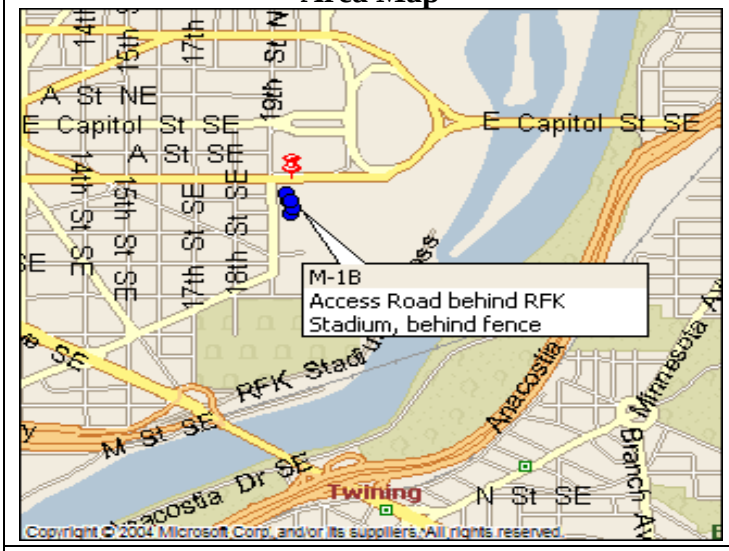
Sensor Configuration:

(Please include Serial Numbers when possible)

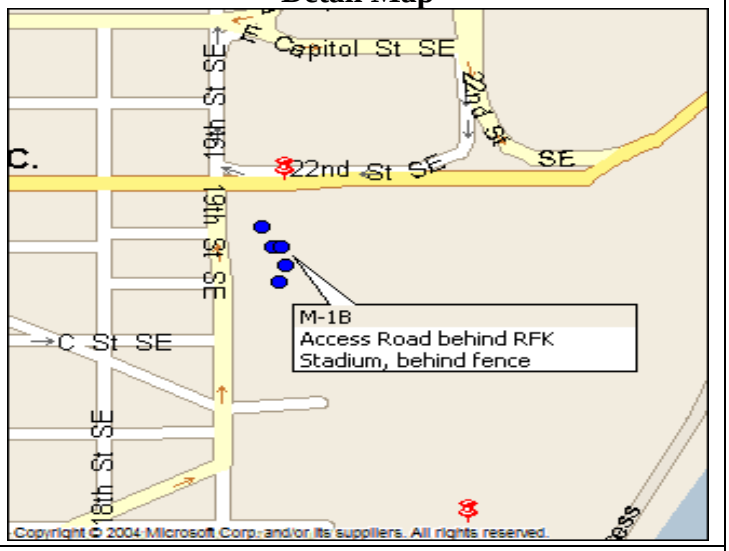
Level	Primary: FL900 A/V
	Redundant:
Velocity	Primary: FL900 A/V
	Redundant:
Meter Logger	Telog

Comments: *M-1A and M-1B meet 13' from the MH*

Area Map



Detail Map



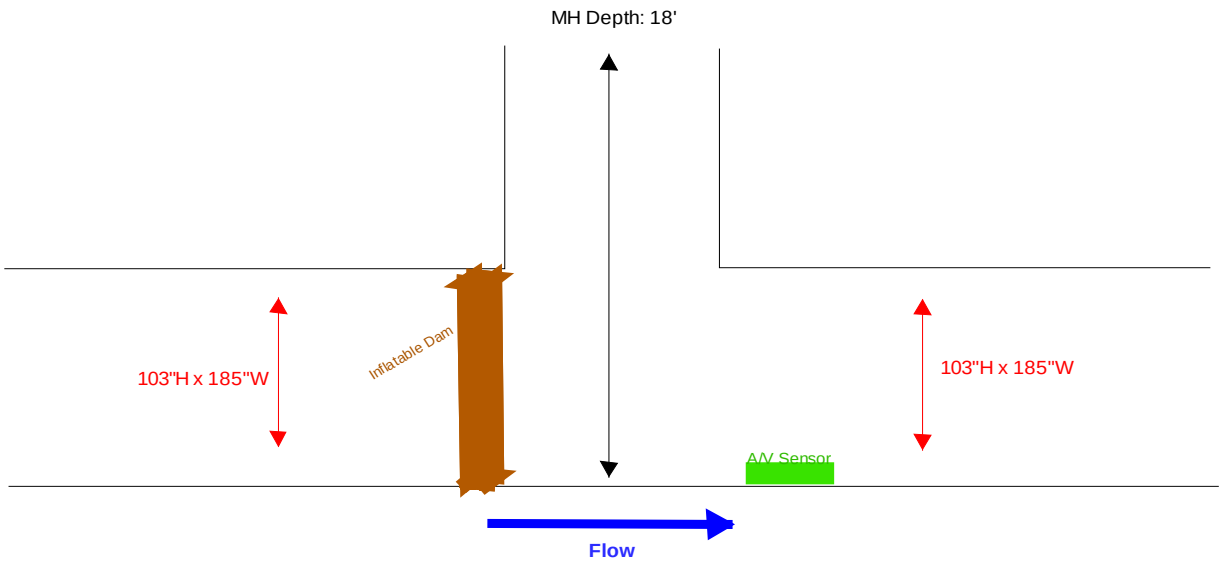
View from top of MH

Site Overview

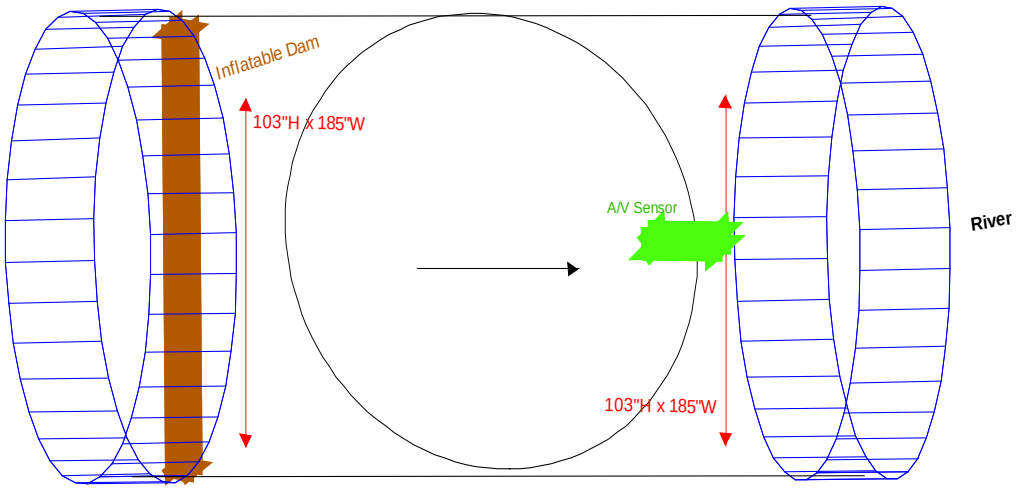
View of flow through influent line

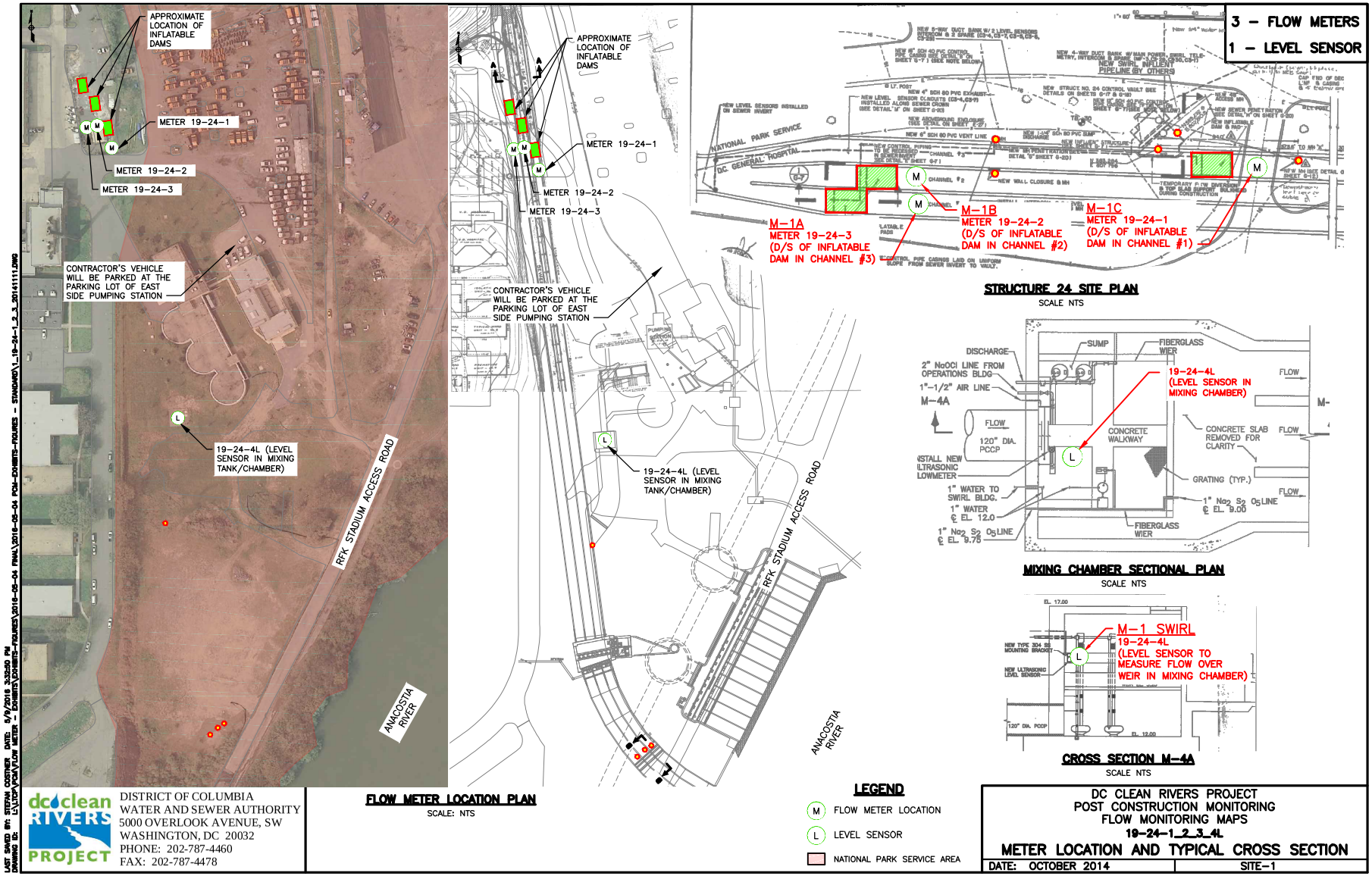
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (pipe profile)





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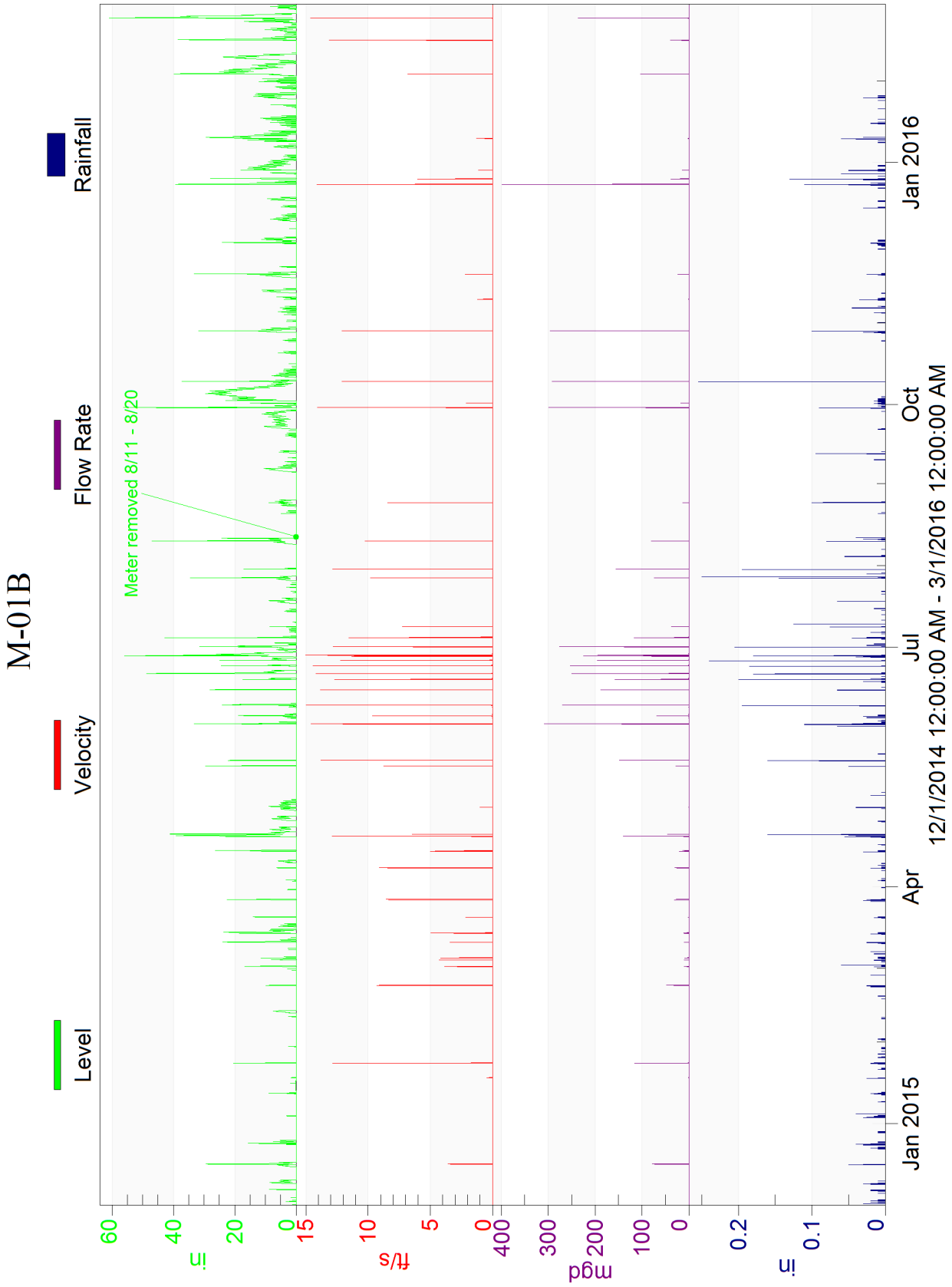
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

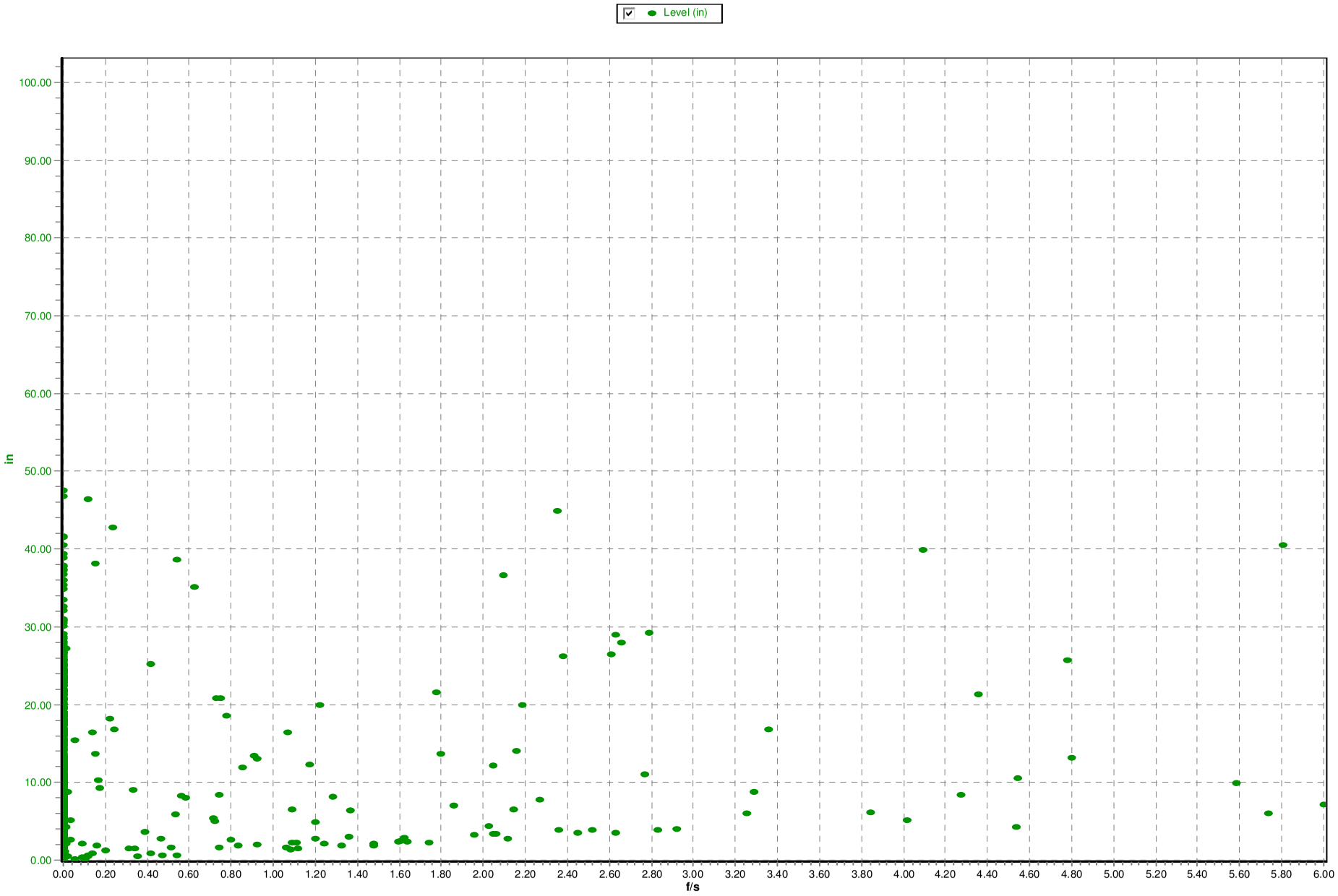
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
19-24-1_2_3_4L
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE-1


M-01B
Level
Velocity
Flow Rate
Rainfall
Meter removed 8/11 - 8/20
in
ft/s
mgd
in
60
40
20
0
15
10
5
0
400
300
200
100
0
0.2
0.1
0
Jan 2015
Apr
Jul
Oct
Jan 2016
12/1/2014 12:00:00 AM - 3/1/2016 12:00:00 AM

M-01B - Access Road behind RFK Stadium (near swirl facility)

Pipe Diameter (in): 103 H X 185 W (12/01/14 to 12/01/15)



M-01B

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/14/2015	11:00	0	0	0	0	0		LR/AP	Install
11/14/2015	11:30	0	0	0	0	0		LR/AP	
11/14/2015	12:00	0	0	0	0	0		LR/AP	
12/9/2014	11:44	6.59	6.5	0	0	0	5.01	LR/AP	CB Telog
12/9/2014	11:49	6.48	6.5	0	0	0		LR/AP	
12/9/2014	11:54	6.51	6.5	0	0	0		LR/AP	
12/16/2014	8:49	2.71	2.5	0	0	0		GM/GH	Standing/15'5" W x 8'7"/DOF 2.5"
1/13/2015	14:00	0	0	0	0	0		LL/AP	Change meter
5/21/2015	9:57		0		0	0	5.9	LR/DW	CB Telog
7/14/2015	13:24		0		0	0	6.07	LR/DW	CB Telog
7/21/2015	12:06		0		0	0	6.2	LR/DW	CB meter
8/13/2015	14:30		0		0	0		LR/DW	Meter removed by DC Water.
8/20/2015	15:36		0		0	0		LR/DW	Meter reinstalled.
10/29/2015	13:48		0		0	0		JC/RM	CB Meter
11/19/2015	11:43		3.75		0	0		JC/RM	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-01C

SEWER: NORTHEAST BOUNDARY TRUNK SEWER

OUTFALL: 019

DURATION: 12/1/14 - 3/1/16

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-01C measured excess flows from the Northeast Boundary Trunk Sewer before entering the Anacostia River through CSO 019 downstream of the inflatable dam Structure 24a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-01C is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	2.983	0.028	0.438
Max	153.482	13.752	759.843

Site Name/Manhole # M-1C Primary: [X] Alternate: [ ]

Investigation Date: 1/2/14 Time: 9:30 Crew Members: LR/JS/BC

Installation Date: 11/18/14 Time: 8:07 Crew Members: LR/SD

Address/Location: RFK Stadium (parking lot behind stadium, access road to the pump station, next to the curb)

Latitude: N 38° 53.139' Longitude: W 77° 58.349'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing water*

Velocity 0 ft/sec

Depth 0.25 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	103"		103"
Width	185"		185"
Material	Concrete w/ Brick Bottom		Concrete w/ Brick Bottom
Shape	Chamber		Chamber

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ (No evidence visible)
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 17'1"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

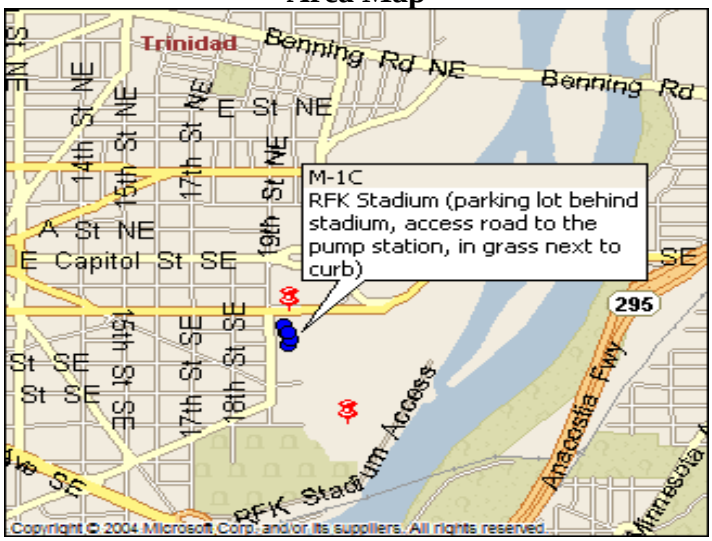
Sensor Configuration:

(Please include Serial Numbers when possible)

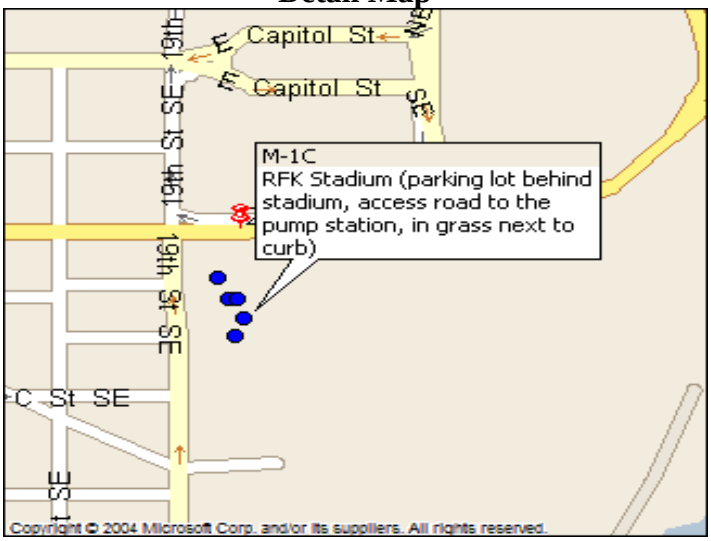
Level	Primary: FL900 AV
	Redundant:
Velocity	Primary: FL900 AV
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map

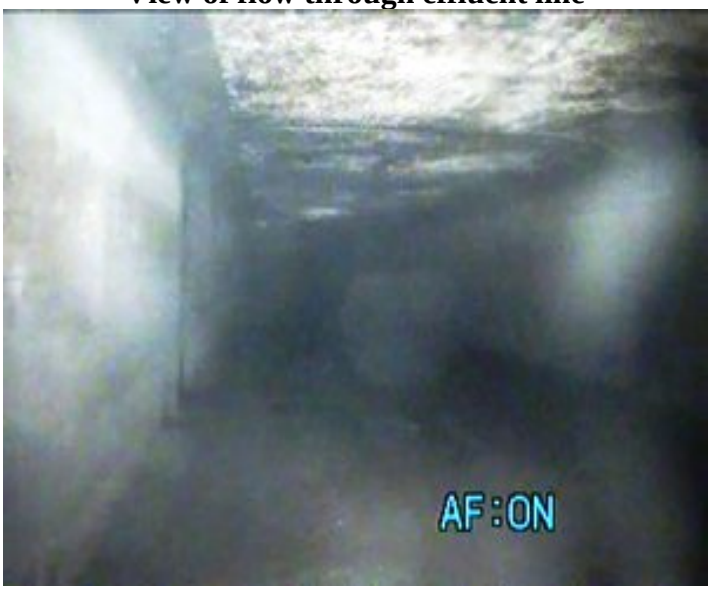


View from top of MH

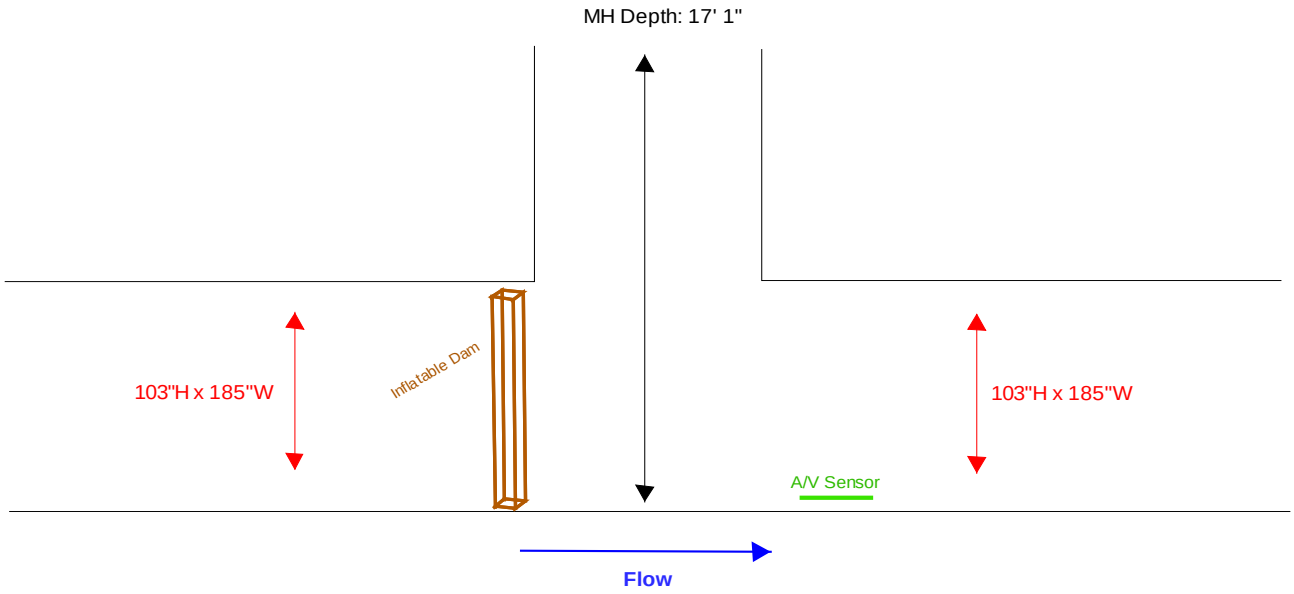
Site Overview

View of flow through influent line

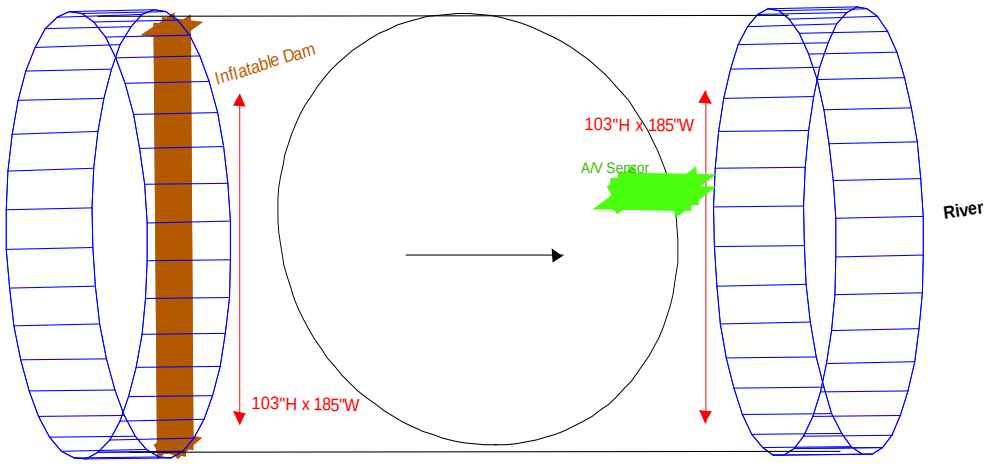
View of flow through effluent line

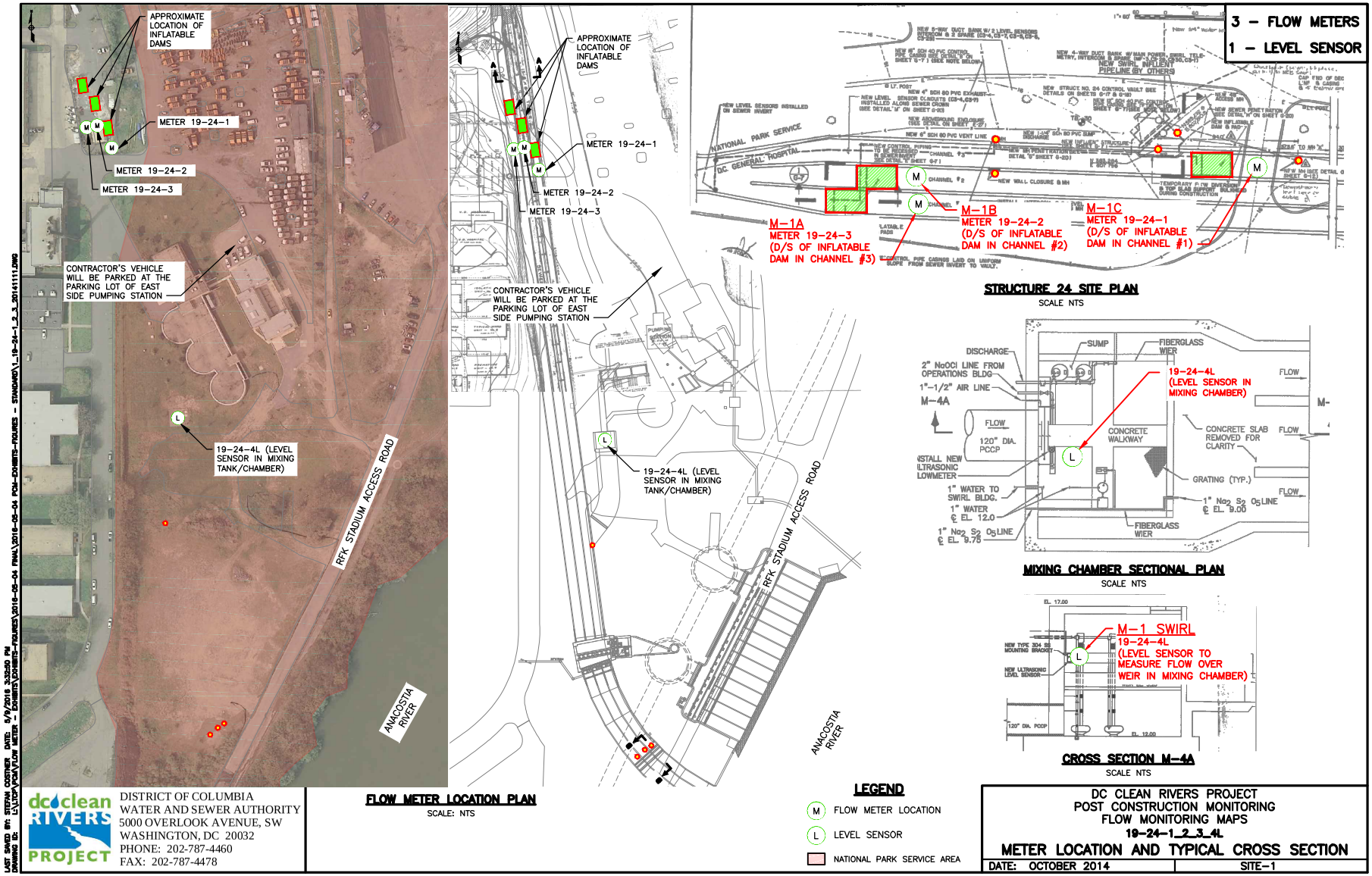


Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)



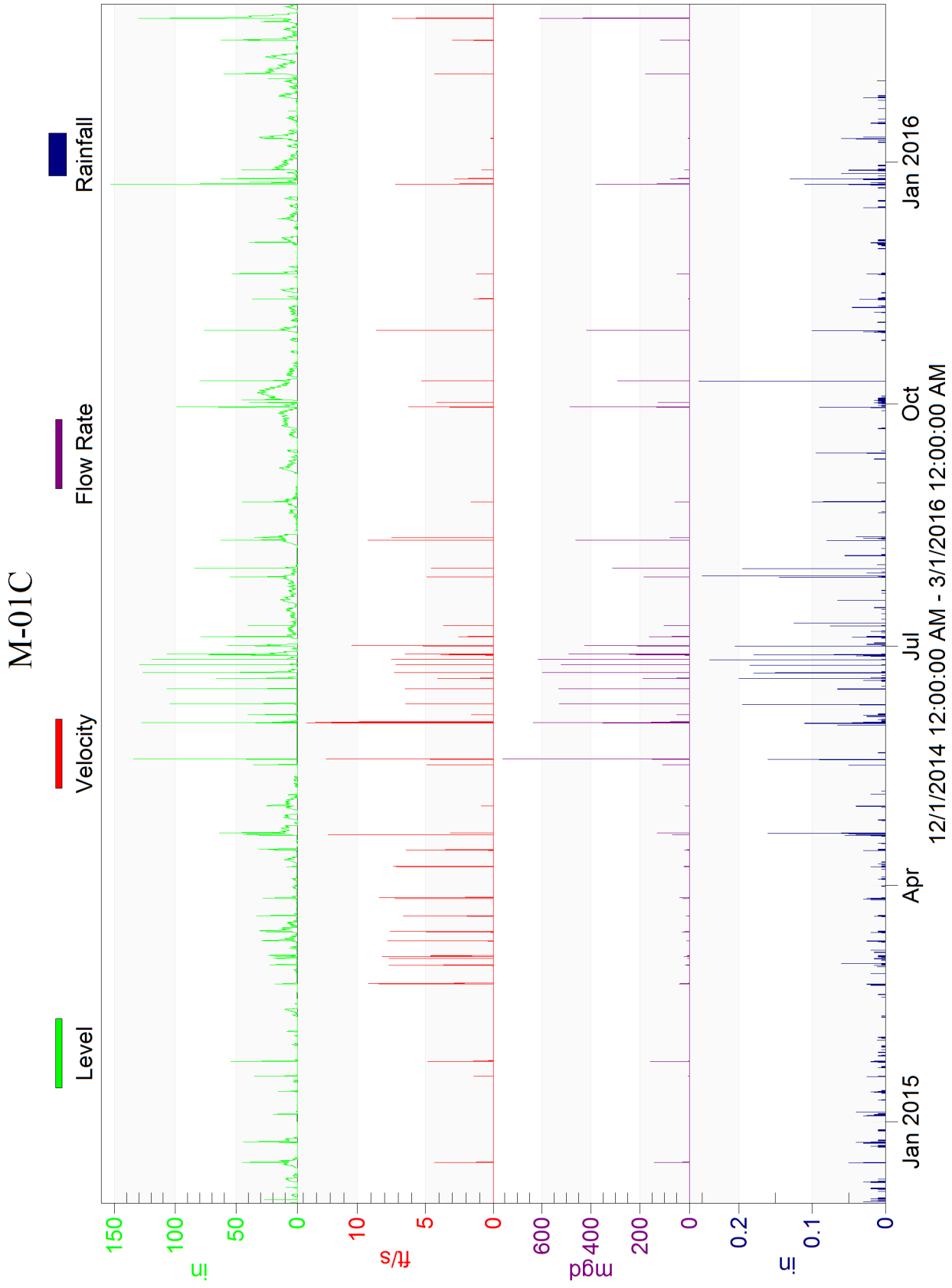


dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
19-24-1_2_3_4L
METER LOCATION AND TYPICAL CROSS SECTION

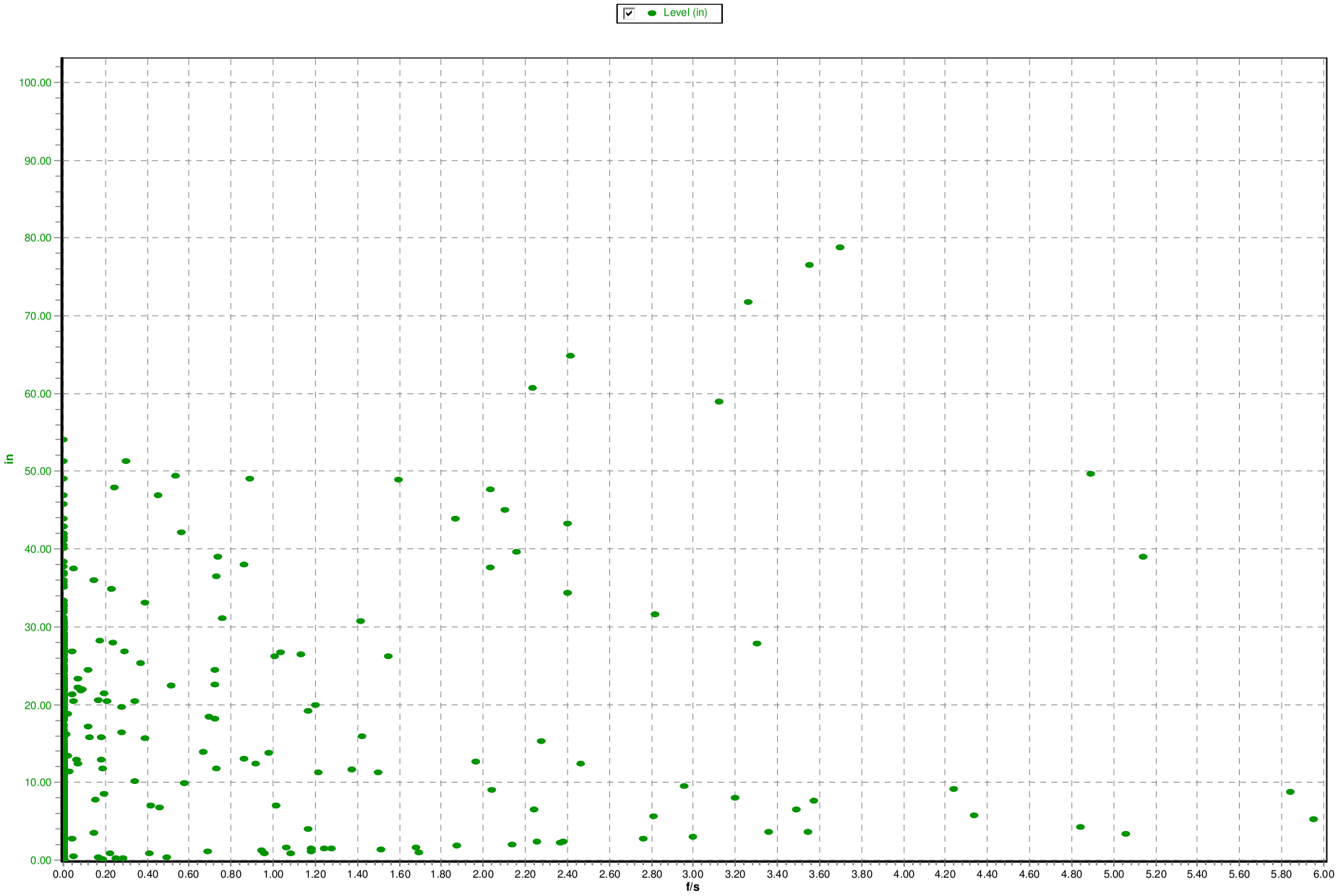
DATE: OCTOBER 2014 | SITE-1

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:32:50 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\1_19-24-1_2_3_20141111.DWG


M-01C
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
150
100
50
0
10
5
0
600
400
200
0
0.2
0.1
0
Jan 2015
Apr
Jul
Oct
Jan 2016
12/1/2014 12:00:00 AM - 3/1/2016 12:00:00 AM

M-01C - RFK Stadium (parking lot behind stadium, access road to the pump station, next to the curb)

Pipe Diameter (in): 103 H X 185 W (12/01/14 to 12/01/15)



M-01C

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/18/2014	9:39	0	0	0	0	0		LL/SD	Install.
11/18/2014	9:44	0	0	0	0	0		LL/SD	
11/18/2014	9:49	0	0	0	0	0		LL/SD	
12/9/2014	9:41	4.31	4.25	0	0	0	5.01	LR/AP	CB Telog.
12/9/2014	9:46	4.55	4.25	0	0	0		LR/AP	
12/9/2014	9:51	4.57	4.25	0	0	0		LR/AP	
12/17/2014	10:41		1.5		0	0		LR/AP	
12/22/2014	11:17	0	0	0	0	0	12.98	LR/AM	Change meter
12/22/2014	11:22	0	0	0	0	0	12.76	LR/AM	
12/22/2014	11:27	0	0	0	0	0	12.89	LR/AM	
1/20/2015	13:25	0	0	0	0	0		LR/AM	
1/20/2015	13:27	0	0	0	0	0		LR/AM	
5/11/2015	17:10	0.8	1		0	0	13.27	LR/DW	Install ultrasonic sensor.
5/11/2015	17:15	0.82	1		0	0	5.76	LR/DW	
5/11/2015	17:20	0.81	1		0	0		LR/DW	
6/5/2015	8:27							LR/DW	Replace Antenna
6/29/2015	13:38							LR/DW	Replace Antenna
7/10/2015	8:10		5		0	0		LR/DW	Replace Antenna / CB meter
8/10/2015	12:52		9.5		0	0		LR/DW	Install redunant meter.
10/5/2015	12:57		27		0	0		JC/RM	CB Meter/Telog.
11/19/2015	12:16		0		0	0		JC/RM	
12/23/2015	8:40		0		0	0		JC/RM	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-02E-DS

SEWER: TIBER CREEK TRUNK SEWER

OUTFALL: 012

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-02E-DS measured excess flows from the Tiber Creek Trunk Sewer before entering the Anacostia River through CSO 012 downstream of the inflatable dam at Structure 16.

3. The continuity equation was used to calculate a flow rate from these measurements. M-02E-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	9.174	0	0
Avg.	47.16	0.004	0.134
Max	95.976	10.909	268.144

Site Name/Manhole # M-2 E DS Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 16:00 Crew Members: LR/JS

Installation Date: 11/5/14 Time: 13:00 Crew Members: LR/CL

Address/Location: 100 O St. (through parking lot from M-3, DC Pump Station)

Latitude: N 38° 52.392’ Longitude: W 77° 0.177’

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 46 in

Turbulence Amplitude:

- (Less than 0.25”)
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	126”		126”
Width	144”		144”
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

(No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

(Good) 20.9 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 13’2”

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

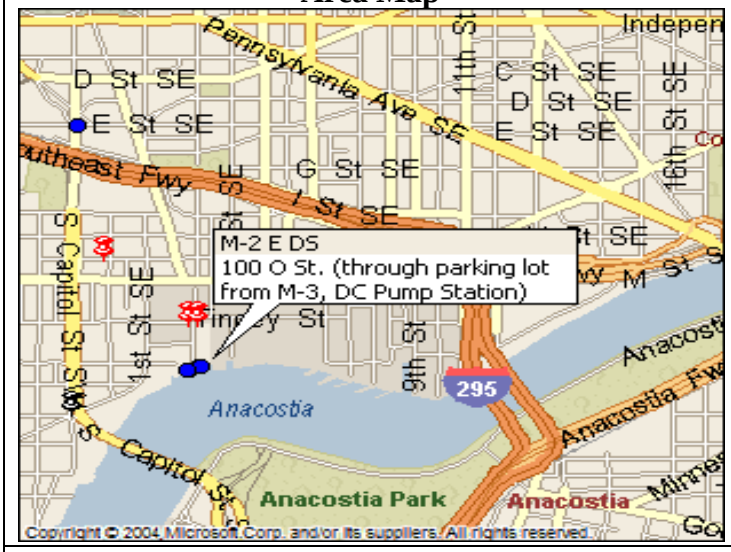
Sensor Configuration:

(Please include Serial Numbers when possible)

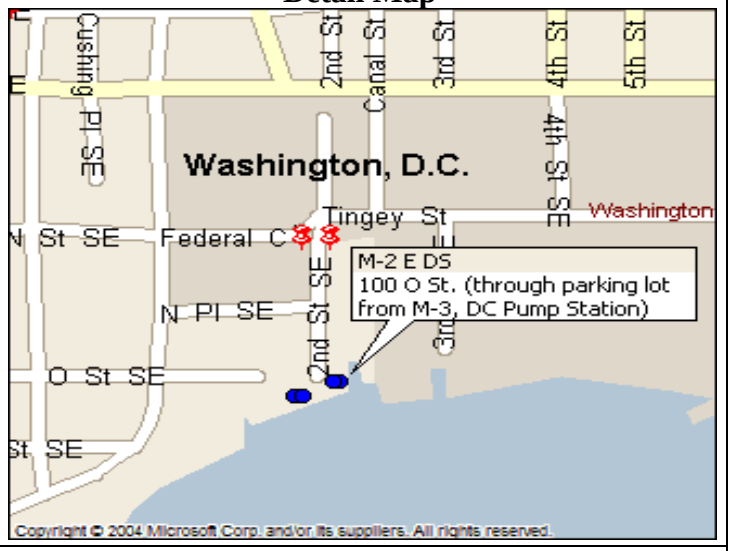
Level	Primary: Isco A/V
	Redundant:
Velocity	Primary: Isco A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



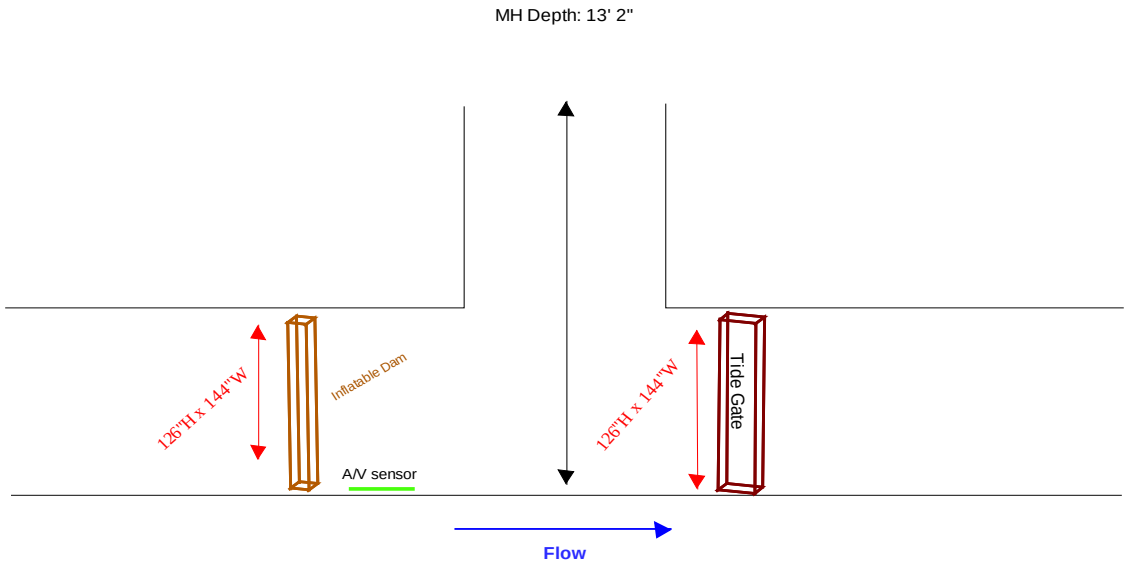
View from top of MH

Site Overview

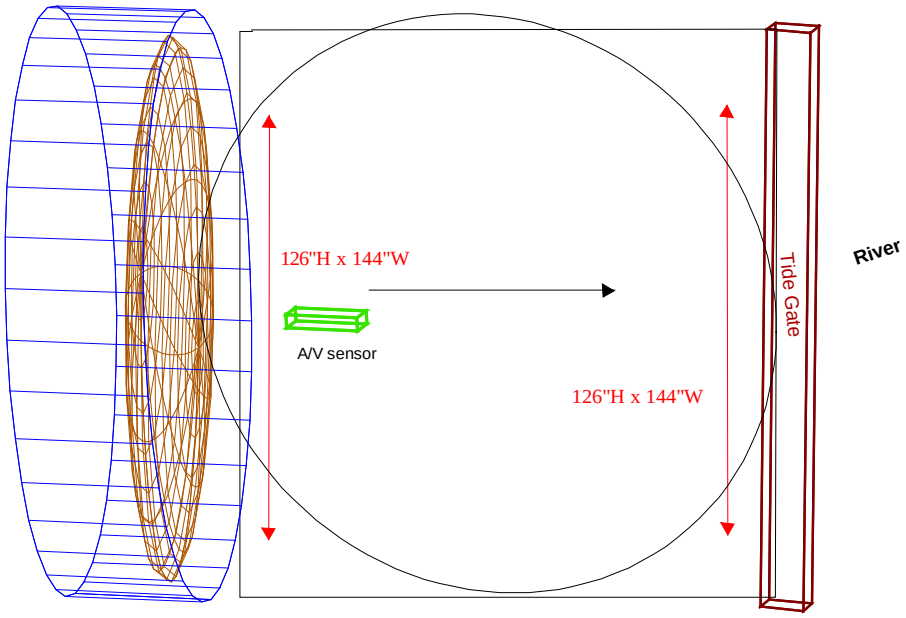
View of flow through influent line

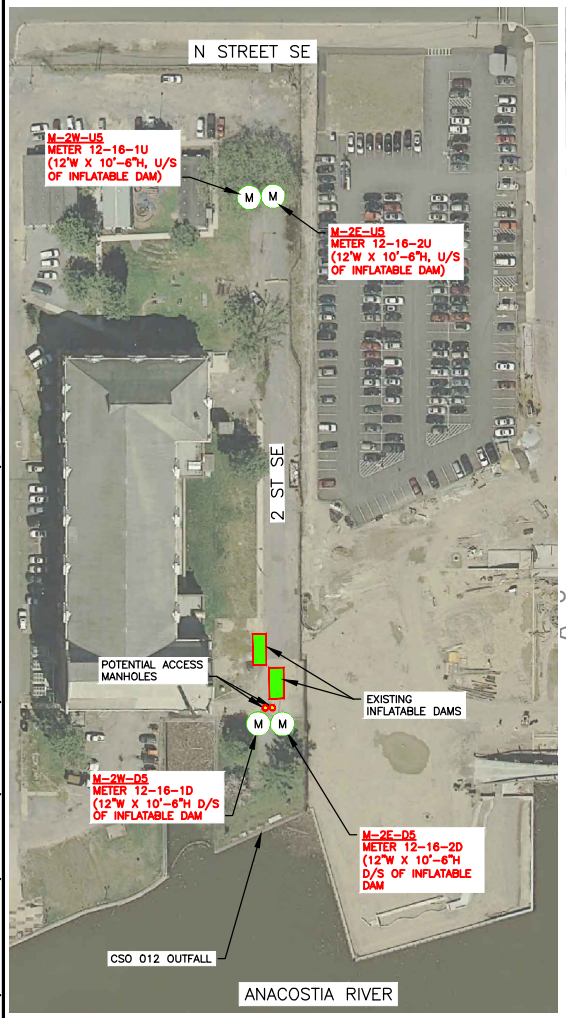
View of flow through effluent line

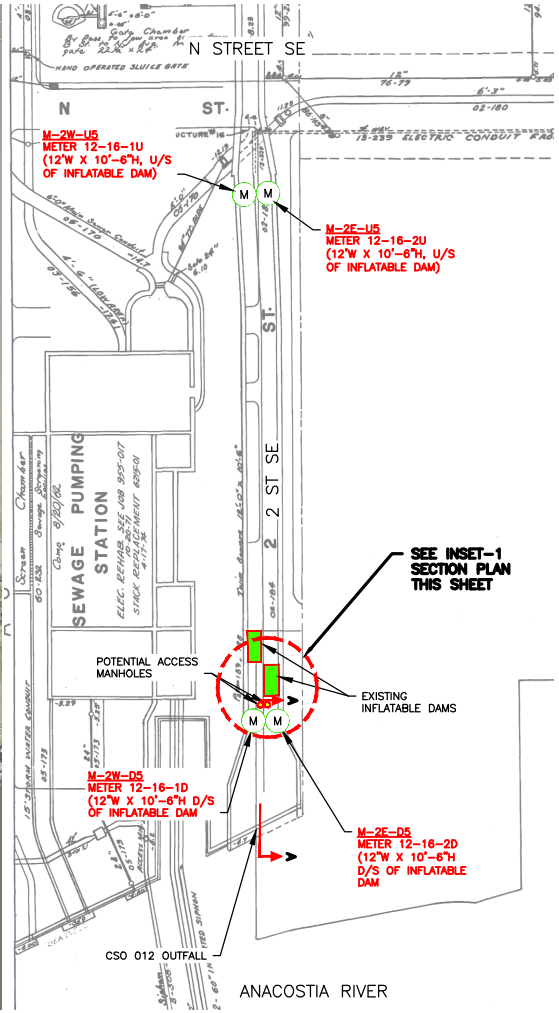
Dimensional Structure Profile View (profile sketch showing location of sensors)



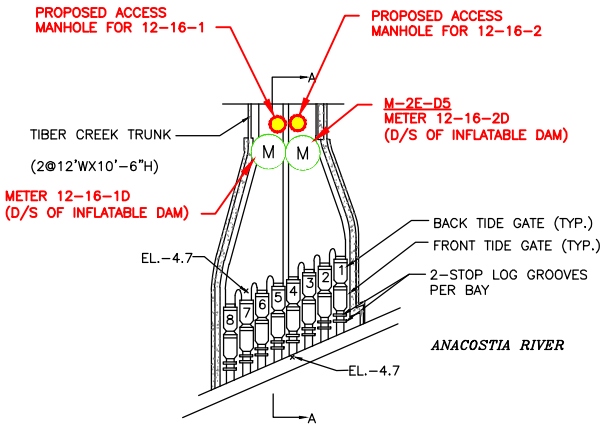
Dimension Structure Detail (Plan View)



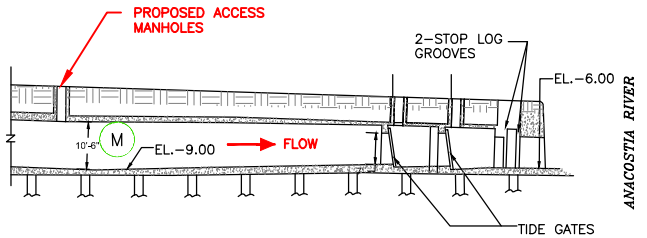




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



TYPICAL SECTION B-B (PROFILE VIEWM PLAN
SCALE NTS

LEGEND

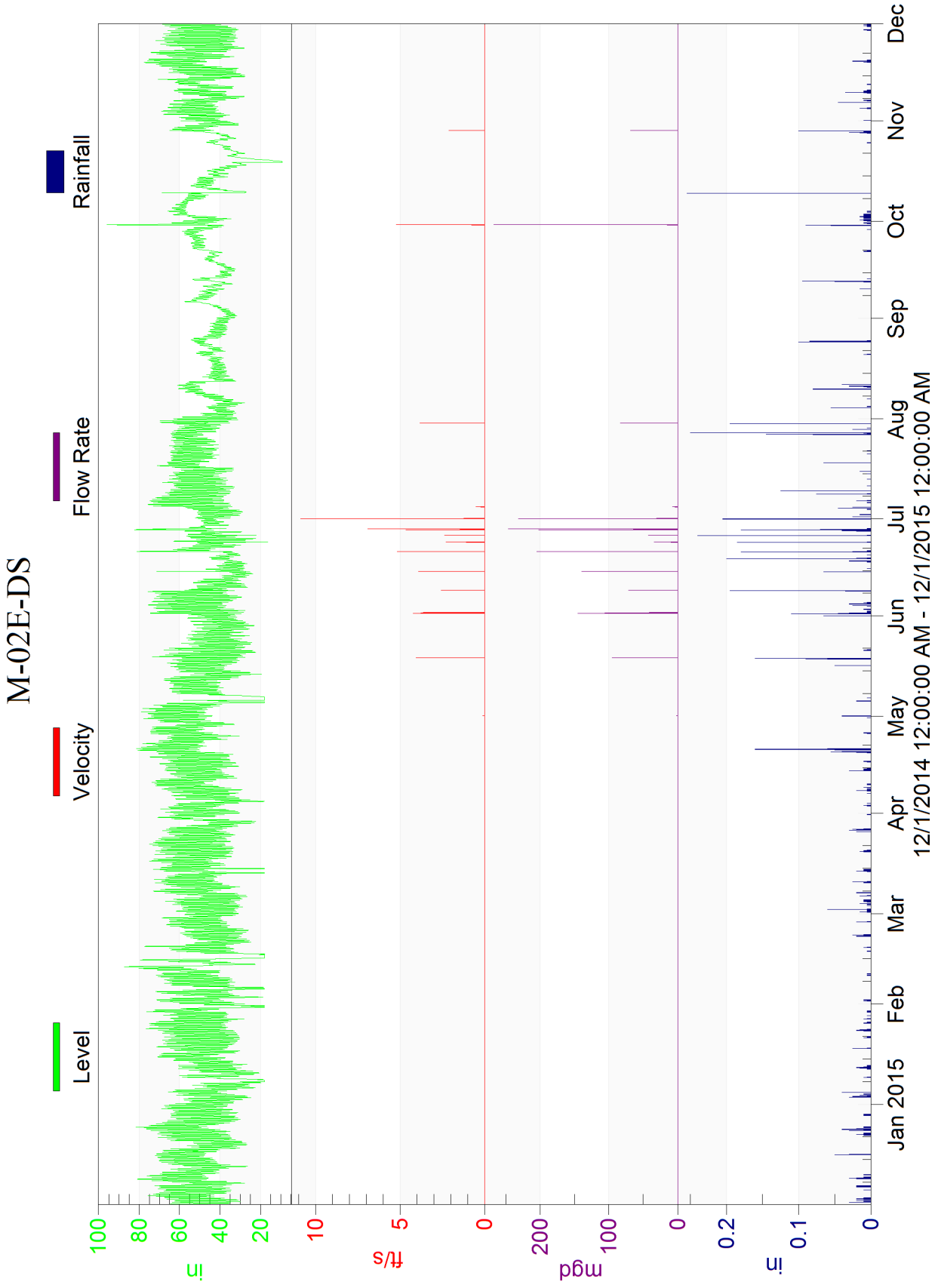
(M) FLOW METER LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
12-16-1U, 12-16-1D, 12-16-2U, 12-16-2D
METER LOCATION AND TYPICAL CROSS SECTION

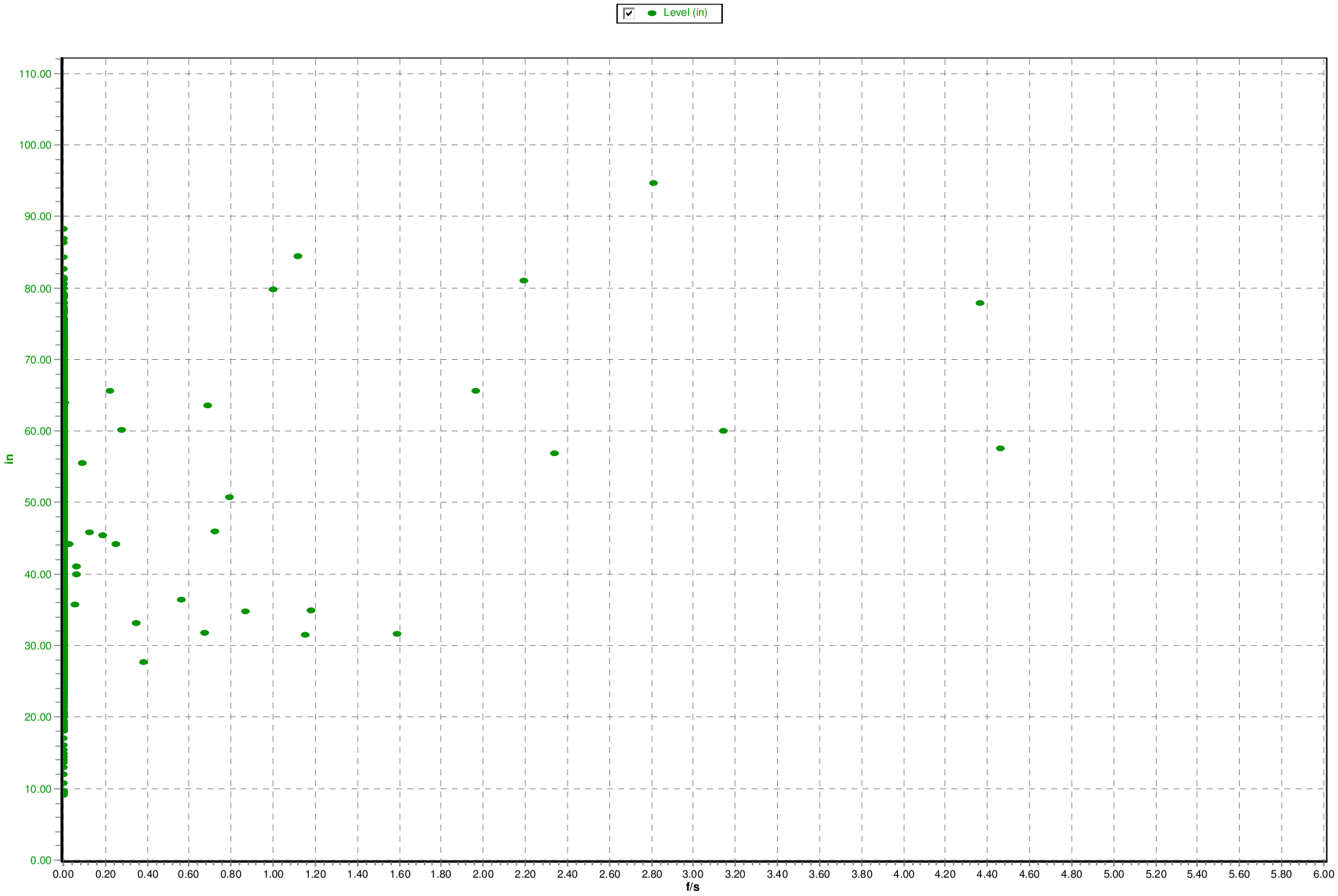
DATE: OCTOBER 2014	SITE 2

LAST SAVED BY: STEFAN OSTNER DATE: 5/10/2016 11:14:00 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\2_12-16-1_2.DWG


M-02E-DS
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
100
80
60
40
20
10
5
0
200
100
0
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-02E-DS - 100 O St. (through parking lot from M-3, DC Pump Station)

Pipe Diameter (in): 112" x 144" (12/01/14 to 12/01/15)



M-02E-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/5/2014	11:25	33.69	33.75	0	0	0		LR/AP	Install.
12/17/2014	11:35	43.34	43	0	0	0	11.1	LR/AP	
3/16/2015	13:00	38.86	39	0	0	0		AP/AM	
4/15/2015	14:30	35.74	36	0	0	0		LR/DW	
5/12/2015	16:55	67.21	67	0	0	0		LR/DW	
7/23/2015	9:25		51.5		0	0		LR/DW	
10/23/2015	9:28		38.25		0	0		JC/RM	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-02E-US

SEWER: TIBER CREEK TRUNK SEWER

OUTFALL: 012

DURATION: 3/1/15 - 8/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-02E-US measured excess flows from the Tiber Creek Trunk Sewer before entering the Anacostia River through CSO 012 upstream of the inflatable dam at Structure 16.

3. The continuity equation was used to calculate a flow rate from these measurements. M-02E-US is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	7.904	0.059	2.092
Max	153.085	8.594	403.362

Site Name/Manhole # M-2 E US Primary: [X] Alternate: [ ]

Investigation Date: 1/2/14 Time: 11:15 Crew Members: LR/JS/BC

Installation Date: 1/9/15 Time: 10:00 Crew Members: LR/PD

Address/Location: Off of 2nd Street SE and Tingey Street SE (Corman construction site)

Latitude: N 38°52.493' Longitude: W 77°00.170'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec *Standing water*

Depth 0.50 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	126"		126"
Width	306"		156"
Material	Concrete/Brick		Concrete/Brick
Shape	Igloo		Igloo

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good ~~(no problems accessing site)~~
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 16' 3"

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: 25 ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

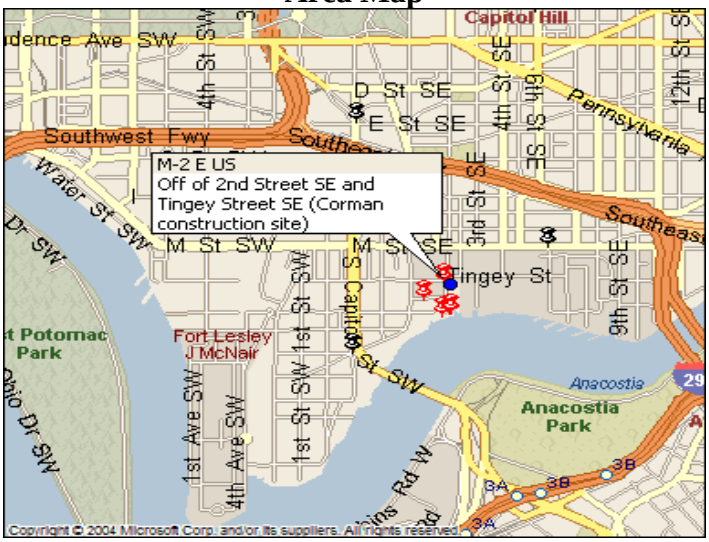
Sensor Configuration:

(Please include Serial Numbers when possible)

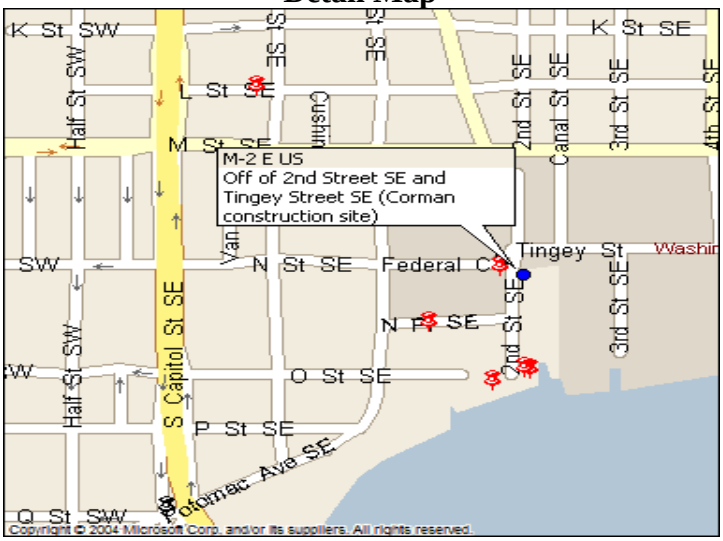
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map



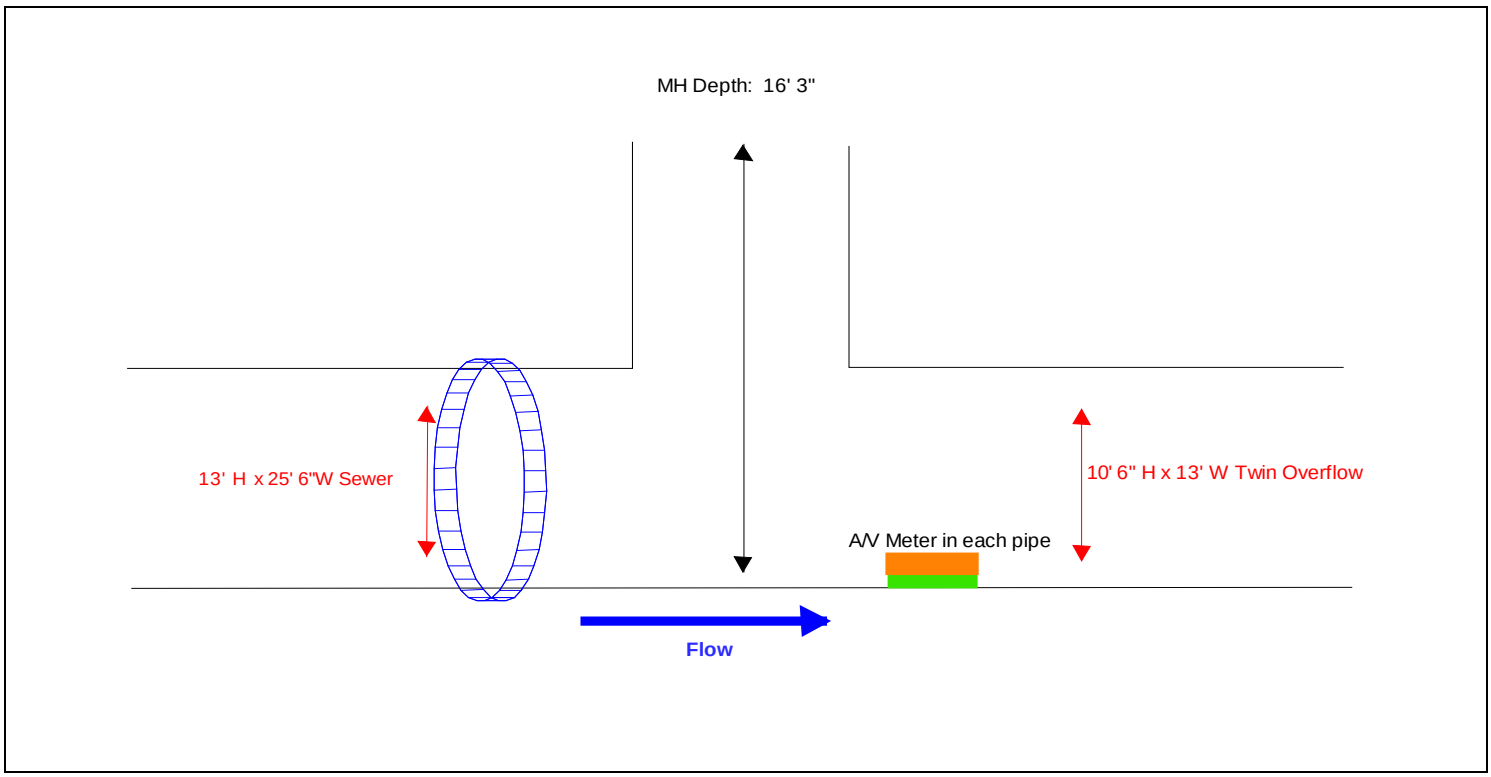
View from top of MH

Site Overview

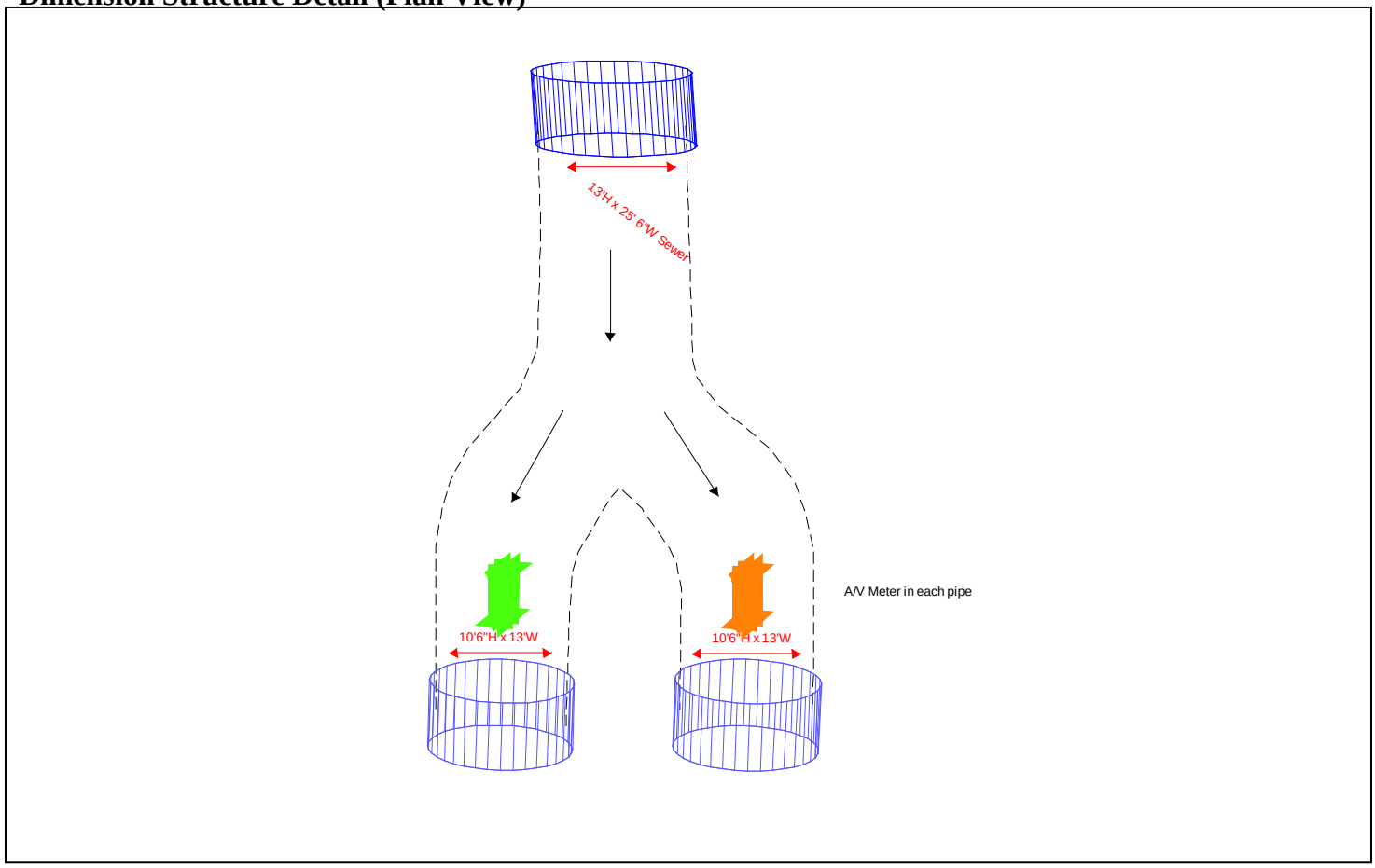
View of flow through influent line

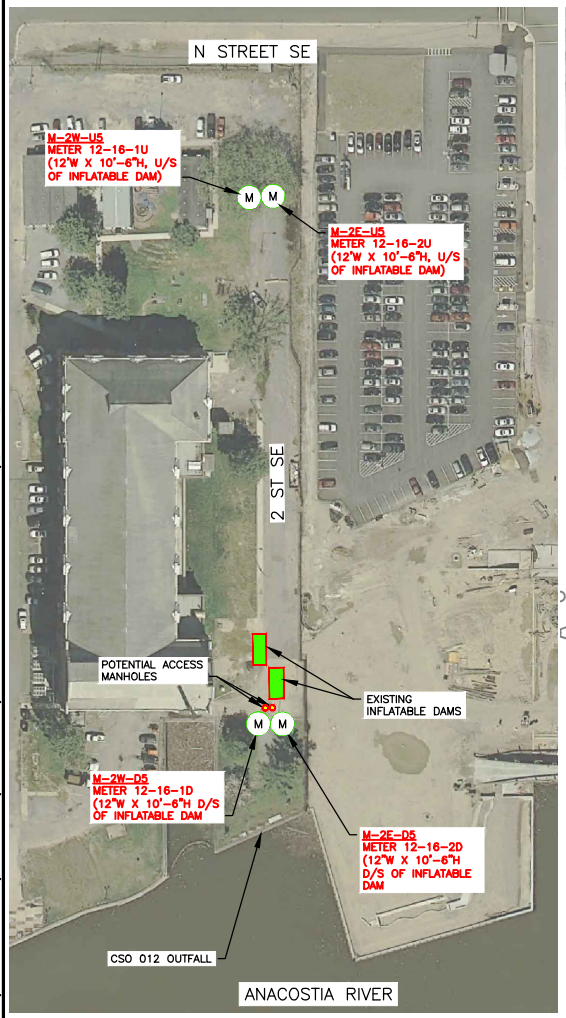
View of flow through effluent line

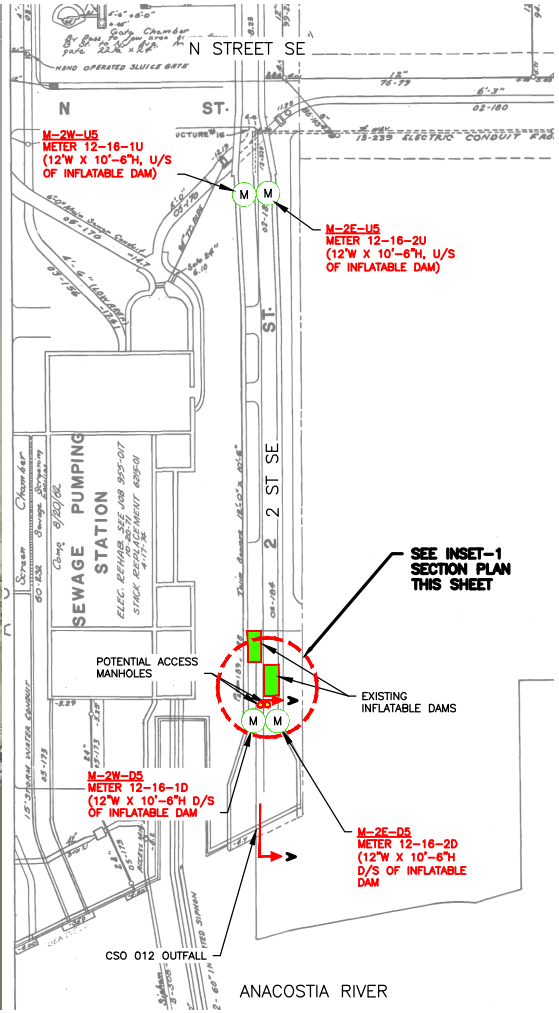
Dimensional Structure Profile View (profile sketch showing location of sensors)



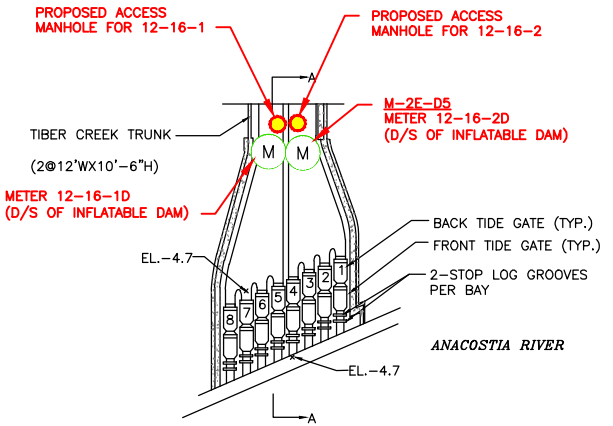
Dimension Structure Detail (Plan View)



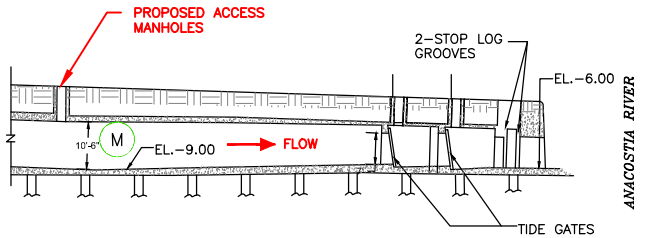




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



TYPICAL SECTION B-B (PROFILE VIEWM PLAN
SCALE NTS

LEGEND

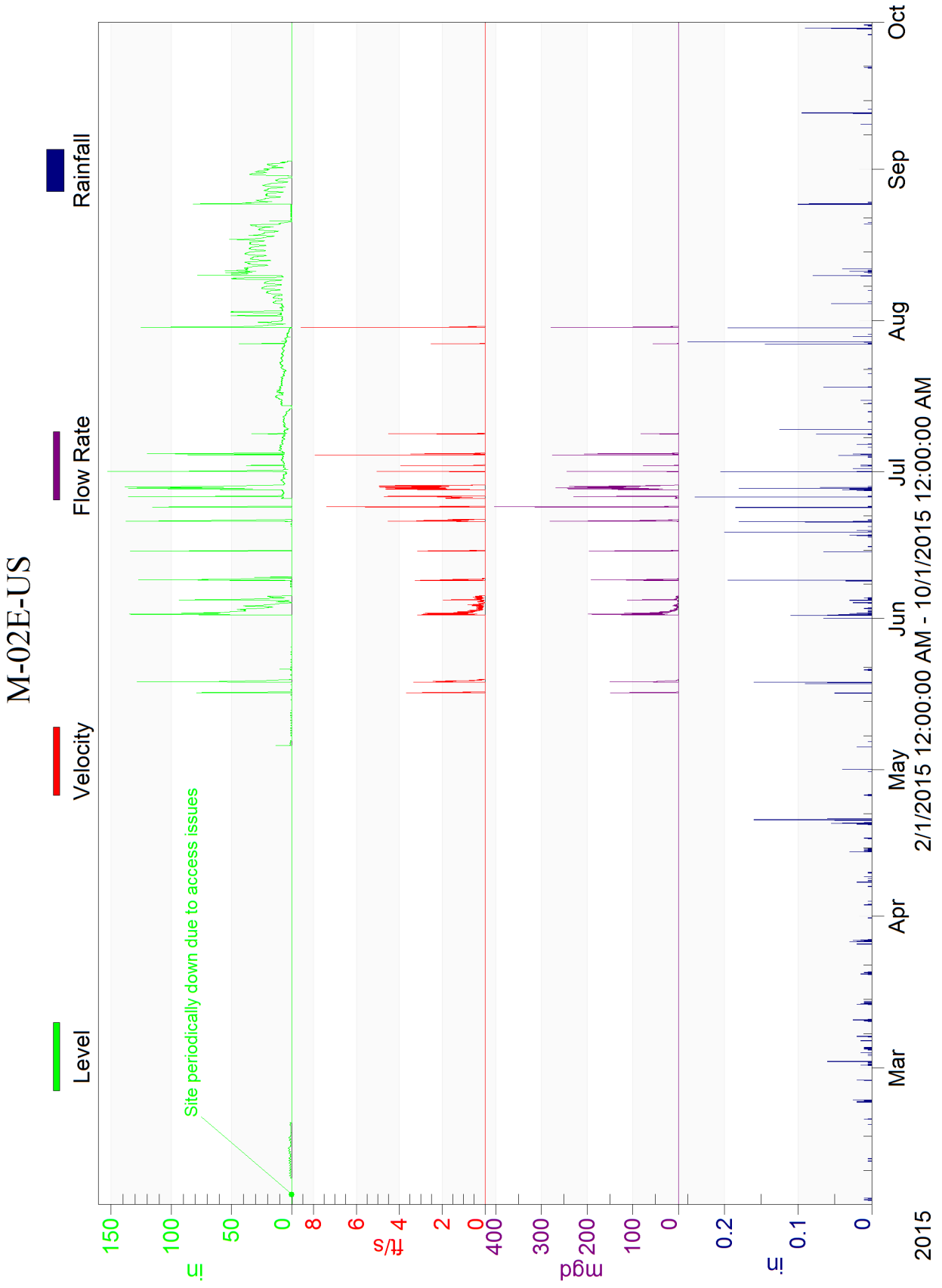
(M) FLOW METER LOCATION

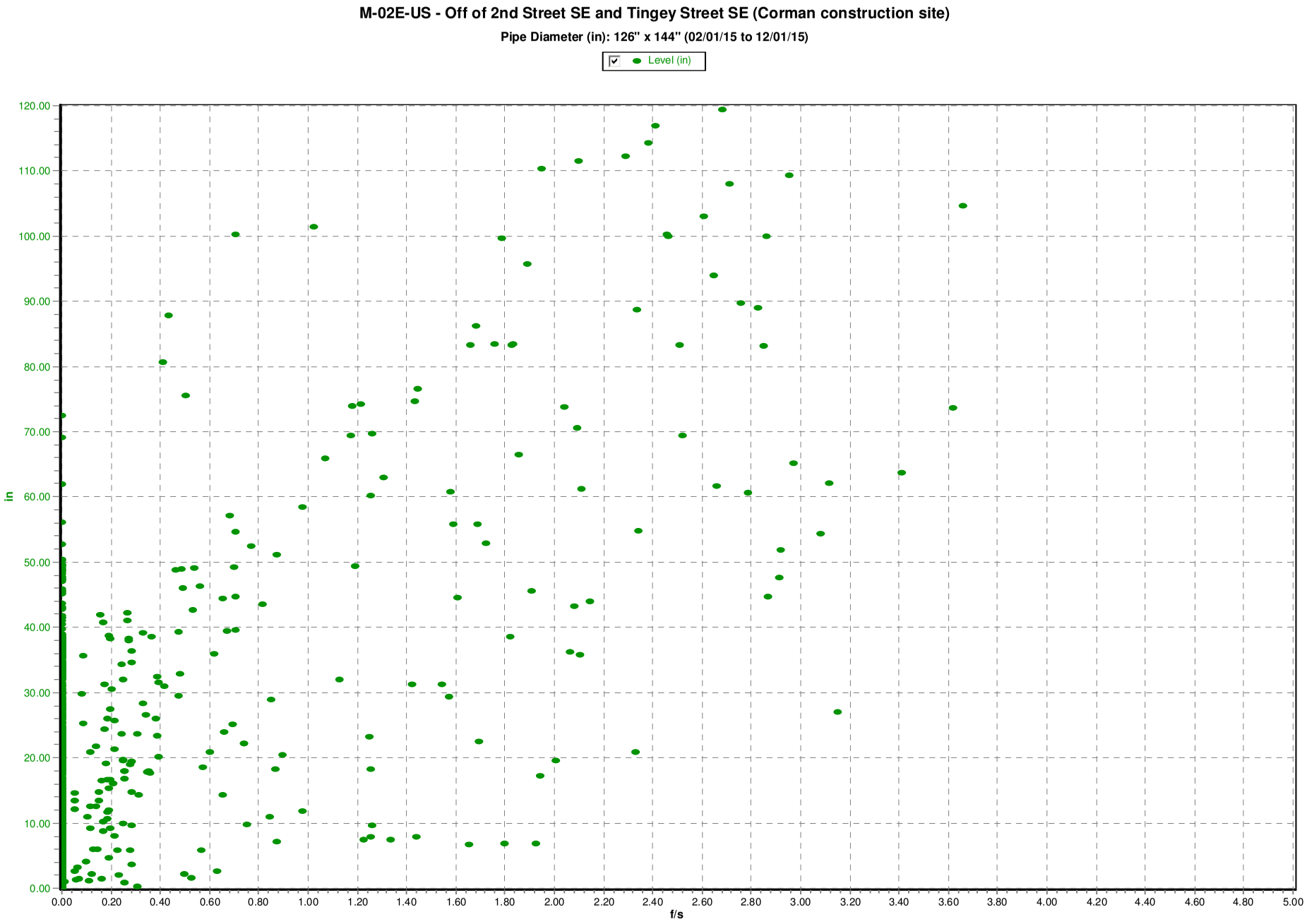
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
12-16-1U, 12-16-1D, 12-16-2U, 12-16-2D
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 2

LAST SAVED BY: STEFAN OSSTNER DATE: 5/10/2016 11:14:00 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\2_12-16-1_2.DWG


M-02E-US
Level
Velocity
Flow Rate
Rainfall
Site periodically down due to access issues
in
ft/s
mgd
in
150
100
50
0
8
6
4
2
0
400
300
200
100
0
0.2
0.1
0
2015
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
2/1/2015 12:00:00 AM - 10/1/2015 12:00:00 AM


M-02E-US - Off of 2nd Street SE and Tingey Street SE (Corman construction site)
Pipe Diameter (in): 126" x 144" (02/01/15 to 12/01/15)
Level (in)
in
f/s
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00
3.20
3.40
3.60
3.80
4.00
4.20
4.40
4.60
4.80
5.00

M-02E-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
1/9/2015	14:53	1.14	1	0	0	0	6.12	LR/PD	Install
1/9/2015	14:58	1.08	1	0	0	0	6.03	LR/PD	
1/9/2015	15:03	1.14	1	0	0	0	5.5	LR/PD	
1/20/2015	13:00						6.14	LR/PD	CB Telog
1/22/2015	12:34							LR/PD	Removed Telog.
2/6/2015	9:00							LR/AP/AM	Reinstall Telog.
2/12/2015	13:45	2.68	2.75	0	0	0	5.81	LR/AM	CB Telog.
2/23/2015	13:00							AP/AM	Lock out tag out / cannot access.
5/5/2015	16:40		0.5		0	0	6.03	LR/DW	CB Telog.
6/2/2015	9:52		48		0.85	0	6.15	LR/DW	CB Telog.
6/9/2015	16:55						6.03	LL/JC	CB Telog.
8/21/2015	12:45		0		0	0		LR/JC	CB Telog.
10/9/2015	8:55		1		0	0		LR/JC	Remove Meter.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-02W-DS

SEWER: TIBER CREEK TRUNK SEWER

OUTFALL: 012

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-02W-DS measured excess flows from the Tiber Creek Trunk Sewer before entering the Anacostia River through CSO 012 downstream of the inflatable dam at Structure 16.

3. The continuity equation was used to calculate a flow rate from these measurements. M-02W-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	60.615	0.002	0.091
Max	114.015	5.038	235.390

Site Name/Manhole # M-2 W DS Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 16:20 Crew Members: LR/JS

Installation Date: 11/5/14 Time: 11:00 Crew Members: LR/CL

Address/Location: 100 O St. (through parking lot from M-3, DC Pump Station)

Latitude: N 38° 52.392’ Longitude: W 77° 0.177’

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 46 in

Turbulence Amplitude:

- (Less than 0.25”)
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	126”		126”
Width	144”		144”
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

(No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

(Good) 20.9 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 13’2”

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

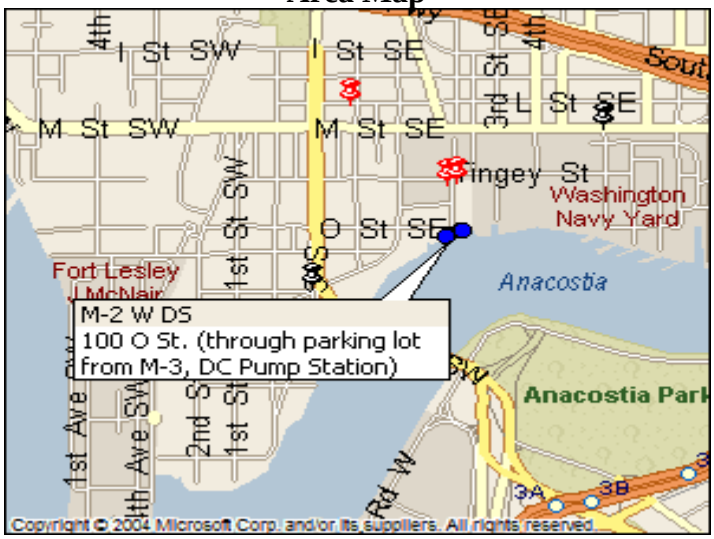
Sensor Configuration:

(Please include Serial Numbers when possible)

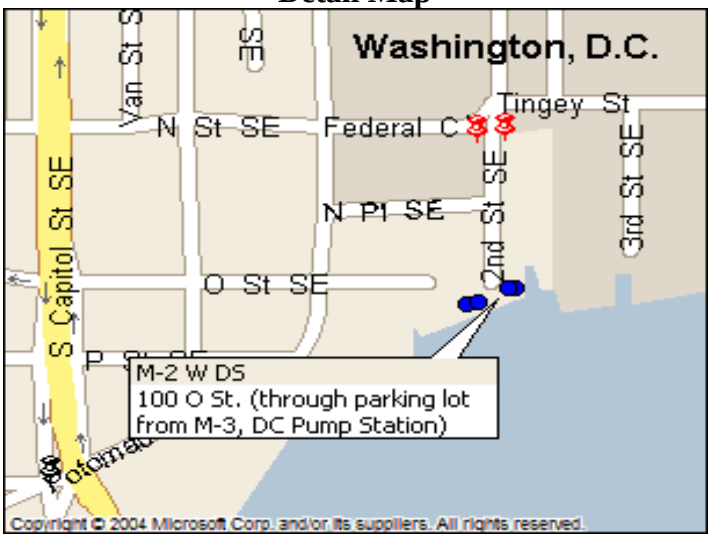
Level	Primary: Isco A/V
	Redundant:
Velocity	Primary: Isco A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



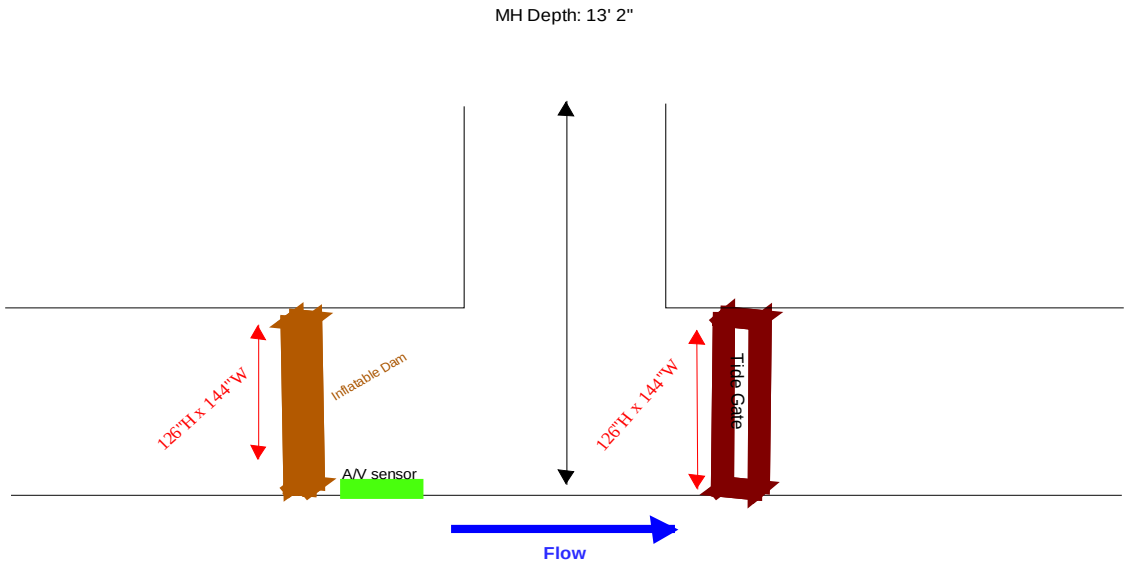
View from top of MH

Site Overview

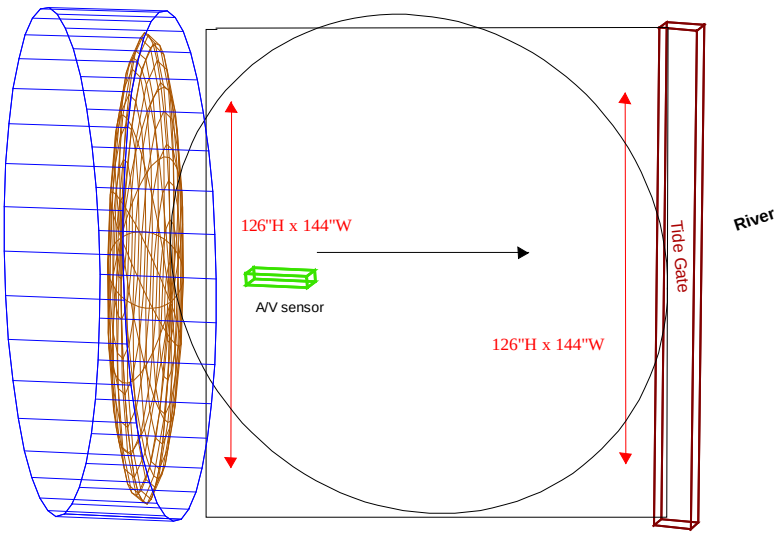
View of flow through influent line

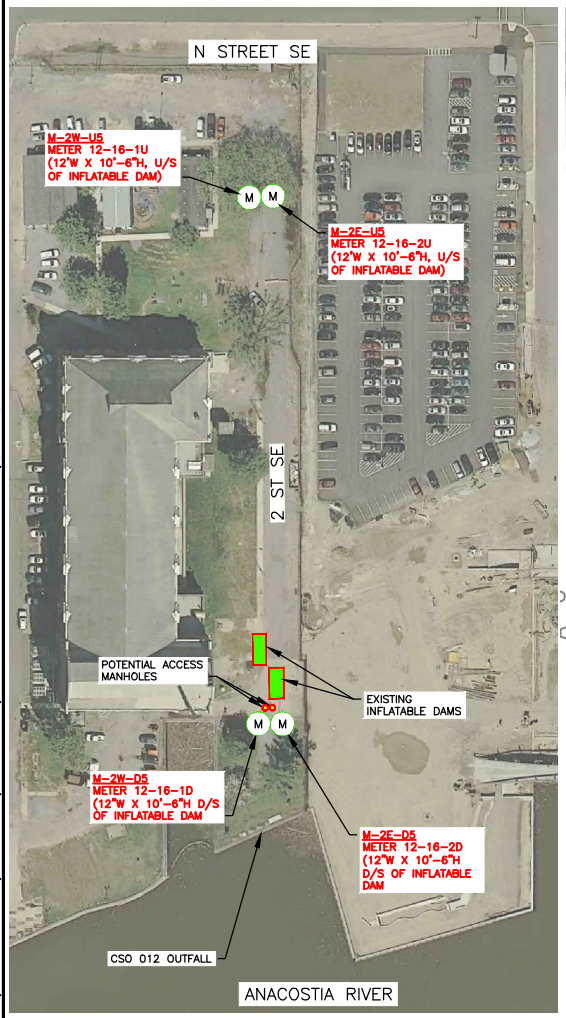
View of flow through effluent line

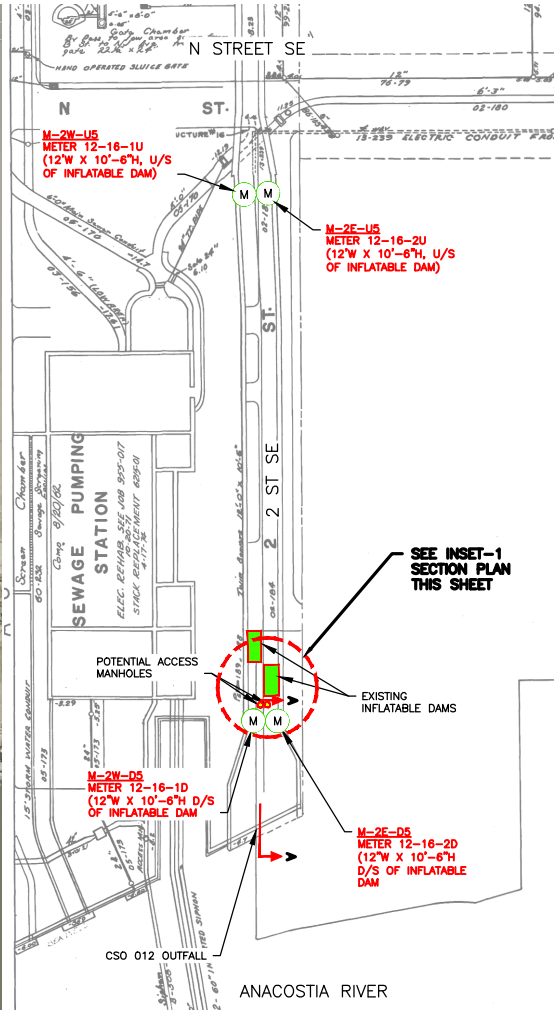
Dimensional Structure Profile View (profile sketch showing location of sensors)



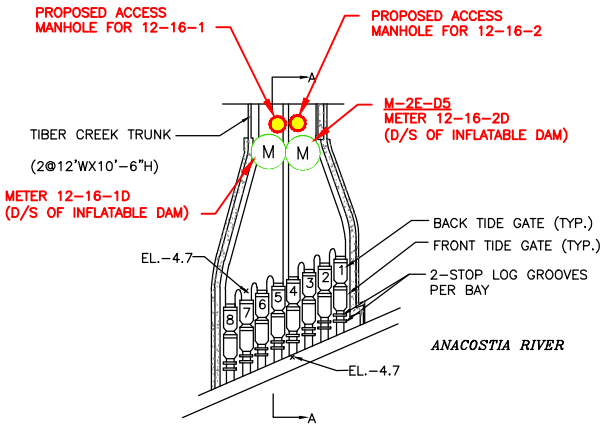
Dimension Structure Detail (Plan View)



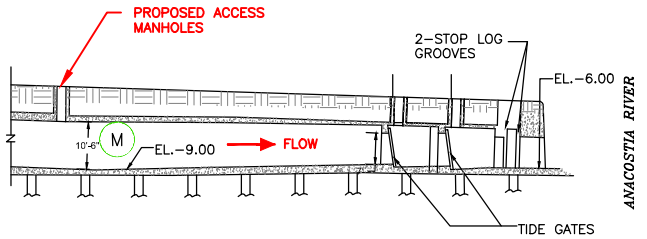




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



TYPICAL SECTION B-B (PROFILE VIEWM PLAN
SCALE NTS

LEGEND

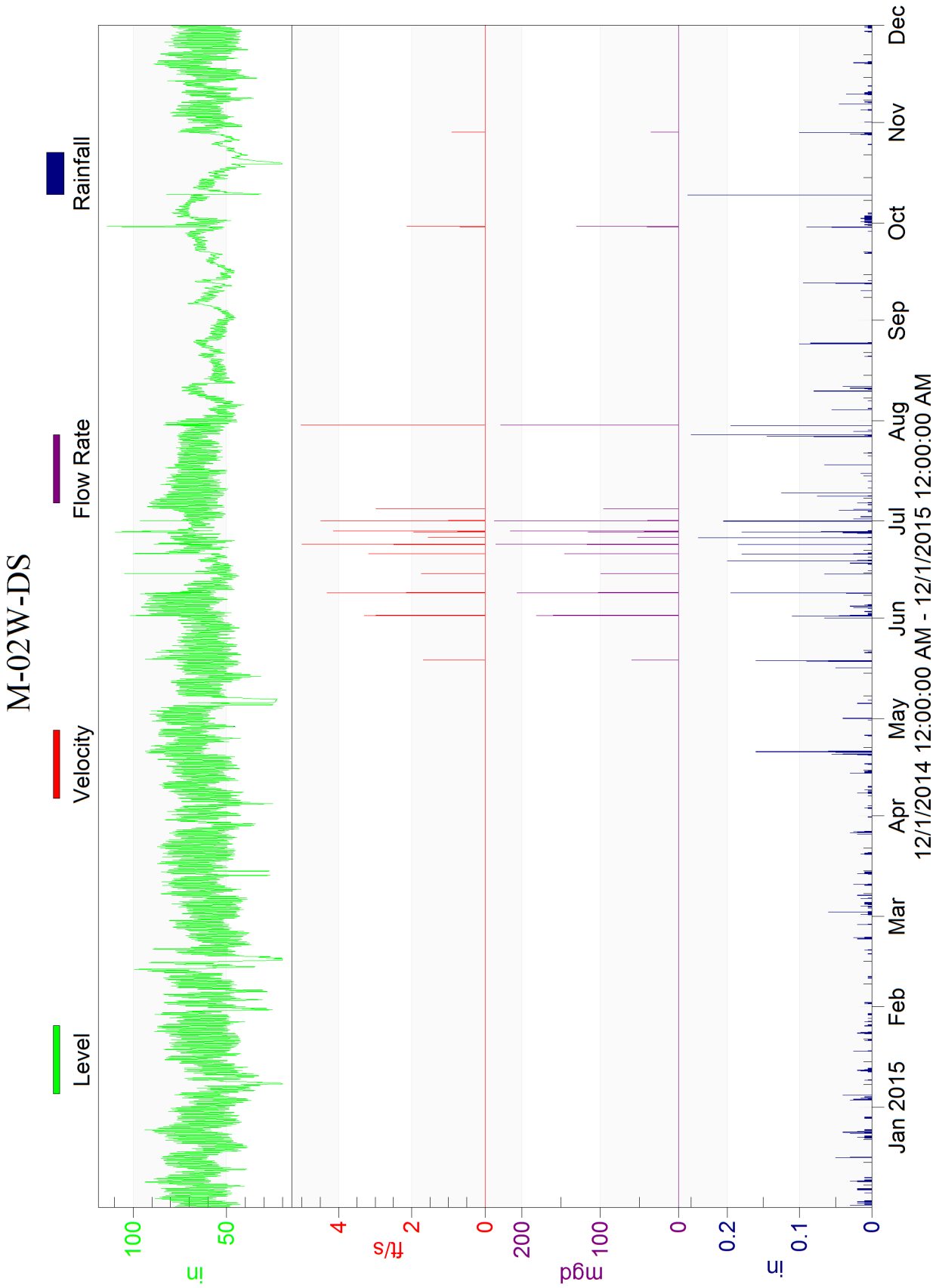
(M) FLOW METER LOCATION

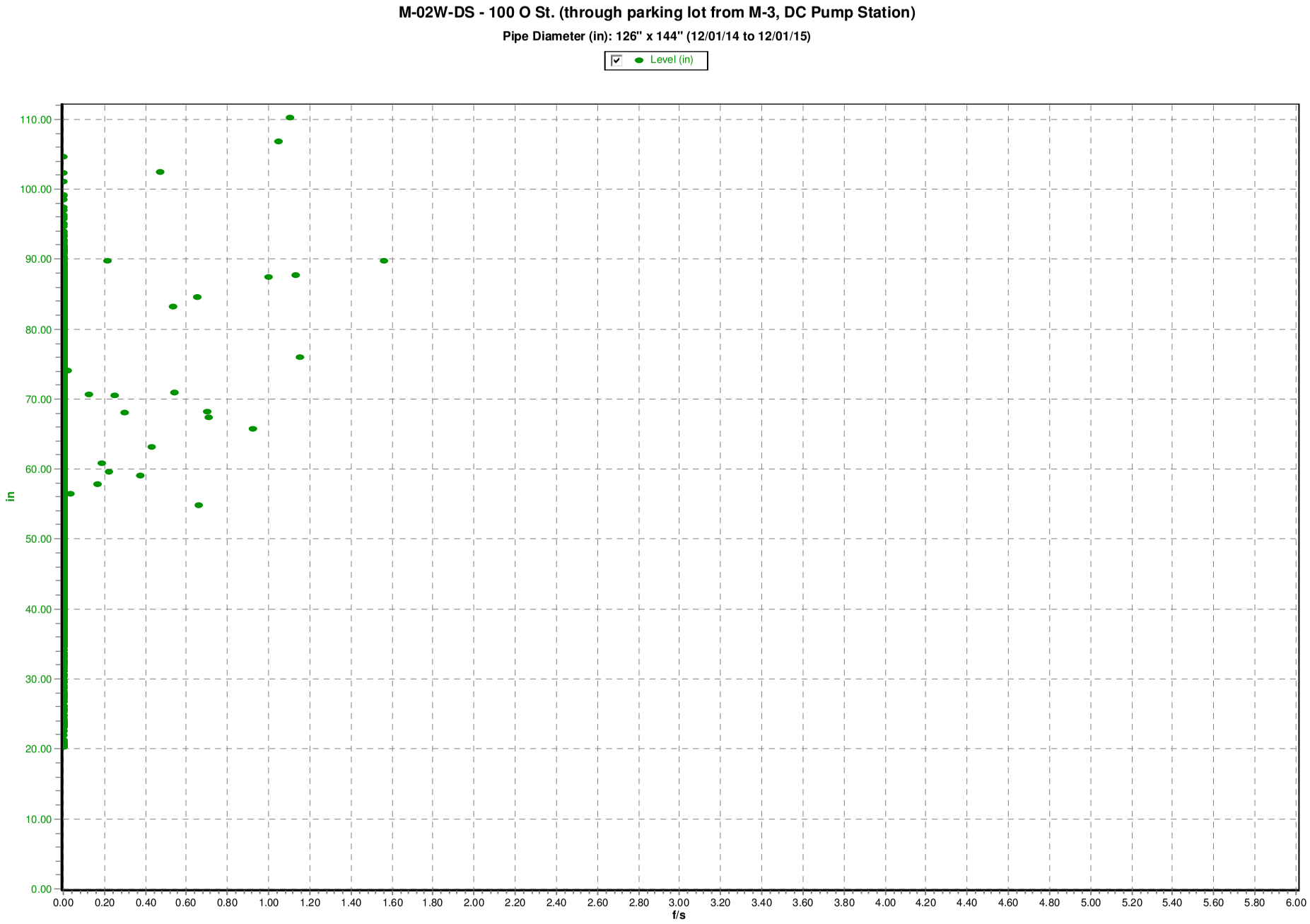
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
12-16-1U, 12-16-1D, 12-16-2U, 12-16-2D
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 2

LAST SAVED BY: STEFAN OSSTNER DATE: 5/10/2016 11:14:00 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\2_12-16-1_2.DWG


M-02W-DS
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
100
50
4
2
0
200
100
0
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-02W-DS - 100 O St. (through parking lot from M-3, DC Pump Station)
Pipe Diameter (in): 126" x 144" (12/01/14 to 12/01/15)
Level (in)
in
f/s
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00

M-02W-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/5/2014	13:30	40.22	40	0	0	0		LR/AP	Install.
12/17/2014	12:05	57.23	57	0	0	0	11.1	LR/AP	
4/15/2015	14:20	46.97	47	0	0	0		LR/DW	
4/28/2015	13:40							LR/DW	Swap Antenna. CB meter.
5/12/2015	17:02	78.44	78.5	0	0	0		LR/DW	
7/23/2015	9:43		65		0	0		LR/DW	
10/23/2015	8:50		49.25			0		JC/RM	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-02W-US

SEWER: TIBER CREEK TRUNK SEWER

OUTFALL: 012

DURATION: 3/1/15 - 8/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-02W-US measured excess flows from the Tiber Creek Trunk Sewer before entering the Anacostia River through CSO 012 upstream of the inflatable dam at Structure 16.

3. The continuity equation was used to calculate a flow rate from these measurements. M-02W-US is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	6.009	0.073	2.031
Max	153.353	6.177	312.310

Site Name/Manhole # M-2 W US Primary: [X] Alternate: [ ]

Investigation Date: 1/2/14 Time: 11:15 Crew Members: LR/JS/BC

Installation Date: 1/9/15 Time: 10:00 Crew Members: LR/AP

Address/Location: Off of 2nd Street SE and Tingey Street SE (Corman construction site)

Latitude: N 38°52.493' Longitude: W 77°00.170'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec *Standing water*

Depth 0.50 in

Turbulence Amplitude:

- (Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	126"		156"
Width	144"		306"
Material	Concrete/Brick		Concrete/Brick
Shape	Igloo		Igloo

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- (No evidence visible)
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good ~~(no problems accessing site)~~
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 16' 3"

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: 25 ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

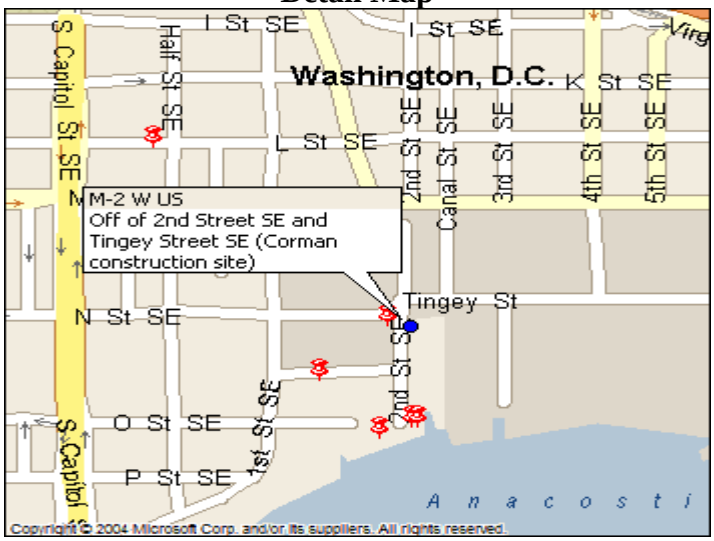
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map

Detail Map



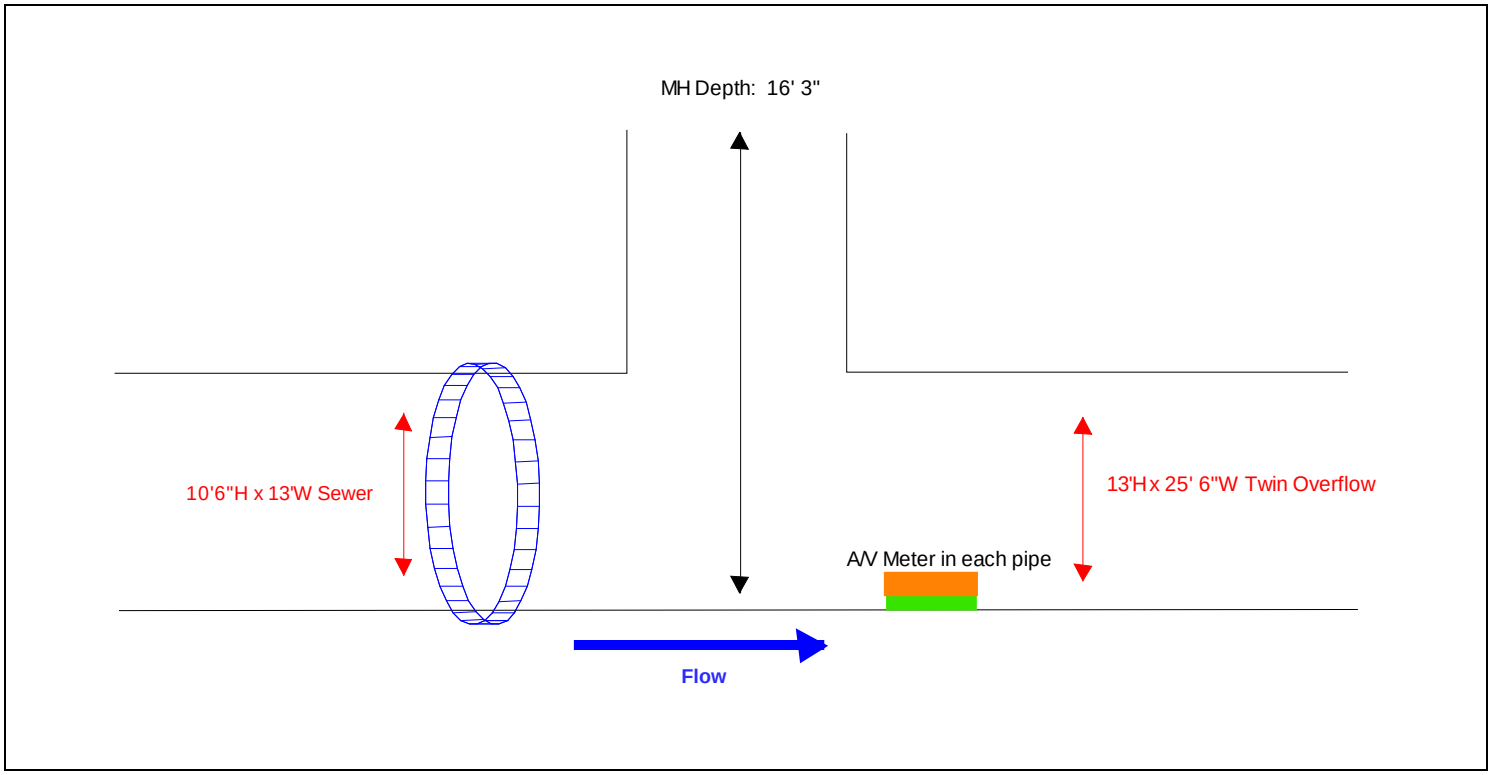
View from top of MH

Site Overview

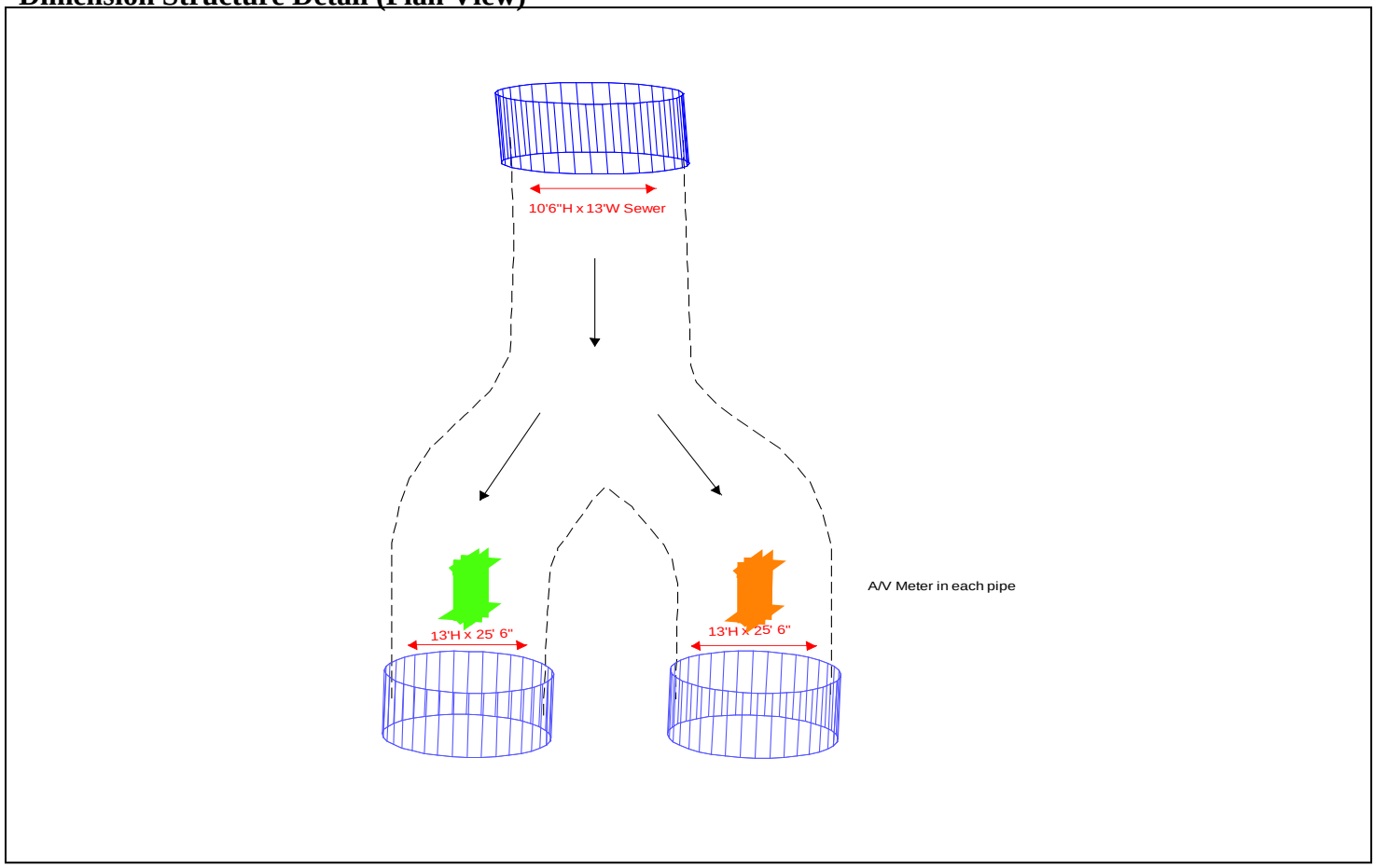
View of flow through influent line

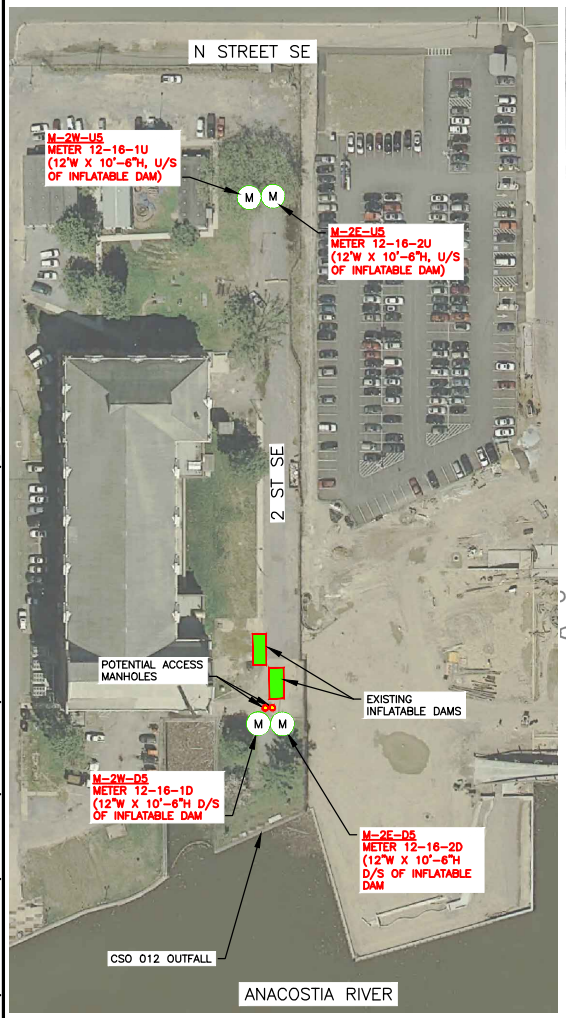
View of flow through effluent line

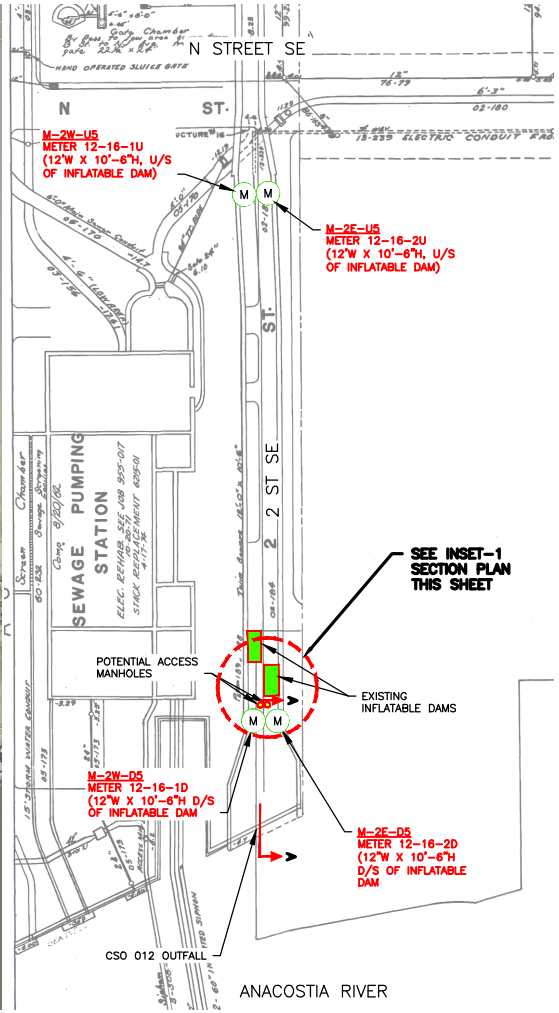
Dimensional Structure Profile View (profile sketch showing location of sensors)



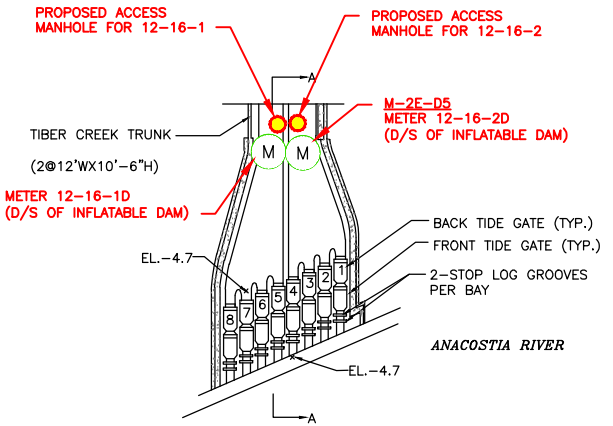
Dimension Structure Detail (Plan View)



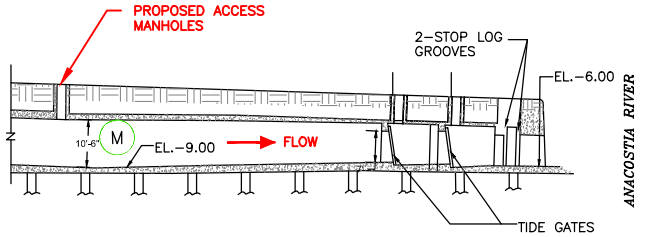




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



TYPICAL SECTION B-B (PROFILE VIEWM PLAN
SCALE NTS

LEGEND

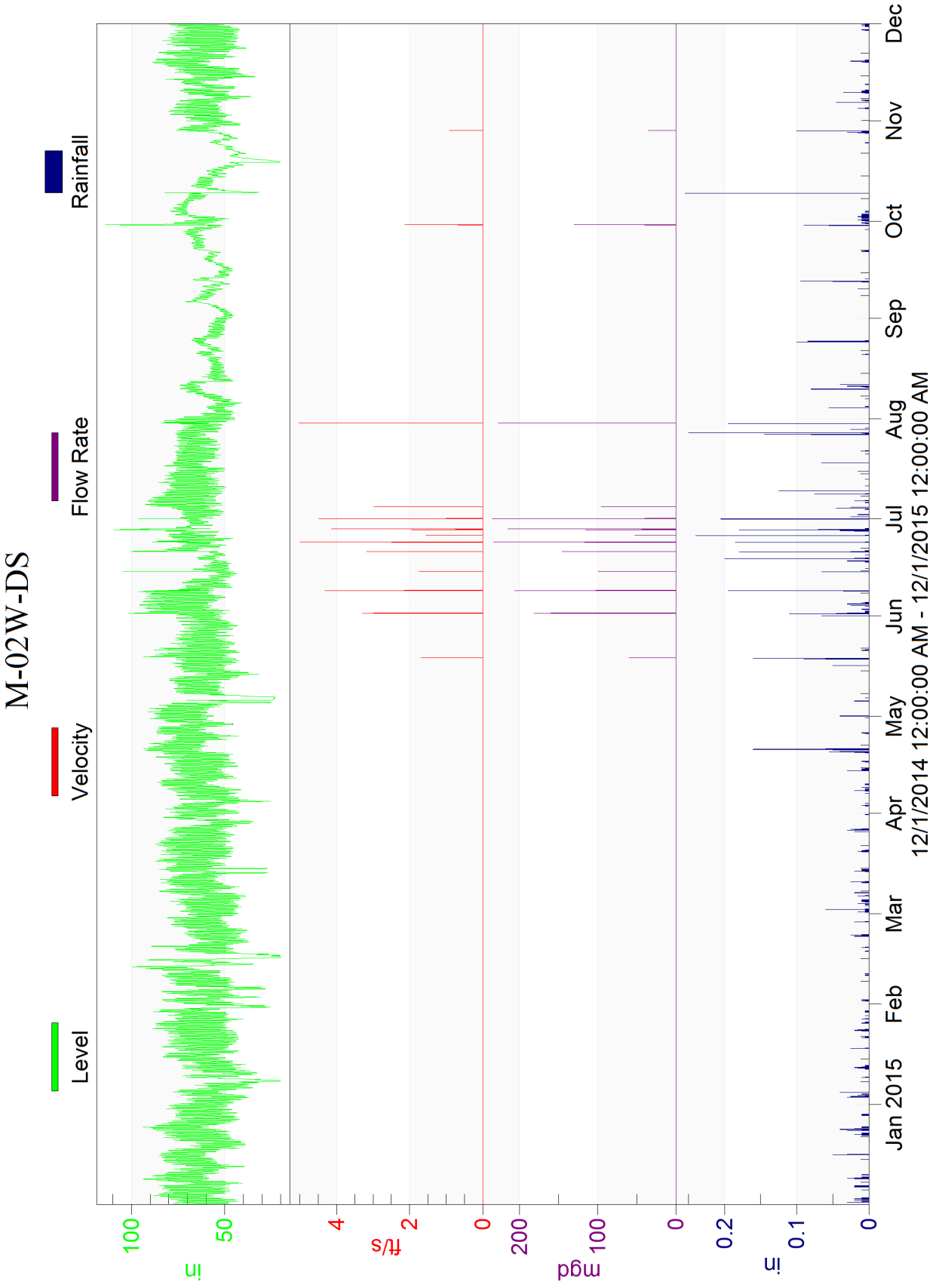
(M) FLOW METER LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
12-16-1U, 12-16-1D, 12-16-2U, 12-16-2D
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 2

LAST SAVED BY: STEFAN OSSTNER DATE: 5/10/2016 11:14:00 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\2_12-16-1_2.DWG


M-02W-DS
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
100
50
4
2
0
200
100
0
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
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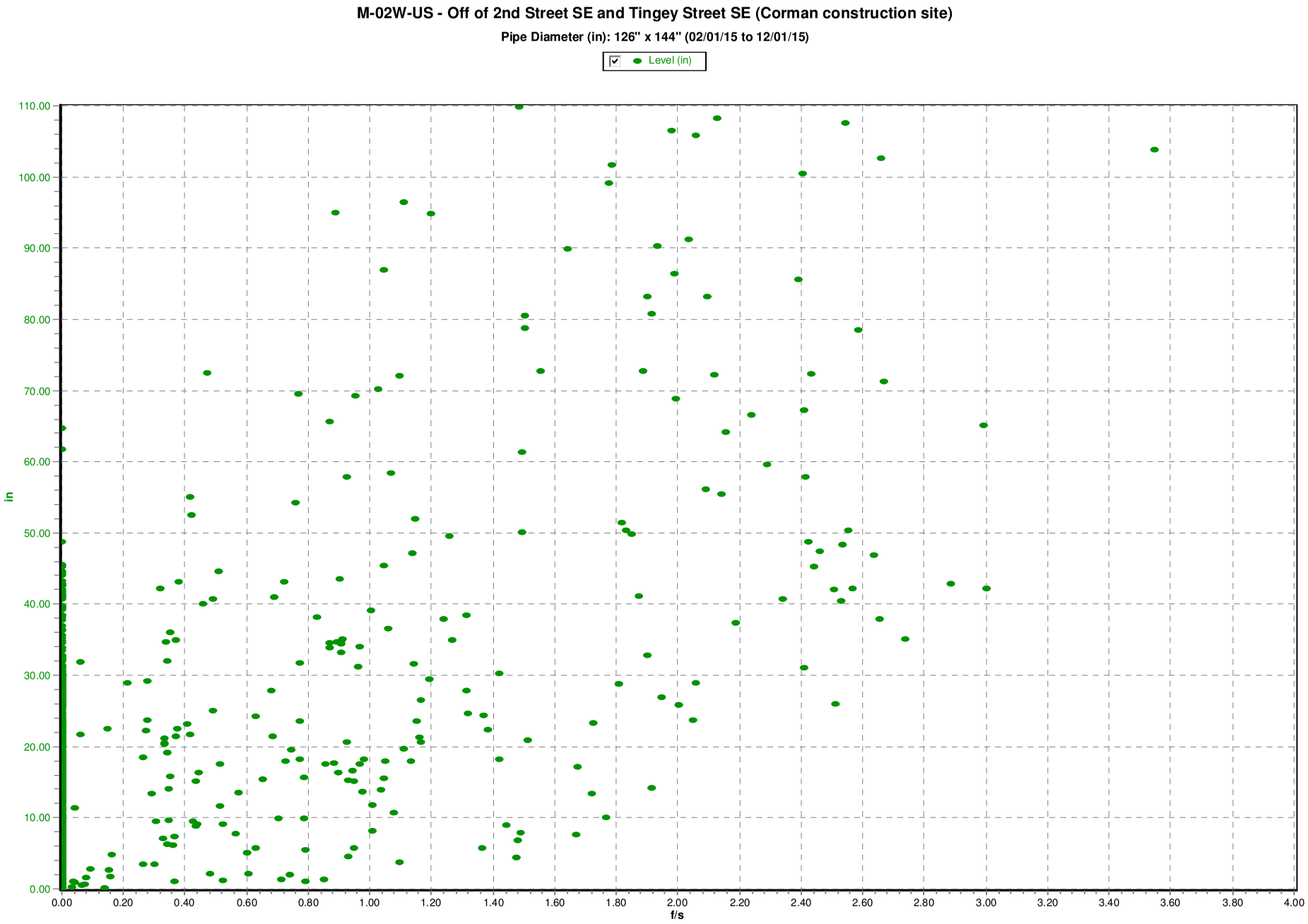
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-02W-US - Off of 2nd Street SE and Tingey Street SE (Corman construction site)
Pipe Diameter (in): 126" x 144" (02/01/15 to 12/01/15)
Level (in)
in
f/s
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
3.00
3.20
3.40
3.60
3.80
4.00

M-02W-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
1/9/2015	15:06	0.75	0.5	0	0	0	6.2	LR/AP	Install.
1/9/2015	15:10	0.69	0.5	0	0	0	5.5	LR/AP	
1/9/2015	15:14	0.7	0.5	0	0	0		LR/AP	
1/22/2015	12:24							LR/PD	Remove Telog.
2/6/2015	9:00							LR/AP/AM	Reinstall Telog.
2/12/2015	13:46	2.52	2.75	0	0	0	5.98	LR/AM	CB Telog.
2/23/2015	13:00							AP/AM	Lock out tag out / cannot access.
5/5/2015	14:00		0.5		0	0	5.68	LR/DW	CB Telog.
6/4/2015	11:14						6.07	LR/DW	CB Telog.
6/9/2015	17:14		0		0	0	5.94	LL/JC	CB Telog.
6/10/2015	17:35						6.14	LL/DW	CB Telog.
8/21/2015	9:34		0		0	0		LR/JC	CB Telog.
10/9/2015	8:56		1.25		0	0		LR/JC	Remove Meter.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-03E-DS

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 011a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-03E-DS measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the Anacostia River through CSO 012 downstream of the inflatable dam at Structure 14.

3. The continuity equation was used to calculate a flow rate from these measurements. M-03E-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	22.003	0	0
Avg.	59.224	0	0.016
Max	144.965	1.982	80.431

Site Name/Manhole # M-3 E DS Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 15:15 Crew Members: LR/JS

Installation Date: 11/18/14 Time: 11:00 Crew Members: CL/PD

Address/Location: Off of 100 O St. (behind the pump station on the other side of the new pump)

Latitude: N 38° 52.390' Longitude: W 77° 0.229'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 45 in

Turbulence Amplitude:

- (Less than 0.25")
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	10'		10'6"
Width	10'		12'
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

- (Yes) Hard packed: _____ in. deep
- ☐ No Soft: 4 + in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

- (Good) 20.9 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 18'6"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

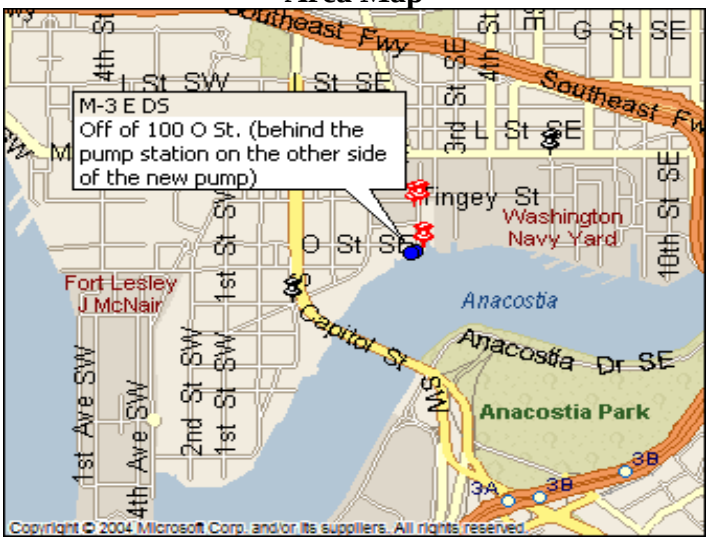
Sensor Configuration:

(Please include Serial Numbers when possible)

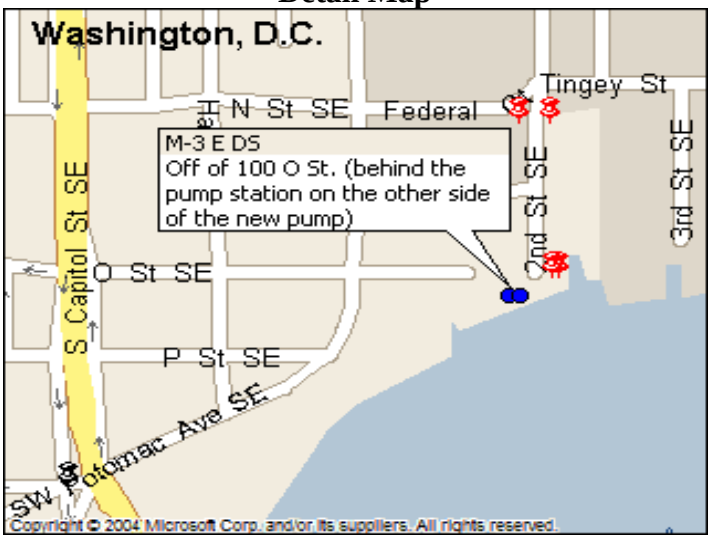
Level	Primary:
	Redundant:
Velocity	Primary:
	Redundant:
Meter Logger	

Comments:

Area Map



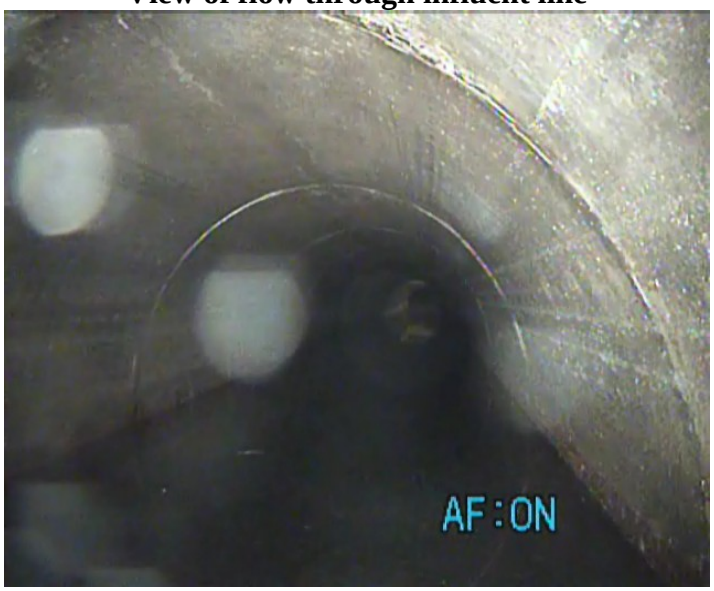
Detail Map



View from top of MH

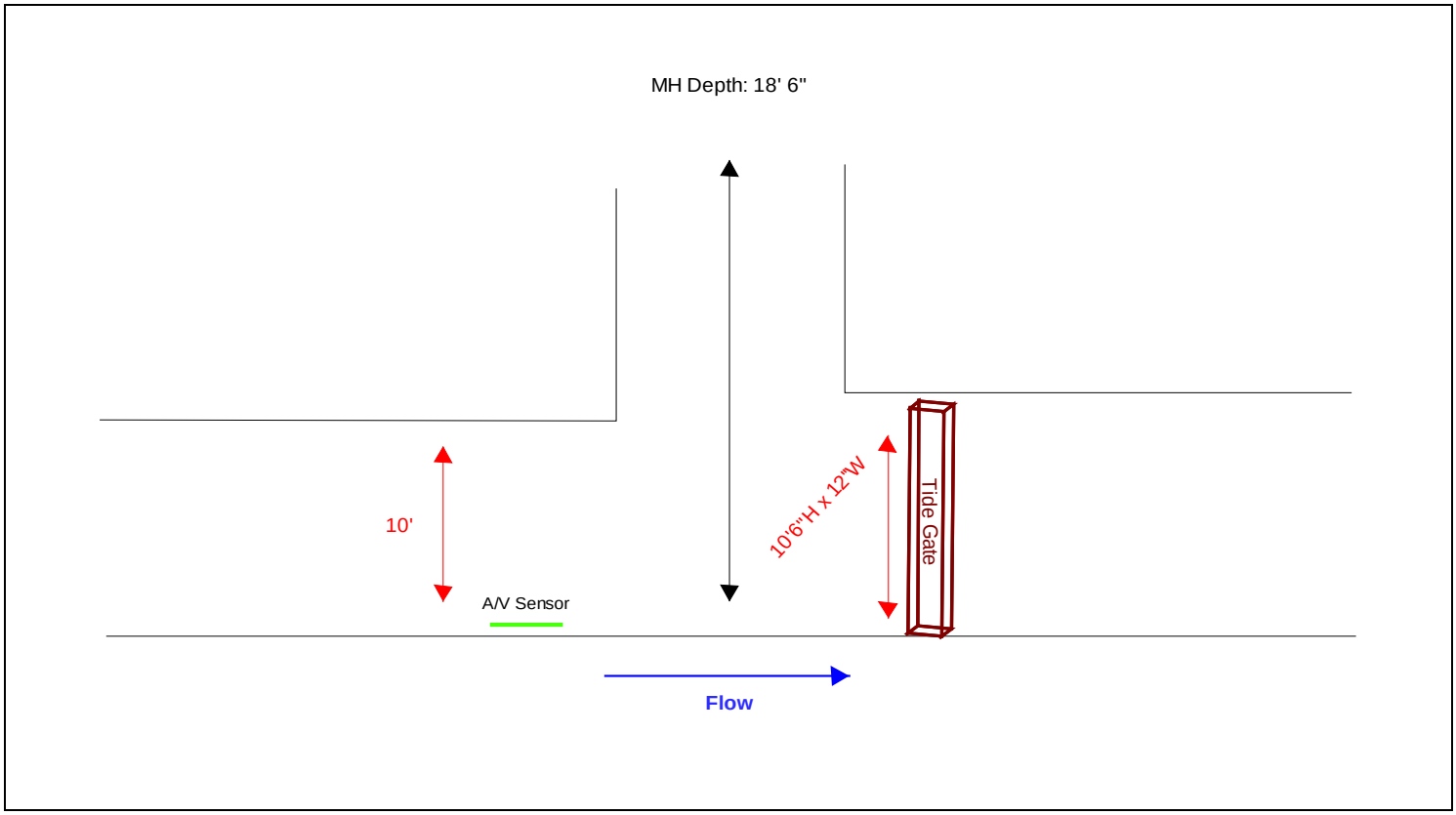
Site Overview

View of flow through influent line

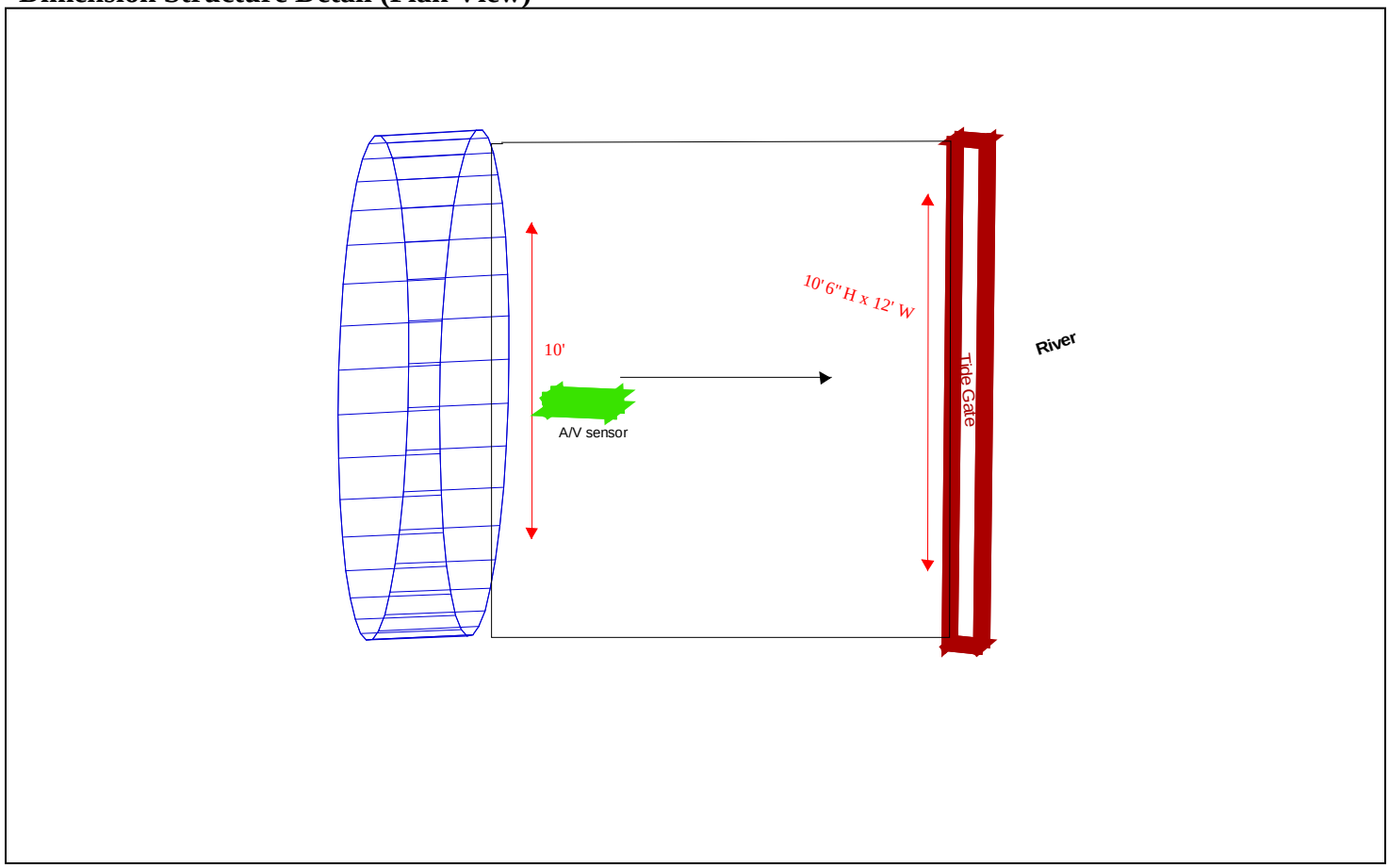


View of flow through effluent line

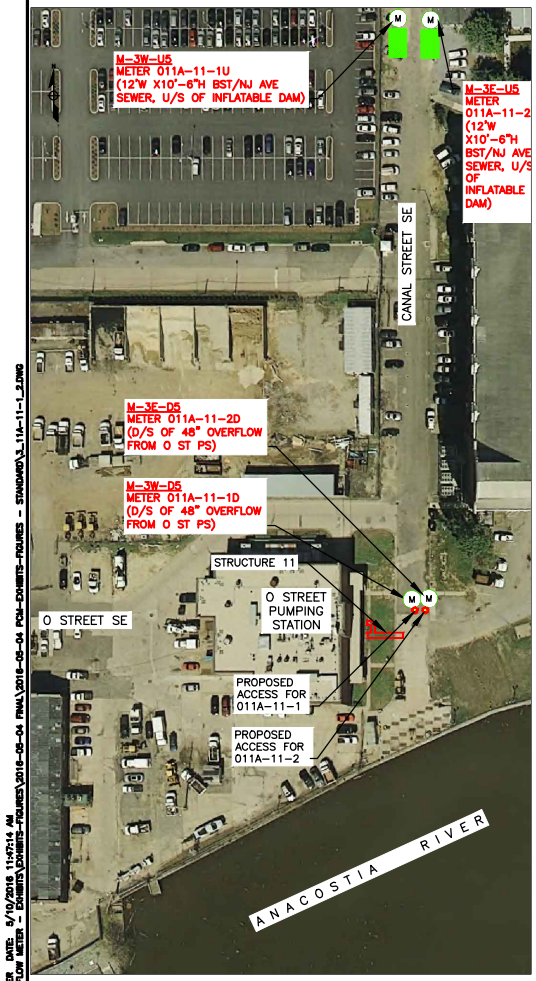
Dimensional Structure Profile View (profile sketch showing location of sensors)

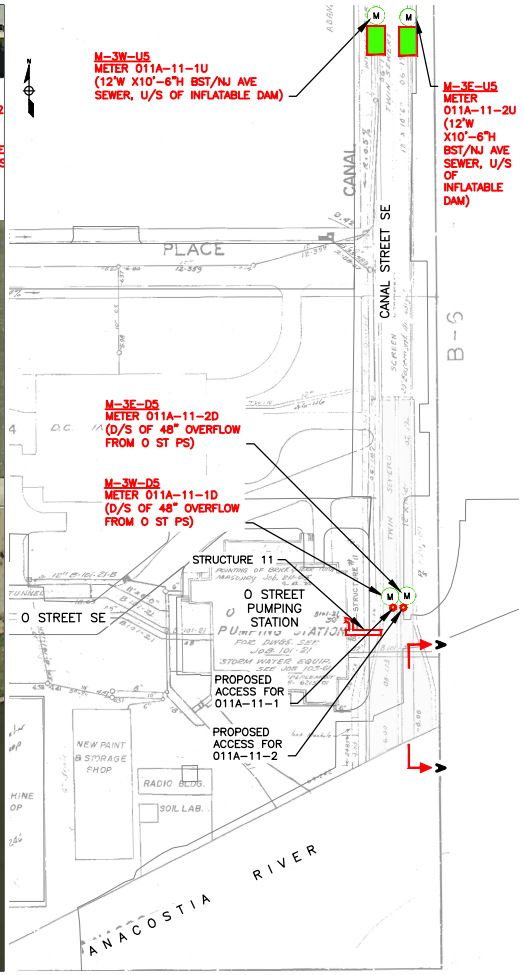


Dimension Structure Detail (Plan View)



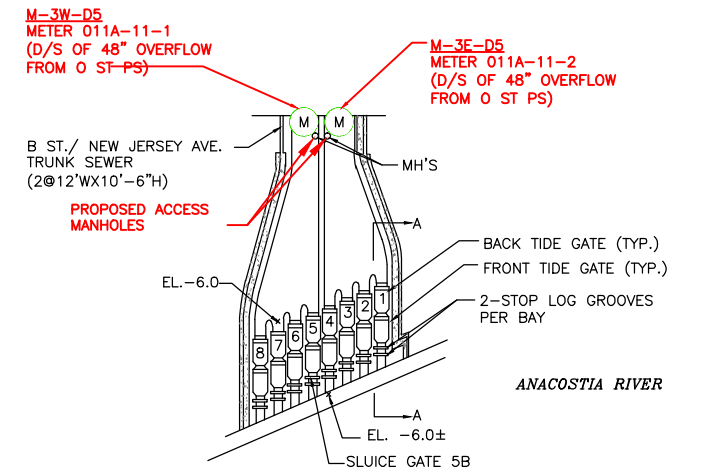
1 – FLOW METER





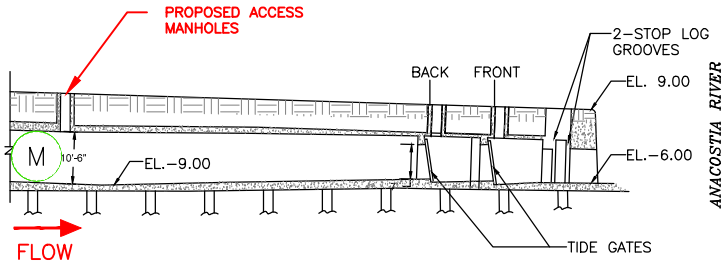
FLOW METER LOCATION PLAN

SCALE: NTS



INSET-1 SECTION PLAN

SCALE NTS



CROSS-SECTION A-A (PROFILE VIEW)

SCALE NTS

LEGEND

(M) FLOW METER LOCATION

dc clean RIVERS PROJECT

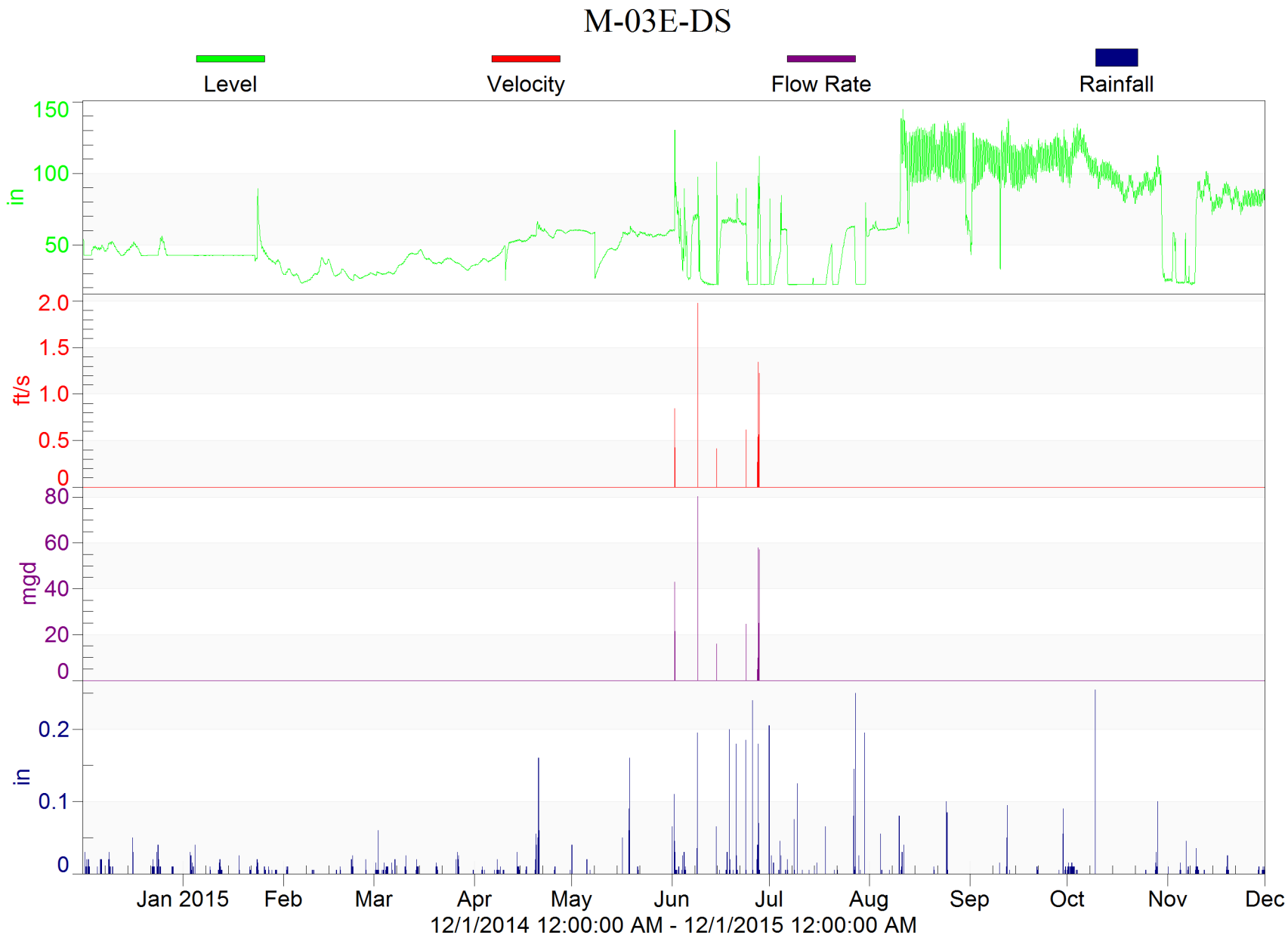
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

11A-11-1U,11A-11-1D,11A-11-2U AND 11A-11-2D METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 3

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:47:14 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\3_11A-11-1_2.DWG


M-03E-DS
Level
Velocity
Flow Rate
Rainfall
150
100
50
in
2.0
1.5
1.0
0.5
0
ft/s
80
60
40
20
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-03E-DS - Off of 100 O St. (behind the pump station on the other side of the new pump)

Pipe Diameter (in): 120" (12/01/14 to 12/01/15)

M-03E-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/18/2015	12:14		56.5	0	0	0		LL/AP	Install.
11/18/2015	12:16		56.4	0	0	0		LL/AP	
11/18/2015	12:24	56.45	56.5	0	0	0		LL/AP	
11/18/2015	12:28	56.25	56	0	0	0		LL/AP	
1/23/2015	6:08	38.77	38.5	0	0	5		LR/AM	
1/23/2015	6:20	38.73	38.5	0	0	5		LR/AM	
1/23/2015	6:23	38.78	38.75	0	0	5		LR/AM	
3/11/2015	15:20						5.5	AP/AM	CB meter.
4/15/2015	15:30		52		0	4		LR/DW	
4/15/2015	15:45		52		0	4		LR/DW	
7/9/2015	14:16	22.26	22.5	0	0	4	6.16	LR/DW	CB Telog. CB meter.
10/23/2015	8:27		93.5		0	3		LR/JC	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-03E-US

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 011a

DURATION: 3/1/15 - 8/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-03E-US measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the Anacostia River through CSO 012 upstream of the inflatable dam at Structure 14.

3. The continuity equation was used to calculate a flow rate from these measurements. M-03E-US is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	10.387	0.108	3.414
Max	134.55	7.62	481.944

Site Name/Manhole # M-3 E US Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 15:15 Crew Members: LR/JS

Installation Date: 2/4/15 Time: 9:46 Crew Members: LR/PD

Address/Location: O St. Pump Station (behind the sewage station)

Latitude: N 38° 52.381' Longitude: W 77° 00.220'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	12'		12'
Width	12'		12'
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☒ (No) Soft: _____ in. deep

Surcharge / Backwater Influence: *Tidal site*

- ☐ No evidence visible
- ☒ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☒ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☒ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☒ (No)

Height above ground ____

Manhole depth 18'4"

Structural Integrity of Manhole:

☐ Good ☒ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☒ (Yes) ☐ No ☐ Maybe

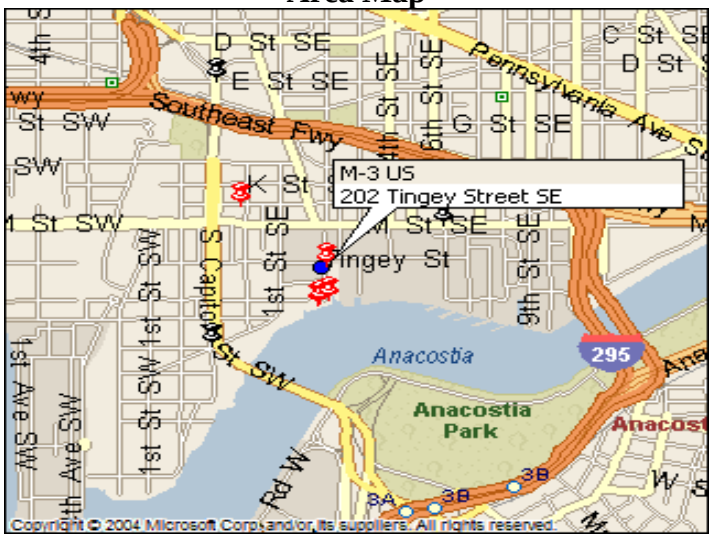
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map

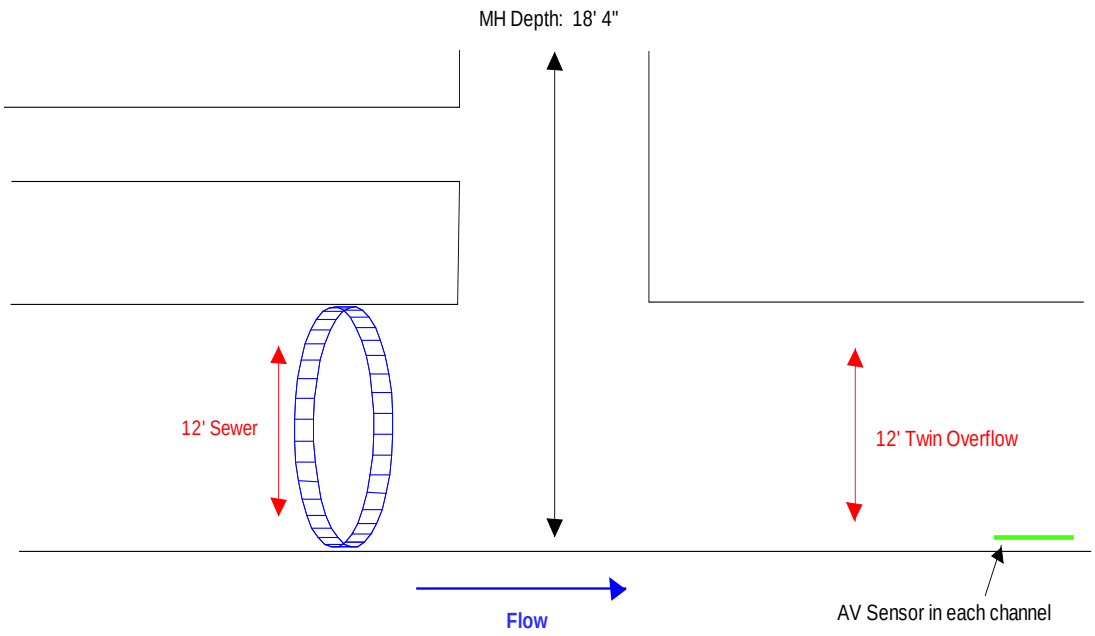
View from top of MH

Site Overview

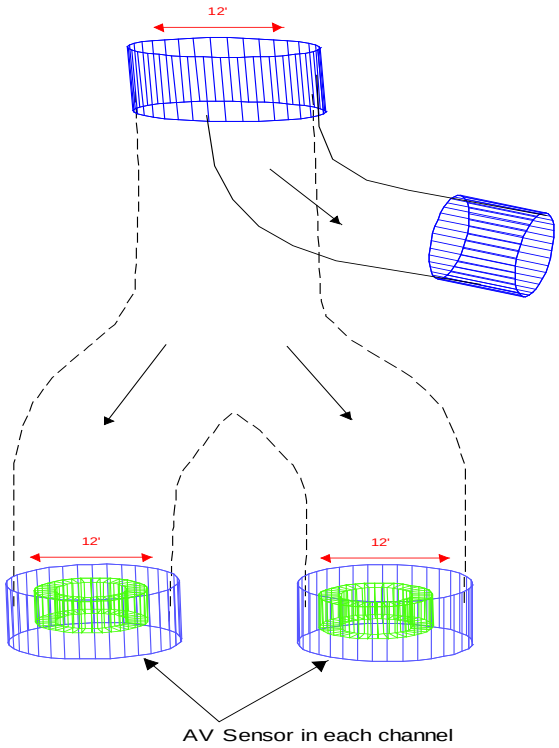
View of flow through influent line

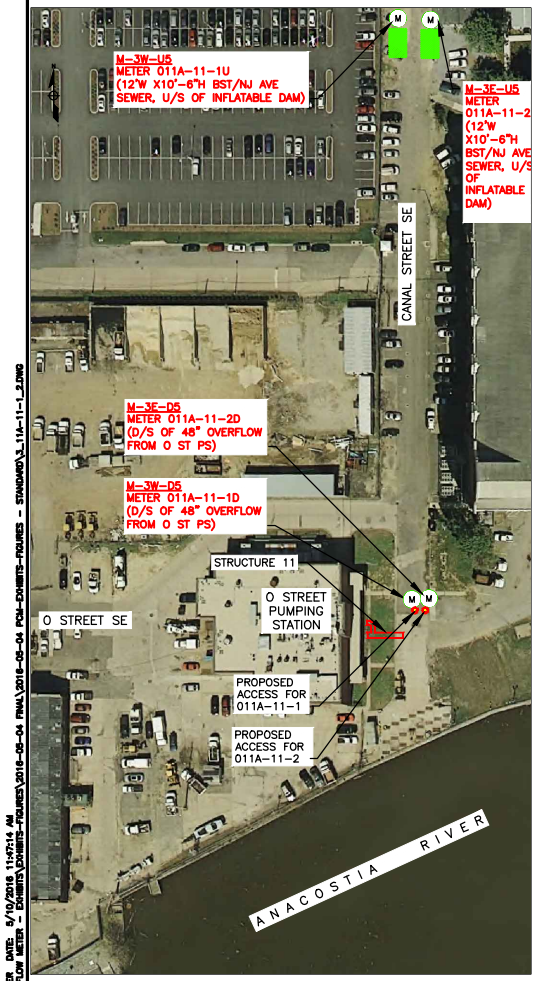
View of flow through effluent line

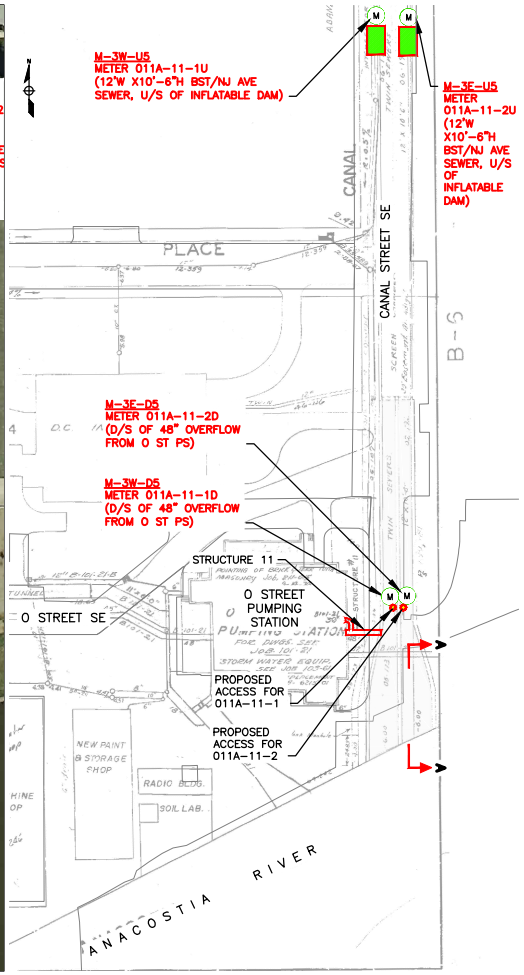
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

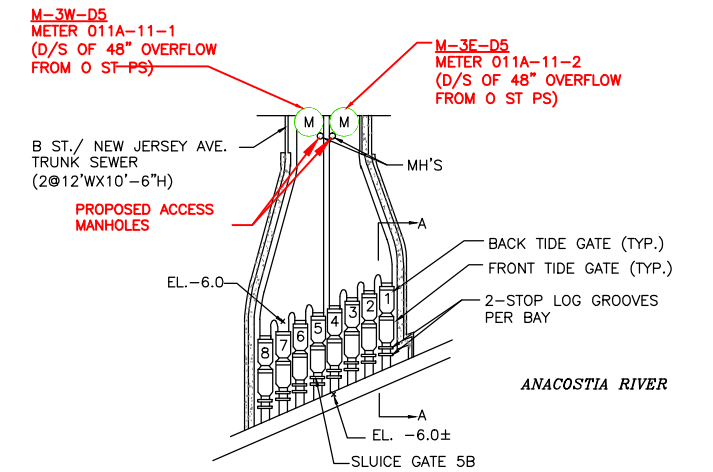






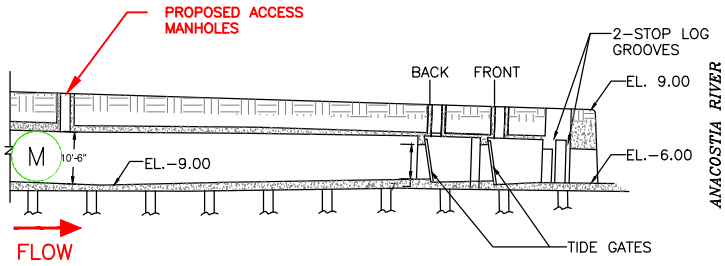
FLOW METER LOCATION PLAN

SCALE: NTS



INSET-1 SECTION PLAN

SCALE NTS



CROSS-SECTION A-A (PROFILE VIEW)

SCALE NTS

LEGEND

M FLOW METER LOCATION

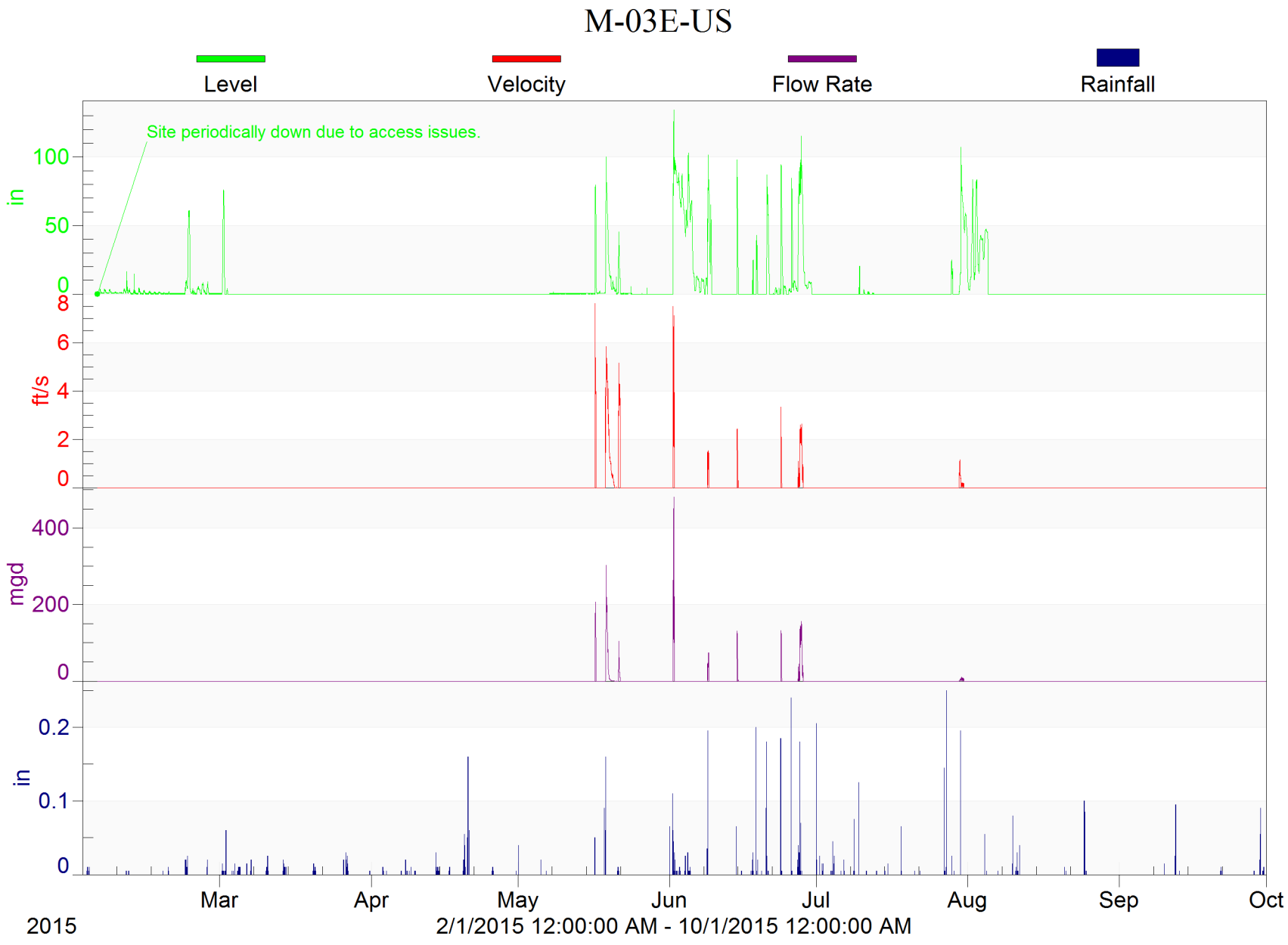
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

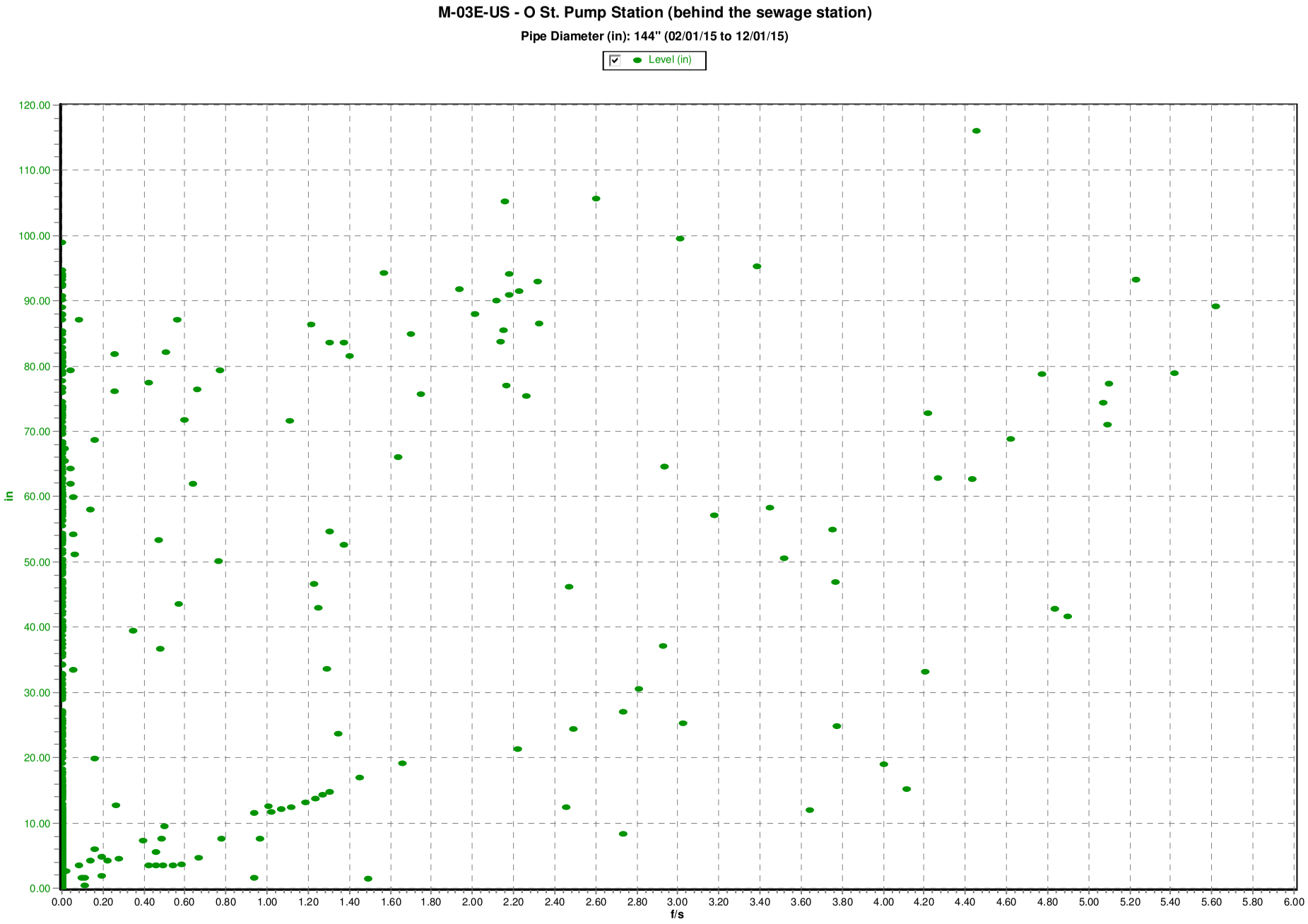
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

11A-11-1U,11A-11-1D,11A-11-2U AND 11A-11-2D METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 3

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:47:14 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\3_11A-11-1_2.DWG


M-03E-US
Level
Velocity
Flow Rate
Rainfall
Site periodically down due to access issues.
in
100
50
0
ft/s
8
6
4
2
0
mgd
400
200
0
in
0.2
0.1
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
2015
2/1/2015 12:00:00 AM - 10/1/2015 12:00:00 AM


M-03E-US - O St. Pump Station (behind the sewage station)
Pipe Diameter (in): 144" (02/01/15 to 12/01/15)
Level (in)
in
f/s
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00

M-03E-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
2/4/2015	16:08	1.59	1.5	0	0	0	6.07	LR/AP	Install
2/4/2015	16:12	1.67	1.5	0	0	0		LR/AP	
2/4/2015	16:15	1.55	1.5	0	0	0		LR/AP	
5/7/2015	12:00		0		0	0		LR/DW	CB Telog.
6/1/2015	12:30	0	0		0	0	6.03	LR/DW	
7/9/2015	17:12		4.23	0	0	0	5.81	LR/DW	
7/23/2015	14:36							LR/DW	CB Telog.
10/9/2015	10:36		10.75		0	0		LR/JC	Remove meter.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-03W-DS

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 011a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-03W-DS measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the Anacostia River through CSO 012 downstream of the inflatable dam at Structure 14.

3. The continuity equation was used to calculate a flow rate from these measurements. M-03W-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	21.115	0	0
Avg.	58.89	0	0.016
Max	144.859	1.746	76.141

Site Name/Manhole # M-3 W DS Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 15:15 Crew Members: LR/JS

Installation Date: 11/18/14 Time: 14:00 Crew Members: CL/PD

Address/Location: Off of 100 O St. (behind the pump station on the other side of the new pump)

Latitude: N 38° 52.390' Longitude: W 77° 0.229'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 45 in

Turbulence Amplitude:

- (Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	10'		10'6"
Width	10'		12'
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

(Yes Hard packed: _____ in. deep

☐ No Soft: 4 + in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

(Good 20.9 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 18'6"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes ☐ No ☐ Maybe

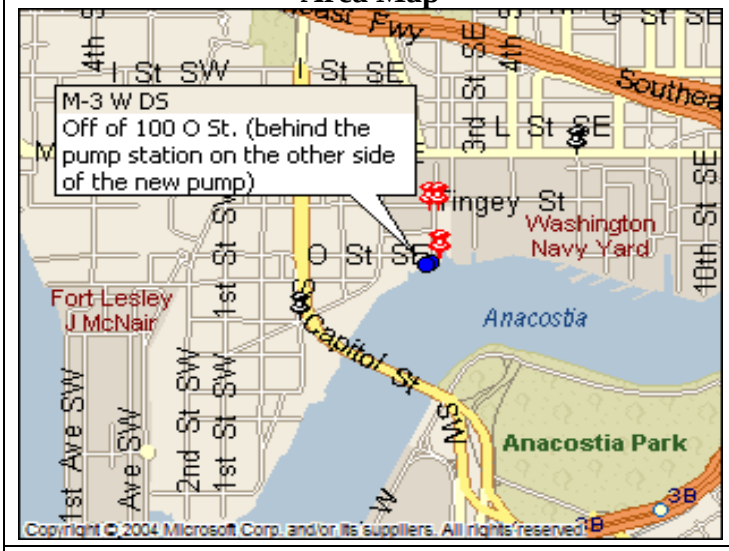
Sensor Configuration:

(Please include Serial Numbers when possible)

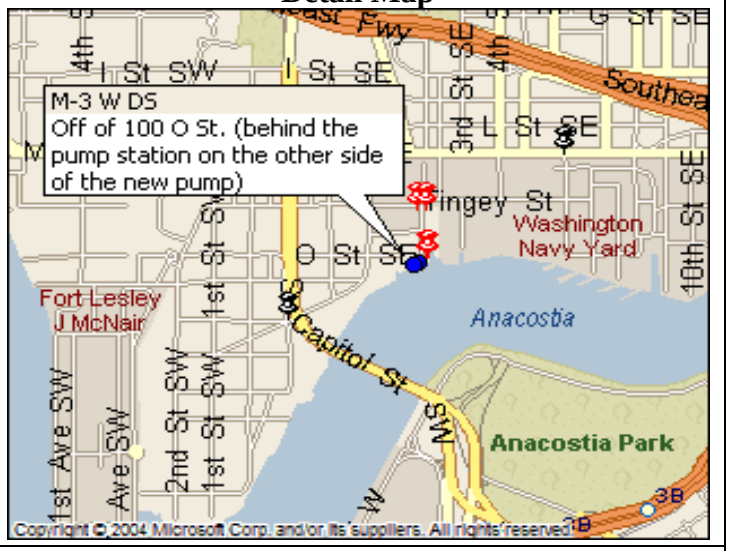
Level	Primary:	
	Redundant:	
Velocity	Primary:	
	Redundant:	
Meter Logger		

Comments:

Area Map



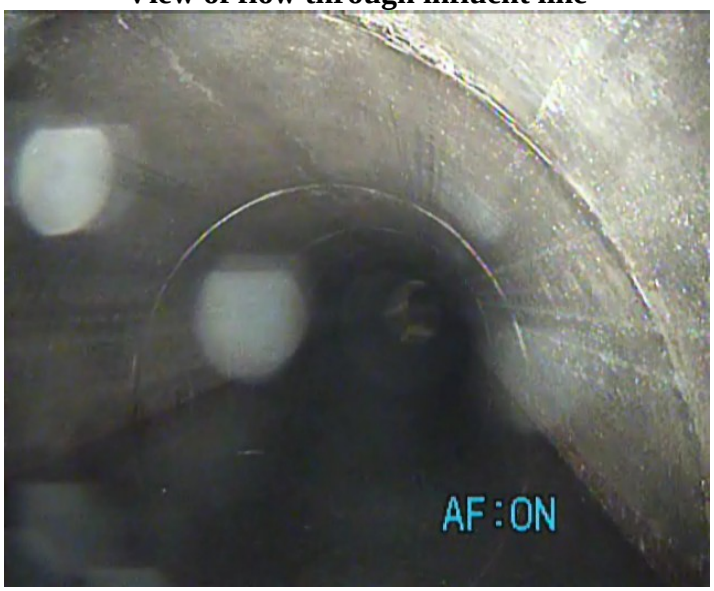
Detail Map



View from top of MH

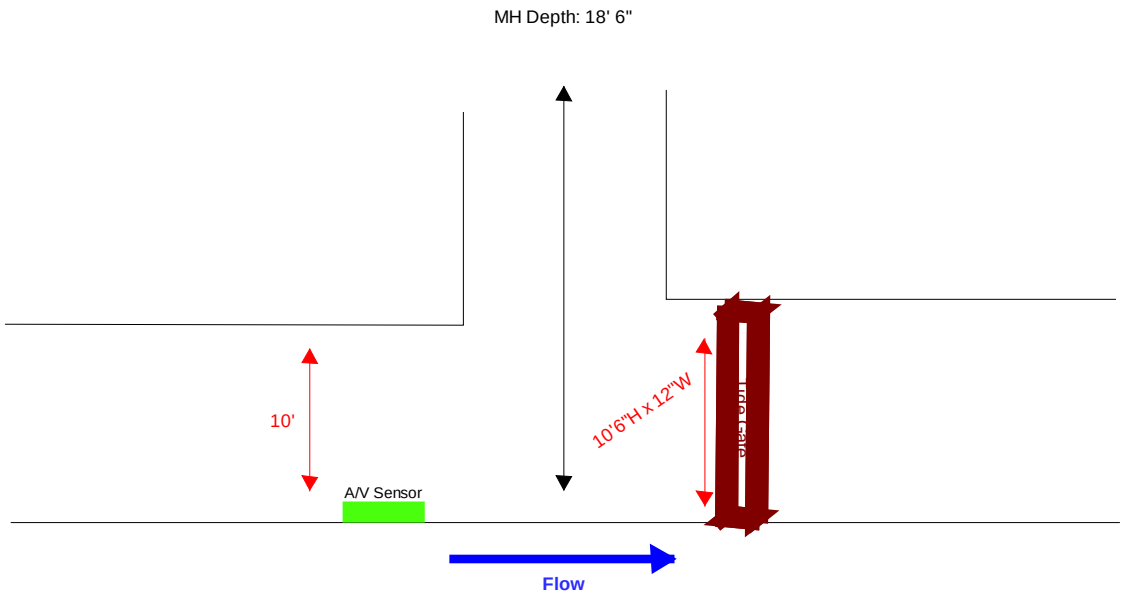
Site Overview

View of flow through influent line

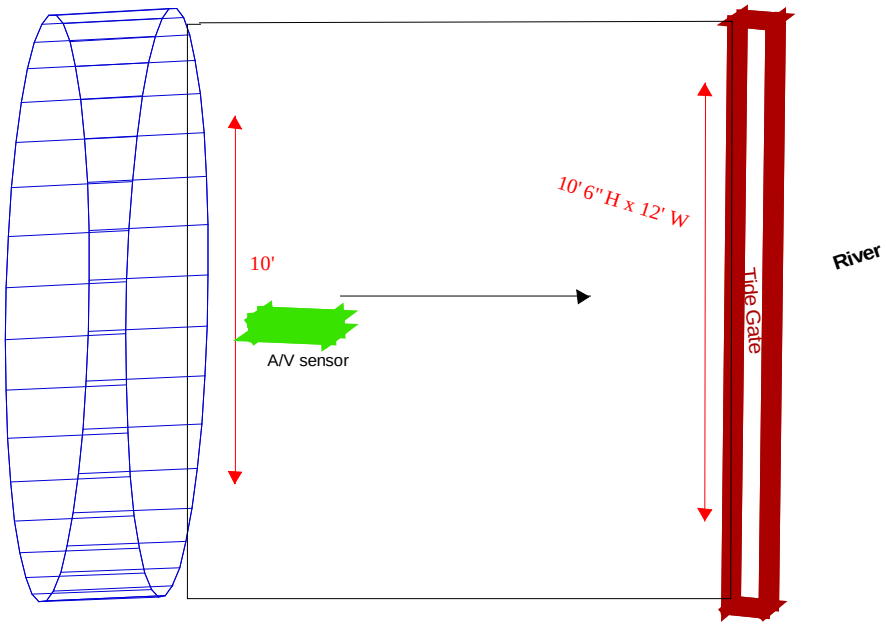


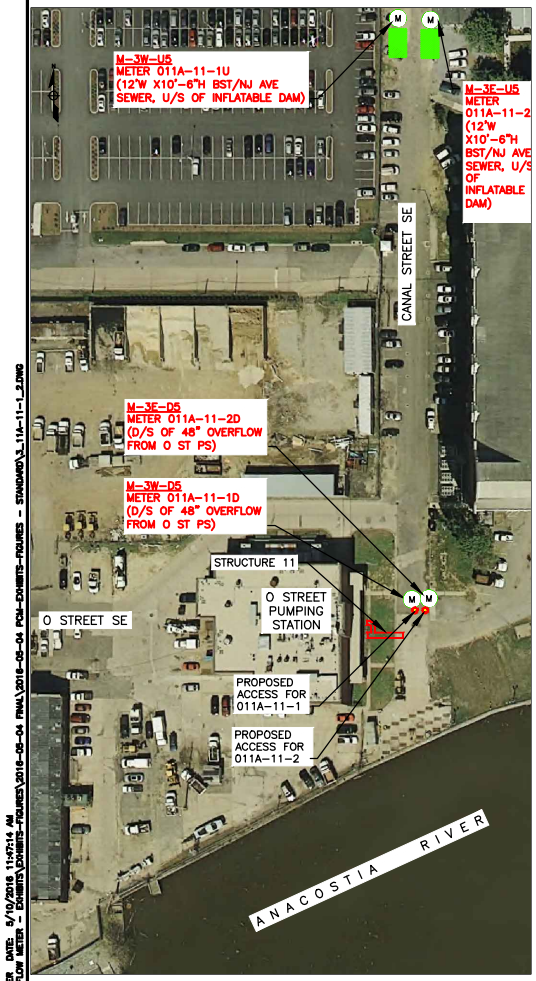
View of flow through effluent line

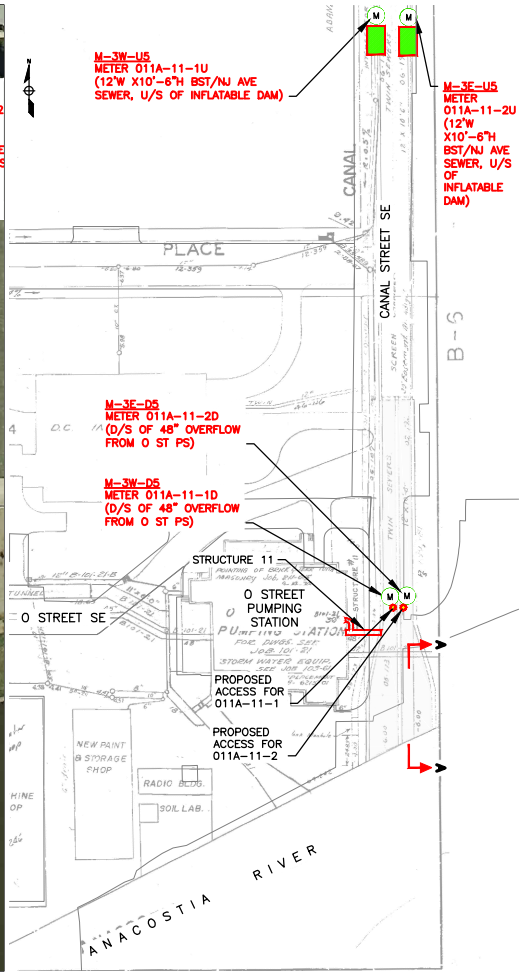
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

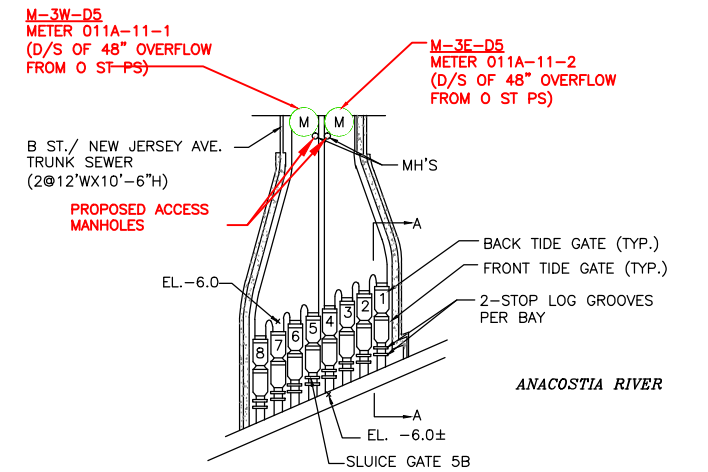






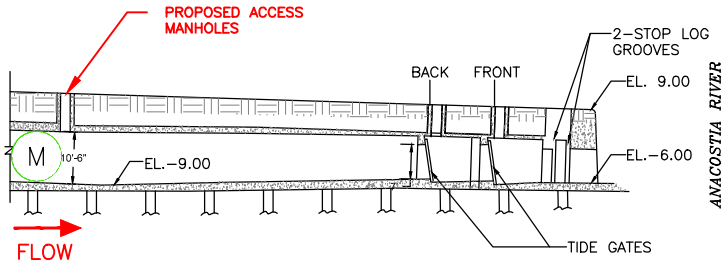
FLOW METER LOCATION PLAN

SCALE: NTS



INSET-1 SECTION PLAN

SCALE NTS



CROSS-SECTION A-A (PROFILE VIEW)

SCALE NTS

LEGEND

M FLOW METER LOCATION

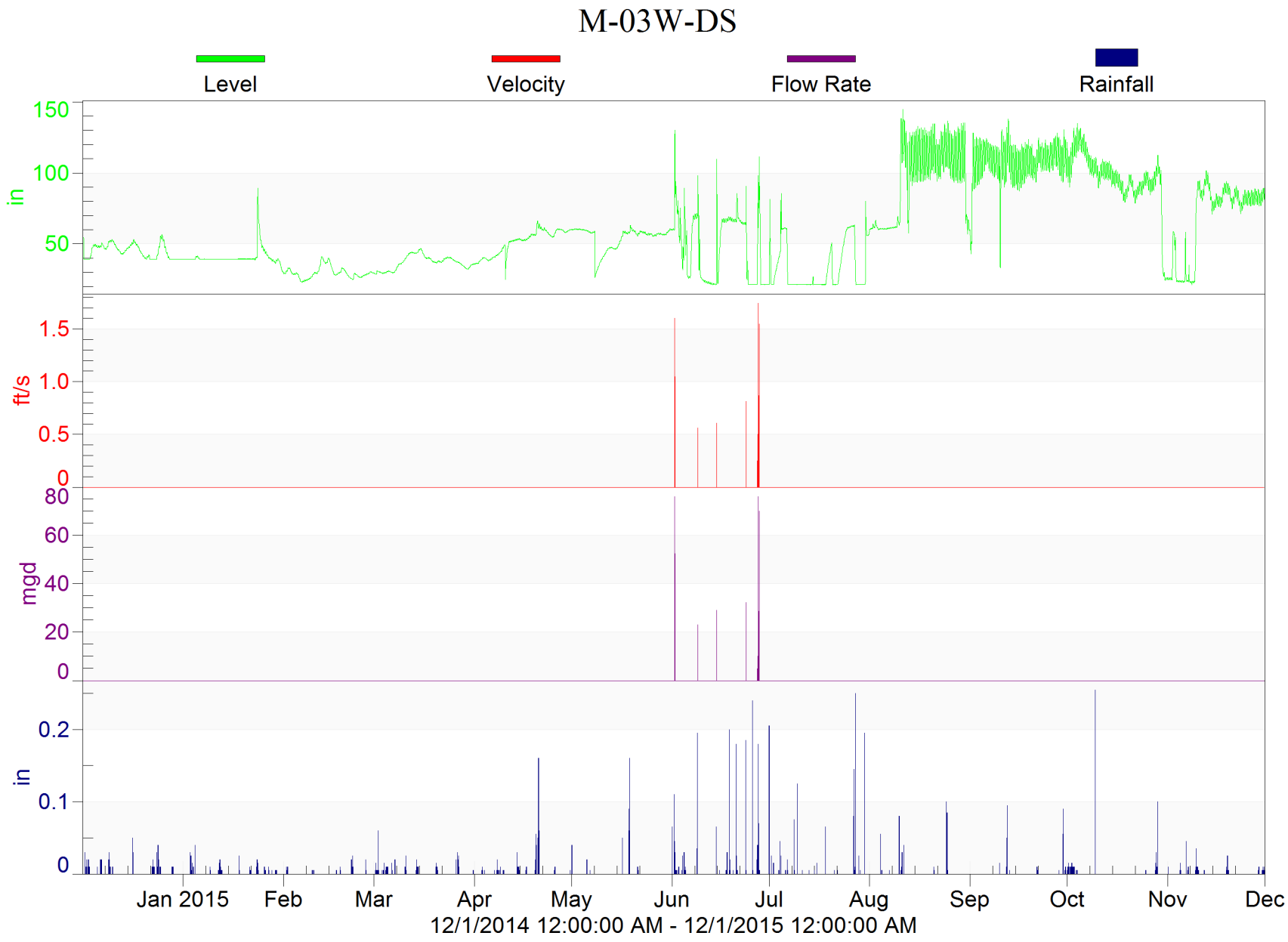
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

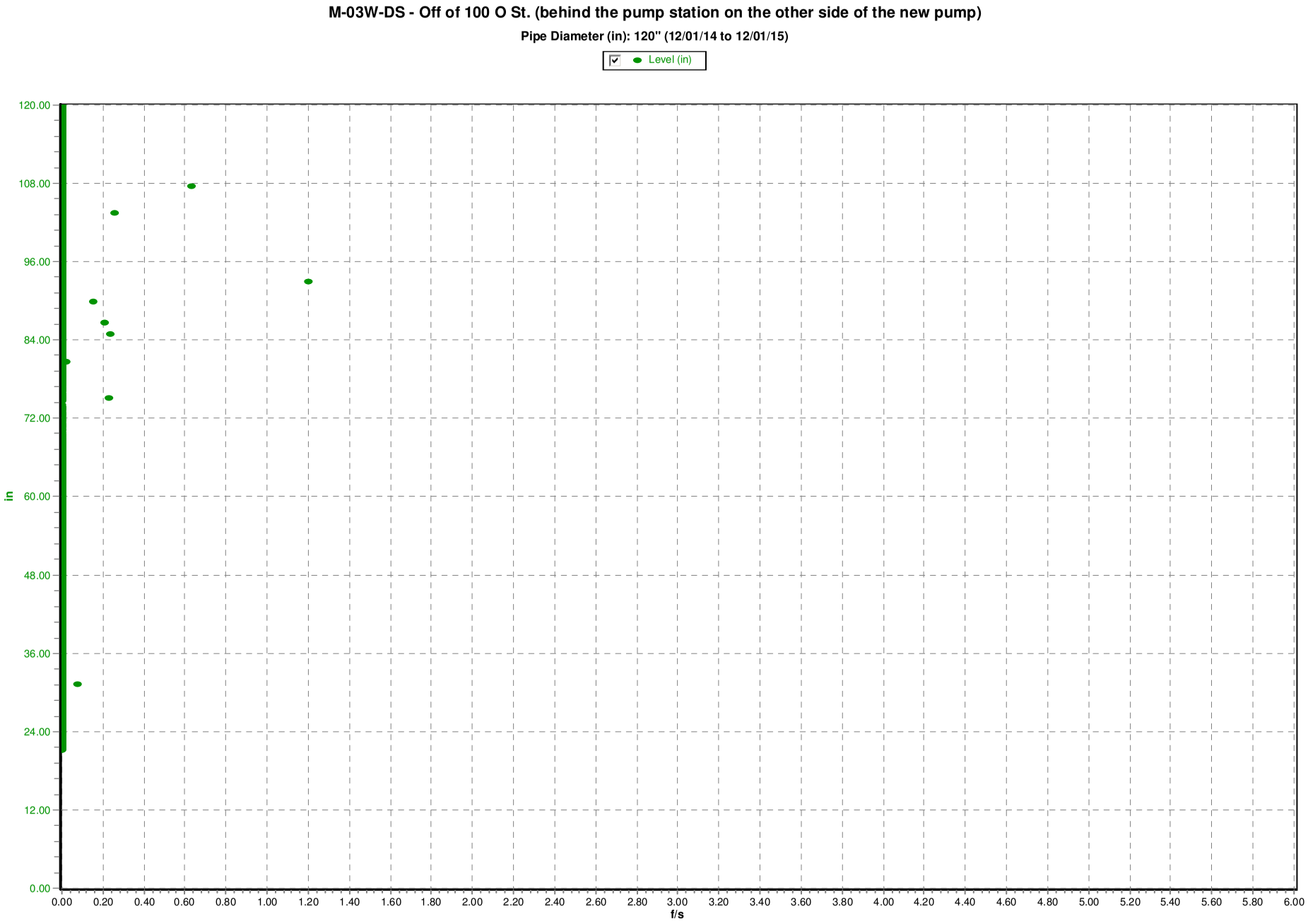
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

11A-11-1U,11A-11-1D,11A-11-2U AND 11A-11-2D METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 3

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:47:14 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\3_11A-11-1_2.DWG


M-03W-DS
Level
Velocity
Flow Rate
Rainfall
150
100
50
in
1.5
1.0
0.5
0
ft/s
80
60
40
20
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-03W-DS - Off of 100 O St. (behind the pump station on the other side of the new pump)
Pipe Diameter (in): 120" (12/01/14 to 12/01/15)
Level (in)
in
120.00
108.00
96.00
84.00
72.00
60.00
48.00
36.00
24.00
12.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00
f/s

M-03W-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/18/2014	14:37	56.55	56.75		0	0		LR/AP	Install.
11/18/2014	14:42	56.76	56.75		0	0		LR/AP	
11/18/2014	14:47	56.73	56.75		0	0		LR/AP	
12/4/2014	8:48	49.65	49.5	0	0	3		LR/AP	
12/4/2014	8:54	49.58	49.5	0	0	3		LR/AP	
1/23/2015	6:53	38.74	38.75	0	0	6		LR/AM	
1/23/2015	7:04	38.75	38.75	0	0	6		LR/AM	
1/23/2015	7:09	38.77	38.75	0	0	6		LR/AM	
3/26/2015	10:40	37.1	37	0	0	3		AP/AM	CB meter.
4/15/2015	16:00		52		0	2		LR/DW	
7/9/2015	14:26		0		0	13		LR/DW	
9/8/2015	11:28					3		LR/JC	CB Telog.
10/23/2015	8:09		93.75		0	2		LR/JC	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-03W-US

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 011a

DURATION: 3/1/15 - 8/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-03W-US measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the Anacostia River through CSO 012 downstream of the inflatable dam at Structure 14.

3. The continuity equation was used to calculate a flow rate from these measurements. M-03W-US is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	10.729	0.056	1.722
Max	135.446	8.527	423.798

Site Name/Manhole # M-3 W US Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 15:15 Crew Members: LR/JS

Installation Date: 2/4/15 Time: 9:46 Crew Members: LR/PD

Address/Location: O St. Pump Station (behind the sewage station)

Latitude: N 38° 52.381' Longitude: W 77° 00.220'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	12'		12'
Width	12'		12'
Material	Concrete		Concrete
Shape	Round		Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☒ (No) Soft: _____ in. deep

Surcharge / Backwater Influence: *Tidal site*

- ☐ No evidence visible
- ☒ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☒ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☒ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☒ (No)

Height above ground ____

Manhole depth 18'4"

Structural Integrity of Manhole:

☐ Good ☒ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☒ (Yes) ☐ No ☐ Maybe

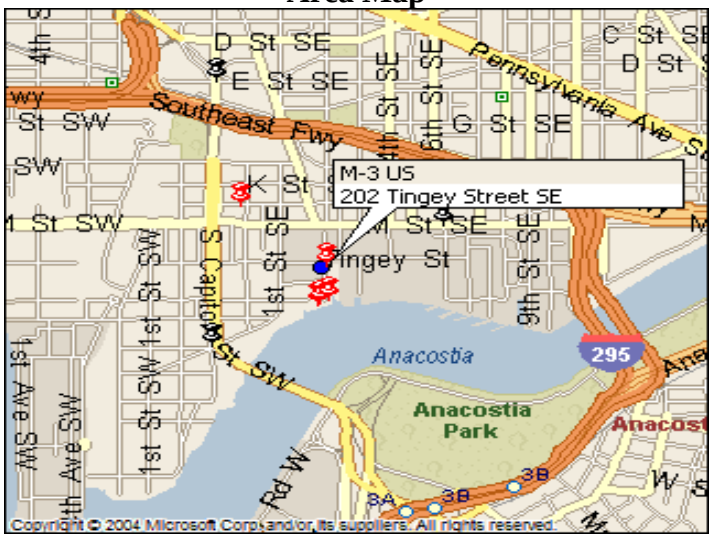
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map

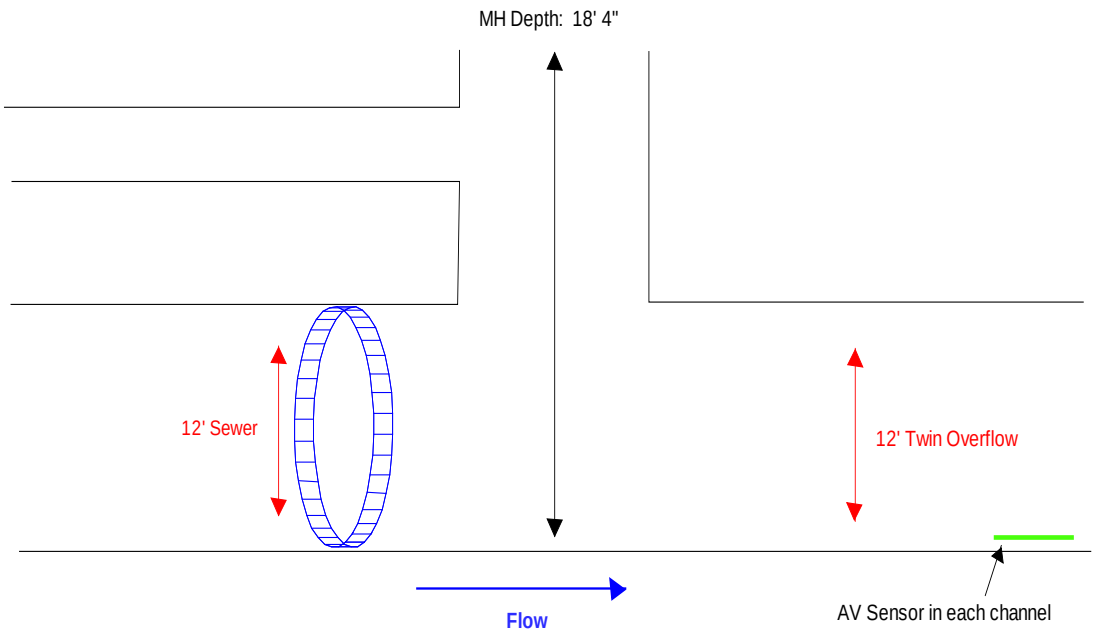
View from top of MH

Site Overview

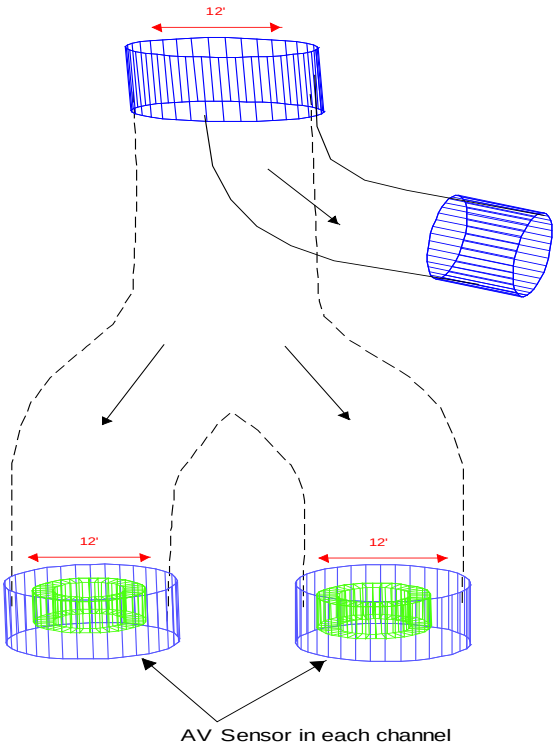
View of flow through influent line

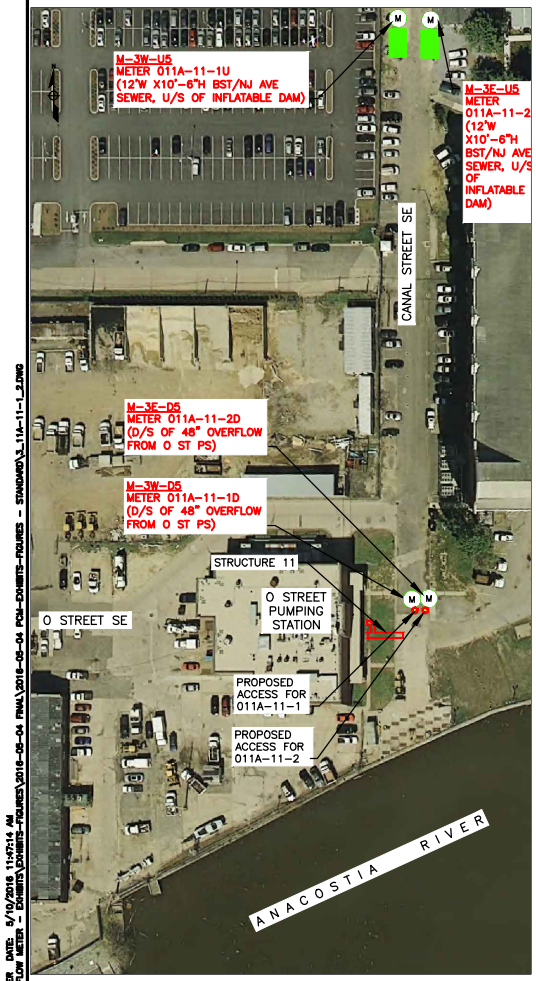
View of flow through effluent line

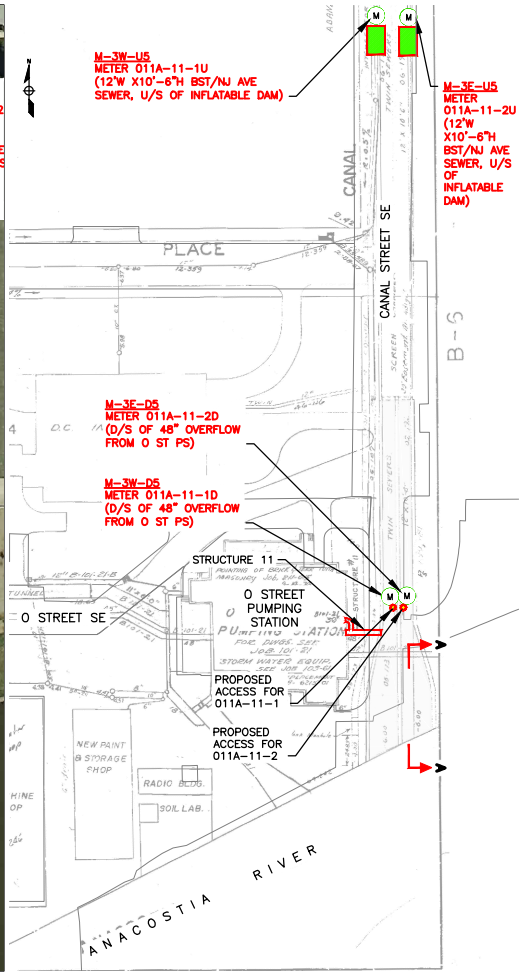
Dimensional Structure Profile View (profile sketch showing location of sensors)



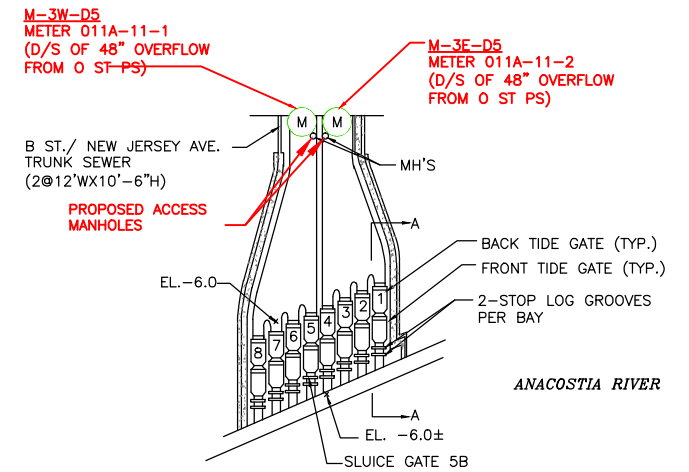
Dimension Structure Detail (Plan View)



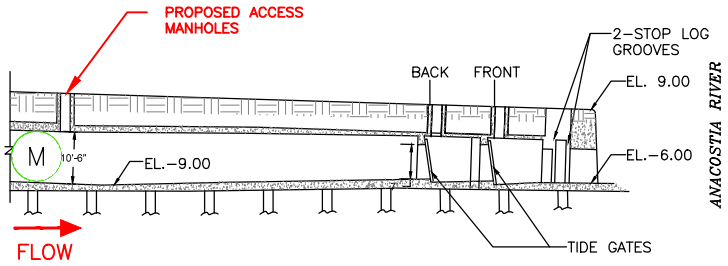




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



CROSS-SECTION A-A (PROFILE VIEW)
SCALE NTS

LEGEND

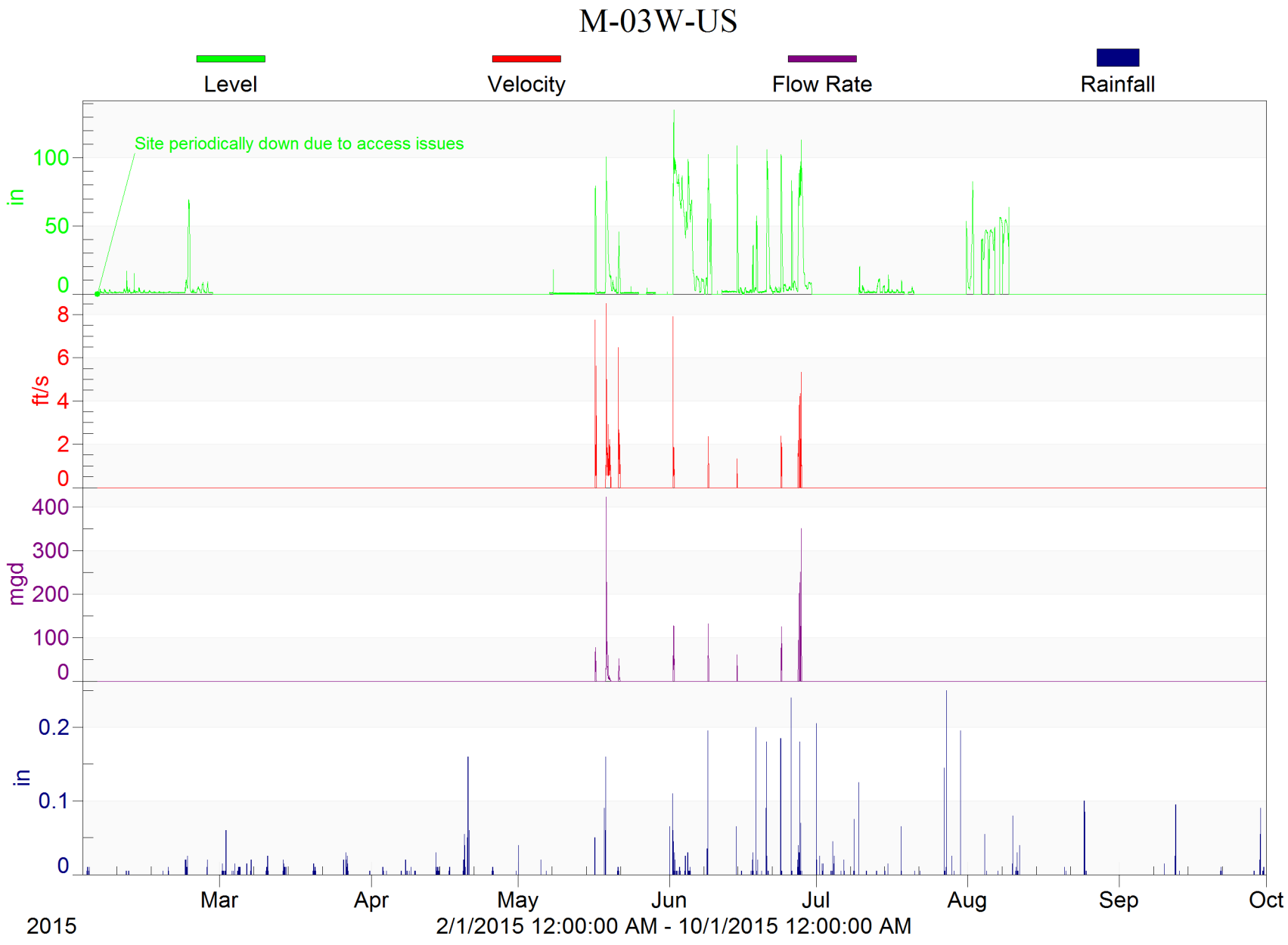
M FLOW METER LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
11A-11-1U,11A-11-1D,11A-11-2U AND 11A-11-2D METER LOCATION AND TYPICAL CROSS SECTION

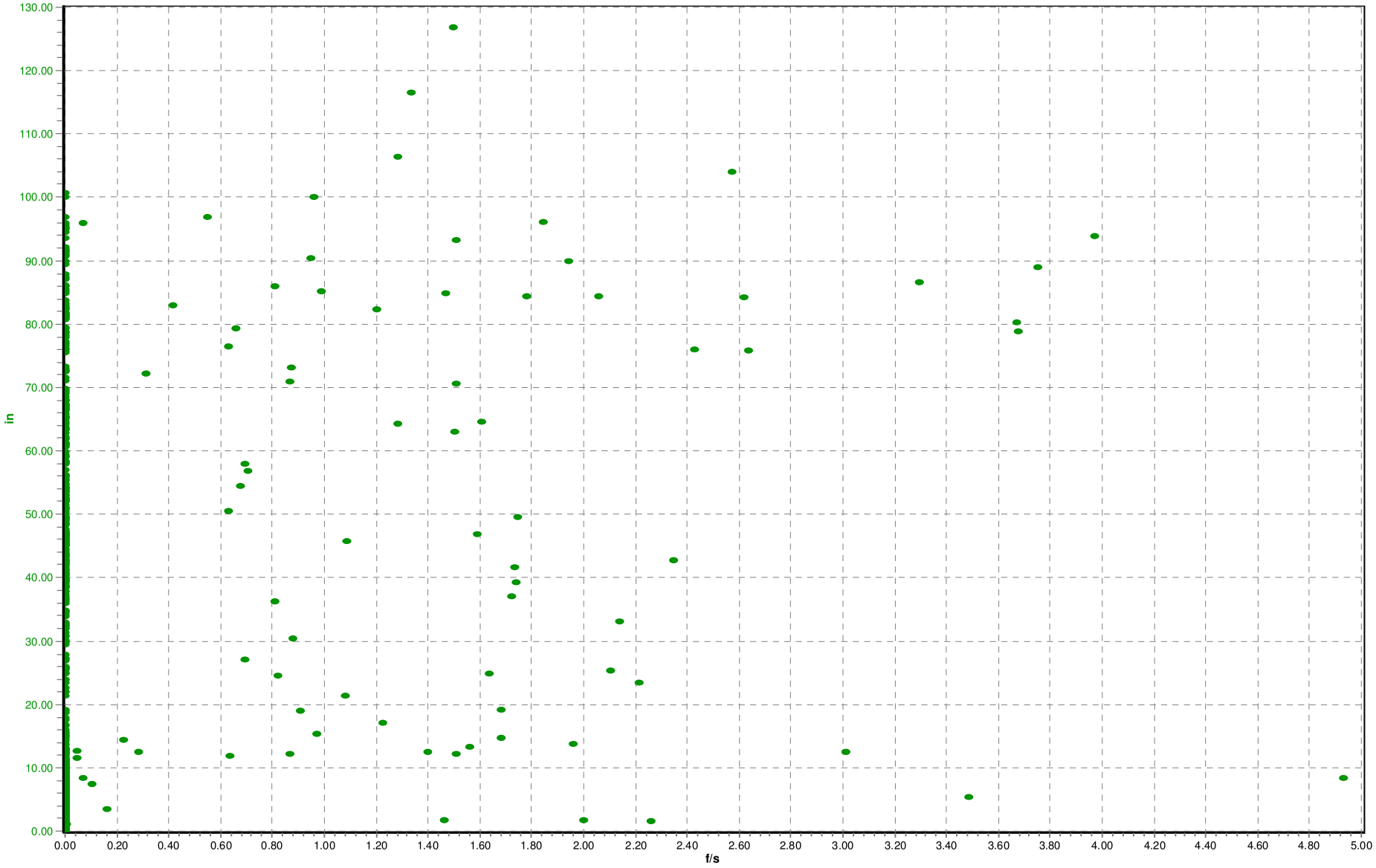
DATE: OCTOBER 2014 | SITE 3

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:47:14 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\3_11A-11-1_2.DWG


M-03W-US
Level
Velocity
Flow Rate
Rainfall
Site periodically down due to access issues
in
100
50
0
ft/s
8
6
4
2
0
mgd
400
300
200
100
0
in
0.2
0.1
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
2015
2/1/2015 12:00:00 AM - 10/1/2015 12:00:00 AM

M-03W-US - O St. Pump Station (behind the sewage station)

Pipe Diameter (in): 144" (02/01/15 to 12/01/15)



M-03W-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
2/4/2015	16:09	1.51	1.75	0	0	0	5.98	LR/AP	Install.
2/4/2015	16:12	1.58	1.75	0	0	0		LR/AP	
2/4/2015	16:15	1.53	1.75	0	0	0		LR/AP	
5/7/2015	11:00		0		0	0	6.03	LR/DW	CB Telog.
6/1/2015	15:54	0	0	0	0	0		LR/DW	
6/10/2015	18:31	0	0	0	0	0		LL/DW	
6/11/2015	17:01	0	0	0	0	0		LL/DW	
7/9/2015	18:20		4		0	0		LR/DW	
7/23/2015	15:40							LR/DW	CB Telog.
10/9/2015	10:39		11.25		0	0		LR/JC	Remove Meter.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-04

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 010

DURATION: 1/1/15 - 1/1/16

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-04 measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the O Street Pump Station downstream of the inflatable dam at Structure 15a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-04 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	1.136	0.031	0.507
Max	194.796	15.41	346.445

Site Name/Manhole # M-4 Primary: [X] Alternate: [ ]

Investigation Date: 2/19/14 Time: 15:15 Crew Members: LR/JS

Installation Date: Time: Crew Members:

Address/Location: S. Capitol & E Street SE

Latitude: N 38° 52.996' Longitude: W 77° 0.538'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Empty Pipe*

Velocity ___ ft/sec

Depth ___ in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height			9'
Width			9'
Material			Concrete
Shape			Chamber

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☒ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☒ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☒ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, ~~No safe place to park, elevated MH >3 ft~~)
- ☒ (Traffic Control only (Requires extra traffic control)
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☒ (No)

Height above ground ____

Manhole depth 25'

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends:

☐ Influent ☒ (Effluent) ☐ Manhole

Approx Distance to bend: 5 ft

Pipe Size/(Geometry)/Material Change:

☐ Influent ☐ Effluent ☒ (Manhole)

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☒ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

(Please include Serial Numbers when possible)

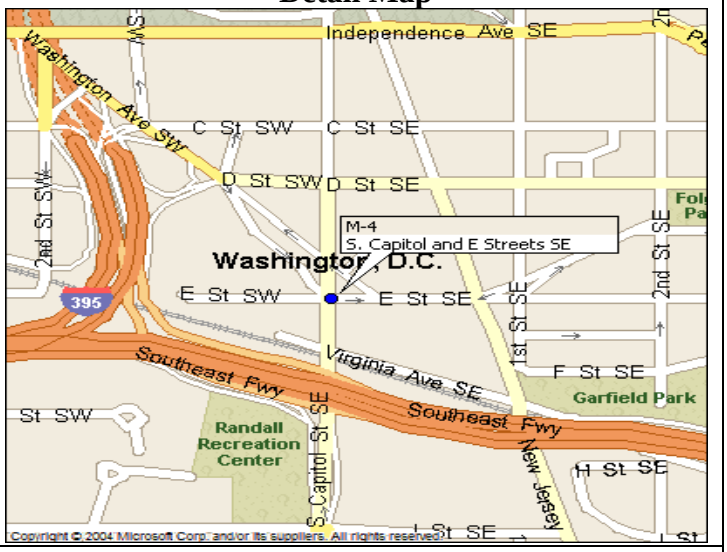
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Inflatable dam*

Bottom of ramp is 12'7"H x 15' W

Area Map

Detail Map



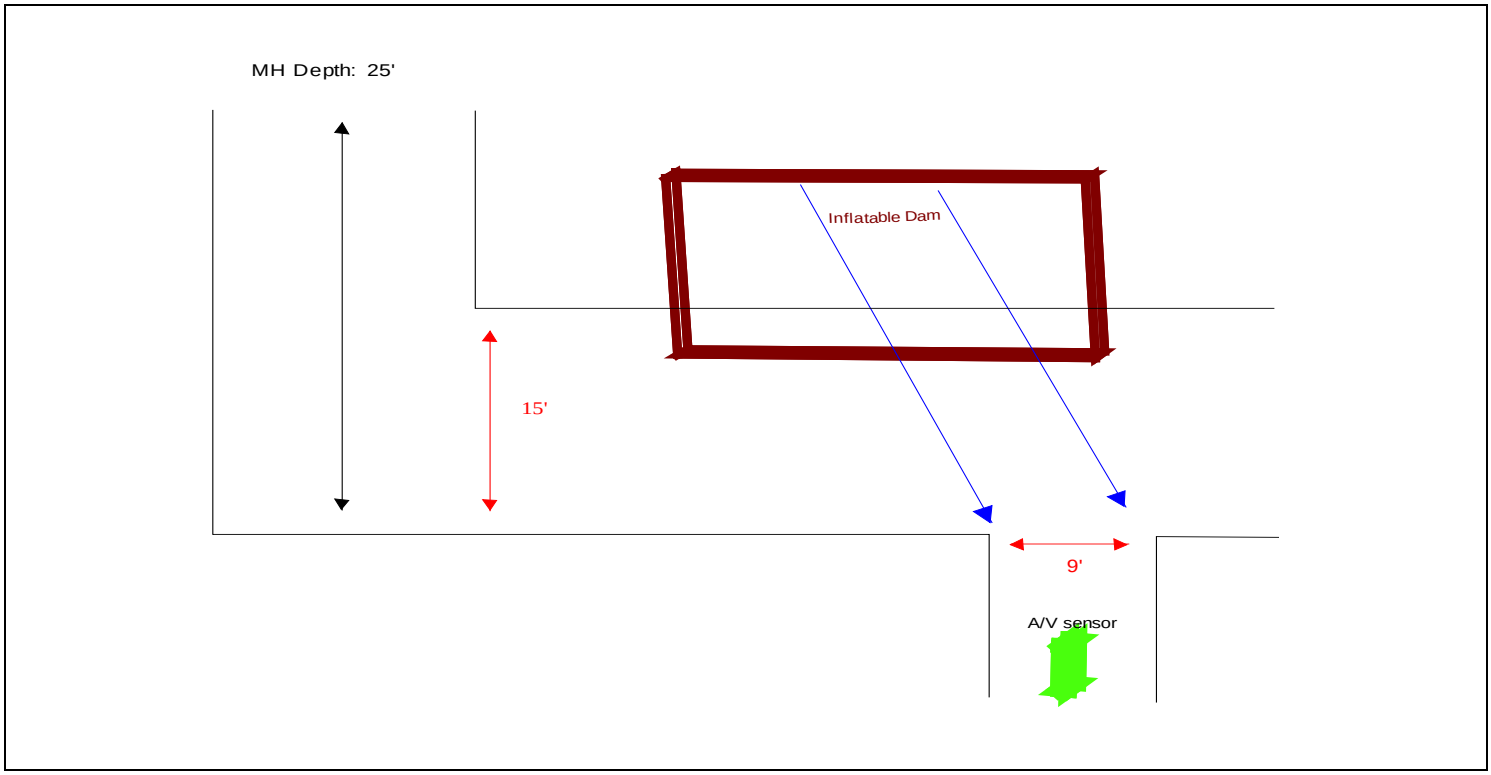
View from top of MH

Site Overview

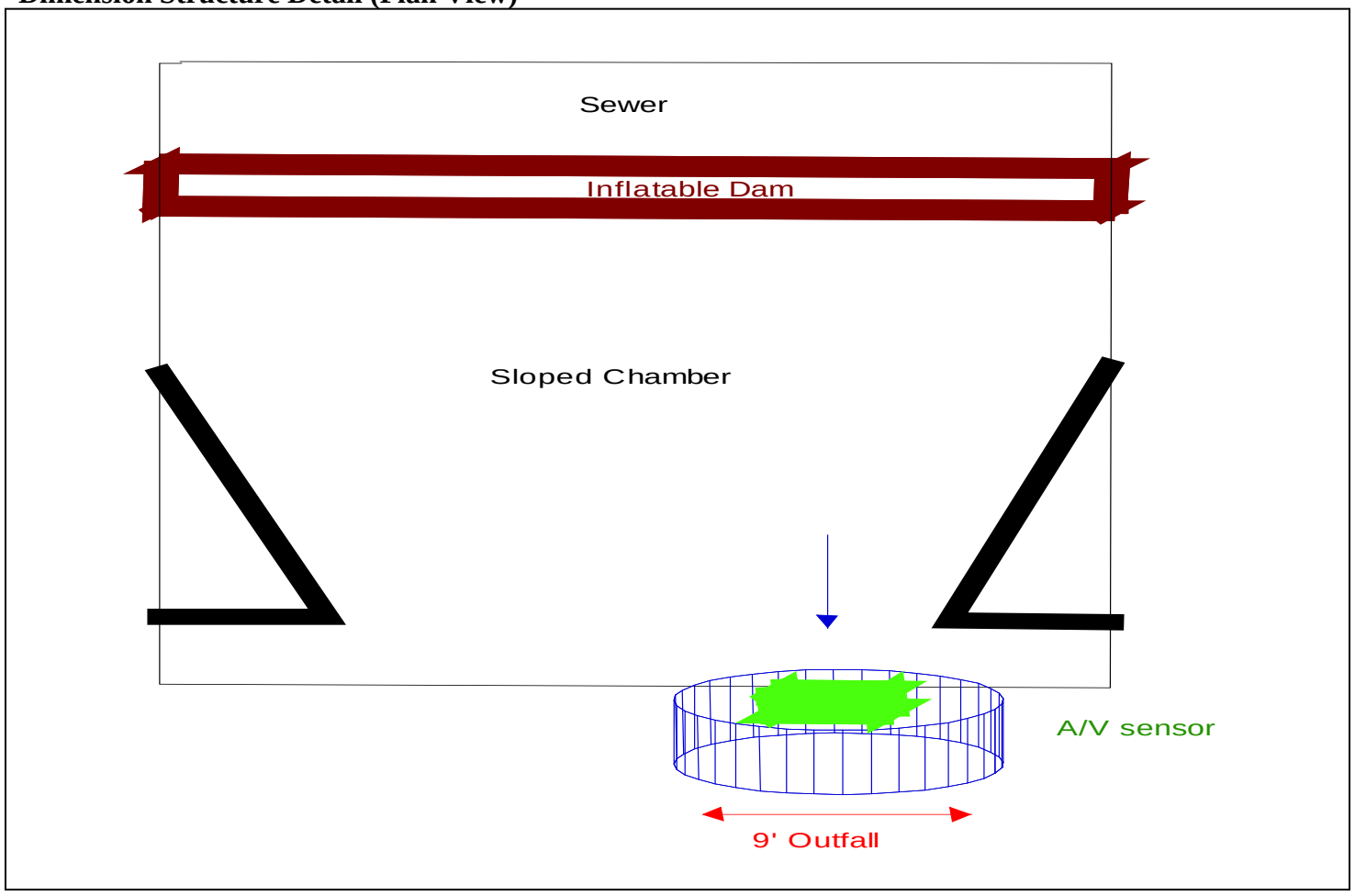
View of flow through influent line

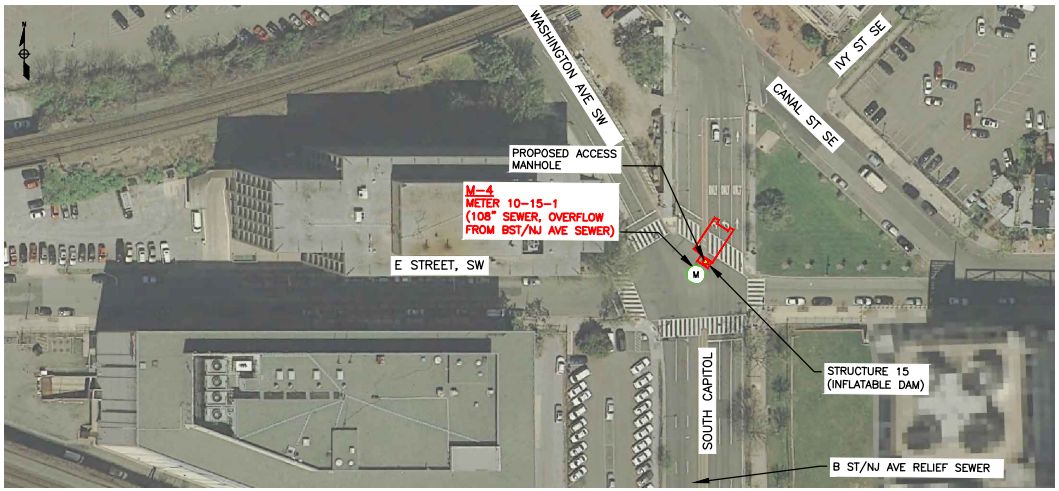
View of flow through effluent line

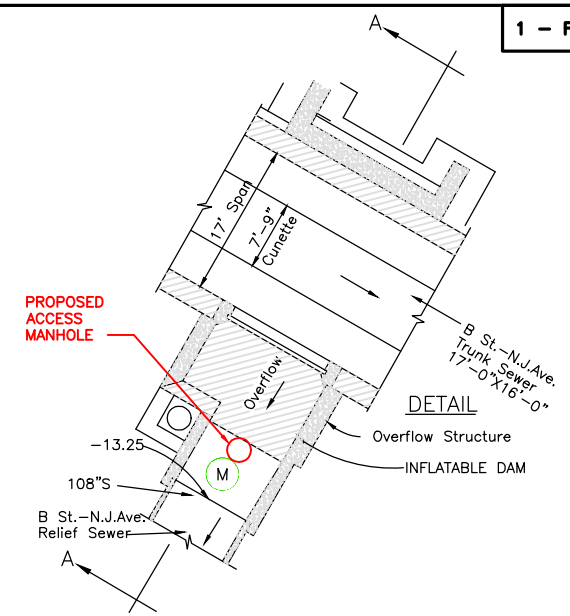
Dimensional Structure Profile View (profile sketch showing location of sensors)

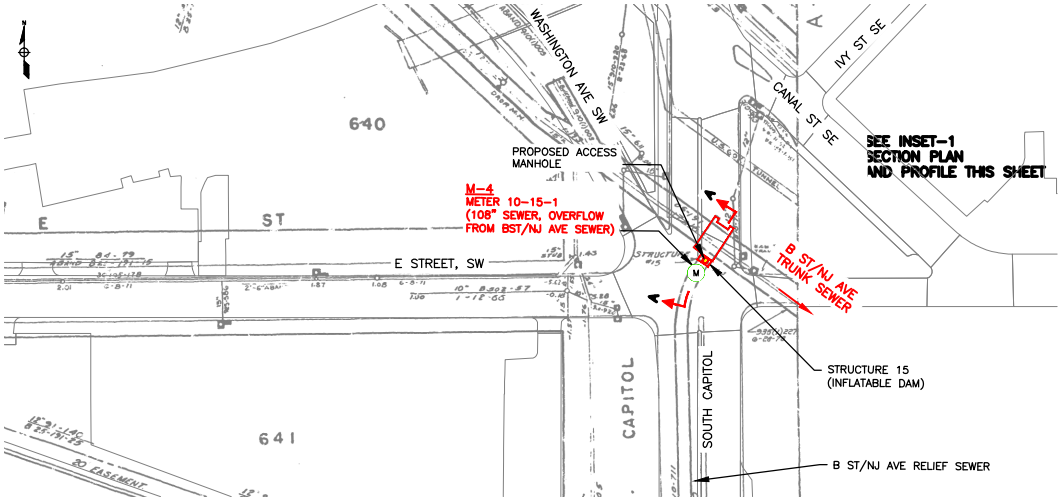


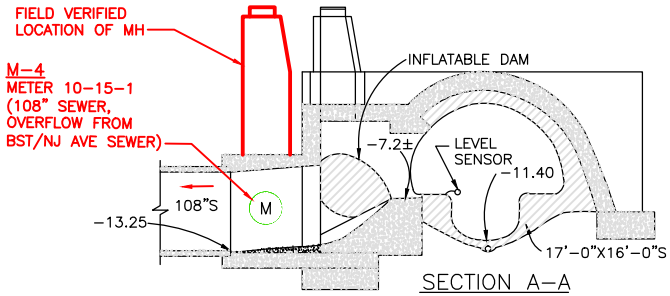
Dimension Structure Detail (Plan View)











INSET-1 SECTION PLAN AND PROFILE
SCALE NTS

FLOW METER LOCATION PLAN
SCALE: NTS

LEGEND

(M) FLOW METER LOCATION

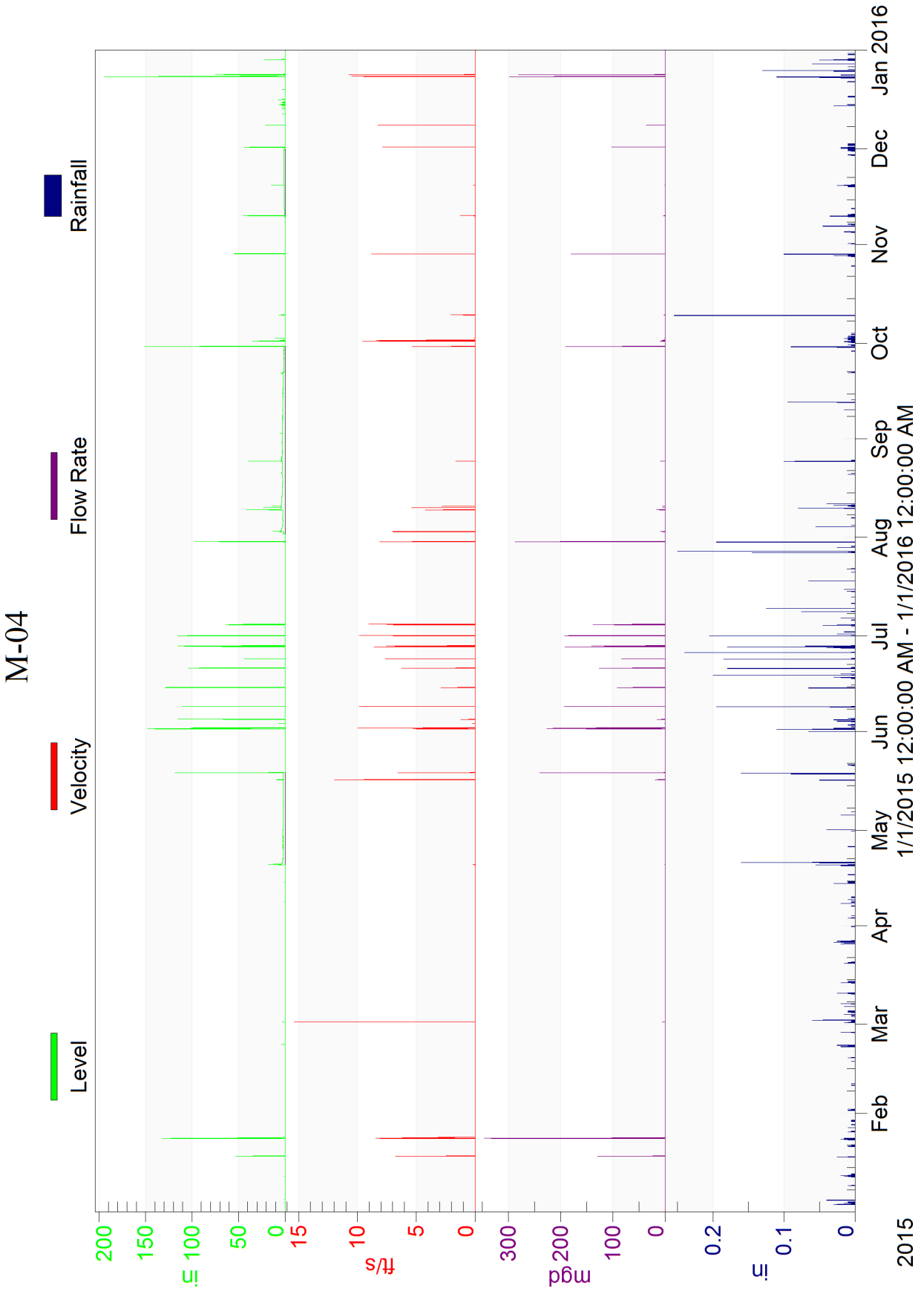
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

10–15–1 METER LOCATION AND TYPICAL CROSS SECTION

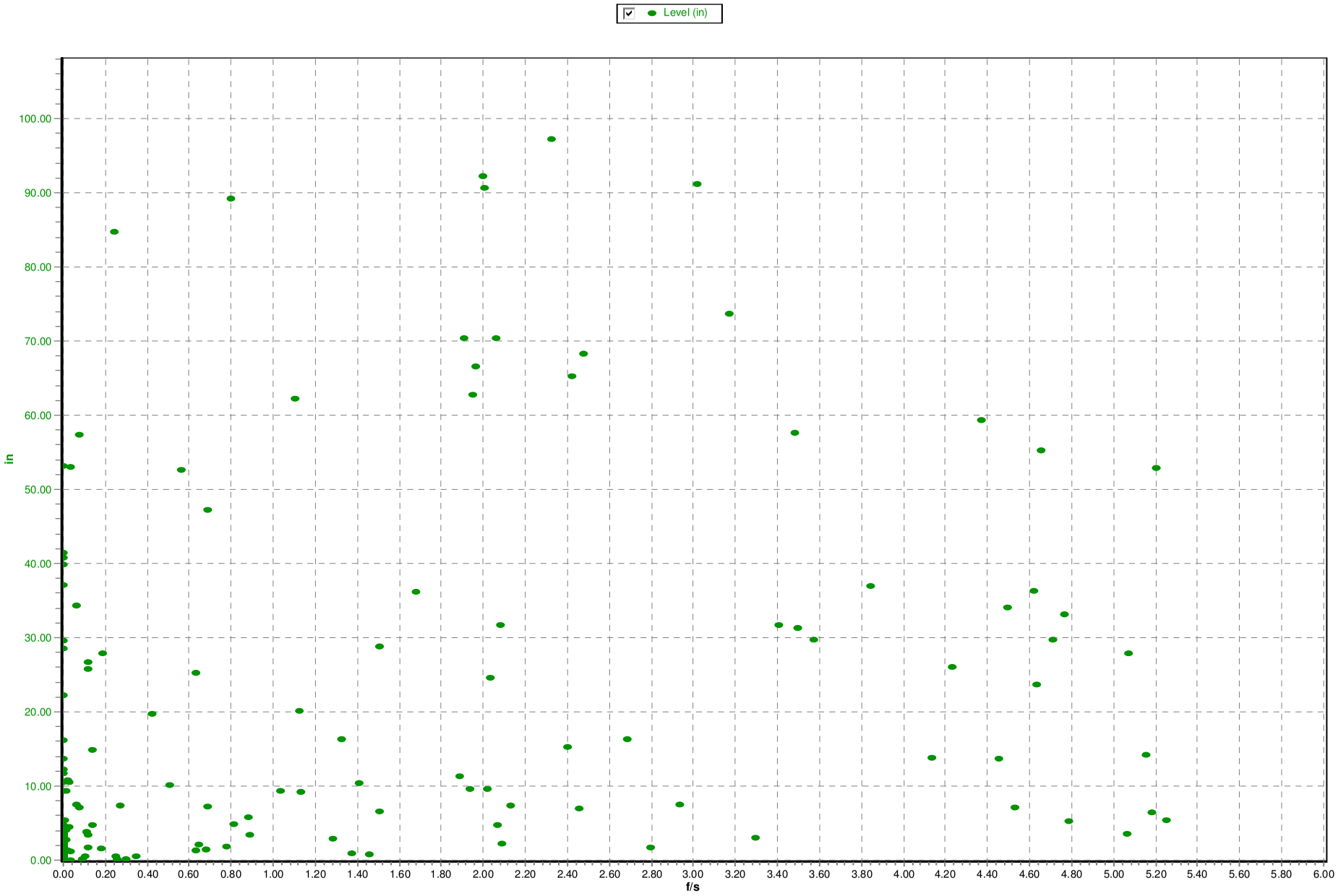
DATE: OCTOBER 2014 | SITE 4

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:42:32 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\X_10-15-1.DWG


M-04
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan 2016
1/1/2015 12:00:00 AM - 1/1/2016 12:00:00 AM

M-04 - S. Capitol & E Street SE

Pipe Diameter (in): 108 (01/01/15 to 01/01/16)



M-04

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
1/8/2014	11:45	0	0	0	0	0		AP/AM	Install.
1/8/2015	12:00	0	0	0	0	0		AP/AM	CB Telog.
2/25/2015	15:00	0	0	0	0	0	6.03	AP/AM	CB Telog.
3/11/2015	13:00		0		0	0	5.98	AP/AM	CB Telog.
4/16/2015	13:41	0	0	0	0	0	6	AP/AM	Change meter.
4/16/2015	13:46	0	0	0	0	0		AP/AM	
4/16/2015	13:51	0	0	0	0	0		AP/AM	
5/27/2015	14:45	0	0	0	0	0		LR/DW	
7/9/2015	10:51	0	0	0	0	0	6.12	LR/DW	CB Telog.
7/20/2015	13:18	0	0	0	0	0	5.98	LR/DW	
10/8/2015	10:34	0	0	0	0	0		LR/JC	
11/14/2015	10:46		1		0	0		LR/JC	
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-05

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: 010

DURATION: 1/1/15 - 1/1/16

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-05 measured excess flows from the B Street / NJ Ave Trunk Sewer before entering the O Street Pump Station downstream of the inflatable dam at Structure 15.

3. The weir formula was used to calculate a flow rate from these measurements. M-05 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	0	0
Avg.	0.126	0.396
Max	113.772	554.991

Site Name/Manhole # M-5 Primary: [X] Alternate: [ ]

Investigation Date: 12/2/13 Time: 15:30 Crew Members: LR/JS

Installation Date: 11/19/14 Time: 13:20 Crew Members: LR/SD

Address/Location: On L St. SE, near the intersection of Half St. SE (by the curb)

Latitude: N 38° 52.652' Longitude: W 77° 0.457'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity *NA* ft/sec

Depth *NA* in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	84"		84"
Width	108"		108"
Material	Brick/Concrete		Brick/Concrete
Shape	Round	Weir	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) ____ (condition)

Site Conditions

Site Access:

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 33'2"

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

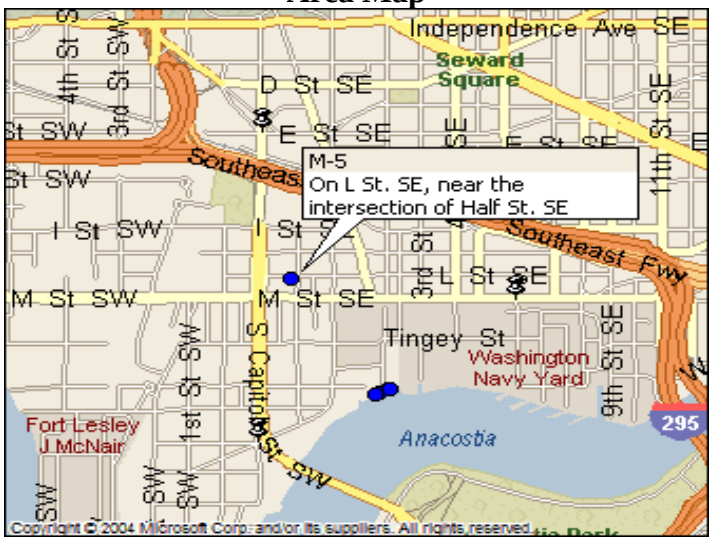
Sensor Configuration:

(Please include Serial Numbers when possible)

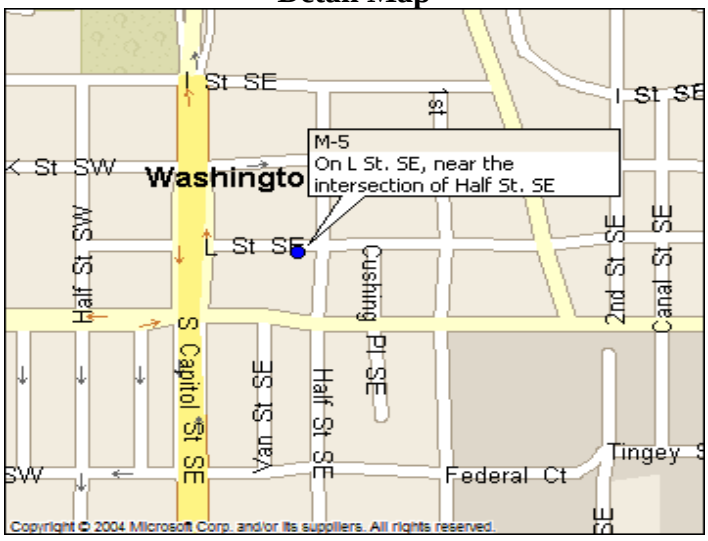
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary:
	Redundant:
Meter Logger	Telog

Comments: 10' pipe running toward stadium; 6.5' from middle of the MH bottom to bottom of bladder; 10.5' to the slope; 63' from slope to the 8" W weir wall

Area Map



Detail Map



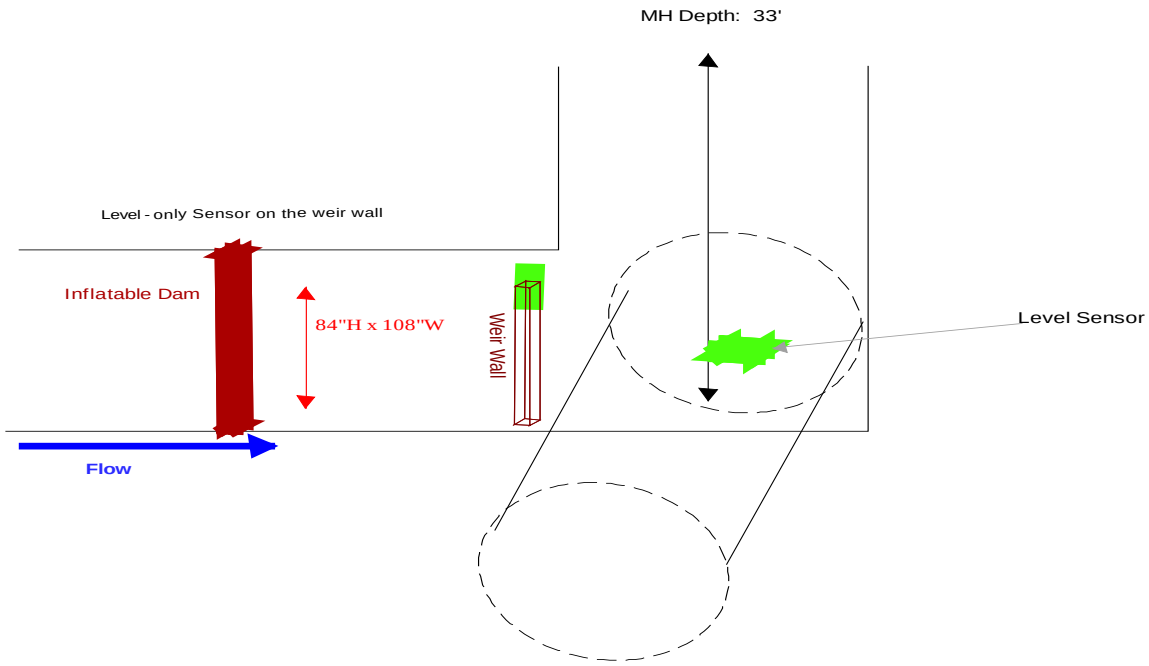
View from top of MH

Site Overview

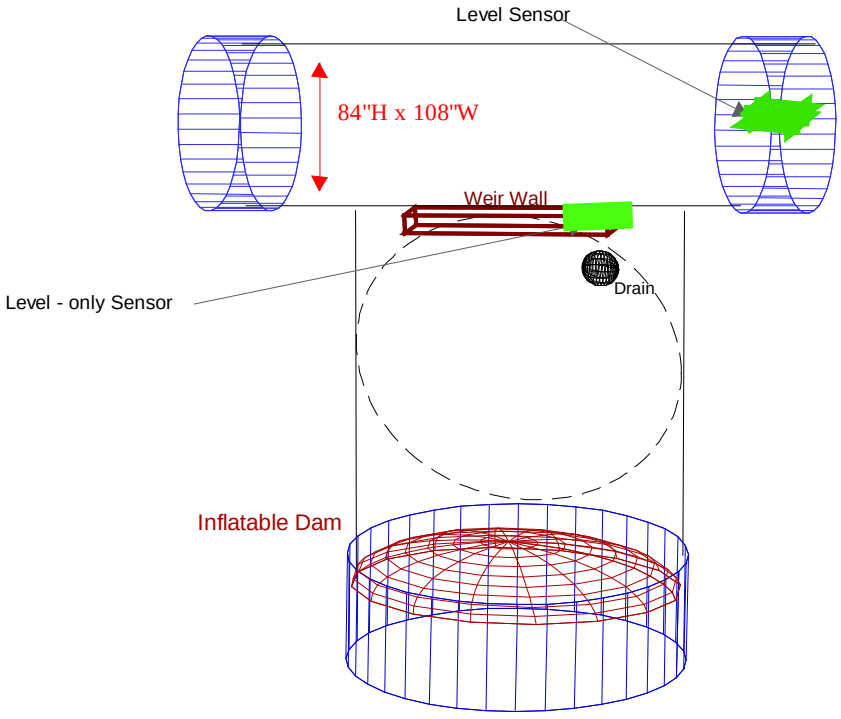
View of flow through influent line

View of flow through effluent line

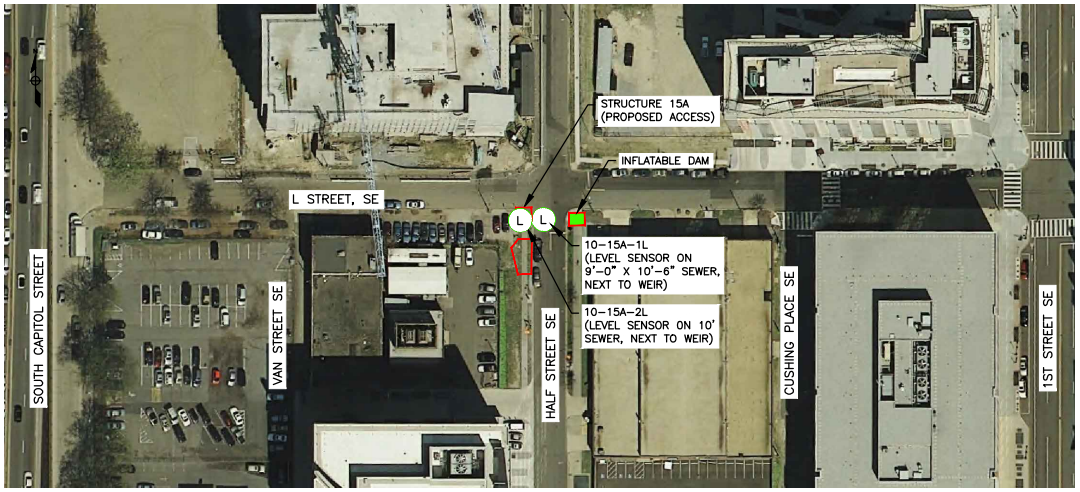
Dimensional Structure Profile View (profile sketch showing location of sensors)

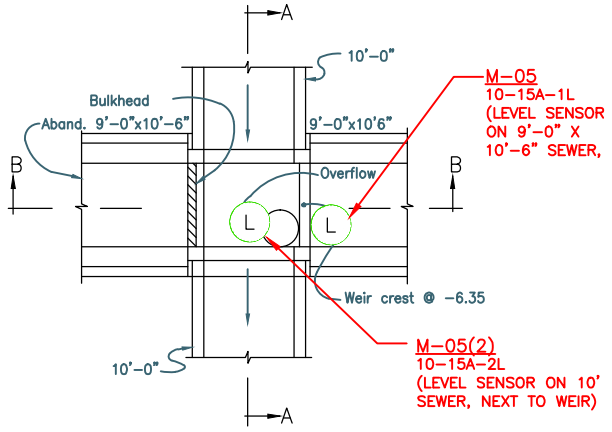


Dimension Structure Detail (Plan View)

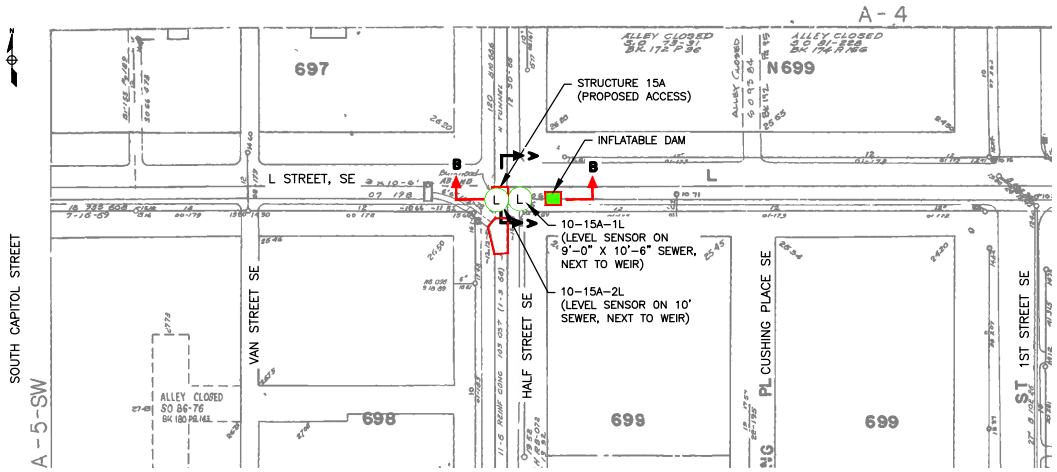


2 – LEVEL SENSORS

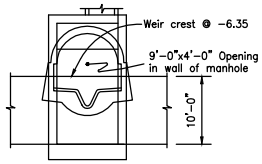




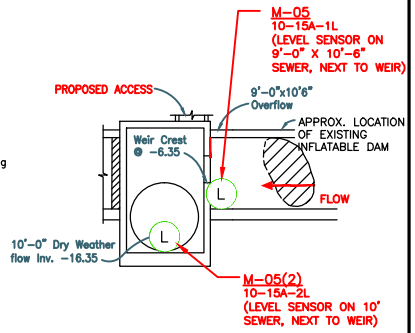
PLAN
SCALE: NTS



FLOW METER LOCATION PLAN
SCALE: NTS



TYPICAL CROSS SECTION A–A
SCALE: NTS



TYPICAL CROSS SECTION B–B
SCALE: NTS

LEGEND

(L) LEVEL SENSOR AND VELOCITY SENSOR

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

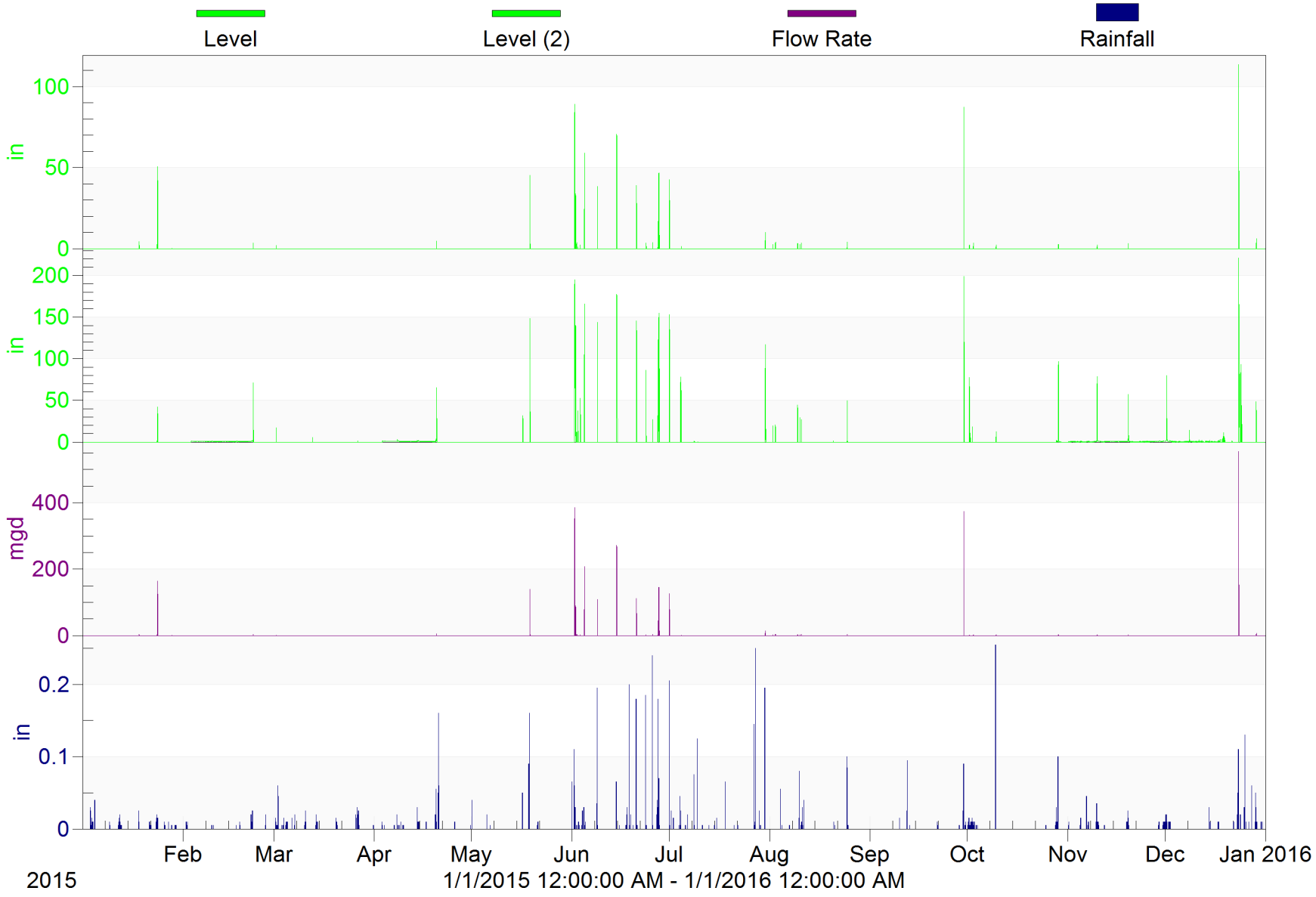
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

10–15A–1L & 10–15A–2L
LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 5

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:42:19 PM
DRAWING ID: L:\LTDA\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\S_10-15A-1.DWG

M-05


Level
Level (2)
Flow Rate
Rainfall
100
50
0
in
200
150
100
50
0
in
400
200
0
mgd
0.2
0.1
0
in
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan 2016
2015
1/1/2015 12:00:00 AM - 1/1/2016 12:00:00 AM

M-05

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/16/2014	14:18	0	0			0		LR/SD	Install.
11/16/2014	14:23	0	0			0		LR/SD	
11/16/2014	14:28	0	0			0		LR/SD	
1/21/2015	14:00		0			0	6.16	AP/AM	CB Telog.
2/3/2015	11:15	0	0			0	5.59	LR/AM	Reposition sensor.
2/3/2015	11:20	0	0			0		LR/AM	
2/3/2015	11:25	0	0			0		LR/AM	
2/23/2015	15:00		0			0	6.03	AP/AM	CB Telog.
3/13/2015	14:00		0			0	6.03	AP/AM	CB Telog.
4/2/2015	14:02	0	0			0	6.07	KE/AP/AM	
4/2/2015	14:30	0	0			0		KE/AP/AM	
4/2/2015	14:33	0	0			0		KE/AP/AM	
4/2/2015	14:36	0	0			0		KE/AP/AM	
4/30/2015	11:00		0			0	6.2	LL/DW	CB Telog.
5/21/2015	12:00		0			0	6.2	LR/DW	CB Telog.
6/18/2015	9:11		0			0	5.9	KE/DW	CB Telog.
7/14/2015	12:34		0			0	5.94	LR/DW	CB Telog.
8/11/2015	11:25		0			0		LR/DW	CB Telog.
9/8/2015	11:55		0			0		LR/JC	CB Telog.
9/28/2015	14:22		0			0		LR/JC	CB Telog.
10/15/2015	11:24	0	0			0		LR/JC	CB Telog.
12/17/2015	13:31	0	0			0		LL/MH	CB Telog.
1/22/2016	9:07	0	0			0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

M-05 (2)

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/16/2014	14:18	0	0			0		LR/SD	Install.
11/16/2014	14:23	0	0			0		LR/SD	
11/16/2014	14:28	0	0			0		LR/SD	
1/21/2015	14:00		0			0	6.16	AP/AM	CB Telog.
2/3/2015	11:15	1.12	1.25			0	5.59	LR/AM	Reposition sensor.
2/3/2015	11:20	1.21	1.25			0		LR/AM	
2/3/2015	11:25	1.24	1.25			0		LR/AM	
2/23/2015	15:00		0			0	6.03	AP/AM	CB Telog.
3/13/2015	14:00		0			0	6.03	AP/AM	CB Telog.
4/2/2015	14:02	0	0			0	6.07	KE/AP/AM	
4/2/2015	14:30	0	0			0		KE/AP/AM	
4/2/2015	14:33	0	0			0		KE/AP/AM	
4/2/2015	14:36	0	0			0		KE/AP/AM	
4/30/2015	11:00		0			0	6.2	LL/DW	CB Telog.
5/21/2015	12:00		0			0	6.2	LR/DW	CB Telog.
6/18/2015	9:11		0			0	5.9	KE/DW	CB Telog.
7/14/2015	12:34		0			0	5.94	LR/DW	CB Telog.
8/11/2015	11:25		0			0		LR/DW	CB Telog.
9/8/2015	11:55		0			0		LR/JC	CB Telog.
9/28/2015	14:22		0			0		LR/JC	CB Telog.
10/15/2015	11:24	0	0			0		LR/JC	
12/17/2015	13:31	0	0			0		LL/MH	CB Telog.
1/22/2016	9:07	1.07	1.25			0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-08

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: n/a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-08 measured flows on the B Street / NJ Ave Trunk sewer downstream of Structure 35a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-08 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	7	0.378	0.300
Avg.	20.653	4.188	15.800
Max	168.185	5.816	70.530

Site Name/Manhole # M-8 Primary: [X] Alternate: [ ]

Investigation Date: 10/29/14 Time: 12:17 Crew Members: LR/PD

Installation Date: 11/25/14 Time: 12:48 Crew Members: CL/PD

Address/Location: 23rd Street NW and Constitution Avenue NW, US Institute of Peace

Latitude: N 38°53,540' Longitude: W 77°03,015'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Choppy flow*

Velocity 3.6 ft/sec

Depth 19.0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	70"		70"
Width	62"		62"
Material	Concrete		Concrete
Shape	Oval		Oval

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

☐ Remains in pipe

☐ _____ft from rim

☐ Reaches Rim (potential meter damage)

☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) ____ (condition)

Site Conditions

Site Access: *Guard*

☐ Good (no problems accessing site)

☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))

☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)

☐ Traffic Control only (Requires extra traffic control

☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 35' *to the bottom for standing*

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *Cannot see into pipe*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

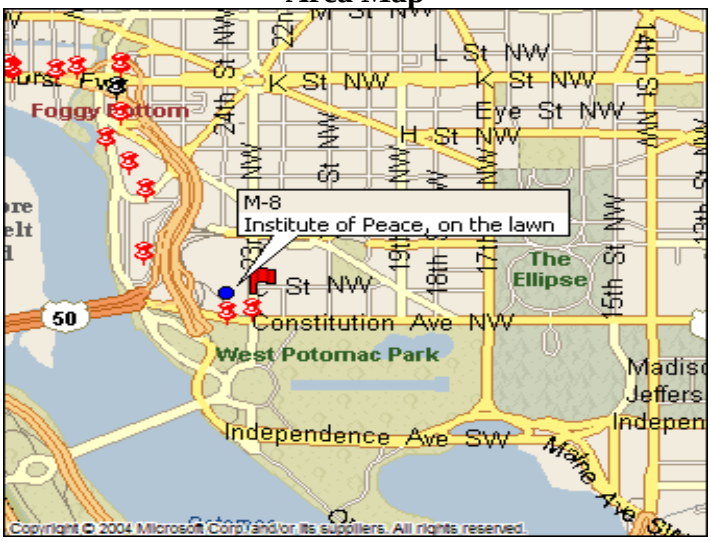
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	FloWav Telog

Comments: *Call Jennifer Kniel at 202-429-7825 for access to MH. Requires 3 crew members.*

Area Map



Detail Map

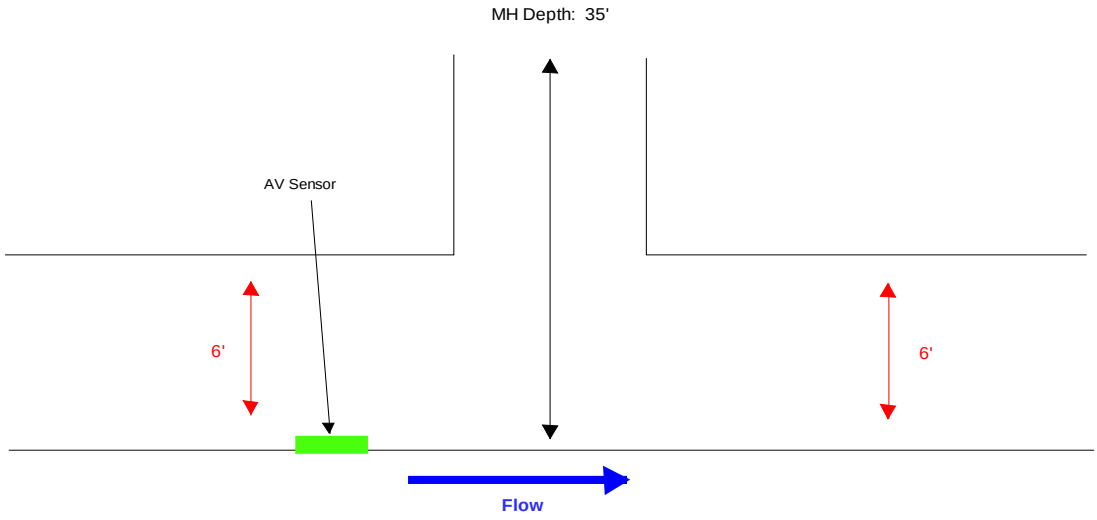
View from top of MH

Site Overview

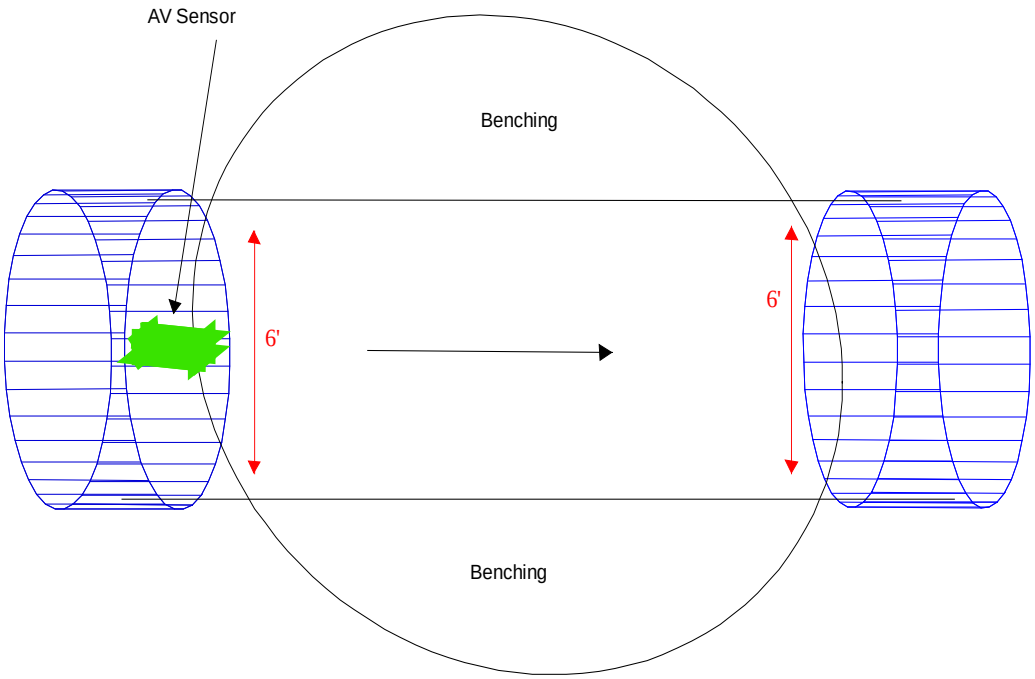
View of flow through influent line

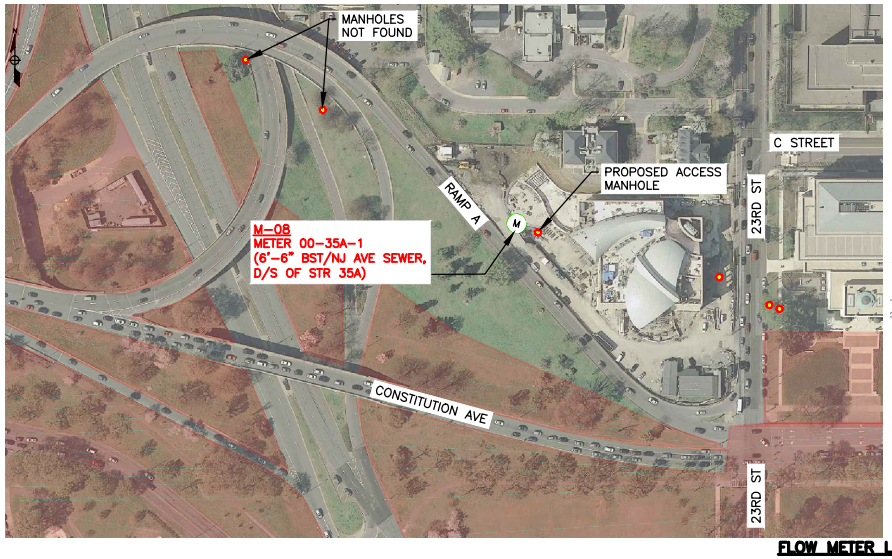
View of flow through effluent line

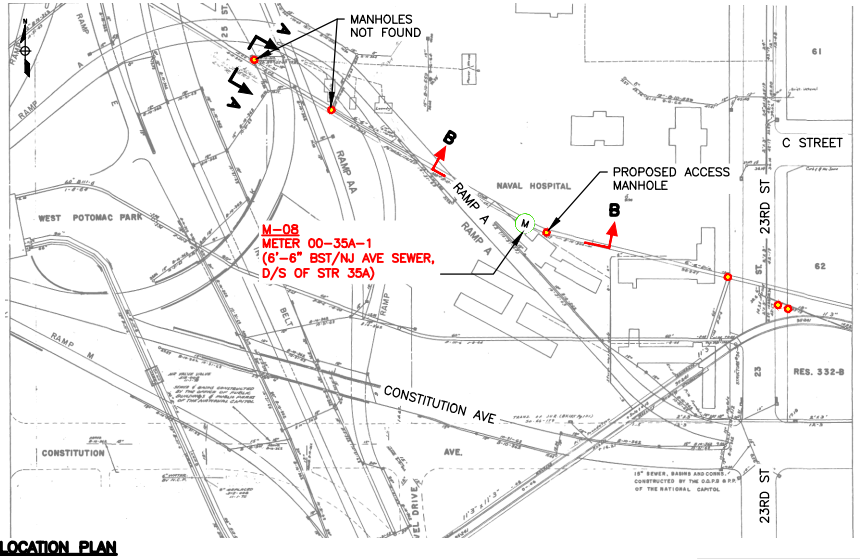
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)



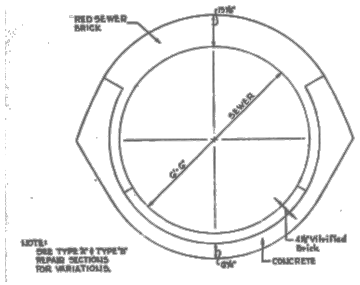




FLOW METER LOCATION PLAN

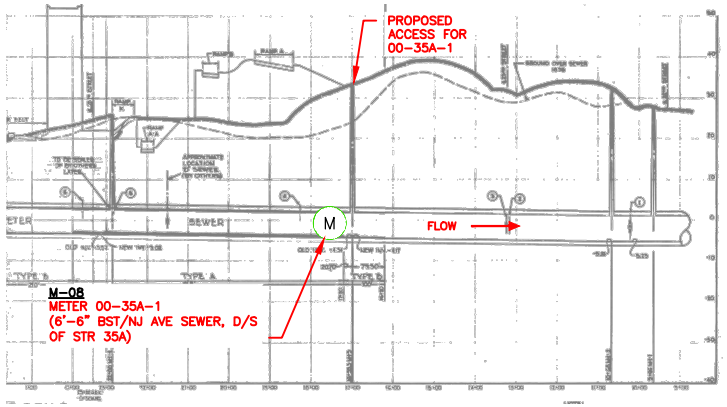
SCALE: NTS

1 – FLOW METER



TYPICAL CROSS SECTION A–A

SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)

SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

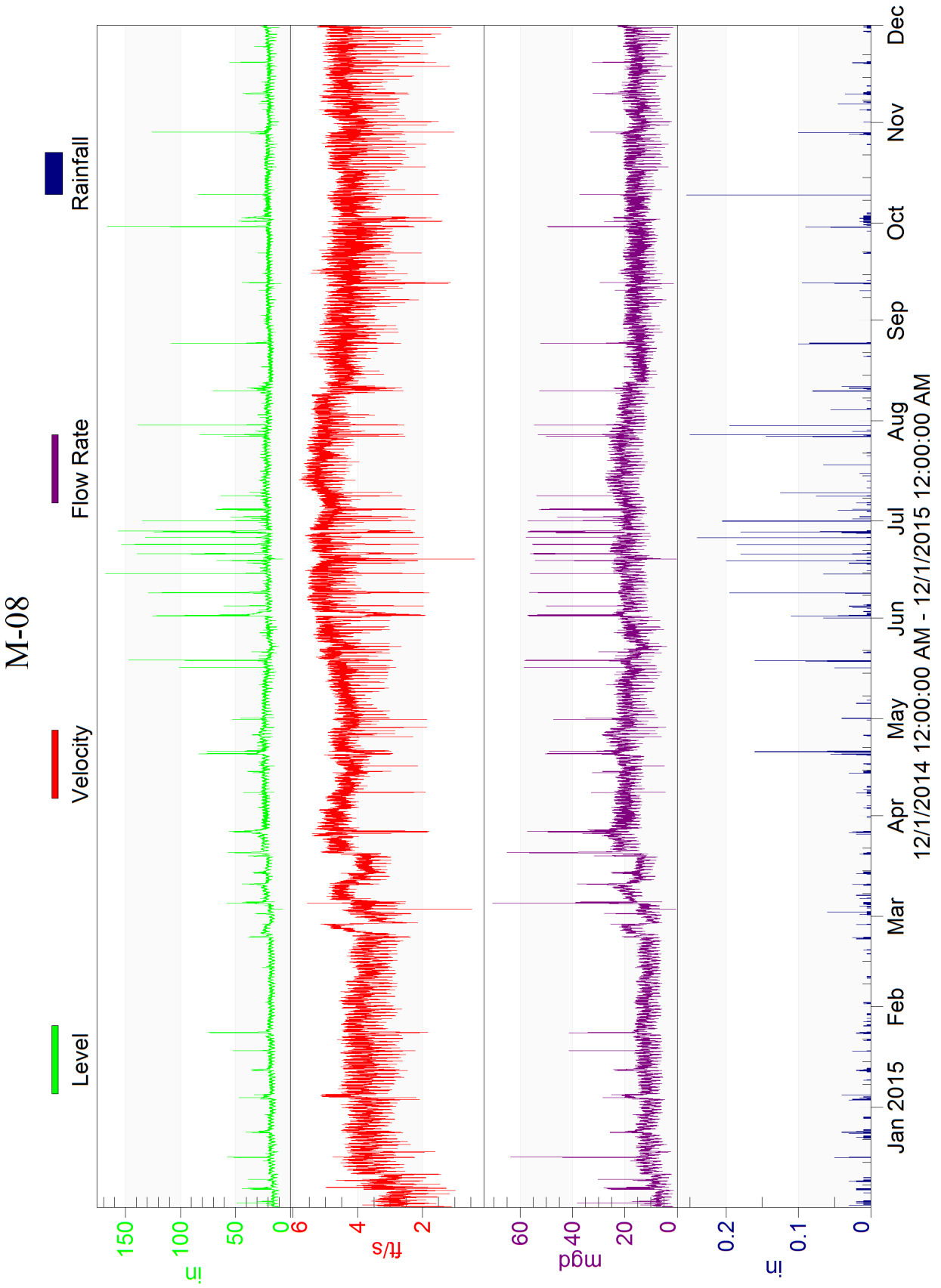
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

00-35A-1

METER LOCATION AND TYPICAL CROSS SECTION

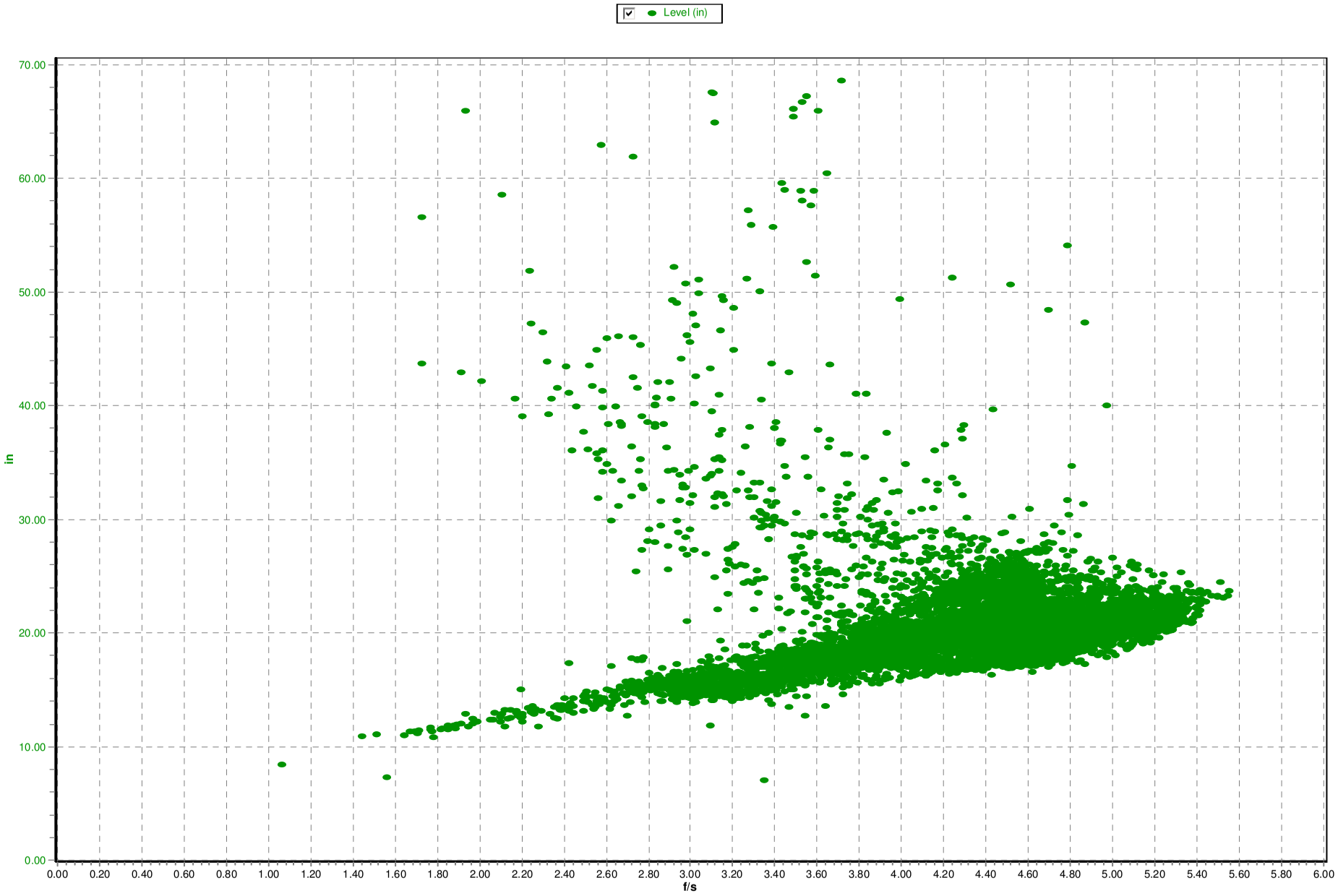
DATE: OCTOBER 2014 | SITE 8

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 8:58:24 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\XX_M-0.DWG


M-08
Level
Velocity
Flow Rate
Rainfall
in
ft/s
mgd
in
150
100
50
0
6
4
2
60
40
20
0
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-08 - 23rd Street NW and Constitution Avenue NW, US Institute of Peace

Pipe Diameter (in): 70 Oval (12/01/14 to 12/01/15)



M-08

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/25/2014	15:40		19		3.6	0		LL/AP	Install.
11/25/2014	15:45	17.18	17	3.65	3.8	0		LL/AP	
11/25/2014	15:50		16		4	0		LL/AP	
12/17/2014	15:20		19.25		3.98	0		LR/AP	
1/16/2015	10:07						6.2	LL/AM	
2/3/2015	14:59	19.378	19.25	4.4	4.2	0	5.81	LR/AM	
2/13/2015	10:40	17.977	18		3.69	0		LR/AM	CB Telog.
2/26/2015	10:55						5.72	AP/AM	CB Telog.
3/20/2015	14:00						5.9	AP/AM	CB Telog.
4/20/2015	13:35		30		3.8	0		AP/DW	
5/15/2015	9:12	23.27	23.5	4.6	4.8	0	6.07	LR/DW	CB Telog.
7/28/2015	11:27		28.5		3.9	0		LR/DW	
9/23/2015	10:30		20.5		4.5	0		LR/JC	
11/13/2015	13:09		24		3.75	0		LR/JC	
2/10/2016	2:40		26		5.26	0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-09-US

SEWER: EASBY POINT TRUNK SEWER

OUTFALL: 020

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-09-US measured excess flows from the Easby Point Trunk Sewer before entering the Potomac River through CSO 020 upstream of the inflatable dam at Structure 34.

3. The continuity equation was used to calculate a flow rate from these measurements. M-09-US is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.41	0.071	0.945
Max	239.831	12.253	787.179

Site Name/Manhole # M-9 US Primary: [X] Alternate: [ ]

Investigation Date: 1/2/14 Time: 13:00 Crew Members: LR/JS/BC

Installation Date: 11/18/14 Time: 11:09 Crew Members: LR/SD

Address/Location: 23rd St NW & Constitution Avenue NW (US Institute of Peace)

Latitude: N 38° 53.533' Longitude: W 77° 3.022'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry Pipe*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	128"		128"
Width	122"		122"
Material	Brick & Concrete		Brick & Concrete
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Need access by security*

- ☐ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 16'9"

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

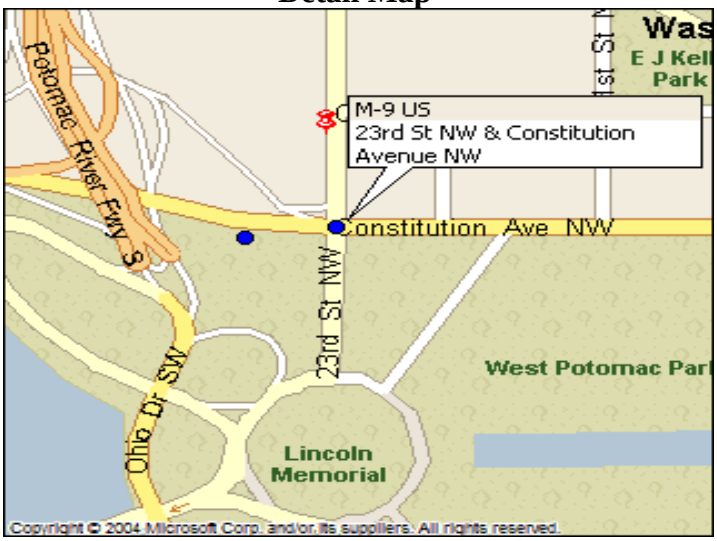
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog

Comments:

Area Map

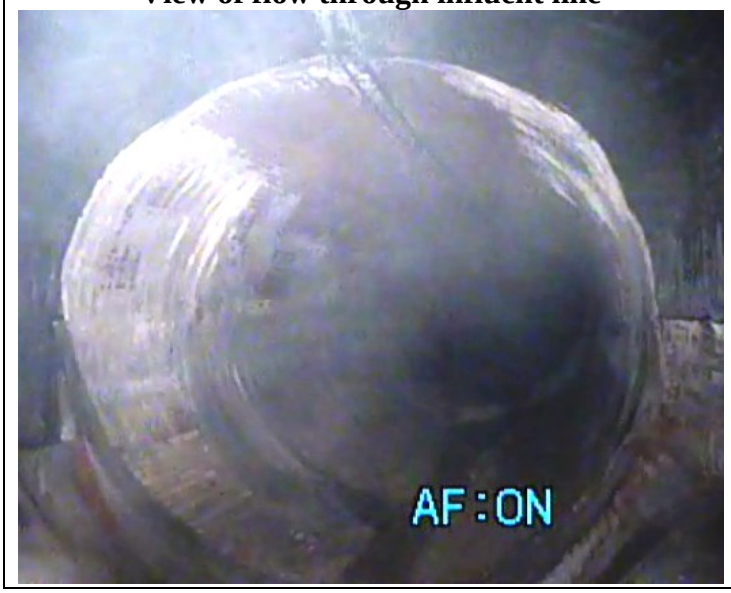
Detail Map



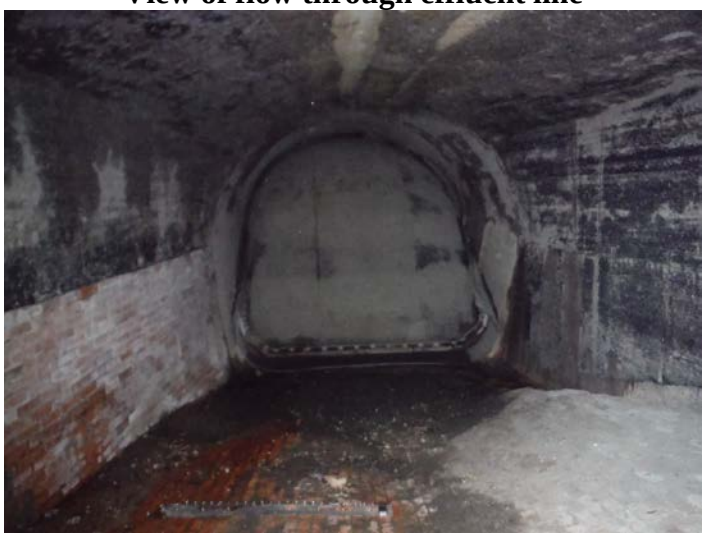
View from top of MH

Site Overview

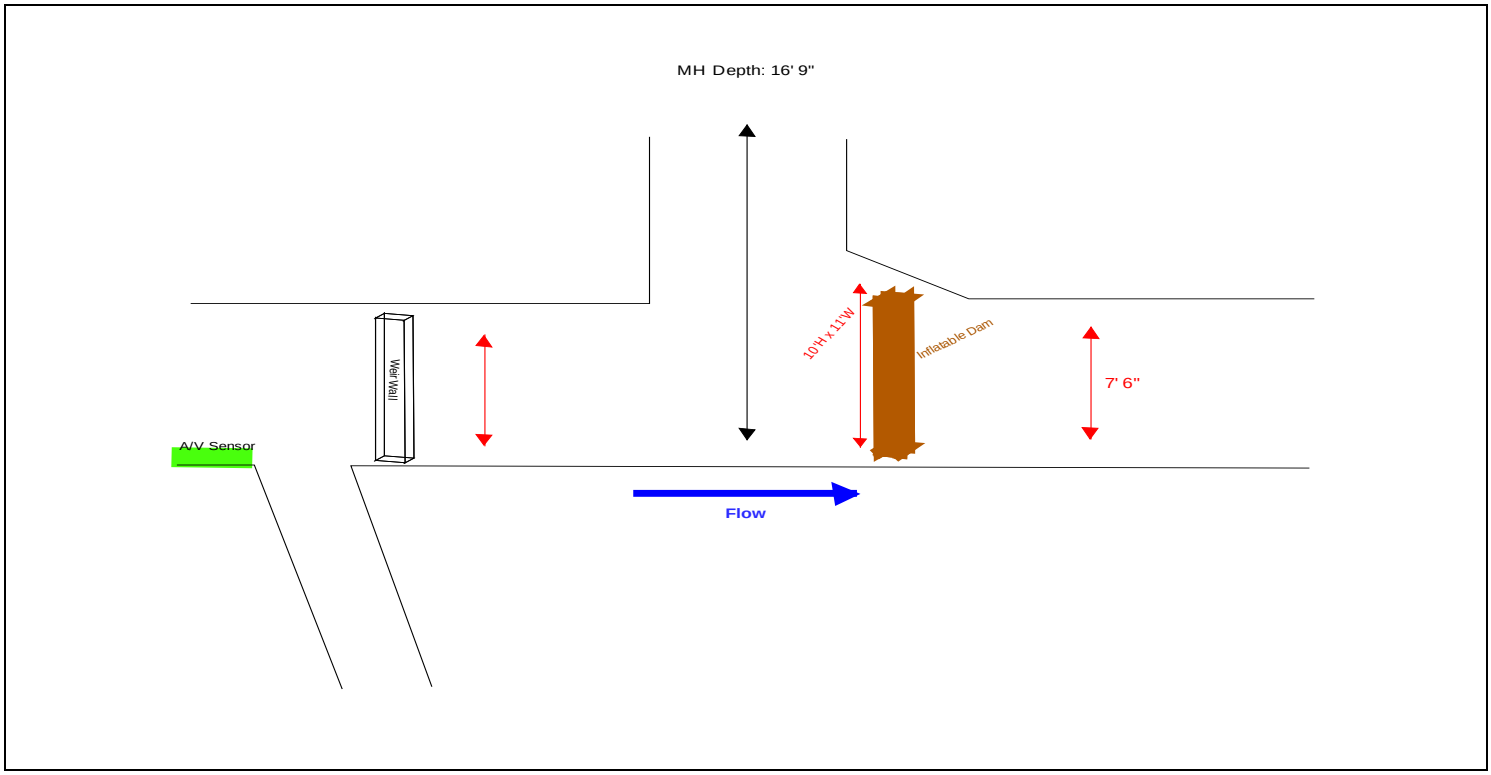
View of flow through influent line



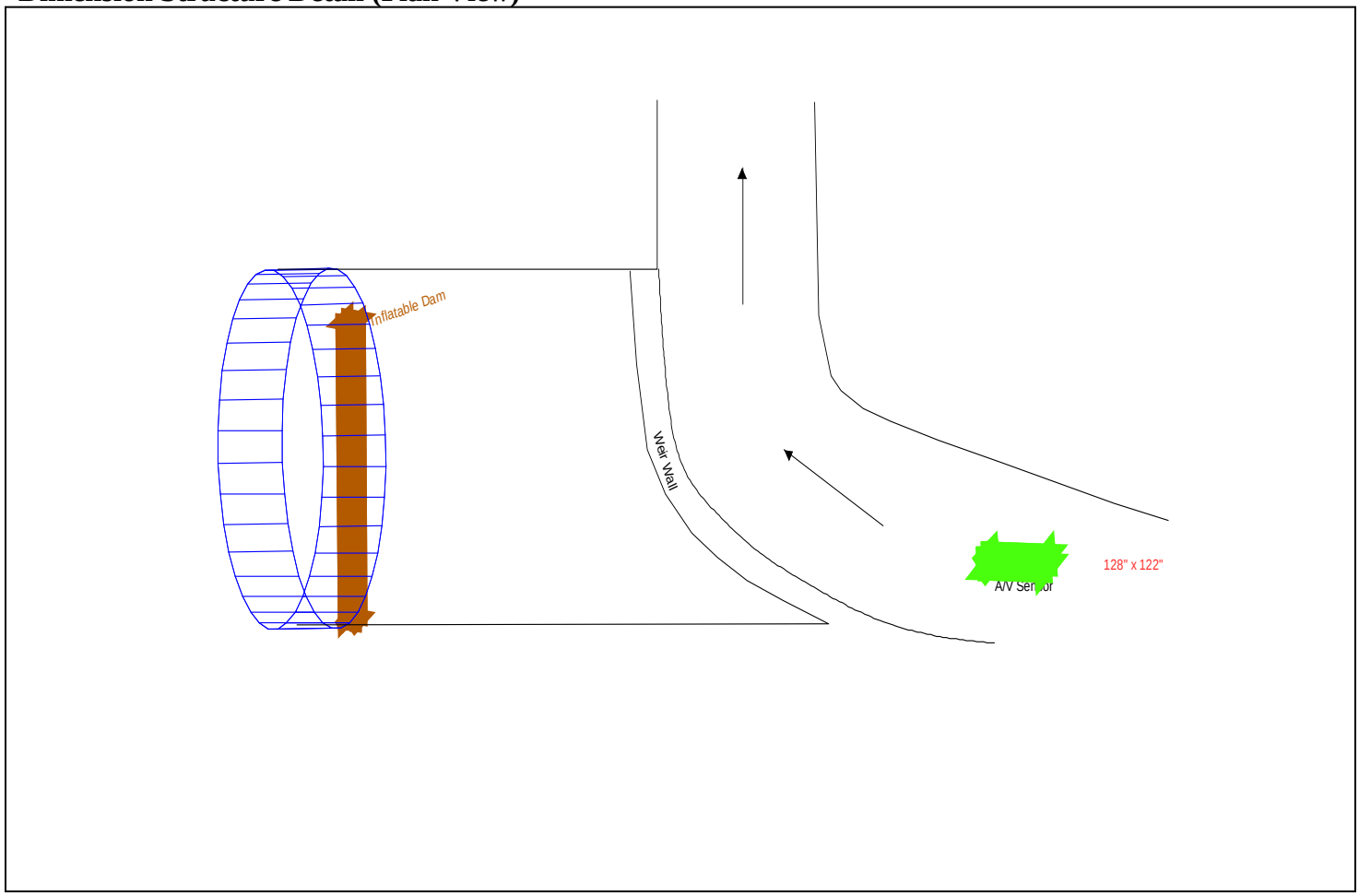
View of flow through effluent line

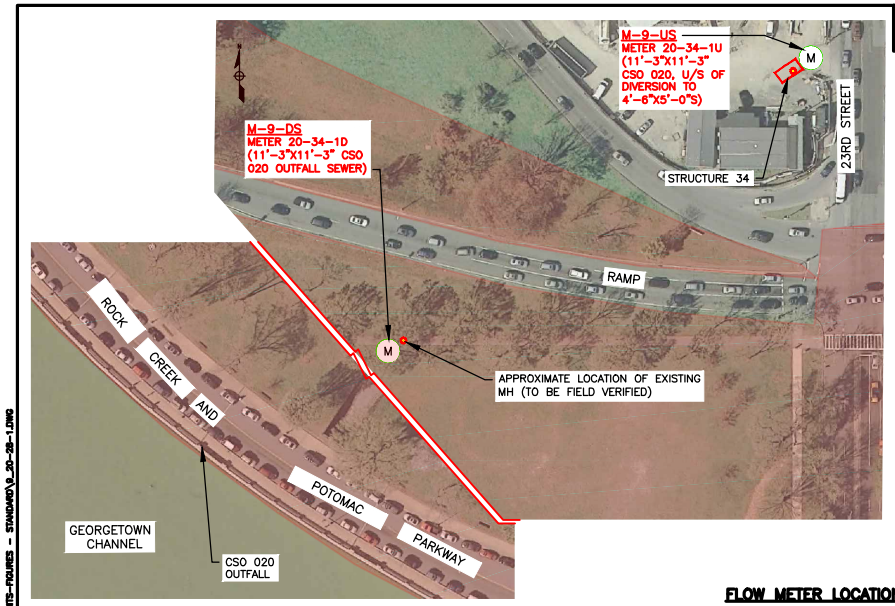


Dimensional Structure Profile View (profile sketch showing location of sensors)



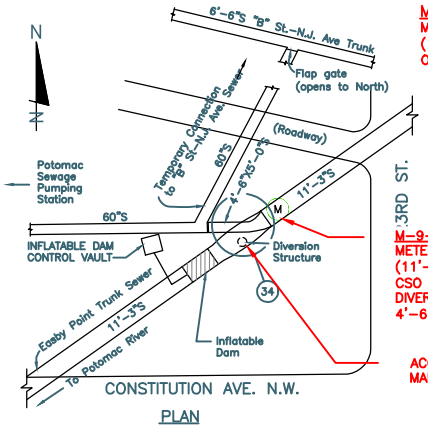
Dimension Structure Detail (Plan View)



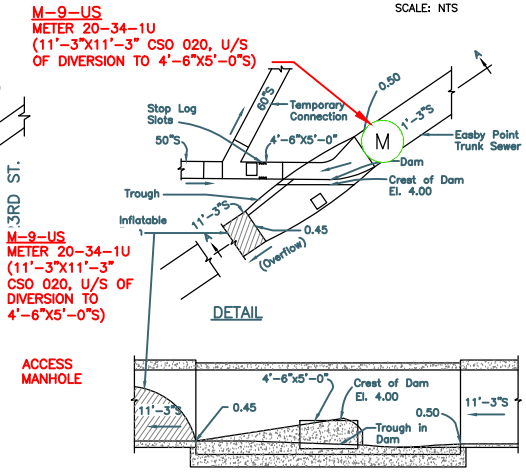


FLOW METER LOCATION PLAN

SCALE: NTS



PLAN

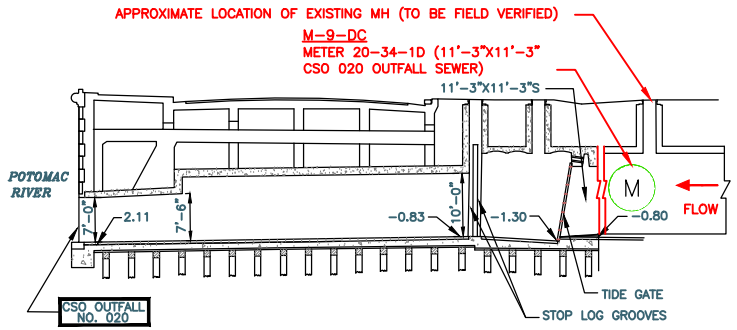


DETAIL

SECTION A–A

STRUCTURE–34 DETAIL

SCALE NTS



SECTION A–A (11'–3" X 11'–3" SEWER PROFILE)

SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

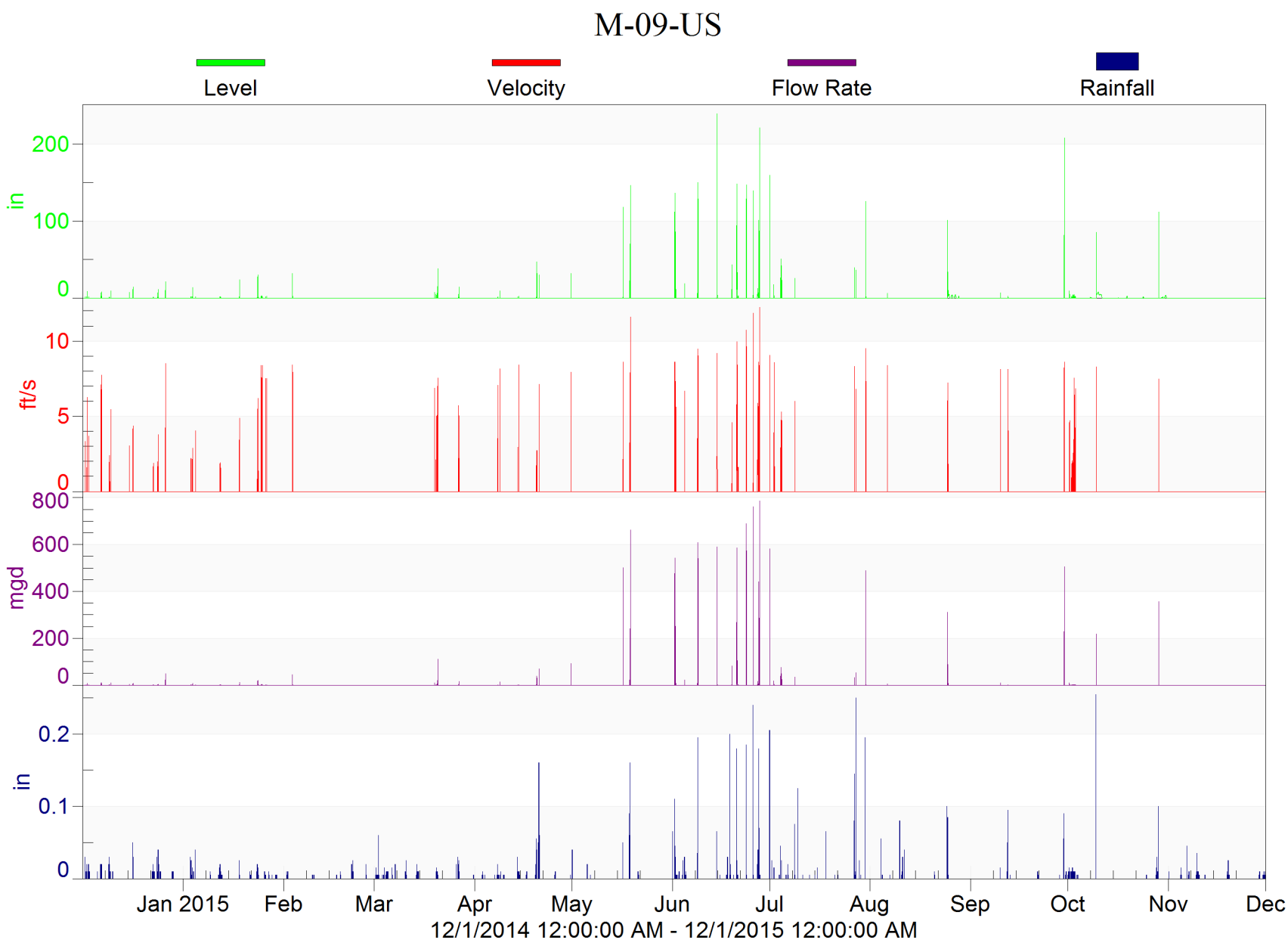
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

20–34–1U AND 20–34–1D METER LOCATION AND TYPICAL CROSS SECTION

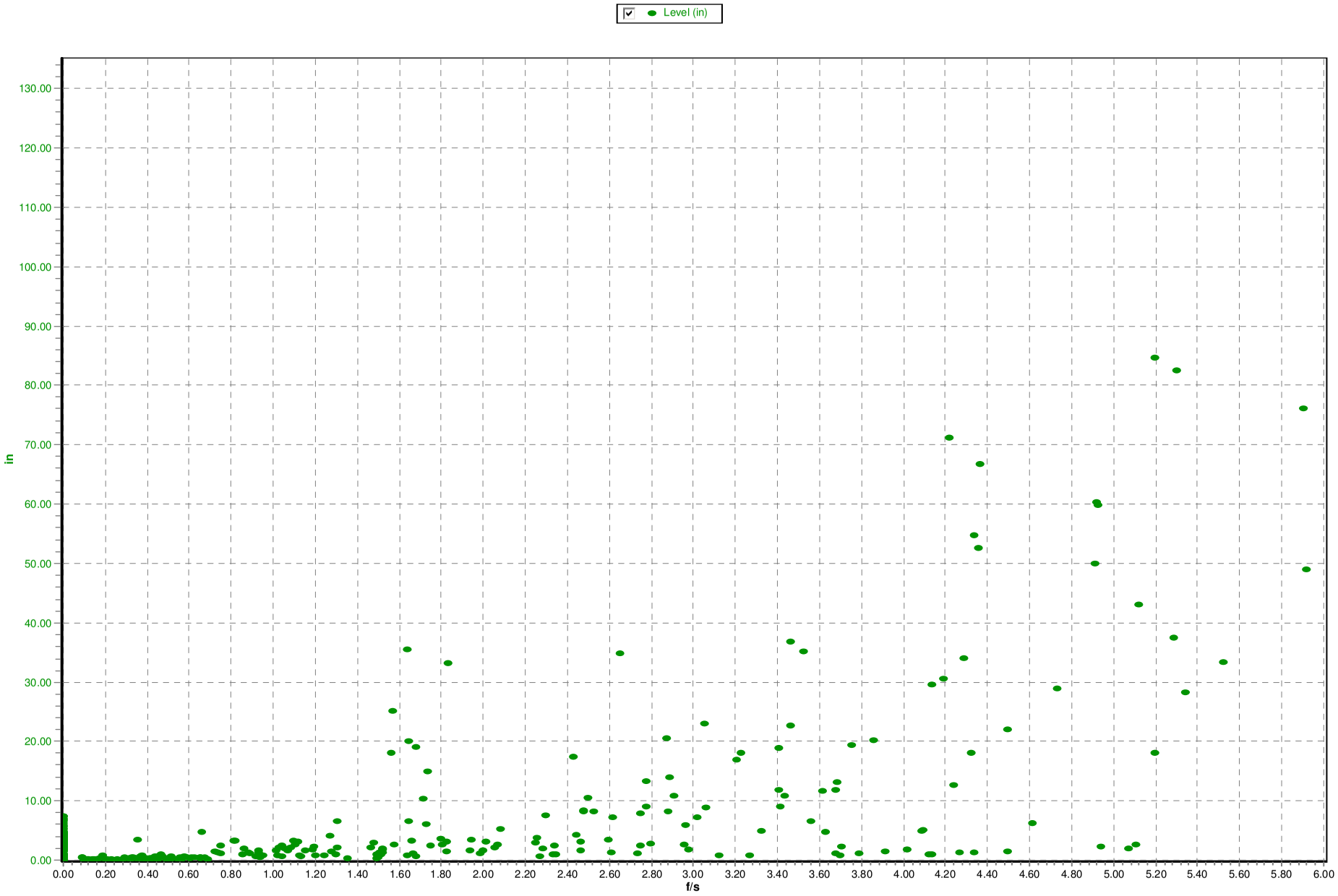
DATE: OCTOBER 2014 | SITE 9

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:42:12 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\9_20-29-1.DWG


M-09-US
Level
Velocity
Flow Rate
Rainfall
in
200
100
0
ft/s
10
5
0
mgd
800
600
400
200
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-09-US - On Constitution Ave. (past 33rd St., on a path, in the grass)

Pipe Diameter (in): 128 H X 122 W (12/01/14 to 12/01/15)



M-09-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/18/2015	14:26	0	0	0	0	0		LL/AP	Install.
11/18/2015	14:31	0	0	0	0	0		LL/AP	
11/18/2015	14:36	0	0	0	0	0		LL/AP	
12/17/2014	16:05		0		0	0		LR/AP	
1/16/2015	9:45		0		0	0	6.2	LL/AM	CB Telog.
2/3/2015	16:00		0		0	0	5.94	AP/AM	CB Telog.
2/26/2015	14:00		0		0	0		AP/AM	Swap antenna.
3/10/2015	12:00		0		0	0		AP/AM	Swap antenna.
3/12/2015	19:00		0		0	0		AP/AM	CB Telog.
3/20/2015	15:00		0		0	0	5.9	AP/AM	
4/3/2015	15:00		0		0	0		AP/AM	Swap antenna.
4/14/2015	14:00		0		0	0	6.03	AP/AM	Swap antenna.
5/15/2015	10:35		0		0	0	6.12	LR/DW	CB Telog.
6/12/2015	7:25		0		0	0		LL/DW	
6/19/2015	9:08		16.75		4.2	0	6.07	KE/DW	
7/21/2015	9:48		0		0	0	6.16	LR/DW	CB Telog.
8/13/2015	12:04		0		0	0		LR/DW	CB Telog.
9/2/2015	9:27		0		0	0		LR/JC	CB Telog.
9/22/2015	9:21		0		0	0		LR/JC	CB Telog.
10/15/2015	9:04		0		0	0		LR/JC	CB Telog.
12/28/2015	13:00		0		0	0		LL/JC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-09-DS

SEWER: EASBY POINT TRUNK SEWER

OUTFALL: 020

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-09-DS measured excess flows from the Easby Point Trunk Sewer before entering the Potomac River through CSO 020 downstream of the inflatable dam at Structure 34.

3. The continuity equation was used to calculate a flow rate from these measurements. M-09-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	1.202	0	0
Avg.	12.255	0.002	0.006
Max	70.974	3.903	65.060

Site Name/Manhole # M-9 DS Primary: [X] Alternate: [ ]

Investigation Date: 12/19/13 Time: 11:10 Crew Members: LR/JS

Installation Date: 11/25/14 Time: 8:59 Crew Members: LR/SD

Address/Location: On Constitution Ave. (past 33rd St., on a path, in the grass)

Latitude: N 38° 53.514' Longitude: W 77° 3.096'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing tide*

Velocity 0 ft/sec

Depth 20.0 in

Turbulence Amplitude:

- (Less than 0.25")
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	128"		128"
Width	122"		122"
Material	Brick		Brick
Shape	Oval		Oval

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

- (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 16'7"

Structural Integrity of Manhole:

☐ Good ☐ Fair (Poor)

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

Sensor Configuration:

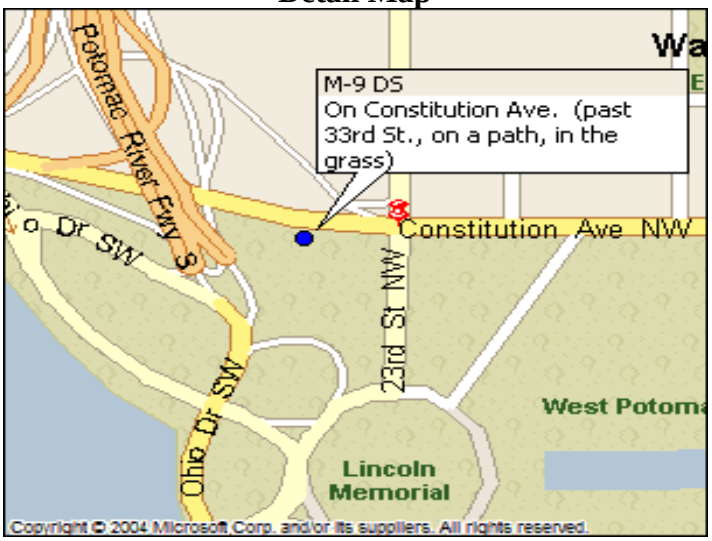
(Please include Serial Numbers when possible)

Level	Primary: Isco A/V
	Redundant:
Velocity	Primary: Isco A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map

Detail Map



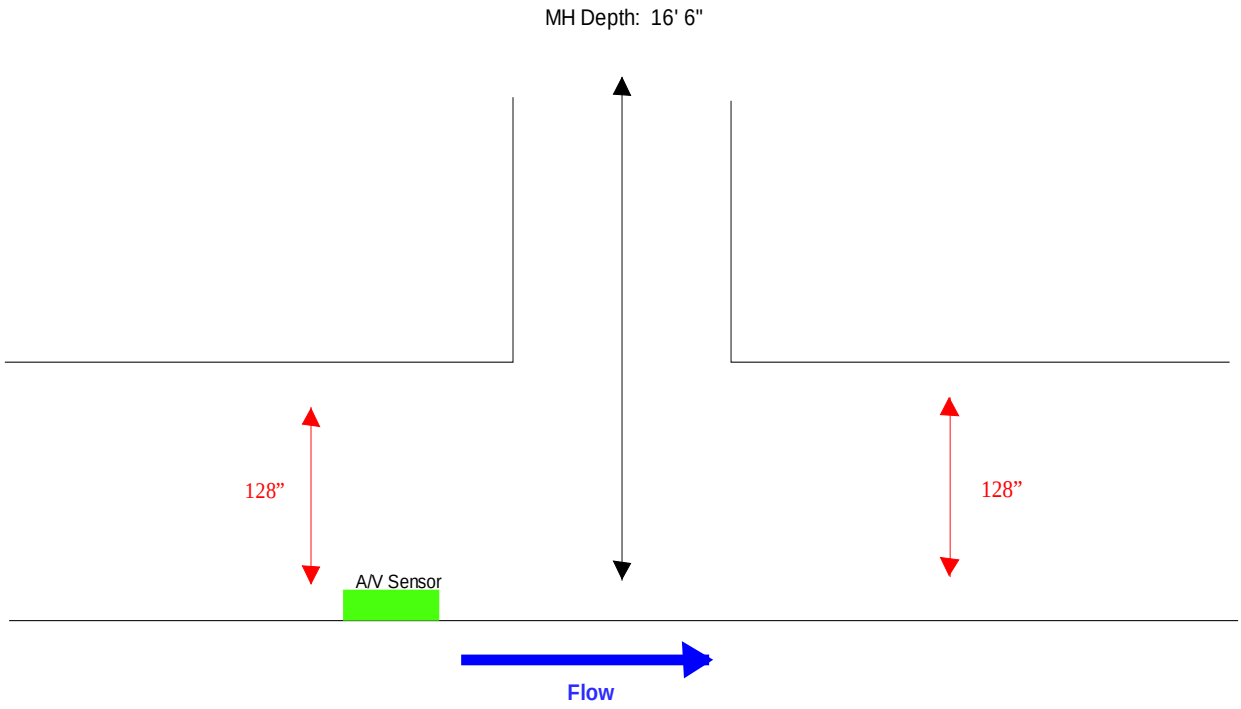
View from top of MH

Site Overview

View of flow through influent line

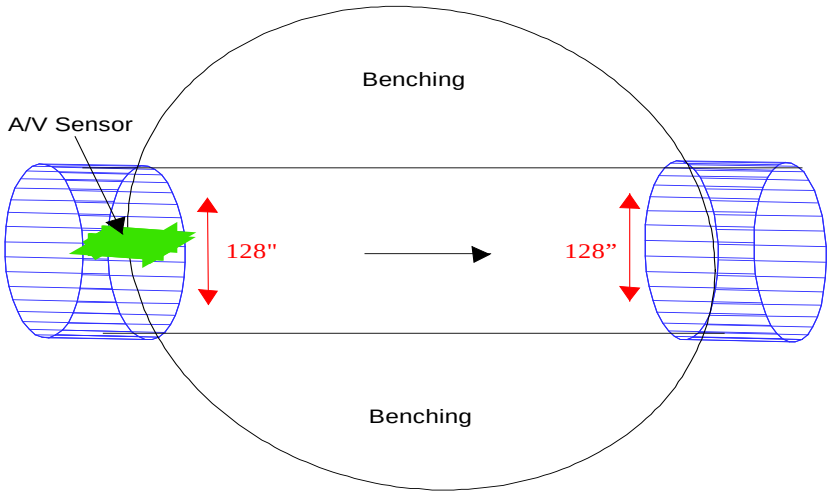
View of flow through effluent line

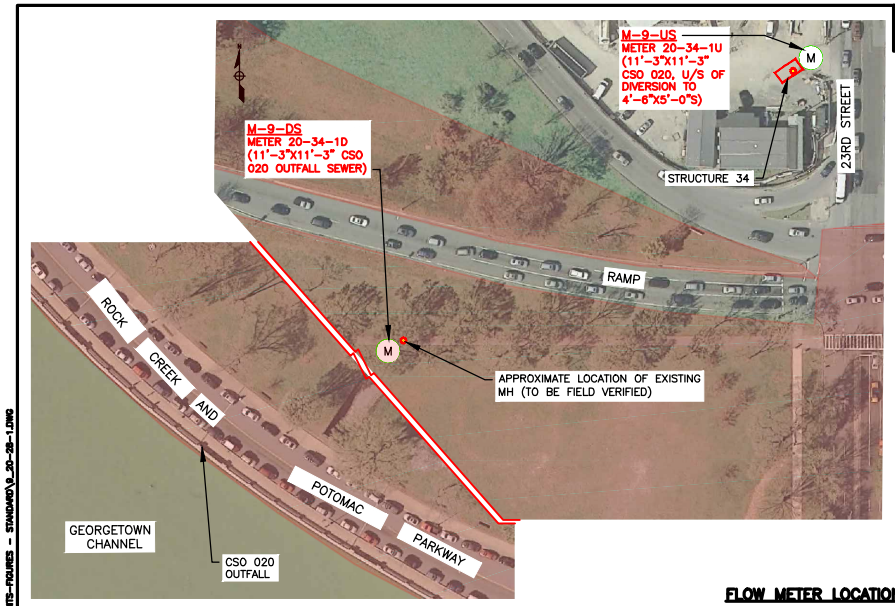
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

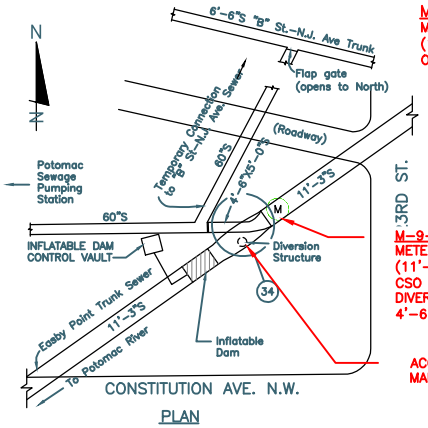
~





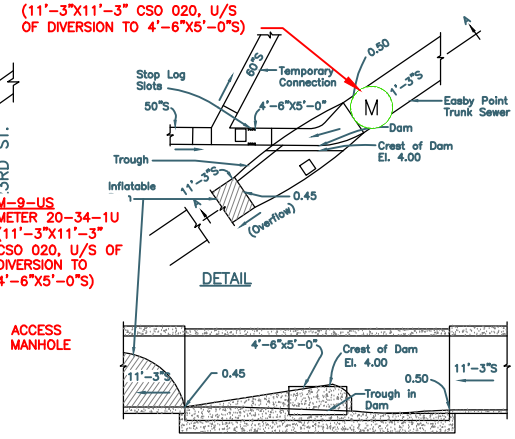
FLOW METER LOCATION PLAN

SCALE: NTS



PLAN

M-9-US
METER 20-34-1U
(11'-3"X11'-3" CSO 020, U/S
OF DIVERSION TO 4'-6"X5'-0"S)



M-9-US
METER 20-34-1U
(11'-3"X11'-3"
CSO 020, U/S OF
DIVERSION TO
4'-6"X5'-0"S)

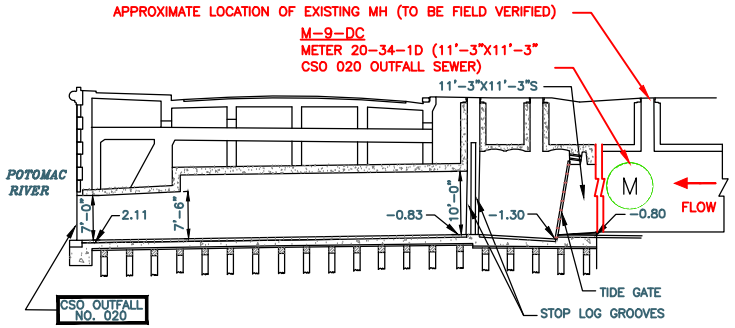
DETAIL

ACCESS
MANHOLE

SECTION A–A

STRUCTURE–34 DETAIL

SCALE NTS



SECTION A–A (11'–3" X 11'–3" SEWER PROFILE)

SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

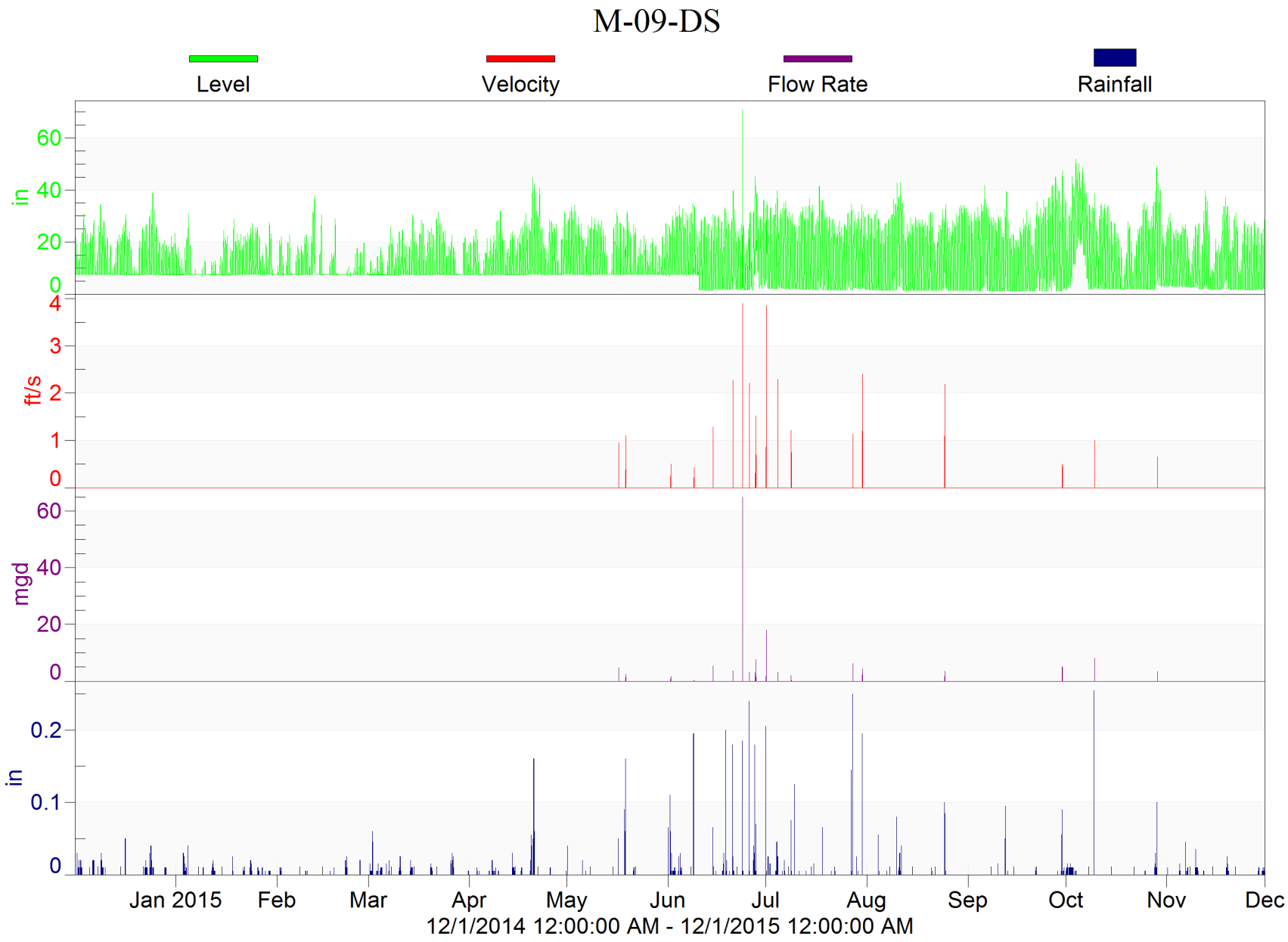
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

20–34–1U AND 20–34–1D METER LOCATION AND TYPICAL CROSS SECTION

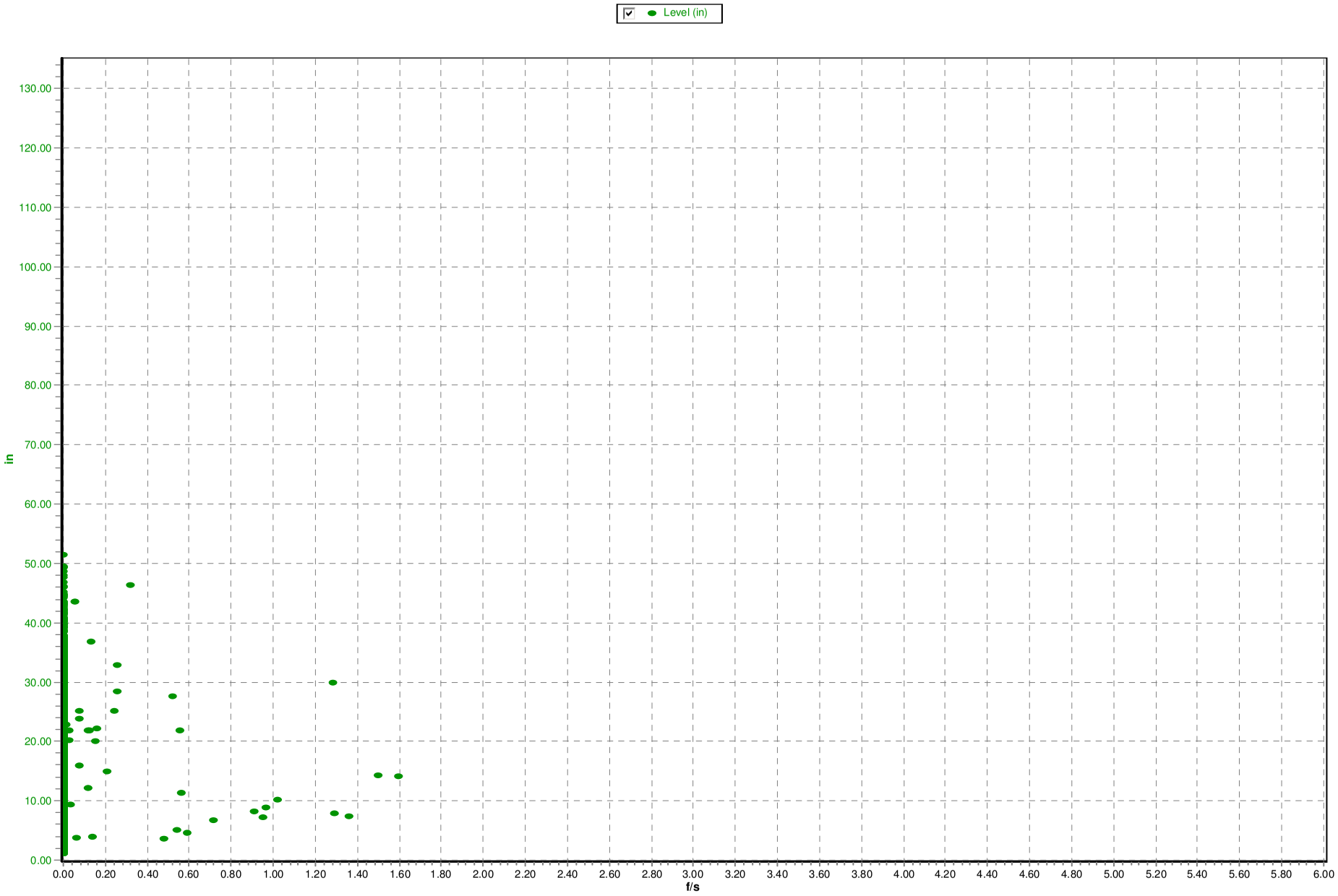
DATE: OCTOBER 2014 | SITE 9

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:42:12 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\9_20-29-1.DWG


M-09-DS
Level
Velocity
Flow Rate
Rainfall
in
60
40
20
0
ft/s
4
3
2
1
0
mgd
60
40
20
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-09-DS - On Constitution Ave. (past 33rd St., on a path, in the grass)

Pipe Diameter (in): 128 H X 122 W (12/01/14 to 12/01/15)



M-09-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/25/2014	10:42	19.85	20	0	0	0		LR/AP	Install.
11/25/2014	10:47	19.84	19.75	0	0	0		LR/AP	
11/25/2014	10:52	19.85	19.75	0	0	0		LR/AP	
12/3/2014	15:20	23.31	23.25	0	0	0	12	LR/AP	CB Telog.
12/3/2014	15:25	23.52	23.25	0	0	0		LR/AP	
12/3/2014	15:30	24.48	24.5	0	0	0		LR/AP	
3/10/2015	10:04		18	0	0	0	5.54	AP/AM	
5/5/2015	8:30	23.88	24	0	0	0	5.5	LR/DW	CB meter.
6/10/2015	9:50		1.5	0	0	0		LL/DW	
6/10/2015	9:56		1.5	0	0	0		LL/DW	
6/10/2015	10:01		1.5	0	0	0		LL/DW	
6/10/2015	10:21	1.58	1.5	0	0	0		LL/DW	Move sensor lower in to flow.
7/21/2015	12:50							LR/DW	Swap antenna.
8/25/2015	13:22		5.5		0	0	0	CL/JC	
10/29/2015	12:10		31.25		0	0		JC/RM	
12/21/2015	17:10		19.75		0	0		SD/LR	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-10

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 021

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-10 measured flows on East Rock Creek Diversion Sewer upstream of Structure 35.

3. The continuity equation was used to calculate a flow rate from these measurements. M-10 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	10.263	1.205	13.939
Avg.	15.433	2.624	30.609
Max	145.381	5.391	357.115

Site Name/Manhole # M-10 Primary: [X] Alternate: [ ]

Investigation Date: 11/22/13 Time: 15:05 Crew Members: LR/JS

Installation Date: 11/24/15 Time: 123:15 Crew Members:

Address/Location: Parking lot at 25th Street NW & Rock Creek Parkway (Kennedy Center for Performing Arts)

Latitude: N 38° 53.623' Longitude: W 77° 3.304'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 2.24 ft/sec

Depth 11.0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ (0.25" to 0.75")
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	90"		66"
Width	164"		66"
Material	Concrete		Concrete
Shape	Rectangle		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth ____

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:__ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

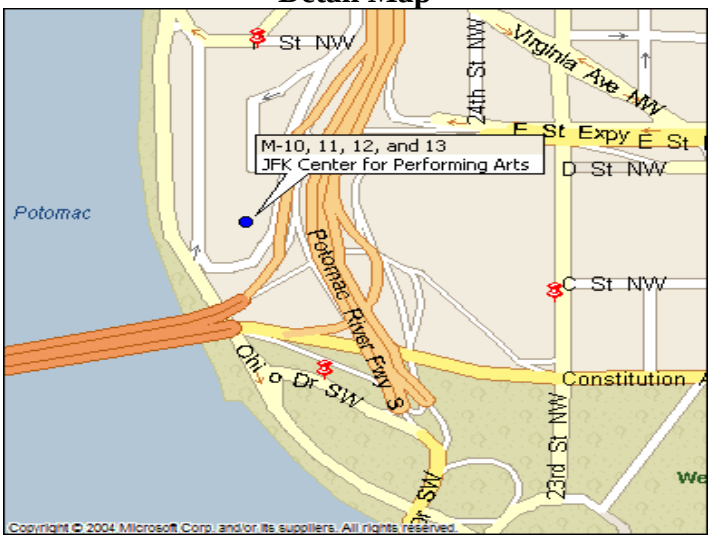
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map

Detail Map



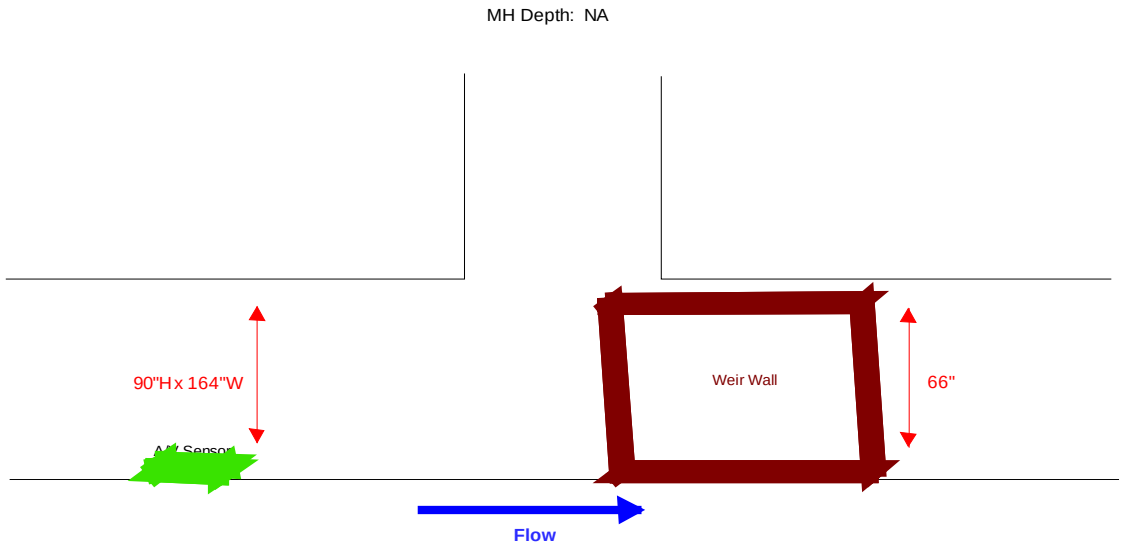
View from top of MH

Site Overview

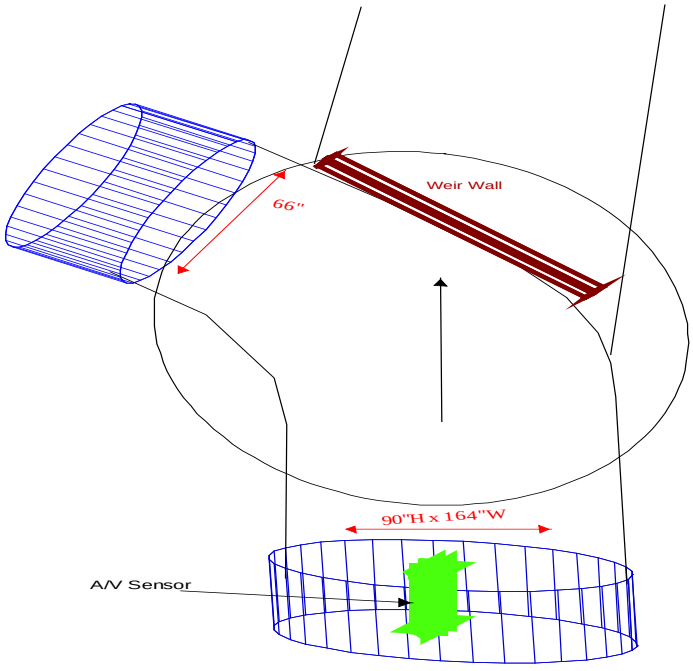
View of flow through influent line

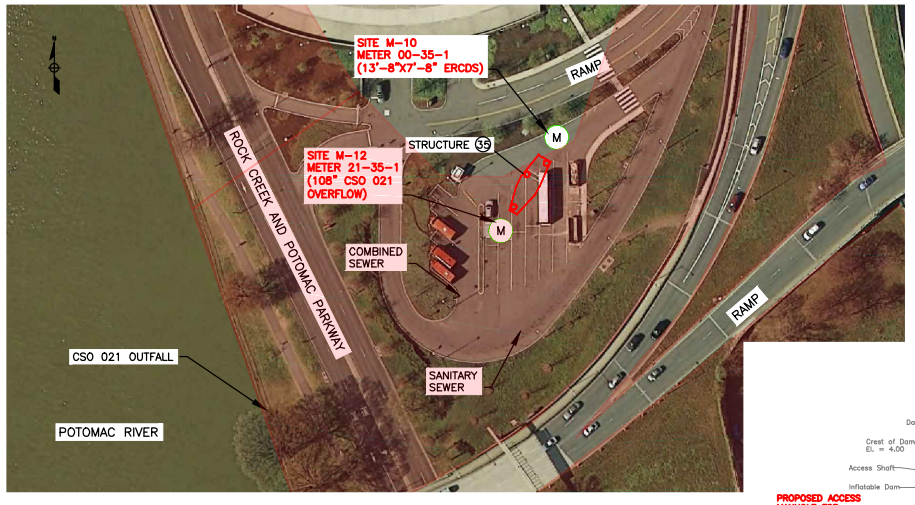
View of flow through effluent line

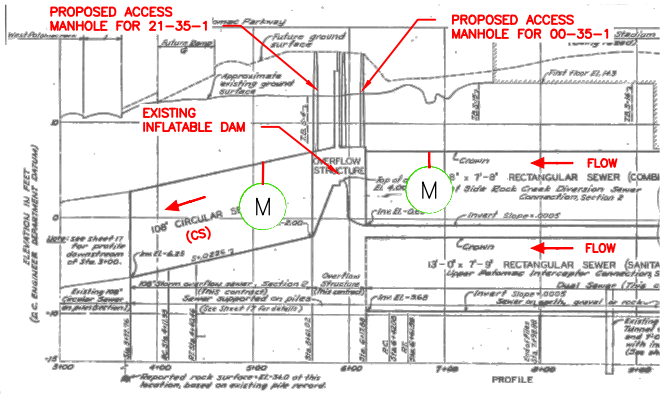
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

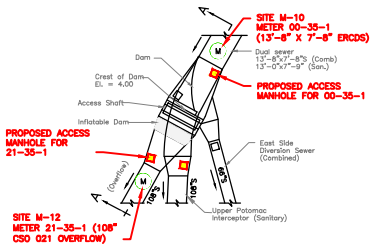






TYPICAL CROSS SECTION A-A (PROFILE VIEW)

SCALE: NTS

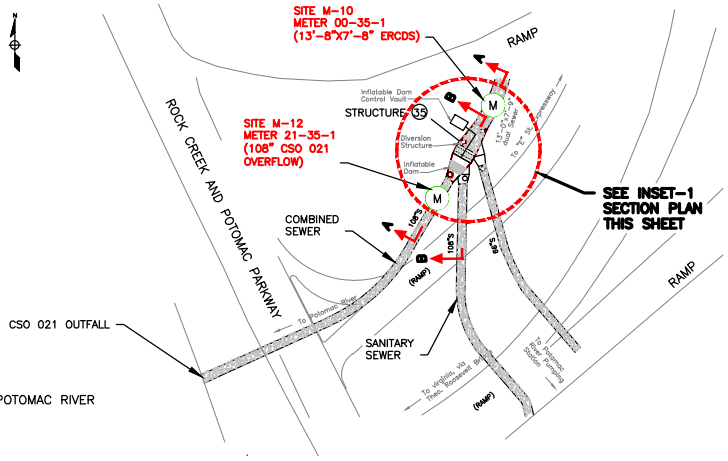


INSET-1 SECTION PLAN

SCALE NTS

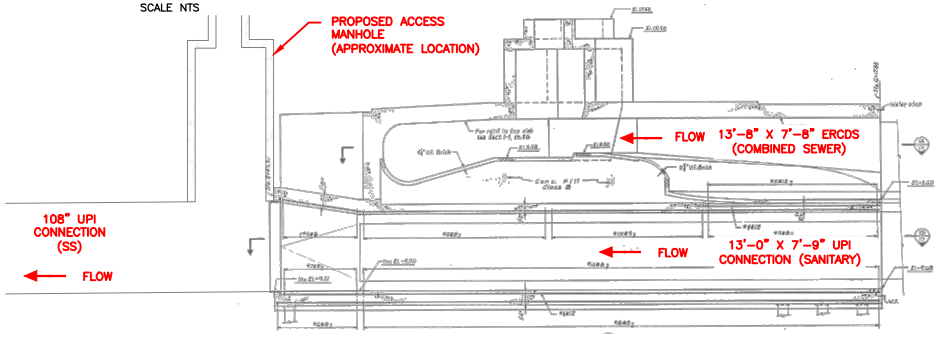
1 - FLOW METER ● M-10

1 - FLOW METER ● M-12



FLOW METER LOCATION PLAN

SCALE: NTS



TYPICAL CROSS SECTION B-B (PROFILE VIEW)

SCALE: NTS

LEGEND

(M) FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

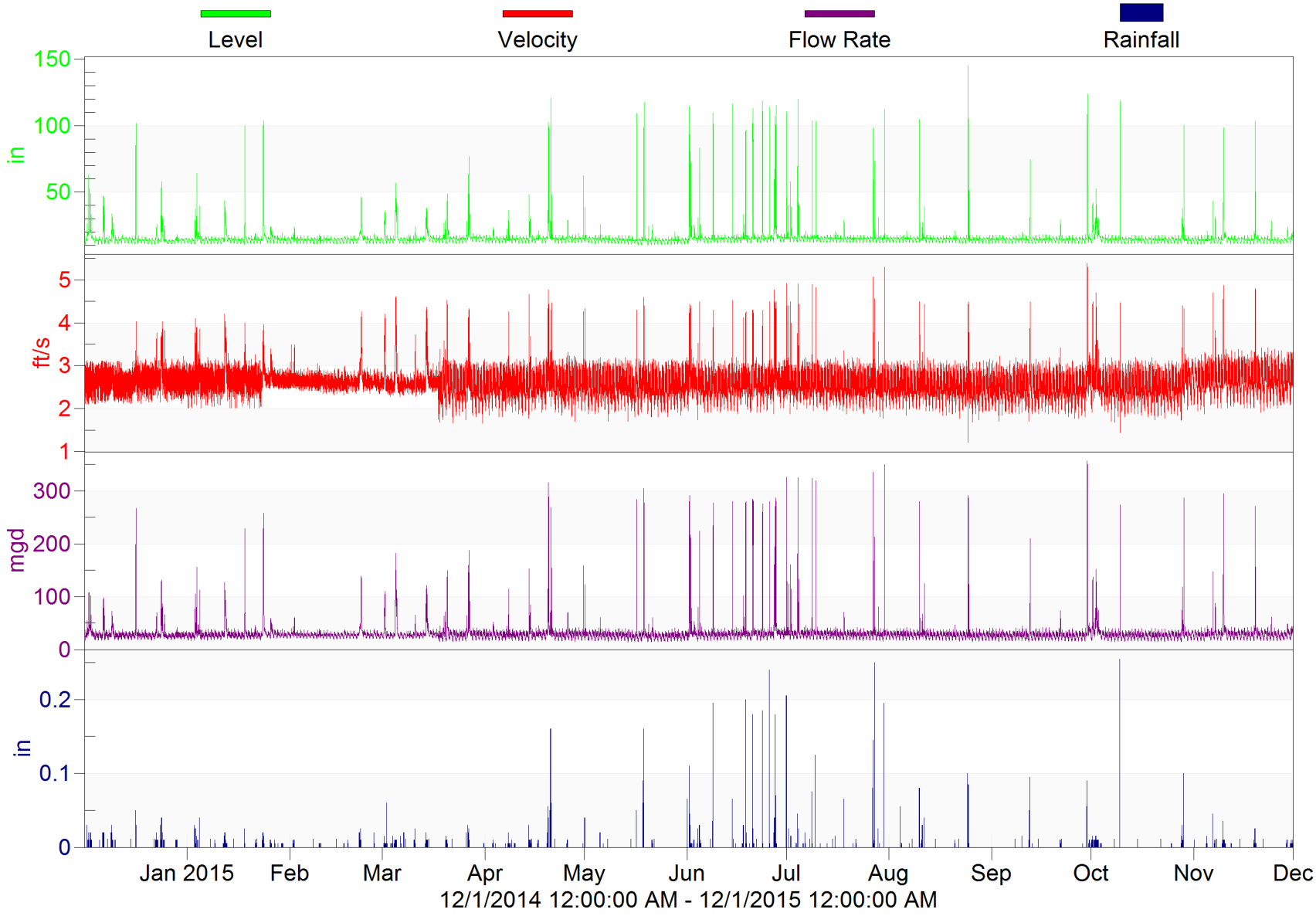
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

21-35-1 AND 00-35-1
METER LOCATIONS AND TYPICAL CROSS SECTIONS

DATE: OCTOBER 2014 | SITE 10 AND 12

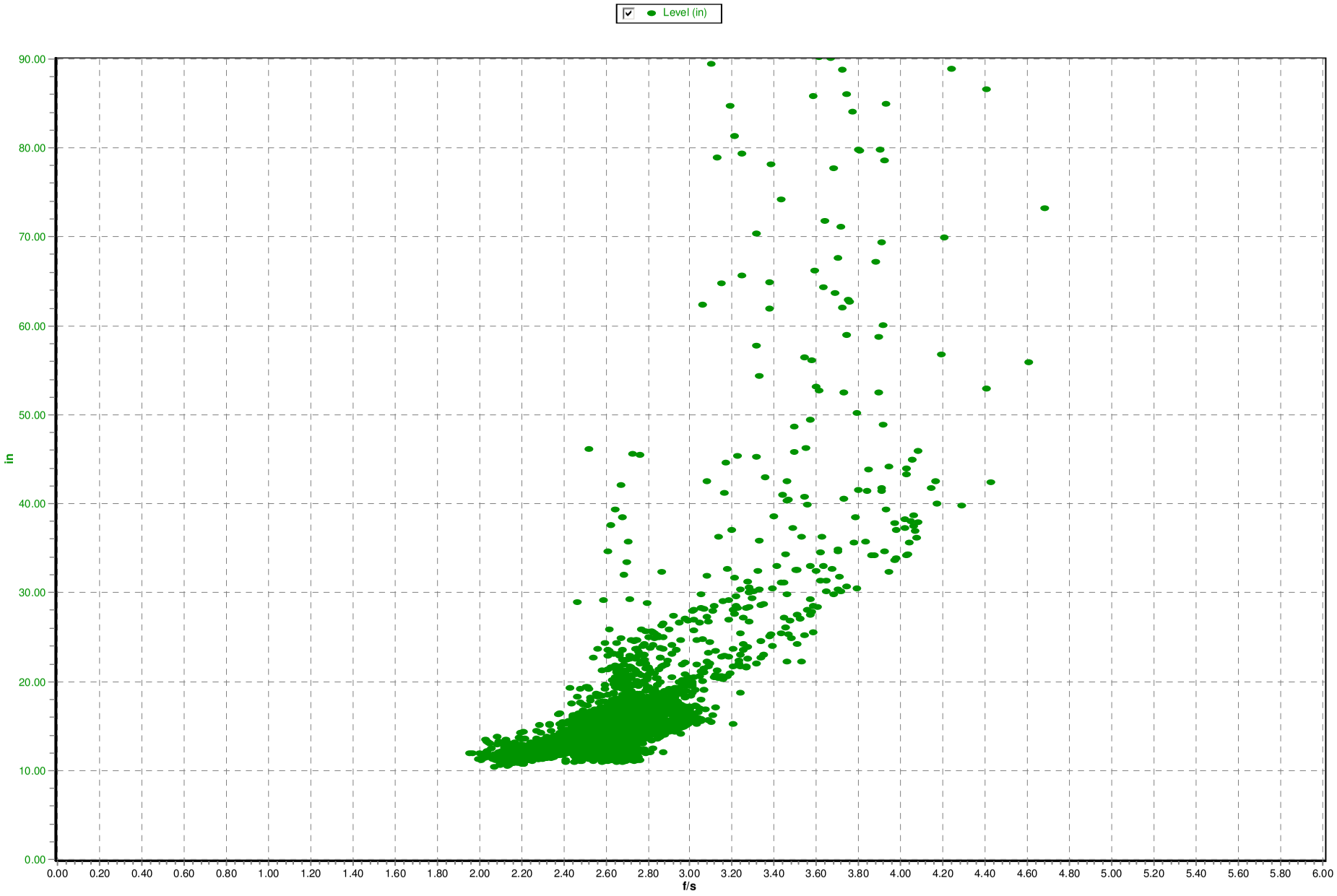
LAST SAVED BY: STEFAN OSTNER DATE: 5/9/2016 3:41:20 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\10-12_21-35-01_00-35-1_2.DWG

M-10


Level
Velocity
Flow Rate
Rainfall
150
100
50
in
5
4
3
2
1
ft/s
300
200
100
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-10 - Parking lot at 25th Street NW & Rock Creek Parkway (Kennedy Center for Performing Arts)

Pipe Diameter (in): 90 H X 164 W (12/01/14 to 12/01/15)



M-10

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/24/2014	12:10	14.63	14.75	2.67	2.79	0		GM/SD	Install.
11/24/2014	13:30	14.14	14	2.89	3.1	0		GM/SD	
11/24/2014	13:35	14.17	14	2.74	2.89	0		GM/SD	
11/24/2014	13:40	14.05	14	2.91	3	0		GM/SD	
12/10/2014	10:29		15		2.8	0		AP/GH	CB Telog.
1/16/2015	10:55							LL/AM	CB Telog.
2/2/2015	16:07		14		2.73	0		LR/AM	CB Telog.
2/11/2015	14:18		10.5		2.86	0	5.85	LR/AM	
3/12/2015	16:00							AP/AM	CB Telog.
3/24/2015	14:51		14.75		2.9	0	5.85	AP/AM	CB Telog.
4/8/2015	17:00							AP/AM	CB Telog.
5/4/2015	15:00							LR/DW	CB Telog.
6/4/2015	12:41							LR/DW	CB Telog.
7/2/2015	10:19							LR/DW	CB Telog.
7/23/2015	15:20		14.5		2.65	0		LR/DW	
8/12/2015	13:58							LR/DW	CB Telog.
9/2/2015	8:57							LR/JC	CB Telog.
9/22/2015	8:21		17		2.9	0		LR/JC	
10/28/2015	9:21							JC/RM	CB Telog.
11/18/2015	8:36		17.5		2.97	0		LR/JC	
12/22/2015	14:20		13		3.08	0		BR/PC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-11

SEWER: B STREET / NJ AVE TRUNK SEWER

OUTFALL: n/a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-11 measured flows on the B Street / NJ Ave Trunk sewer upstream of Structure 35b.

3. The continuity equation was used to calculate a flow rate from these measurements. M-11 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	19.737	5.273	31.543
Avg.	28.204	8.708	57.846
Max	128.42	15.595	267.486

Site Name/Manhole # M-11 Primary: [X] Alternate: [ ]

Investigation Date: 10/16/14 Time: 12:40 Crew Members: LR/JS

Installation Date: 11/26/14 Time: 5:50 Crew Members: CL/PD/GM/LP

Address/Location: In grass on the Rock Creek Pkwy side of the Watergate Hotel (700 New Hampshire Ave NW)

Latitude: N 38°53.921' Longitude: W 77°3.385'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Range of Air*

Velocity 9.60 ft/sec

Depth 43.0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	6'	12"	6'
Width	6'	12"	6'
Material	Brick	Concrete	Brick
Shape	Round	Round	Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ No Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ 8 ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, ~~can safely carry equipment to site~~)
- ☐ Poor (remote areas, steel embankments, ~~No safe place to park, elevated MH >3 ft~~)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ No

Height above ground ____

Manhole depth 11"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ Yes ☐ No ☐ Maybe

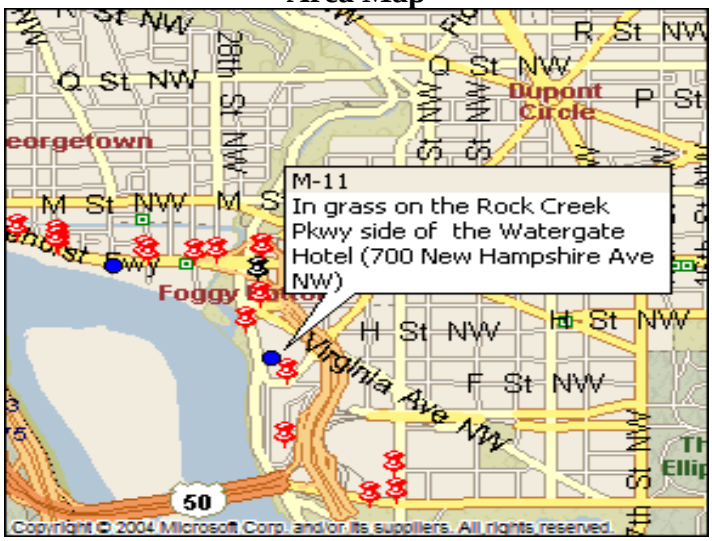
Sensor Configuration:

(Please include Serial Numbers when possible)

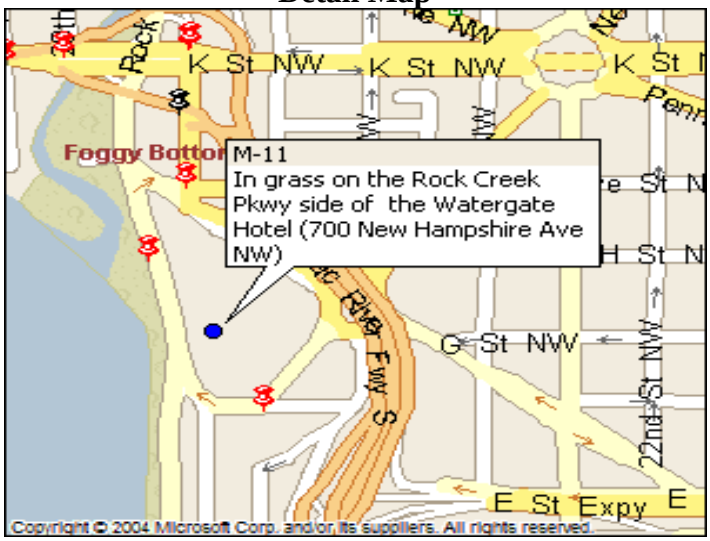
Level	Primary: Ultrasonic Depth
	Redundant:
Velocity	Primary: ADS Surface Combo
	Redundant:
Meter Logger	Triton 20203

Comments:

Area Map



Detail Map



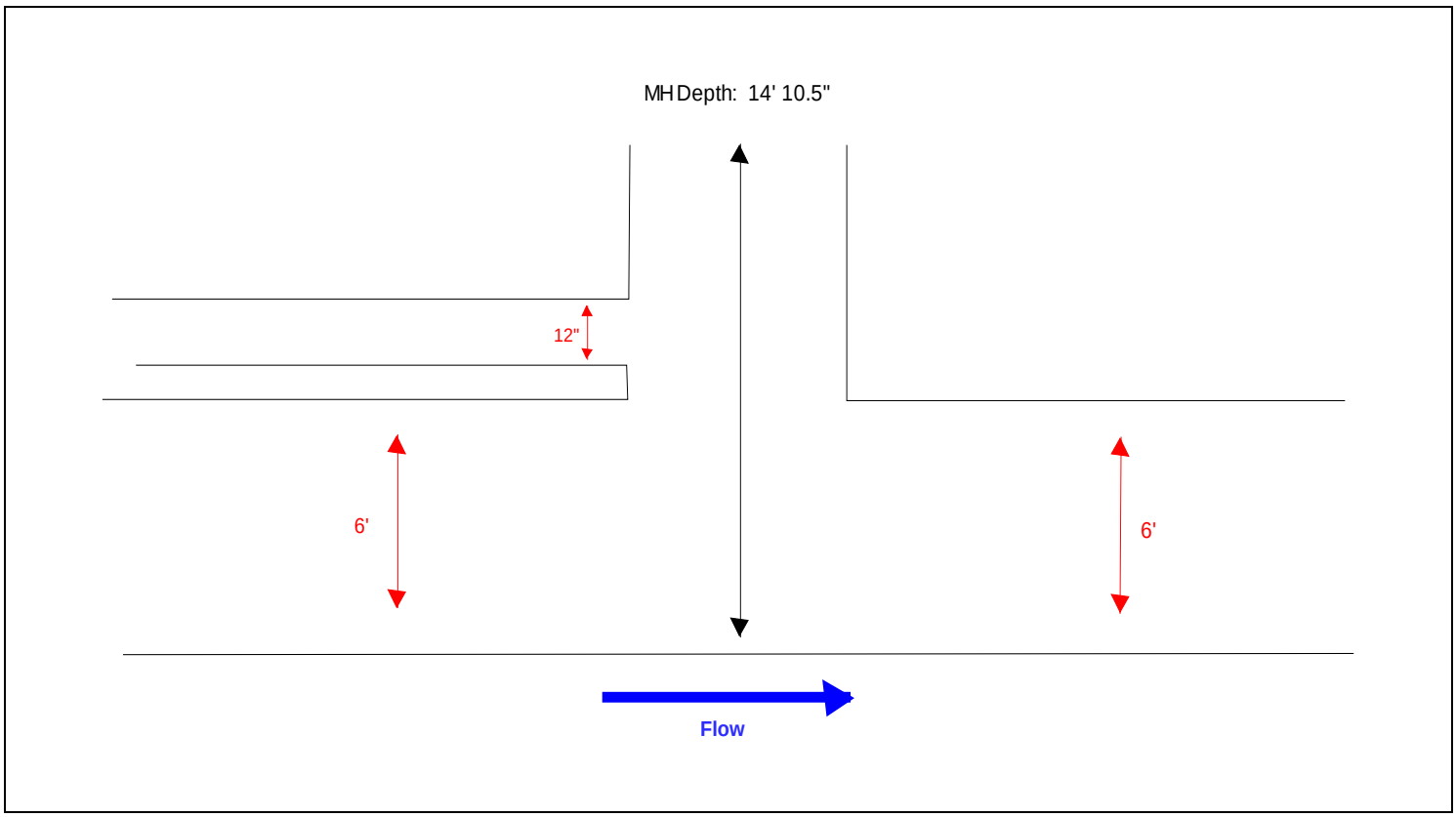
View from top of MH

Site Overview

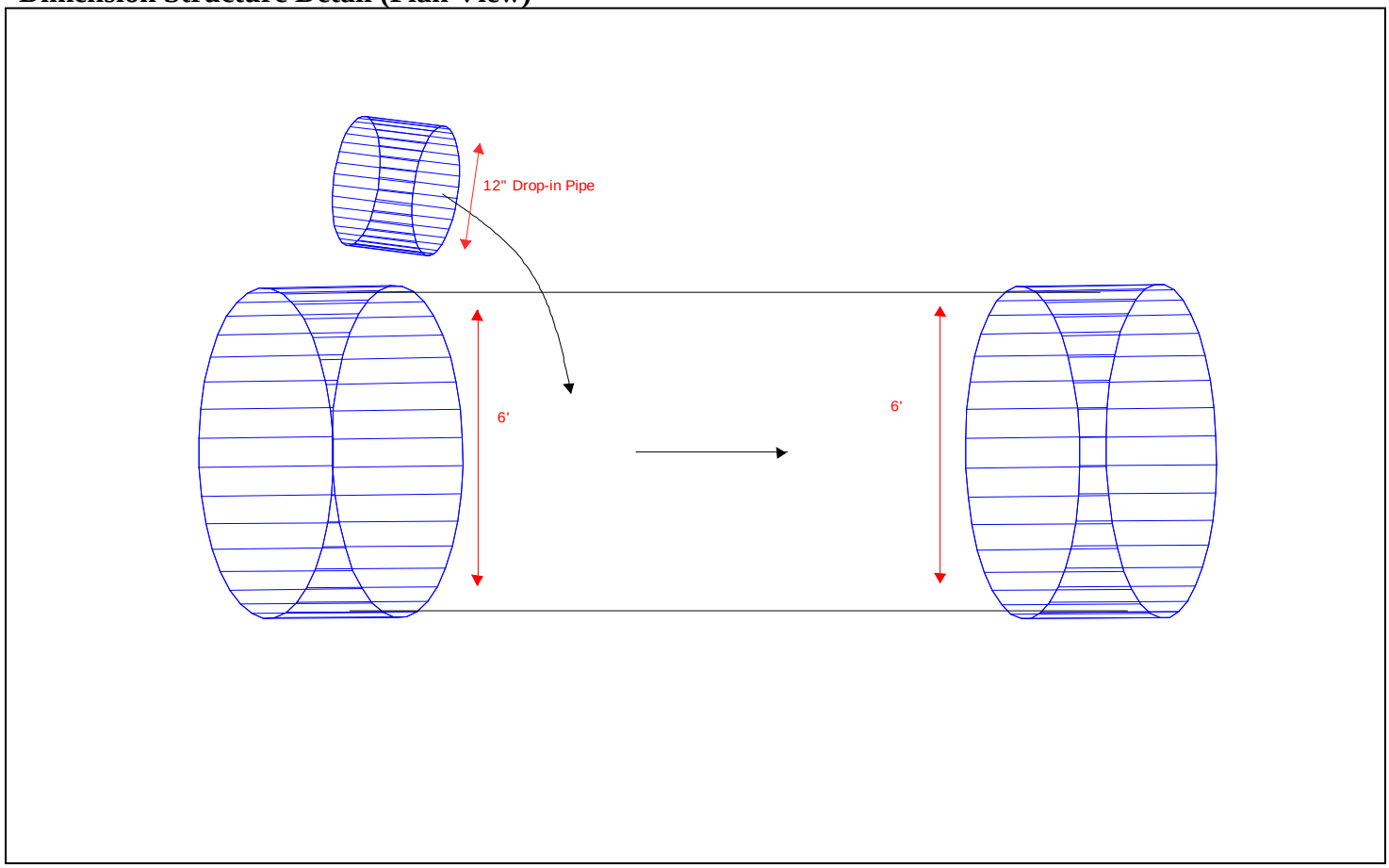
View of flow through influent line

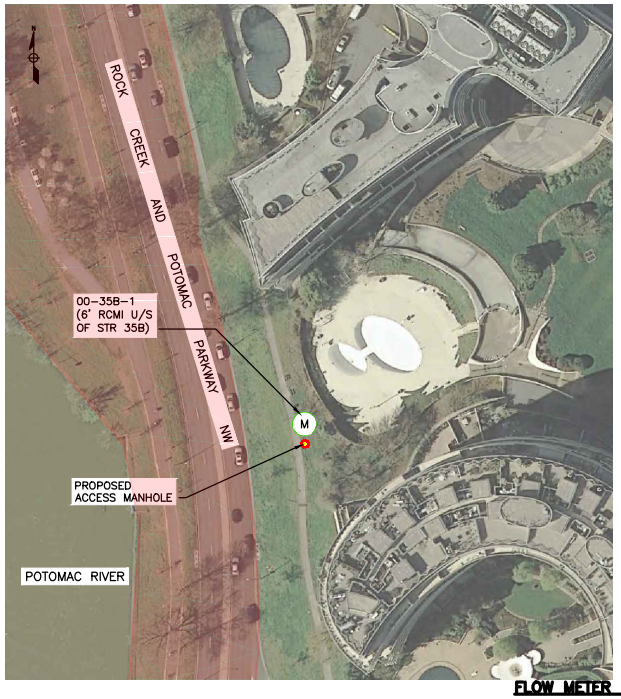
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

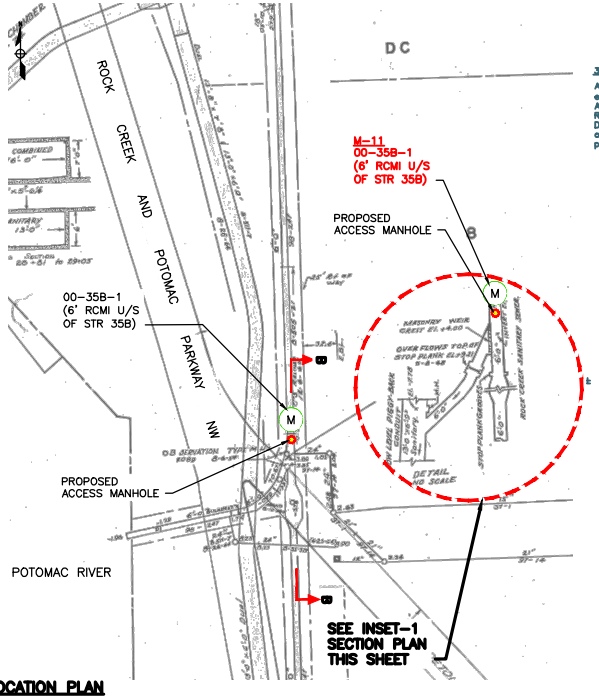


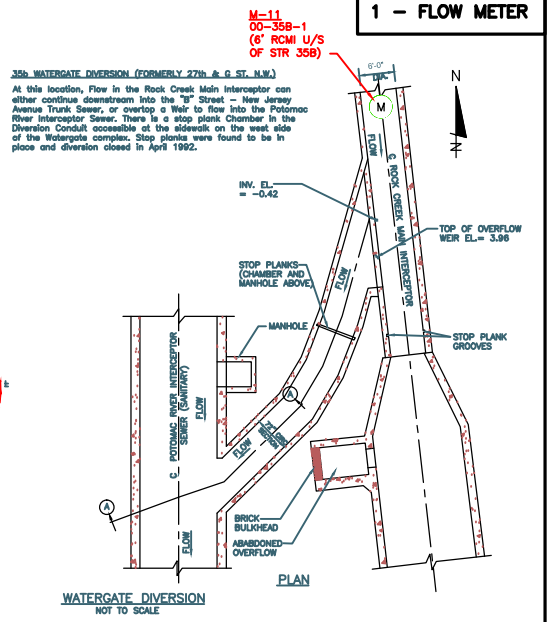
Dimension Structure Detail (Plan View)



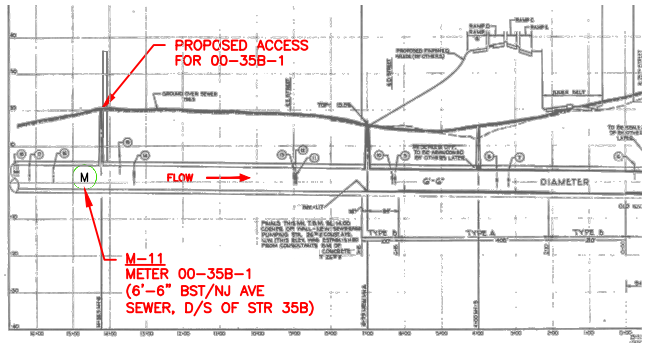


FLOW METER LOCATION PLAN
SCALE: NTS





INSET–1 LOCATION DETAIL
SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

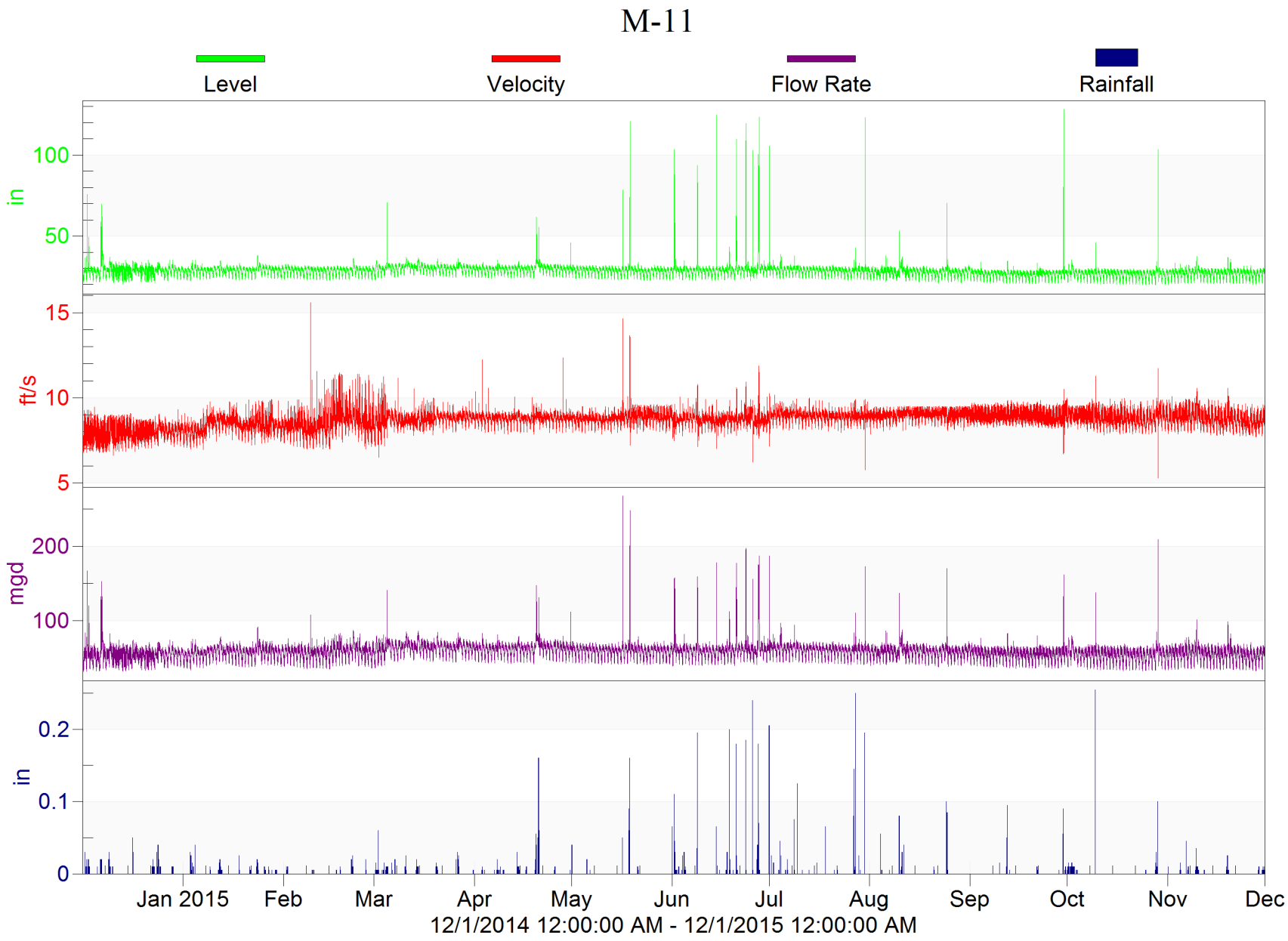
LEGEND
(M) FLOW METER LOCATION
NATIONAL PARK SERVICE AREA

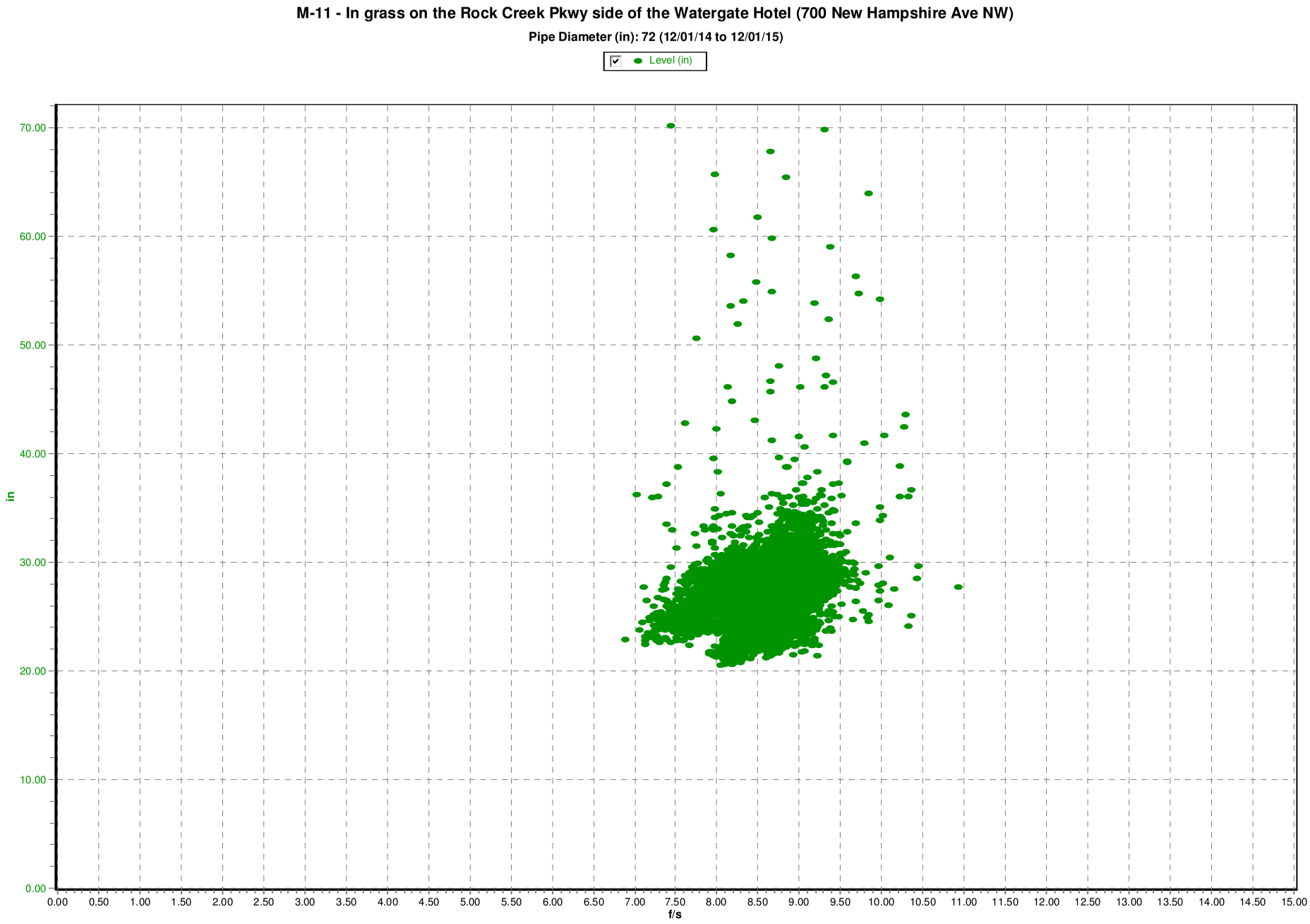
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00–35B–1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE M–11

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:23:52 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER – EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES – STANDARD\XX_M–11.DWG


M-11
Level
Velocity
Flow Rate
Rainfall
in
100
50
ft/s
15
10
5
mgd
200
100
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-11 - In grass on the Rock Creek Pkwy side of the Watergate Hotel (700 New Hampshire Ave NW)
Pipe Diameter (in): 72 (12/01/14 to 12/01/15)
Level (in)
in
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00 6.50 7.00 7.50 8.00 8.50 9.00 9.50 10.00 10.50 11.00 11.50 12.00 12.50 13.00 13.50 14.00 14.50 15.00
f/s

M-11

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/26/2014	7:16	40.35	40.25	9.28	9.6	0		GM/LL	Install.
11/26/2014	7:21	40.51	40.5	8.76	9.24	0		GM/LL	
11/26/2014	7:26	41.82	42	9.4	8.99	0		GM/LL	
12/4/2014	13:53	28.81	29	9.33	8.9	0	10.03	LR/AP	
12/4/2014	14:06	29.29	29.25	8.28	8.5	0	10.02	LR/AP	
12/17/2014	17:04		29		8.2	0		AP/AM	
12/24/2014	12:24		28		8.9	0		AP/GH	
1/13/2015	15:51		28		8.69	0		LL/AP	
1/28/2015	13:29		30.25		9.12	0		LR/AM	
3/25/2015	12:50		31.5		9.1	0		AP/AM	
5/18/2015	14:30		28.5		9.1	0		LR/AM	
5/18/2015	14:47		29		9.2	0		LR/AM	
5/18/2015	14:50		28.75		8.9	0		LR/AM	
5/18/2015	14:53		28.5		9	0		LR/AM	
7/1/2015	9:05		29.25		10.5	0		LR/DW	
7/1/2015	9:46		29.5		9.1	0		LR/DW	
8/12/2015	14:42		31		9.4	0		LR/DW	
9/21/2015	14:34		27		9.9	0		LR/JC	
10/6/2015	12:32		29.25		9.1	0		LR/JC	
12/8/2015	12:32		24		9.9	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-12

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 021

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-12 measured excess flows from the East Rock Creek Diversion Sewer before entering the Potomac River through CSO 021 downstream of the inflatable dam at Structure 35.

3. The continuity equation was used to calculate a flow rate from these measurements. M-12 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	30.42	0.018	0.370
Max	122.865	14.494	273.331

Site Name/Manhole # M-12 Primary: [X] Alternate: [ ]

Investigation Date: 11/22/13 Time: 12:35 Crew Members: LR/JS

Installation Date: 11/25/14 Time: 8:08 Crew Members: CL/PD

Address/Location: Parking lot at 25th Street NW & Rock Creek Parkway (Kennedy Center for Performing Arts)

Latitude: N 38° 53,638' Longitude: W 77° 3,316'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing water*

Velocity 0 ft/sec

Depth 43.5 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ (0.25" to 0.75")
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	108"	15"	108"
Width	108"	15"	108"
Material	Brick	Concrete	Brick
Shape	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ (Good) (no problems accessing site)

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 22'8"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:__ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

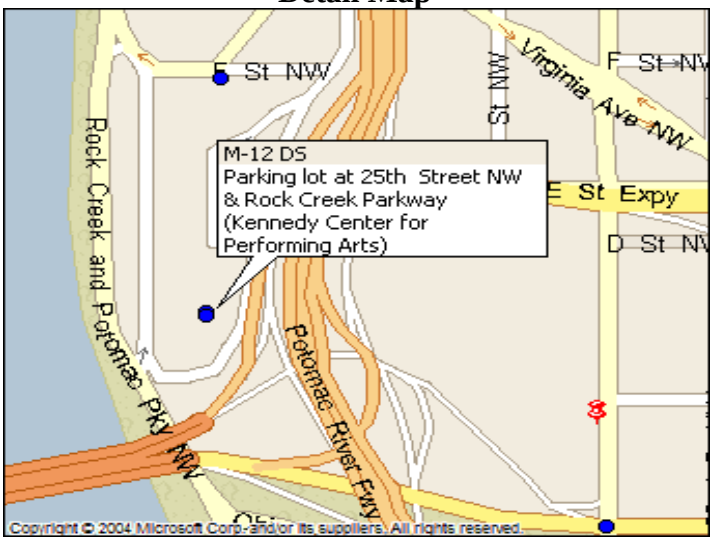
(Please include Serial Numbers when possible)

Level	Primary: Sigma A/V
	Redundant:
Velocity	Primary: Sigma A/V
	Redundant:
Meter Logger	FL900 140000296000

Comments:

Area Map

Detail Map



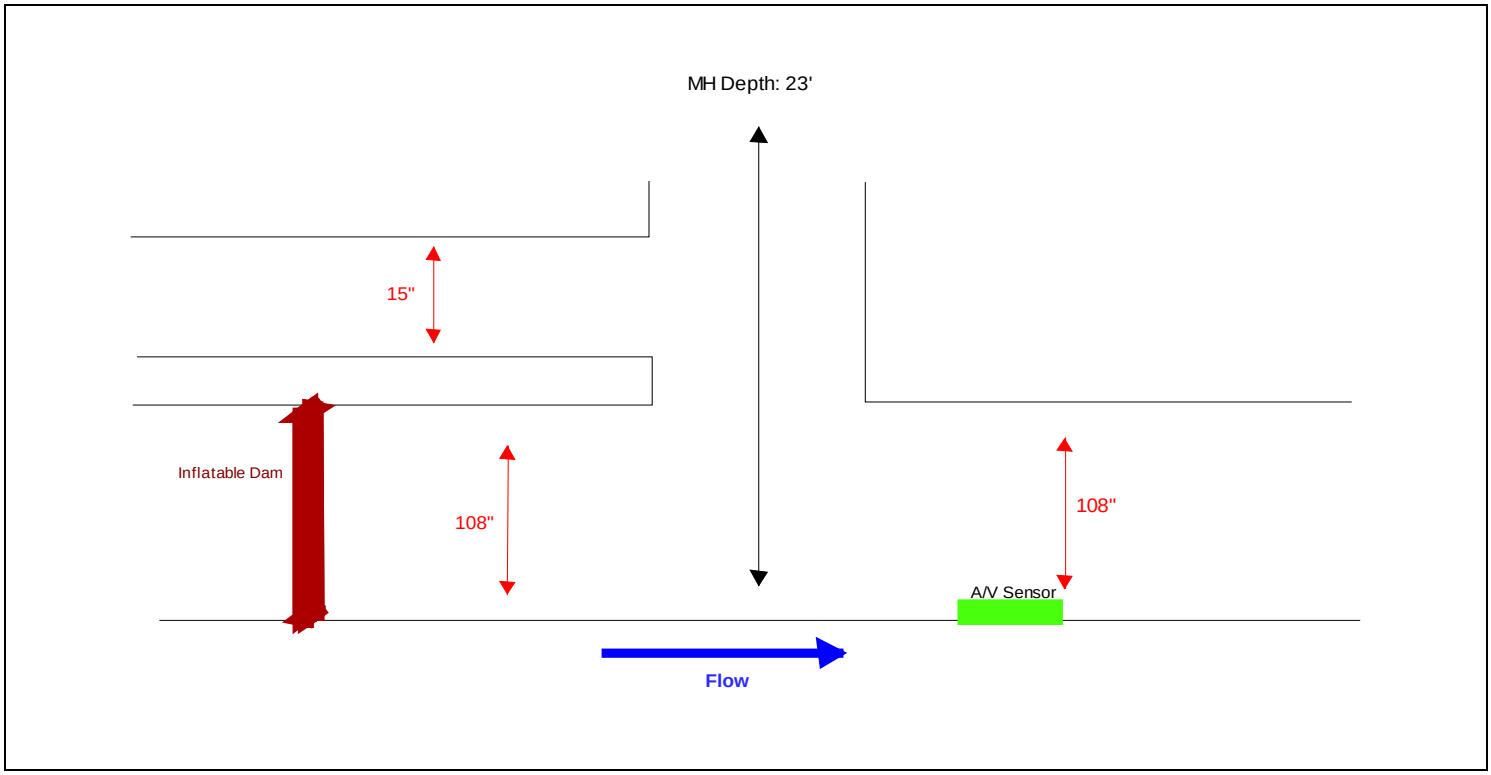
View from top of MH

Site Overview

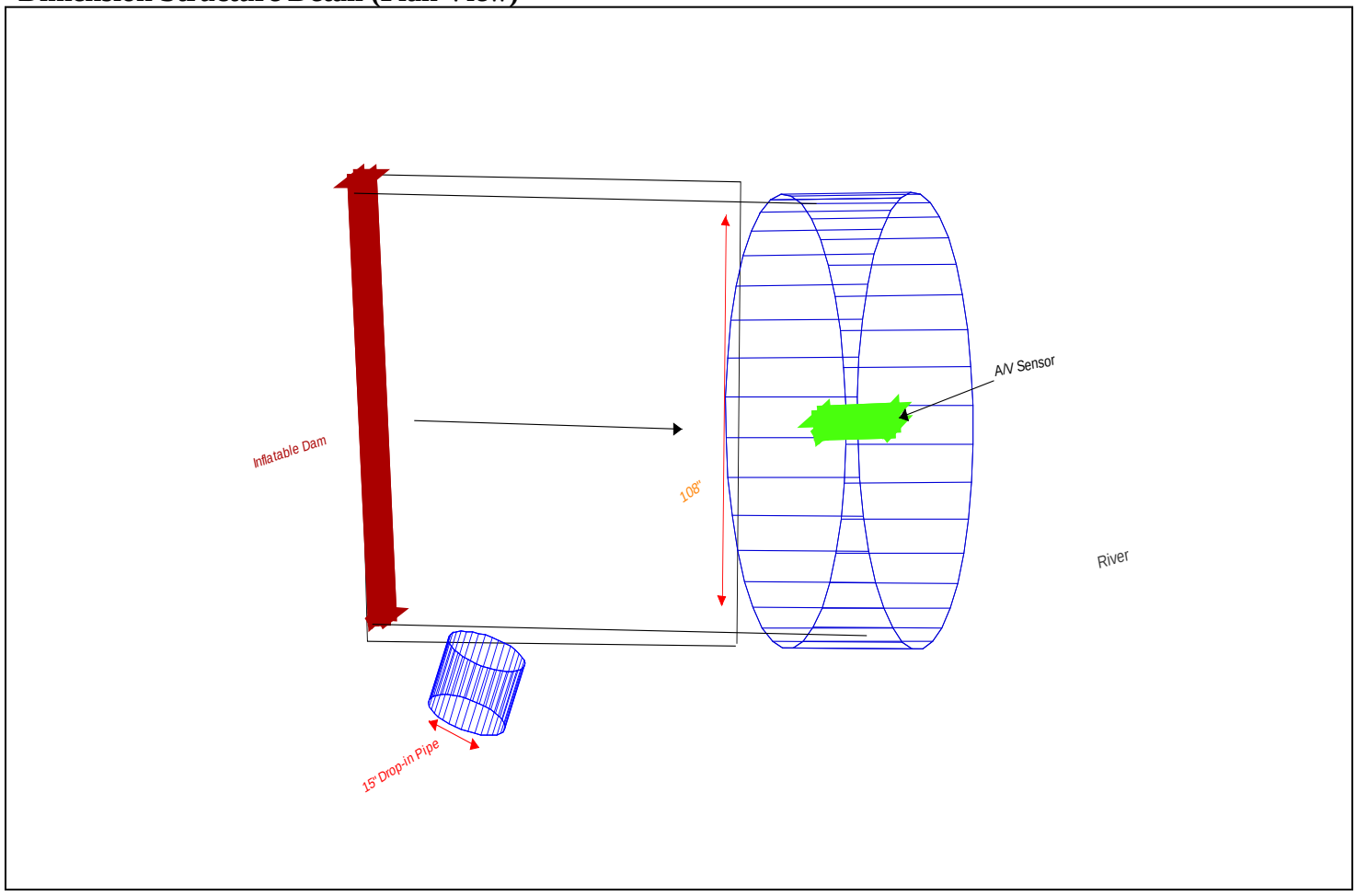
View of flow through influent line

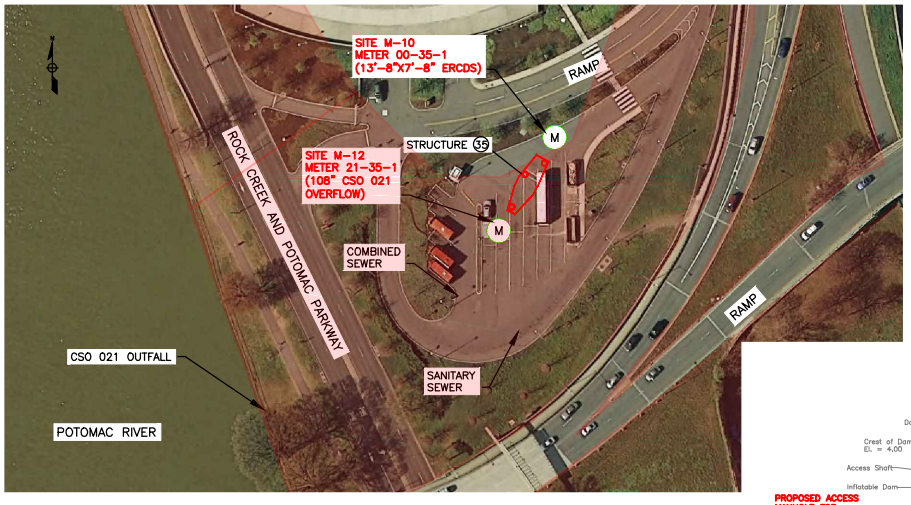
View of flow through effluent line

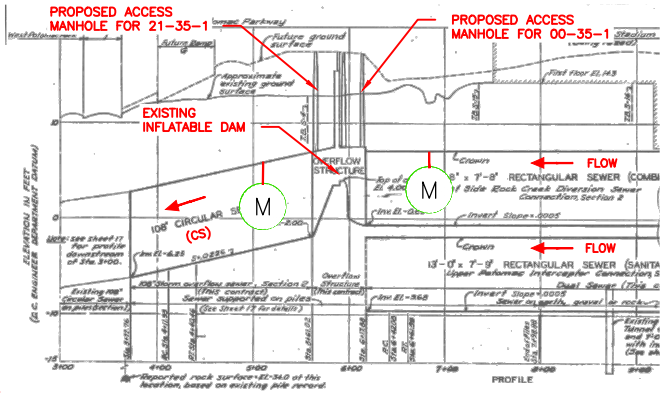
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

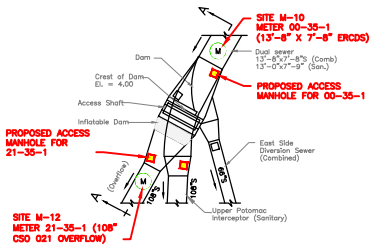






TYPICAL CROSS SECTION A-A (PROFILE VIEW)

SCALE: NTS

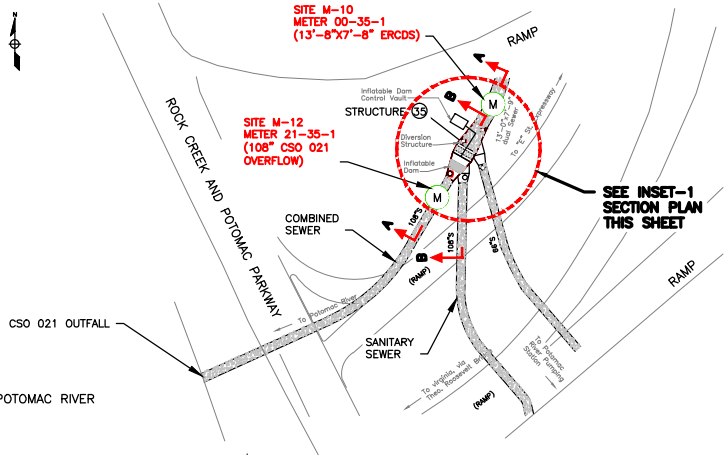


INSET-1 SECTION PLAN

SCALE NTS

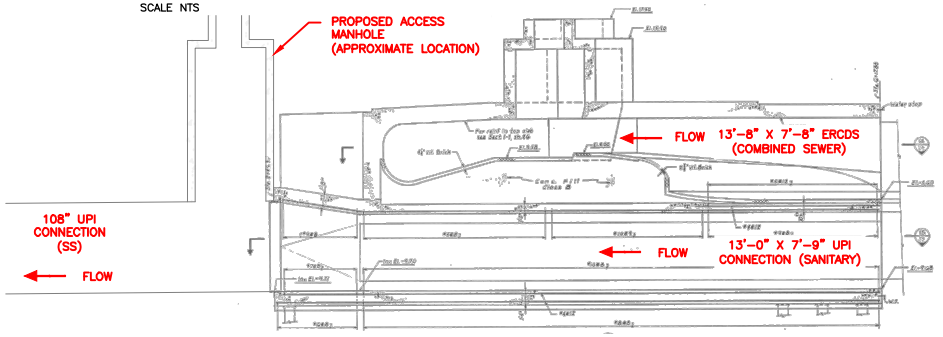
1 - FLOW METER ⊙ M-10

1 - FLOW METER ⊙ M-12



FLOW METER LOCATION PLAN

SCALE: NTS



TYPICAL CROSS SECTION B-B (PROFILE VIEW)

SCALE: NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

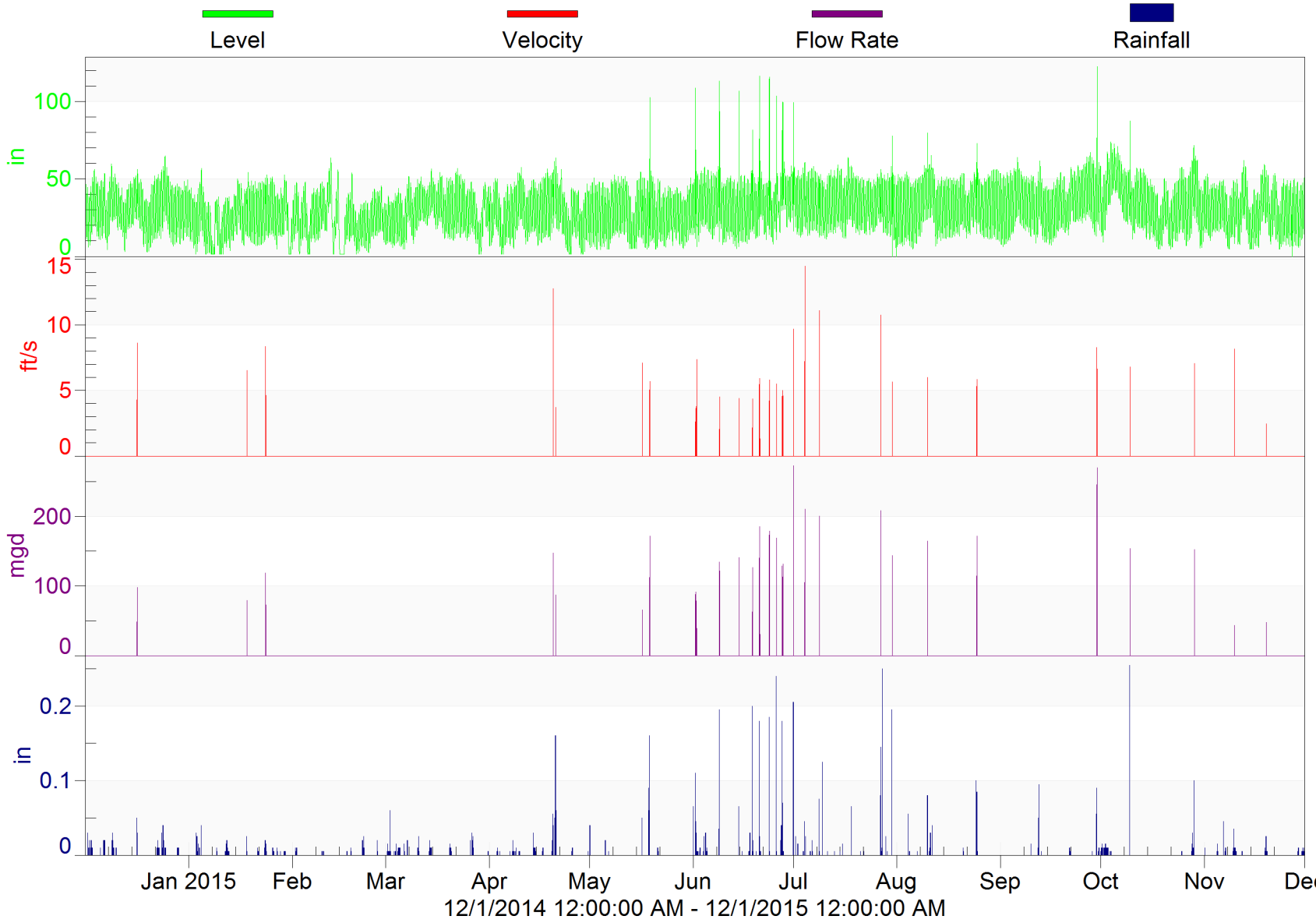
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

21-35-1 AND 00-35-1
METER LOCATIONS AND TYPICAL CROSS SECTIONS

DATE: OCTOBER 2014 | SITE 10 AND 12

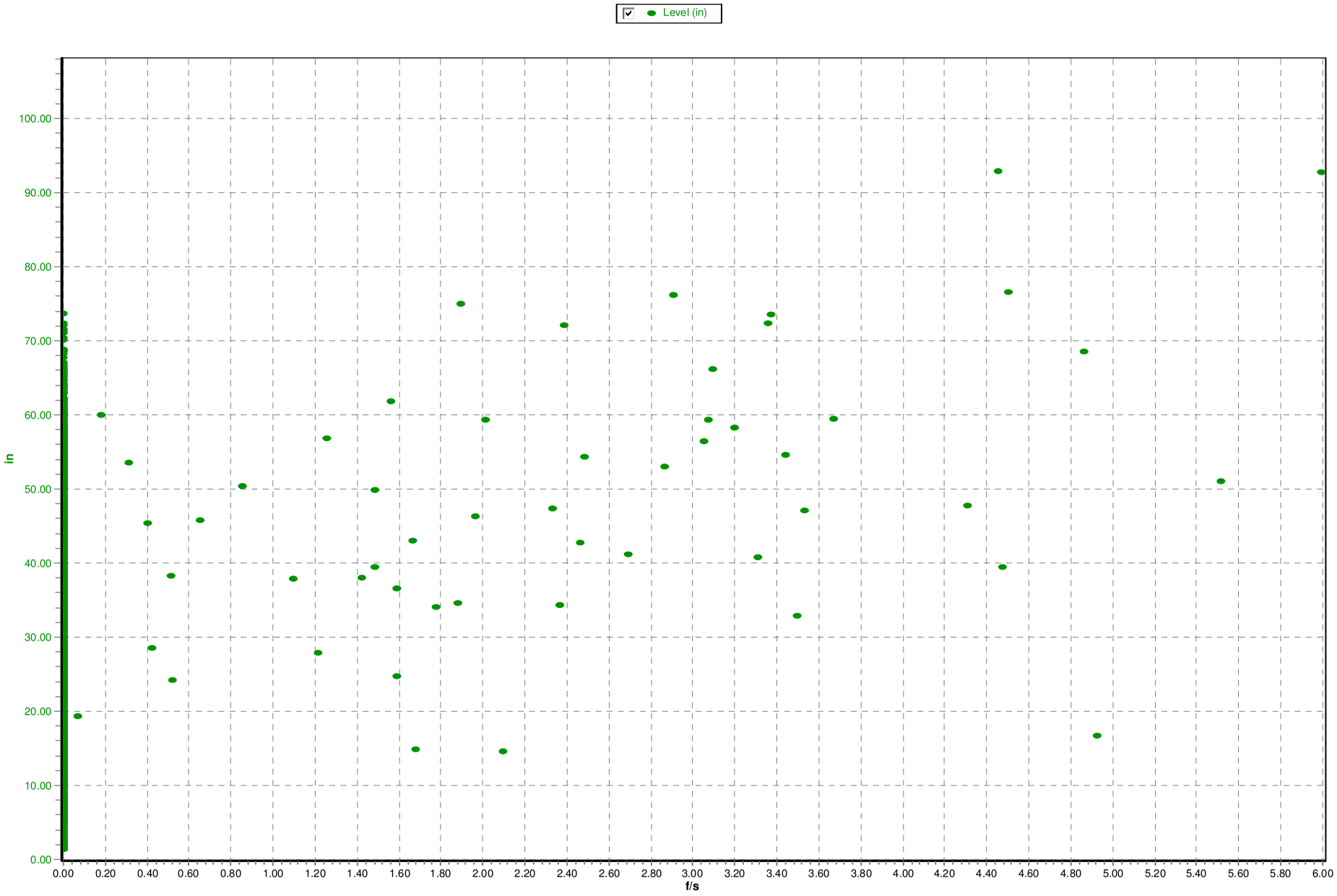
LAST SAVED BY: STEFAN OSTNER DATE: 5/9/2016 3:41:20 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\10-12_21-35-01_00-35-1_2.DWG

M-12


Level
Velocity
Flow Rate
Rainfall
in
100
50
0
ft/s
15
10
5
0
mgd
200
100
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-12 - Parking lot at 25th Street NW & Rock Creek Parkway (Kennedy Center for Performing Arts)

Pipe Diameter (in): 108 (12/01/14 to 12/01/15)



M-12

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/25/2014	10:50	12.55	12.5	0	0	0		LL/AP	Install.
11/25/2014	10:55	12.54	12.5	0	0	0		LL/AP	
11/25/2014	11:00	12.55	12.5	0	0	0	13	LL/AP	
12/18/2014	13:20		11.75		0	0.25		AM/GH	
5/4/2015	14:37		23		0	0.25	5.58	LR/DW	
5/5/2015	16:55		13.5		0	0		LR/DW	
5/5/2015	18:10	11.24	11	0	0	0		LR/DW	
5/7/2015	15:28	23.06	23	0	0	0		LR/DW	
5/7/2015	15:57	20.7	20.5	0	0	0		LR/DW	
7/23/2015	14:40		47		0	0		LR/DW	
9/28/2015	13:19		29.5		0	0		LR/JC	CB Telog.
11/18/2015	9:07		37		0	0		LR/JC	
12/22/2015	16:26		38		0	0		BP/JC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-14

SEWER: ROCK CREEK DIVERSION SEWER

OUTFALL: 022

DURATION: 1/1/15-12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-14 measured excess flows from the Rock Creek Diversion Sewer before entering the Potomac River through CSO 022.

3. The continuity equation was used to calculate a flow rate from these measurements. M-14 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.987	0.05	0.053
Max	82.434	7.318	161.101

Site Name/Manhole # M-14 Primary: [X] Alternate: [ ]

Investigation Date: 12/4/13 Time: 10:20 Crew Members: LR/JS

Installation Date: 12/11/14 Time: 11:20 Crew Members: AP/GH

Address/Location: 27th St NW & I Street NW

Latitude: N 38° 54.043' Longitude: W 77° 3.369'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry Pipe*

Velocity 2.50 ft/sec

Depth 1.25 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	11'6"		11'6"
Width	11'6"		11'6"
Material	Brick		Brick
Shape	Igloo		Igloo

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, ~~No safe place to park, elevated MH >3 ft~~)
- ☐ (Traffic Control only (Requires extra traffic control)
- ☐ Unusable (~~Document in Comments section~~)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 14'6"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

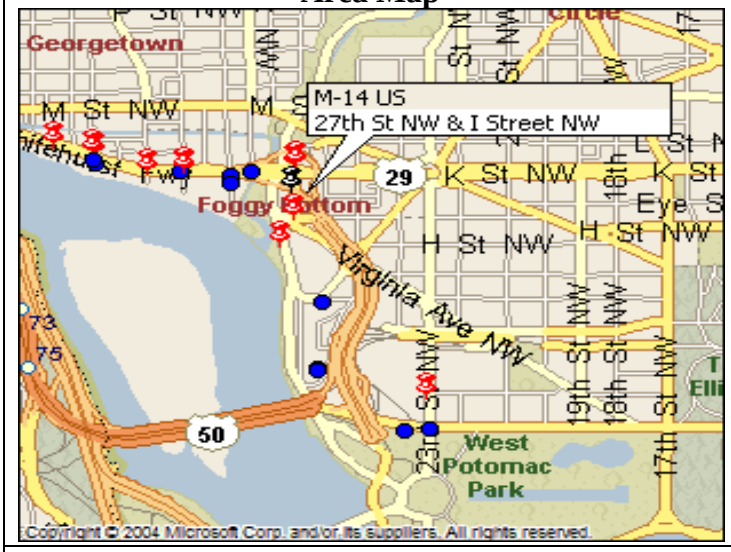
Sensor Configuration:

(Please include Serial Numbers when possible)

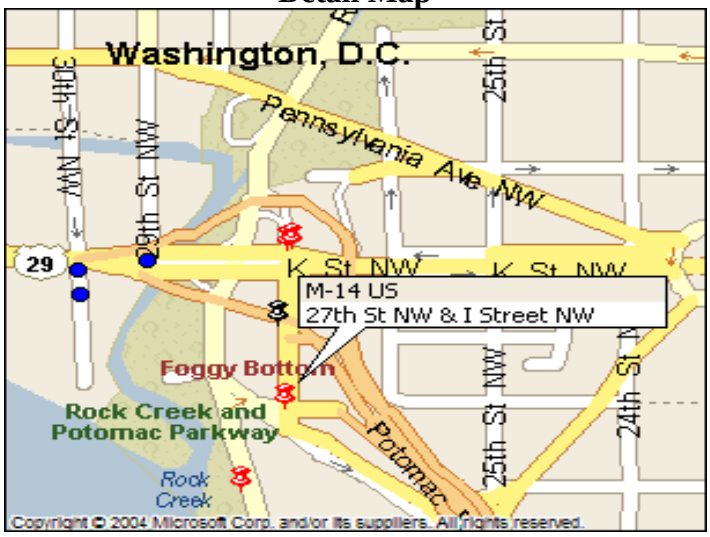
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map



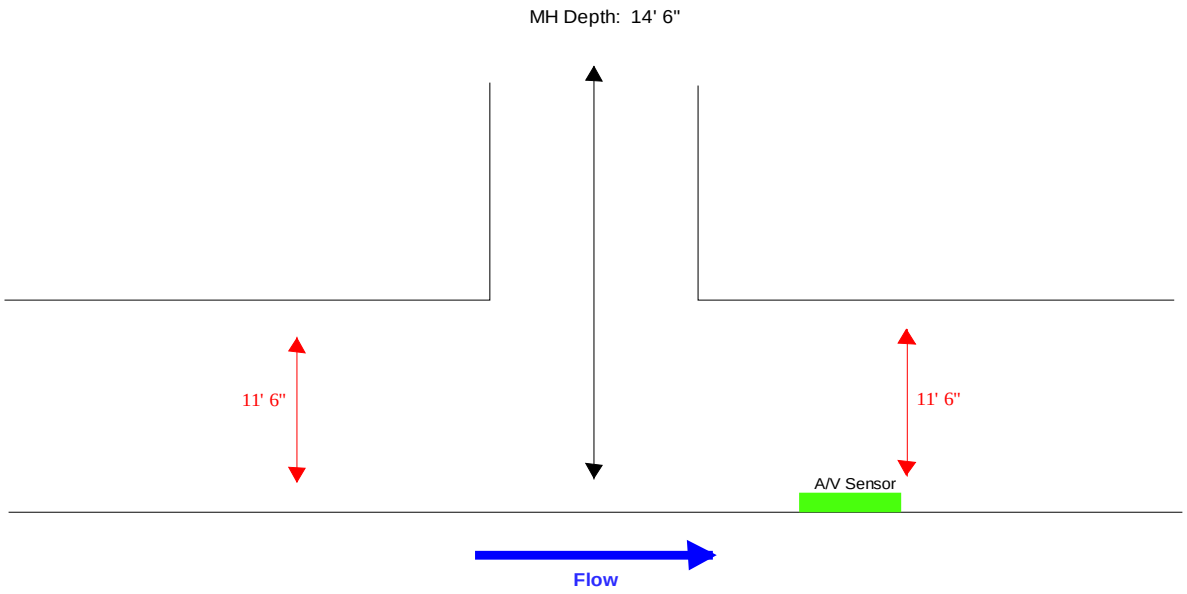
View from top of MH

Site Overview

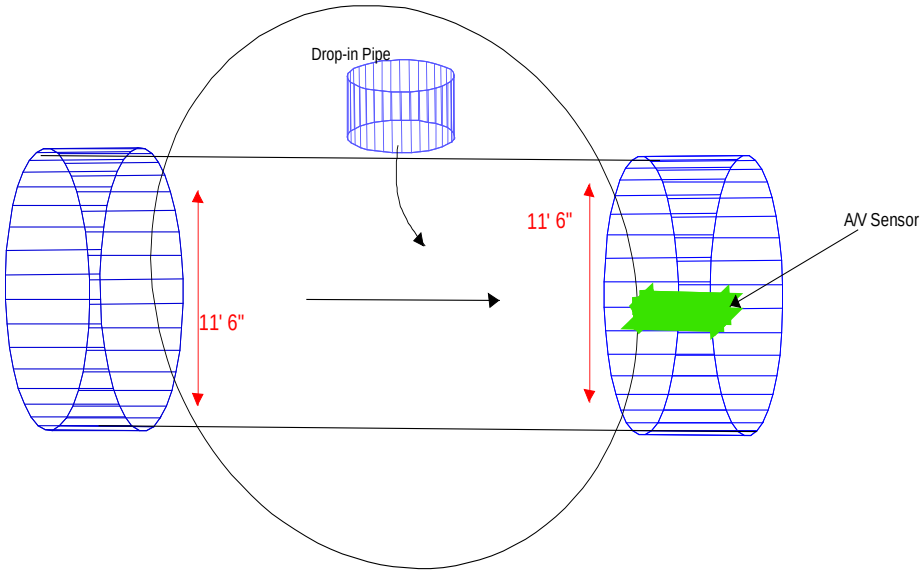
View of flow through influent line

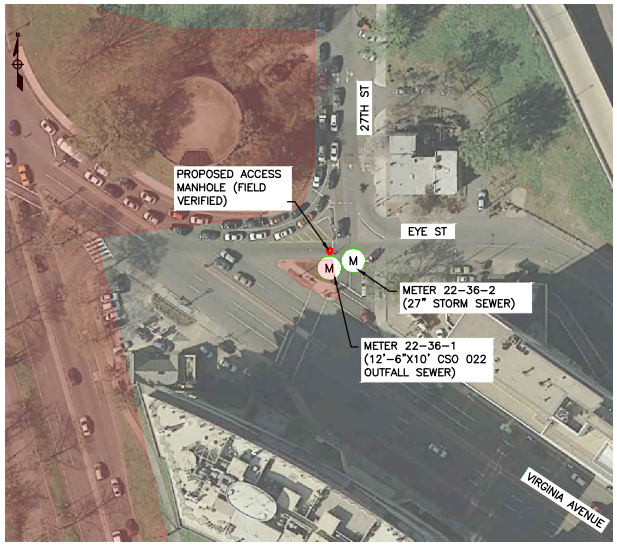
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

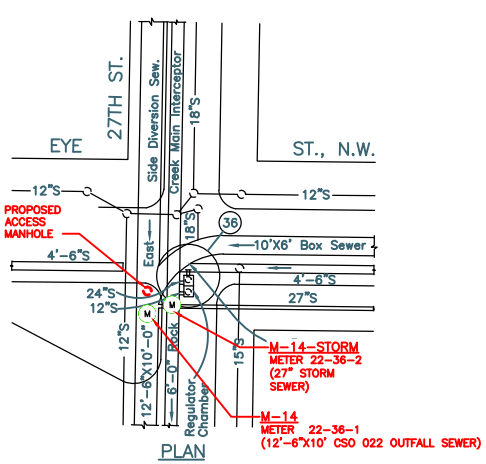


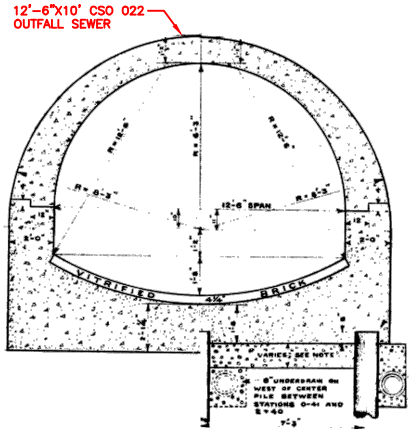
Dimension Structure Detail (Plan View)



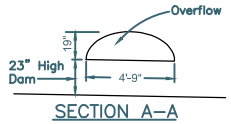


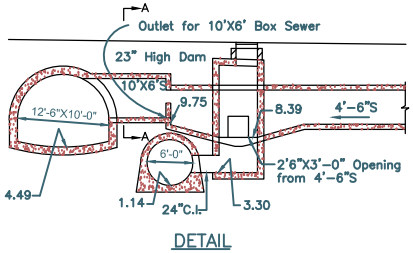
FLOW METER LOCATION PLAN
SCALE: NTS





TYPICAL CROSS SECTION A–A
SCALE NTS





STRUCTURE – 36 DETAIL
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

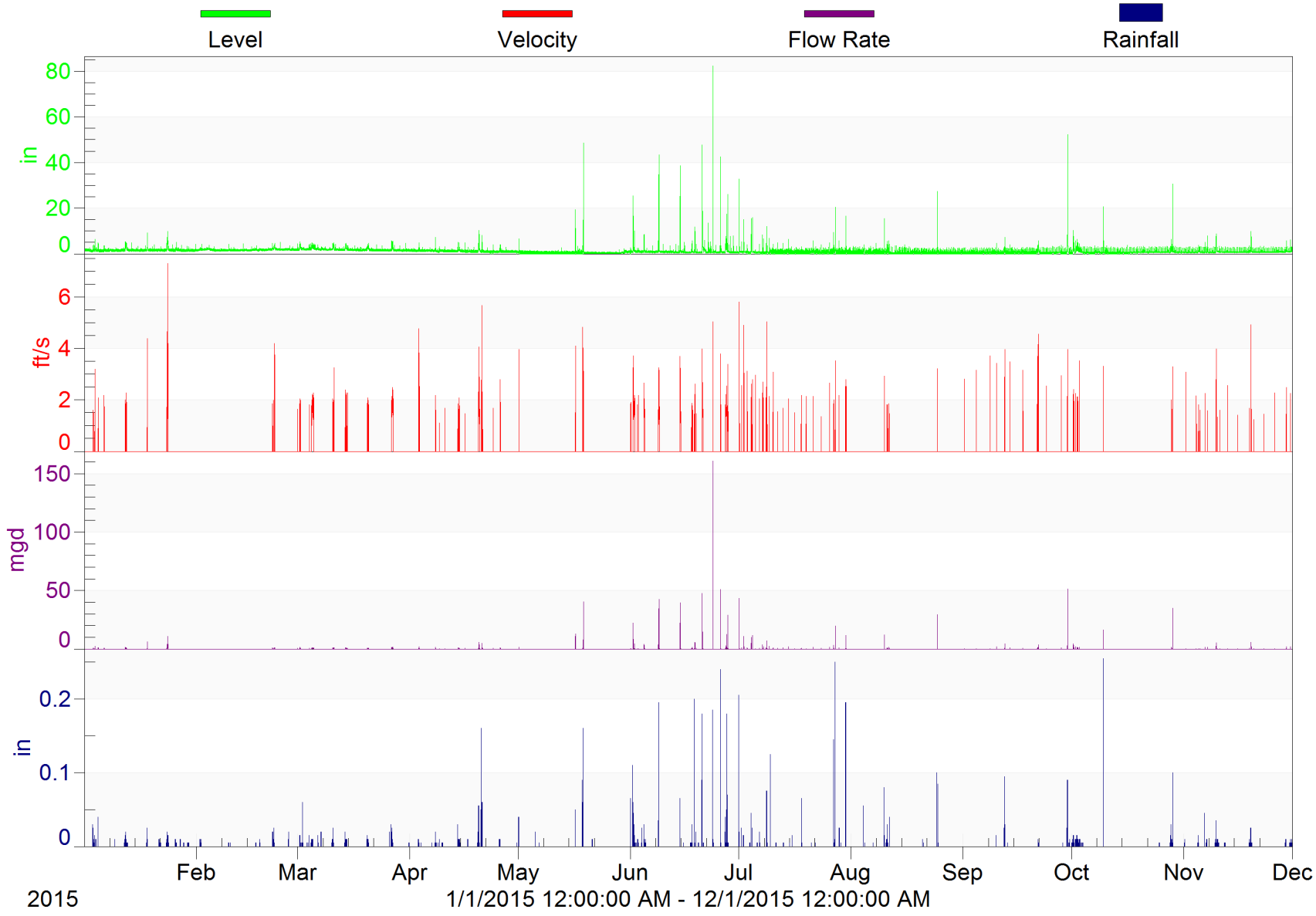
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

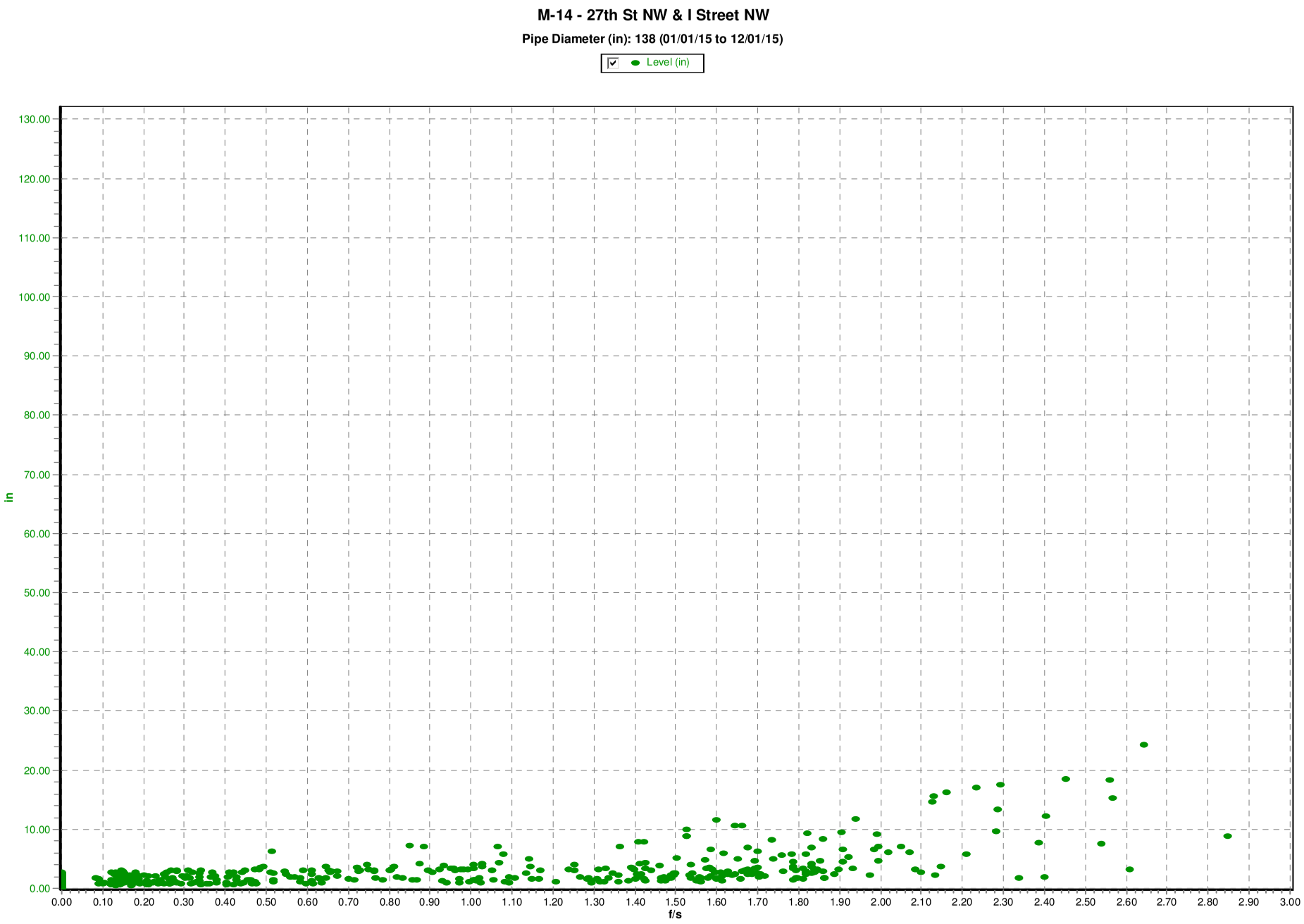
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
22–36–1_2 – 22–36–1_2
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE–14

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:33:33 PM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\14_22-36-1_2.DWG

M-14


Level
Velocity
Flow Rate
Rainfall
80
60
40
20
0
in
6
4
2
0
ft/s
150
100
50
0
mgd
0.2
0.1
0
in
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2015
1/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM


M-14 - 27th St NW & I Street NW
Pipe Diameter (in): 138 (01/01/15 to 12/01/15)
Level (in)
in
f/s
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00

M-14

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
12/11/2014	14:41		1.25		0	0		AP/GH	Install.
12/11/2014	14:46		1.25		0	0		AP/GH	
12/11/2014	14:51		1.25		0	0		AP/GH	
1/15/2015	10:24		0.5		0	0		AP/AM	CB Telog.
2/20/2015	12:00		0		0	0	5.98	AP/AM	CB Telog.
3/4/2015	13:00		0.5		0	0	6.12	AP/AM	CB Telog.
3/18/2015	15:00		0		0	0	6.07	AP/AM	CB Telog.
4/3/2015	14:00		0.5		0	0	6.03	AP/AM	CB Telog.
4/30/2015	12:00		0		0	0	6.12	LL/DW	CB Telog.
5/29/2015	11:56		1		0	0		LR/DW	CB Telog.
5/29/2015	12:02	0.89	1		0	0		LR/DW	CB Telog.
6/23/2015	11:00		0		0	0		LL/DW	CB Telog.
6/24/2015	10:30		0.25		0	0		LL/DW	Swap Antenna.
7/23/2015	11:59		0.5		0	0		LL/DW	CB Telog.
8/14/2015	11:20		0		0	0		LR/DW	CB Telog.
9/8/2015	10:29		0.5		0	0		LR/JC	CB Telog.
10/22/2015	12:52		0.5		0	0		JC/RM	CB Telog.
12/22/2015	11:15		0		0	0		BR/PC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-14-Storm

SEWER: ROCK CREEK DIVERSION SEWER

OUTFALL: 022

DURATION: 7/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-14-Storm measured storm flows that enter the overflow sewer upstream of the meter at M-14.

3. The continuity equation was used to calculate a flow rate from these measurements. M-14-Storm is a storm pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.039	0.026	0.005
Max	9.711	3.861	2.565

Site Name/Manhole # M-14-Storm Primary: [X] Alternate: [ ]

Investigation Date: 6/23/15 Time: 12:15 Crew Members: CL/JC/DW

Installation Date: 6/23/15 Time: 12:30 Crew Members: CL/JC/DW

Address/Location: 27th St NW & I Street NW

Latitude: N 38° 54.043' Longitude: W 77° 3.369'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec

Depth 0.0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	27"		27"
Width	27"		27"
Material	Brick		Brick
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

☐ Remains in pipe

☐ _____ft from rim

☐ Reaches Rim (potential meter damage)

☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ Good (no problems accessing site)

☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)

☐ Poor (remote areas, steel embankments, ~~No safe place to park, elevated MH >3 ft)~~

☐ (Traffic Control only (Requires extra traffic control)

☐ Unusable (~~Document in Comments section~~)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 14'6"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

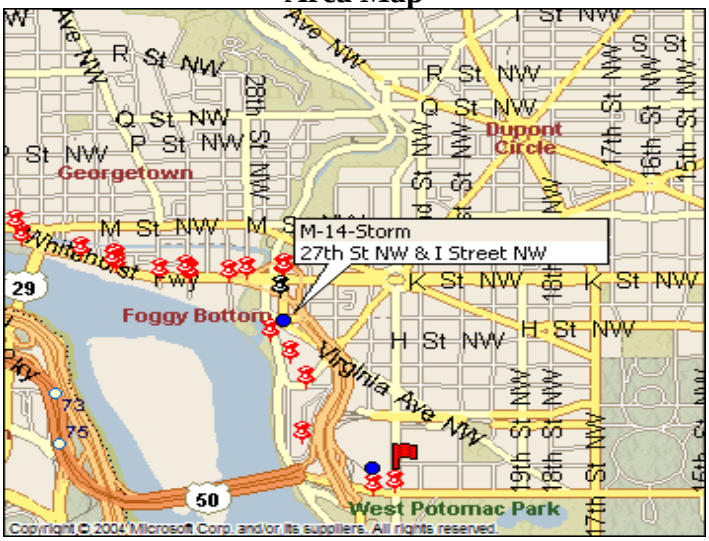
Sensor Configuration:

(Please include Serial Numbers when possible)

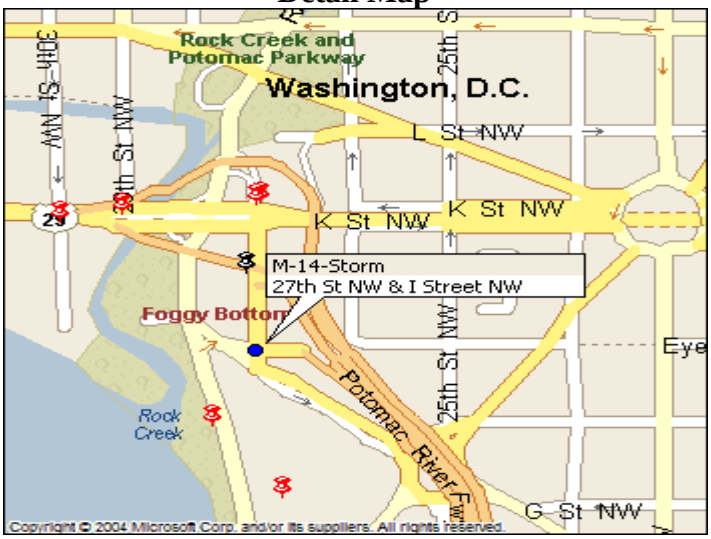
Level	Primary: Flowav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



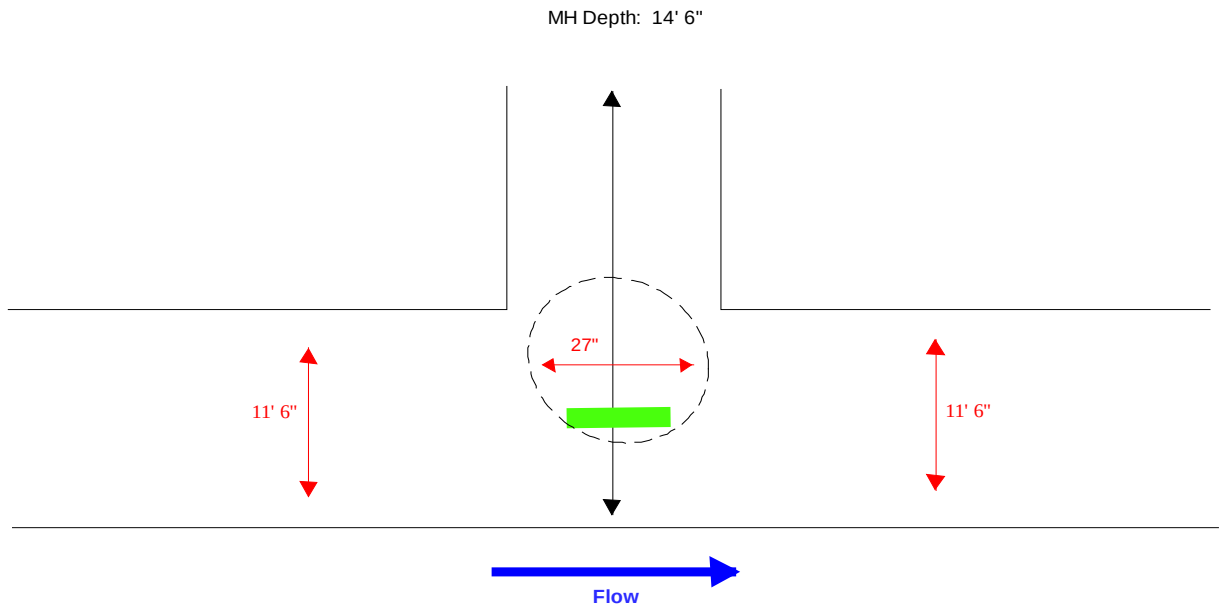
View from top of MH

Site Overview

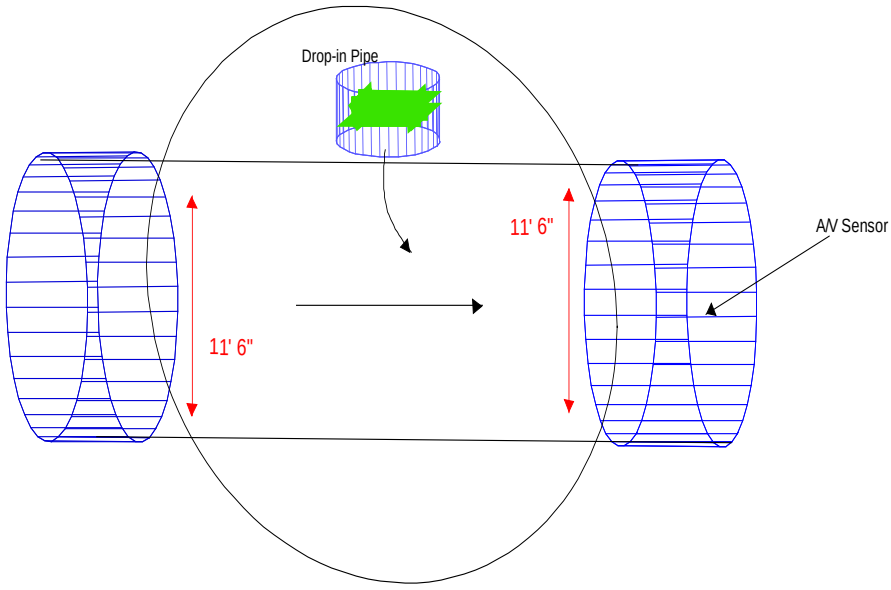
View of flow through influent line

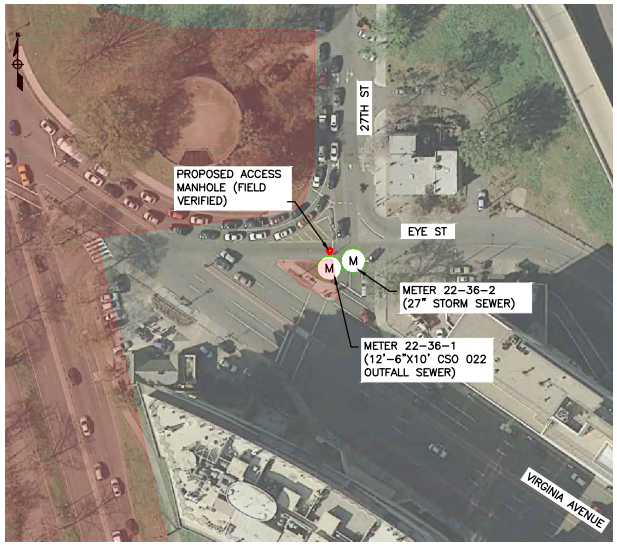
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

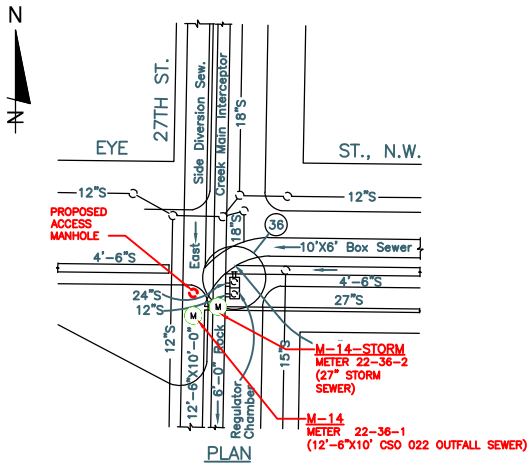


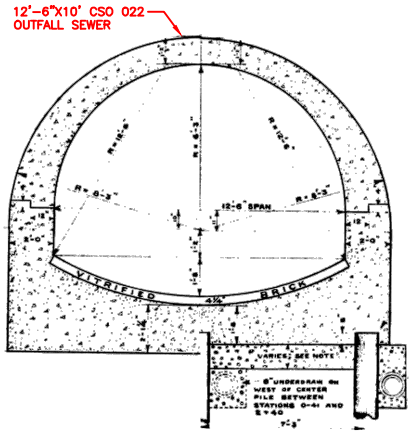
Dimension Structure Detail (Plan View)



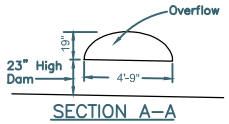


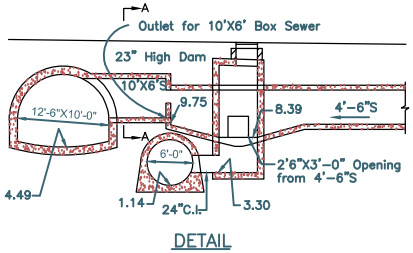
FLOW METER LOCATION PLAN
SCALE: NTS





TYPICAL CROSS SECTION A–A
SCALE NTS





STRUCTURE – 36 DETAIL
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
22–36–1_2 – 22–36–1_2
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE–14

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:33:33 PM
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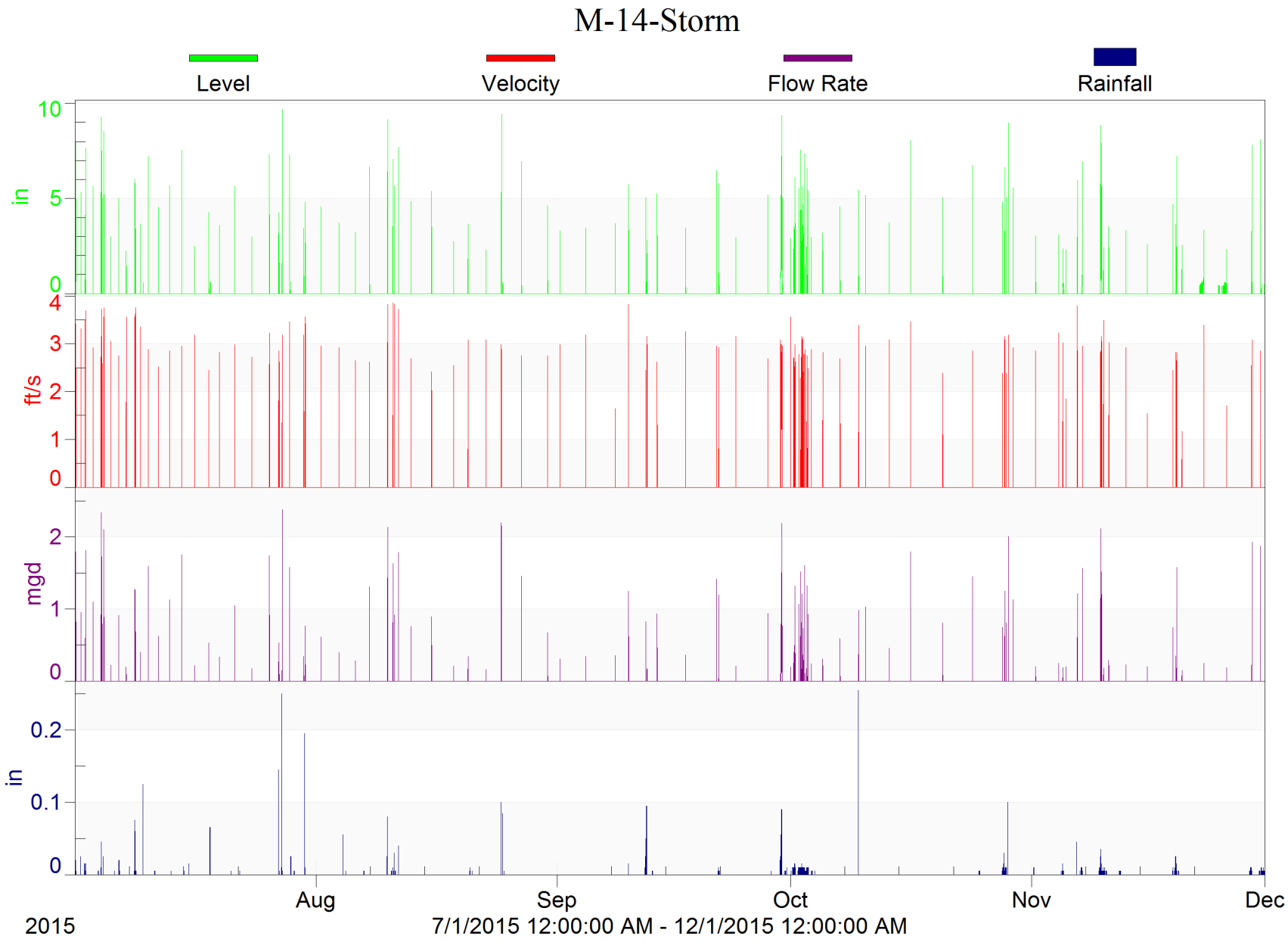
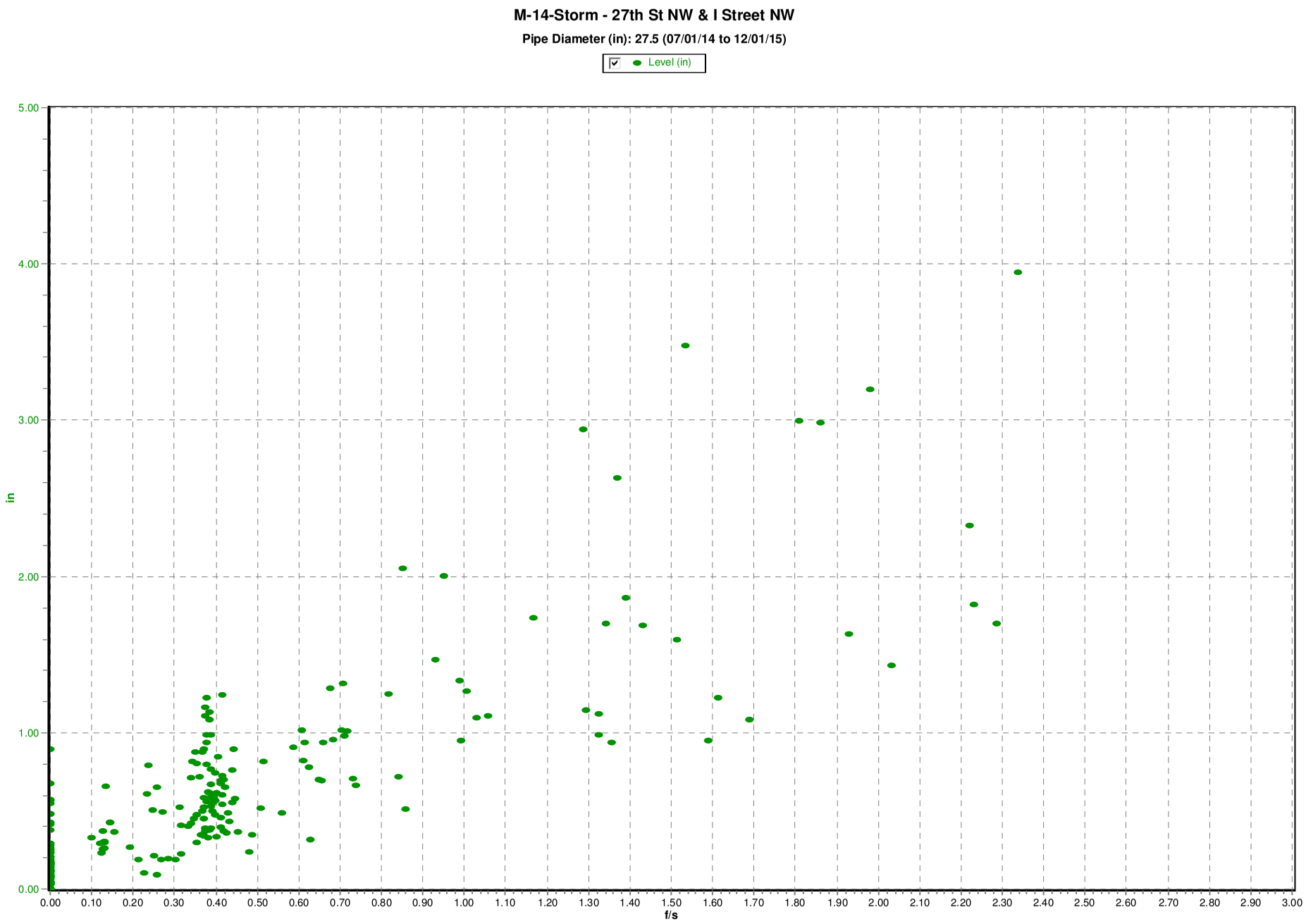

M-14-Storm
Level
Velocity
Flow Rate
Rainfall
10
5
0
in
4
3
2
1
0
ft/s
2
1
0
mgd
0.2
0.1
0
in
Aug
Sep
Oct
Nov
Dec
2015
7/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM


M-14-Storm - 27th St NW & I Street NW
Pipe Diameter (in): 27.5 (07/01/14 to 12/01/15)
Level (in)
in
f/s
5.00
4.00
3.00
2.00
1.00
0.00
0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80 1.90 2.00 2.10 2.20 2.30 2.40 2.50 2.60 2.70 2.80 2.90 3.00

M-14-Storm

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
6/23/2015	13:29	0	0	0	0	0		LL/DW	Install.
9/8/2015	10:45		0		0	0		LR/JC	CB Telog.
11/12/2015	9:11		0		0	0		LR/JC	CB Telog.
12/22/2015	11:30	0	0	0	0	0		BR/PC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-15

SEWER: POTOMAC RIVER INTERCEPTOR

OUTFALL: n/a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-15 measured flows on the Potomac River Interceptor downstream of Structure 37a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-15 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	31.795	0	0
Avg.	68.008	2.984	74.576
Max	201.794	11.281	207.148

Site Name/Manhole # M-15 Primary: [X] Alternate: [ ]

Investigation Date: 12/3/13 Time: 15:30 Crew Members: LR/JS/BC

Installation Date: 11/24/14 Time: 16:25 Crew Members: LR/SD

Address/Location: In the grass on 27th St NW, between K St. NW & Virginia Ave NW (by the overpass)

Latitude: N 38° 54.090' Longitude: W 77° 3.363'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 3.64 ft/sec

Depth 63.25 in

Turbulence Amplitude:

- (Less than 0.25"
- 0.25" to 0.75"
- 0.75" to 1.5"
- 1.5" to 3"
- Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	8'	36"	8'
Width	8'	36"	8'
Material	Concrete	Concrete	Concrete
Shape	Round	Round	Chamber

Sediment Present:

(Yes Hard packed: 6 in. deep

No Soft: __ in. deep

Surcharge / Backwater Influence:

- No evidence visible
- (Remains in pipe
- _____ft from rim
- Reaches Rim (potential meter damage)
- Evidence unclear: _____ft from rim

Gas Investigation: *Bad air (Low oxygen, 18.7)*

- Good 18.7 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site)
- Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- Traffic Control only (Requires extra traffic control
- Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: Yes (No)

Height above ground ____

Manhole depth 28'

Structural Integrity of Manhole:

Good (Fair) Poor

Pipe Bends: *None within camera view*

Influent (Effluent) Manhole

Approx Distance to bend: 6.5 ft

Pipe Size/Geometry/Material Change:

Influent Effluent Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) No Maybe

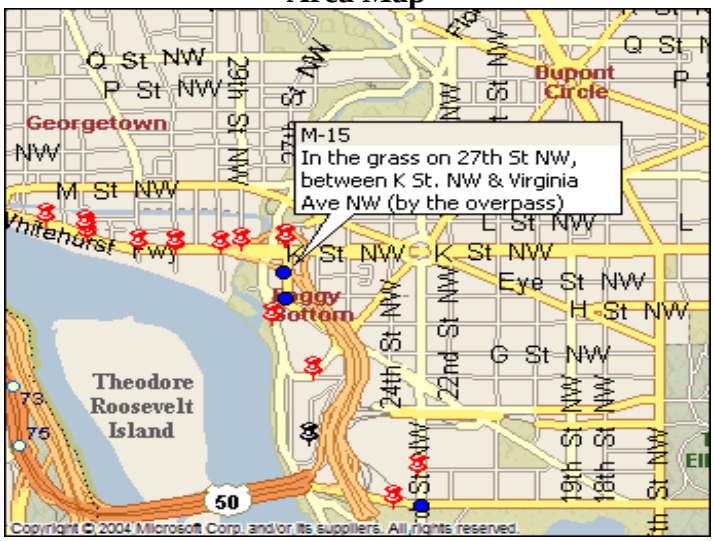
Sensor Configuration:

(Please include Serial Numbers when possible)

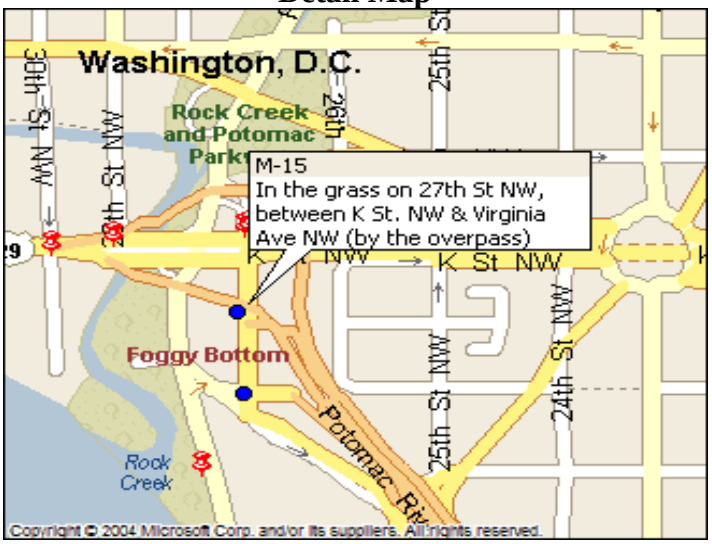
Level	Primary: Ultrasonic Depth
	Redundant:
Velocity	Primary: ADS Surface Combo
	Redundant:
Meter Logger	Triton 20084

Comments: *2' of chamber US before pipe connects. Chamber is 8' wide.*

Area Map



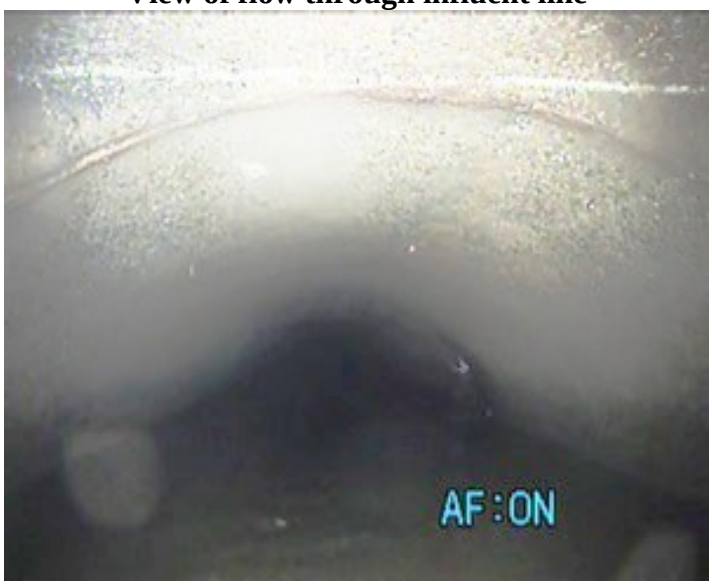
Detail Map



View from top of MH

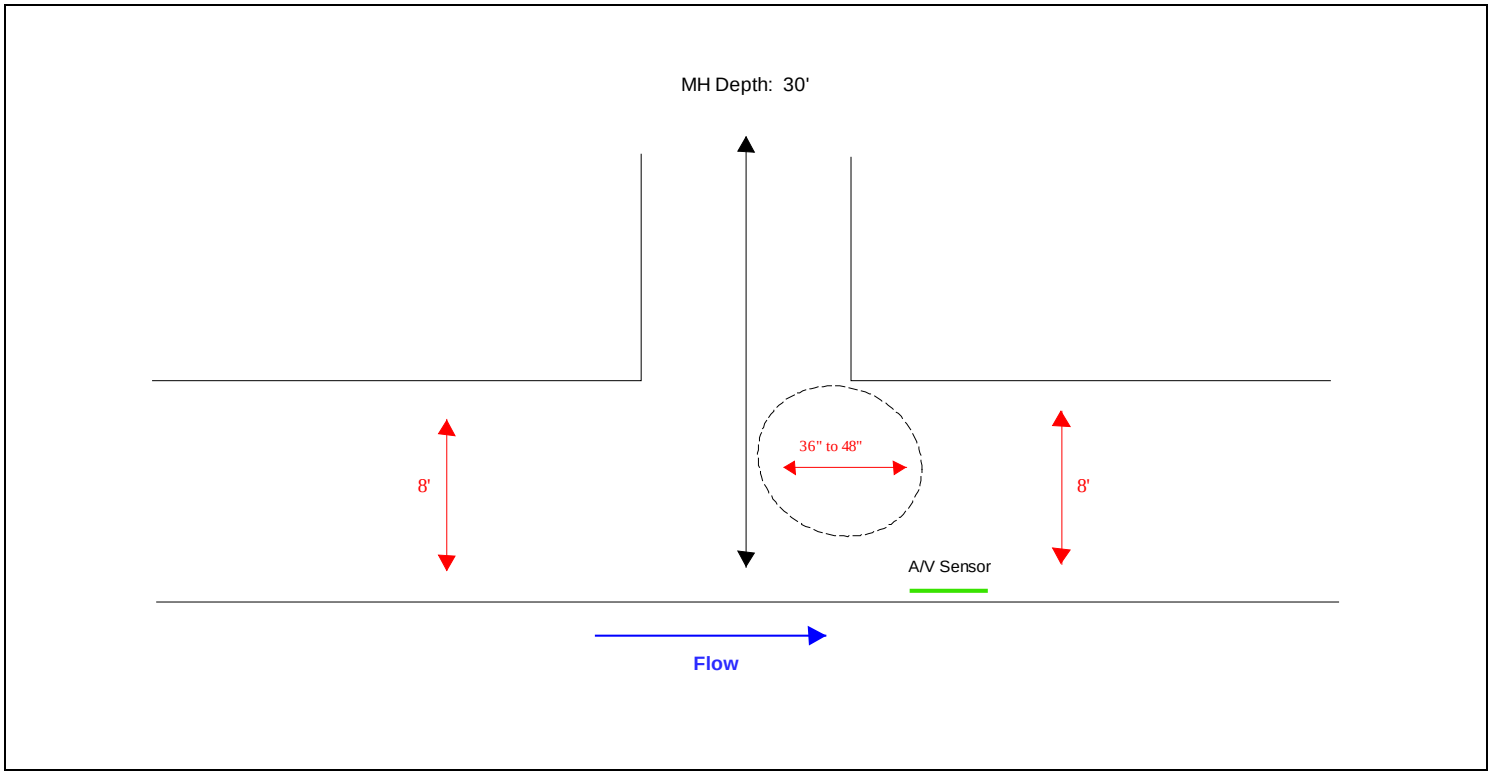
Site Overview

View of flow through influent line

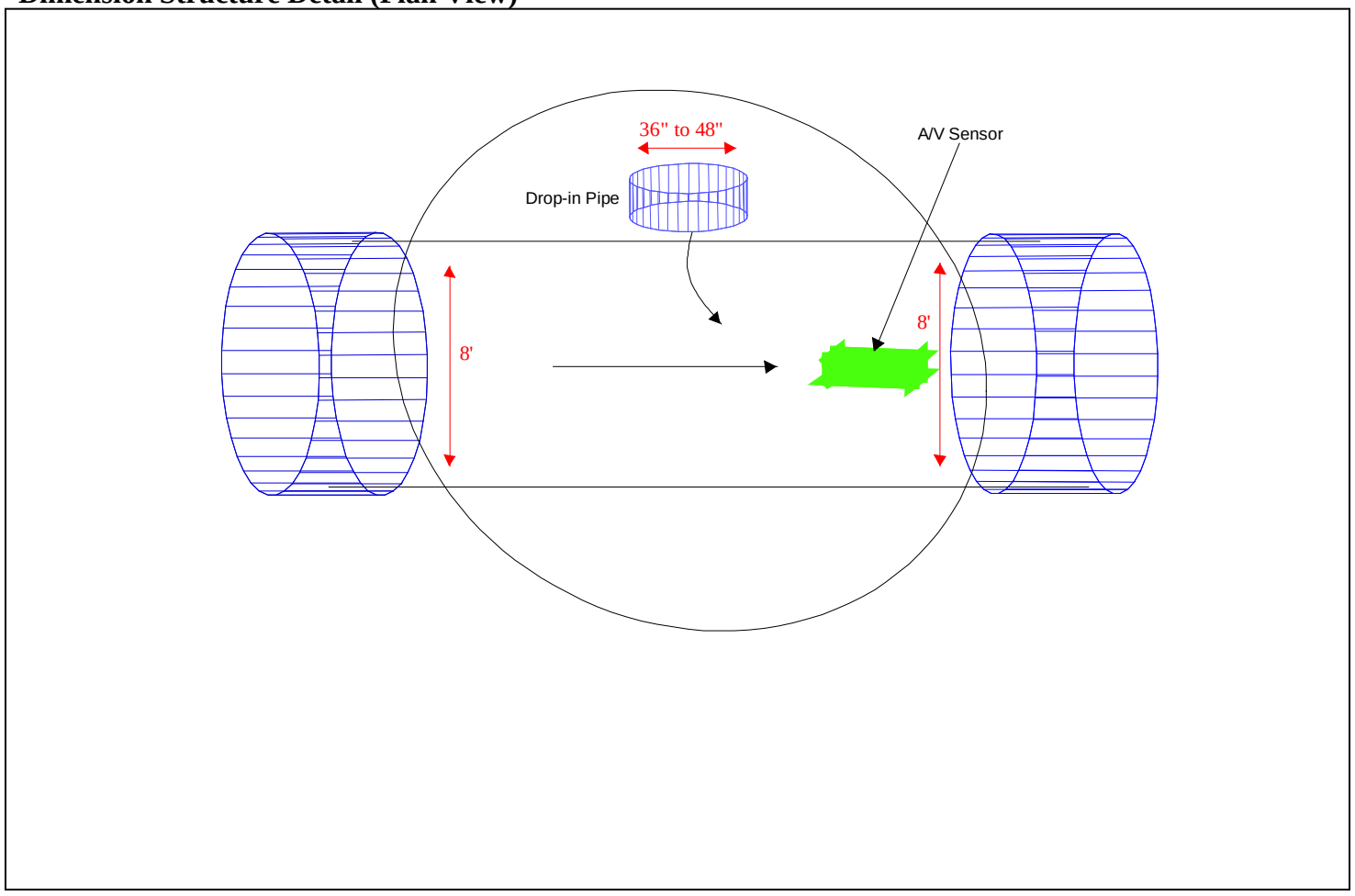


View of flow through effluent line

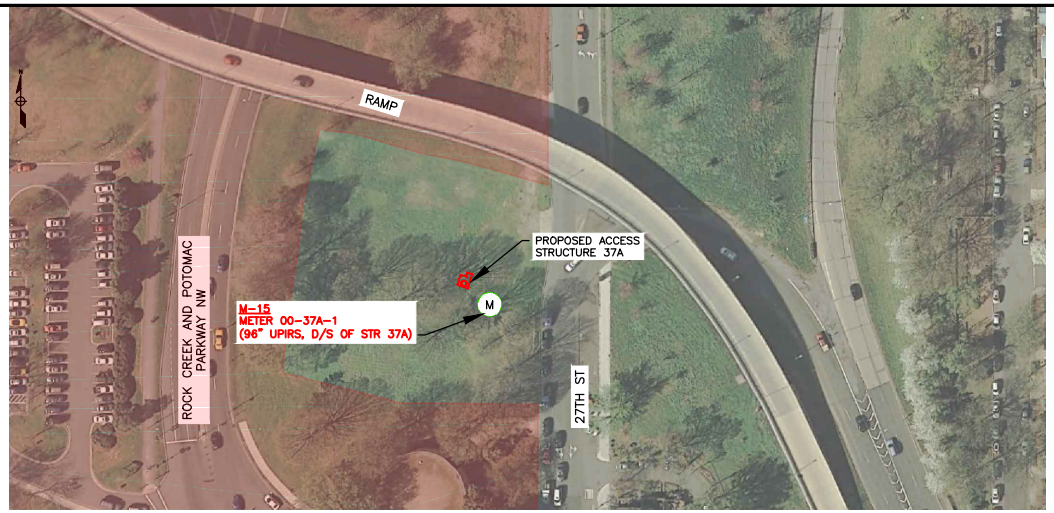
Dimensional Structure Profile View (profile sketch showing location of sensors)

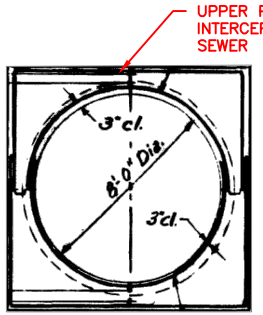


Dimension Structure Detail (Plan View)

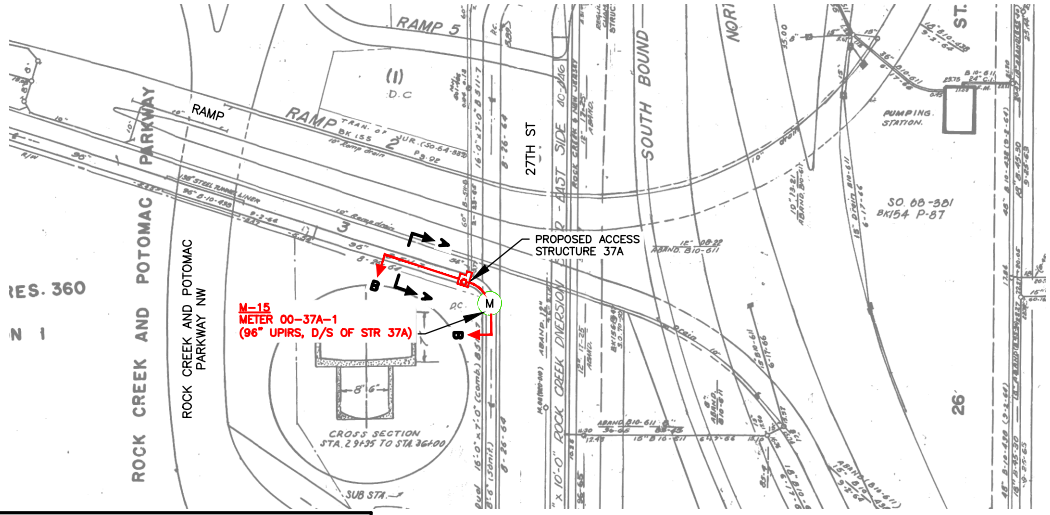


1 – FLOW METER

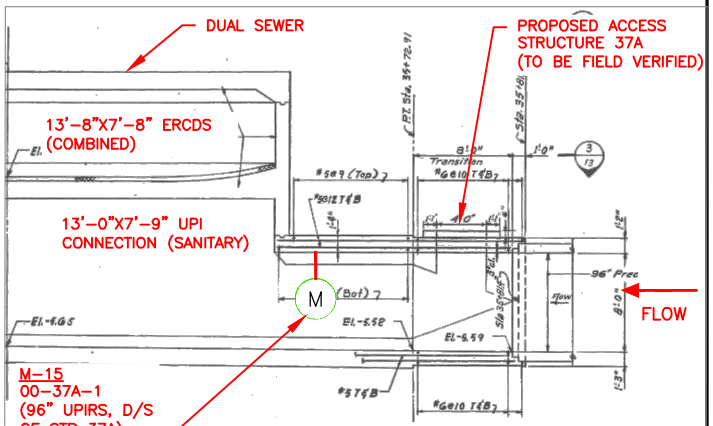




TYPICAL CROSS SECTION A–A
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

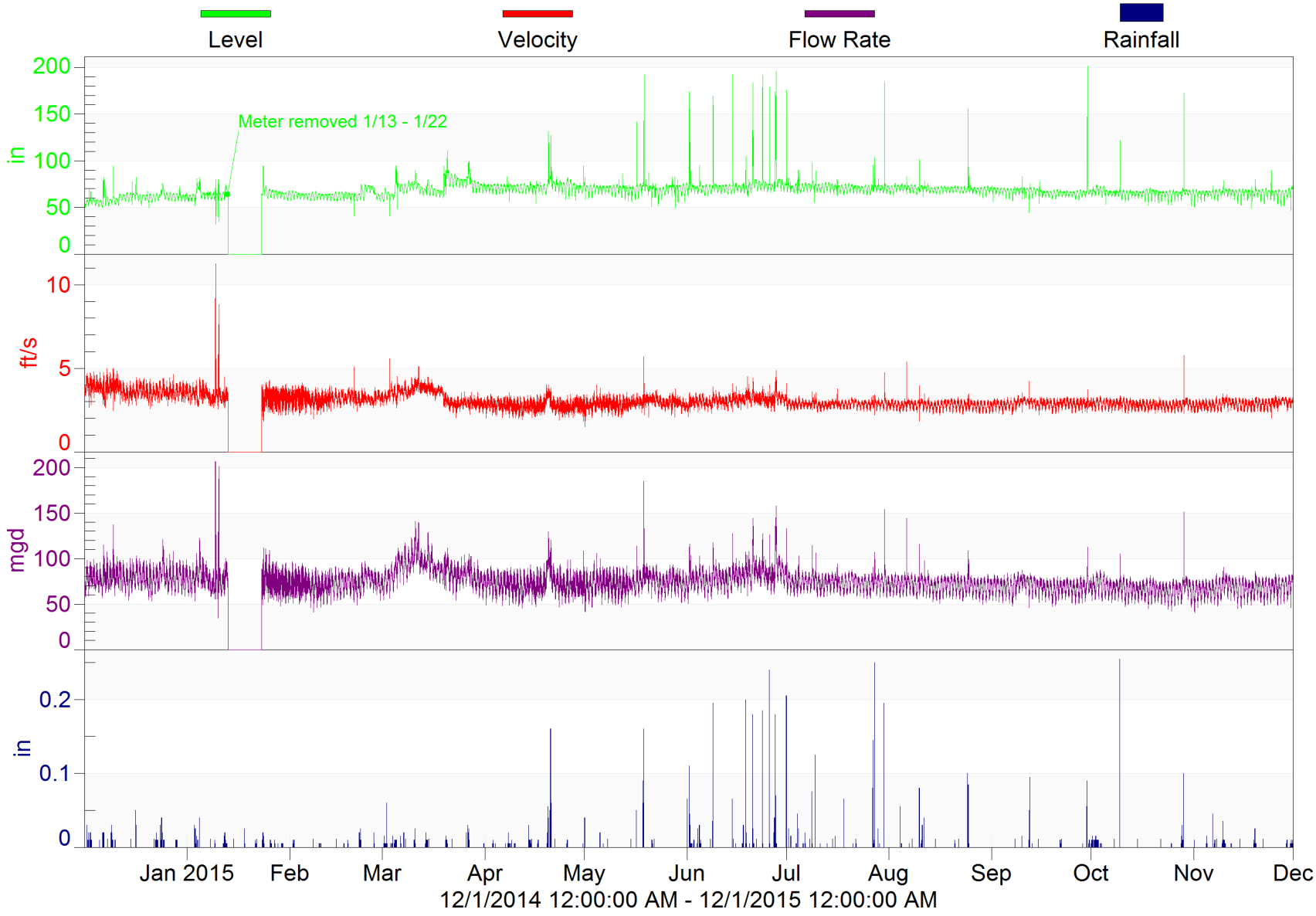
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

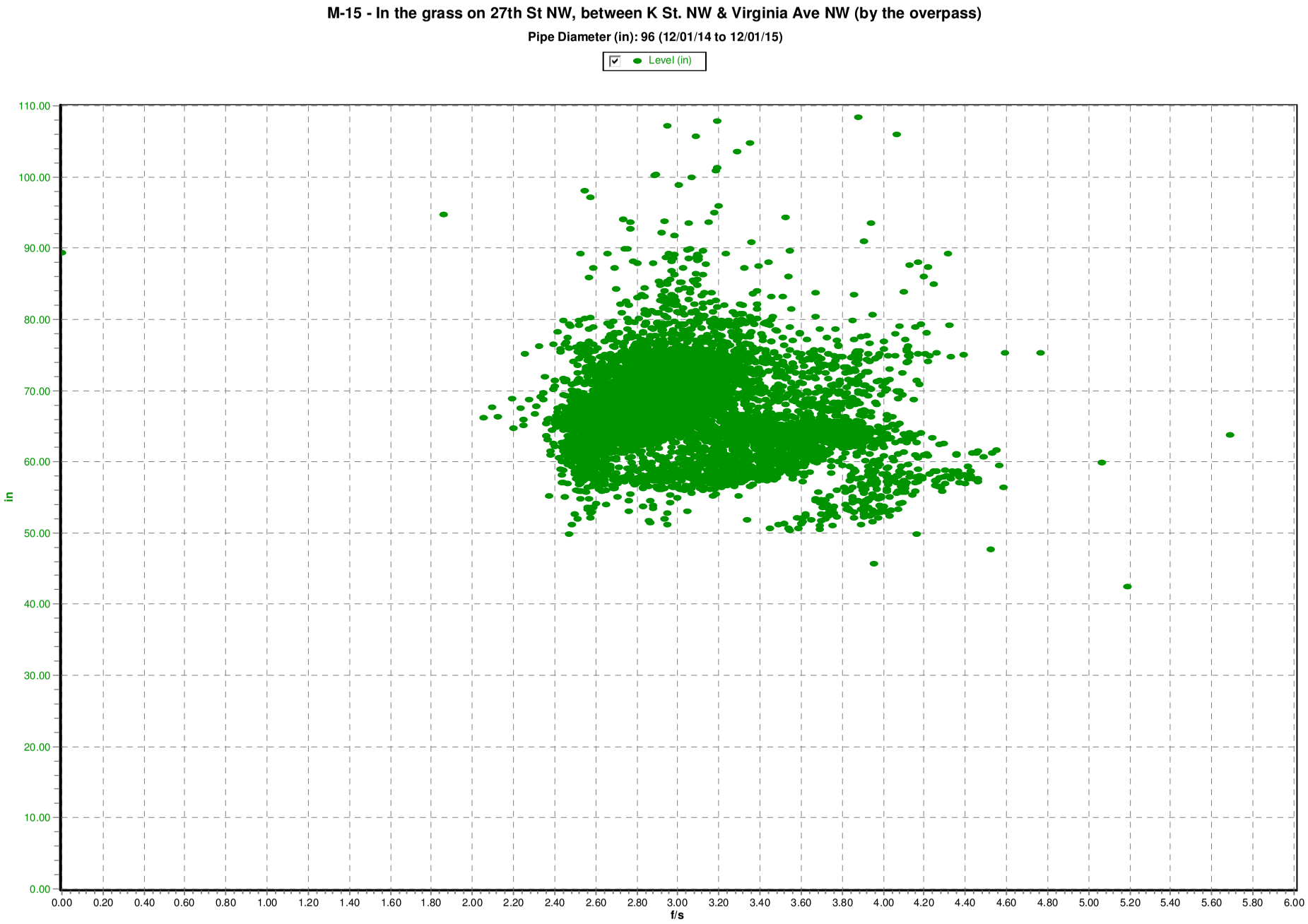
00-37A-1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 15

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:12:01 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\15_00-37A-1.DWG

M-15


Level
Velocity
Flow Rate
Rainfall
Meter removed 1/13 - 1/22
in
200
150
100
50
0
ft/s
10
5
0
mgd
200
150
100
50
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-15 - In the grass on 27th St NW, between K St. NW & Virginia Ave NW (by the overpass)
Pipe Diameter (in): 96 (12/01/14 to 12/01/15)
Level (in)
in
f/s
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00

M-15

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/25/2014	17:15		63.25		3.4	0		LR/AP	Install.
11/25/2014	17:23	62.92	63.25	3.34	3.5	0		LR/AP	
11/25/2014	17:28	62.78	63.25	3.55	3.83	0		LR/AP	
11/25/2014	17:33	63.01	63.25	3.48	3.64	0		LR/AP	
12/29/2014	15:00		66.25		3.5	0		LR/AP	
1/21/2015	10:36		63.5		3.41	0	11.17	AP/AM	Swap antenna. Restore meter function.
1/22/2015	10:00		66		3.33	0		AP/AM	
2/13/2015	8:41	57.3	57.5	3.05	3.1	0	11.8	LR/AM	
3/17/2015	16:20		68		3.8	0	10.69	AP/AM	
3/23/2015	12:10		77		2.8	0		AP/AM	
5/14/2015	14:26	70.87	71	3.05	3.1	0		LR/DW	
7/14/2015	11:32		70.5		2.23	0		LR/DW	
8/12/2015	13:09		72		2.8	0		LR/DW	
9/22/2015	15:02		66.25		3.2	0		LR/JC	
11/20/2015	8:37		63.5		2.64	0		LR/JC	
12/21/2015	15:00		69		2.45	0		BR/PC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-16-Weir

SEWER: WEST ROCK CREEK DIVERSION SEWER

OUTFALL: 024

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-16-Weir measured excess flows from the West Rock Creek Diversion Sewer before entering the Potomac River through CSO 024.

3. The weir formula was used to calculate a flow rate from these measurements. M-16-Weir is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.02	0.011	0.028
Max	27.503	5.942	74.676

Site Name/Manhole # M-16-Weir Primary: [X] Alternate: [ ] Grade: [ ]

Investigation Date: 11/21/13 Time: 16:05 Crew Members: LR/JS

Installation Date: 11/18/14 Time: 10:00 Crew Members: LR/CL

Address/Location: 30th St. NW, in the vicinity of the Swedish Embassy at 2901 K St. NW

Latitude: N 38°54,153' Longitude: W 77°3,547'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0 ft/sec

Depth 39.0 in

Turbulence Amplitude: *NA*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	7' 8"	~	7' 8"
Width	7' 8"		7' 8"
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 14.5'

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ Yes ☐ No ☐ Maybe

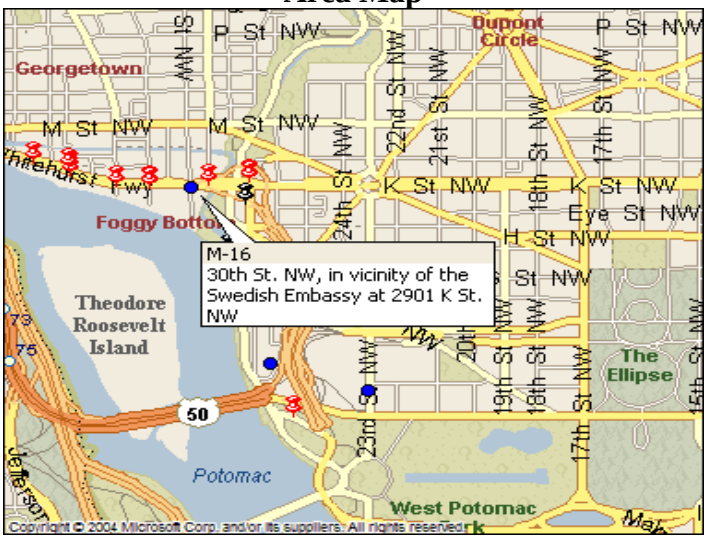
Sensor Configuration:

(Please include Serial Numbers when possible)

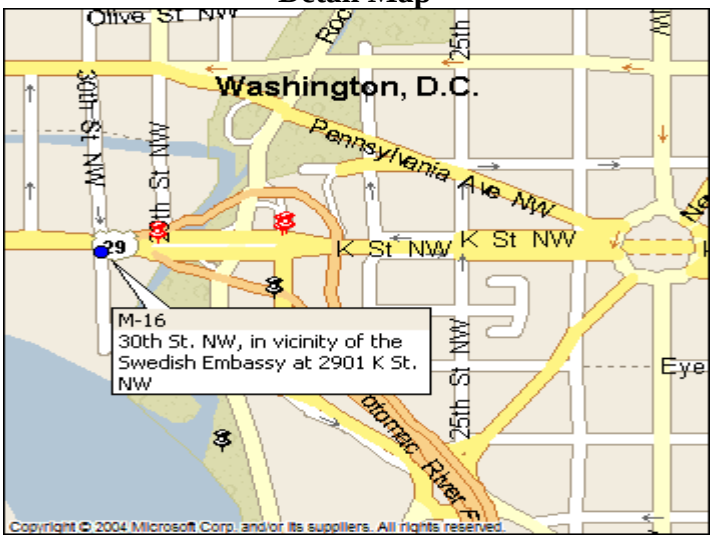
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Existing sensor*

Area Map



Detail Map

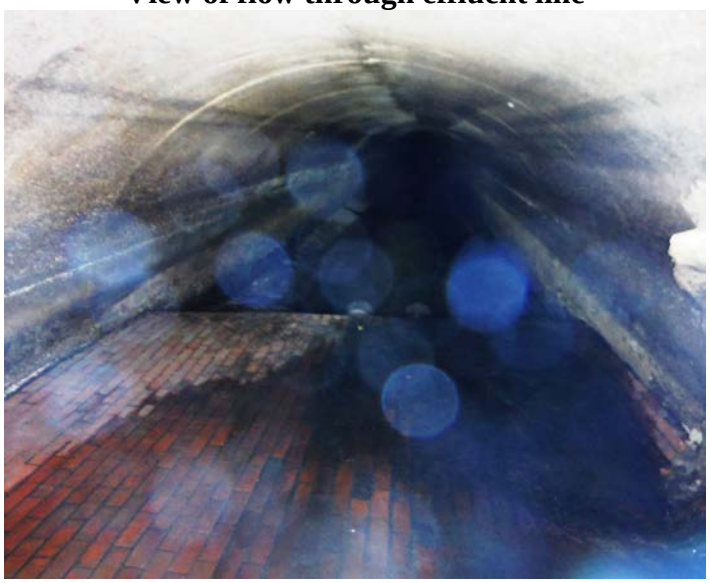


View from top of MH

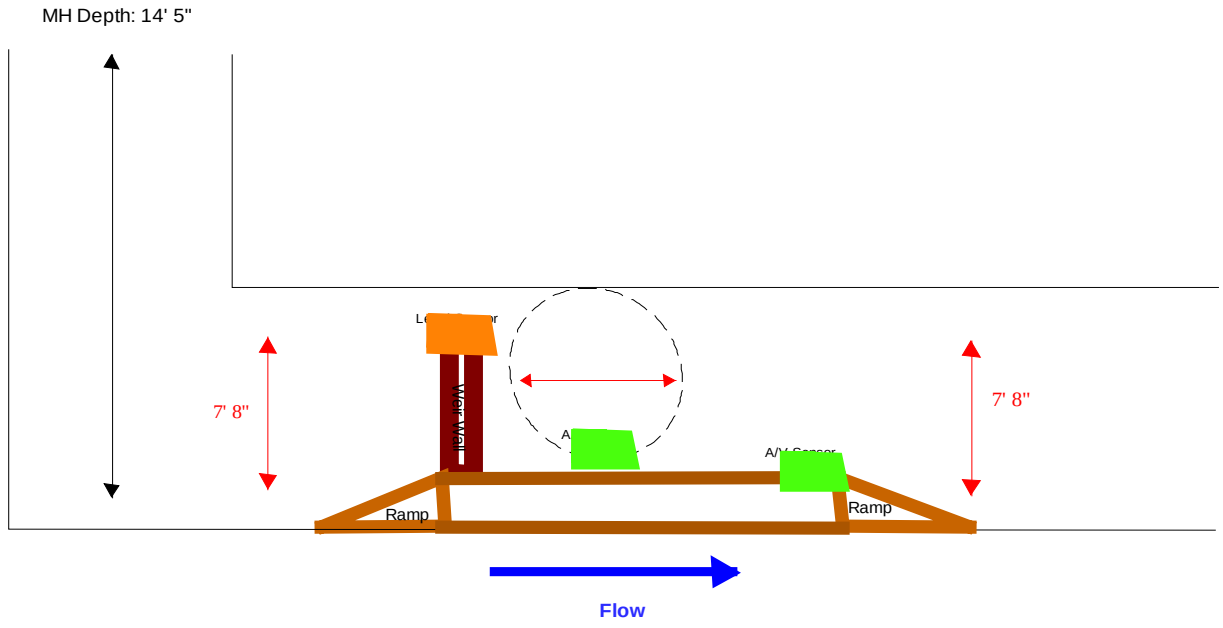
Site Overview

View of flow through influent line

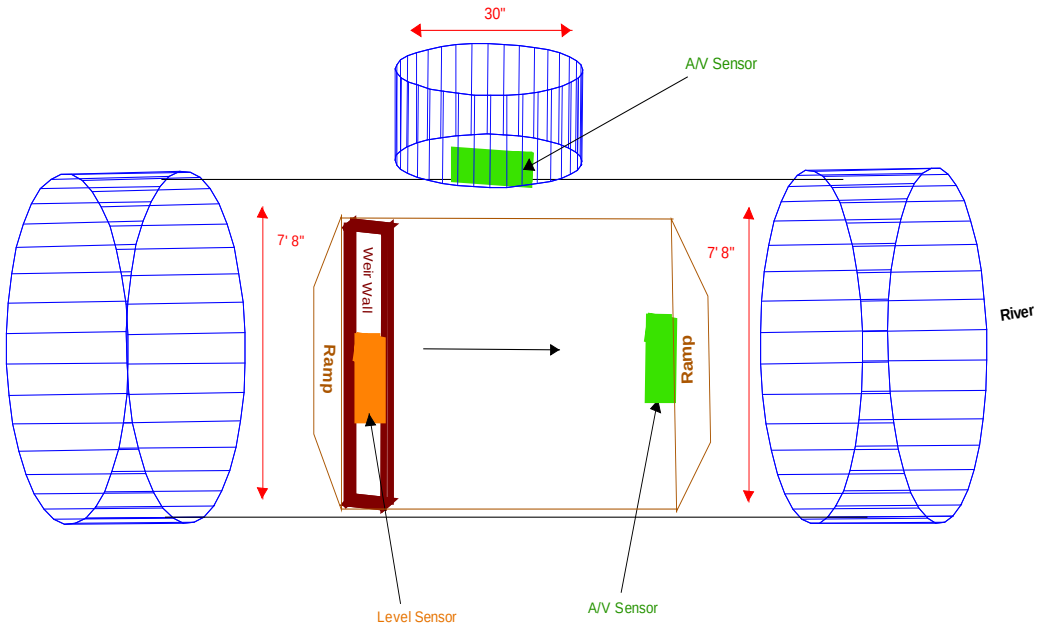
View of flow through effluent line



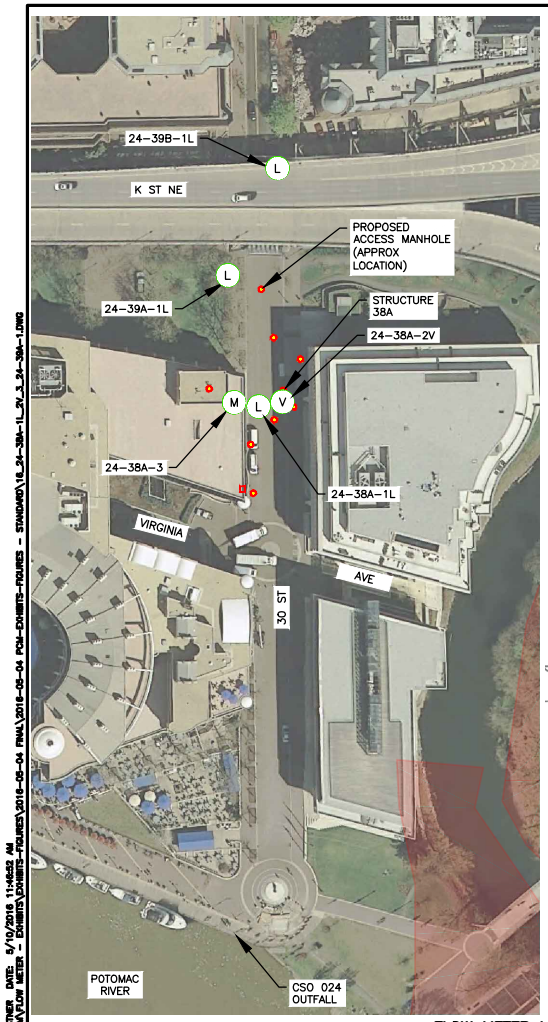
Dimensional Structure Profile View (profile sketch showing location of sensors)



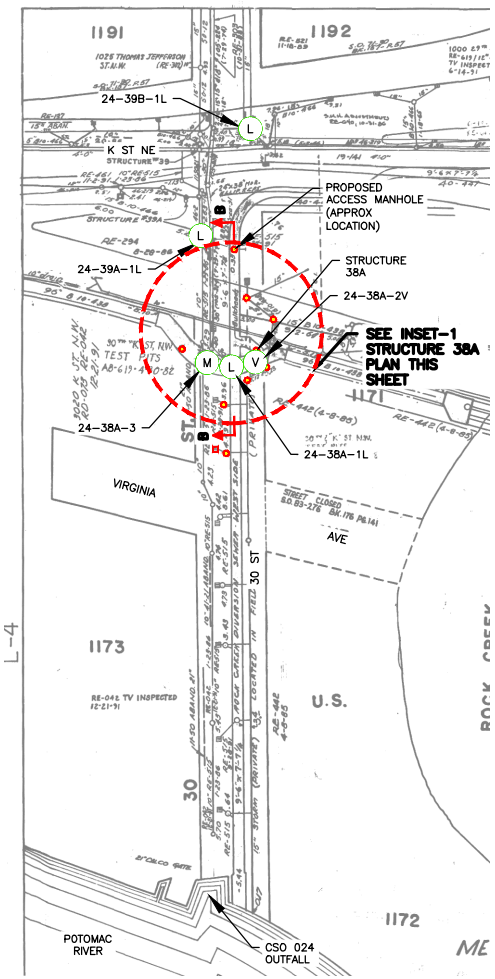
Dimension Structure Detail (pipe profile)

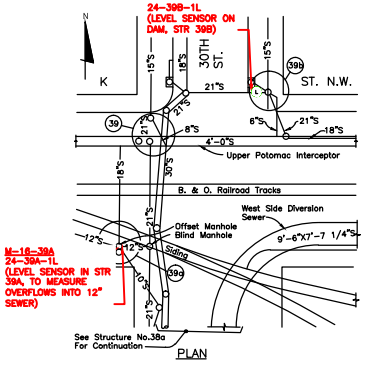


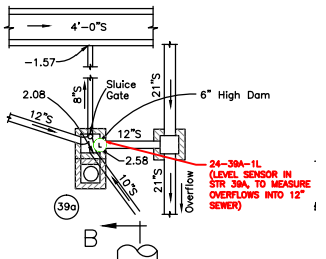
All sensor locations are provisional



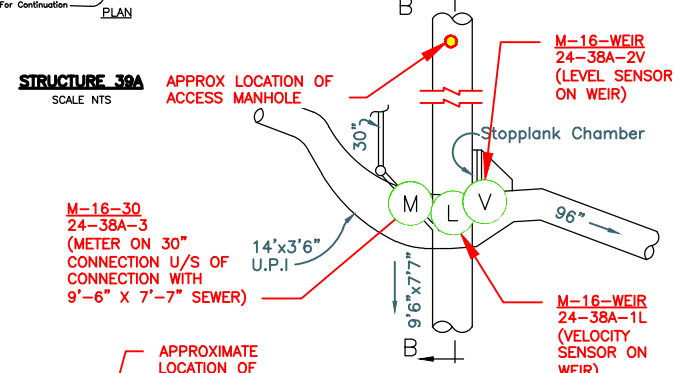
FLOW METER LOCATION PLAN
SCALE: NTS

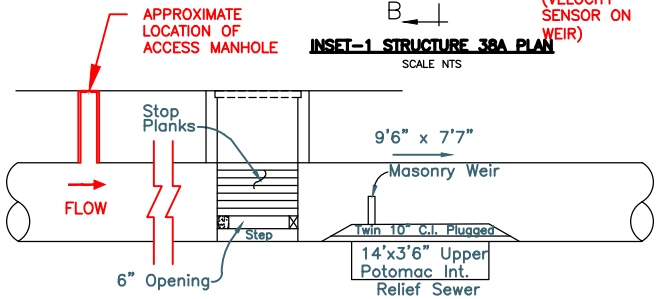






2 – FLOW METERS
3 – LEVEL SENSORS
1 – VELOCITY SENSOR





LEGEND

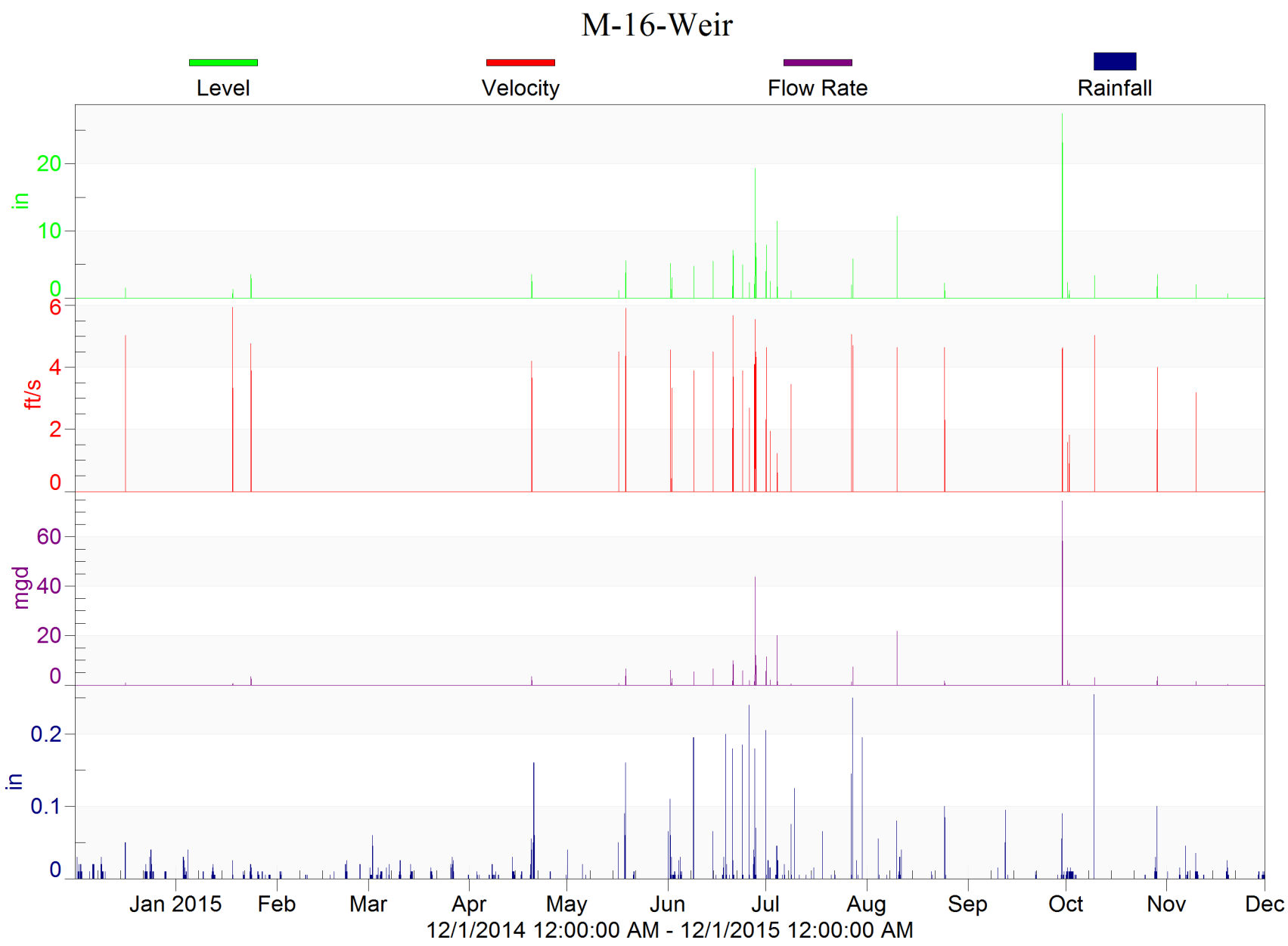
- M — FLOW METER LOCATION
- L — LEVEL SENSOR LOCATION
- V — VELOCITY SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
24-38A-1L_2V_3_24-39A-1 – 24-38A-1
24-39A-1L,24-39B-1L

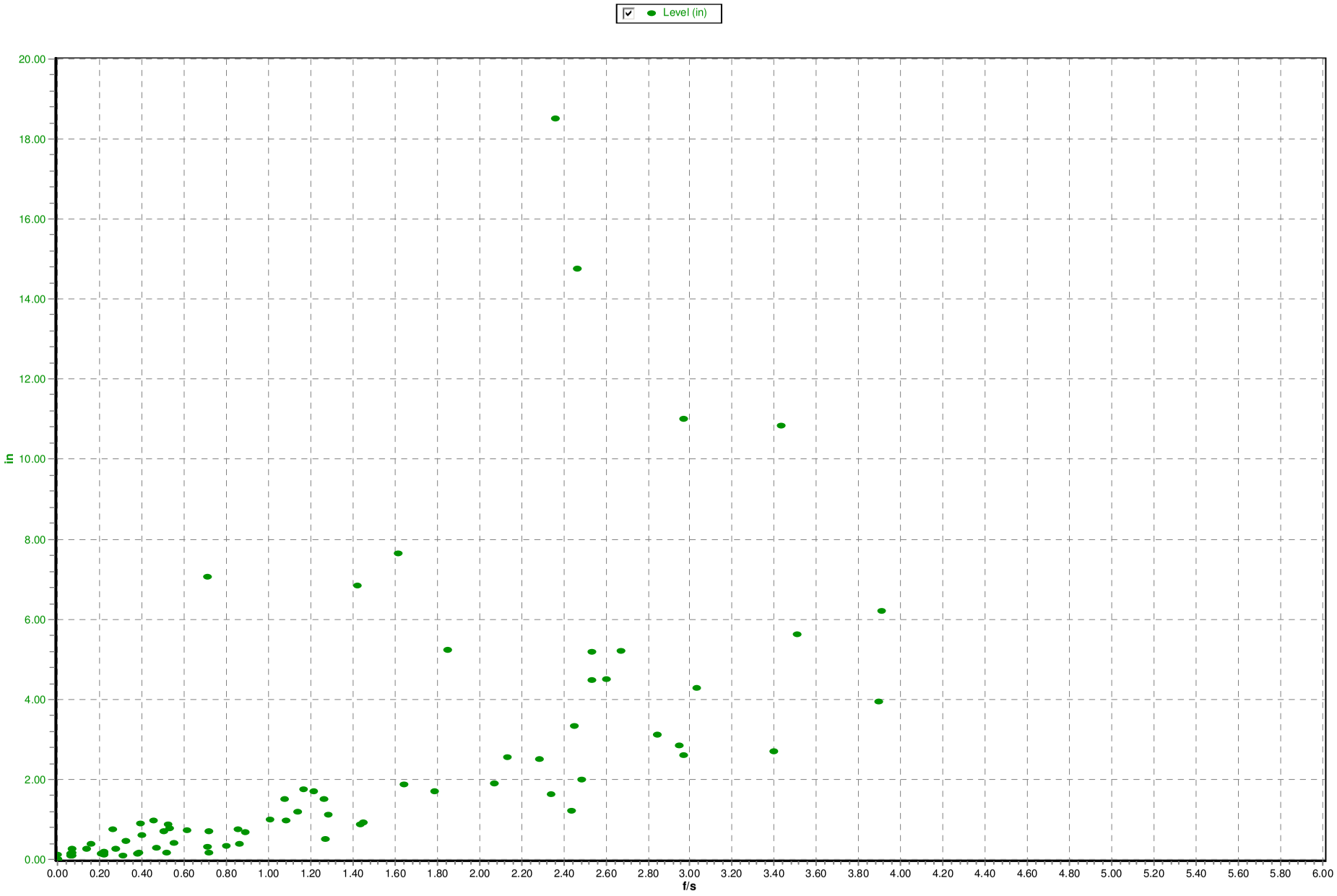
DATE: OCTOBER 2014,REV. 7/15 | SITE-16

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:46:52 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\14_24-38A-1L_2V_3_24-39A-1.DWG


M-16-Weir
Level
Velocity
Flow Rate
Rainfall
in
20
10
0
ft/s
6
4
2
0
mgd
60
40
20
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-16-Weir - 30th St. NW, in the vicinity of the Swedish Embassy at 2901 K St. NW

Pipe Diameter (in): 92 (12/01/14 to 12/01/15)



M-16

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/20/2014	14:22	0	0	0	0	0		LR/SD	Install.
11/20/2014	14:27	0	0	0	0	0		LR/SD	
11/20/2014	14:32	0	0	0	0	0		LR/SD	
1/14/2015	16:00		0		0	0	6.07	LL/AM	CB Telog.
2/18/2015	13:00		0		0	0		AP/AM	CB Telog.
2/26/2015	12:00		0		0	0		AP/AM	Swap Antenna.
4/3/2015	13:00		0		0	0	6.03	AP/AM	CB Telog.
5/14/2015	15:00		0		0	0	6.12	LL/DW	CB Telog.
7/14/2015	10:44		0		0	0	5.85	LR/DW	CB Telog.
8/5/2015	10:08							LR/DW	Replace antenna.
9/8/2015	9:50		0		0	0		LR/JC	CB Telog.
11/10/2015	12:13		0		0	0		LR/JC	CB Telog.
1/22/2016	9:07		0		0	0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-16-30

SEWER: WEST ROCK CREEK DIVERSION SEWER

OUTFALL: 024

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-16-30 measured storm flows that enter the overflow sewer downstream of the weir at CSO 024.

3. The continuity equation was used to calculate a flow rate from these measurements. M-16-30 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	2.785	0.389	0.122
Max	58.906	2.954	9.265

Site Name/Manhole # M-16-30 Primary: [X] Alternate: [ ] Grade: [ ]

Investigation Date: 11/21/13 Time: 16:05 Crew Members: LR/JS

Installation Date: 11/13/14 Time: 8:32 Crew Members: LR/SD

Address/Location: 30th St. NW near the Swedish Embassy (in the street after the bike rental)

Latitude: N 38°54.132' Longitude: W 77°03.546'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Debris in flow*

Velocity 0.75 ft/sec **not measured*

Depth 4.0 in

Turbulence Amplitude: *NA*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	30"		30"
Width	30"		30"
Material	Concrete		Concrete
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: 1.5 in. deep

☐ No Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ No evidence visible

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ No

Height above ground ____

Manhole depth 10'4"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ Yes ☐ No ☐ Maybe

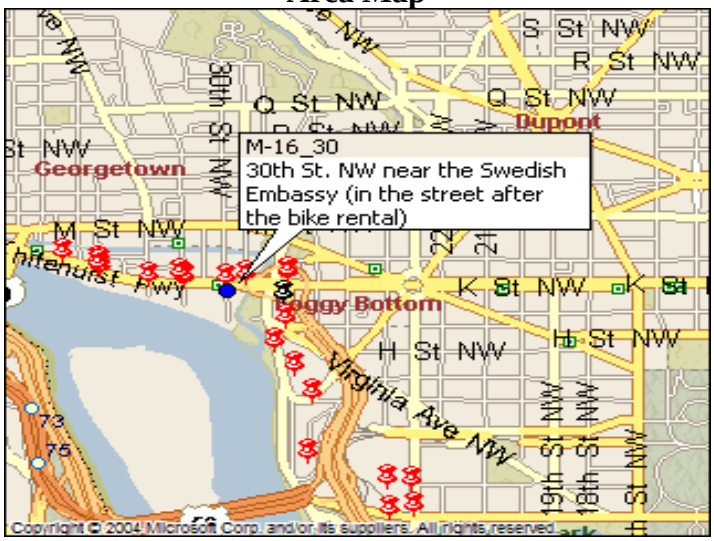
Sensor Configuration:

(Please include Serial Numbers when possible)

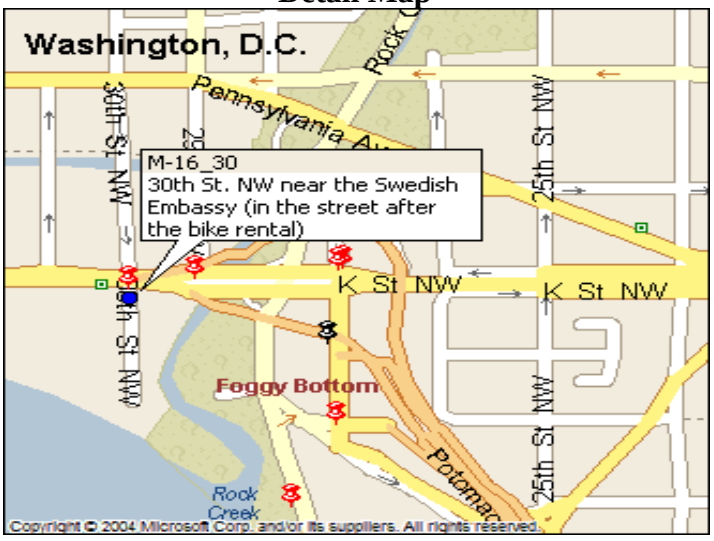
Level	Primary: Flowav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



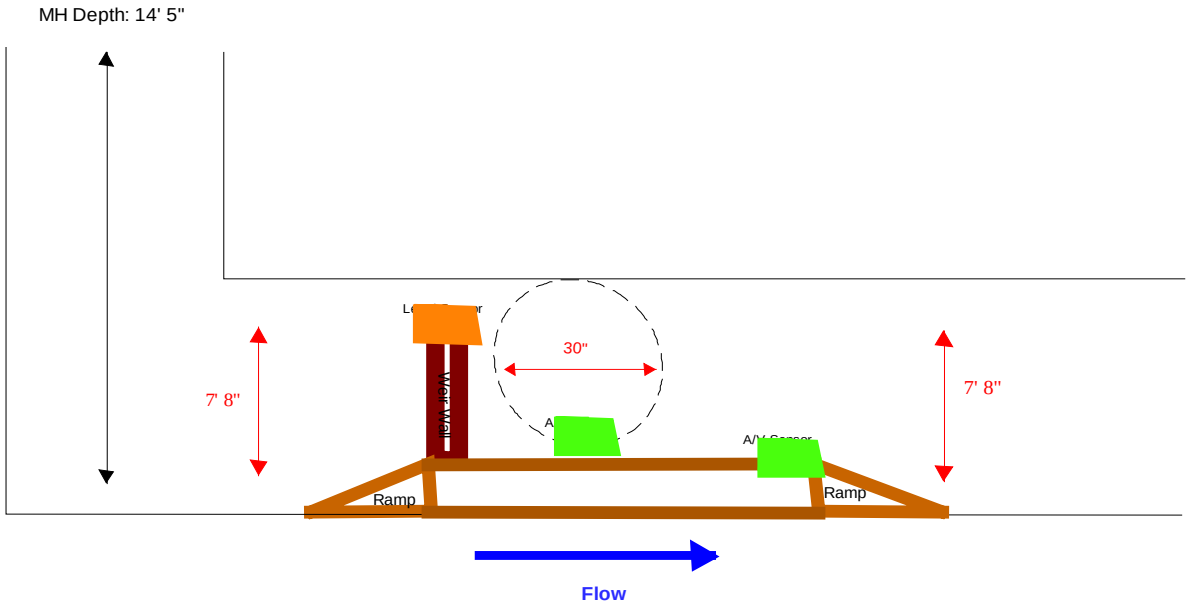
View from top of MH

Site Overview

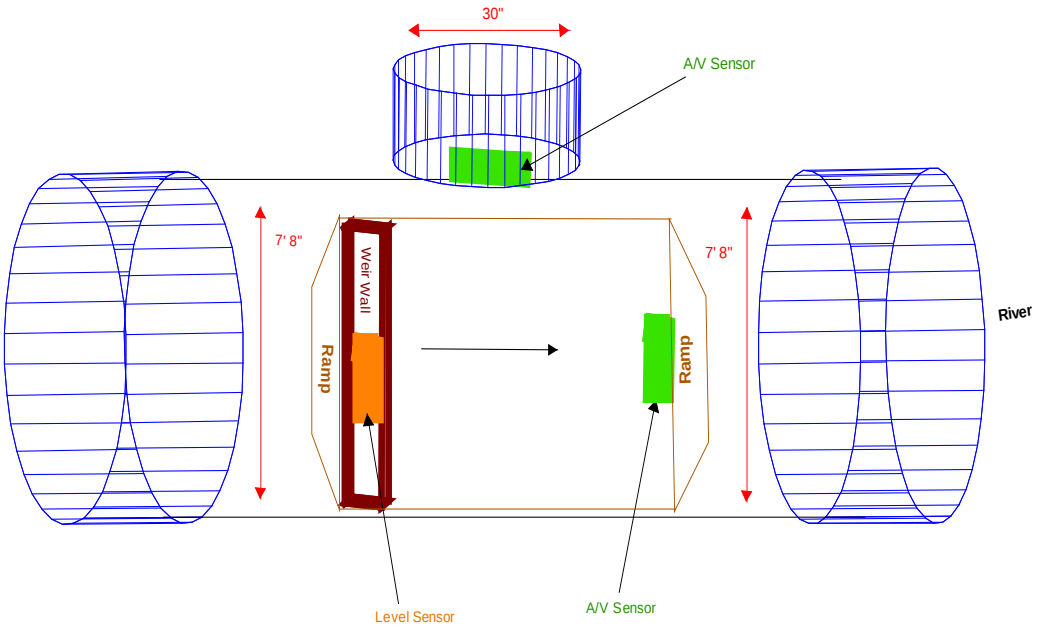
View of flow through influent line

View of flow through effluent line

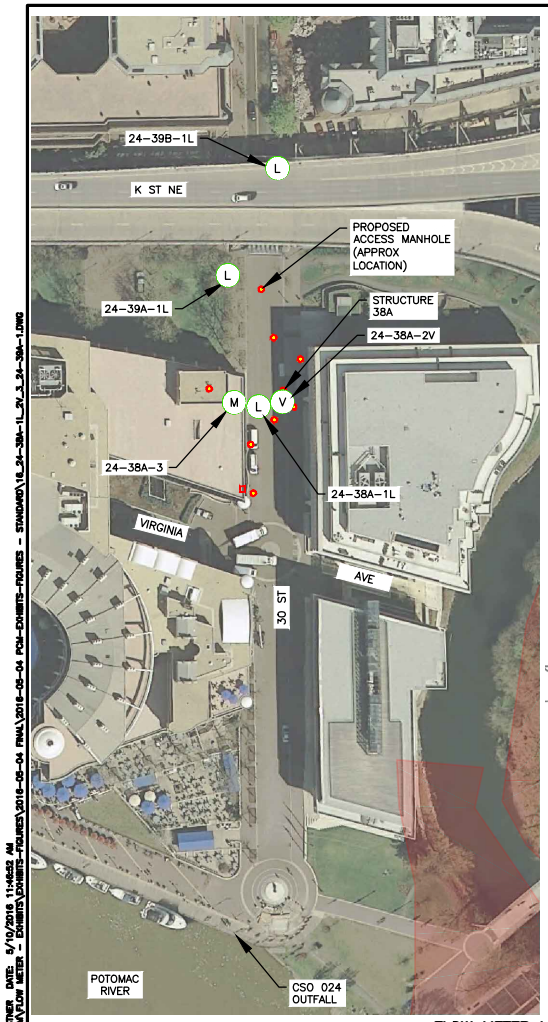
Dimensional Structure Profile View (profile sketch showing location of sensors)



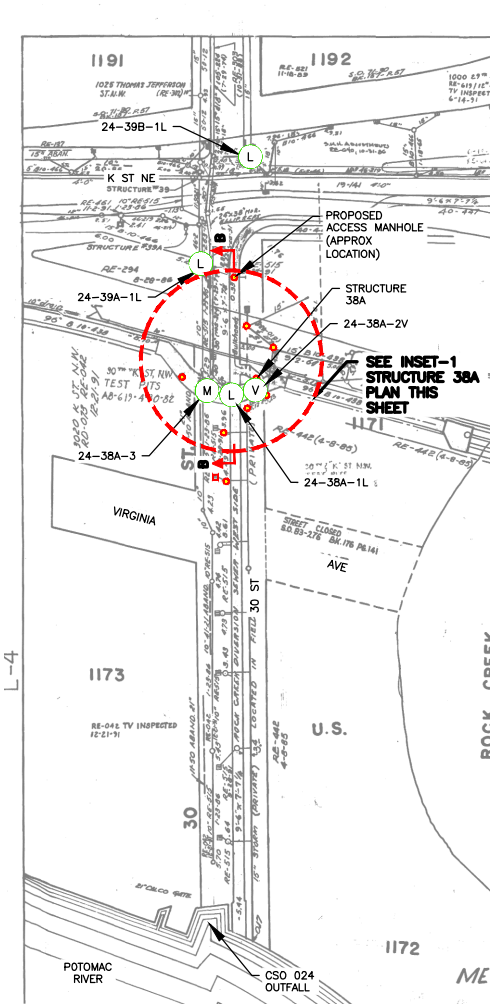
Dimension Structure Detail (pipe profile)

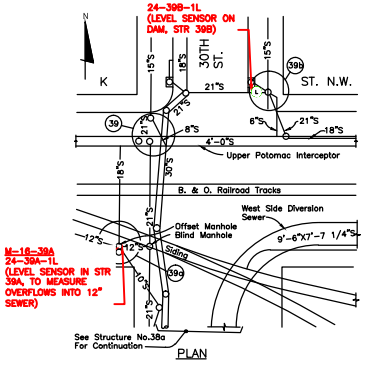


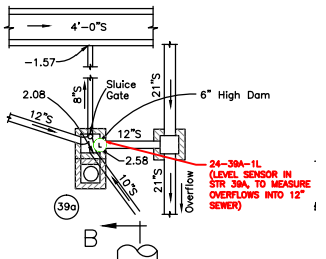
All sensor locations are provisional



FLOW METER LOCATION PLAN
SCALE: NTS

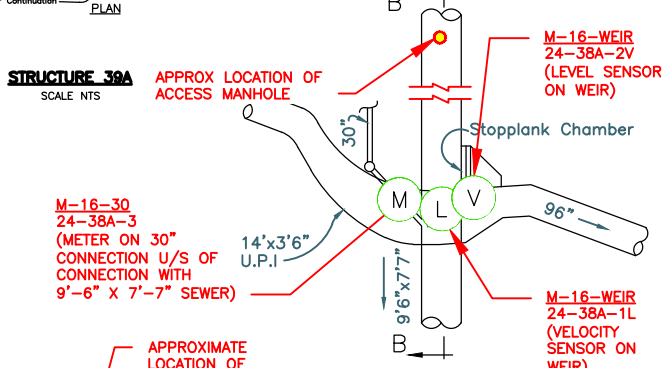




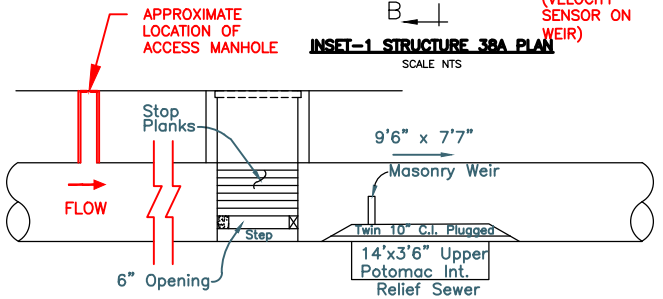


2 – FLOW METERS
3 – LEVEL SENSORS
1 – VELOCITY SENSOR

STRUCTURE 39A
SCALE NTS



INSET-1 STRUCTURE 38A PLAN
SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND

- M — FLOW METER LOCATION
- L — LEVEL SENSOR LOCATION
- V — VELOCITY SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

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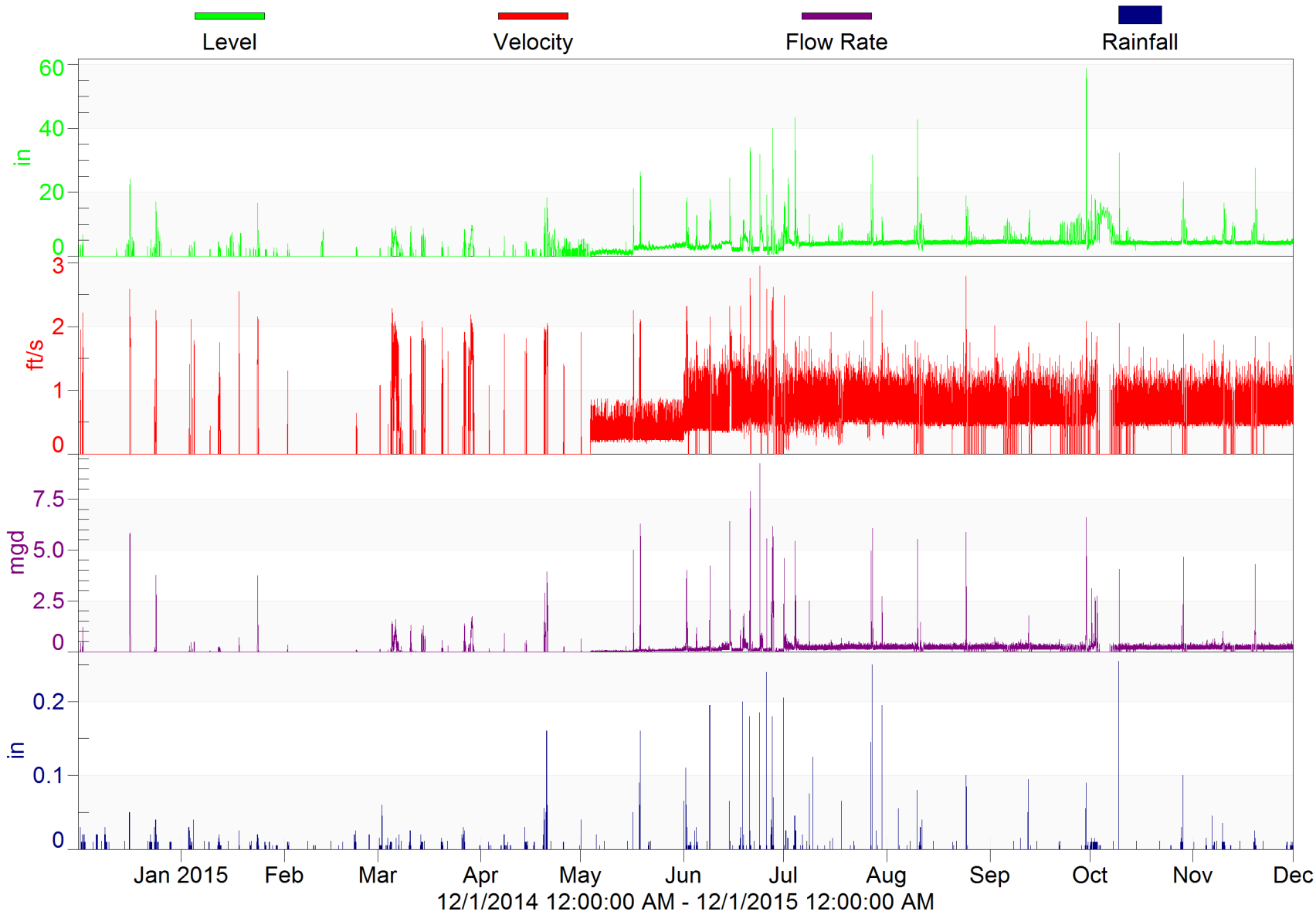
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
24-38A-1L_2V_3_24-39A-1 – 24-38A-1
24-39A-1L,24-39B-1L

DATE: OCTOBER 2014,REV. 7/15 | SITE-16

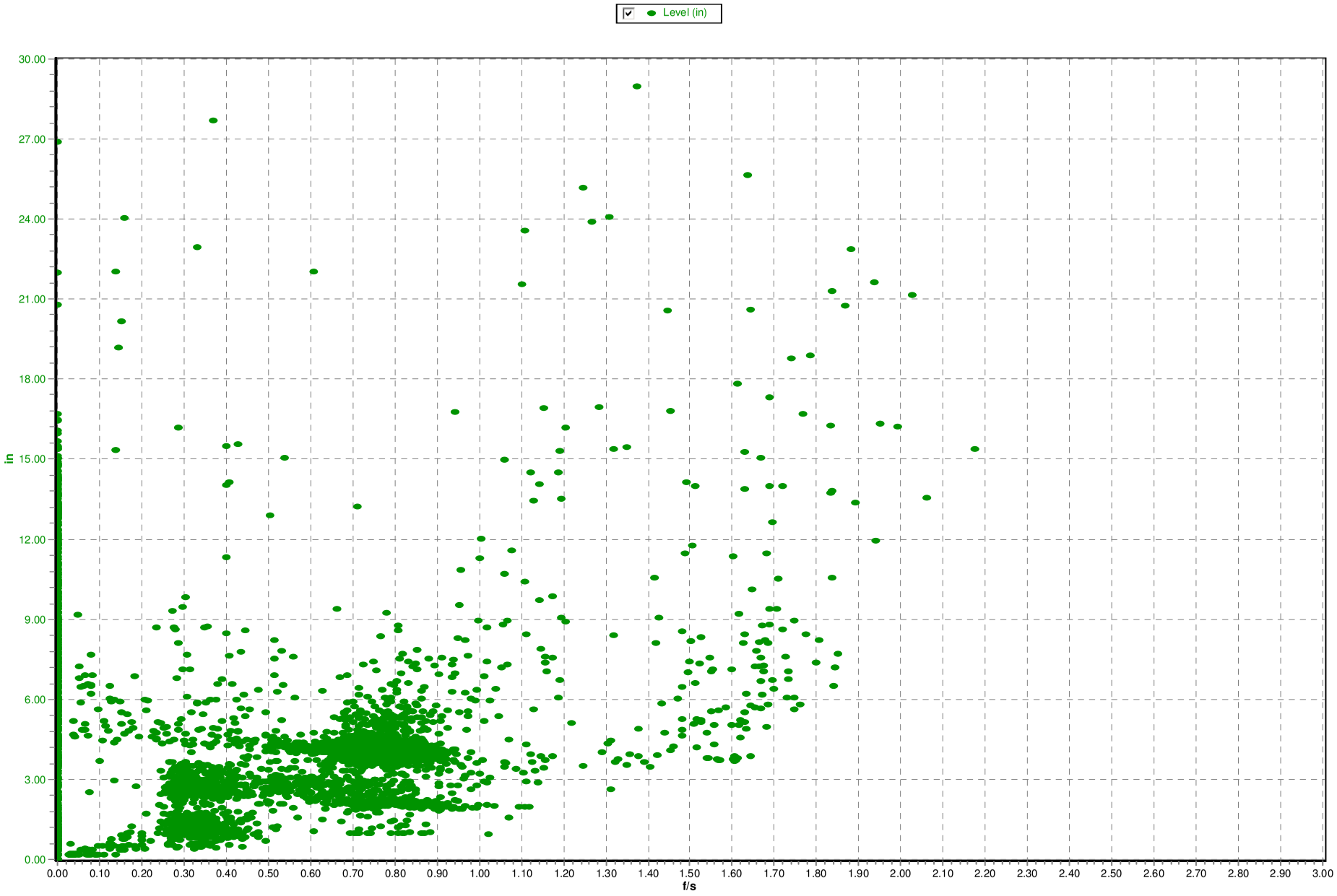
LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:46:52 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\14_24-38A-1L_2V_3_24-39A-1.DWG

M-16-30


Level
Velocity
Flow Rate
Rainfall
60
40
20
0
in
3
2
1
0
ft/s
7.5
5.0
2.5
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-16-30 - 30th St. NW near the Swedish Embassy (in the street after the bike rental)

Pipe Diameter (in): 30 (12/01/14 to 12/01/15)



M-16-30

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/13/2014	12:05		4.25	0.31	0.38	1.5		LR/SD	Install.
11/13/2014	12:10		4	0.29	0.48	1.5		LR/SD	
11/13/2014	12:15		3.75	0.38	0.32	1.5		LR/SD	
11/25/2014	18:00							LL/AP	CB Telog.
12/17/2014	11:50		2.75		0.6	2		AM/GH	CB Telog.
1/8/2015	4:00		2.75		0.4	2		AP/AM	
2/19/2015	17:00						5.98	AP/AM	CB Telog.
3/3/2015	12:00						5.94	AP/AM	Swap antenna. CB Telog.
4/14/2015	16:00						6.12	AP/MH	CB Telog.
5/14/2015	16:00						6.07	LR/DW	CB Telog.
6/11/2015	14:12	3.08	3.25	0.4	0.6	1		LL/DW	CB Telog.
7/14/2015	11:04						5.94	LR/DW	CB Telog.
8/5/2015	10:43		3.75		0.9	1		LR/DW	
9/14/2015	13:26							LR/JC	CB Telog.
10/14/2015	15:39		3		0.9	0		LR/JC	
11/10/2015	12:37							LR/JC	CB Telog.
12/9/2015	16:55		3.25		0.24	2		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-16-39A

SEWER: WEST ROCK CREEK DIVERSION SEWER

OUTFALL: 024

DURATION: 9/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-16-39A measured excess storm flows from Structure 39a.

3. The continuity equation was used to calculate a flow rate from these measurements. M-16-39A is a storm pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.483	0	0.019
Max	37.547	0	5.956

Site Name/Manhole # M-16-Str 39A Primary: [X] Alternate: [ ]

Investigation Date: 7/1/15 Time: 10:30 Crew Members: LR/DW/JC/BC

Installation Date: Time: Crew Members:

Address/Location: 30th St NW and K St NW

Latitude: N 38° 54.148' Longitude: W 77° 3.552'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 2	Effluent
Height	12"	10"	7"	12"
Width	12"	10"	7"	12"
Material	Brick	Brick	Brick	Brick
Shape	Round	Round	Round	Round

Sediment Present:

☐ (Yes) Hard packed: _____ in. deep

☐ No Soft: 2 in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

☐ Remains in pipe

☐ ___ ft from rim

☐ Reaches Rim (potential meter damage)

☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ (Good) (no problems accessing site)

☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)

☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)

☐ Traffic Control only (Requires extra traffic control

☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 4'

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

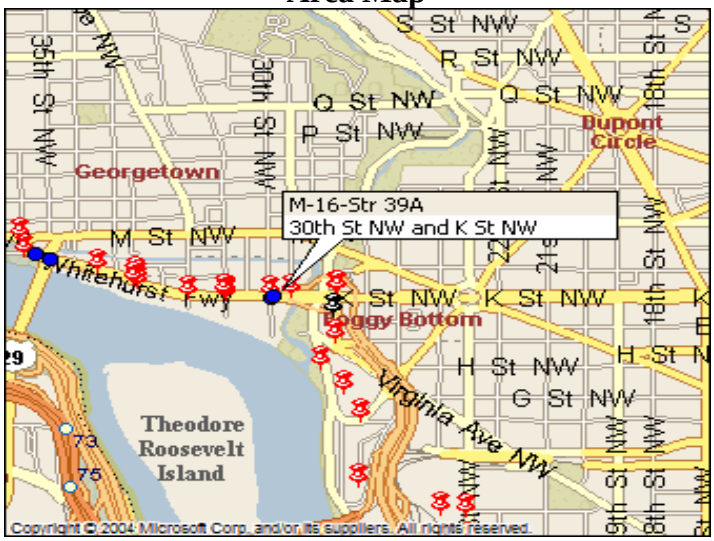
Sensor Configuration:

(Please include Serial Numbers when possible)

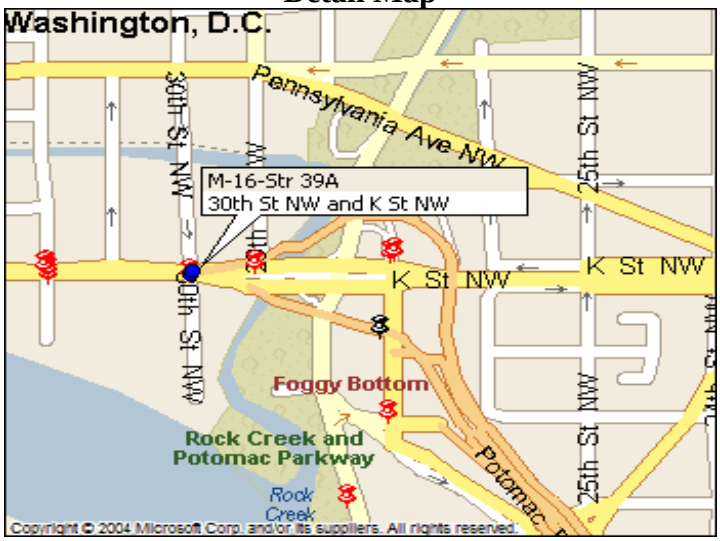
Level	Primary: Flowav A/V
	Redundant:
Velocity	Primary: Flowav A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



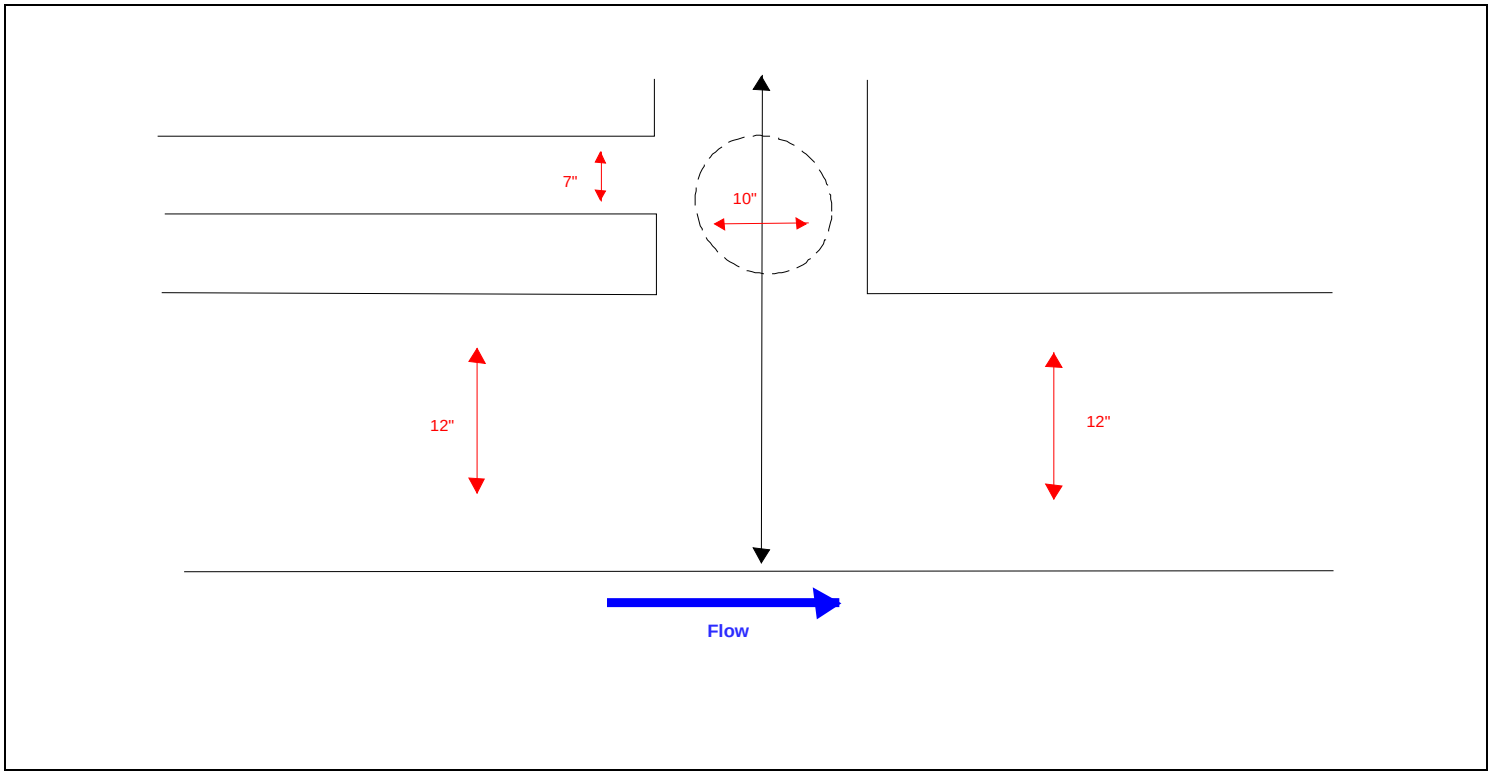
View from top of MH

Site Overview

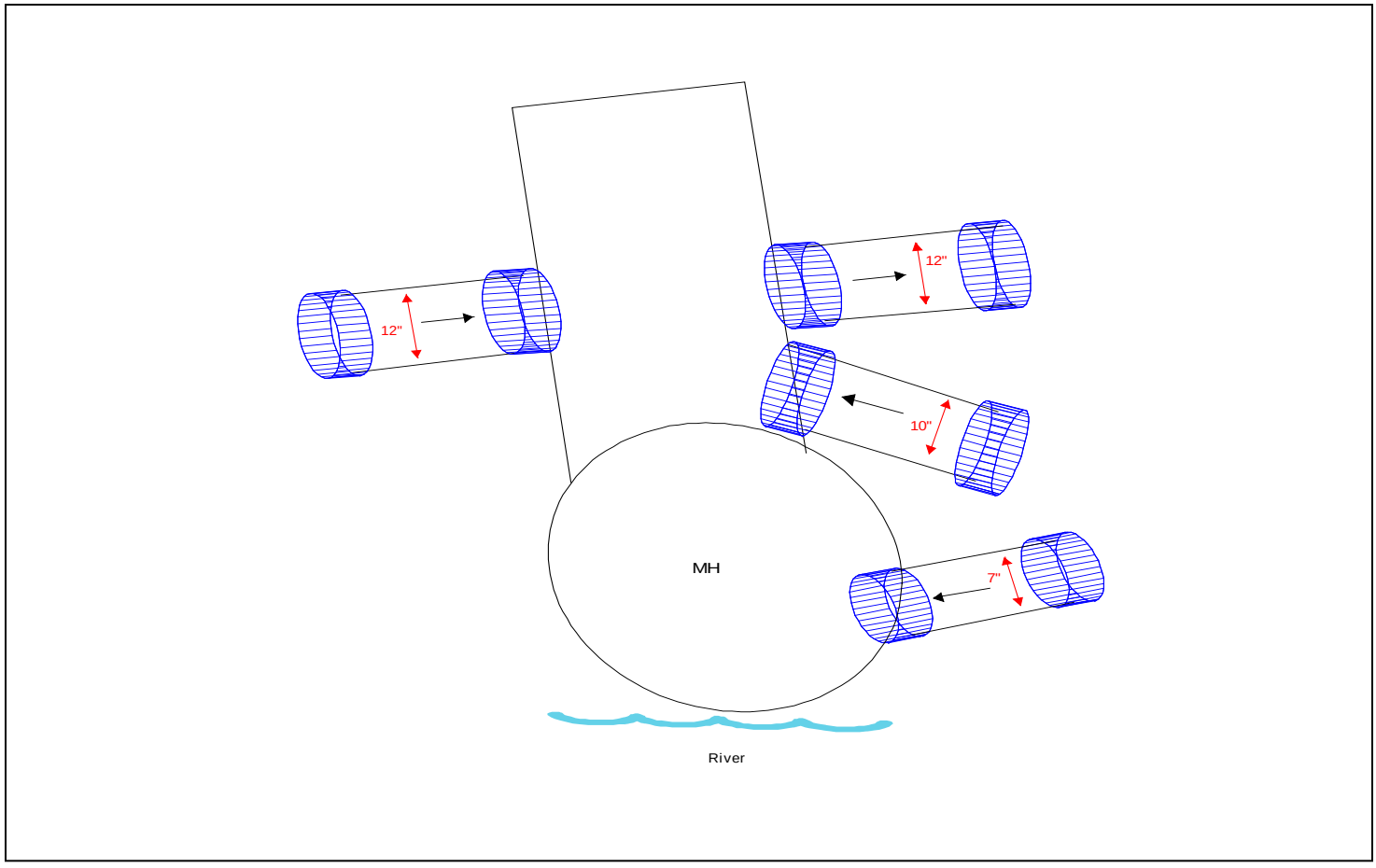
View of flow through influent line

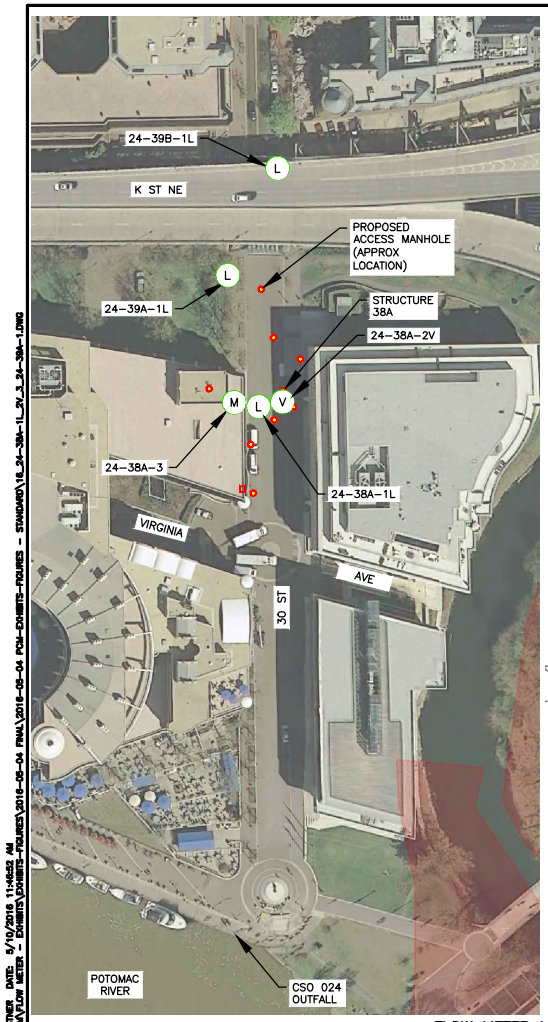
View of flow through effluent line

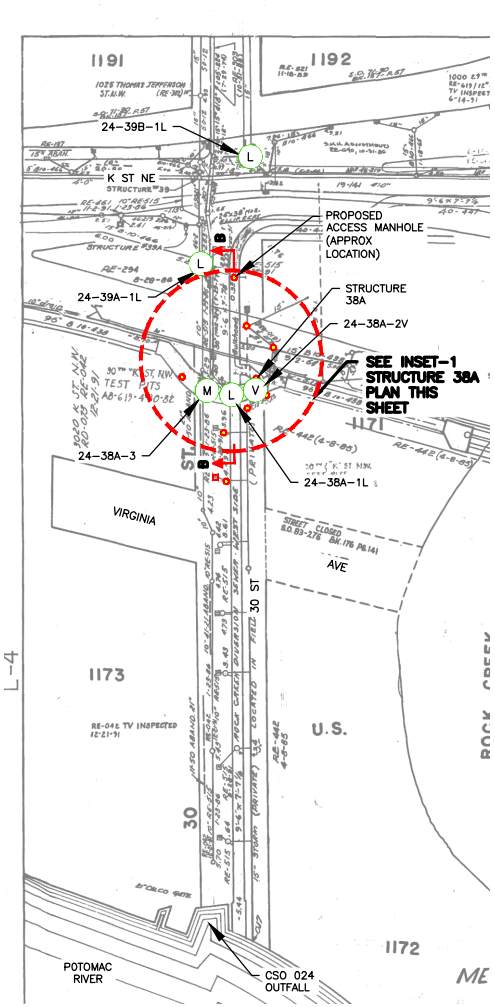
Dimensional Structure Profile View (profile sketch showing location of sensors)



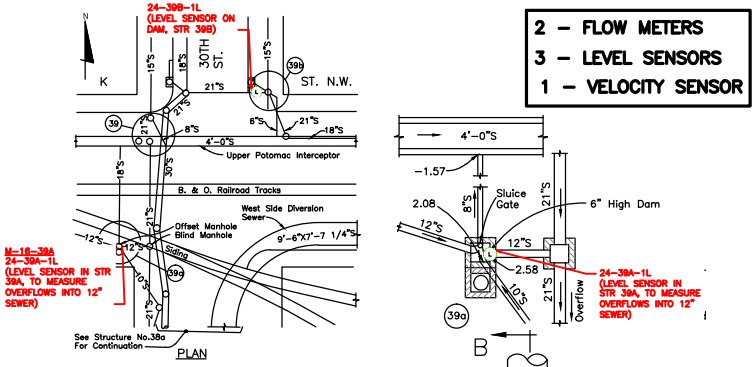
Dimension Structure Detail (Plan View)



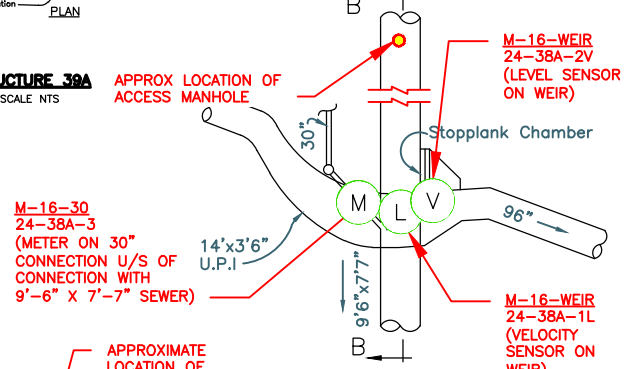




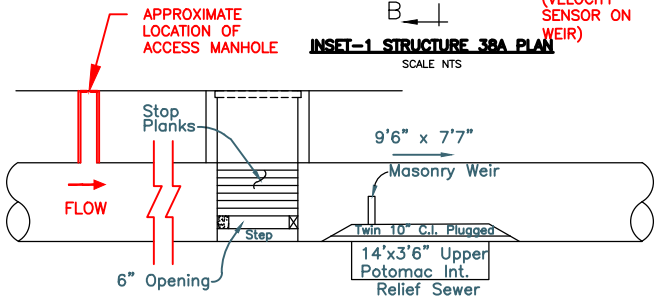
FLOW METER LOCATION PLAN
SCALE: NTS



STRUCTURE 39A
SCALE NTS



INSET-1 STRUCTURE 38A PLAN
SCALE NTS



CROSS SECTION B-B (SEWER PROFILE)
SCALE NTS

LEGEND

- M — FLOW METER LOCATION
- L — LEVEL SENSOR LOCATION
- V — VELOCITY SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

2 – FLOW METERS
3 – LEVEL SENSORS
1 – VELOCITY SENSOR

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DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
24-38A-1L_2V_3_24-39A-1 – 24-38A-1
24-39A-1L,24-39B-1L

DATE: OCTOBER 2014,REV. 7/15 | SITE-16

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:46:52 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\16_24-38A-1L_2V_3_24-39A-1.DWG

M-16-39A

Level
Flow Rate
Rainfall
in
30
20
10
0
mgd
6
5
4
3
2
1
0
in
0.25
0.20
0.15
0.10
0.05
0
8 Tue
15 Tue
22 Tue
1 Thu
8 Thu
15 Thu
22 Thu
1 Sun
8 Sun
15 Sun
22 Sun
1 Tue
Sep 2015
9/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-16-39A

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
8/5/2015	9:20		0		0	variable		LR/DW	Install
8/11/2015	16:00		3		0	variable		LR/DW	
9/1/2015	13:54		0		0	variable		LR/JC	
11/12/2015	12:26		1.5		0	variable		LR/JC	CB Telog
12/10/2015	10:24		0		0	variable		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-16-39B

SEWER: WEST ROCK CREEK DIVERSION SEWER

OUTFALL: 024

DURATION: 9/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-16-39B measured excess storm flows from Structure 39b.

3. The continuity equation was used to calculate a flow rate from these measurements. M-16-39B is a storm pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0	0	0
Max	0	0	0

Site Name/Manhole # M-16-Str 39B Primary: [X] Alternate: [ ]

Investigation Date: 7/1/15 Time: 12:10 Crew Members: LR/BC/DW/JC

Installation Date: Time: Crew Members:

Address/Location: 30th St NW and K St NW (in the sidewalk across from M-16)

Latitude: N 38° 54.115' Longitude: W 77° 3.540'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: ***OF***

Velocity 0.40 ft/sec

Depth < 0.25 in

Turbulence Amplitude:

- (Less than 0.25")
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics: *Influent storm is 15" round concrete*

	Sewer Influent 1	*OF* Influent 2	*Sewer* Influent 2	*OF* Effluent
Height	12"	21"	6"	21"
Width	14"	21"	6"	21"
Material	PVC	Cast Iron	Cast Iron	Cast Iron
Shape	Odd	Round	Round	Round

Sediment Present: *trace in sewer*

(Yes) Hard packed: _____ in. deep

☐ No Soft: *trace* in. deep

Surcharge / Backwater Influence:

- (No evidence visible)
- ☐ Remains in pipe
- ☐ ___ ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

(Good) 20.1 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 116"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change: *Both*

☐ Influent ☐ Effluent (Manhole)

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

Sensor Configuration:

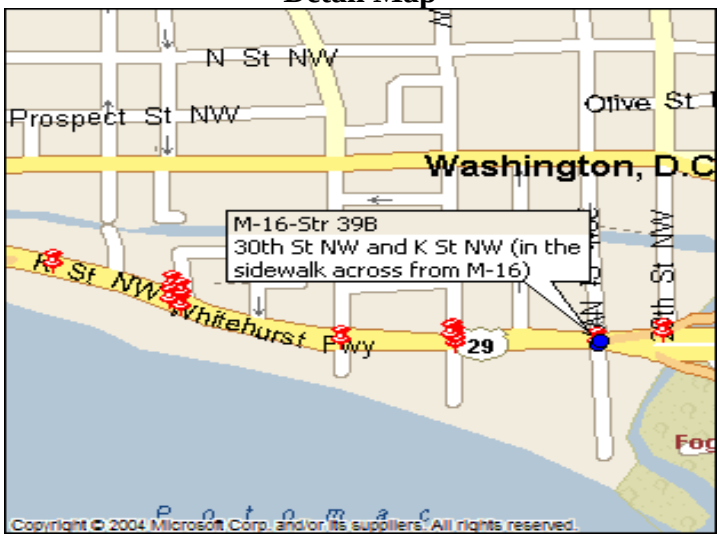
(Please include Serial Numbers when possible)

Level	Primary:	
	Redundant:	
Velocity	Primary:	
	Redundant:	
Meter Logger		

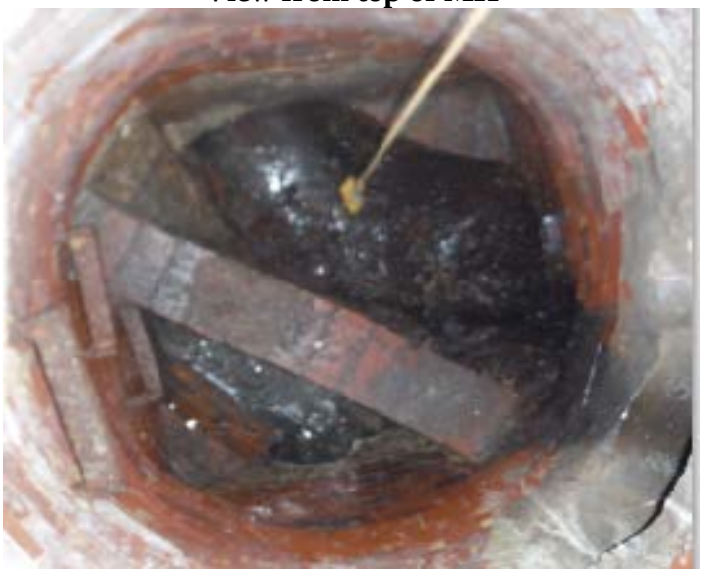
Comments:

Area Map

Detail Map



View from top of MH

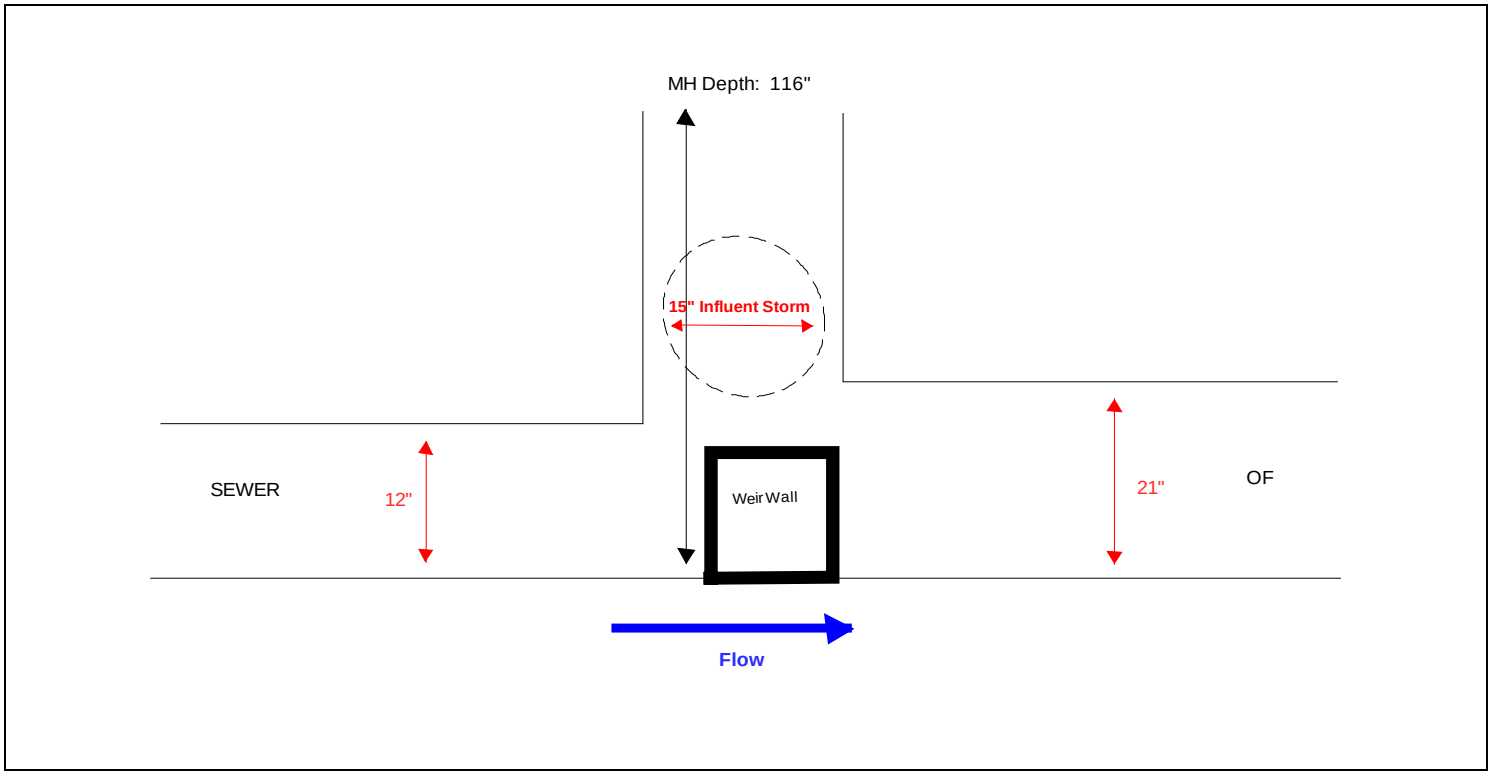


Site Overview

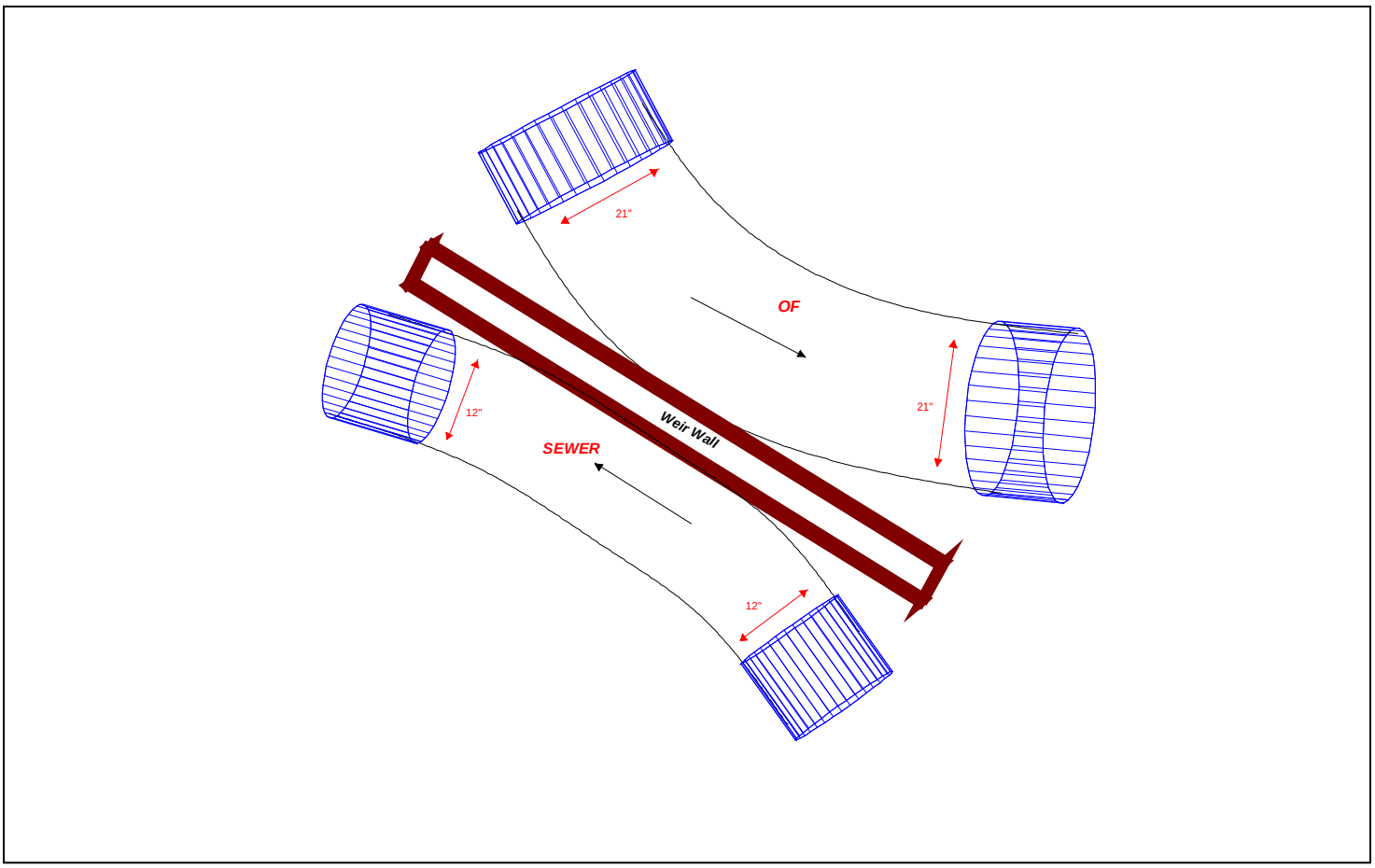
View of flow through influent line

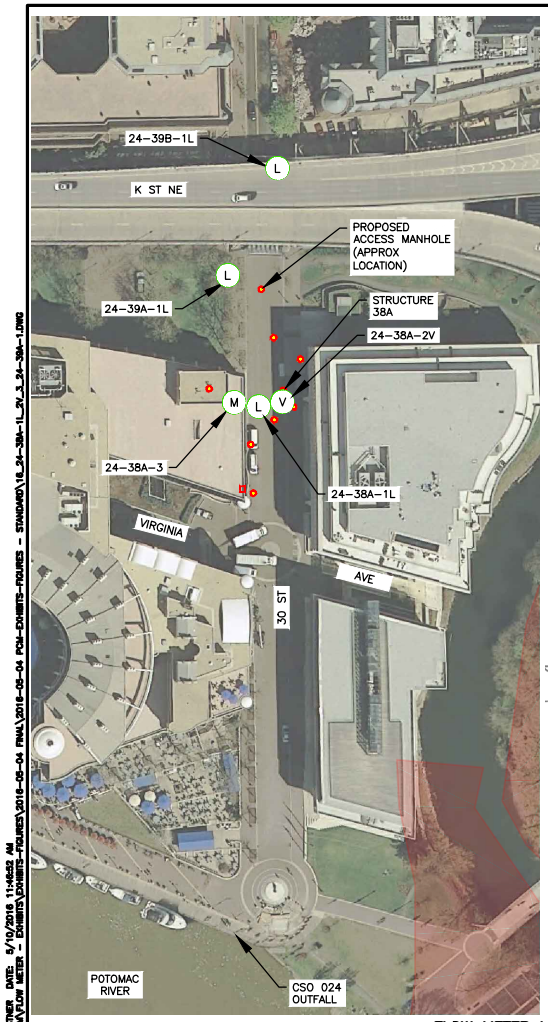
View of flow through effluent line

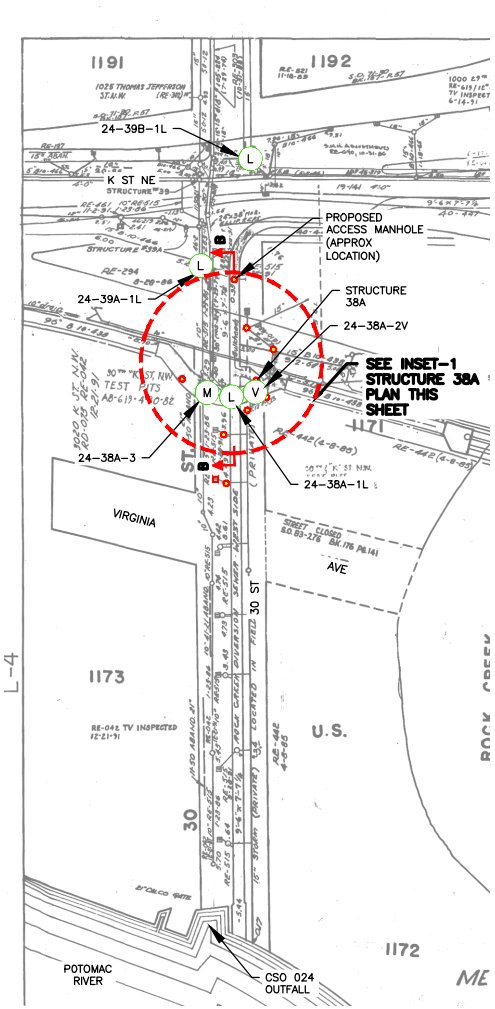
Dimensional Structure Profile View (profile sketch showing location of sensors)



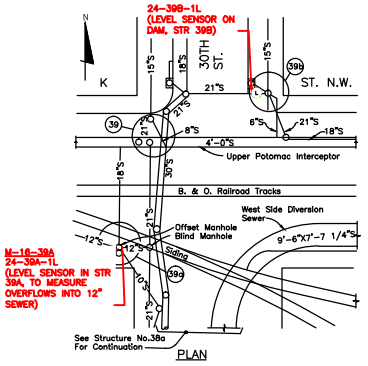
Dimension Structure Detail (Plan View)

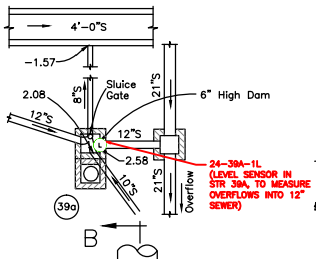






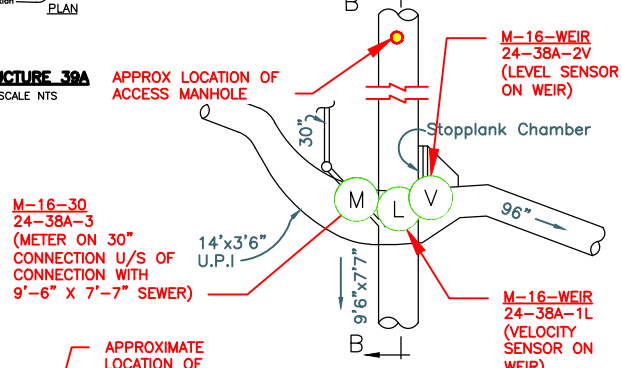
FLOW METER LOCATION PLAN
SCALE: NTS



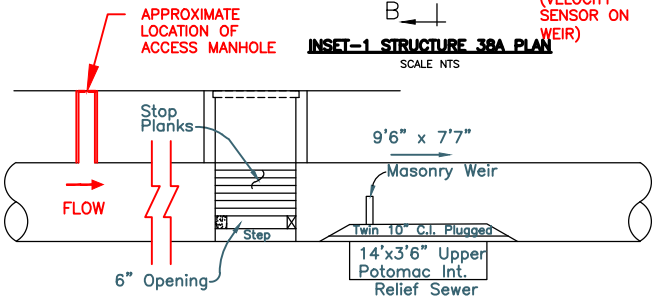


2 – FLOW METERS
3 – LEVEL SENSORS
1 – VELOCITY SENSOR

STRUCTURE 39A
SCALE NTS



INSET-1 STRUCTURE 38A PLAN
SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS

LEGEND

- M — FLOW METER LOCATION
- L — LEVEL SENSOR LOCATION
- V — VELOCITY SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
24-38A-1L_2V_3_24-39A-1 – 24-38A-1
24-39A-1L,24-39B-1L

DATE: OCTOBER 2014,REV. 7/15 | SITE-16

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:46:52 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\16_24-38A-1L_2V_3_24-39A-1.DWG

M-16-39B

Level
Flow Rate
Rainfall
1.0
0.5
0
-0.5
-1.0
in
1.0
0.5
0
-0.5
-1.0
mgd
0.25
0.20
0.15
0.10
0.05
0
in
8 Tue
15 Tue
22 Tue
1 Thu
8 Thu
15 Thu
22 Thu
1 Sun
8 Sun
15 Sun
22 Sun
1 Tue
Sep 2015
9/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-16-39B

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
8/4/2015	15:30	0	0		0	0	6.2	LR/DW	Install
8/12/2015	12:35	0	0		0	0		LR/DW	
9/1/2015	13:54		0		0	0		LR/JC	
9/28/2015	11:56							LR/JC	CB Telog.
10/22/2015	11:31		0		0	0		JC/RM	
11/10/2015	11:59		0		0	0		LR/JC	CB Telog.
12/10/2015	9:45		0		0	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-17

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: n/a

DURATION: 3/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-17 measured flows on the Upper Potomac Interceptor upstream of Structure 38. This flow is heavily influenced by the Rock Creek Pump Station.

3. The continuity equation was used to calculate a flow rate from these measurements. M-17 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	5.661	0	0
Avg.	33.113	0.685	3.964
Max	129.957	6.871	46.103

Site Name/Manhole # M-17 Primary: [X] Alternate: [ ]

Investigation Date: 12/3/13 Time: 13:40 Crew Members: LR/JS

Installation Date: 2/11/15 Time: 9:30 Crew Members: LR/A**P**

Address/Location: 29th St NW & K Street NW

Latitude: N 38° 54.158' Longitude: W 77° 3.501'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.21 ft/sec

Depth 25.5 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ (0.25" to 0.75")
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	*No flow* Influent 3	Effluent
Height	48"	24"		48"
Width	48"	24"		48"
Material	Brick	PVC	Cast Iron	Brick
Shape	Round	Round	Round	Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ (10 ft from rim)
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, ~~No safe place to park, elevated MH >3 ft~~)
- ☐ Traffic Control only (Requires extra traffic control)
- ☐ Unusable (~~Document in Comments section~~)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 21'4"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends:

☐ Influent ☐ (Effluent) ☐ Manhole

Approx Distance to bend: 12 ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

.

Area Map

Detail Map

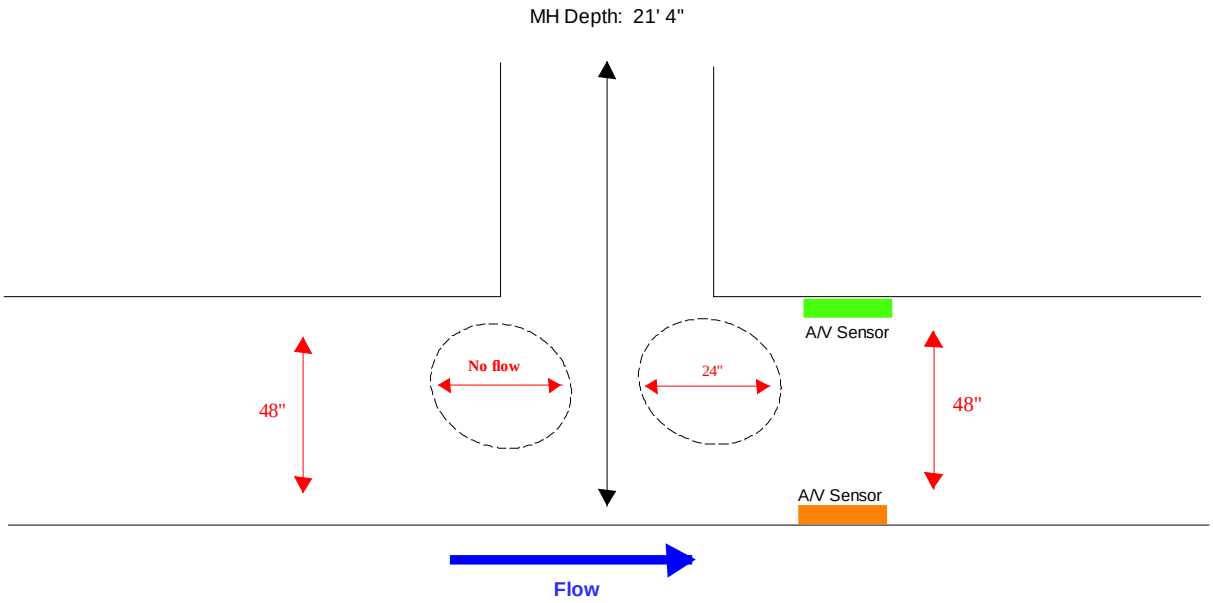
View from top of MH

Site Overview

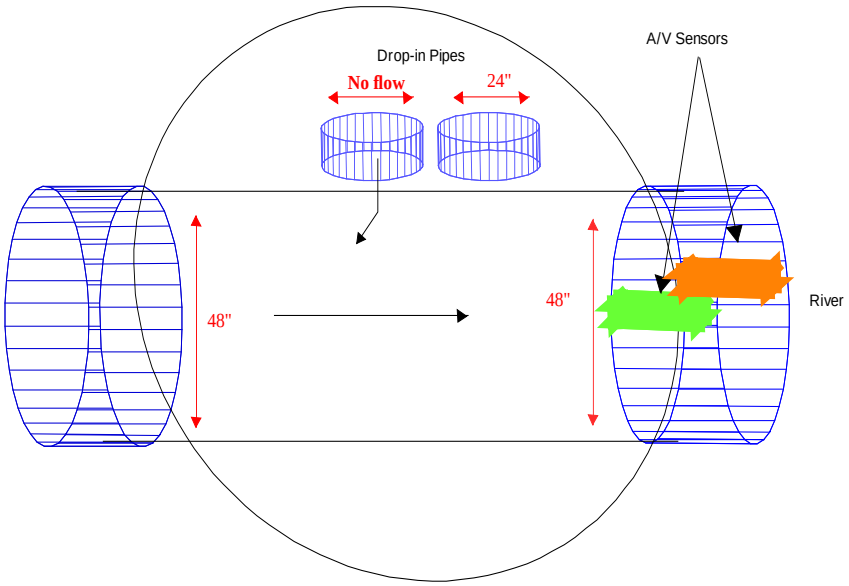
View of flow through influent line

View of flow through effluent line

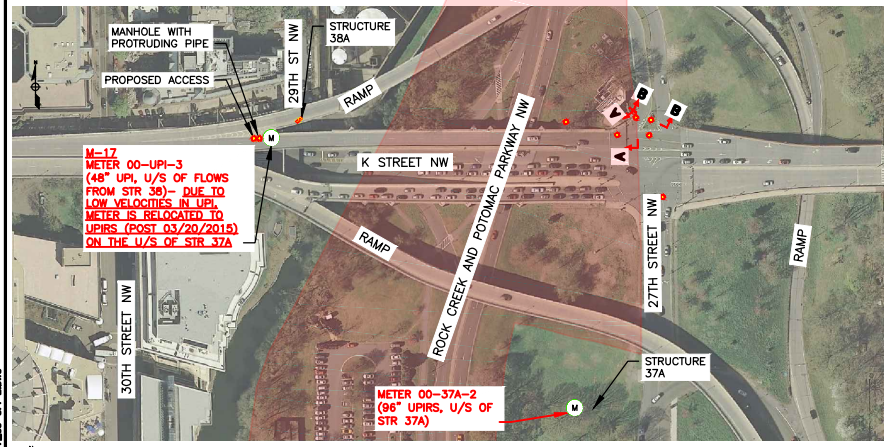
Dimensional Structure Profile View (profile sketch showing location of sensors)

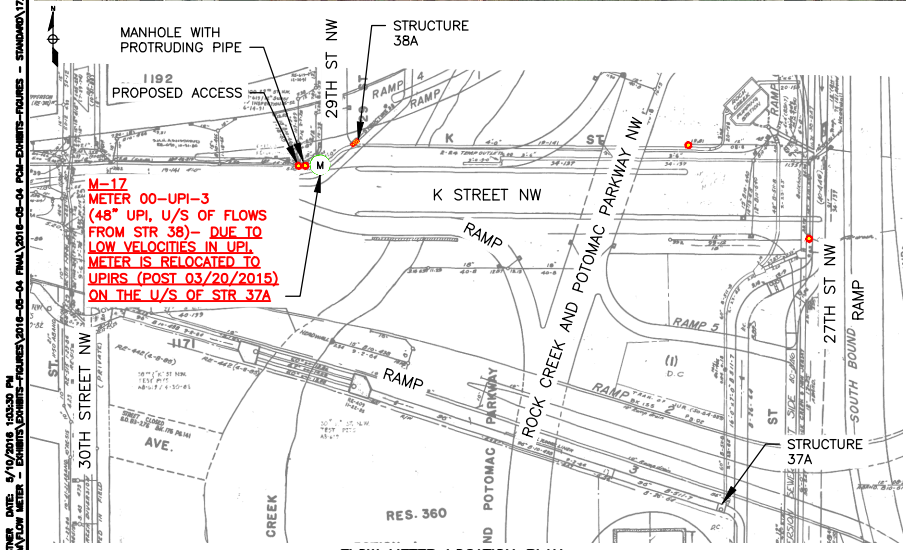


Dimension Structure Detail (Plan View)

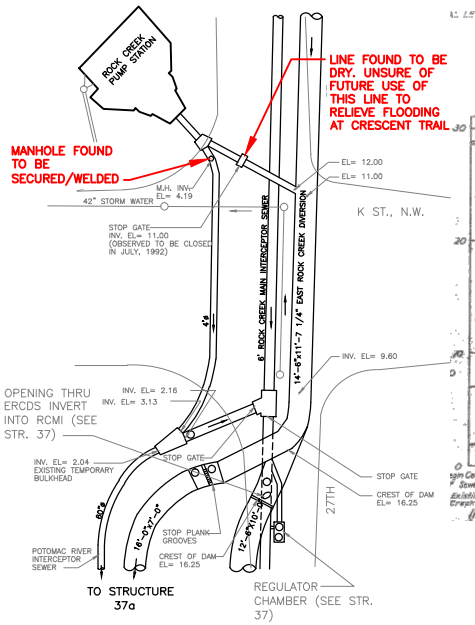


1 – FLOW METER

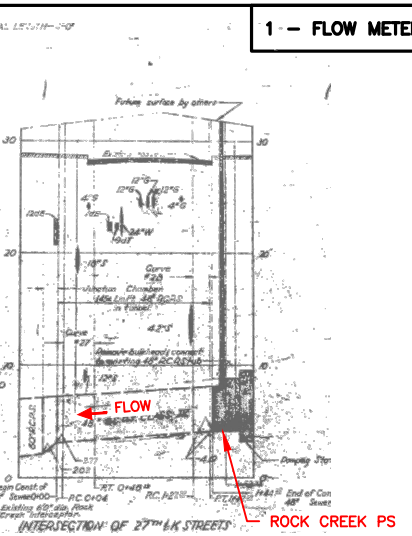




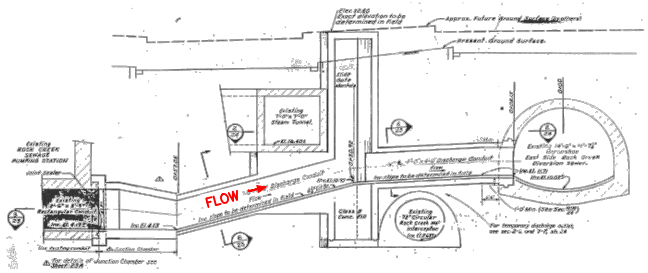
FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 LOCATION DETAIL
SCALE NTS



CROSS SECTION A-A (PROFILE FOR 00-UPI-2)
SCALE NTS



CROSS SECTION B-B (PROFILE FOR 00-UPI-3)
SCALE NTS

LEGEND
- M — FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00-37A-2
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 17

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 1:03:30 PM
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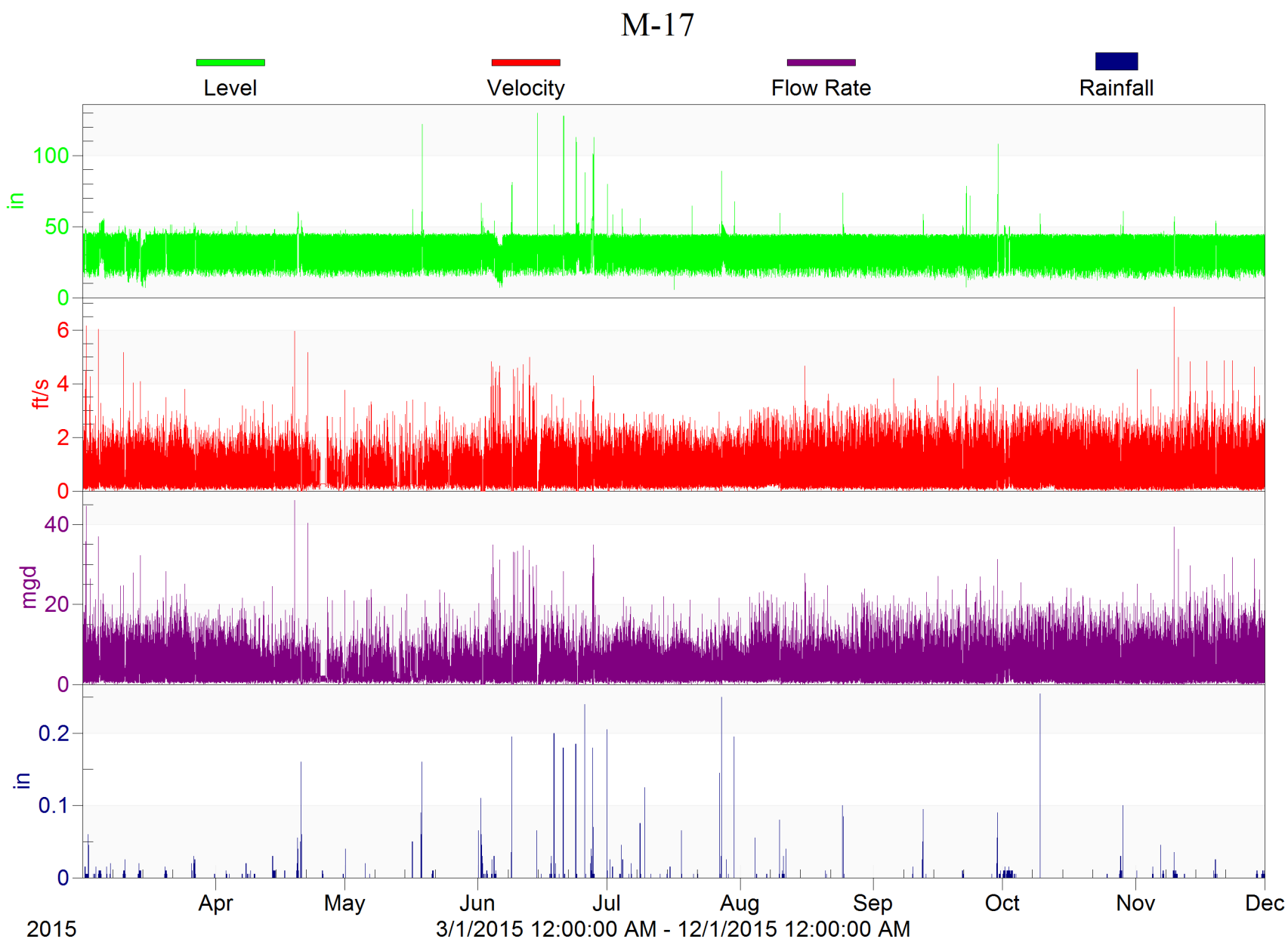
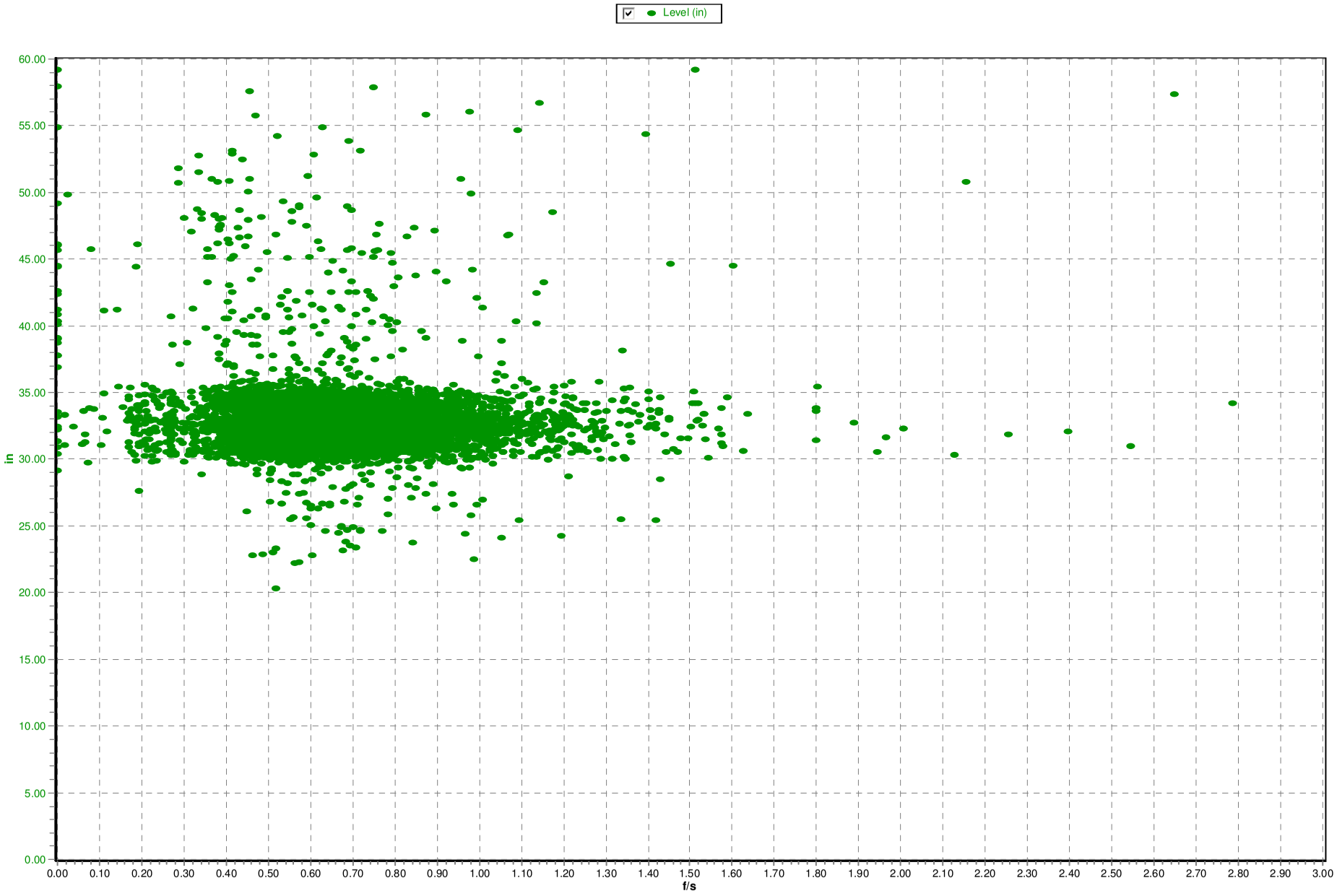

M-17
Level
Velocity
Flow Rate
Rainfall
100
50
0
in
6
4
2
0
ft/s
40
20
0
mgd
0.2
0.1
0
in
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2015
3/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-17 - 29th St NW & K Street NW

Pipe Diameter (in): 48 (03/01/15 to 12/01/15)



M-17

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
2/11/2015	11:55	24	25.5	0	0.21	0	5.98	LR/AM	Install.
2/11/2015	11:58	26.76	28	0	0.18	0		LR/AM	
2/11/2015	12:01	29.15	30	0	0.13	0		LR/AM	
3/16/2015	16:00						5.9	AP/AM	CB Telog.
3/31/2015	13:00						6.03	AP/AM	CB Telog.
4/8/2015	16:00							AP/AM	CB Telog.
4/20/2015	15:00						6.12	AP/DW	CB Telog.
5/8/2015	10:00						5.85	LR/DW	CB Telog.
5/19/2015	10:38	34.61	33.75	0.19	0.25	0	6.2	LR/DW	
5/19/2015	11:21	21.77	21.75	0.34	0.31	0		LR/DW	
6/19/2015	12:22							LR/DW	CB Telog.
7/10/2015	9:34						5.94	LR/DW	CB Telog.
7/23/2015	13:07	22.68	22.5	0.34	0.29	0		LR/DW	
8/3/2015	12:09							LR/DW	CB Telog.
9/1/2015	11:28							LR/JC	CB Telog.
9/22/2015	14:02							LR/JC	CB Telog.
11/11/2015	13:07		23		1.4	0		LR/JC	CB Telog.
12/17/2015	11:24		36.75		1	0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-18

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 025

DURATION: 1/1/15-7/6/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-18 measured excess flows downstream of Structures 41b and 41c before entering the Potomac River through CSO 025.

3. The continuity equation was used to calculate a flow rate from these measurements. M-18 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.125	0.045	0.005
Max	43.964	4.263	2.879

Site Name/Manhole # M-18 Primary: [X] Alternate: [ ]

Investigation Date: 2/20/14 Time: 8:15 Crew Members: LR/JS

Installation Date: 12/12/14 Time: 10:00 Crew Members: AP/LR/AM/GH

Address/Location: On 31st St. NW, near the intersection of K St. NW

Latitude: N 38° 54.153' Longitude: W 77° 3.667'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry pipe*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude: *Dry pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Infl. 1	Influent 2	Influent 3	Effluent	
Height	18"	12"	18"	14"	18"
Width	18"	12"	18"	15"	18"
Material	Concrete	Concrete	Concrete	Concrete	Concrete
Shape	Round	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Permit and traffic plan required*

- ☐ Good (no problems accessing site)
- ☐ (Fair) (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 5'

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends

☐ Influent ☐ (Effluent) ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

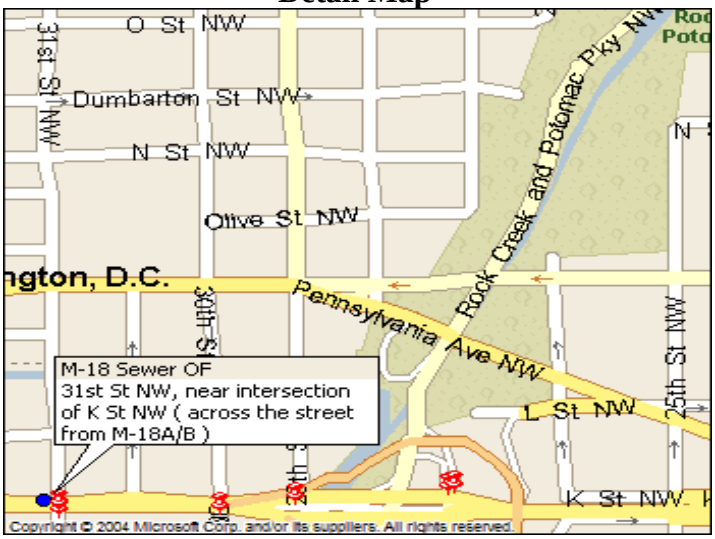
(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *MH is downstream of sewer overflow. DS install*

Area Map

Detail Map



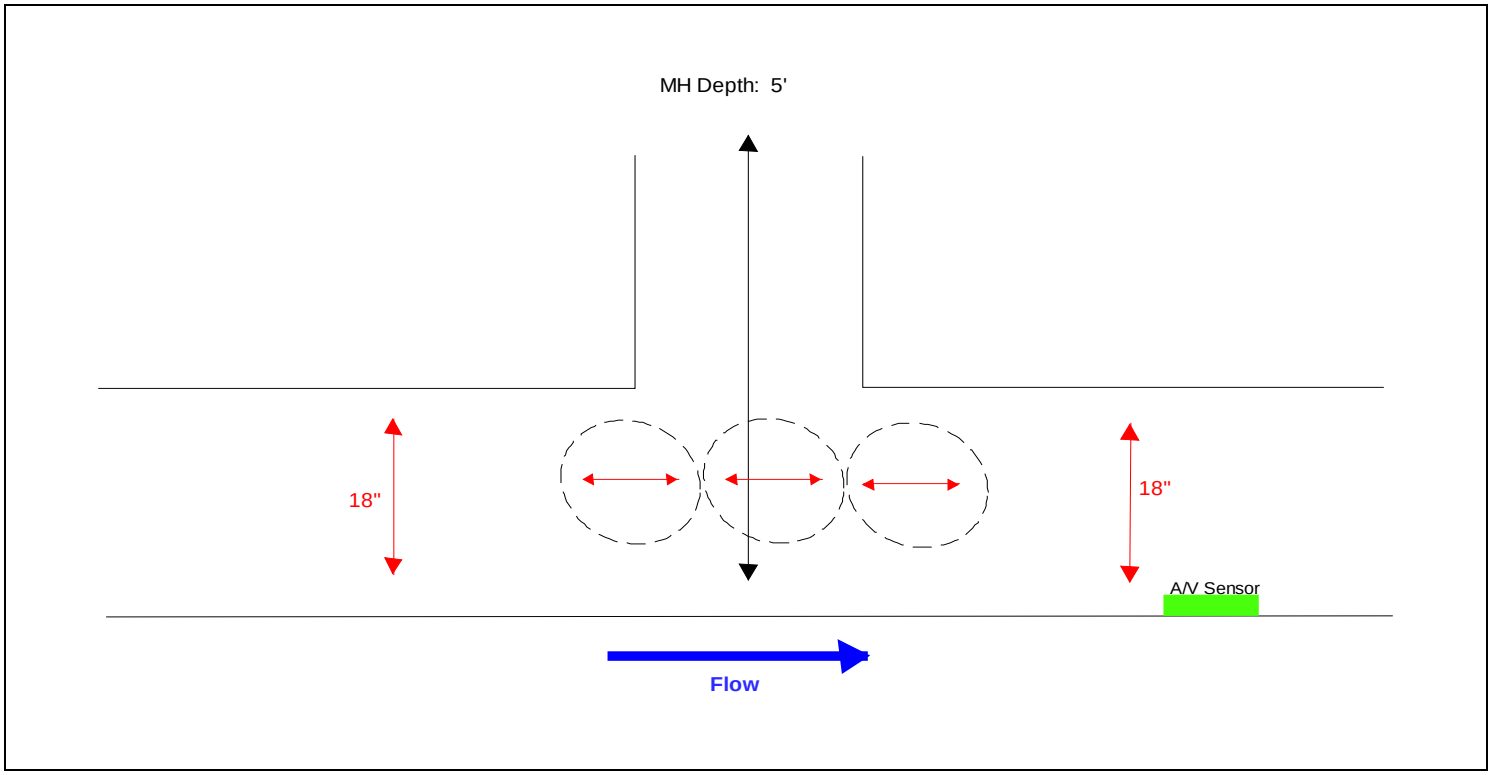
View from top of MH

Site Overview

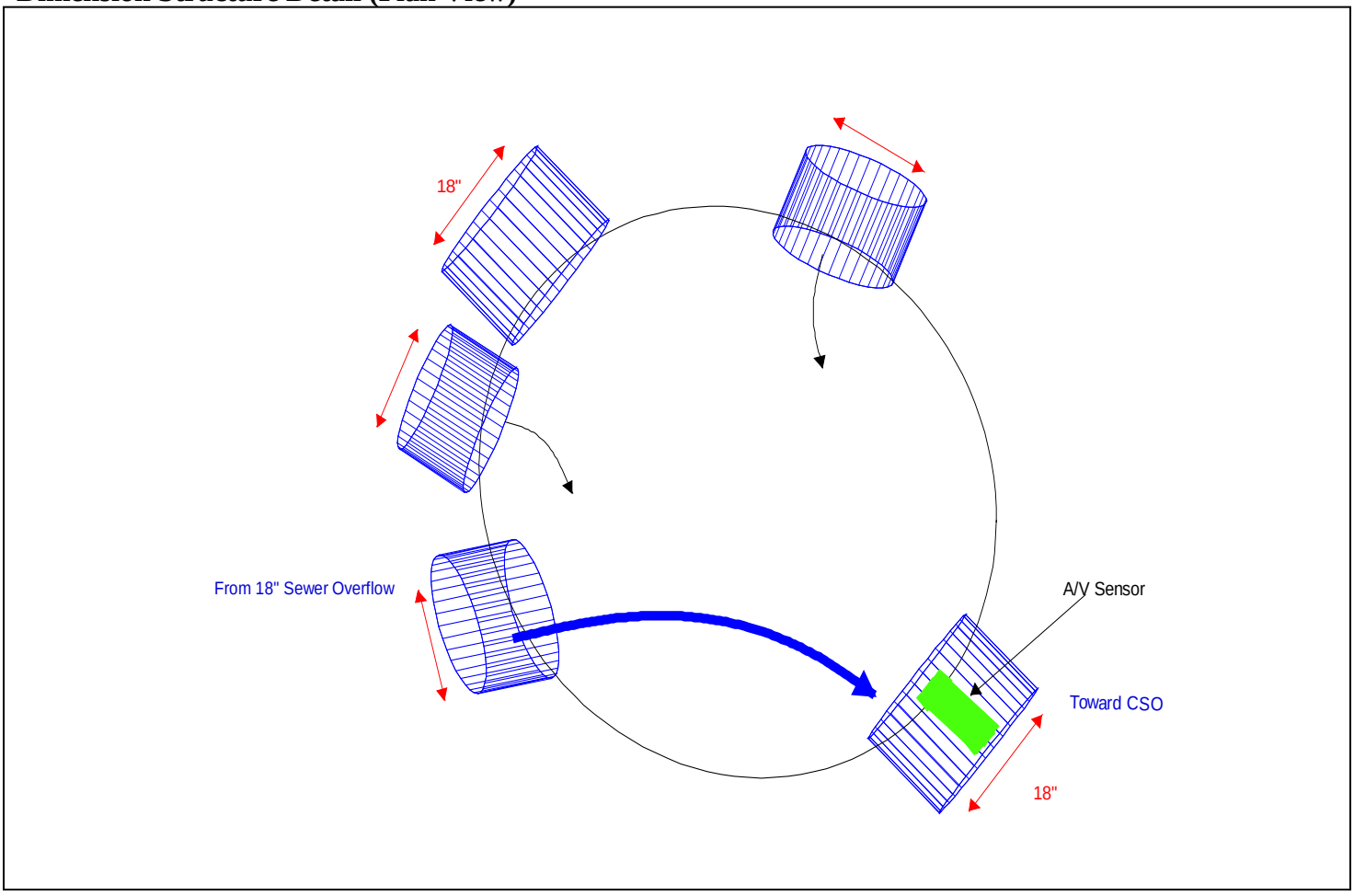
View of flow through influent line

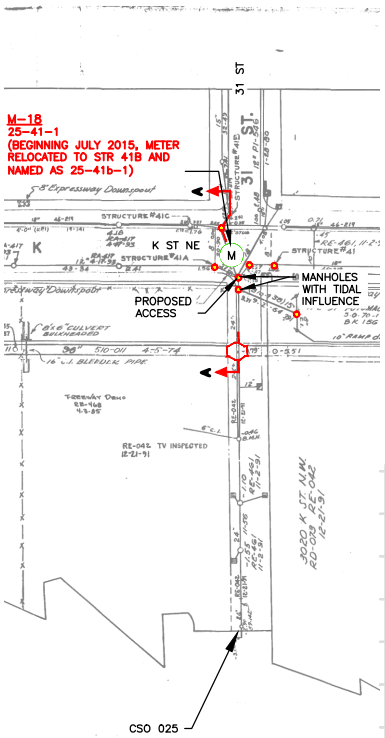
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

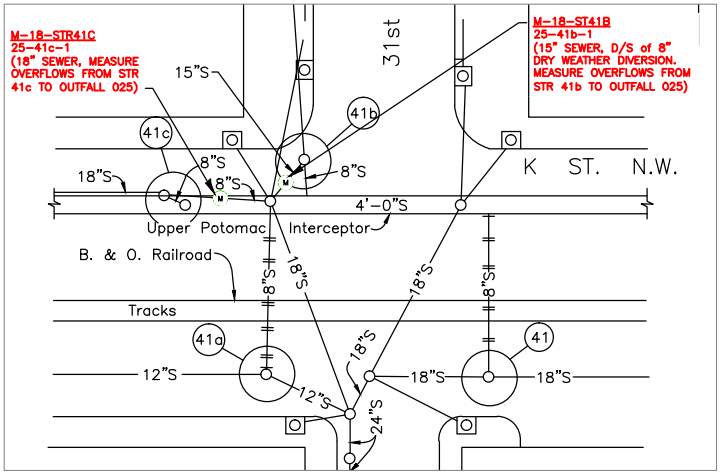


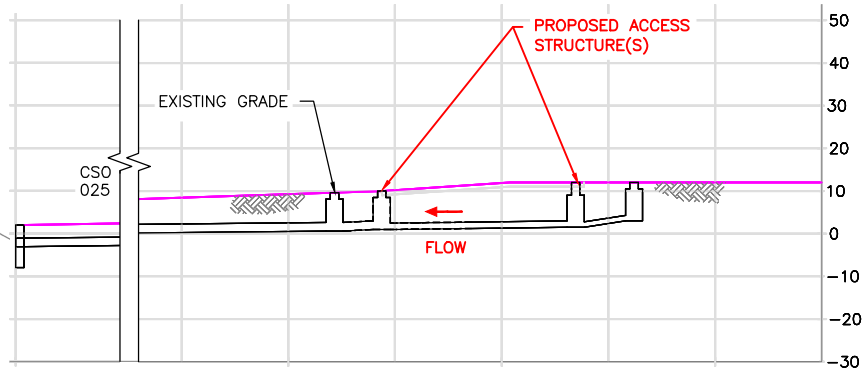
Dimension Structure Detail (Plan View)





FLOW METER LOCATION PLAN
SCALE: NTS





CROSS SECTION A–A (SEWER PROFILE)
SCALE NTS

LEGEND
(M) FLOW METER LOCATION
NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
25–41b–1 & 25–41c–1
METER LOCATION AND TYPICAL CROSS SECTION
DATE: OCTOBER 2014,Rev 7/'15 | SITE 18

LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 3:28:47 PM
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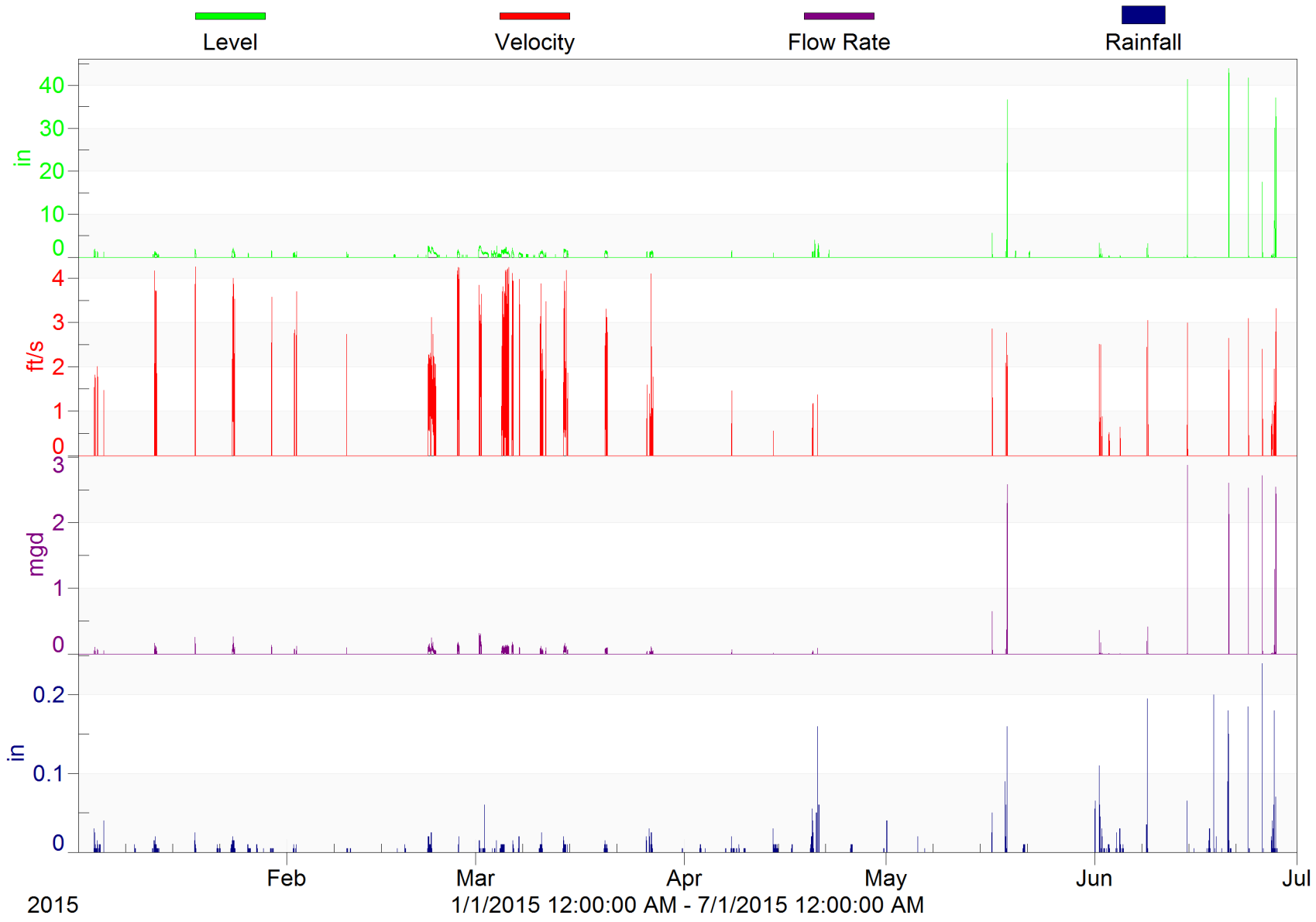
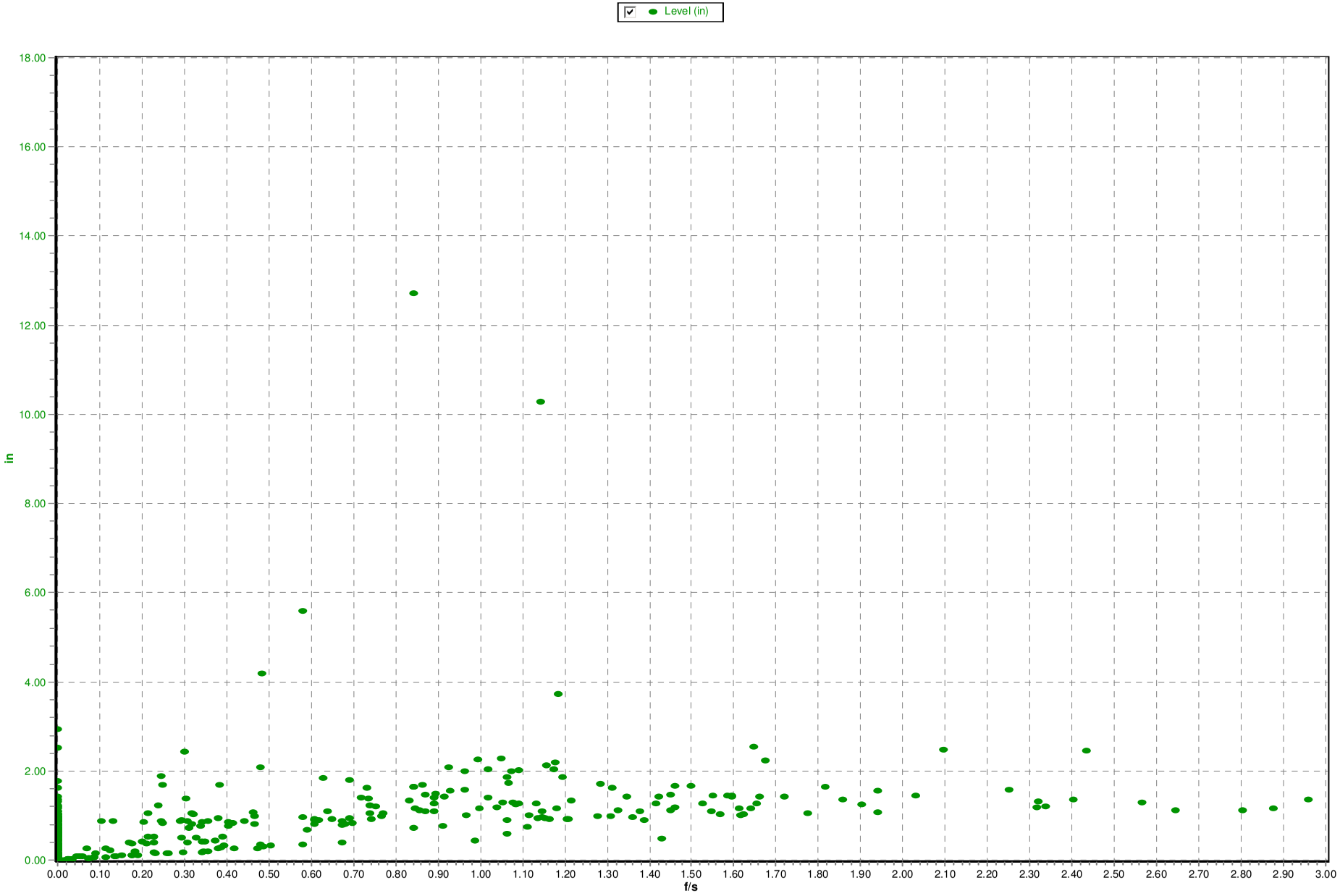
M-18


Level
Velocity
Flow Rate
Rainfall
in
40
30
20
10
0
ft/s
4
3
2
1
0
mgd
3
2
1
0
in
0.2
0.1
0
Feb
Mar
Apr
May
Jun
Jul
2015
1/1/2015 12:00:00 AM - 7/1/2015 12:00:00 AM

M-18 - On 31st St. NW, near the intersection of K St. NW

Pipe Diameter (in): 18 (01/01/15 to 07/06/15)



M-18

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
12/12/2014	11:14	0	0	0	0	0		LR/AP	Install.
12/12/2014	11:19	0	0	0	0	0		LR/AP	
12/12/2014	11:24	0	0	0	0	0		LR/AP	
1/8/2015	2:30		0		0	0		AP/AM	CB Telog.
1/29/2015	9:30		0		0	0	6.03	LA/AM	CB Telog.
2/20/2015	11:00		0		0	0	6.03	AP/AM	CB Telog.
3/13/2015	14:00		0		0	0	5.98	AP/AM	CB Telog.
4/3/2015	14:00		0		0	0	6.03	AP/AM	CB Telog.
4/22/2015	14:00		0		0	0		LL/DW	
6/23/2015	14:47	0	0	0	0	0	5.72	LL/DW	
7/7/2015	12:26	0	0	0	0	0	5.54	LR/DW	Moved meter from DS pipe to US 18" pipe
7/21/2015	13:31	0	0	0	0	0	5.54	LR/DW	
9/21/2015	12:49	0	0	0	0	0	6.21	LR/JC	Move meter to upstream manhole.
10/29/2015	10:56		0		0	0		JC/RM	
12/17/2015	9:51		0		0	0		LL/MH	Remove both 41a and 41b.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-18-Str41b

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 025

DURATION: 7/8/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-18-Str41b measured excess flows from Structure 41b before entering the Potomac River through CSO 025.

3. The continuity equation was used to calculate a flow rate from these measurements. M-18-Str41b is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	-3.227	-2.061
Avg.	0.022	-0.008	-0.001
Max	39.98	1.064	0.787

Site Name/Manhole # M-18-Str 41b Primary: [X] Alternate: [ ]

Investigation Date: 2/20/14 Time: 8:15 Crew Members: LR/JS

Installation Date: 7/7/15 Time: 12:00 Crew Members: LR/DW/JC

Address/Location: On 31st St. NW, near the intersection of K St. NW

Latitude: N 38° 54.153' Longitude: W 77° 3.667'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry pipe*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude: *Dry pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Infl. 1	Infl 2	Infl 3	Infl 4	Effluent
Height	18"	12"	18"	15"	18"
Width	18"	12"	18"	15"	18"
Material	Concrete	Concrete	Concrete	Concrete	Concrete
Shape	Round	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Permit and traffic plan required*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 5'

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends

☐ Influent ☐ (Effluent) ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

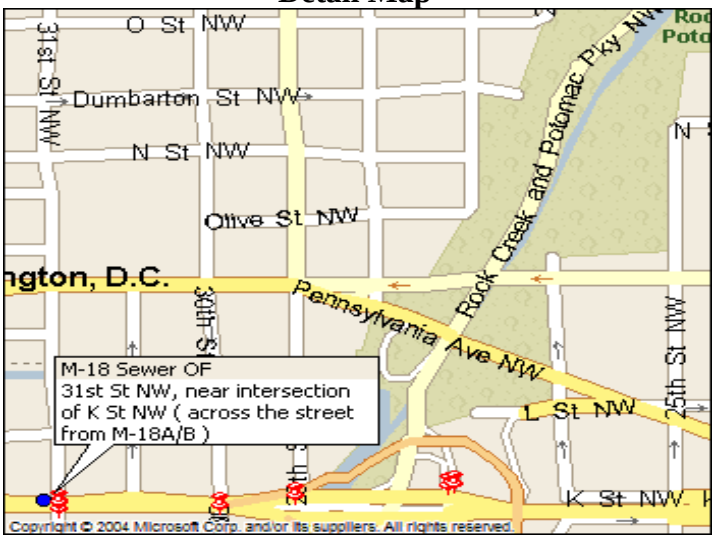
(Please include Serial Numbers when possible)

Level	Primary: Isco A/V
	Redundant:
Velocity	Primary: Isco A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map

Detail Map



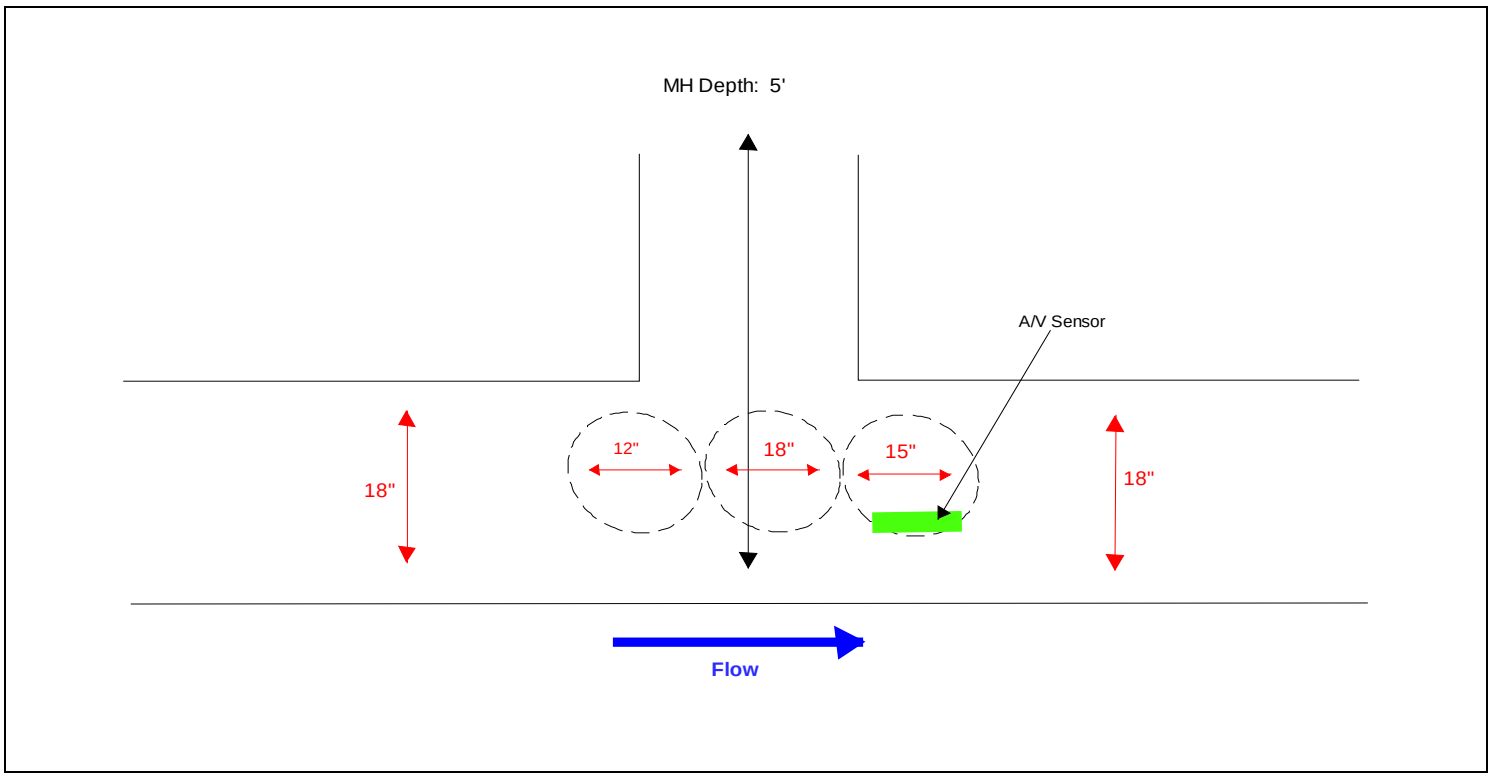
View from top of MH

Site Overview

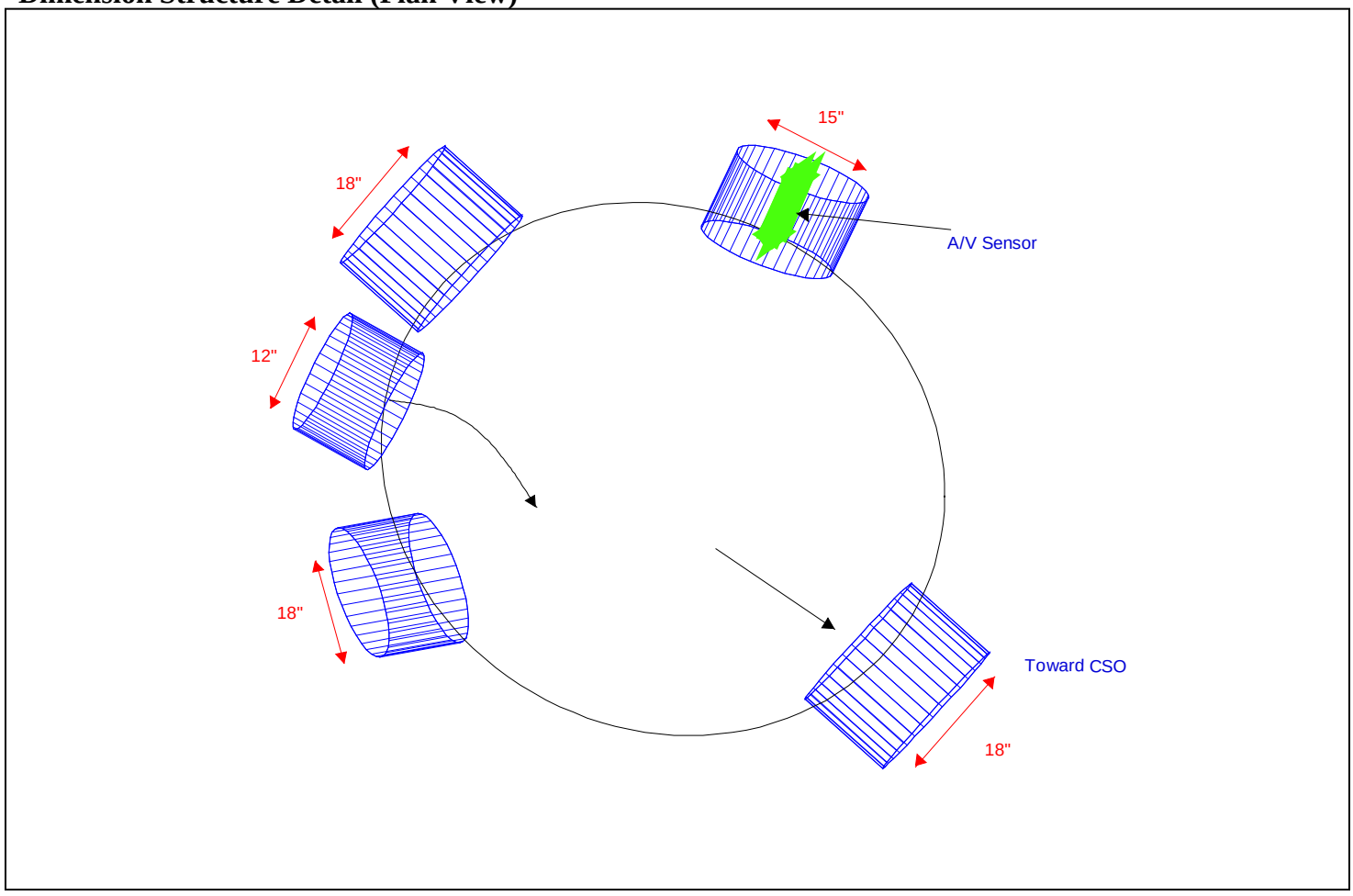
View of flow through influent line

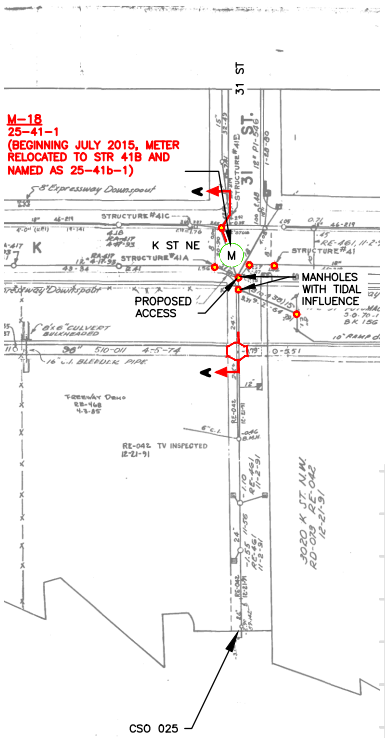
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

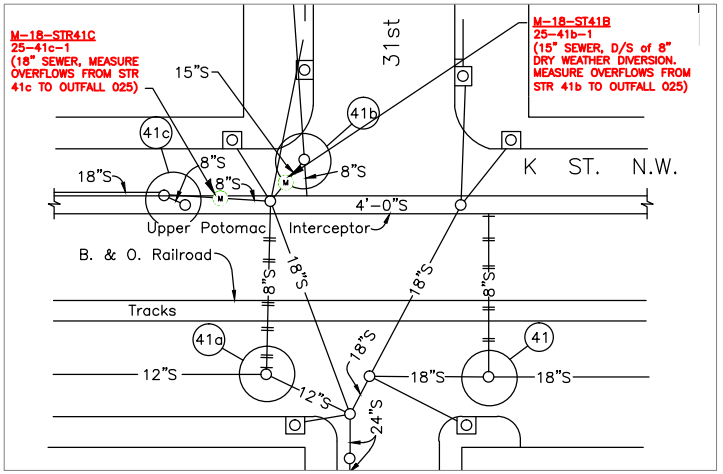


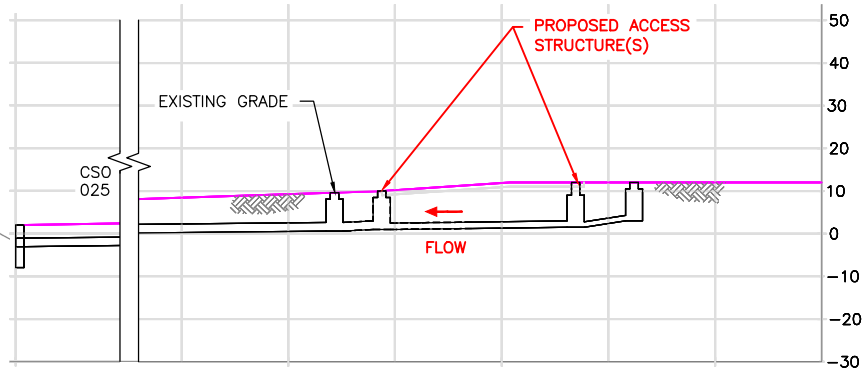
Dimension Structure Detail (Plan View)





FLOW METER LOCATION PLAN
SCALE: NTS





CROSS SECTION A–A (SEWER PROFILE)
SCALE NTS

LEGEND
(M) FLOW METER LOCATION
NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
25–41b–1 & 25–41c–1
METER LOCATION AND TYPICAL CROSS SECTION
DATE: OCTOBER 2014,Rev 7/*15 | SITE 18

LAST SAVED BY: STEFAN OSTNER DATE: 5/9/2016 3:28:47 PM
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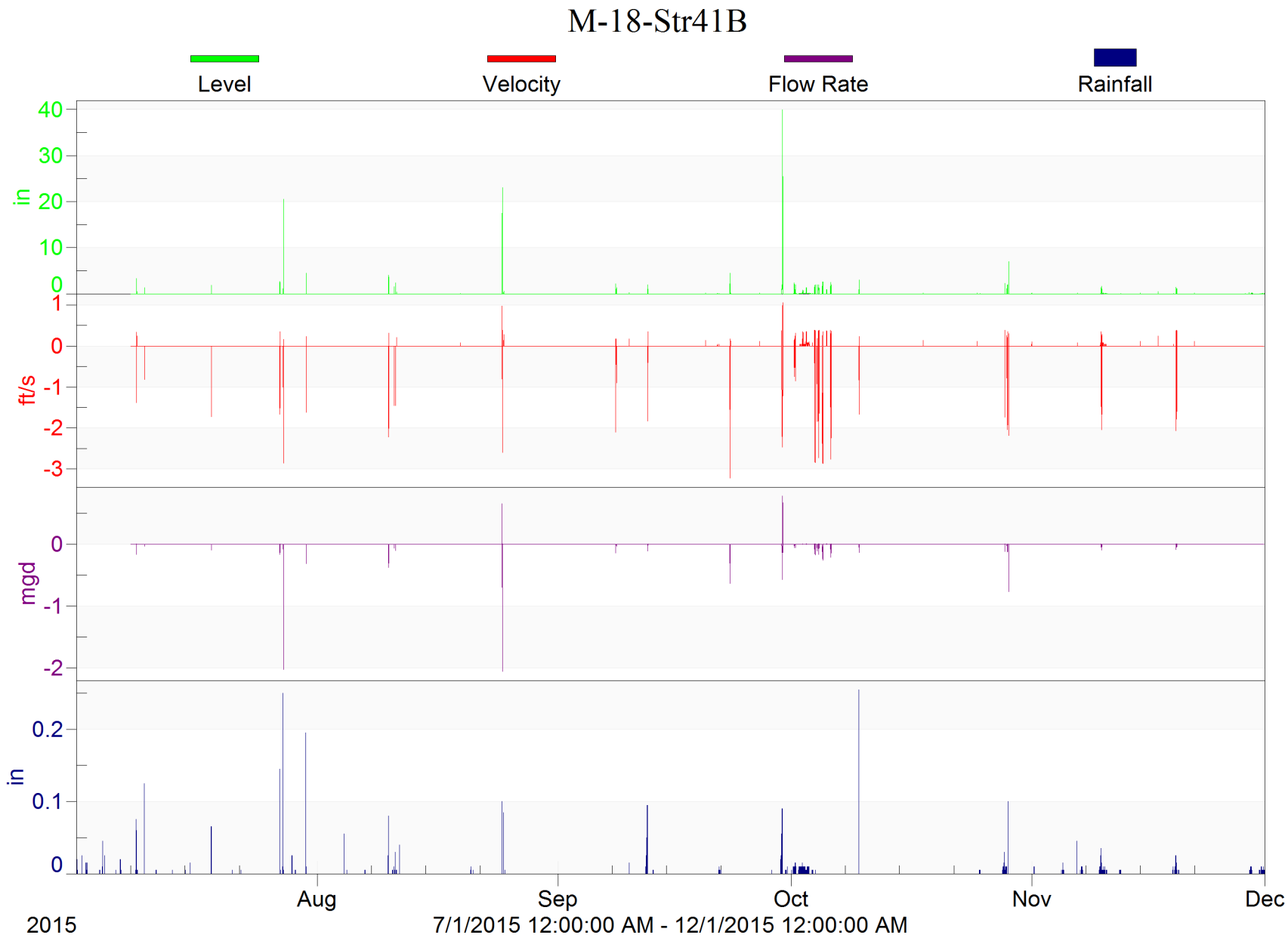
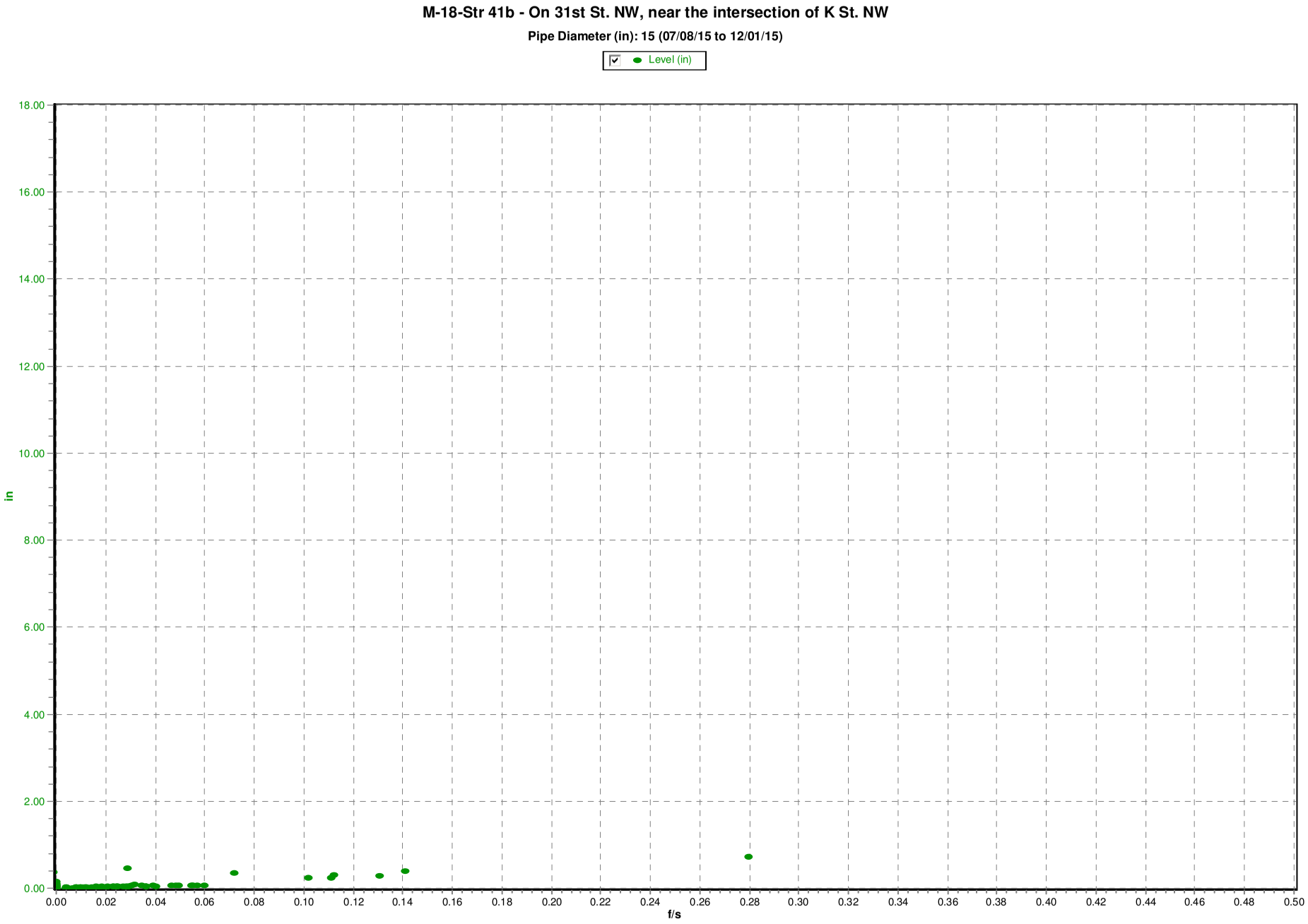

M-18-Str41B
Level
Velocity
Flow Rate
Rainfall
40
30
20
10
0
in
1
0
-1
-2
-3
ft/s
0
-1
-2
mgd
0.2
0.1
0
in
Aug
Sep
Oct
Nov
Dec
2015
7/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM


M-18-Str 41b - On 31st St. NW, near the intersection of K St. NW
Pipe Diameter (in): 15 (07/08/15 to 12/01/15)
Level (in)
in
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50
f/s

Site Summary

METER: M-18-Str41c

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 025

DURATION: 7/8/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-18-Str41c measured excess flows from Structure 41c before entering the Potomac River through CSO 025.

3. The continuity equation was used to calculate a flow rate from these measurements. M-18-Str41c is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.019	0.009	0.001
Max	37.712	2.604	1.160

Site Name/Manhole # M-18-Str 41c Primary: [X] Alternate: [ ]

Investigation Date: 2/20/14 Time: 8:15 Crew Members: LR/JS

Installation Date: 7/7/15 Time: 10:00 Crew Members: LR/DW/JC

Address/Location: On 31st St. NW, near the intersection of K St. NW

Latitude: N 38° 54.153' Longitude: W 77° 3.667'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry pipe*

Velocity 0 ft/sec

Depth 0 in

Turbulence Amplitude: *Dry pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Infl. 1	Infl 2	Infl 3	Infl 4	Effluent
Height	18"	12"	18"	15"	18"
Width	18"	12"	18"	15"	18"
Material	Concrete	Concrete	Concrete	Concrete	Concrete
Shape	Round	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: *Permit and traffic plan required*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 5'

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends

☐ Influent ☐ (Effluent) ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:

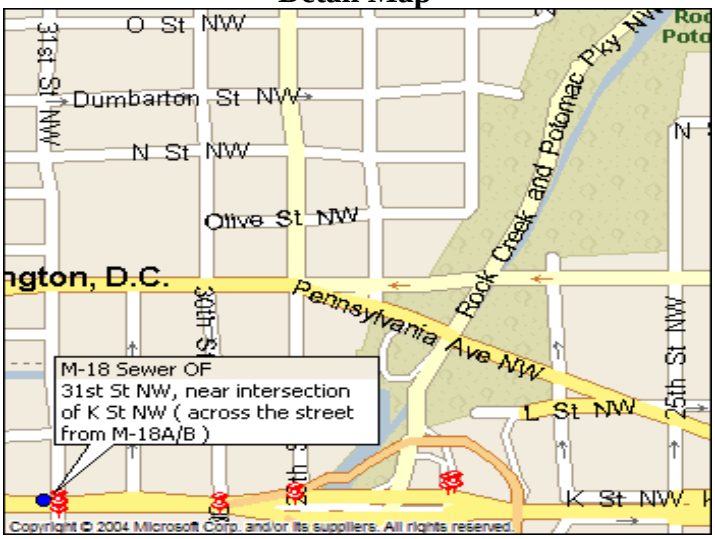
(Please include Serial Numbers when possible)

Level	Primary: Isco A/V
	Redundant:
Velocity	Primary: Isco A/V
	Redundant:
Meter Logger	Telog

Comments:

Area Map

Detail Map



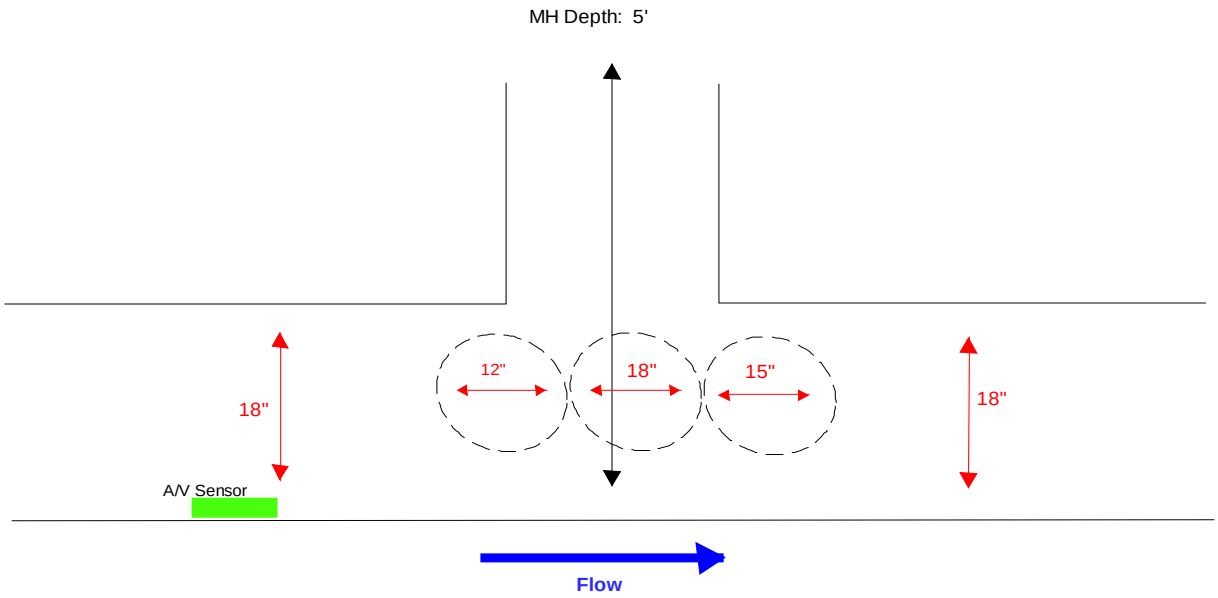
View from top of MH

Site Overview

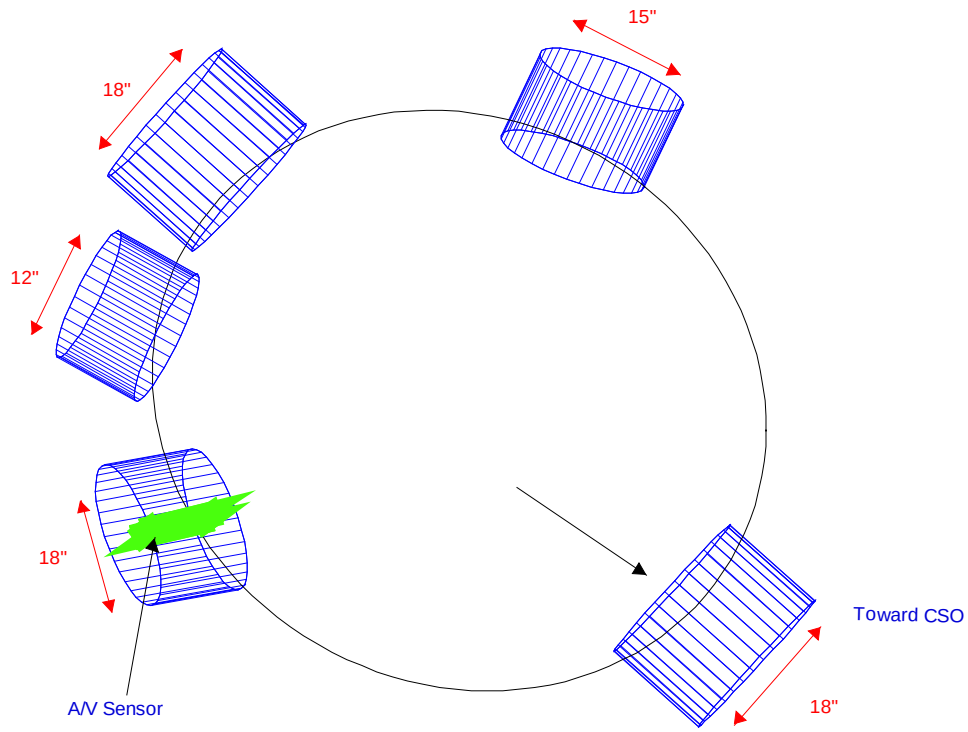
View of flow through influent line

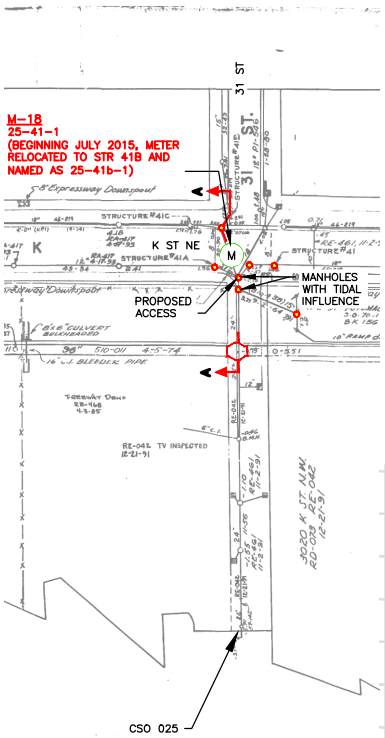
View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

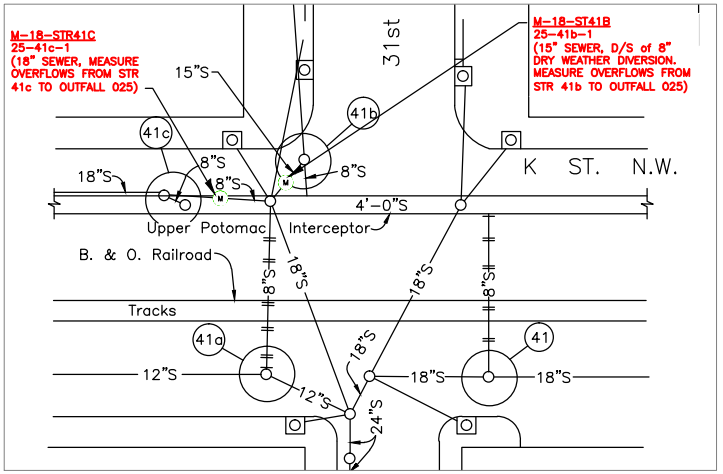


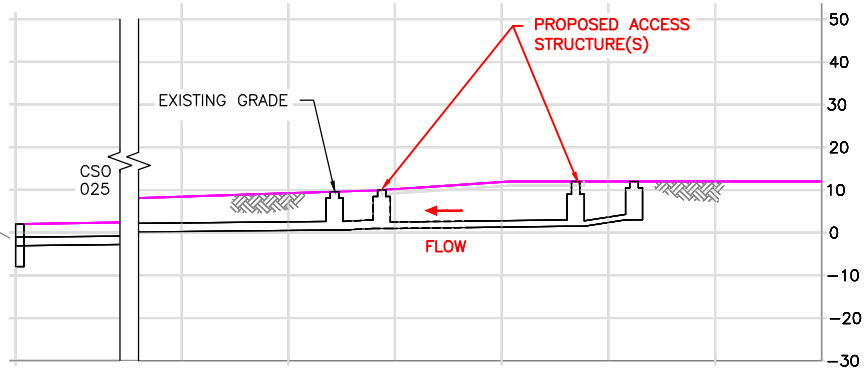
Dimension Structure Detail (Plan View)





FLOW METER LOCATION PLAN
SCALE: NTS





CROSS SECTION A–A (SEWER PROFILE)
SCALE NTS

LEGEND
M FLOW METER LOCATION
NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
25–41b–1 & 25–41c–1
METER LOCATION AND TYPICAL CROSS SECTION
DATE: OCTOBER 2014,Rev 7/*15 | SITE 18

LAST SAVED BY: STEFAN OSSTNER DATE: 5/9/2016 3:28:47 PM
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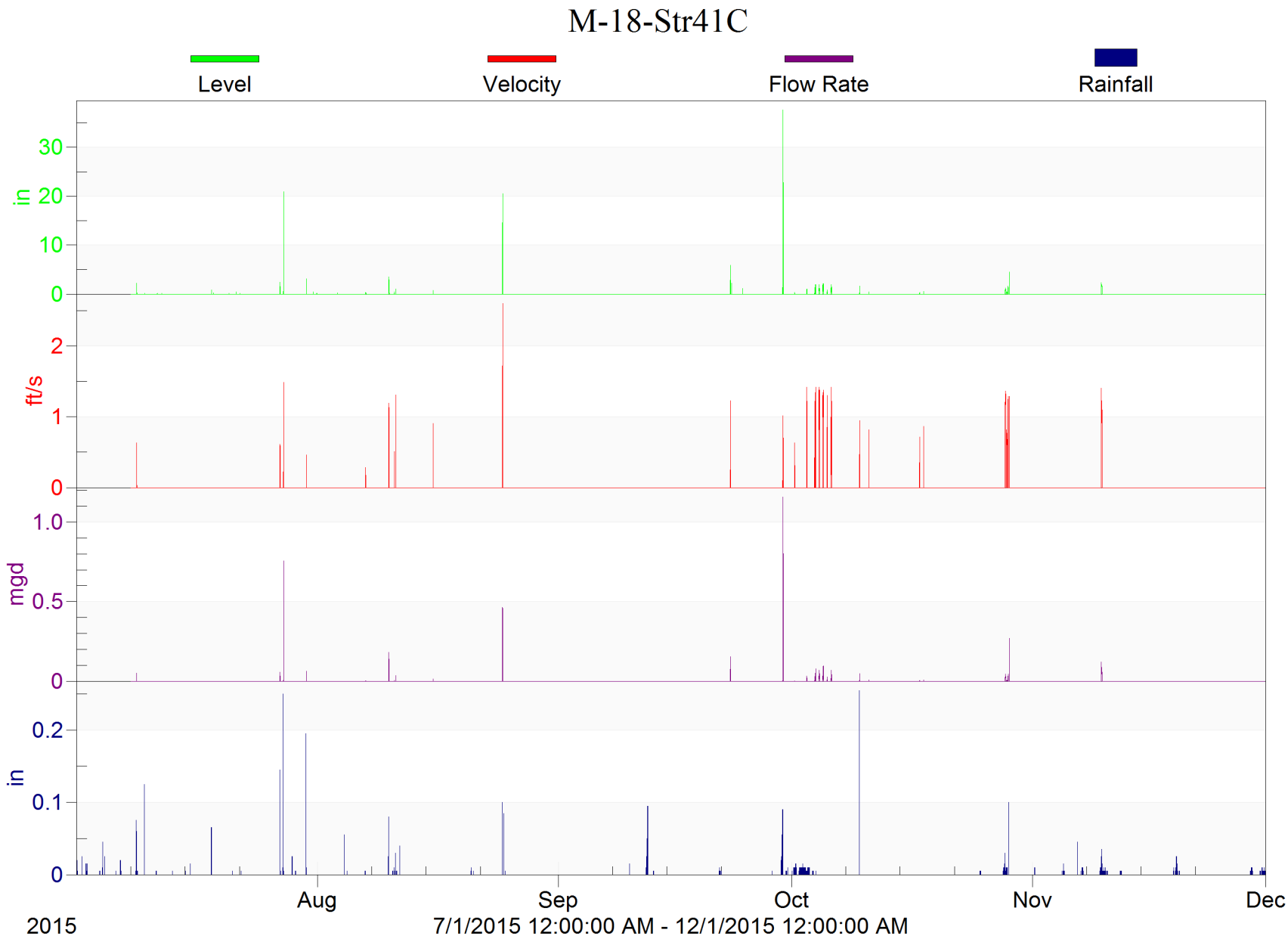
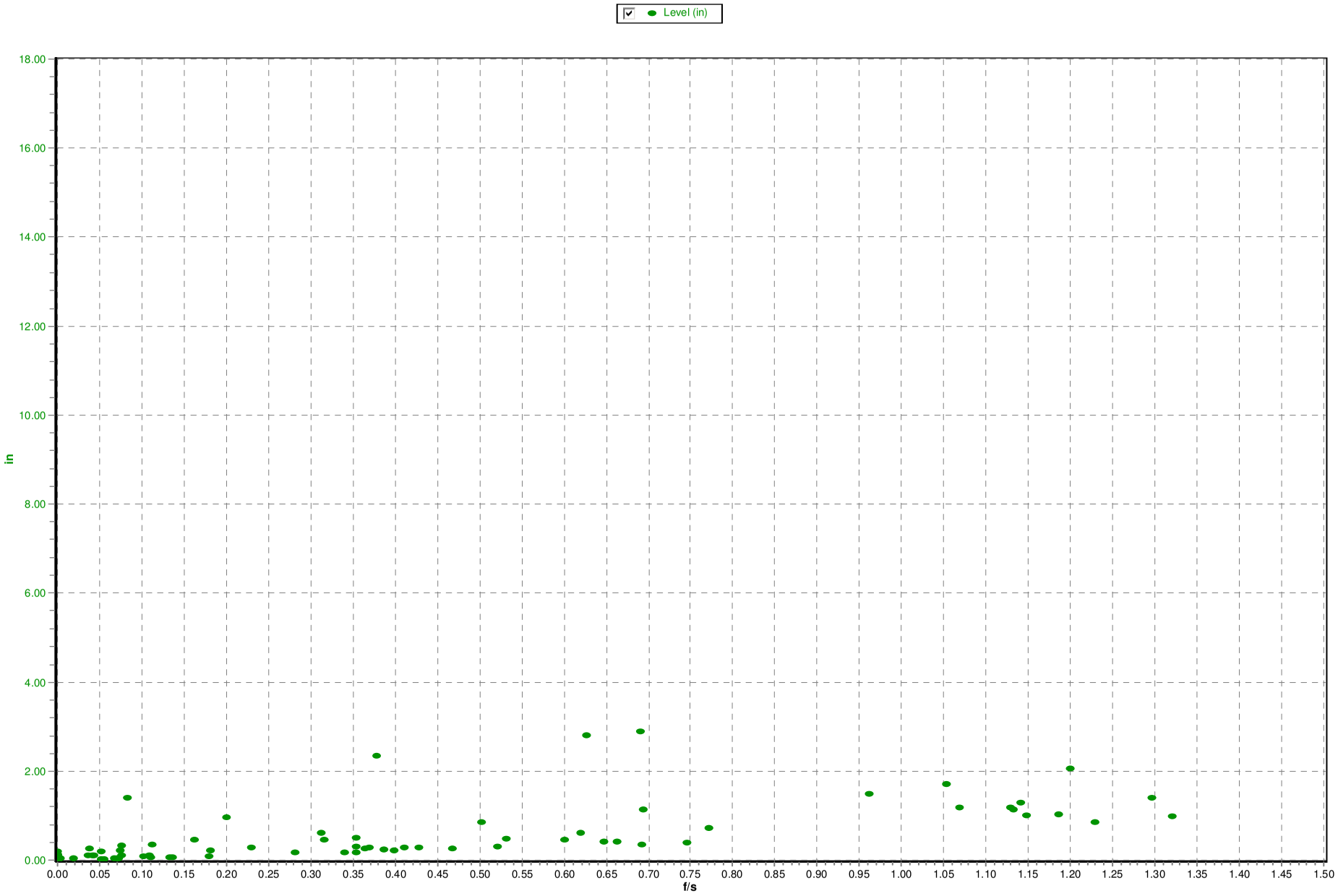

M-18-Str41C
Level
Velocity
Flow Rate
Rainfall
in
30
20
10
0
ft/s
2
1
0
mgd
1.0
0.5
0
in
0.2
0.1
0
Aug
Sep
Oct
Nov
Dec
2015
7/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-18-Str 41c - On 31st St. NW, near the intersection of K St. NW

Pipe Diameter (in): 18 (07/08/15 to 12/01/15)



Site Summary

METER: M-19

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 026

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-19 measured excess flows from Structure 42 before entering the Potomac River through CSO 025.

3. The continuity equation was used to calculate a flow rate from these measurements. M-19 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.001	0	0
Max	2.769	2.098	0.230

Site Name/Manhole # M-19 Primary: [X] Alternate: [ ]

Investigation Date: 10/16/14 Time: 11:00 Crew Members: LR/JS

Installation Date: 11/20/14 Time: 15:48 Crew Members: LR/SD

Address/Location: K Street NW & Wisconsin Avenue NW (on the sidewalk)

Latitude: N 38° 54.160’ Longitude: W 77° 3.779’

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity ___ ft/sec

Depth ___ in ***N/A***

Dry Overflow Pipe

Turbulence Amplitude:

- ☐ Less than 0.25”
- ☐ 0.25” to 0.75”
- ☐ 0.75” to 1.5”
- ☐ 1.5” to 3”
- ☐ Greater than 3”

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent	Overflow
Height	12”	12”	12”	18”
Width	12”	12”	12”	18”
Material	Clay	Clay	Clay	Clay
Shape	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access: ~~*Sidewalk*~~

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 5’3”

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

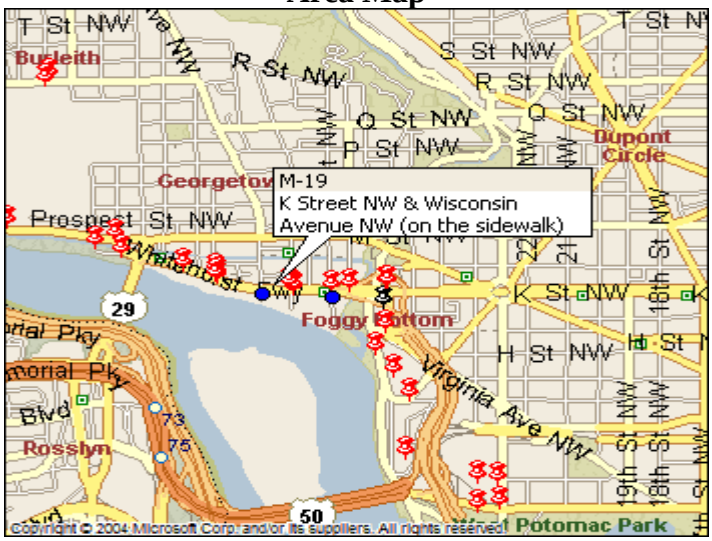
Sensor Configuration:

(Please include Serial Numbers when possible)

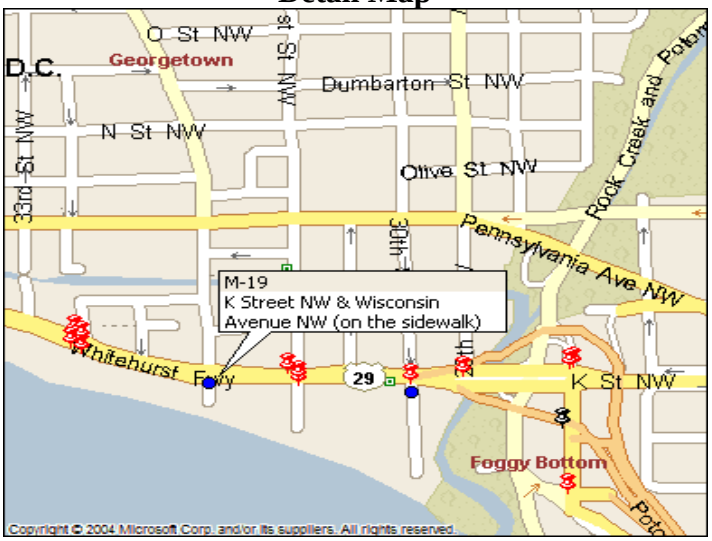
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



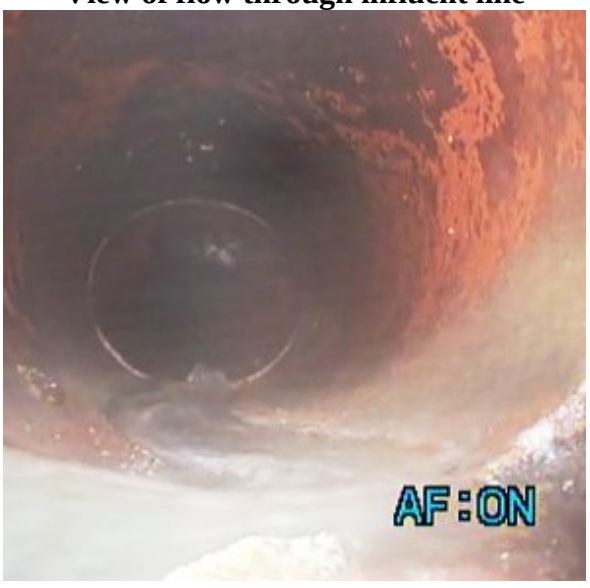
Detail Map



View from top of MH

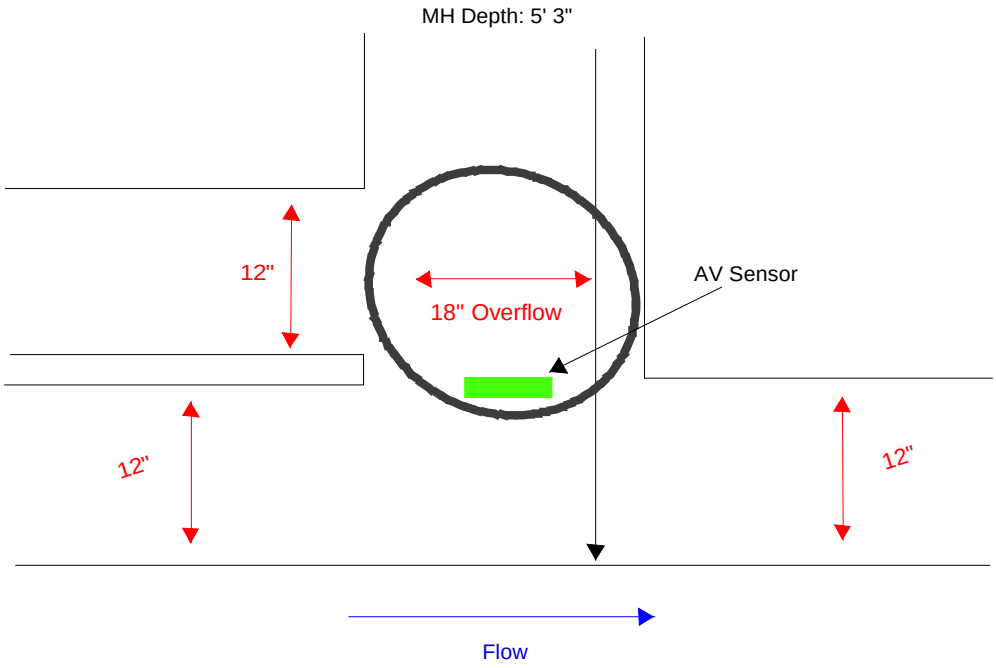
Site Overview

View of flow through influent line

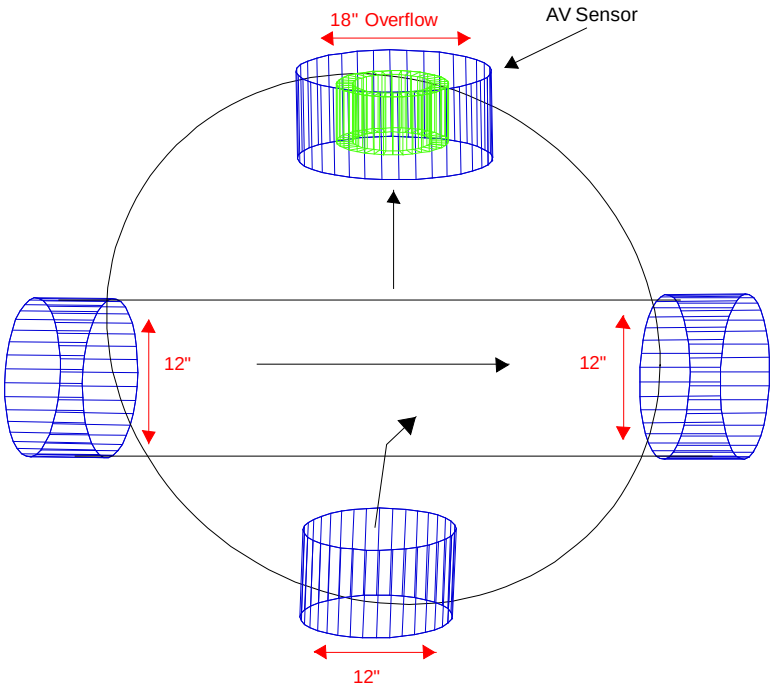


View of flow through effluent line

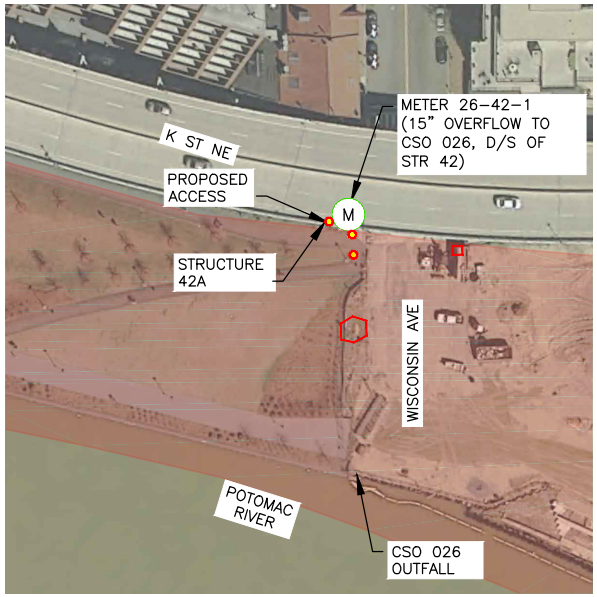
Dimensional Structure Profile View (profile sketch showing location of sensors)

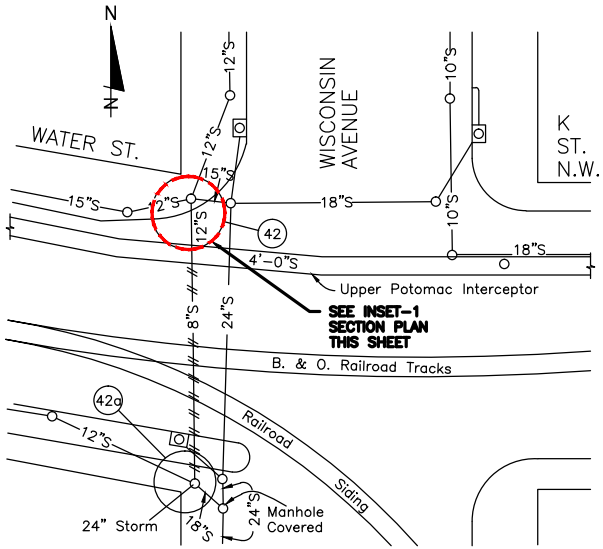


Dimension Structure Detail (Plan View)

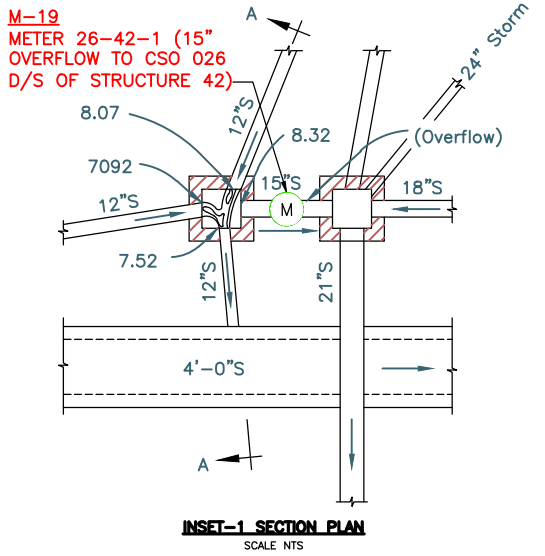


1 – FLOW METER

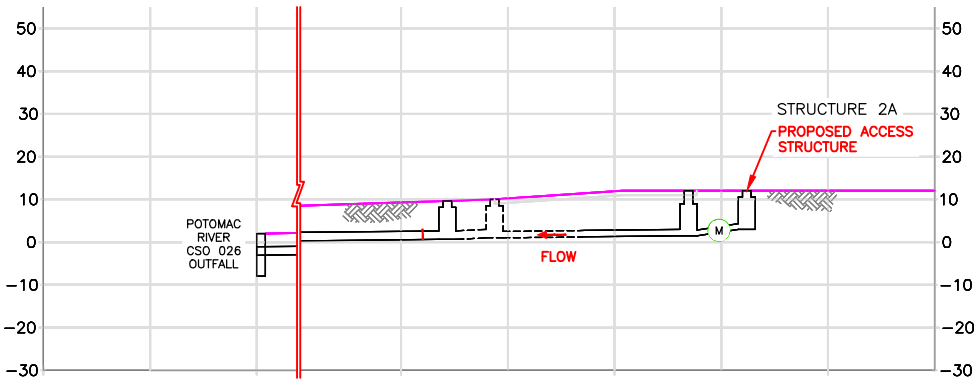




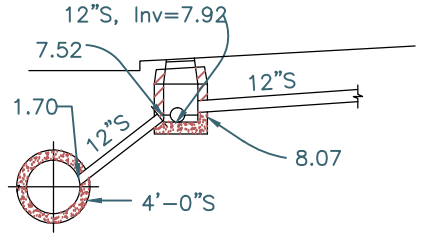
FLOW METER LOCATION PLAN
SCALE: NTS



INSET–1 SECTION PLAN
SCALE NTS



CROSS SECTION B–B (SEWER PROFILE)
SCALE NTS



SECTION A–A

LEGEND

M FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

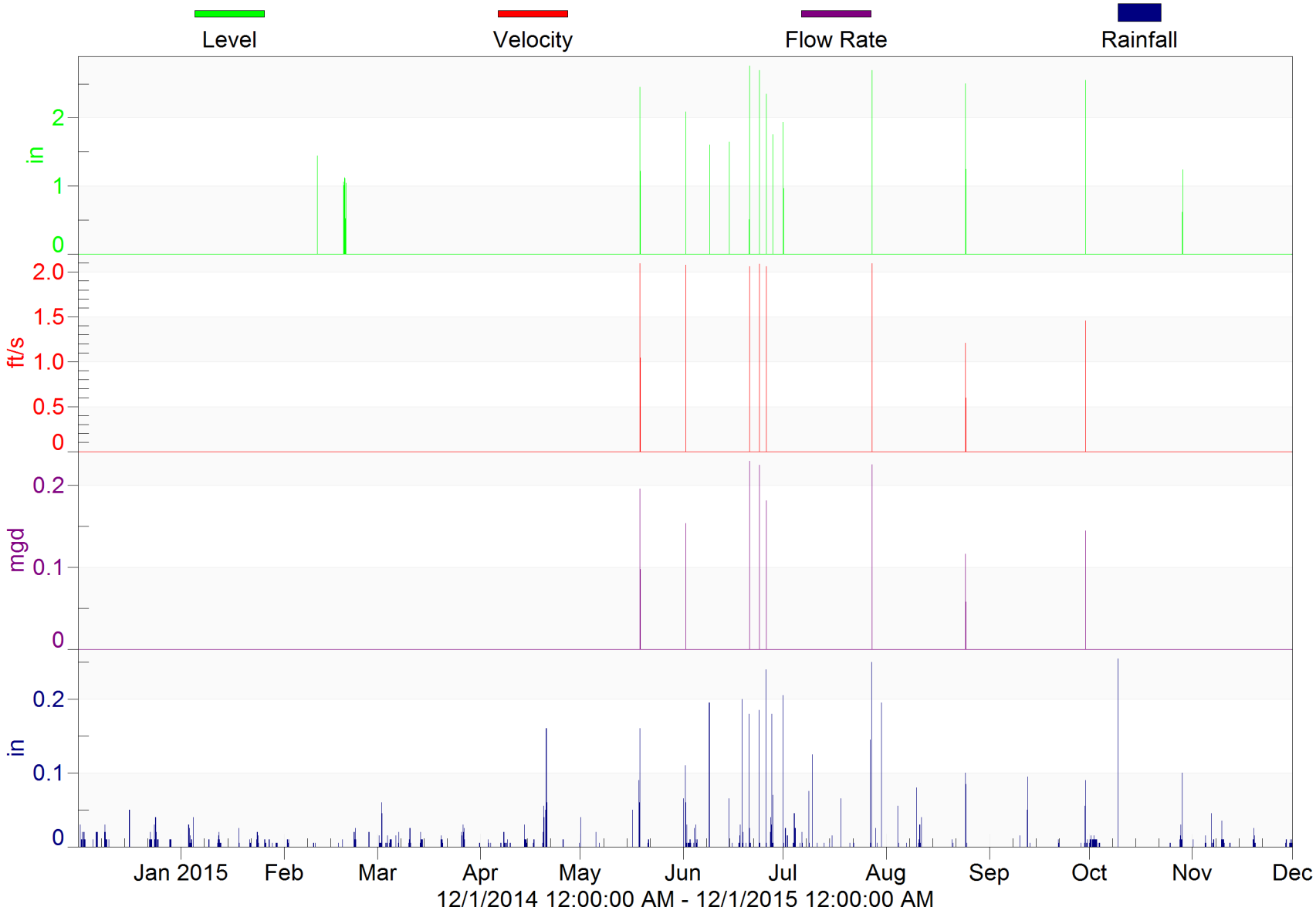
26–42–1

METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 19

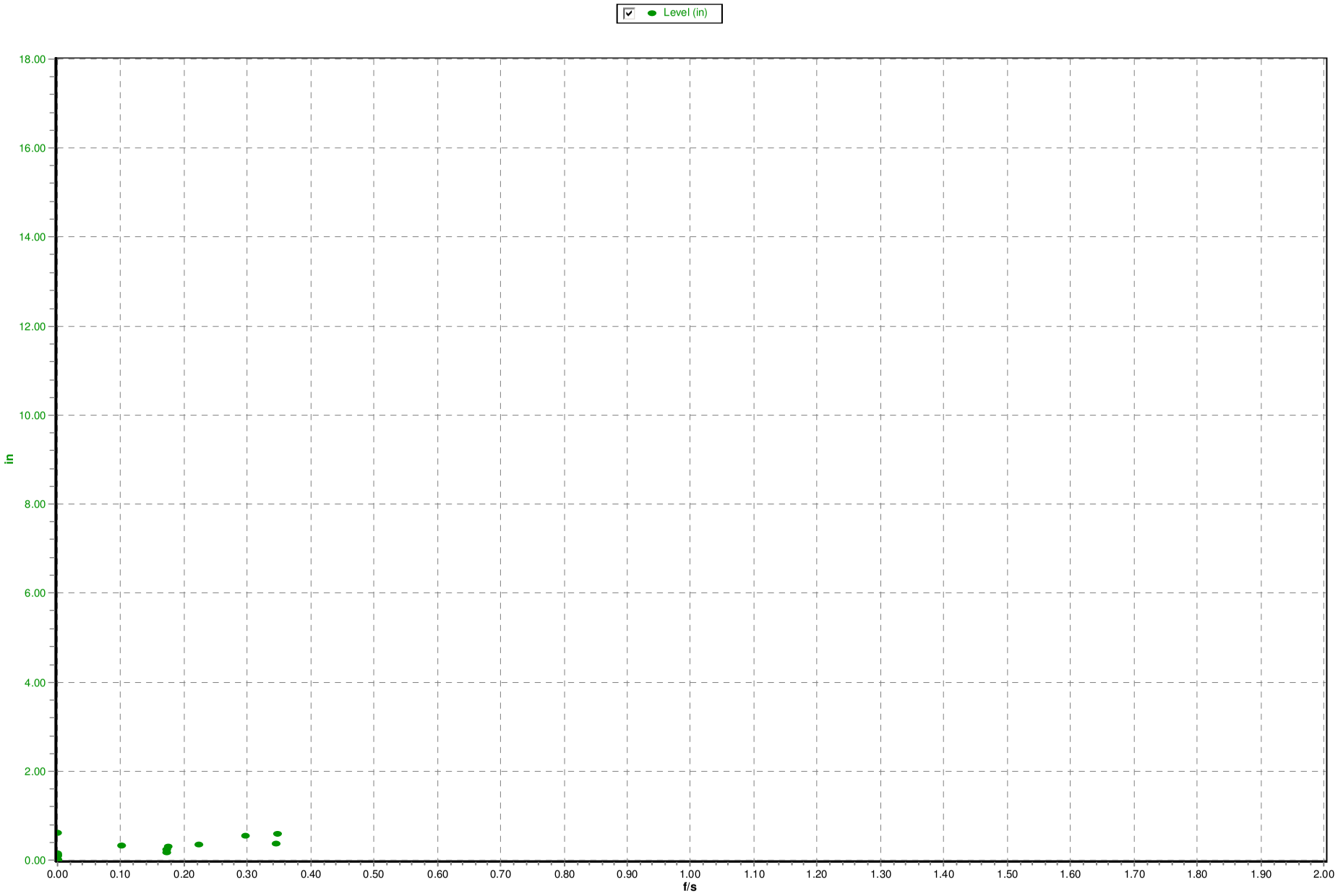
LAST SAVED BY: STEFAN COSTNER DATE: 5/9/2016 4:20:57 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\19_26-42A-1.DWG

M-19


Level
Velocity
Flow Rate
Rainfall
in
2
1
0
ft/s
2.0
1.5
1.0
0.5
0
mgd
0.2
0.1
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-19 - K Street NW & Wisconsin Avenue NW (on the sidewalk)

Pipe Diameter (in): 12 (12/01/14 to 12/01/15)



M-19

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/20/2014	16:56	0	0	0	0	0		LR/SD	Install.
11/20/2014	17:01	0	0	0	0	0		LR/SD	
11/20/2014	17:06	0	0	0	0	0		LR/SD	
12/17/2014	10:40		0		0	0		AM/GH	
12/22/2014	15:00		0		0	0		LR/AM	CB Telog.
1/13/2015	17:00		0		0	0		LL/AP	CB Telog.
2/10/2015	9:00		0		0	0	5.9	LR/AM	CB Telog.
2/24/2015	11:00		0		0	0	5.94	AP/AM	CB Telog.
3/24/2015	10:00		0		0	0	5.98	AP/AM	CB Telog.
4/27/2015	17:00		0		0	0		LL/DW	CB telog
5/19/2015	10:00		0		0	0	6.12	LL/DW	CB telog
6/9/2015	14:03		0		0	0		LL/DW	CB telog
6/18/2015	16:04		0		0	0	5.98	KE/DW	CB telog
7/14/2015	10:19		0		0	0	6.07	LR/DW	CB telog
8/11/2015	15:32		0		0	0		LR/JC	CB telog
9/8/2015	9:26		0		0	0		LR/JC	CB telog
9/28/2015	15:09		0		0	0		LR/JC	CB telog
11/10/2015	13:04		0		0	0		LR/JC	CB telog
12/9/2015	15:54		0		0	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-20P

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 027

DURATION: 1/1/15-12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was found at this location.

2. M-20P measured excess flows from the combined sewer on Potomac Street before reaching the Potomac River through CSO 027 downstream of Structure 43.

3. The continuity equation was used to calculate a flow rate from these measurements. M-20P is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	1.124	0.047	0.022
Max	66.85	8.024	50.820

Site Name/Manhole # M-20P Primary: [X] Alternate: [ ]

Investigation Date: 11/21/13 Time: 12:10 Crew Members: LR/JS

Installation Date: 12/10/14 Time: 15:00 Crew Members: LR/AM

Address/Location: On K St. NW, near the intersection of Potomac St. NW

Latitude: N 38° 54.192' Longitude: W 77° 3.921'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Radar, less than ½ depth*

Velocity 0.8 ft/sec

Depth ±0.25 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☑ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	54.5"		54.5"
Width	54.5"		54.5"
Material	Brick		Brick
Shape	Round		Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☑ No Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☑ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☑ Good 20.9 (condition)

Site Conditions

Site Access: *Permit and traffic plan needed*

- ☐ Good (no problems accessing site)
- ☑ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☑ No

Height above ground ____

Manhole depth 10' 11"

Structural Integrity of Manhole:

☐ Good ☑ Fair ☐ Poor

Pipe Bends:

☑ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: 1 ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☑ Yes ☐ No ☐ Maybe

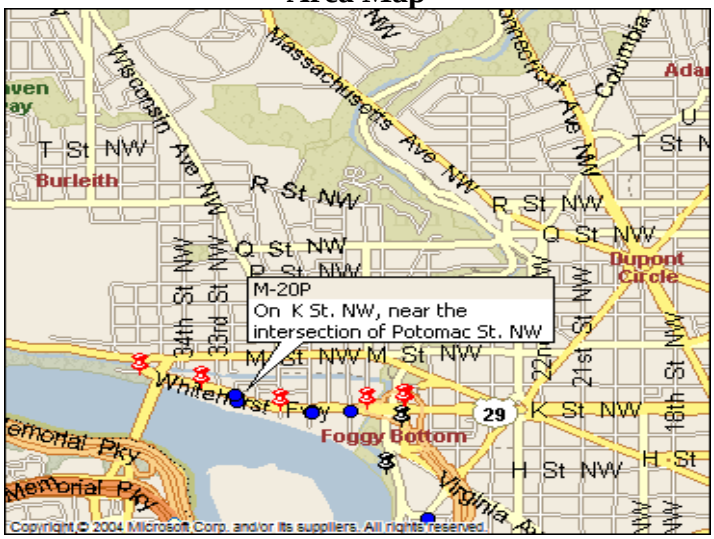
Sensor Configuration:

(Please include Serial Numbers when possible)

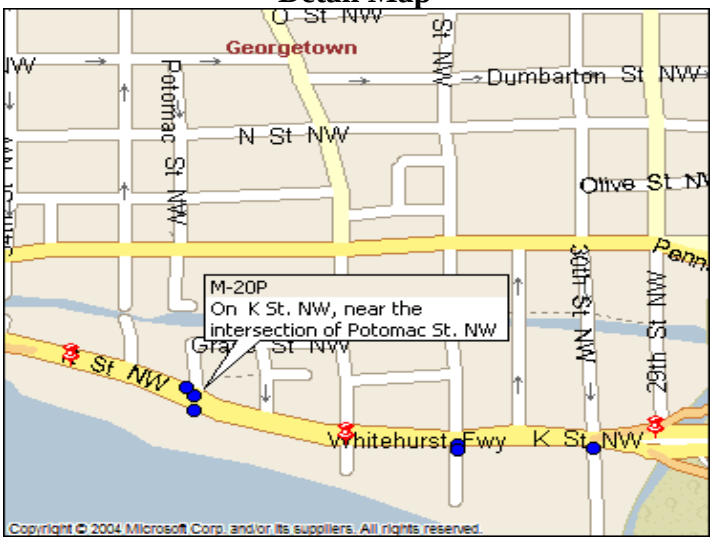
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *DS install*

Area Map



Detail Map



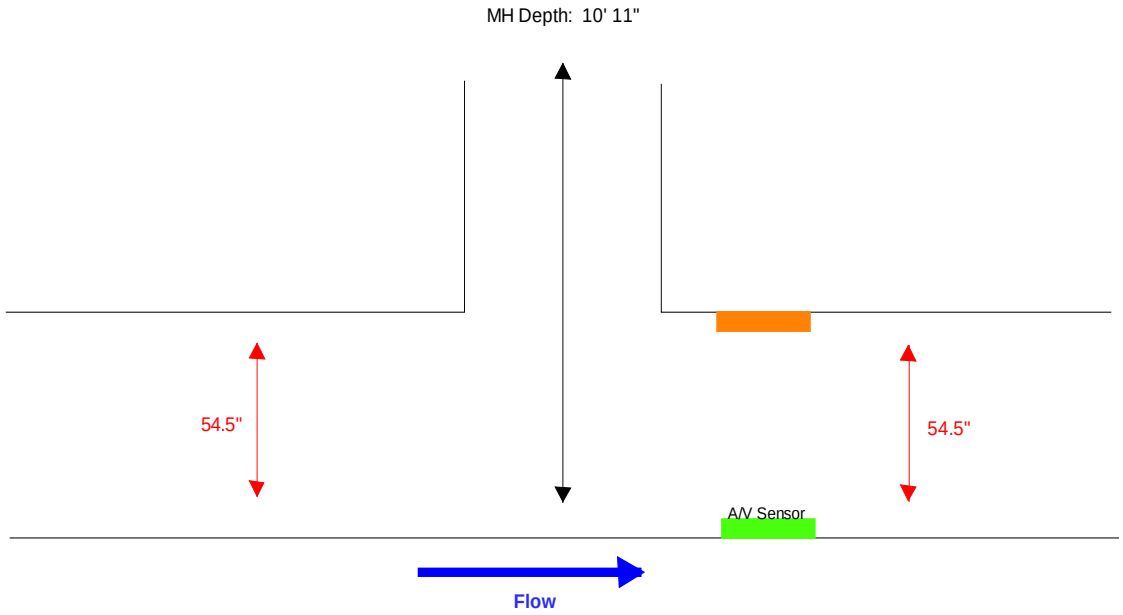
View from top of MH

Site Overview

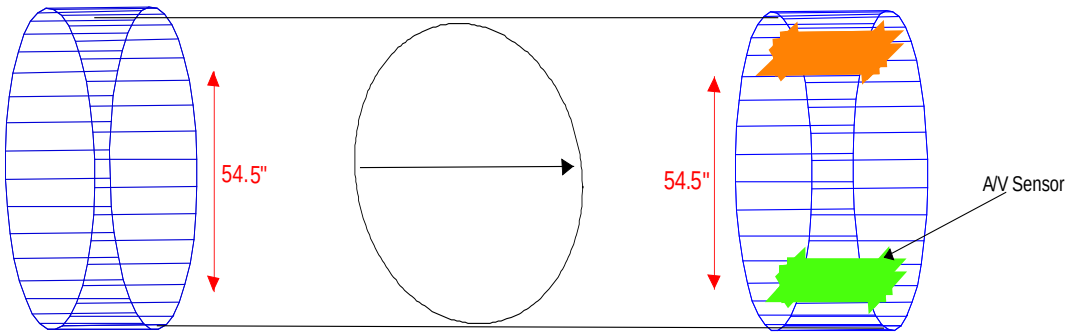
View of flow through influent line

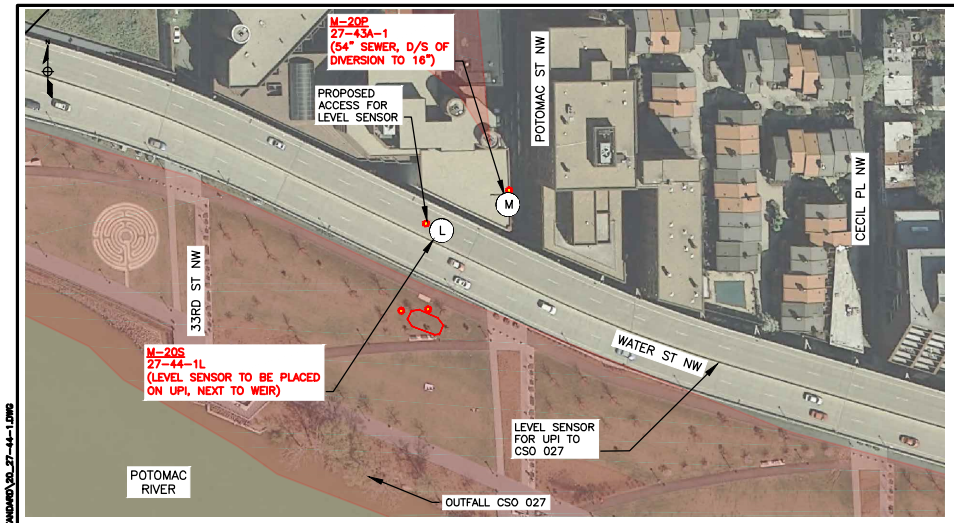
View of flow through effluent line

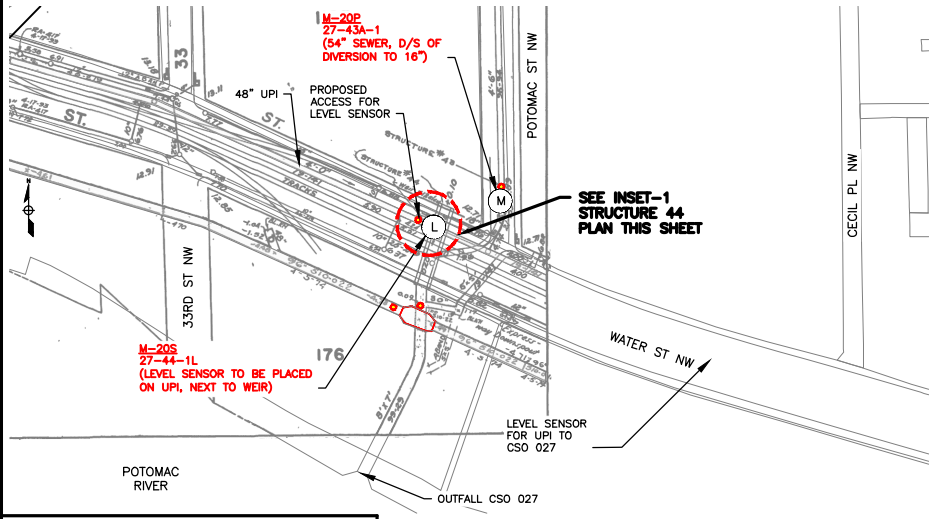
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

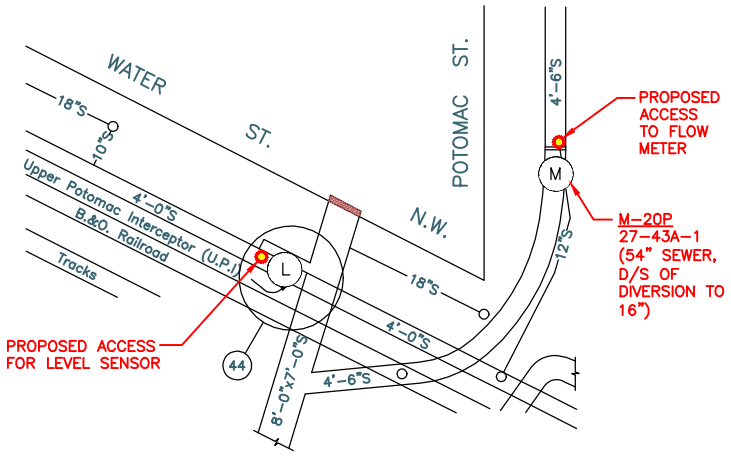




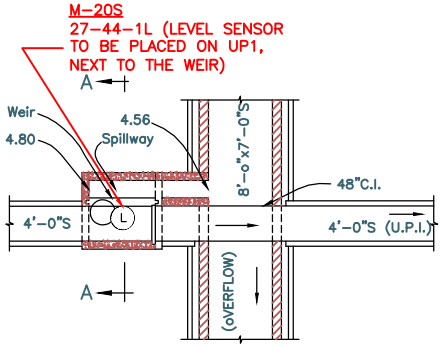


LEVEL SENSOR LOCATION PLAN
SCALE: NTS

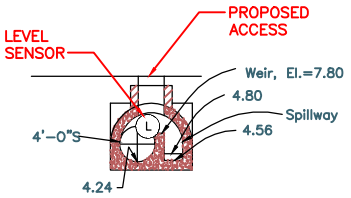
1 – FLOW METER
1 – LEVEL SENSOR



INSET-1 STRUCTURE 44 PLAN
SCALE NTS



STRUCTURE 44 DETAIL
SCALE NTS



SECTION A-A
SCALE NTS

LEGEND

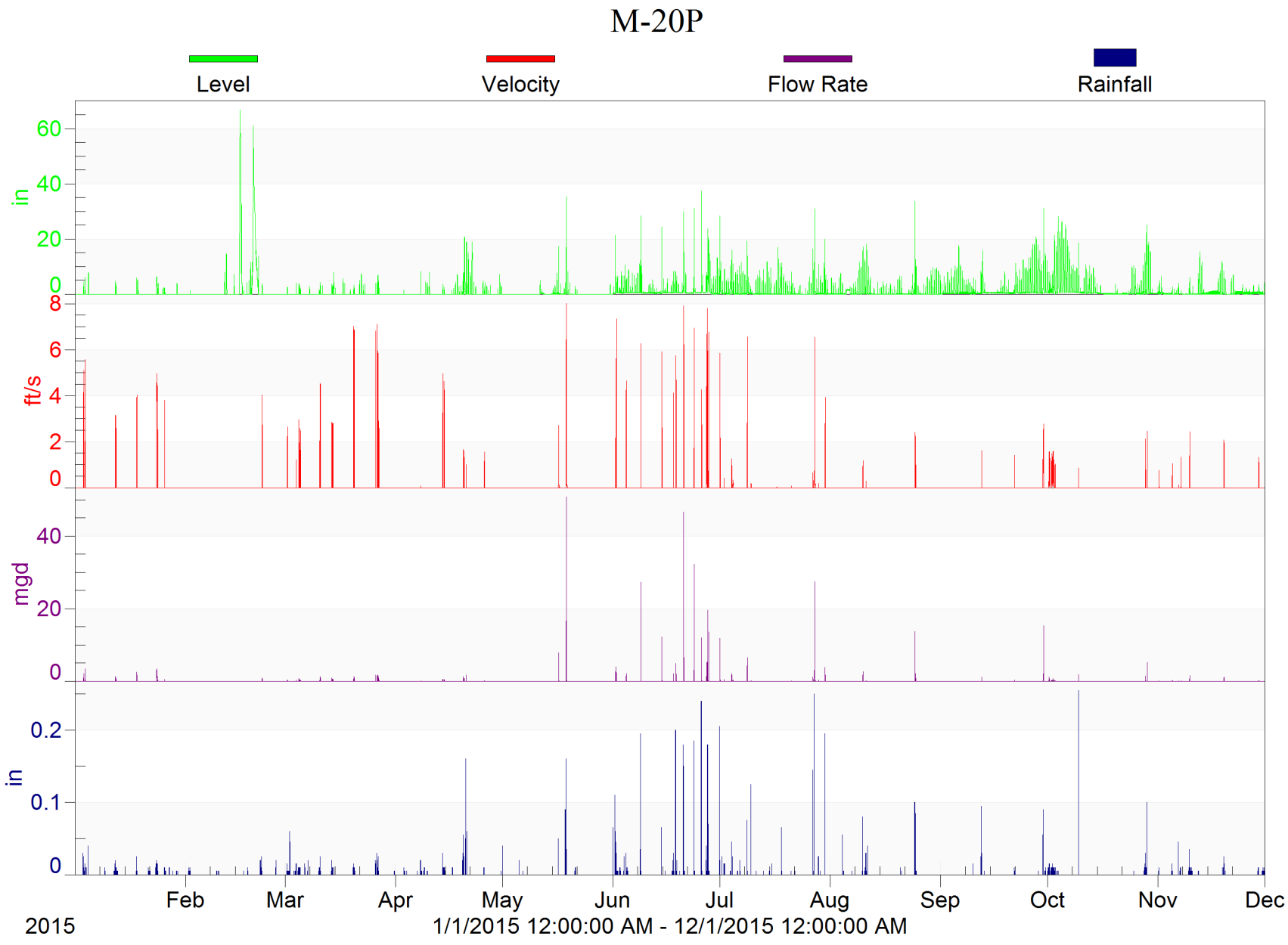
- (M) LEVEL SENSOR LOCATION
- (L) LEVEL SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

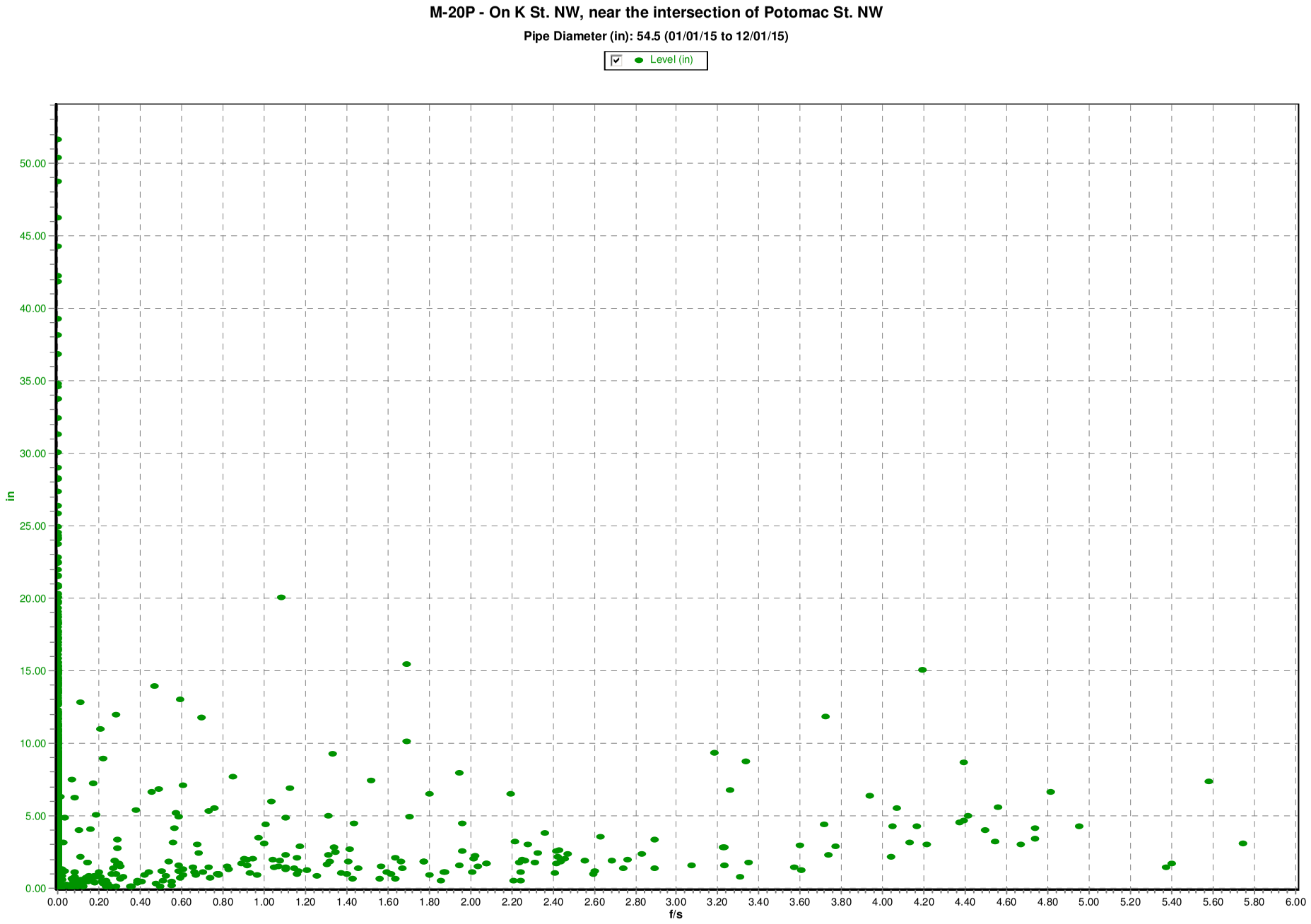
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
27-43A-1 AND 27-44-1L
LEVEL SENSOR LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 20

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 10:12:50 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\20_27-44-1.DWG


M-20P
Level
Velocity
Flow Rate
Rainfall
in
60
40
20
0
ft/s
8
6
4
2
0
mgd
40
20
0
in
0.2
0.1
0
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2015
1/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM


M-20P - On K St. NW, near the intersection of Potomac St. NW
Pipe Diameter (in): 54.5 (01/01/15 to 12/01/15)
Level (in)
in
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00
f/s

M-20P

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
12/12/2014	13:00		0		0	0		LR/AP	Install.
12/16/2014	15:09		6.75		0	0		GM/SD	
1/20/2015	14:30						6.12	AP/AM	CB Telog.
2/10/2015	14:00		0		0	0	6.12	LR/AM	CB Telog.
2/24/2015	12:00						6.03	AP/AM	CB Telog.
3/17/2015	15:00						5.81	AP/AM	CB Telog.
4/3/2015	13:00		0		0	0	6.03	AP/AM	CB Telog.
5/7/2015	14:35	0.23	0.25	0	0	0	12.5	LR/DW	Change meter.
5/7/2015	14:40	0.184	0.25	0	0	0	12.6	LR/DW	
5/7/2015	14:45	0.122	0.25	0	0	0	12.6	LR/DW	
5/11/2015	13:00						6.16	LR/DW	CB Telog.
9/1/2015	12:09		0.25		0	0	6.2	LR/JC	CB Telog.
10/29/2015	10:20		17		0	0		JC/RM	
12/21/2015	12:30		0.25		0	0		LR/DN	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-20S

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 027

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-20S measured excess flows from the Upper Potomac Interceptor before reaching the Potomac River through CSO 027 downstream of Structure 44.

3. The weir formula was used to calculate a flow rate from these measurements. M-20S is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	9.206	0
Avg.	11.475	0.003
Max	53.908	11.953

Site Name/Manhole # M-20S Primary: [X] Alternate: [ ]

Investigation Date: 11/21/13 Time: 12:40 Crew Members: LR/JS

Installation Date: 11/13/14 Time: 8:06 Crew Members: LR/SD

Address/Location: In the sidewalk on K St. NW, approx. 40' from the intersection of Potomac St. NW

Latitude: N 38° 54.192' Longitude: W 77° 3.925'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Debris flow*

Velocity 0.44 ft/sec

Depth 10.25 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☑ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Overflow	Effluent
Height	48"	60"	48"
Width	48"	24"	48"
Material	Concrete w/ Brick Bottom	Concrete w/ Brick Bottom	Concrete w/ Brick Bottom
Shape	Round	Rectangle	Round

Sediment Present: *Silt not measured at installation*

- ☑ Yes Hard packed: ___ in. deep
- ☐ No Soft: ___ in. deep

Surcharge / Backwater Influence:

- ☐ ~~No evidence visible~~
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☑ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☑ No

Height above ground ____

Manhole depth 8'8"

Structural Integrity of Manhole:

☑ Good ☐ Fair ☐ Poor

Pipe Bends:

☑ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ~20 ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☑ Yes ☐ No ☐ Maybe

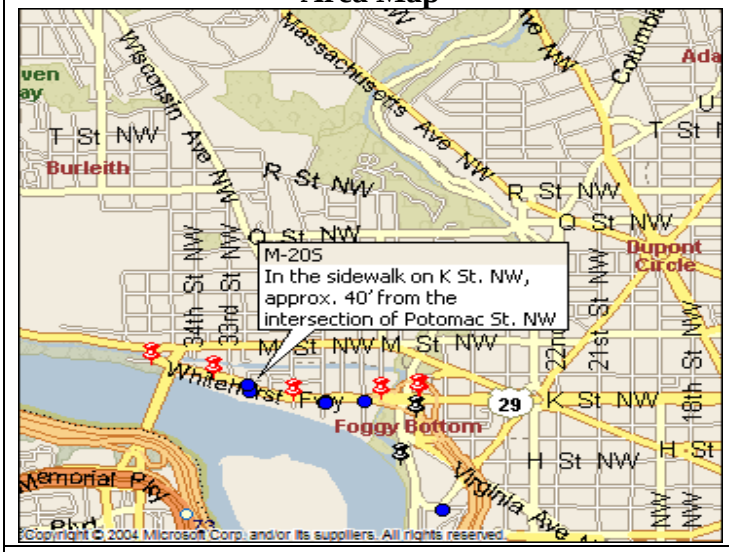
Sensor Configuration:

(Please include Serial Numbers when possible)

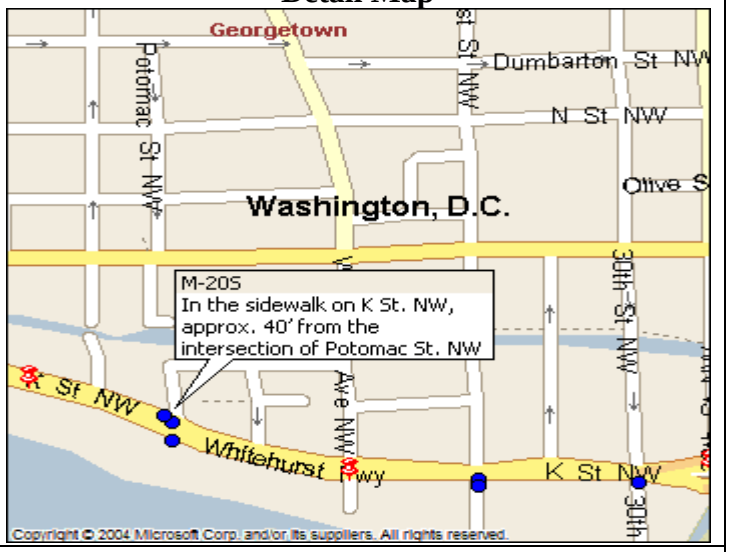
Level	Primary: Flowav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog

Comments:

Area Map

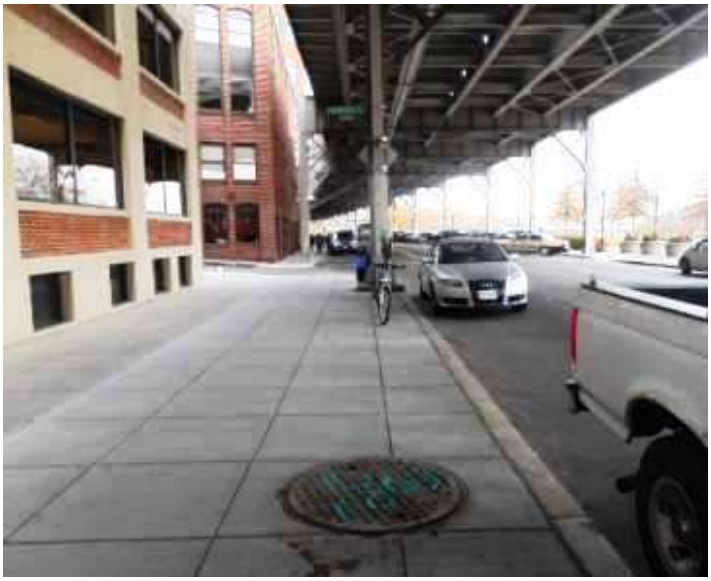


Detail Map



View from top of MH

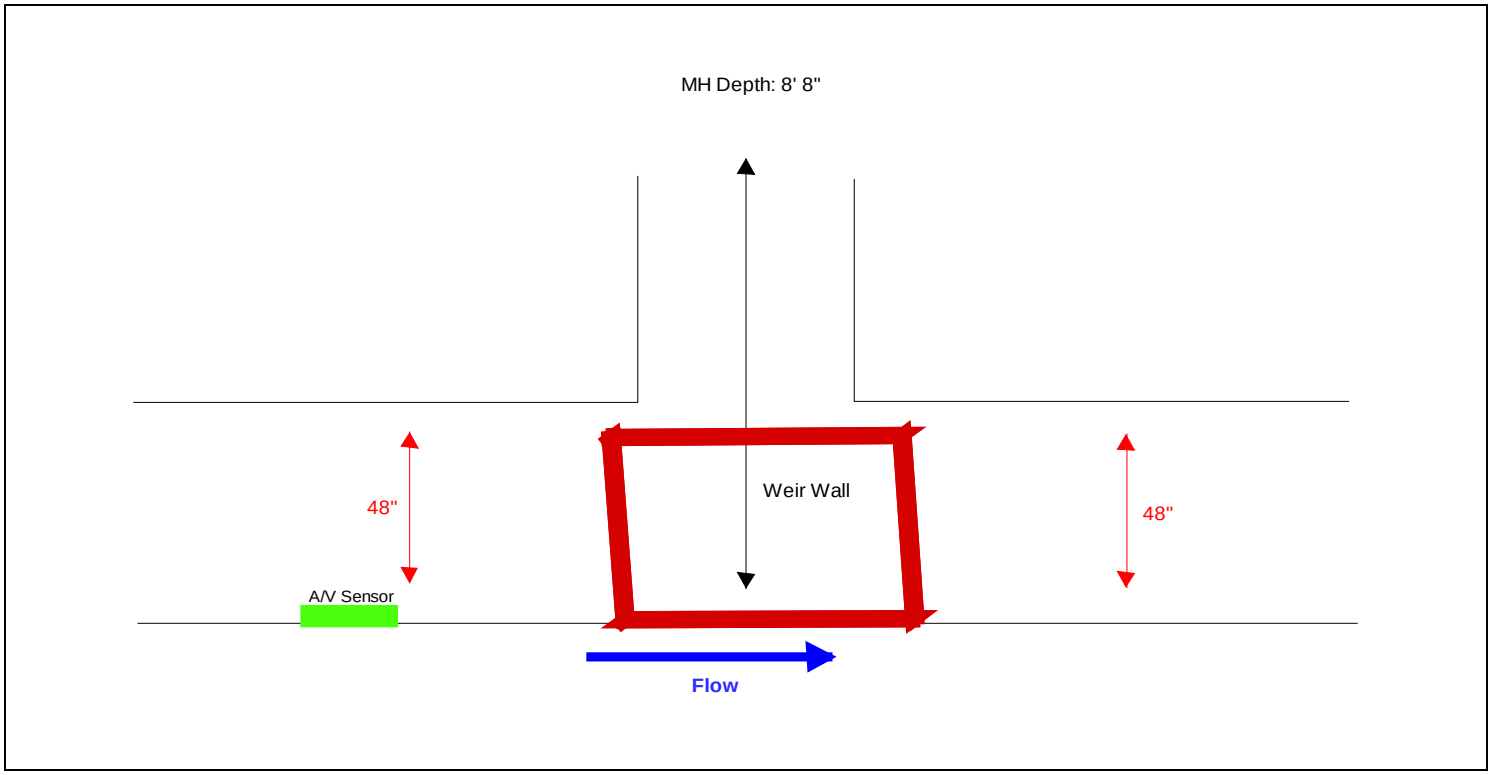
Site Overview



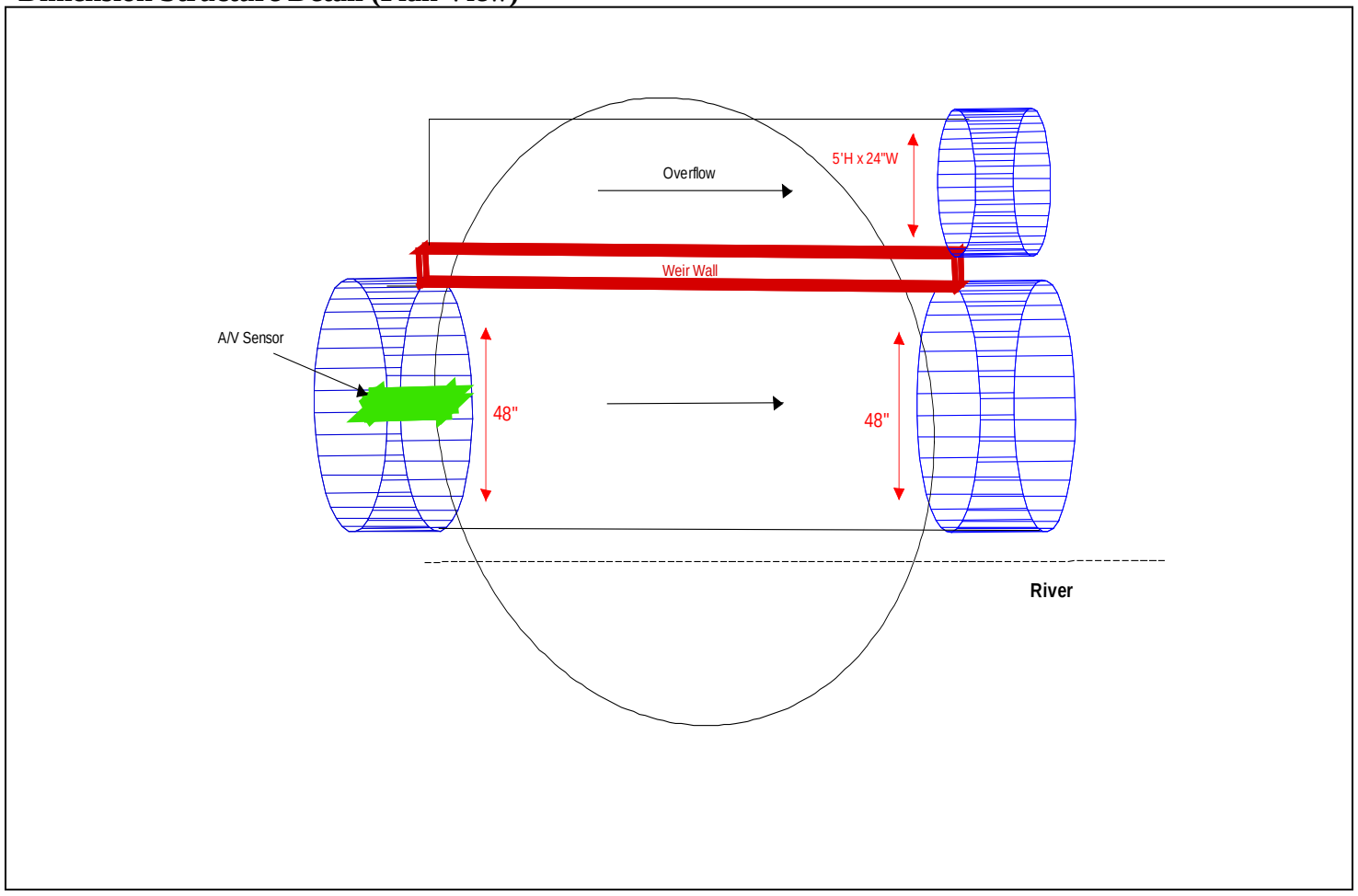
View of flow through influent line

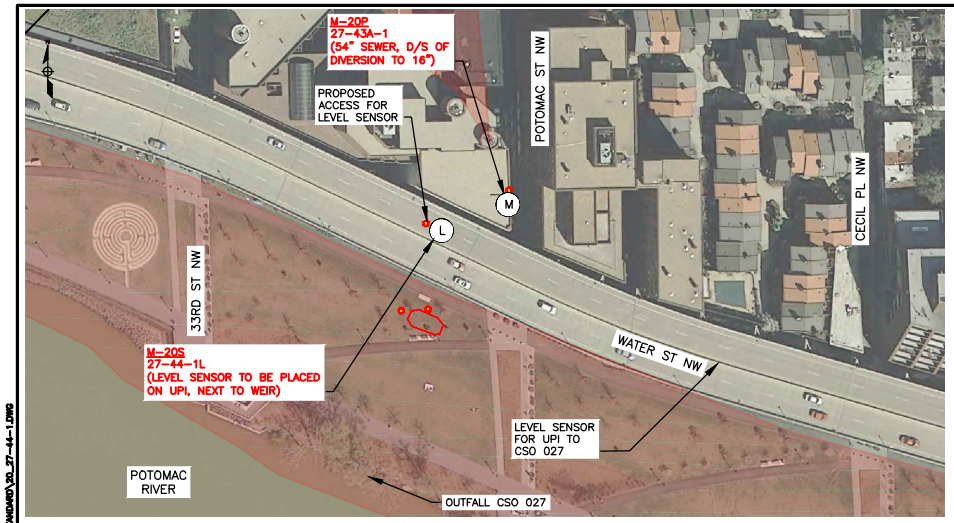
View of flow through effluent line

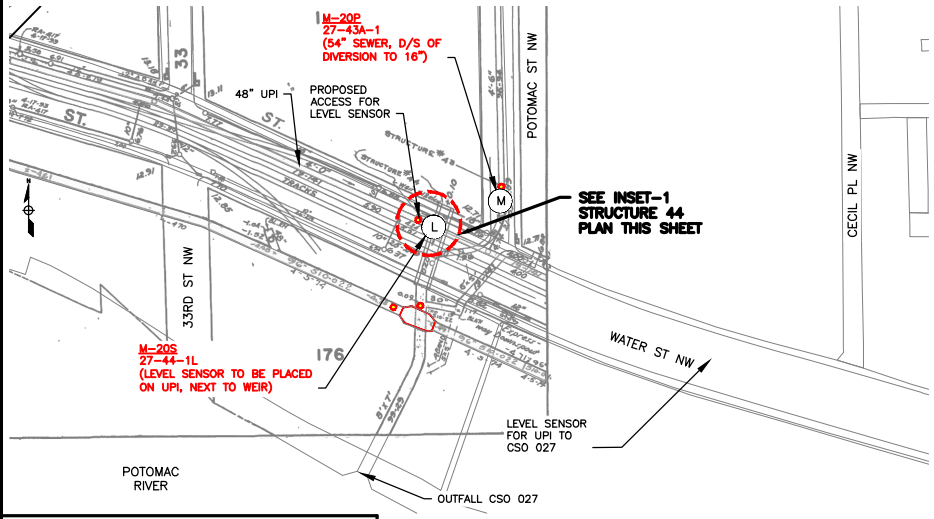
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)

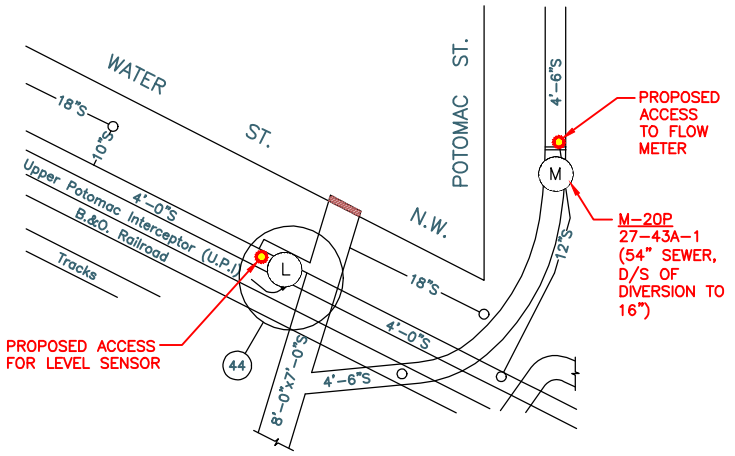




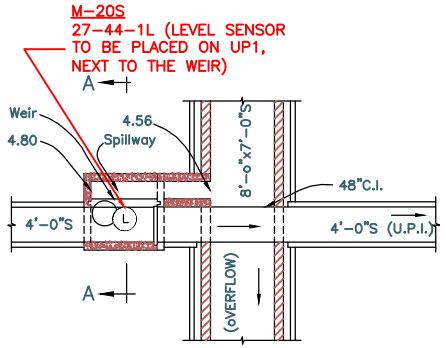


LEVEL SENSOR LOCATION PLAN
SCALE: NTS

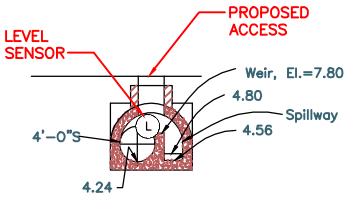
1 – FLOW METER
1 – LEVEL SENSOR



INSET-1 STRUCTURE 44 PLAN
SCALE NTS



STRUCTURE 44 DETAIL
SCALE NTS



SECTION A-A
SCALE NTS

LEGEND

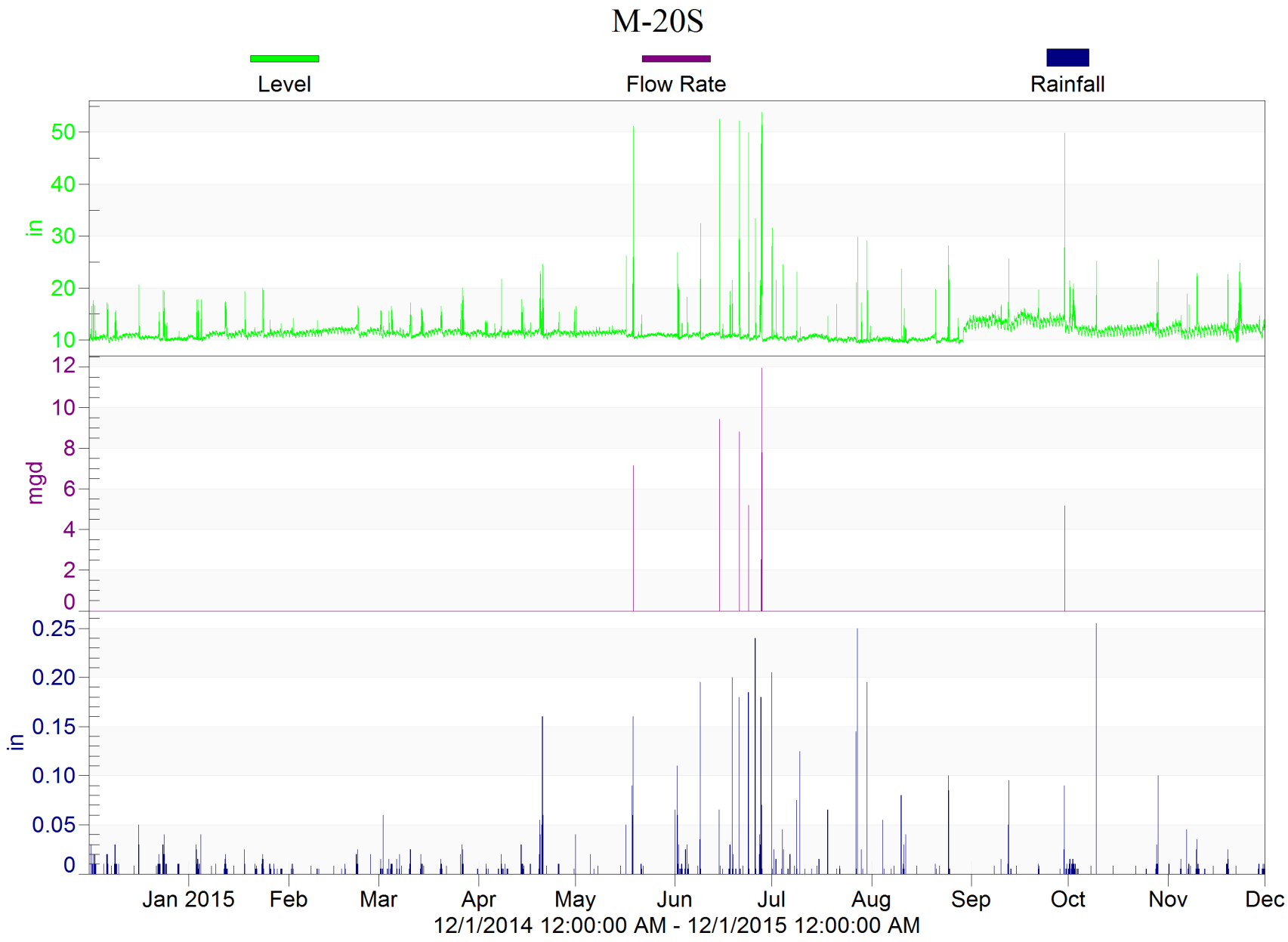
- (M) LEVEL SENSOR LOCATION
- (L) LEVEL SENSOR LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
27-43A-1 AND 27-44-1L
LEVEL SENSOR LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 20

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 10:12:50 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\20_27-44-1.DWG


M-20S
Level
Flow Rate
Rainfall
in
50
40
30
20
10
mgd
12
10
8
6
4
2
0
in
0.25
0.20
0.15
0.10
0.05
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-20S

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/12/2014			10.25			3		LR/SD	Install.
11/12/2014	10:48	10.1	10.25			3		LR/SD	
11/12/2014	10:53	10.15	10.25			3		LR/SD	
11/12/2014	10:58	10.33	10.25			3		LR/SD	
12/16/2014	14:30		14.25			7		GM/SD	
1/13/2015	18:00							LL/AP	CB Telog.
2/18/2015	16:00							AP/AM	CB Telog.
3/4/2015	11:00						6.03	AP/AM	CB Telog.
4/27/2015	17:00							LL/DW	CB Telog.
5/19/2015	9:03		10.25			2	6.12	LR/ ECE	CB Telog.
6/9/2015	14:23						5.98	LL/DW	CB Telog.
6/18/2015	16:18						6.12	KE/DW	CB Telog.
7/21/2015	8:28		9.5			4.5		LR/DW	CB Telog.
8/13/2015	10:45							LR/JC	CB Telog.
9/28/2015	12:22		14.5			4		LR/JC	CB Telog.
10/7/2015	9:39		12.5			5		JC/RM	
11/18/2015	12:27		12			0		LR/JC	
12/9/2015	15:00		13.25			0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-21

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: n/a

DURATION: 12/1/14 - 4/20/15, 8/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-21 measured flows on the Upper Potomac Interceptor upstream of Structure 44.

3. The continuity equation was used to calculate a flow rate from these measurements. M-21 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	2.572	0.839	0.227
Avg.	6.796	1.481	1.086
Max	49.401	3.593	27.549

Site Name/Manhole # M-21 Primary: [X] Alternate: [ ]

Investigation Date: 10/28/14 Time: 12:10 Crew Members: LR/PD

Installation Date: 11/24 Time: 18:00 Crew Members: GM/LP

Address/Location: End of K Street NW, on the right side of the bike path

Latitude: N 38°54.268' Longitude: W 77°04.259'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 0.0 ft/sec *Standing water*

Depth 2.0 in

Turbulence Amplitude: *Standing water*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	Closed		48"
Width	Closed		48"
Material		Concrete	Concrete
Shape	Round	Rectangle	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ (4 ft from rim)
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.1 (condition)

Site Conditions

Site Access: *Need access from DSS*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ (Yes) ☐ No

Height above ground 4' 7"

Manhole depth 10'2"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

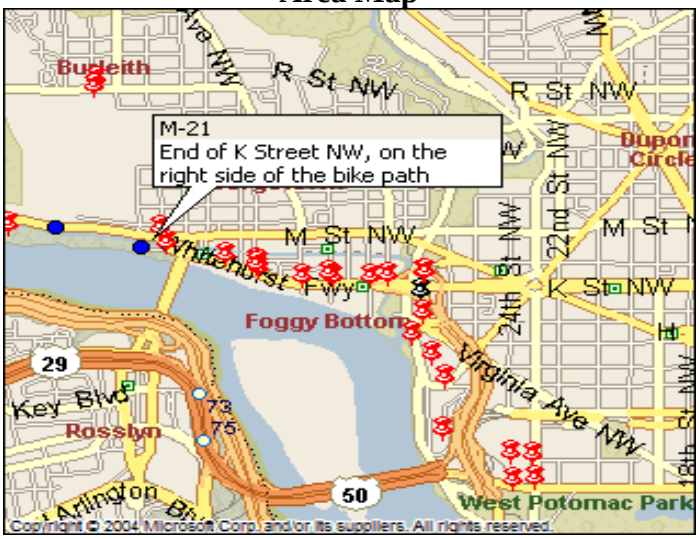
Sensor Configuration:

(Please include Serial Numbers when possible)

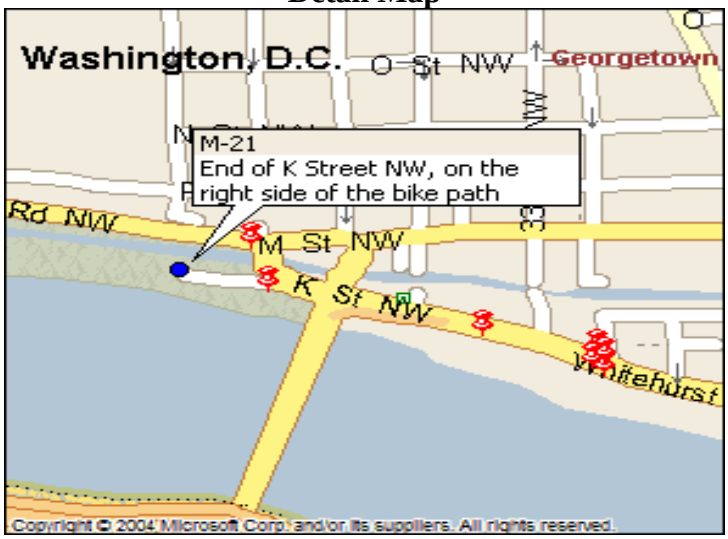
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map



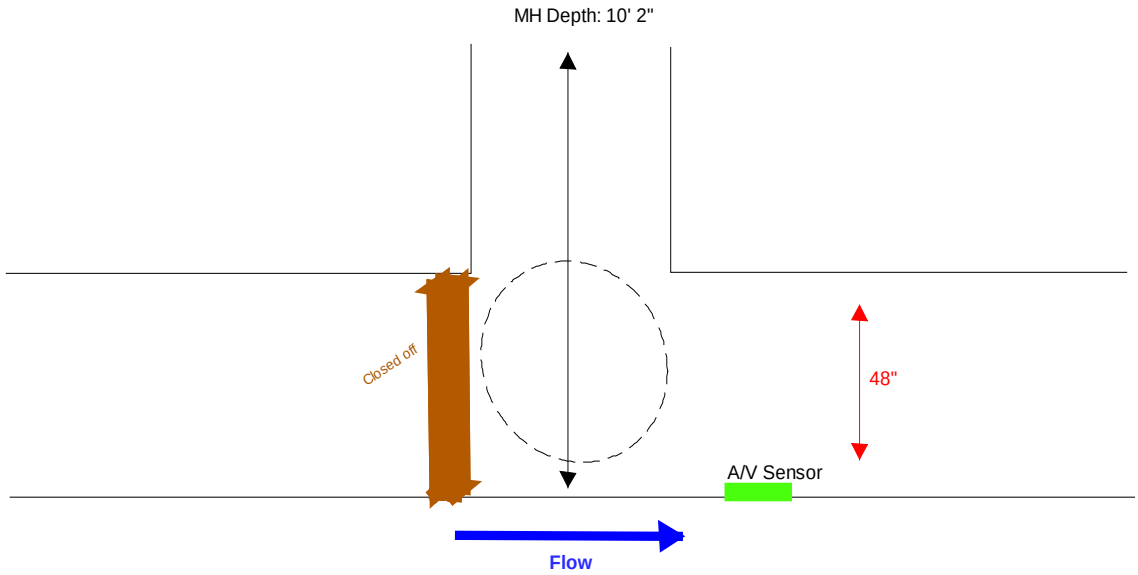
View from top of MH

Site Overview

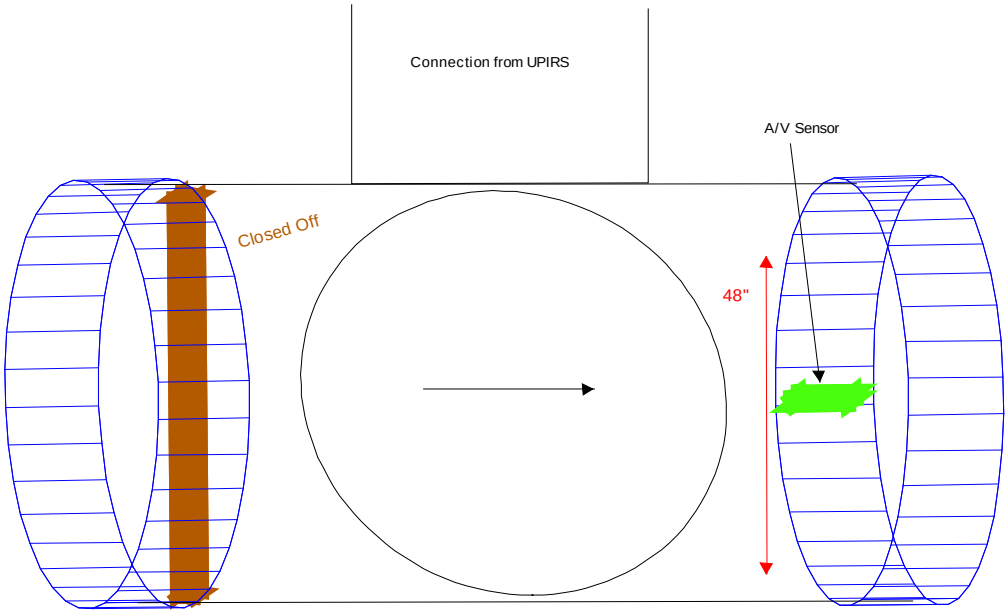
View of flow through influent line

View of flow through effluent line

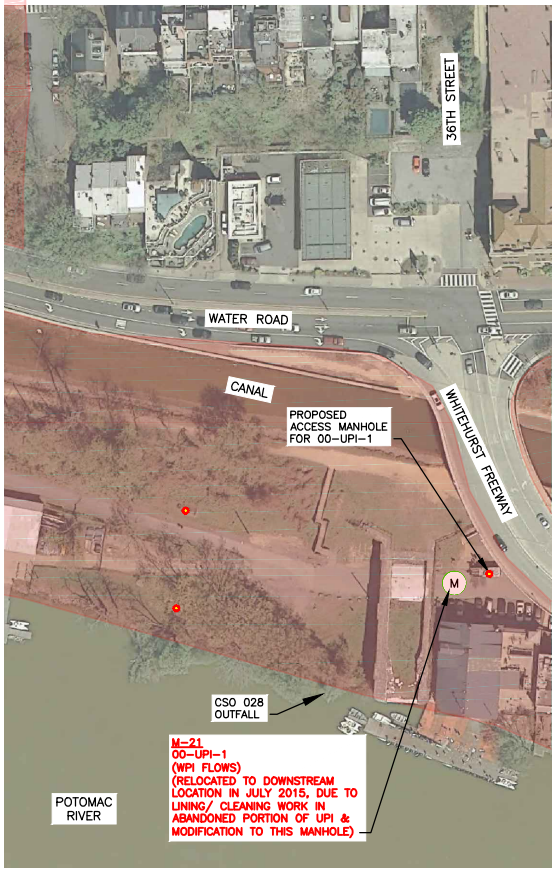
Dimensional Structure Profile View (profile sketch showing location of sensors)



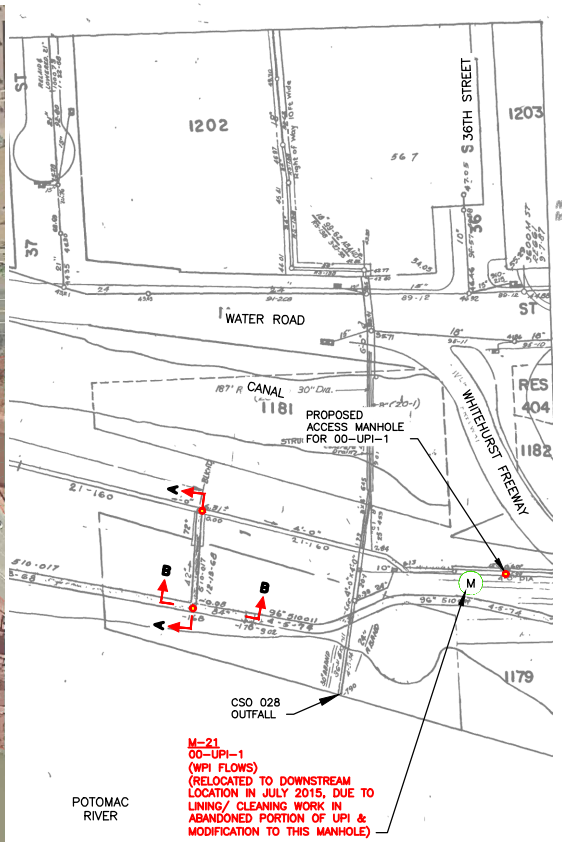
Dimension Structure Detail (Plan View)

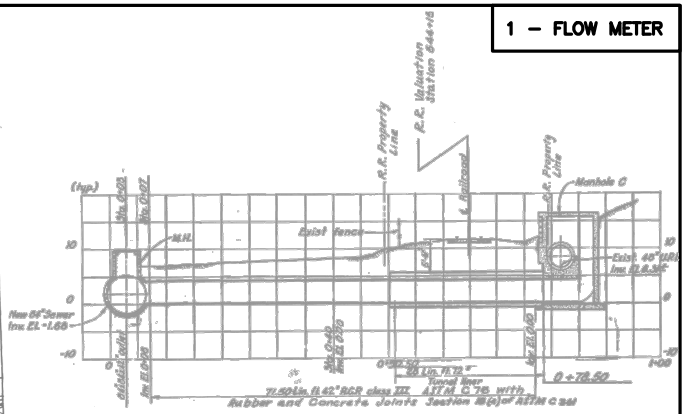


1 – FLOW METER

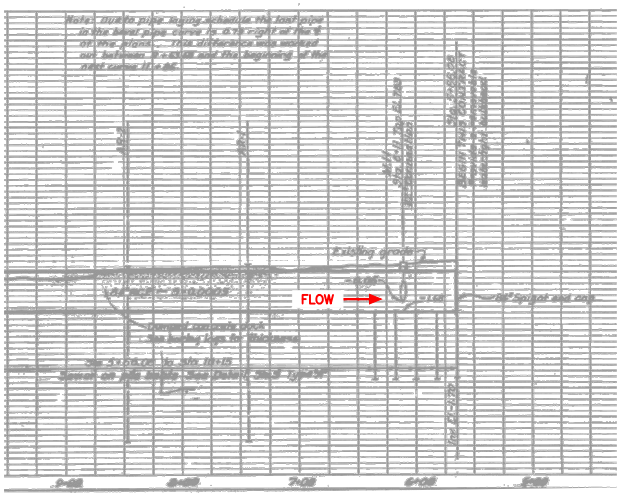


FLOW METER LOCATION PLAN
SCALE: NTS





CROSS SECTION A–A (PROFILE)
SCALE NTS



CROSS SECTION B–B (PROFILE)
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

00–UPI–1
METER LOCATIONS AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 21

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 1:00:57 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\21_00-UPI#S-UPI-1.DWG

Site Name/Manhole # M-21 (new location) Primary: [ ] Alternate: [X]

Investigation Date: 7/2/15 Time: 9:24 Crew Members: LR/DW/JC

Installation Date: 7/22/2015 Time: 14:00 Crew Members: LR/JC

Address/Location: At the end of K St NW (on right, just before bike path gate)

Latitude: N 38° 54.265' Longitude: W 77° 04.219'

Weather Conditions: (Wet) Dry *Light rain*

Hydraulic Conditions

Influent Flow:

Velocity 0.63 ft/sec

Depth 3.5 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ (0.25" to 0.75")
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 2	Effluent
Height	48"	12"	12"	48"
Width	48"	12"	12"	48"
Material	Brick/Concrete	Iron	Iron	Brick/Concrete
Shape	Round	Round	Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ (5 ft from rim)
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ (Good) (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 7'

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

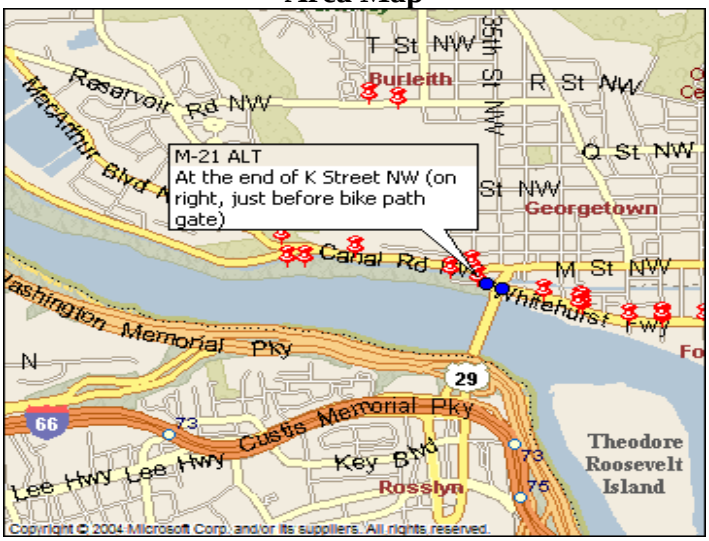
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



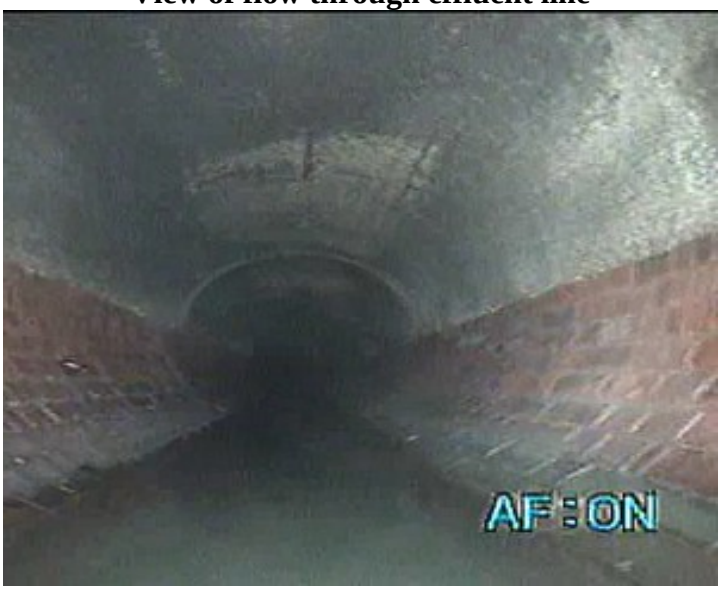
Detail Map

View from top of MH

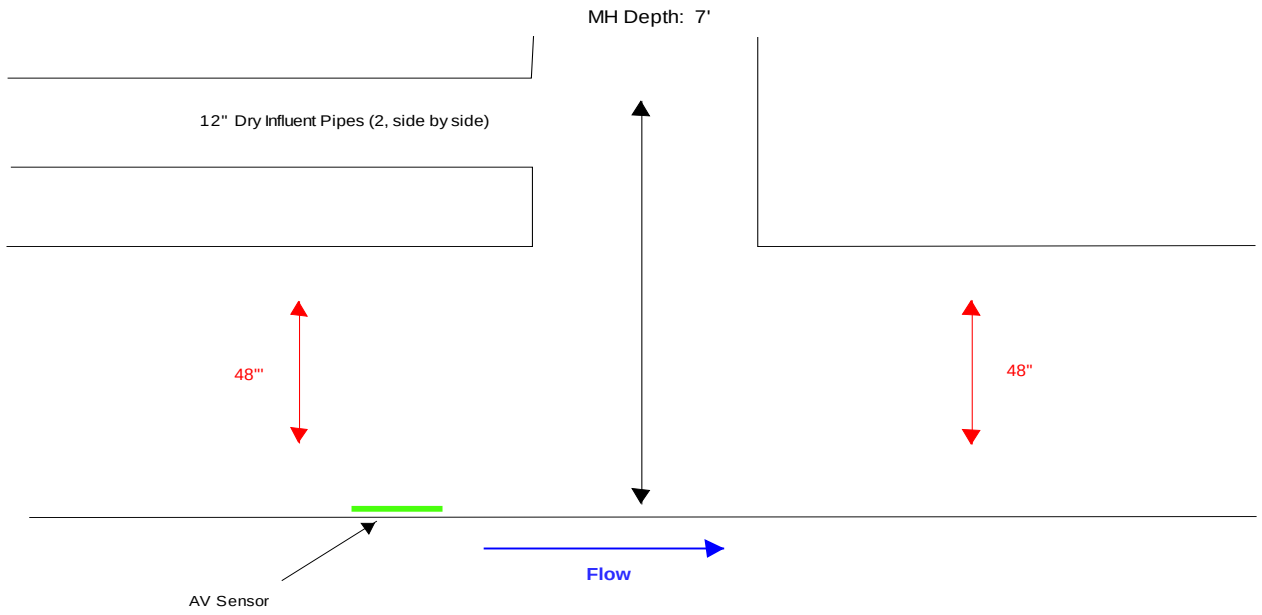
Site Overview

View of flow through influent line

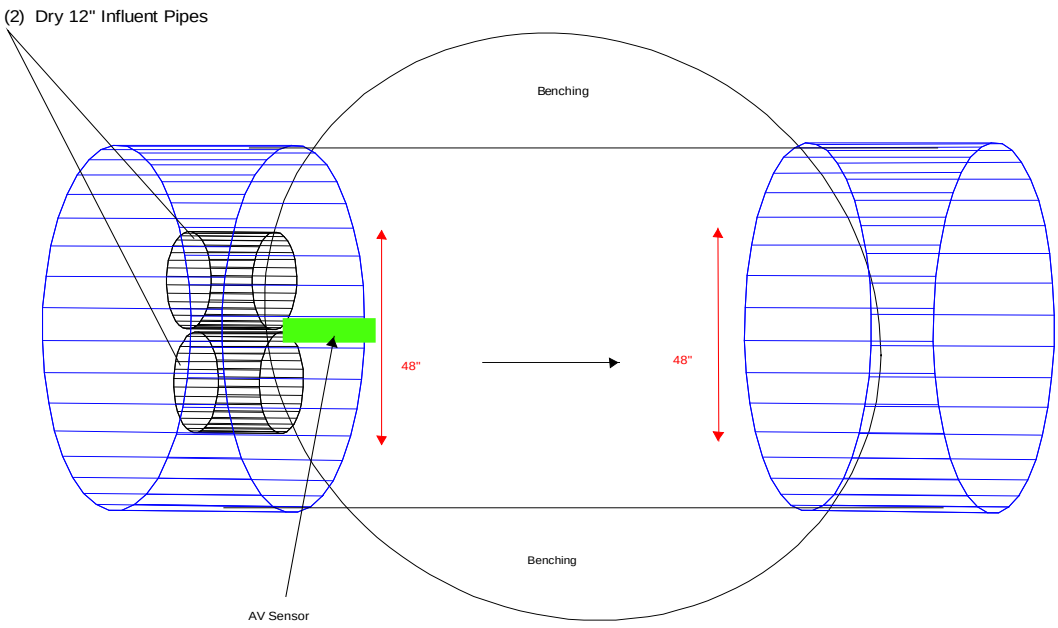
View of flow through effluent line



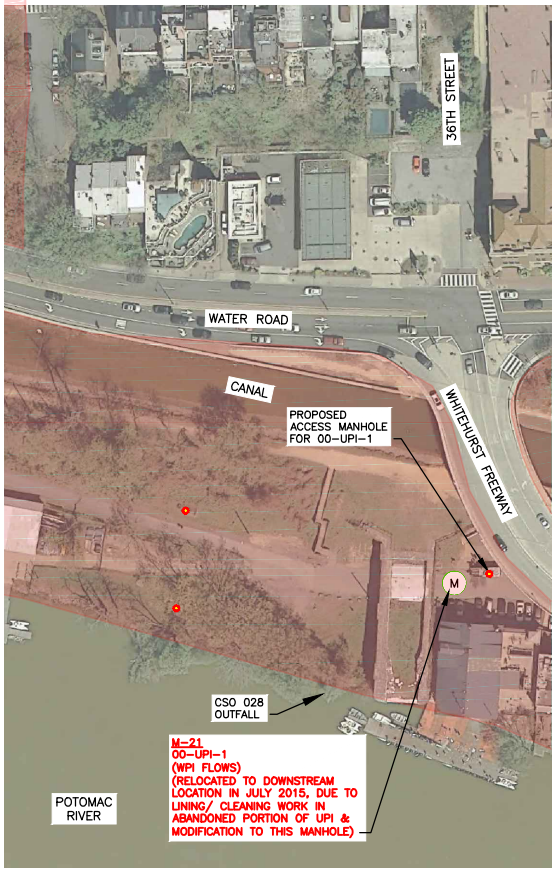
Dimensional Structure Profile View (profile sketch showing location of sensors)



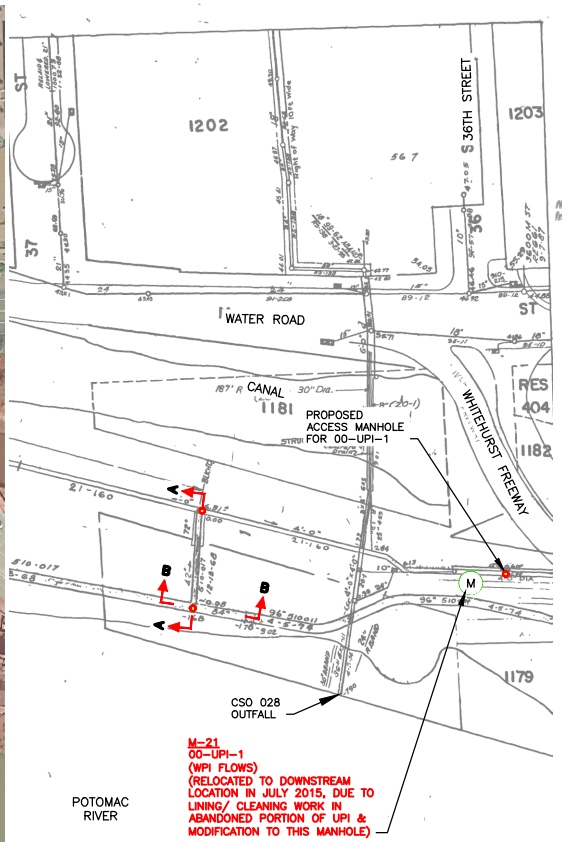
Dimension Structure Detail (Plan View)

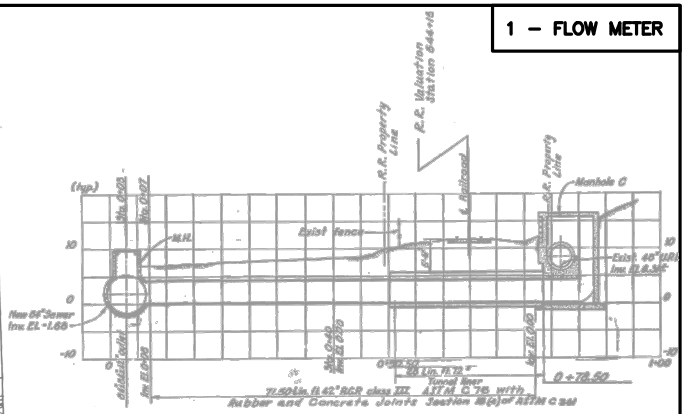


1 – FLOW METER

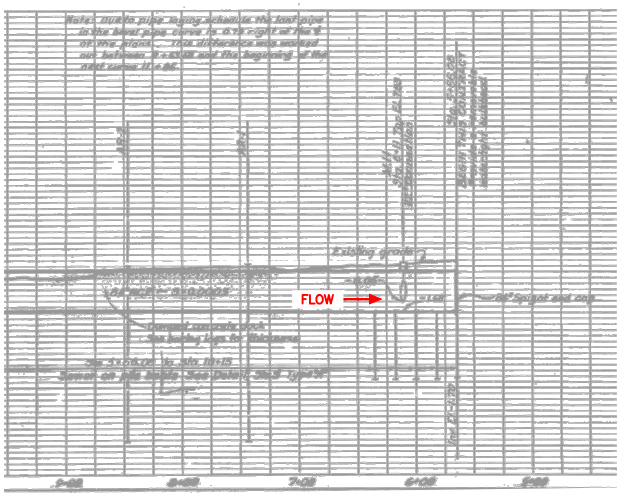


FLOW METER LOCATION PLAN
SCALE: NTS





CROSS SECTION A–A (PROFILE)
SCALE NTS



CROSS SECTION B–B (PROFILE)
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

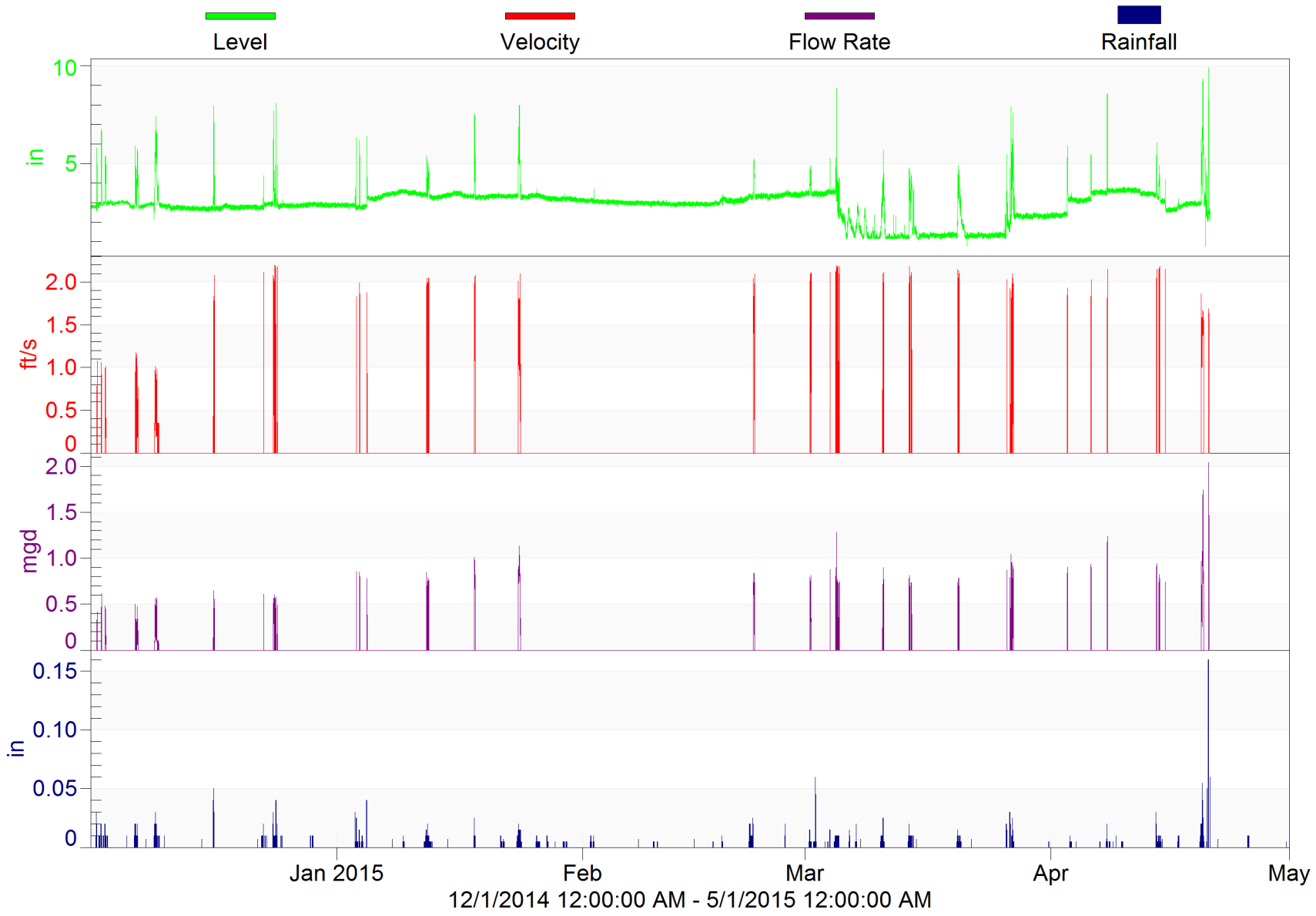
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

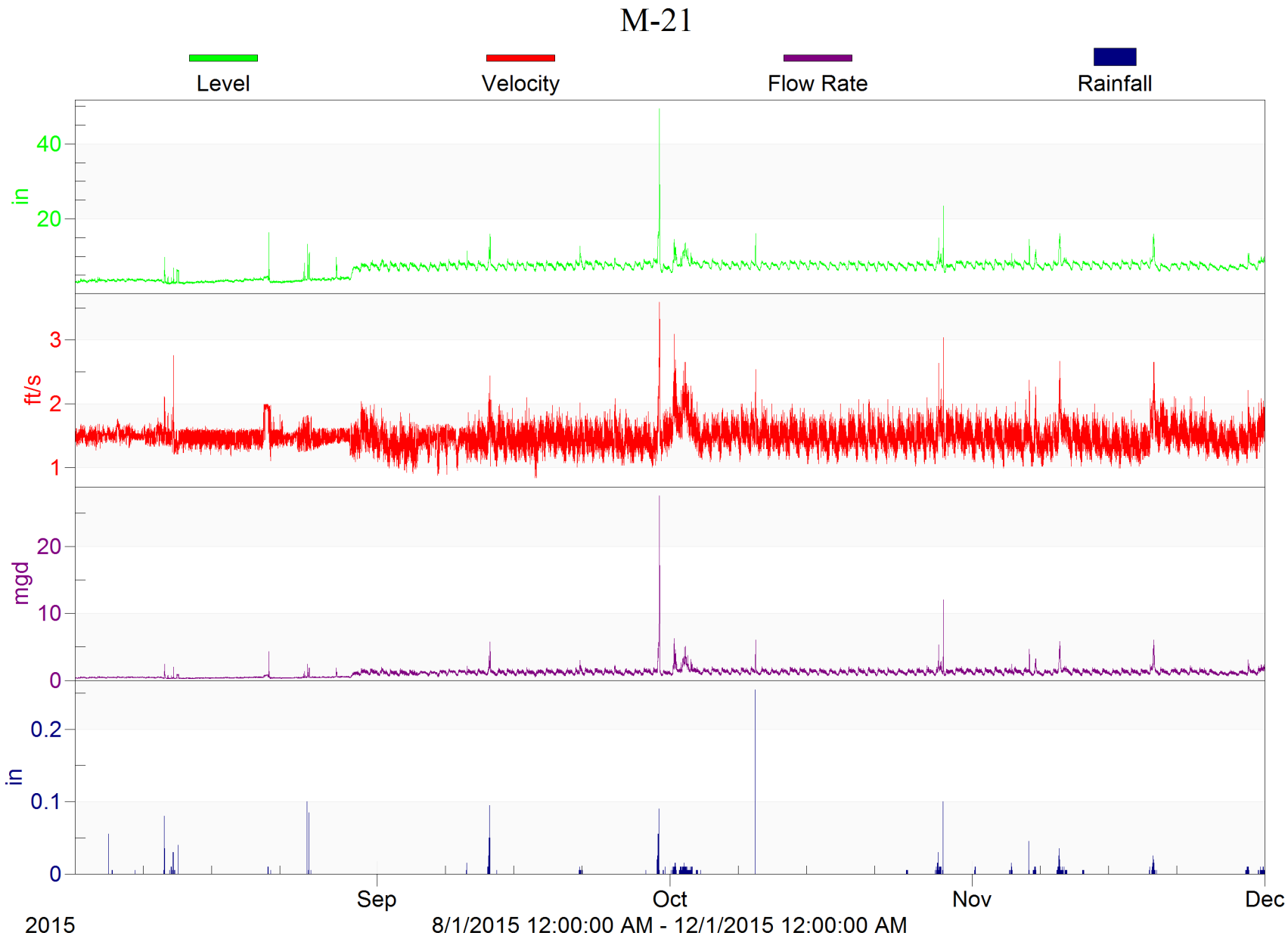
00–UPI–1
METER LOCATIONS AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 21

LAST SAVED BY: STEFAN OSSTNER DATE: 5/10/2016 1:00:57 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\21_00-UPI#S-UPI-1.DWG

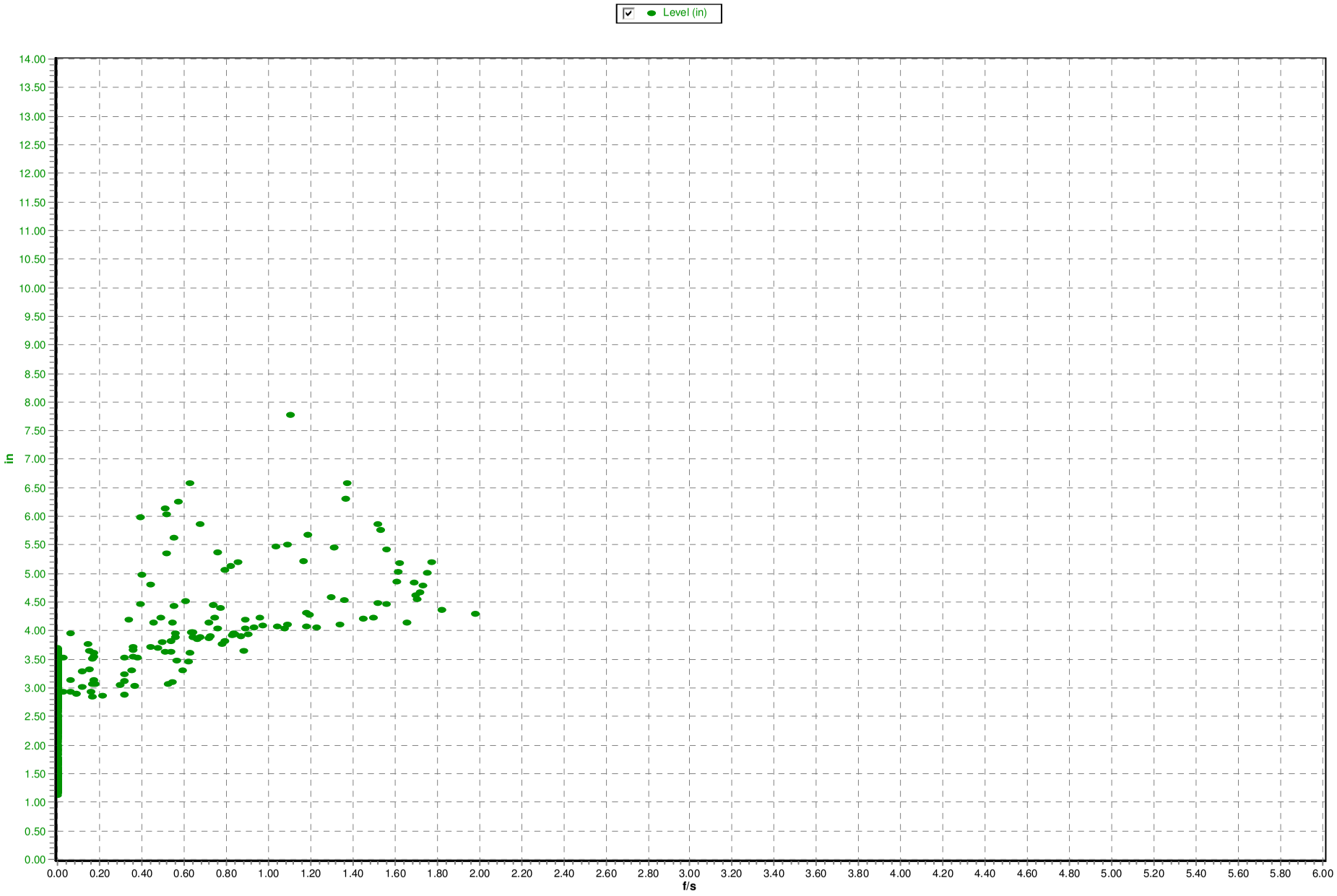
M-21


Level
Velocity
Flow Rate
Rainfall
10
5
in
2.0
1.5
1.0
0.5
0
ft/s
2.0
1.5
1.0
0.5
0
mgd
0.15
0.10
0.05
0
in
Jan 2015
Feb
Mar
Apr
May
12/1/2014 12:00:00 AM - 5/1/2015 12:00:00 AM


M-21
Level
Velocity
Flow Rate
Rainfall
40
20
in
3
2
1
ft/s
20
10
0
mgd
0.2
0.1
0
in
Sep
Oct
Nov
Dec
2015
8/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

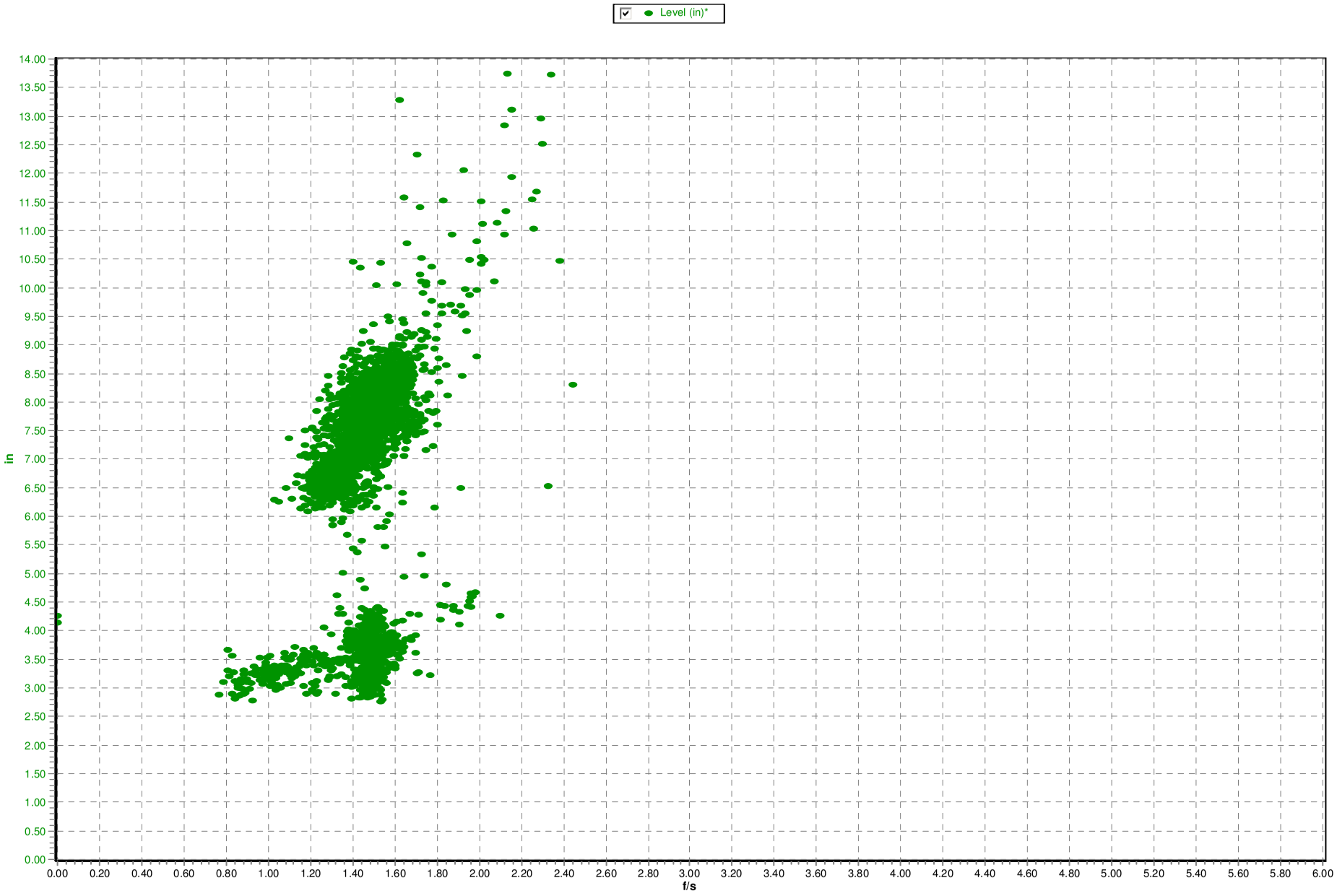
M-21 - End of K Street NW, on the right side of the bike path

Pipe diameter (in): 48 (12/01/14 to 04/15/15)



M-21 - End of K Street NW, on the right side of the bike path

Pipe diameter (in): 48 (07/22/15 to 12/01/15)



M-21

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/24/2014	16:20	2.57	2.75	0	0	0		GD/DS	Install.
11/24/2014	16:30		2.5		0	0		GD/DS	
11/24/2014	16:35		2.5		0	0		GD/DS	
11/24/2014	16:40	2.64	2.5	0	0	0		GD/DS	
1/13/2015	17:00		3		0	0		LL/AP	CB Telog.
2/10/2015	10:00		3		0	0	5.94	LR/AM	CB Telog.
3/16/2015	14:00		1.5		0	0	5.98	AP/AM	CB Telog.
4/21/2015	13:55		2.5		0	0		LL/DW	Meter removed.
7/22/2015	11:50		3.5		0.5	0		LR/KE	Install meter in new location.
7/27/2015	11:43		2.5		0.54	0		LR/DW	
8/31/2015	16:23		7.25		1.45	0		LR/JC	
9/11/2015	9:45		8.25		1.67	0		LR/JC	
10/22/2015	12:04		8		1.6	0		LR/JC	
11/12/2015	13:00		8		1.57	0		LR/JC	CB Telog.
12/8/2015	14:00		8.25		1.7	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-23

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 028

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-23 measured excess flows from the combined sewer from M Street NW before entering the Potomac River through CSO 028 downstream of Structure 45.

3. The continuity equation was used to calculate a flow rate from these measurements. M-23 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.026	0.018	0.008
Max	24.192	8.191	21.566

Site Name/Manhole # M-23 Primary: [X] Alternate: [ ]

Investigation Date: 3/26/14 Time: 17:30 Crew Members: LR/JS

Installation Date: 11/13/14 Time: 14:12 Crew Members: LR/SD

Address/Location: On Canal Road, before the Whitehurst Freeway ramp

Latitude: N 38°54.303' Longitude: W 77°04.276'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry*

Velocity 0.0 ft/sec

Depth 0.0 in

Turbulence Amplitude:

- ☐ ~~Less than 0.25"~~
- ☐ (0.25" to 0.75")
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Overflow	Effluent	Overflow
Height	36"		8"	30"
Width	36"		8"	30"
Material	Concrete		Concrete	Concrete
Shape	Round		Round	Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

☐ Remains in pipe

☐ _____ft from rim

☐ Reaches Rim (potential meter damage)

☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ Good ~~(no problems accessing site)~~

☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))

☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)

☐ Traffic Control only (Requires extra traffic control

☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 23'5"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *DS*

☐ Influent ☐ Effluent ☐ (Manhole)

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: ___ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

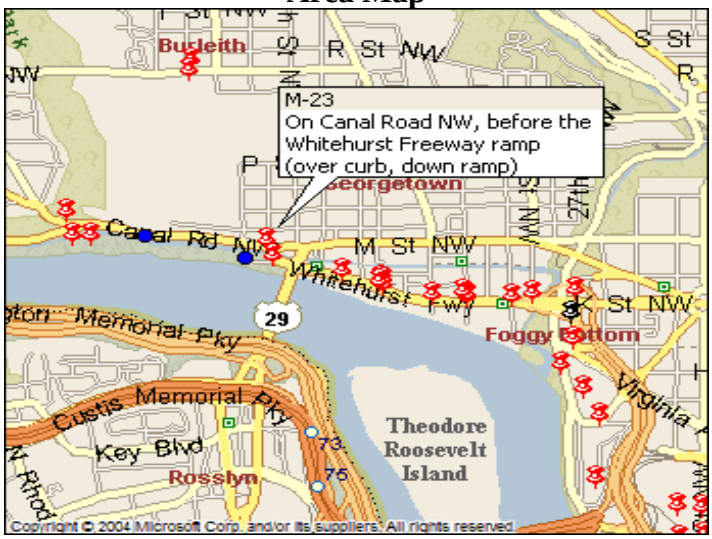
Sensor Configuration:

(Please include Serial Numbers when possible)

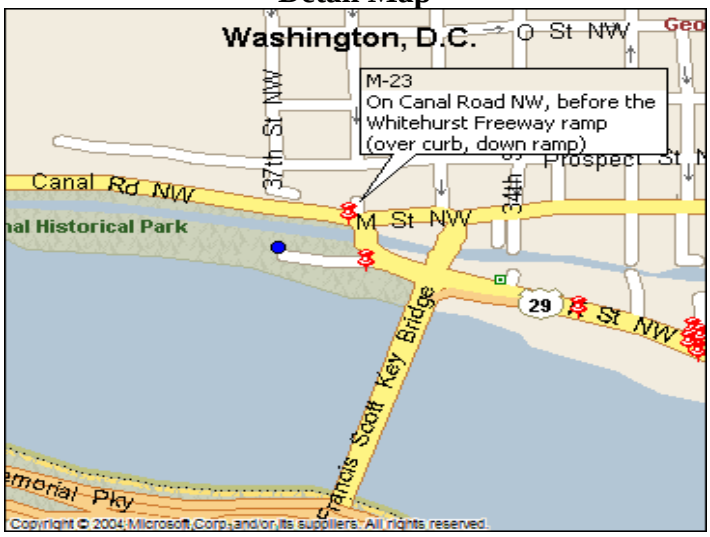
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *36" Sewer turns into 8" pipe and passes over a weir wall. There is a 30" OF on the other side of the weir wall.*

Area Map



Detail Map



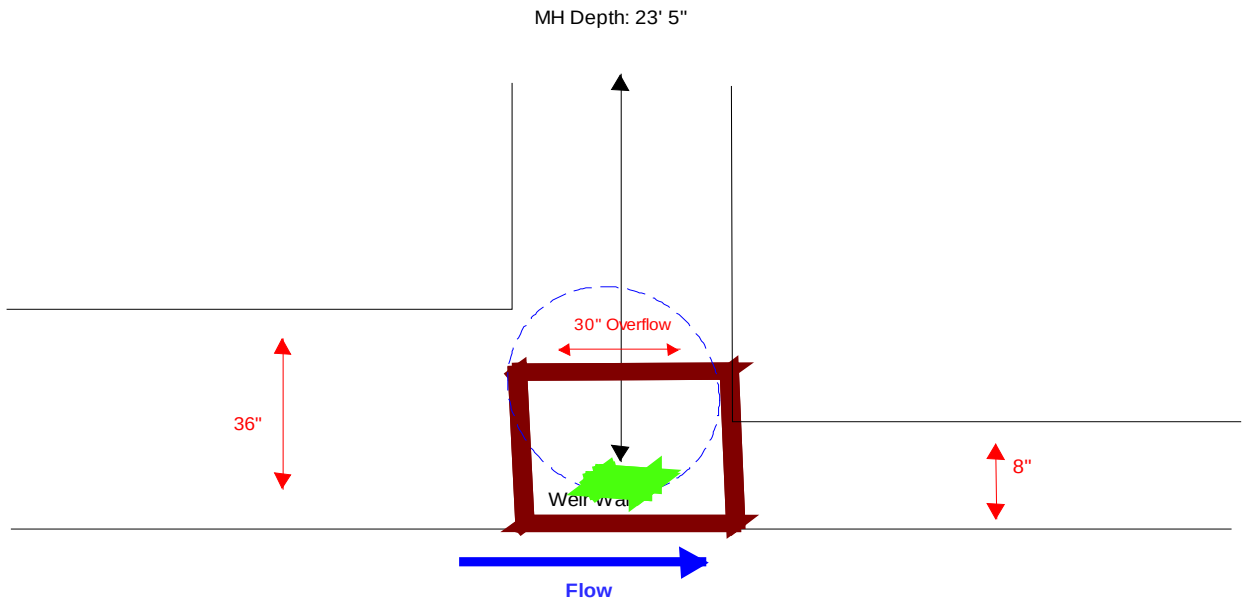
View from top of MH

Site Overview

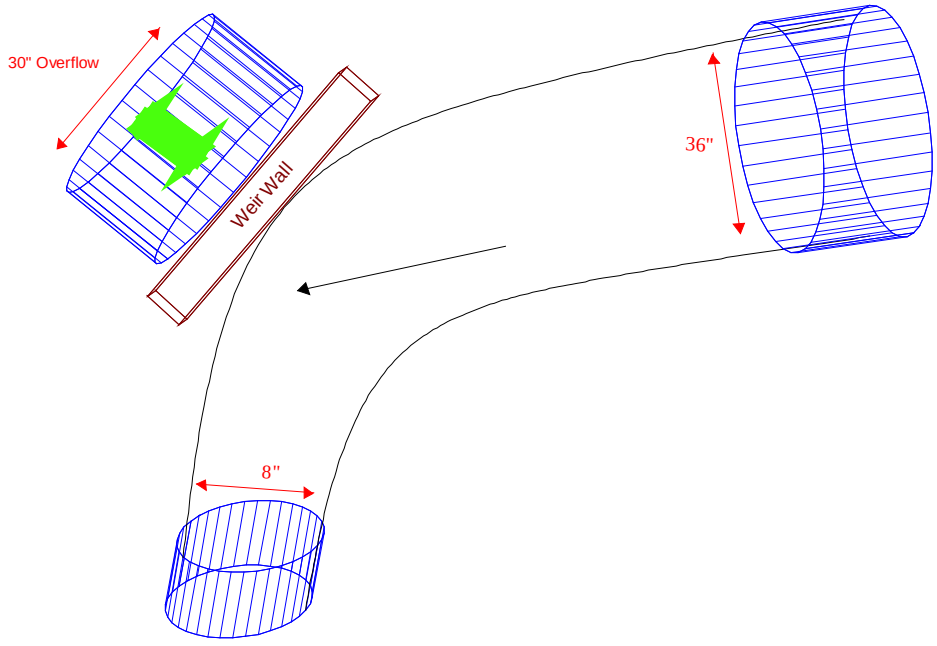
View of flow through influent line

View of flow through effluent line

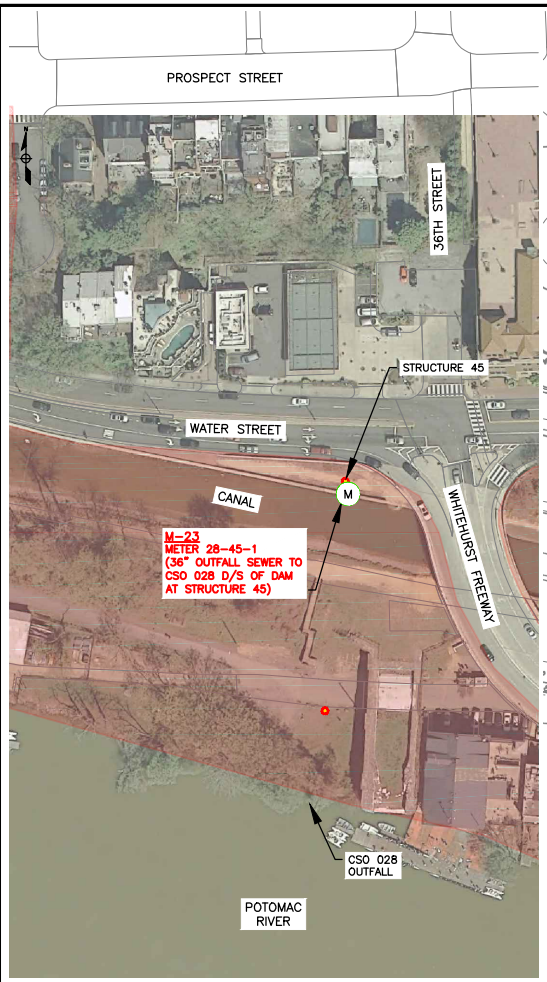
Dimensional Structure Profile View (profile sketch showing location of sensors)

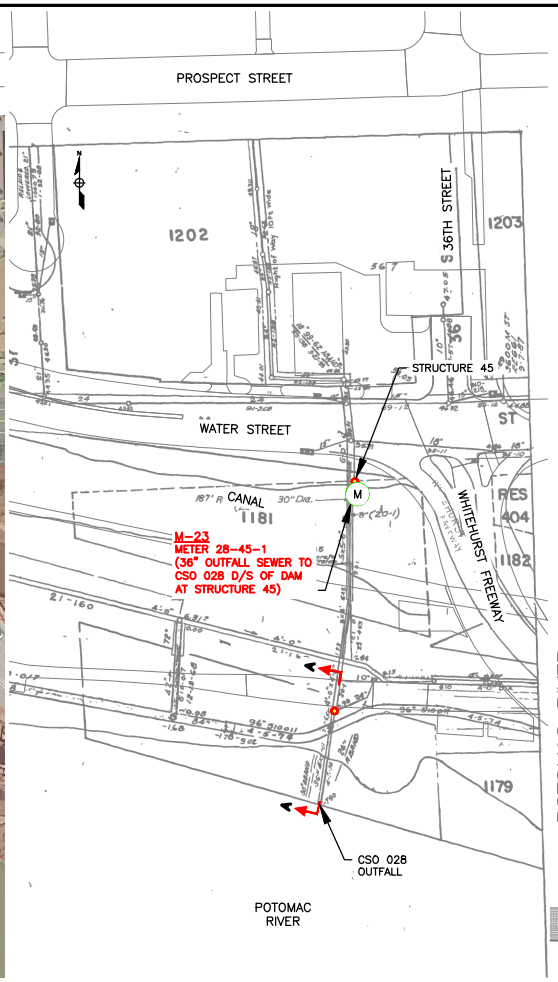


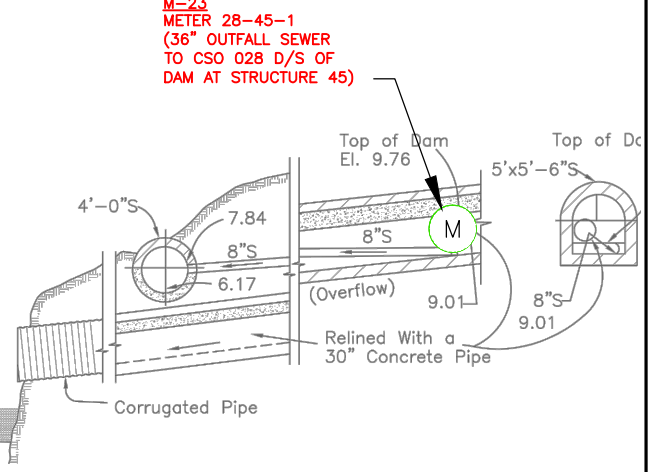
Dimension Structure Detail (Plan View)



1 – FLOW METER







FLOW METER LOCATION PLAN
SCALE: NTS

CROSS SECTION A–A (PROFILE)
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

NATIONAL PARK SERVICE AREA

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

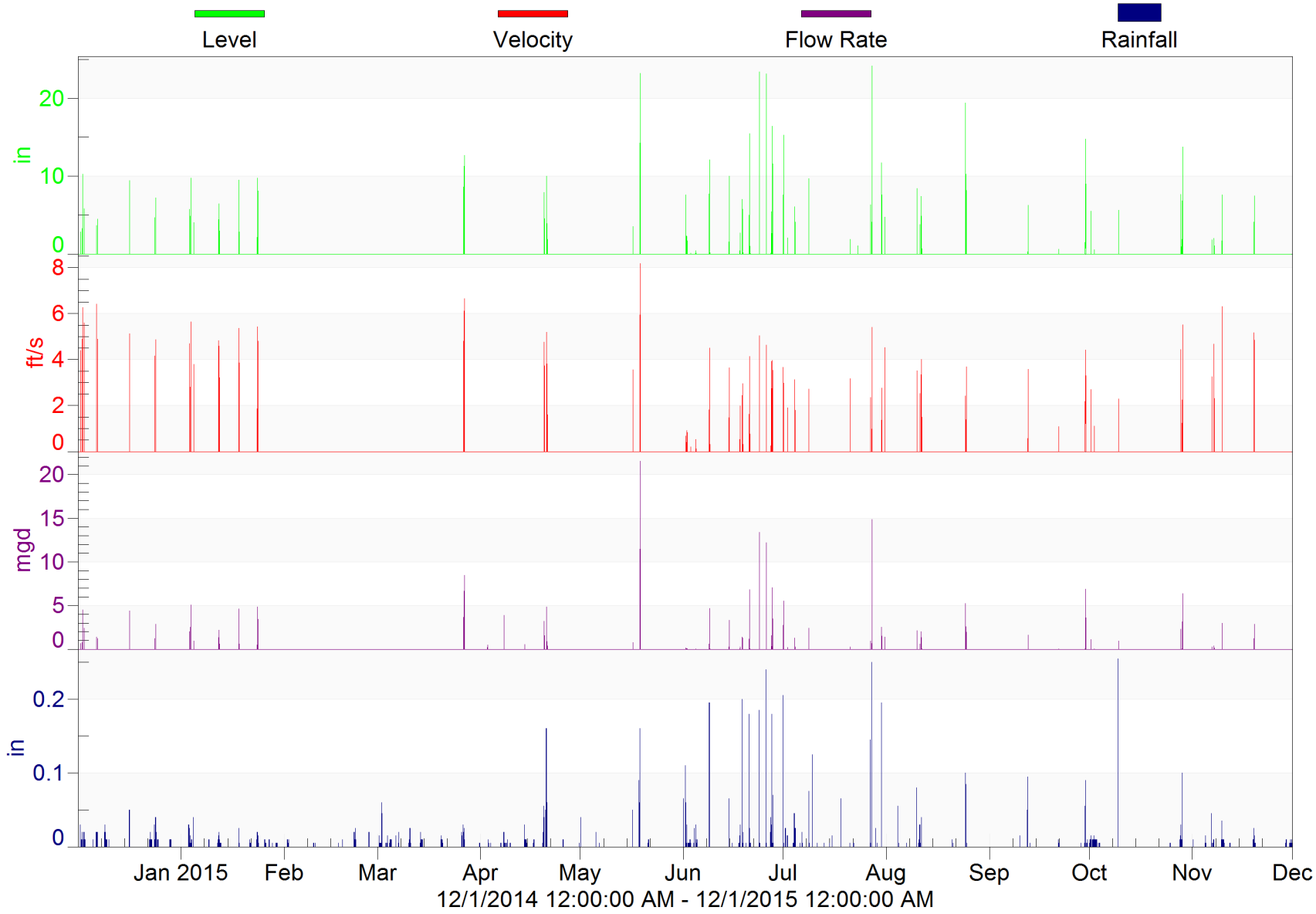
28–45–1

METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 23

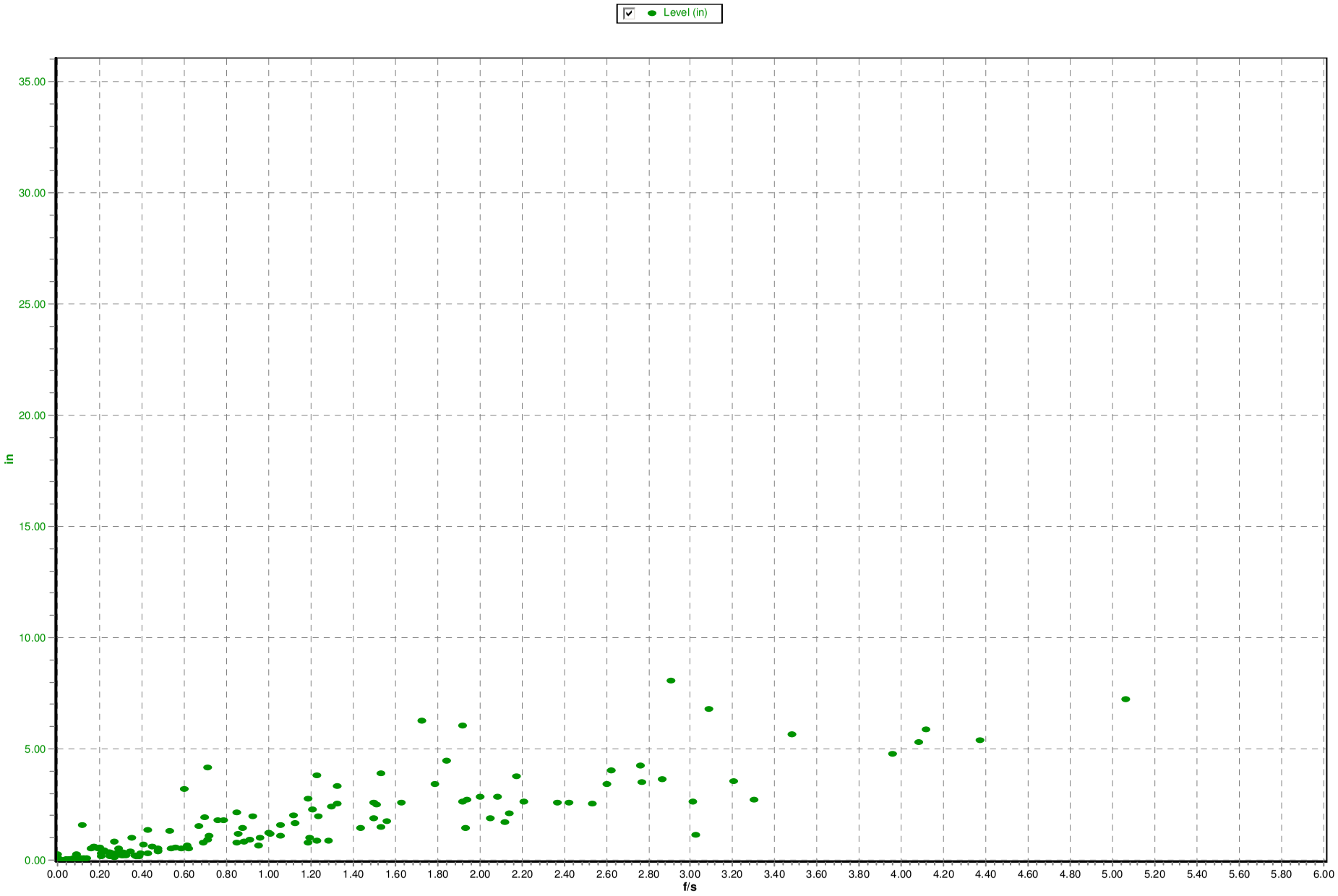
LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 8:58:24 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\23_28-45-1.DWG

M-23


Level
Velocity
Flow Rate
Rainfall
in
20
10
0
ft/s
8
6
4
2
0
mgd
20
15
10
5
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-23 - On Canal Road, before the Whitehurst Freeway ramp

Pipe Diameter (in): 36 (12/01/14 to 12/01/15)



M-23

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/13/2014	4:04	0	0	0	0	0		LR/SD	Install.
11/13/2014	4:09	0	0	0	0	0		LR/SD	
11/13/2014	4:14	0	0	0	0	0		LR/SD	
12/17/2014	13:04		0		0	0		AM/GH	
1/20/2015	14:02		0		0	0	6.12	AP/AM	CB Telog.
2/10/2015	13:00		0		0	0	6.07	LR/AM	CB Telog.
2/24/2015	15:00		0		0	0	6.07	AP/AM	CB Telog.
3/17/2015	16:00		0		0	0	6.07	AP/AM	CB Telog.
4/28/2015	15:00		0		0	0	6.16	LL/DW	CB Telog.
5/22/2015	9:35	0	0	0	0	0		LR/DW	Change meter.
7/10/2015	11:49	0	0	0	0	0		LR/DW	Swap antenna.
7/16/2015	14:49	0	0	0	0	0	11.72	LR/DW	
9/1/2015	13:15		0		0	0		LR/JC	
10/8/2015	15:47		0		0	0		LR/JC	
12/28/2015	13:00		0		0	0		LR/DN	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-24

SEWER: UPPER POTOMAC INTERCEPTOR

OUTFALL: 029

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-24 measured flows on the sewer line downstream of structure 47 upstream of Structure 46.

3. The continuity equation was used to calculate a flow rate from these measurements. M-24 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0.4	0.504	0.032
Avg.	6.74	3.85	1.656
Max	46.711	7.2	11.461

Site Name/Manhole # M-24 Primary: [X] Alternate: [ ]

Investigation Date: 10/30/14 Time: 11:30 Crew Members: LR/PD

Installation Date: 10/30/14 Time: 11:30 Crew Members: LR/PD

Address/Location: In sidewalk 20 feet from exit to Georgetown University

Latitude: N 38°54.331' Longitude: W 77°3.542'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 5.03 ft/sec

Depth 7.75 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ (1.5" to 3")
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	21"		21"
Width	21"		21"
Material	Concrete		Concrete
Shape	Round	Round	Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ (No evidence visible)
- ☐ Remains in pipe
- ☐ ___ ft from rim
  Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good ~~(no problems accessing site)~~
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 8'4"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ (Manhole)

Approx Distance to bend: ____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

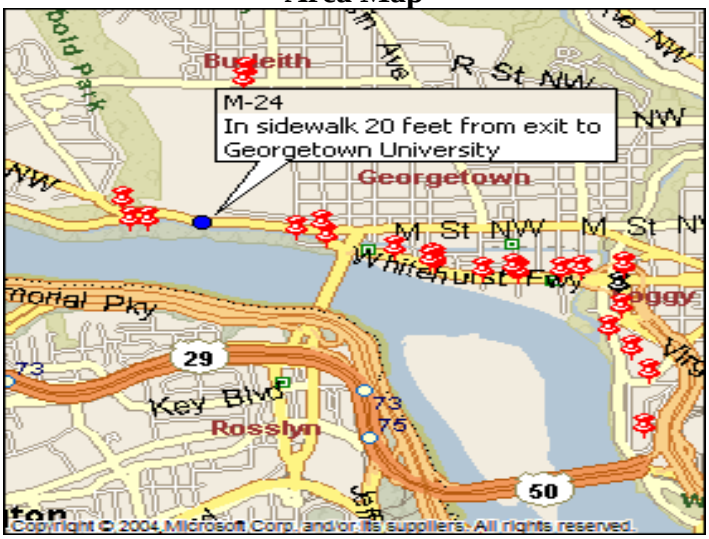
Sensor Configuration:

(Please include Serial Numbers when possible)

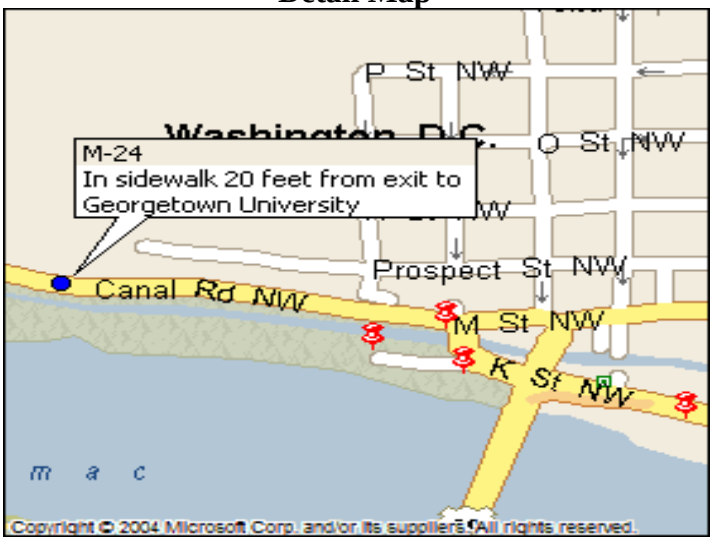
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments:

Area Map



Detail Map



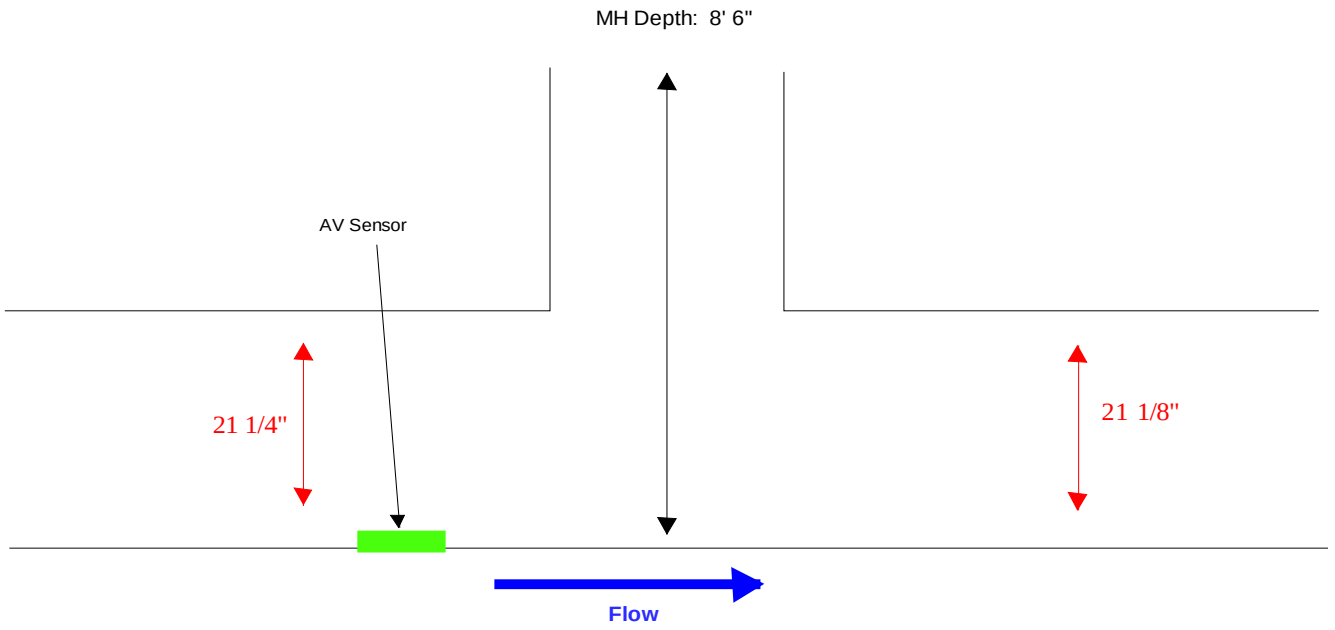
View from top of MH

Site Overview

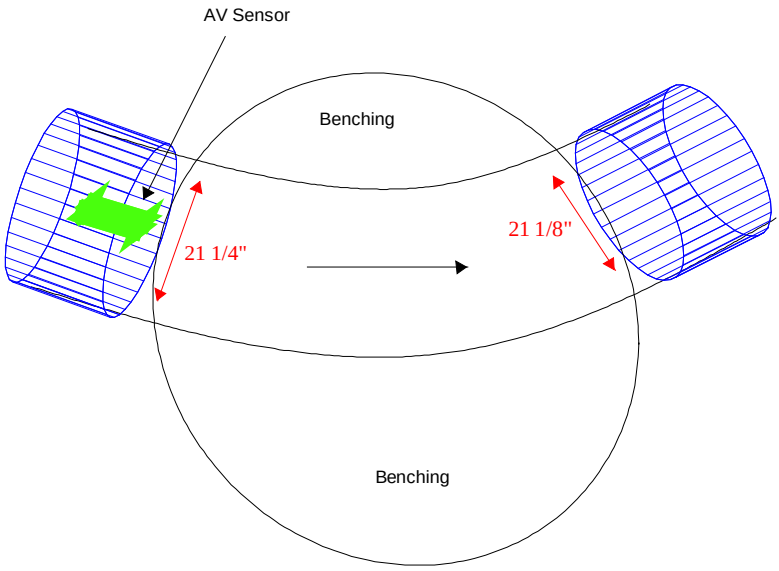
View of flow through influent line

View of flow through effluent line

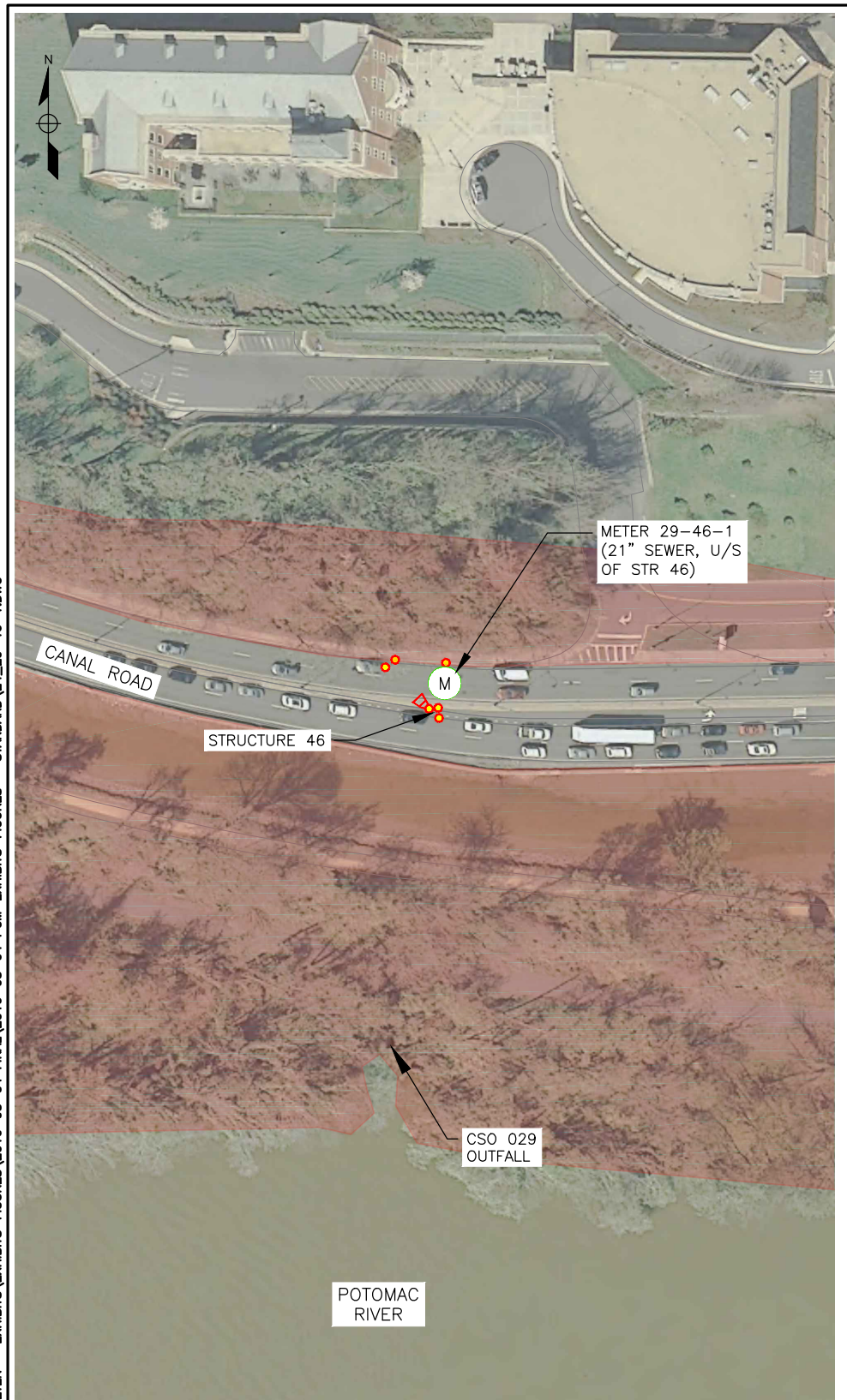
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)



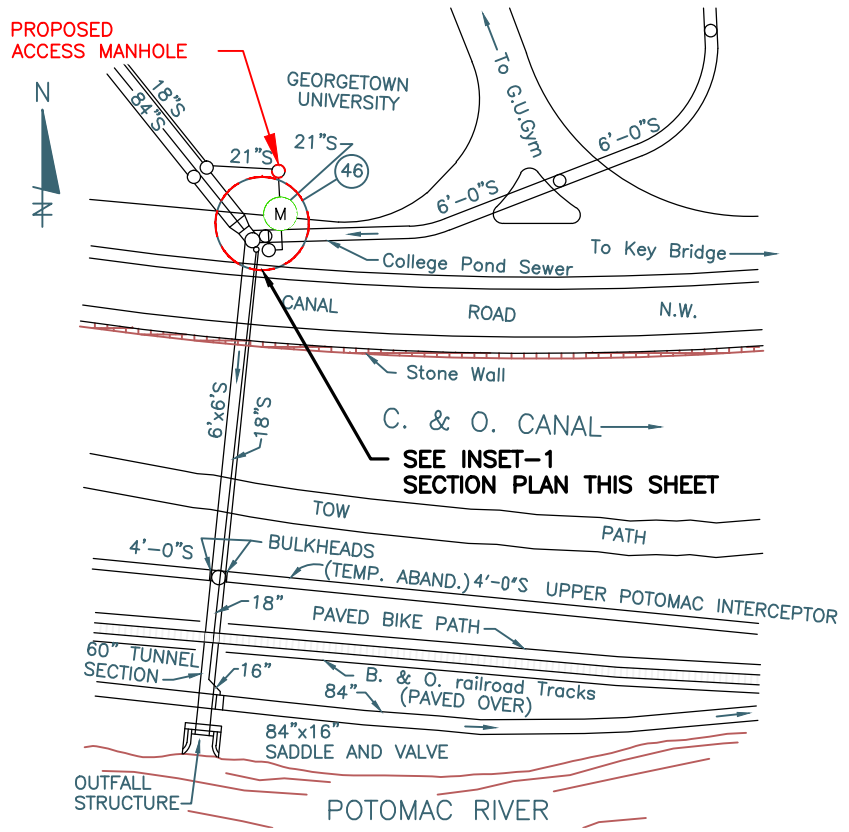
1 – FLOW METER



STRUCTURE NO. 46, College Pond Sewer, Canal Road about 1,000 ft. East of Foxhall Road, N.W. This structure has a slot–type regulator. The Storm Overflow is formed by a depressed slot and a masonry dam. A 6–ft. Combined Sewer enters the Diversion Chamber, and there is a slot in the invert which collects the Dry–Weather Flow into a sump–like structure, and the flow is then conveyed through an 18–in. intercepting connection to the Upper Potomac Interceptor Relief Sewer. The Upper Potomac Interceptor is temporarily abandoned.

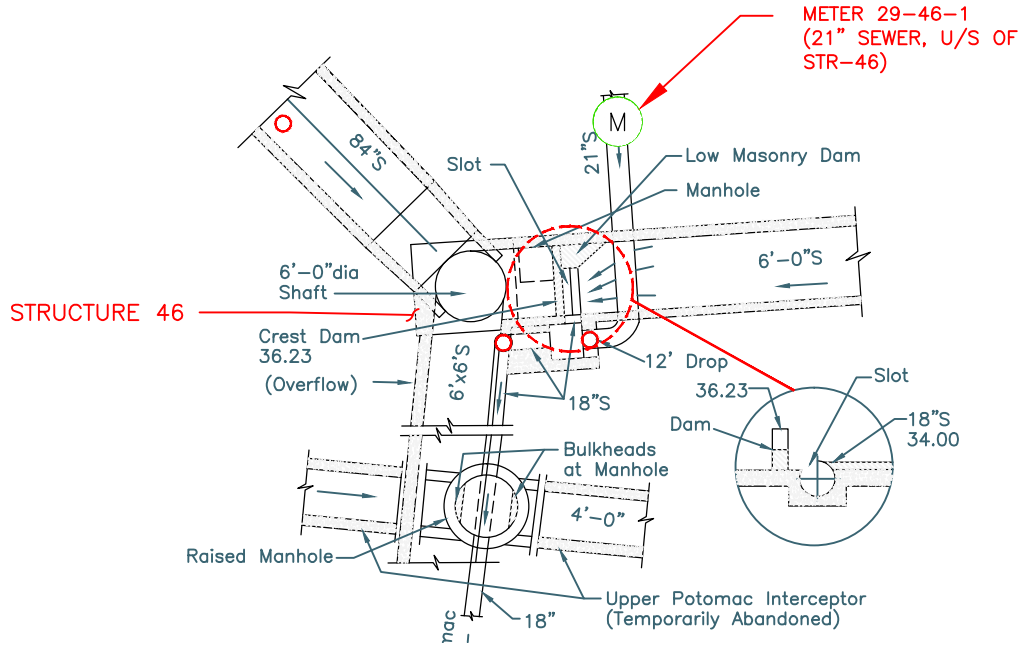
The 6–ft. by 6–ft. Overflow line discharges to the Potomac River.

There is an Outlet Structure and Gate at the outlet.



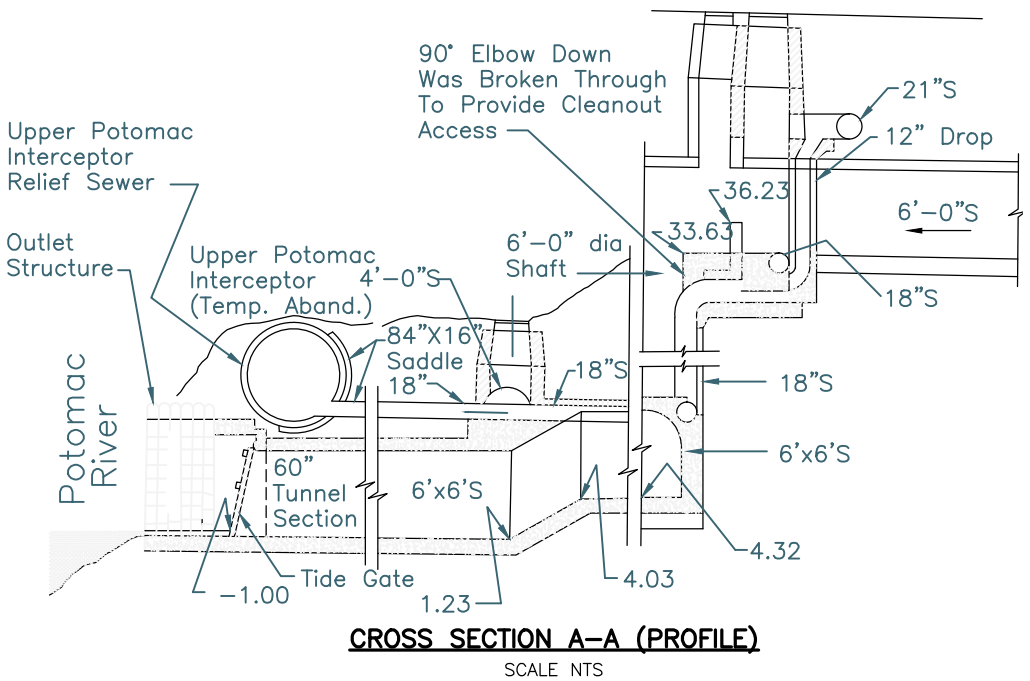
FLOW METER LOCATION PLAN

SCALE: NTS



INSET–1 SECTION PLAN

SCALE NTS



CROSS SECTION A–A (PROFILE)

SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

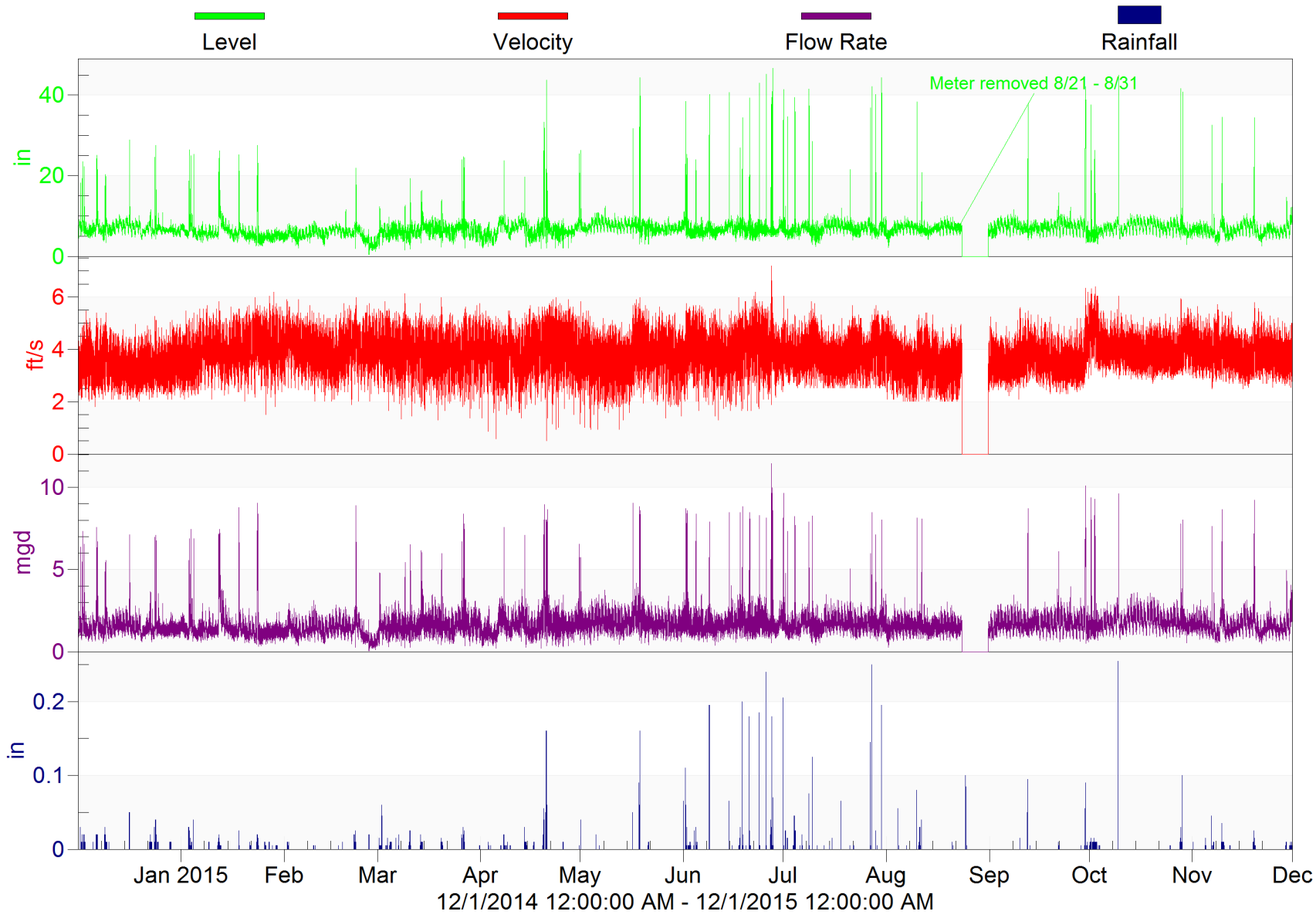
29–46–1

METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 24

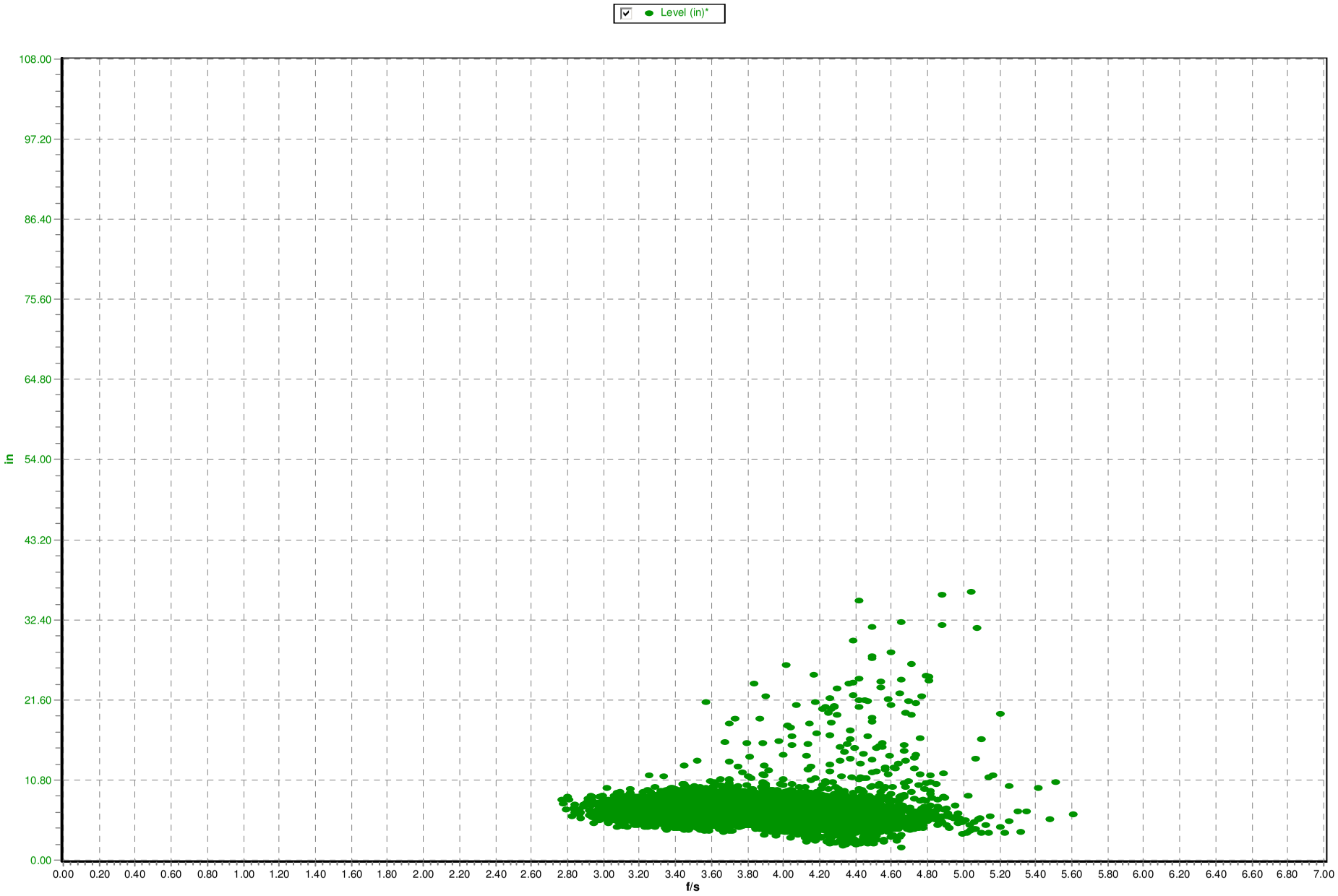
LAST SAVED BY: STEFAN COSTNER DATE: 5/4/2016 5:07:52 PM
DRAWING ID: L:\LTCP\PCM\FLOW METER – EXHIBITS\EXHIBITS–FIGURES\2016–05–04 FINAL\2016–05–04 PCM–EXHIBITS–FIGURES – STANDARD\24_29–46–1.DWG

M-24


Level
Velocity
Flow Rate
Rainfall
Meter removed 8/21 - 8/31
in
40
20
0
ft/s
6
4
2
0
mgd
10
5
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-24 - In sidewalk 20 feet from exit to Georgetown University

Pipe Diameter (in): 21.25 (12/01/14 to 12/01/15)



M-24

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
10/30/2014	11:30		7.75		5.03	0		LR/PD	Install.
10/30/2014	12:55	7.84	7.75	4.84	4.9	0		LR/PD	
10/30/2014	13:05	7.99	7.75	4.67	5.05	0		LR/PD	
10/30/2014	13:10	8.01	7.75	4.55	4.85	0		LR/PD	
12/26/2014	13:00							LR/AP	CB Telog.
1/7/2015	15:29		5		4.3	0		LR/PD	
1/29/2015	10:44	5.26	5.25	4.32	4.5	0		LR/AM	
2/19/2015	12:00		7		4.56	0		AP/AM	
2/19/2015	12:03		7		4.34	0		AP/AM	
2/19/2015	12:06		7		4.21	0		AP/AM	
2/26/2015	12:00							AP/AM	CB Telog.
4/14/2015	14:00							AP/MH	CB Telog.
5/20/2015	13:34						5.98	LR/DW	CB Telog.
7/24/2015	13:55		6		4.6	0		LR/DW	
8/13/2015	11:14							CL/JC	CB Telog.
8/25/2015	11:49							LR/JC	Can't access site due to construction.
8/31/2015	15:44							LR/JC	Restore meter function after construction.
10/7/2015	11:22		7		3.8	0		LR/JC	
11/3/2015	9:54		8.5		4.2	0		JC/RM	CB Telog.
12/17/2015	14:33		7.5		4.34	0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-25-US

SEWER: COLLEGE POND SEWER

OUTFALL: 029

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-25-US measured flows on the College Pond Sewer upstream of Structure 47.

3. The continuity equation was used to calculate a flow rate from these measurements. M-25-US is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0.01	0.056	0
Avg.	1.011	1.65	0.143
Max	33.579	9.64	48.114

Site Name/Manhole # M-25 US Primary: [X] Alternate: [ ]

Investigation Date: 2/20/14 Time: 4:20 Crew Members: LR/JS

Installation Date: 11/24/14 Time: 10:10 Crew Members: CL/PD

Address/Location: 38th Street NW & Reservoir Avenue NW (entrance to Georgetown Hospital)

Latitude: N 38°54,746' Longitude: W 77°4,462'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 3.86 ft/sec

Depth 1.25 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	6'		6'
Width	6'		6'
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ No Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ ____ ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ Good 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ No

Height above ground ____

Manhole depth 19'3"

Structural Integrity of Manhole:

☐ Good ☐ Fair ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: 10 ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: 10 ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ Yes ☐ No ☐ Maybe

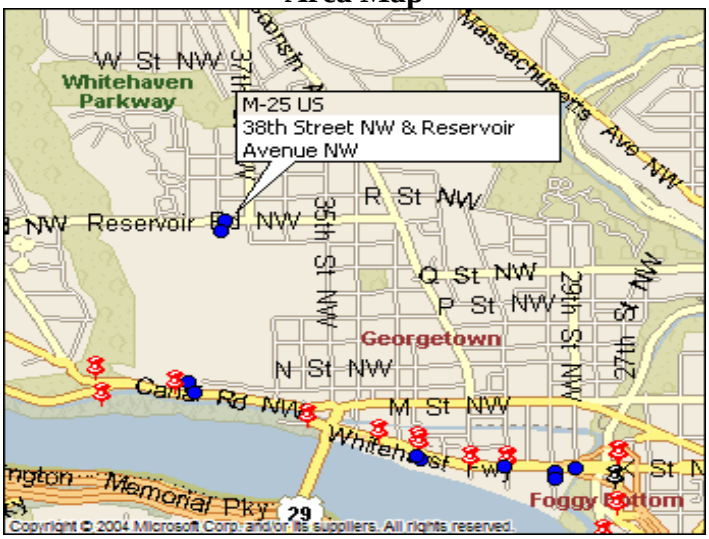
Sensor Configuration:

(Please include Serial Numbers when possible)

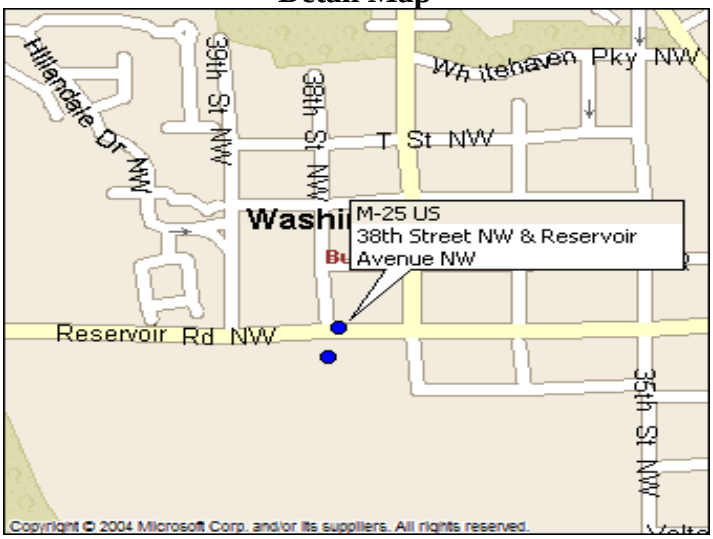
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Approximately 10' DS of MH, effluent pipe bend to the left and appears to get smaller*

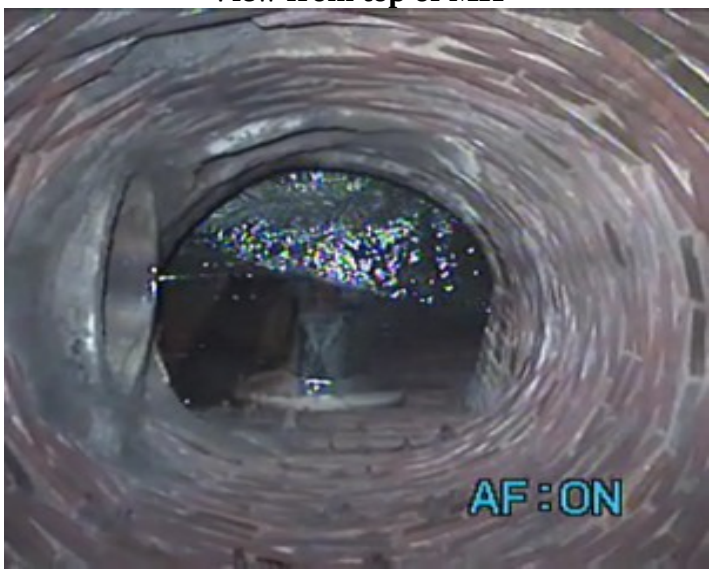
Area Map



Detail Map



View from top of MH

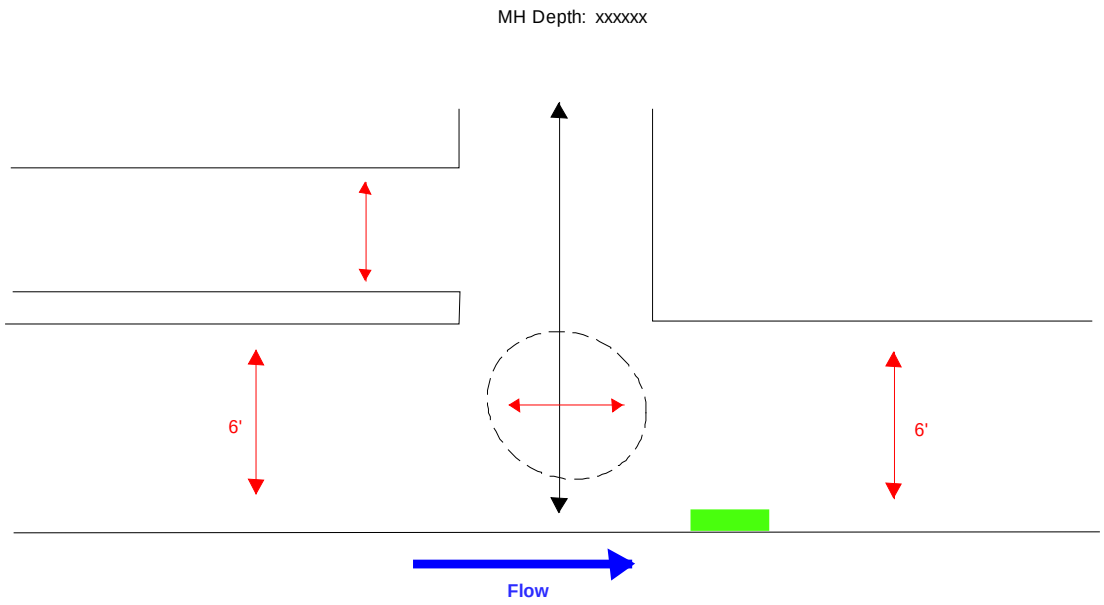


Site Overview

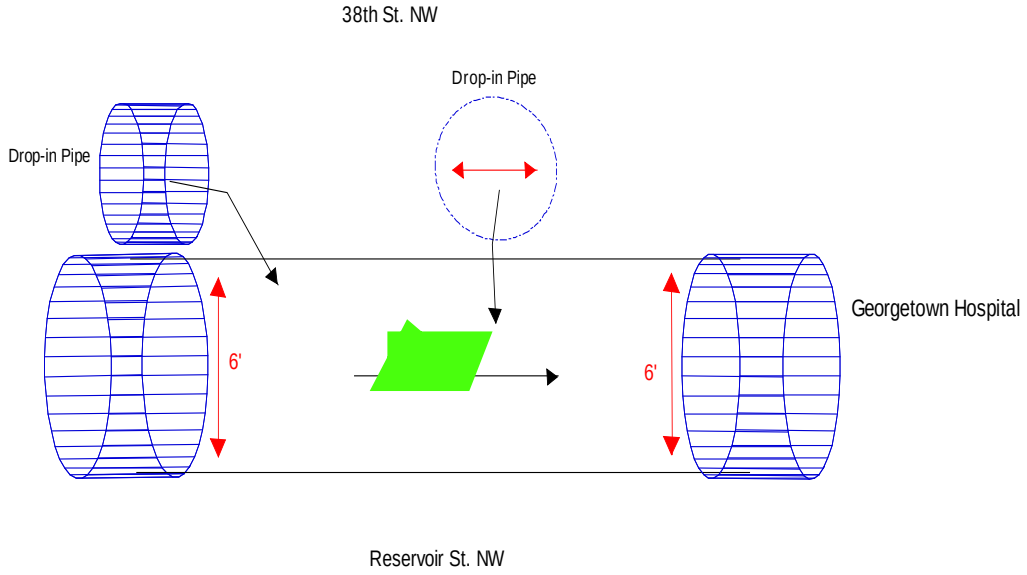
View of flow through influent line

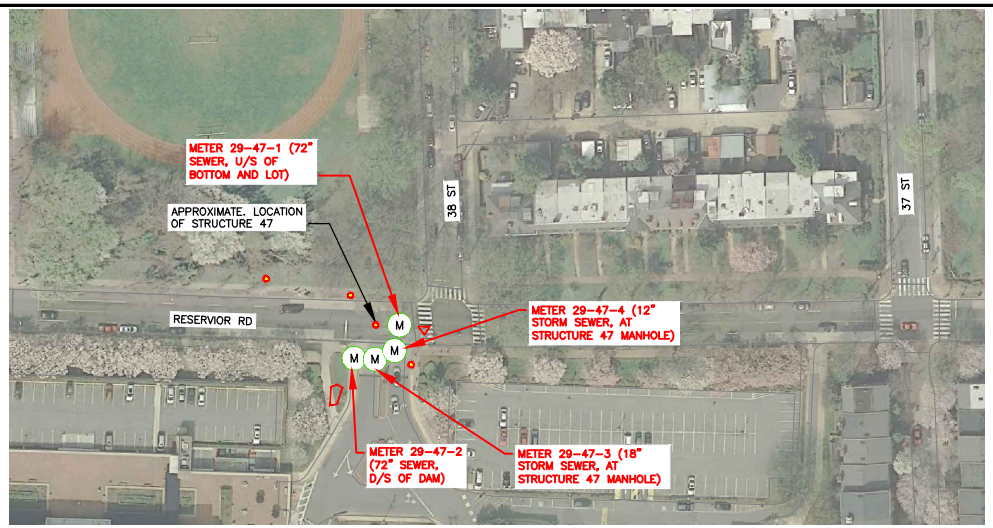
View of flow through effluent line

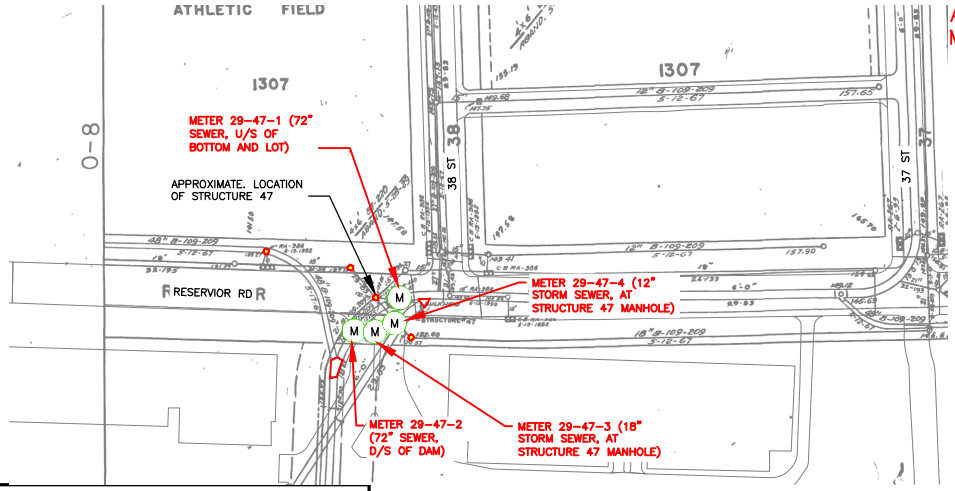
Dimensional Structure Profile View (profile sketch showing location of sensors)



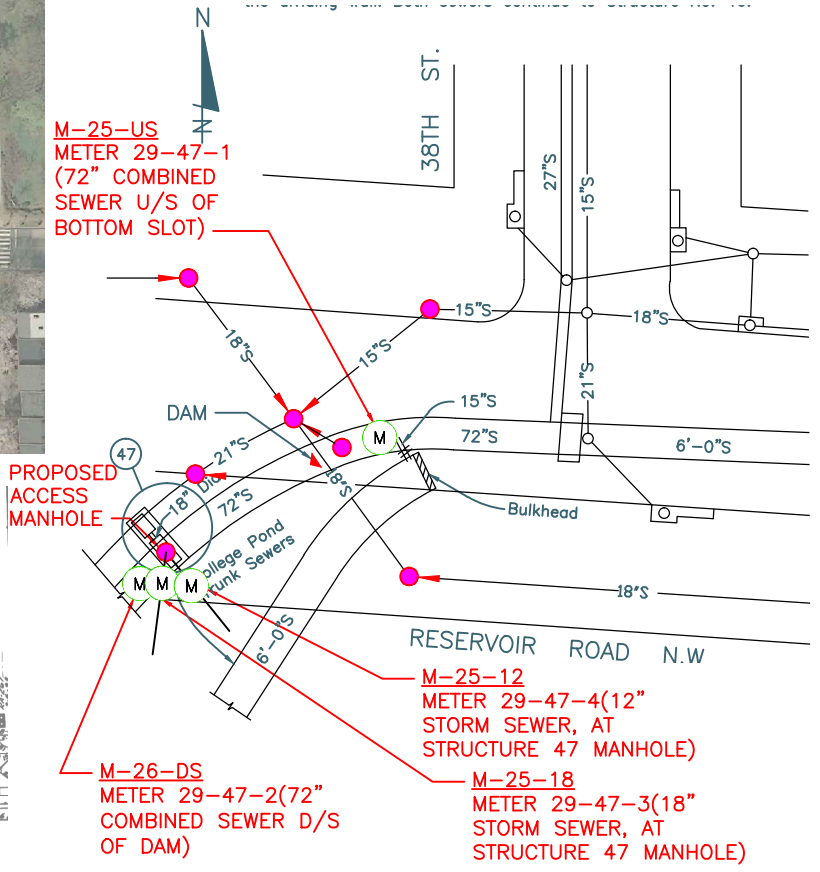
Dimension Structure Detail (Plan View)







FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 STRUCTURE 47 DETAIL
SCALE NTS

LEGEND

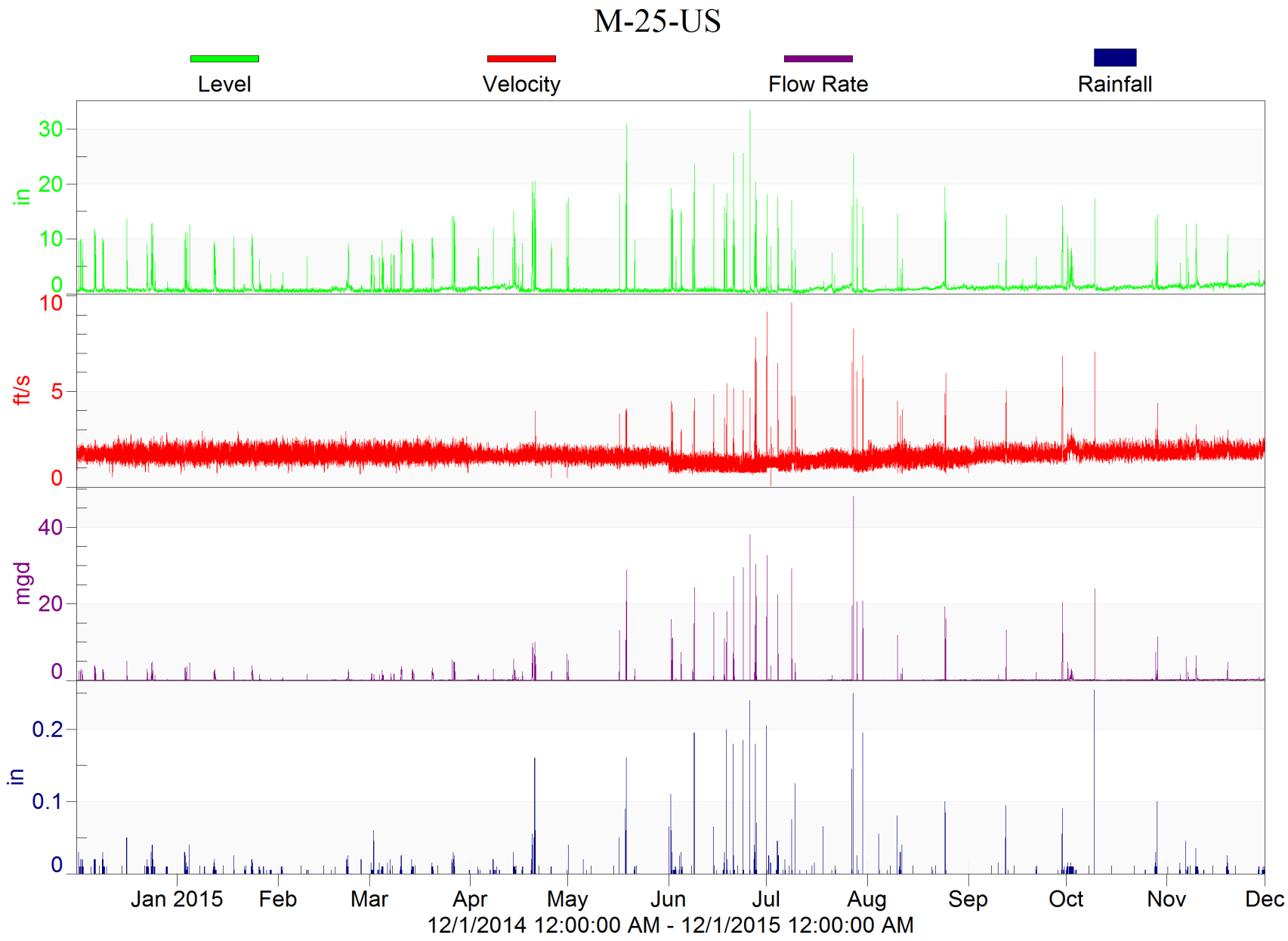
(M) FLOW METER LOCATION

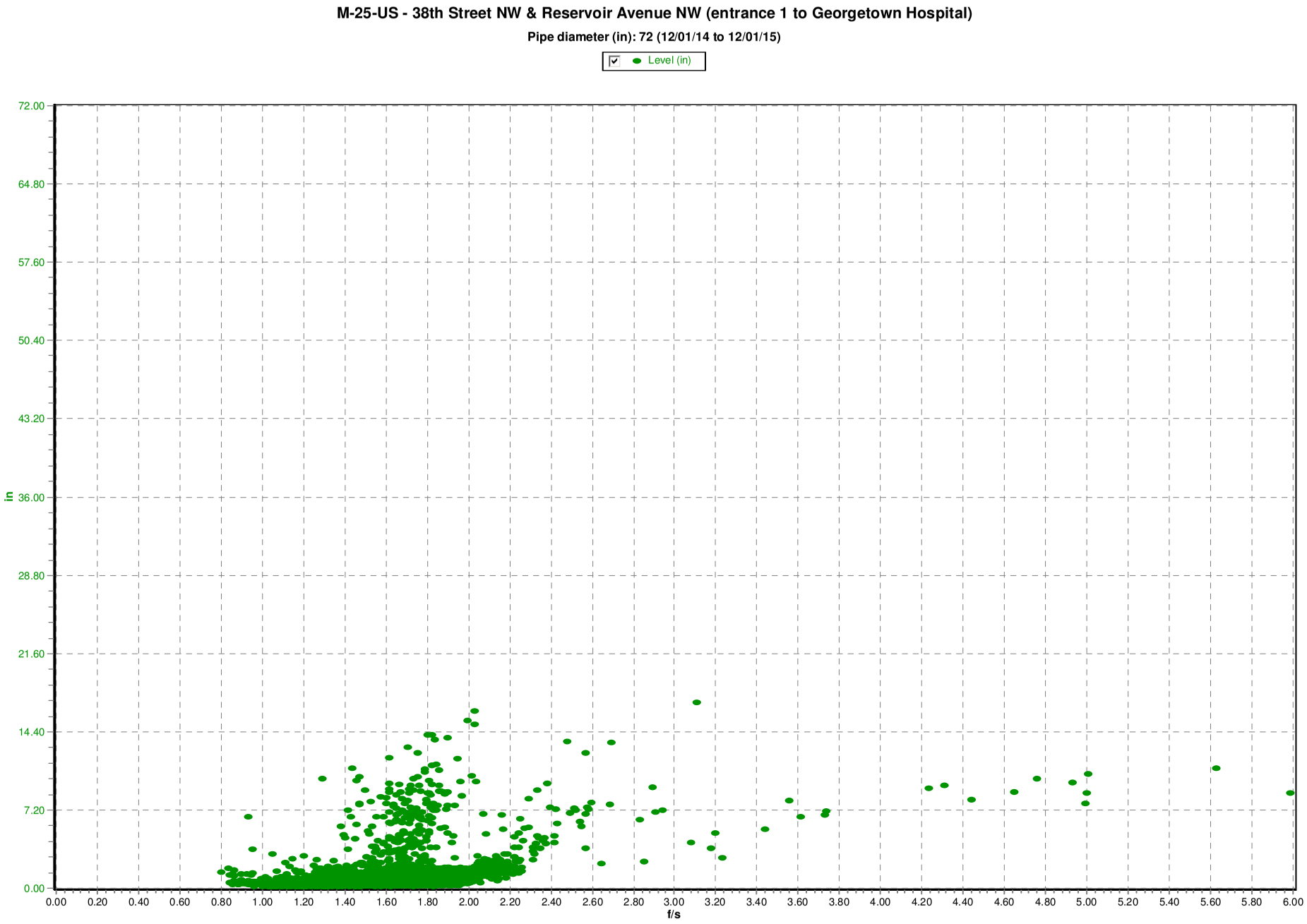
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29-47-1_2_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 25

LAST SAVED BY: STEFAN OSTNER DATE: 5/12/2016 1:48:28 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28_29-47-1_2_3.DWG


M-25-US
Level
Velocity
Flow Rate
Rainfall
30
20
10
0
in
10
5
0
ft/s
40
20
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-25-US - 38th Street NW & Reservoir Avenue NW (entrance 1 to Georgetown Hospital)
Pipe diameter (in): 72 (12/01/14 to 12/01/15)
Level (in)
in
72.00
64.80
57.60
50.40
43.20
36.00
28.80
21.60
14.40
7.20
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00
f/s

M-25-US

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/24/2014	12:45	0	1.25	0	2	0		LL/PD	Install.
11/24/2014	12:50	0	1.25	0	1.945	0		LL/PD	
11/24/2014	12:55	0	1.25	0	1.96	0		LL/PD	
1/8/2015	11:00						6.03	LR/AM	CB Telog.
1/29/2015	11:35						5.9	LR/AM	CB Telog.
2/24/2015	16:00							AP/AM	CB Telog.
3/18/2015	14:00						5.94	AP/AM	CB Telog.
5/8/2015	10:30						6.03	LR/DW	CB Telog.
6/2/2015	12:03						5.98	LR/DW	CB Telog.
6/5/2015	10:03		1		1.9	0		LR/DW	
6/23/2015	16:05						5.81	LL/DW	CB Telog.
7/14/2015	9:13	0.98	1.25	2.28	2.1	0		LR/DW	CB Telog.
8/13/2015	16:05		1.25		1.97	0		CL/JC	CB Telog.
9/2/2015	14:28		1.25		1.7	0		LR/JC	
10/22/2015	9:23							JC/RM	CB Telog.
11/20/2015	9:50		1		2	0		JC/RM	CB Telog.
12/10/2015	12:10		1		2	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-25-DS

SEWER: COLLEGE POND SEWER

OUTFALL: 029

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-25-DS measured excess flows from the College Pond Sewer before entering the Potomac River through CSO 029 downstream fo Structure 47.

3. The continuity equation was used to calculate a flow rate from these measurements. M-25-DS is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.078	0.027	0.026
Max	37.956	10.512	29.373

Site Name/Manhole # M-25 DS Primary: [X] Alternate: [ ]

Investigation Date: 4/16/14 Time: 16:30 Crew Members: LR/JS

Installation Date: 11/7/14 Time: 8:30 Crew Members: LR/PD

Address/Location: 38th Street NW & Reservoir Avenue NW (entrance 1 to Georgetown Hospital)

Latitude: N 38°54,747' Longitude: W 77°4,459'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry Pipe*

Velocity ____ ft/sec

Depth ____ in

Turbulence Amplitude: *Dry Pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	6'		6'
Width	6'		6'
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information: *None within camera view*

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 19'9"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: ___ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

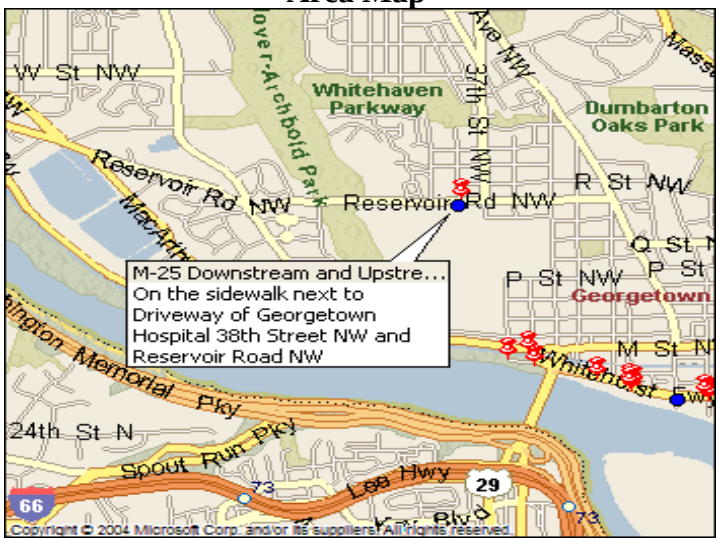
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: FloWav
	Redundant: FloWav
Velocity	Primary: FloWav
	Redundant: FloWav
Meter Logger	Telog 294985

Comments:

Area Map



Detail Map

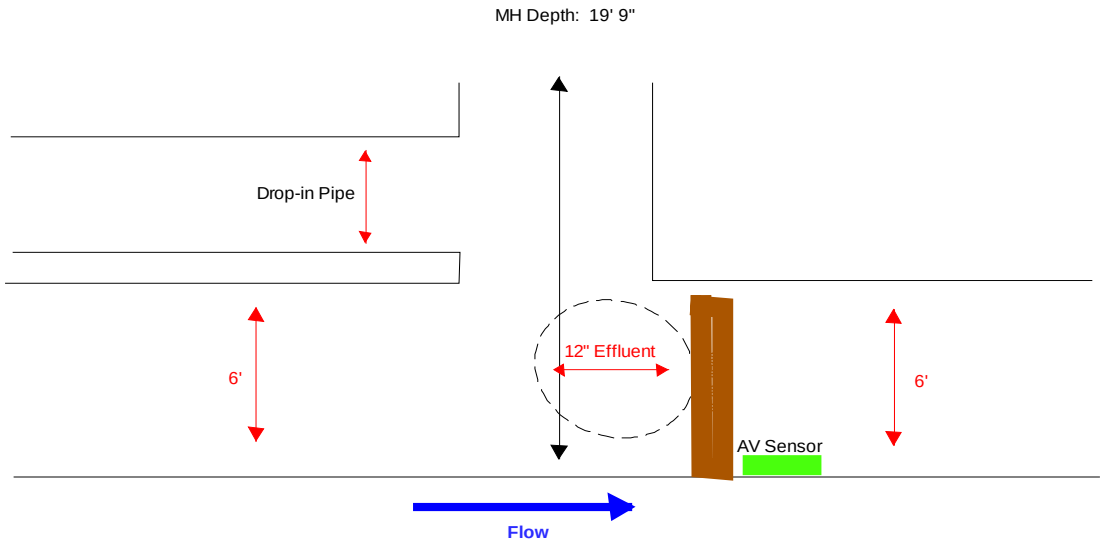
View from top of MH

Site Overview

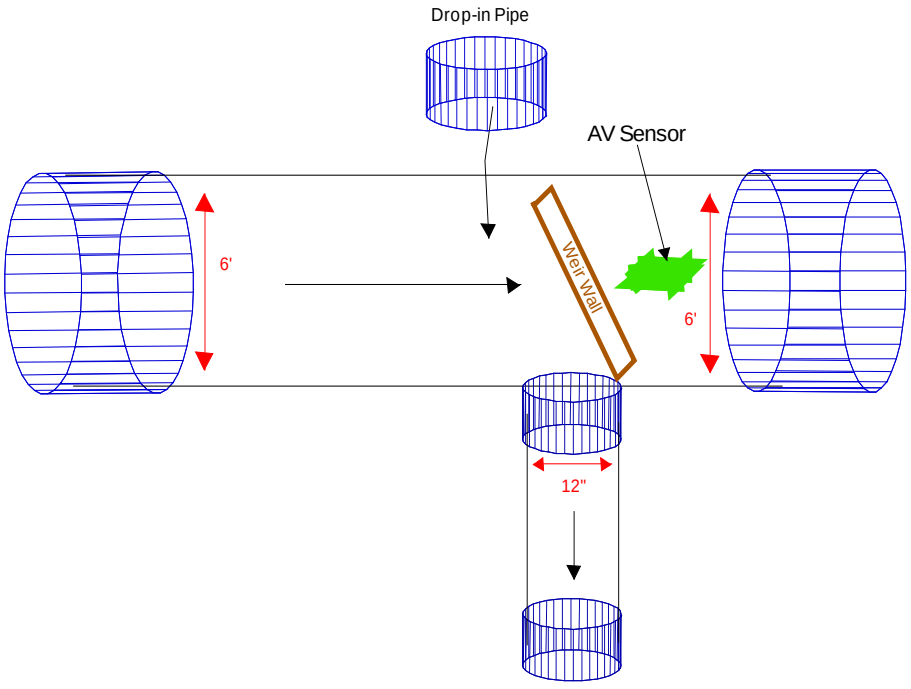
View of flow through influent line

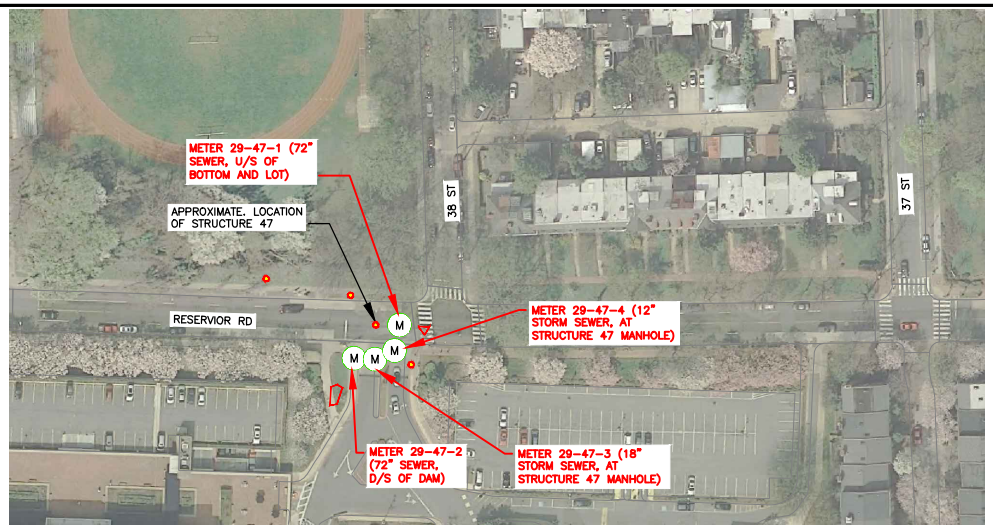
View of flow through effluent line

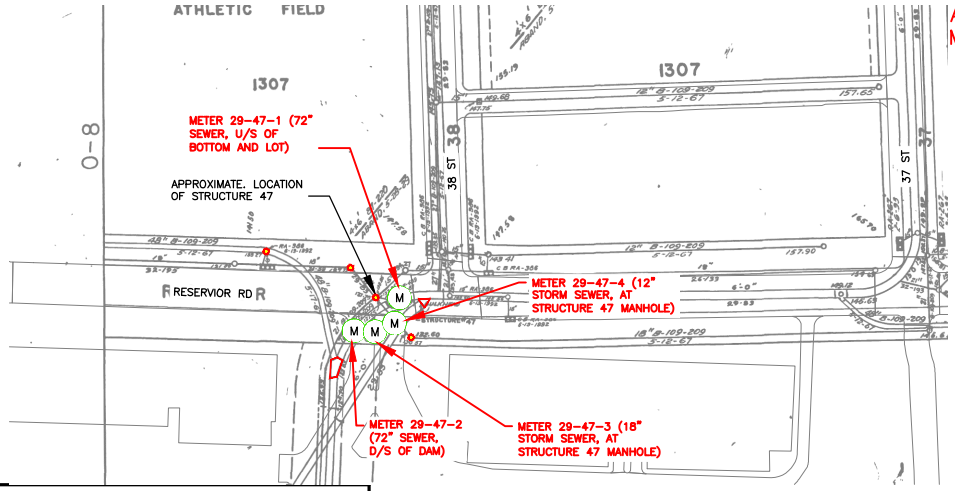
Dimensional Structure Profile View (profile sketch showing location of sensors)



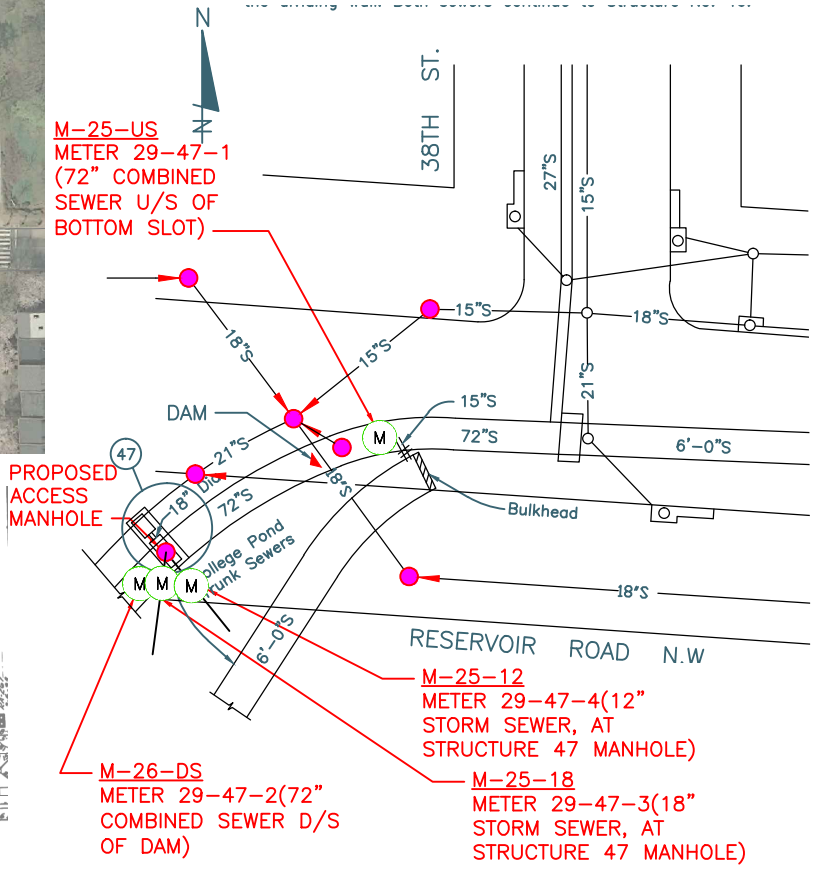
Dimension Structure Detail (Plan View)







FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 STRUCTURE 47 DETAIL
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29-47-1_2_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 25

LAST SAVED BY: STEFAN OSSTNER DATE: 5/12/2016 1:48:28 PM
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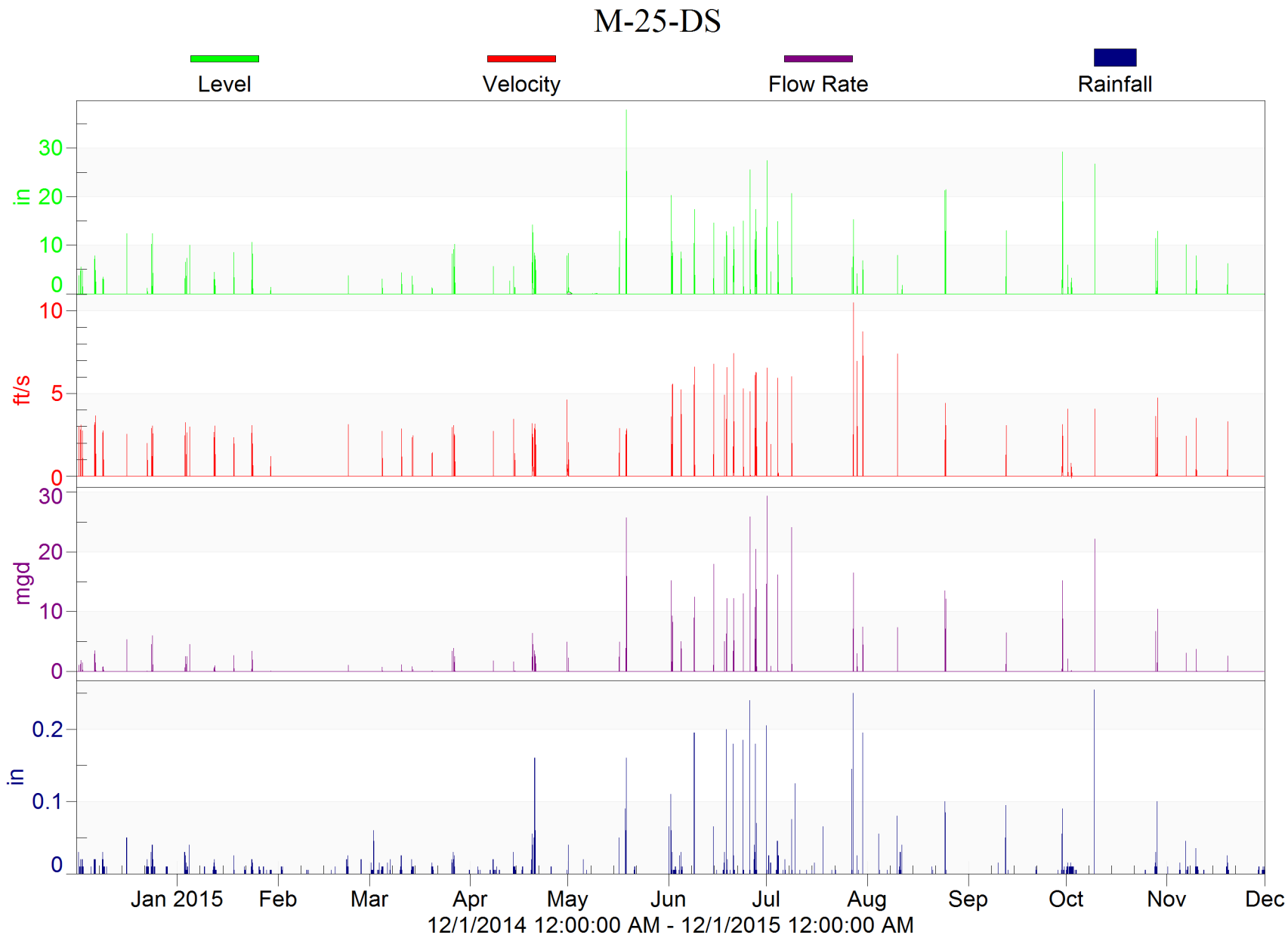
M-25-DS
Level
Velocity
Flow Rate
Rainfall
in
30
20
10
0
ft/s
10
5
0
mgd
30
20
10
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
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Sep
Oct
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Dec
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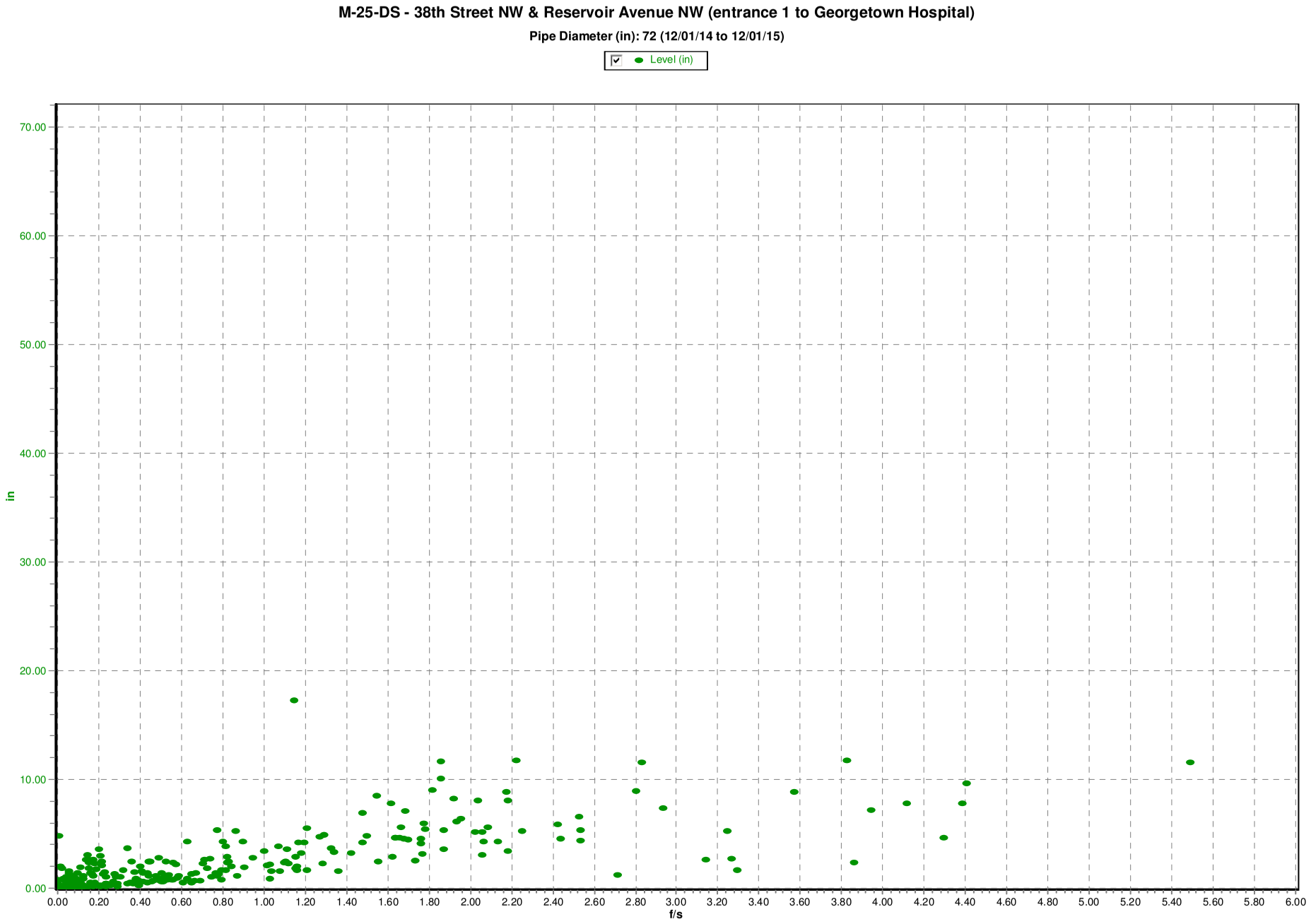

M-25-DS - 38th Street NW & Reservoir Avenue NW (entrance 1 to Georgetown Hospital)
Pipe Diameter (in): 72 (12/01/14 to 12/01/15)
Level (in)
in
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00
f/s

M-25-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/7/2014	8:56		0		0	0		LR/AP	Install.
12/16/2014	13:00		0		0	0		LR/AP	CB Telog.
1/20/2015	13:30		0		0	0	5.98	AP/AM	CB Telog.
2/24/2015	16:00		0		0	0	5.98	AP/AM	CB Telog.
3/18/2015	13:15		0		0	0	5.94	AP/AM	CB Telog.
4/30/2015	12:43		0		0	0		LL/DW	Change meter.
5/11/2015	14:00		0		0	0	6.12	LR/DW	
7/14/2015	9:22		0		0	0	5.59	LR/DW	
10/29/2015	11:38		0		0	0		JC/RM	
12/10/2015	12:25		0		0	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-25-12

SEWER: COLLEGE POND SEWER

OUTFALL: 029

DURATION: 7/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-25-12 measured flows from the 12" storm pipe entering the manhole at Structure 47.

3. The continuity equation was used to calculate a flow rate from these measurements. M-25-12 is a storm pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.052	0.039	0.001
Max	3.859	8.594	0.858

Site Name/Manhole # M-25-12 Primary: [X] Alternate: [ ]

Investigation Date: 6/15/15 Time: 12:30 Crew Members: CL/DW

Installation Date: 6/15/15 Time: 12:30 Crew Members: CL/DW

Address/Location: 38th Street NW & Reservoir Avenue NW (entrance 1 to Georgetown Hospital)

Latitude: N 38°54,747' Longitude: W 77°4,459'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry Pipe*

Velocity ____ ft/sec

Depth ____ in

Turbulence Amplitude: *Dry Pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	12"		6'
Width	12"		6'
Material	PVC		RCP
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information: *None within camera view*

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 15"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: ___ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

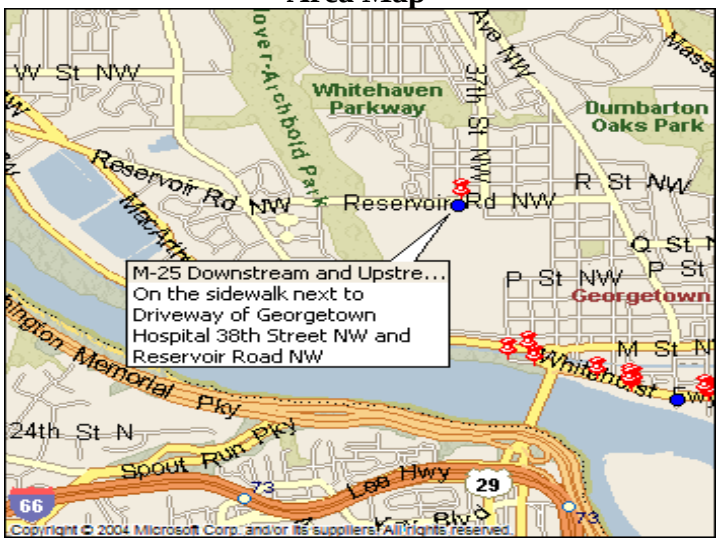
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: FloWav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog 1114-2058

Comments: *Sensor is installed in US*

Area Map



Detail Map

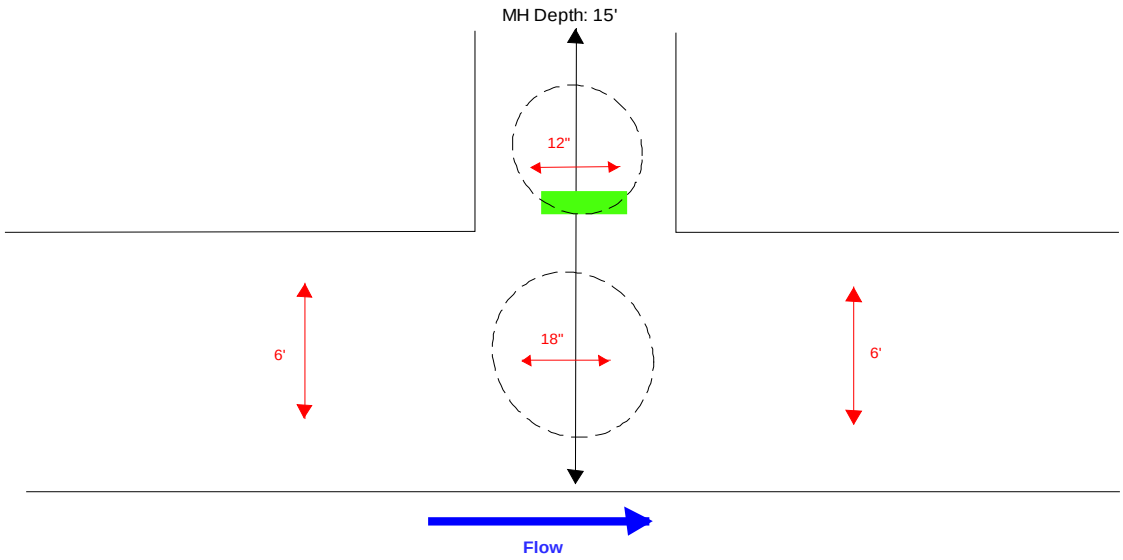
View from top of MH

Site Overview

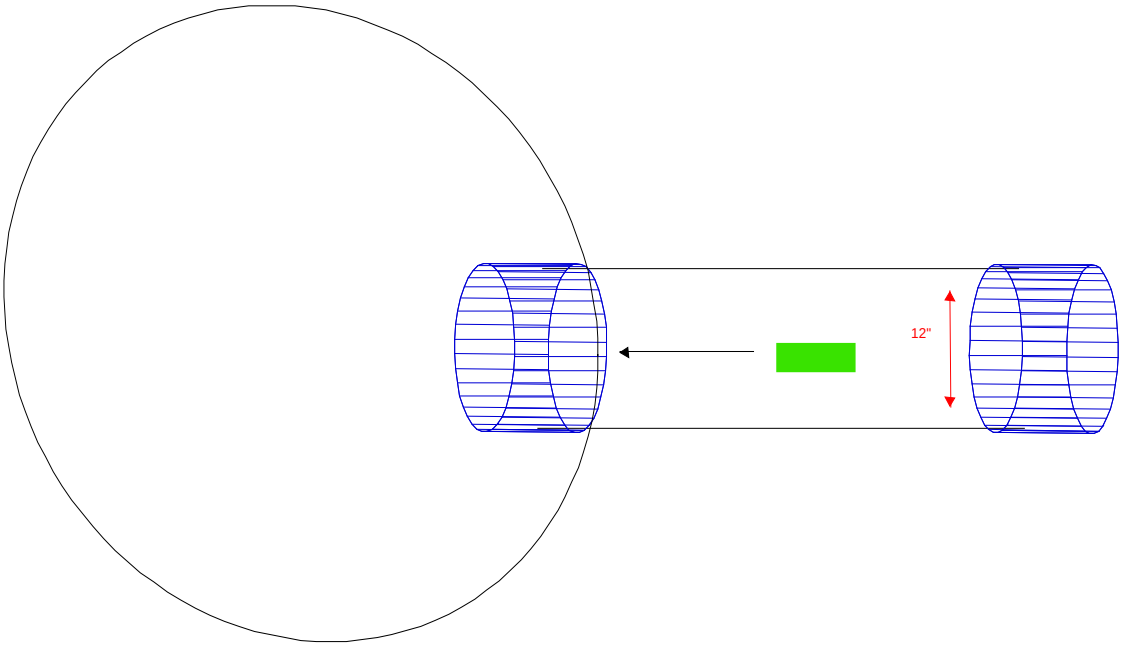
View of flow through influent line

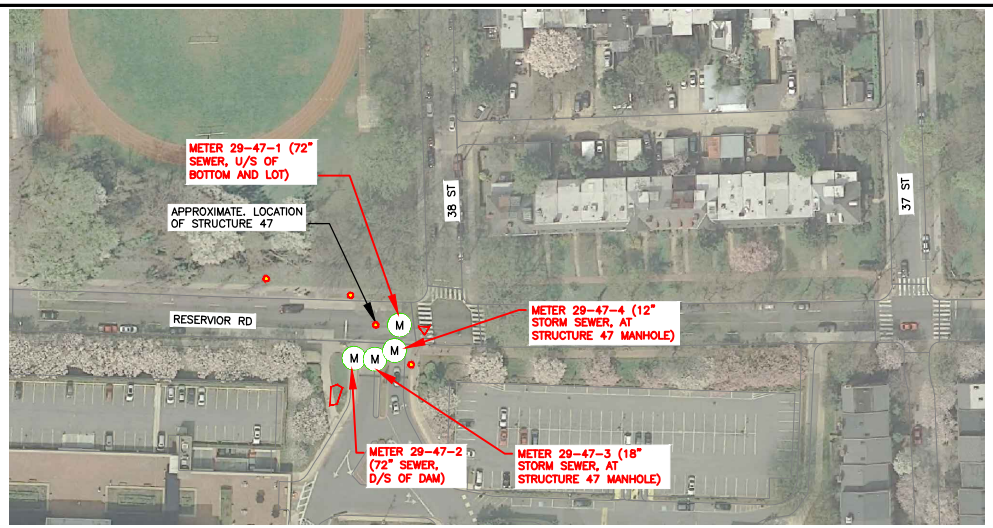
View of flow through effluent line

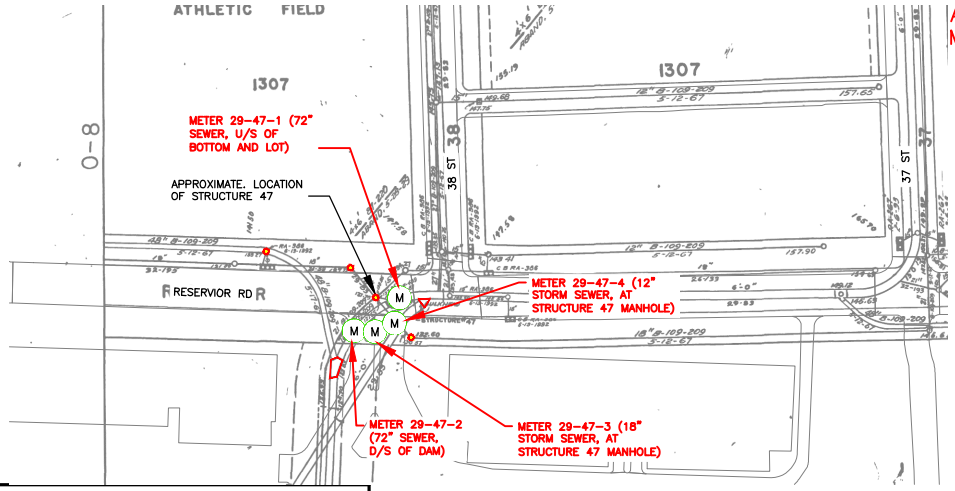
Dimensional Structure Profile View (profile sketch showing location of sensors)



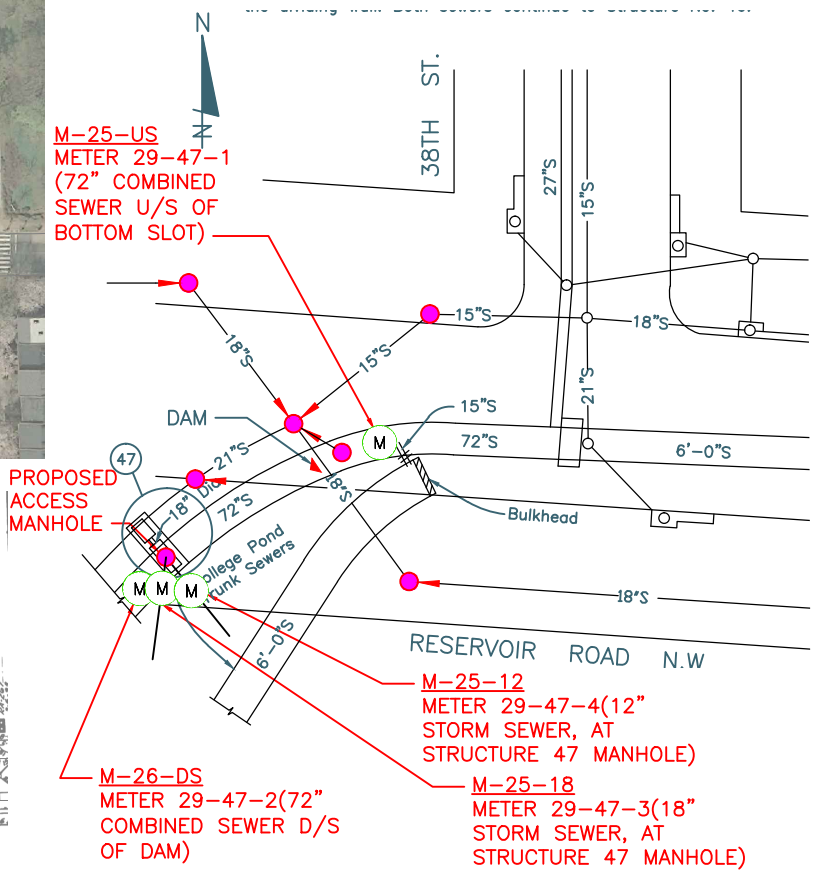
Dimension Structure Detail (Plan View)







FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 STRUCTURE 47 DETAIL
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

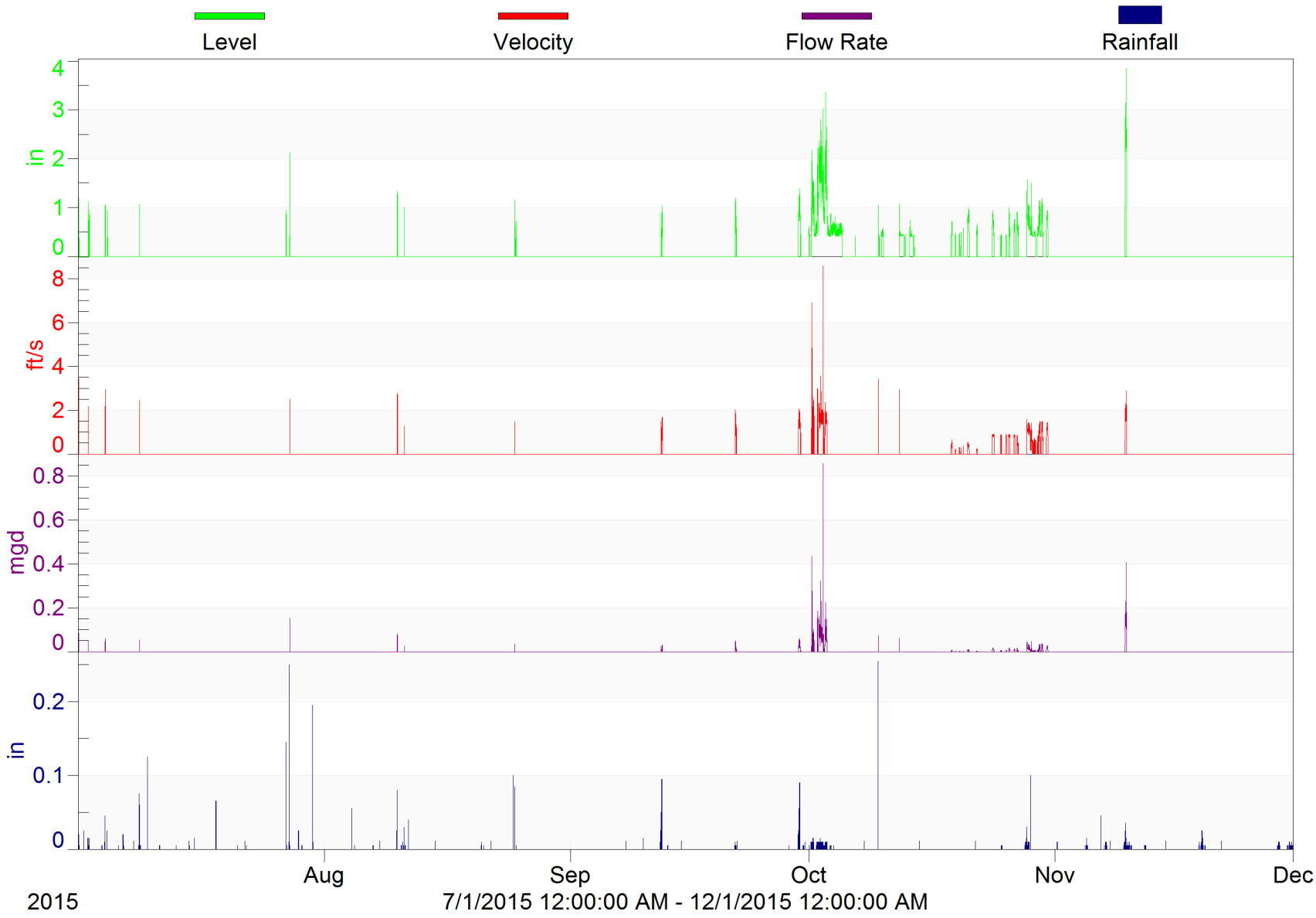
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29-47-1_2_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 25

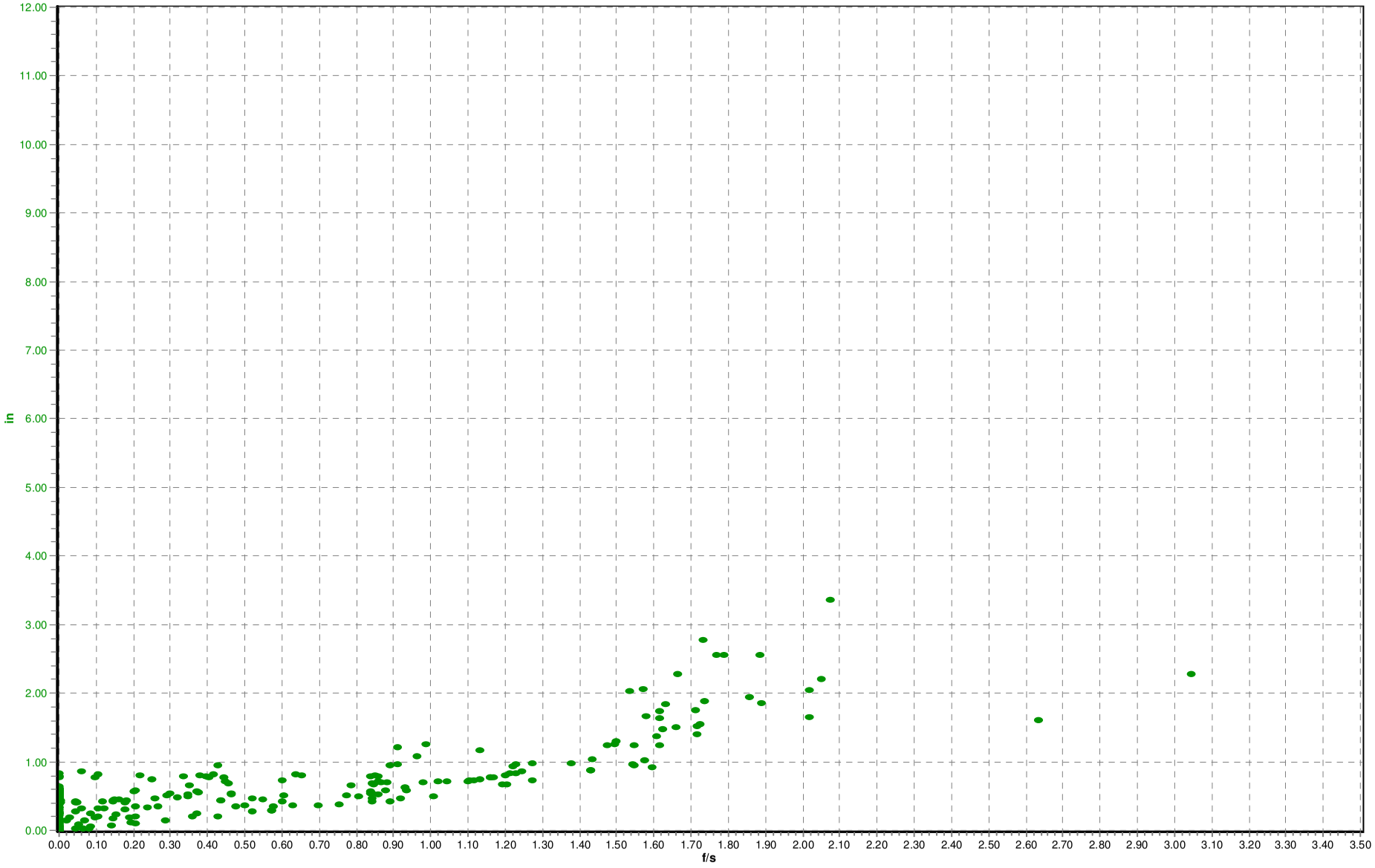
LAST SAVED BY: STEFAN OSTNER DATE: 5/12/2016 1:49:28 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28_29-47-1_2_3.DWG

M-25-12


Level
Velocity
Flow Rate
Rainfall
in
4
3
2
1
0
ft/s
8
6
4
2
0
mgd
0.8
0.6
0.4
0.2
0
in
0.2
0.1
0
Aug
Sep
Oct
Nov
Dec
2015
7/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-25-12 - 38th Street NW & Reservoir Avenue NW

Pipe Diameter (in): 12 (07/01/15 to 12/01/15)



M-25-12

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
6/15/2015	13:21		0		0	0		LL/DW	Install.
6/15/2015	14:30		0		0	0		LL/DW	
6/29/2015	14:47		0		0	0		LR/DW	
7/14/2015	9:04		0		0	0	5.85	LR/DW	CB Telog.
8/19/2015	13:19		0		0	0		CL/JC	CB Telog.
9/28/2015	11:05		0		0	0		LR/JC	CB Telog.
11/11/2015	9:21		0		0	0		LR/JC	CB Telog.
12/10/2015	12:03		0		0	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-25-18

SEWER: COLLEGE POND SEWER

OUTFALL: 029

DURATION: 7/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-25-18 measured flows from the 18" storm pipe entering the manhole at Structure 47.

3. The continuity equation was used to calculate a flow rate from these measurements. M-25-18 is a storm pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.001	0.002	0
Max	1.487	3.477	0.116

Site Name/Manhole # M-25-18 Primary: [X] Alternate: [ ]

Investigation Date: 6/15/15 Time: 16:30 Crew Members: CL/DW

Installation Date: 6/15/15 Time: 16:30 Crew Members: CL/DW

Address/Location: 38th Street NW & Reservoir Avenue NW (entrance 1 to Georgetown Hospital)

Latitude: N 38°54,747' Longitude: W 77°4,459'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Dry Pipe*

Velocity ____ ft/sec

Depth ____ in

Turbulence Amplitude: *Dry Pipe*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	18"		6'
Width	18"		6'
Material	RCP		RCP
Shape	Round		Round

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ (No evidence visible)

- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ (Good (no problems accessing site))

- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information: *None within camera view*

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 15'

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend: ___ ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change: ___ ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

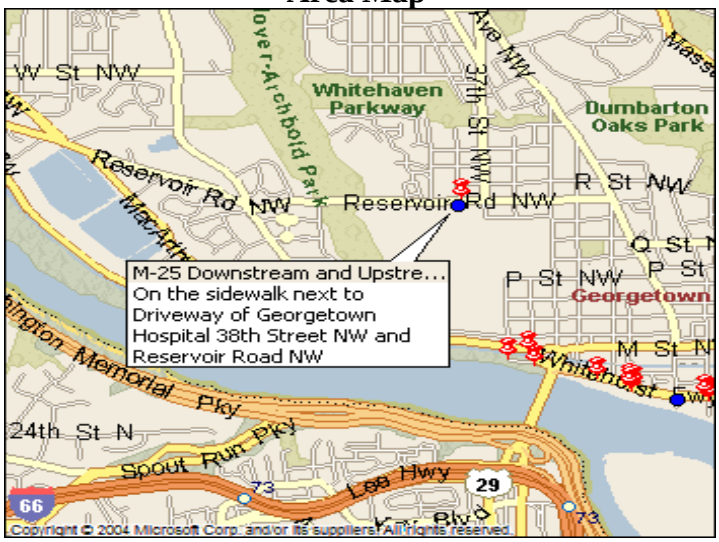
Sensor Configuration:

(Please include Serial Numbers when possible)

Level	Primary: FloWav
	Redundant:
Velocity	Primary: FloWav
	Redundant:
Meter Logger	Telog 1014-2010

Comments: *Sensor is installed in US*

Area Map



Detail Map

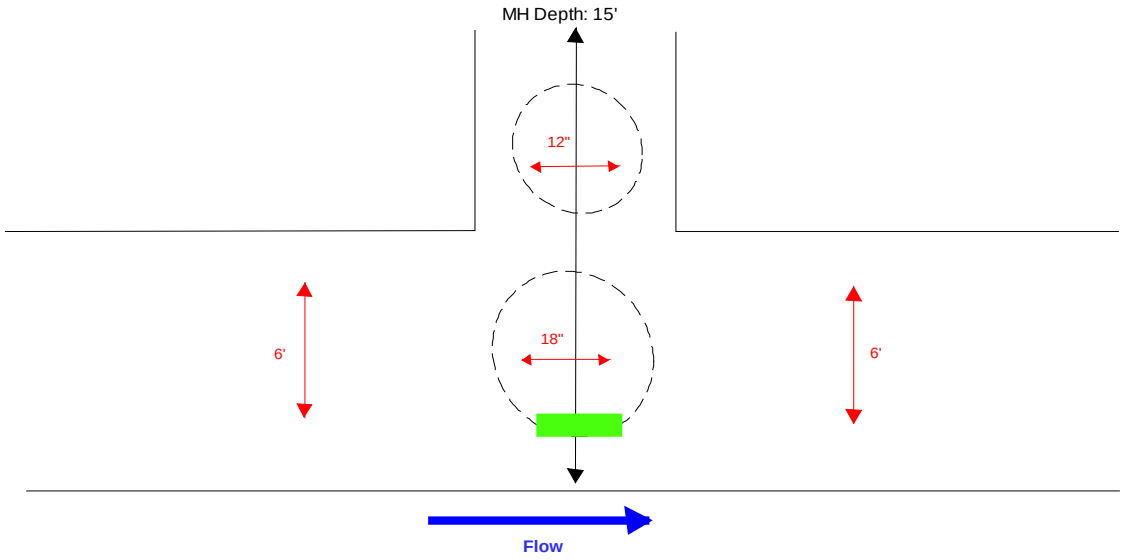
View from top of MH

Site Overview

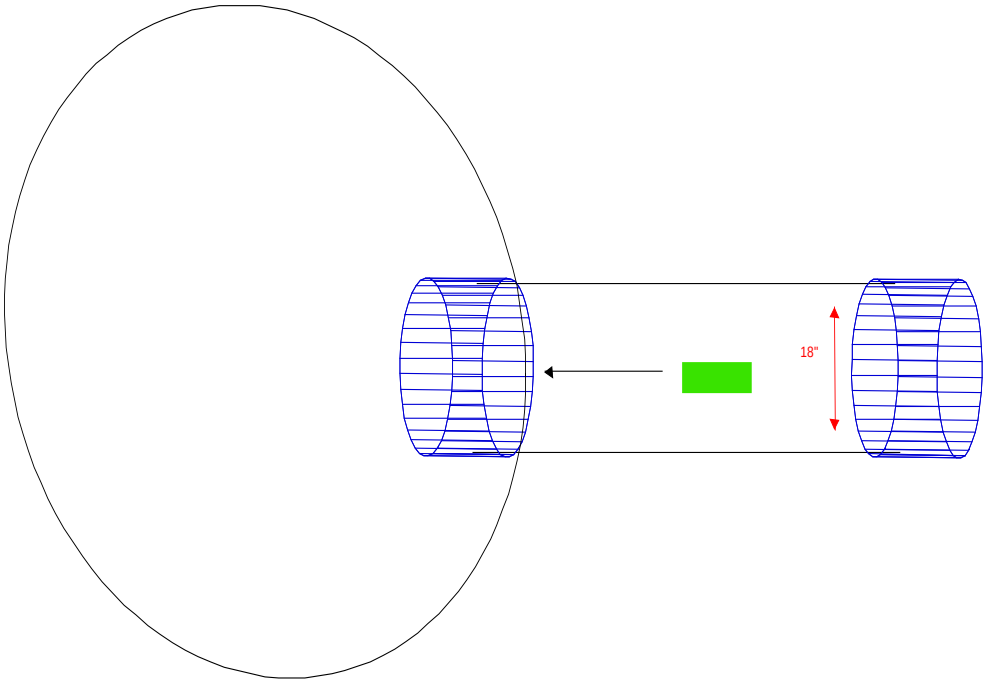
View of flow through influent line

View of flow through effluent line

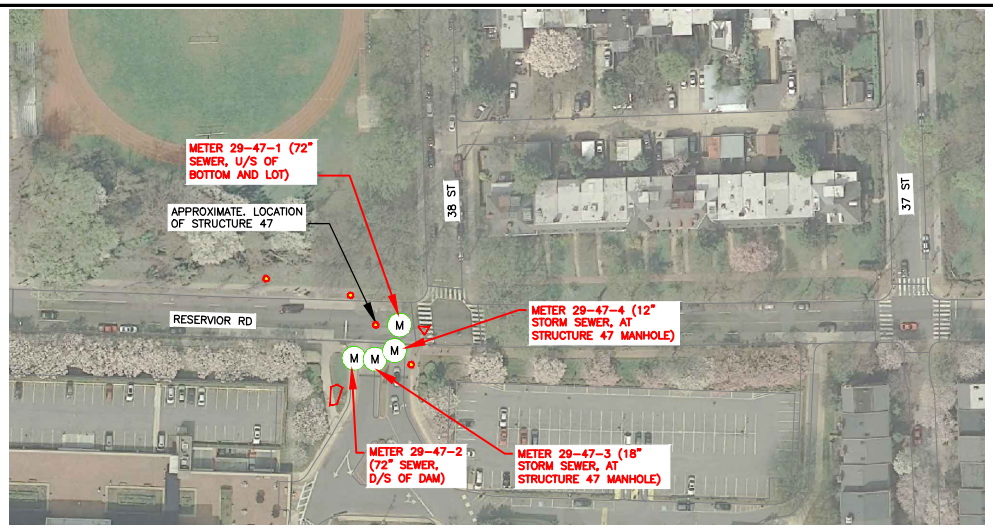
Dimensional Structure Profile View (profile sketch showing location of sensors)

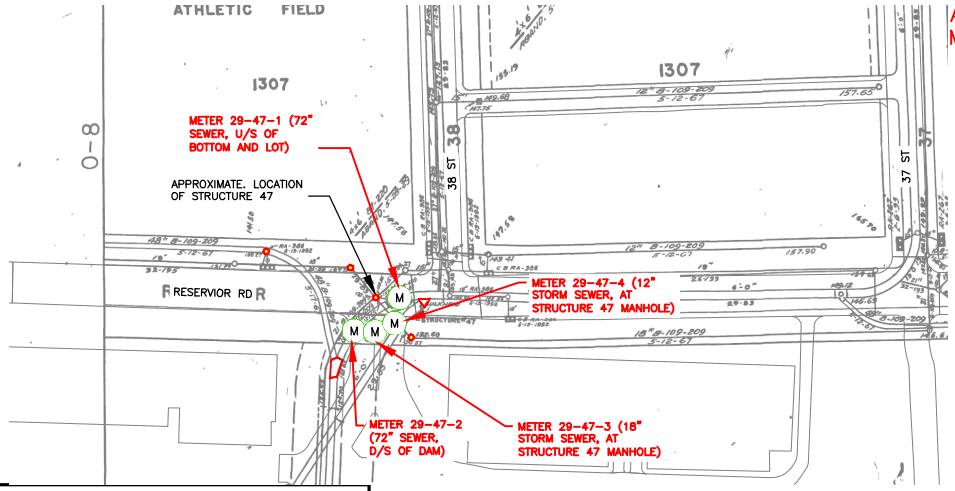


Dimension Structure Detail (Plan View)

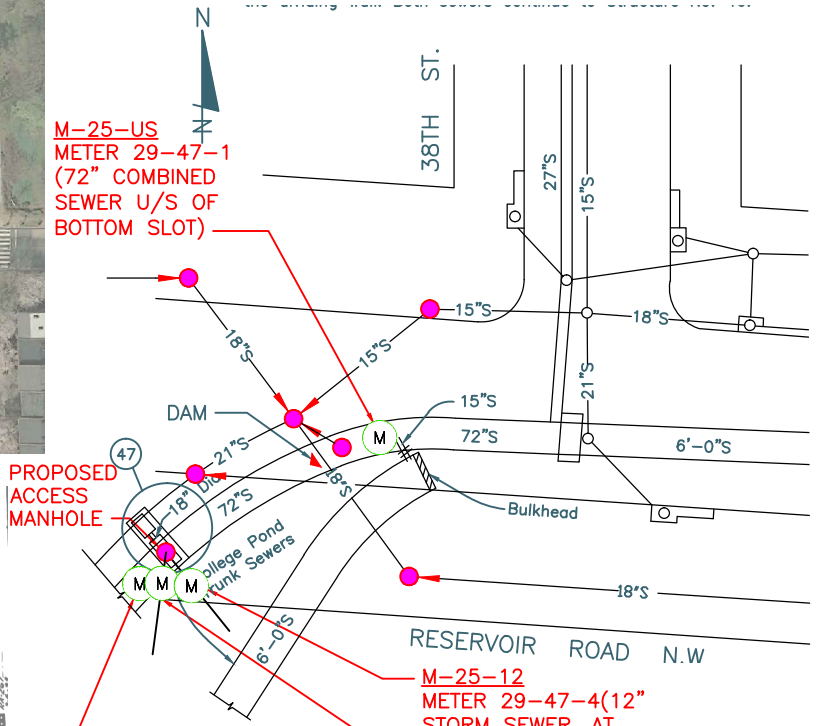


4 – FLOW METERS





FLOW METER LOCATION PLAN
SCALE: NTS



INSET–1 STRUCTURE 47 DETAIL
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

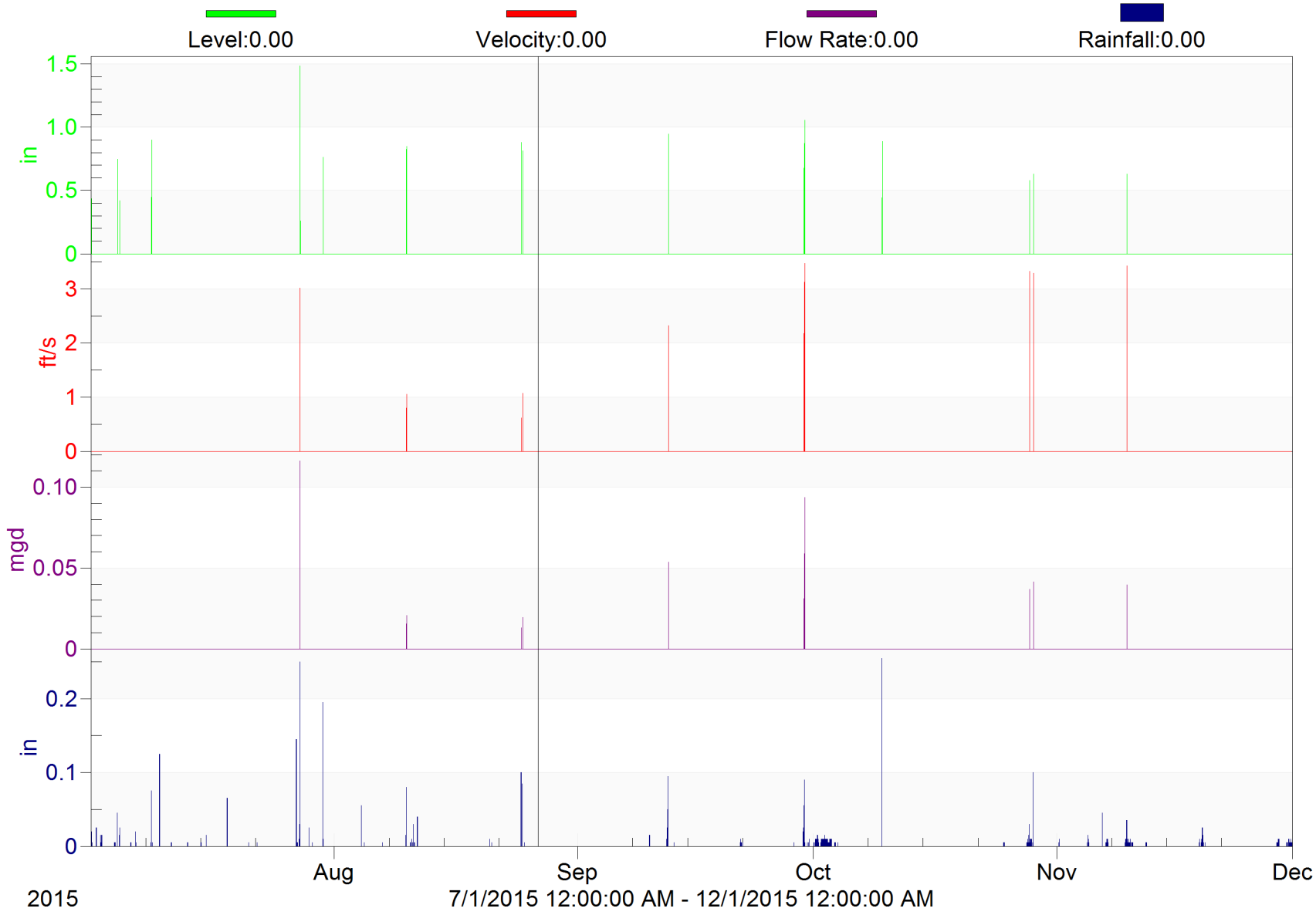
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
29–47–1_2_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 25

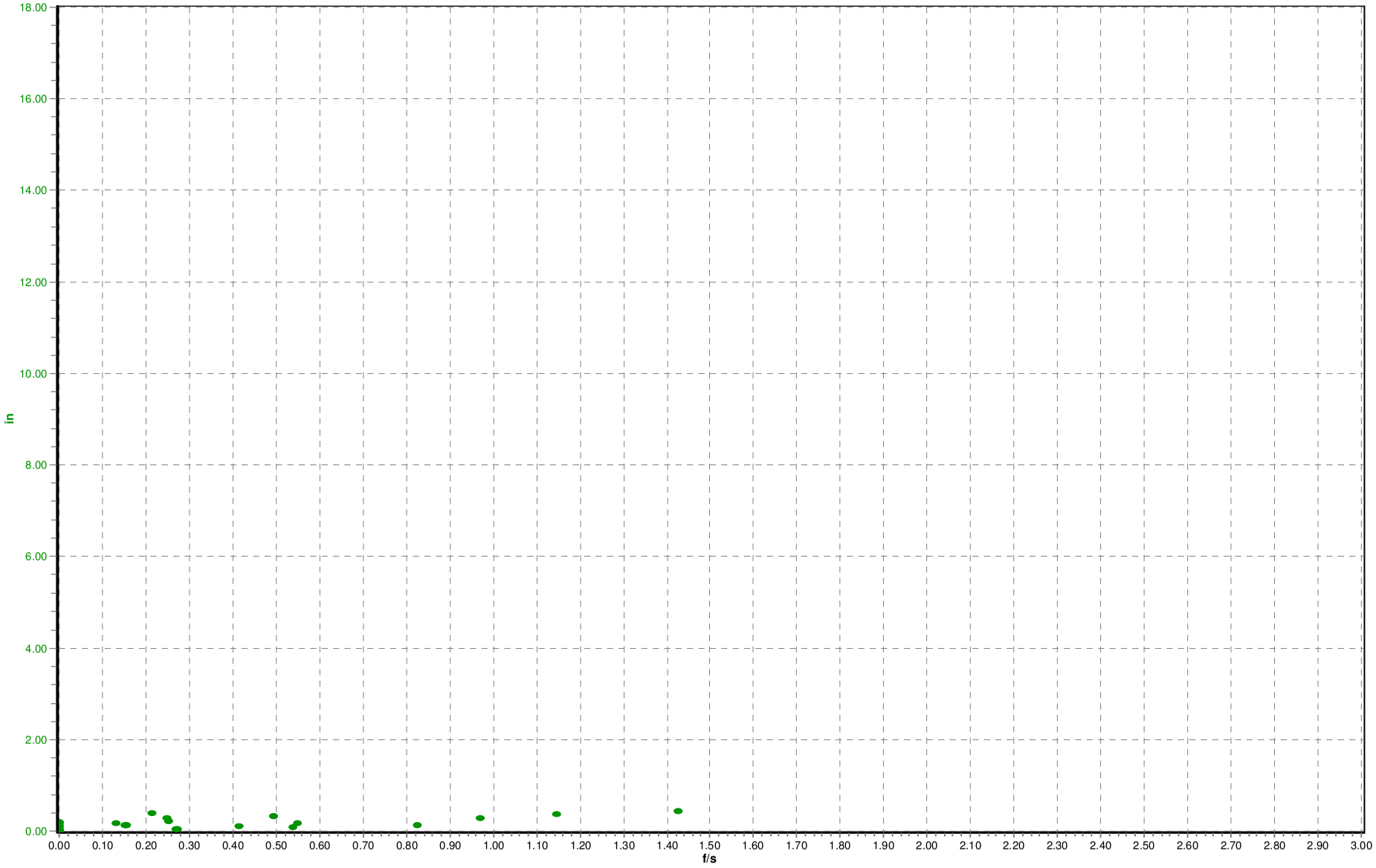
LAST SAVED BY: STEFAN OSTNER DATE: 5/12/2016 1:48:28 PM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28_29-47-1_2_3.DWG

M-25-18


Level:0.00
Velocity:0.00
Flow Rate:0.00
Rainfall:0.00
1.5
1.0
0.5
0
in
3
2
1
0
ft/s
0.10
0.05
0
mgd
0.2
0.1
0
in
Aug
Sep
Oct
Nov
Dec
2015
7/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM

M-25-18 - 38th Street NW & Reservoir Avenue NW

Pipe Diameter (in): 18 (07/01/15 to 12/01/15)



M-25-18

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
6/15/2015	13:21		0		0	0		LL/DW	Install.
6/15/2015	14:30		0		0	0		LL/DW	
6/29/2015	14:47		0		0	0		LR/DW	
7/14/2015	9:04		0		0	0	5.85	LR/DW	CB Telog.
8/19/2015	13:19		0		0	0		CL/JC	CB Telog.
9/28/2015	11:05		0		0	0		LR/JC	CB Telog.
12/10/2015	12:05		0		0	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-26

SEWER: UPPER POTOMAC INTERCEPTOR RELIEF SEWER

OUTFALL: n/a

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-26 measured flows on the Upper Potomac Interceptor Relief Sewer upstream of Structure 46.

3. The continuity equation was used to calculate a flow rate from these measurements. M-26 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	31.565	2.485	27.083
Avg.	42.716	5.149	65.925
Max	167.801	7.888	145.156

Site Name/Manhole # M-26 Primary: [X] Alternate: [ ]

Investigation Date: 11/4/14 Time: 10:50 Crew Members: LR/PD

Installation Date: 11/25/14 Time: 11:45 Crew Members:

Address/Location: Across from Canal Road NW at MacArthur Boulevard NW, in the park

Latitude: N 38°54,306' Longitude: W 77°04,591'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 6.10 ft/sec

Depth 39.75 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ (0.75" to 1.5")
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	7'		7'
Width	7'		7'
Material			
Shape	Round		Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ (Reaches Rim (potential meter damage))
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

- ☐ Good 19.8 (condition) ( )

Site Conditions

Site Access: *Need trail access from park rangers*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ (Yes) ☐ No

Height above ground 4"

Manhole depth 11'9"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ Yes ☐ No ☐ (Maybe)

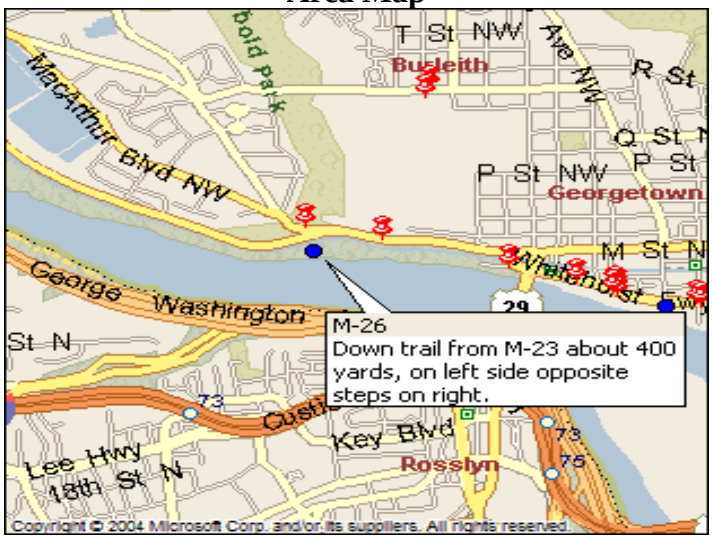
Sensor Configuration:

(Please include Serial Numbers when possible)

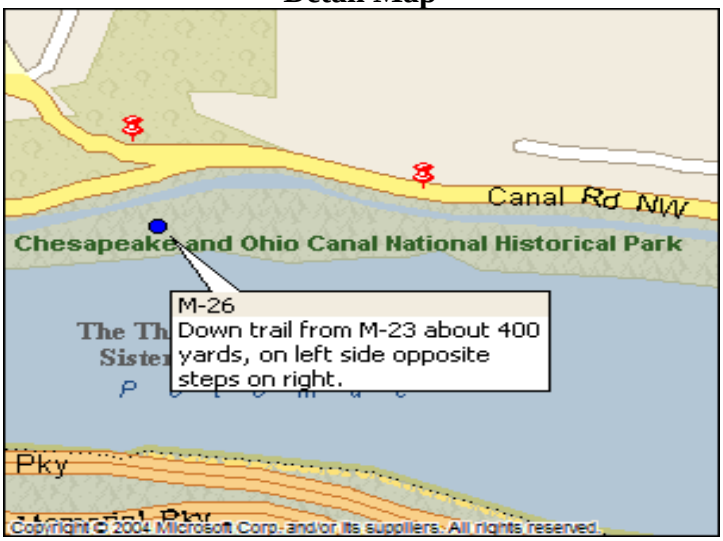
Level	Primary: Ultrasonic Depth
	Redundant:
Velocity	Primary: ADS Surface Combo
	Redundant:
Meter Logger	Triton

Comments:

Area Map



Detail Map



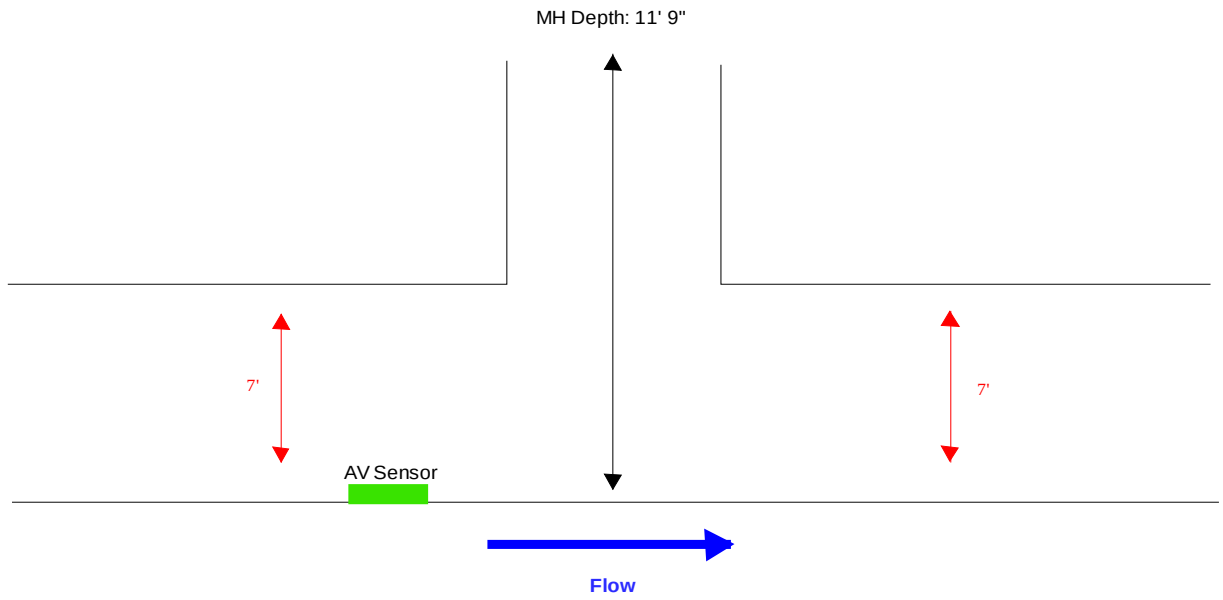
View from top of MH

Site Overview

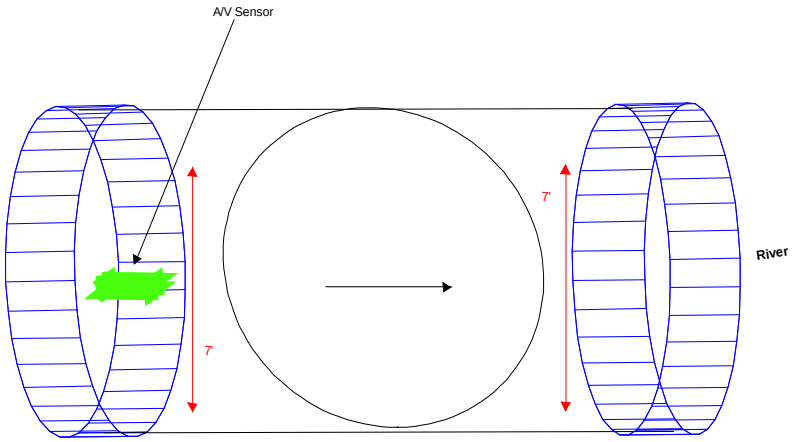
View of flow through influent line

View of flow through effluent line

Dimensional Structure Profile View (profile sketch showing location of sensors)

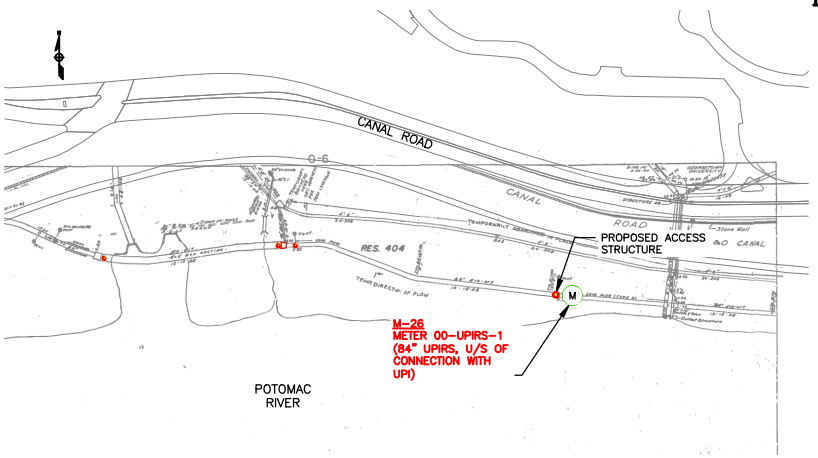


Dimension Structure Detail (Plan View)

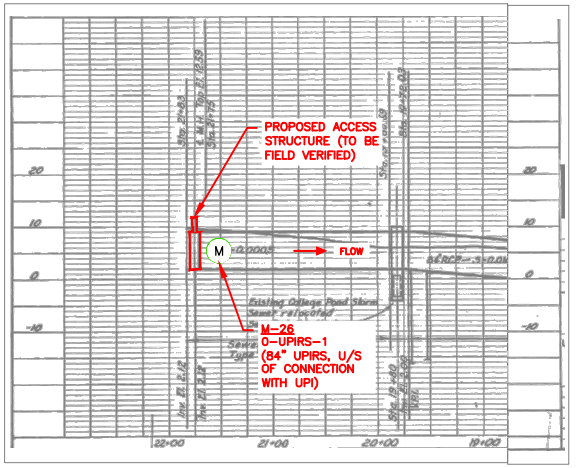


1 – FLOW METER

FLOW METER LOCATION PLAN
SCALE: NTS



FLOW METER LOCATION PLAN
SCALE: NTS



SEWER PROFILE
SCALE NTS

LEGEND

- (M) FLOW METER LOCATION
- NATIONAL PARK SERVICE AREA

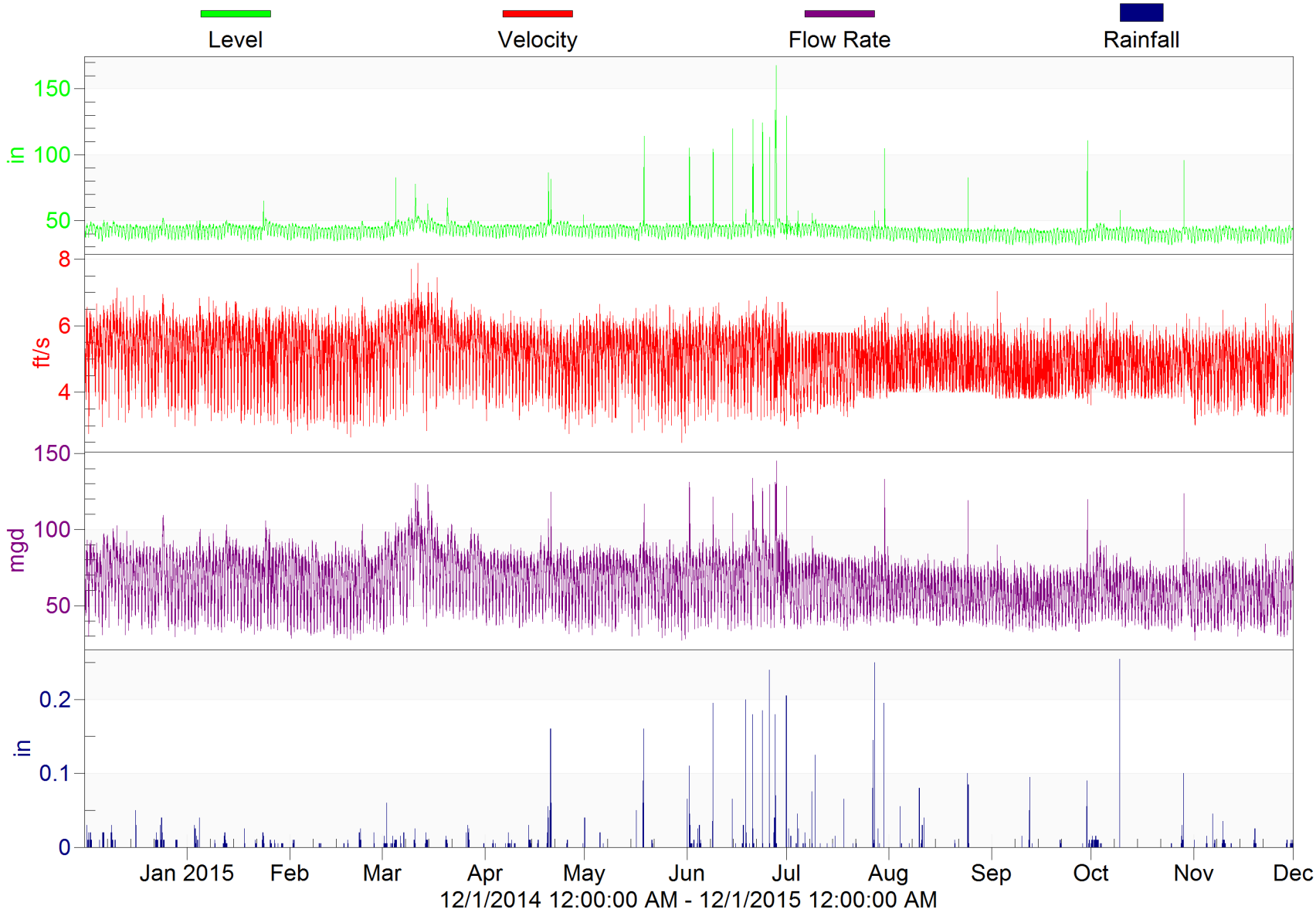
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00-UPIRS-1
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 26

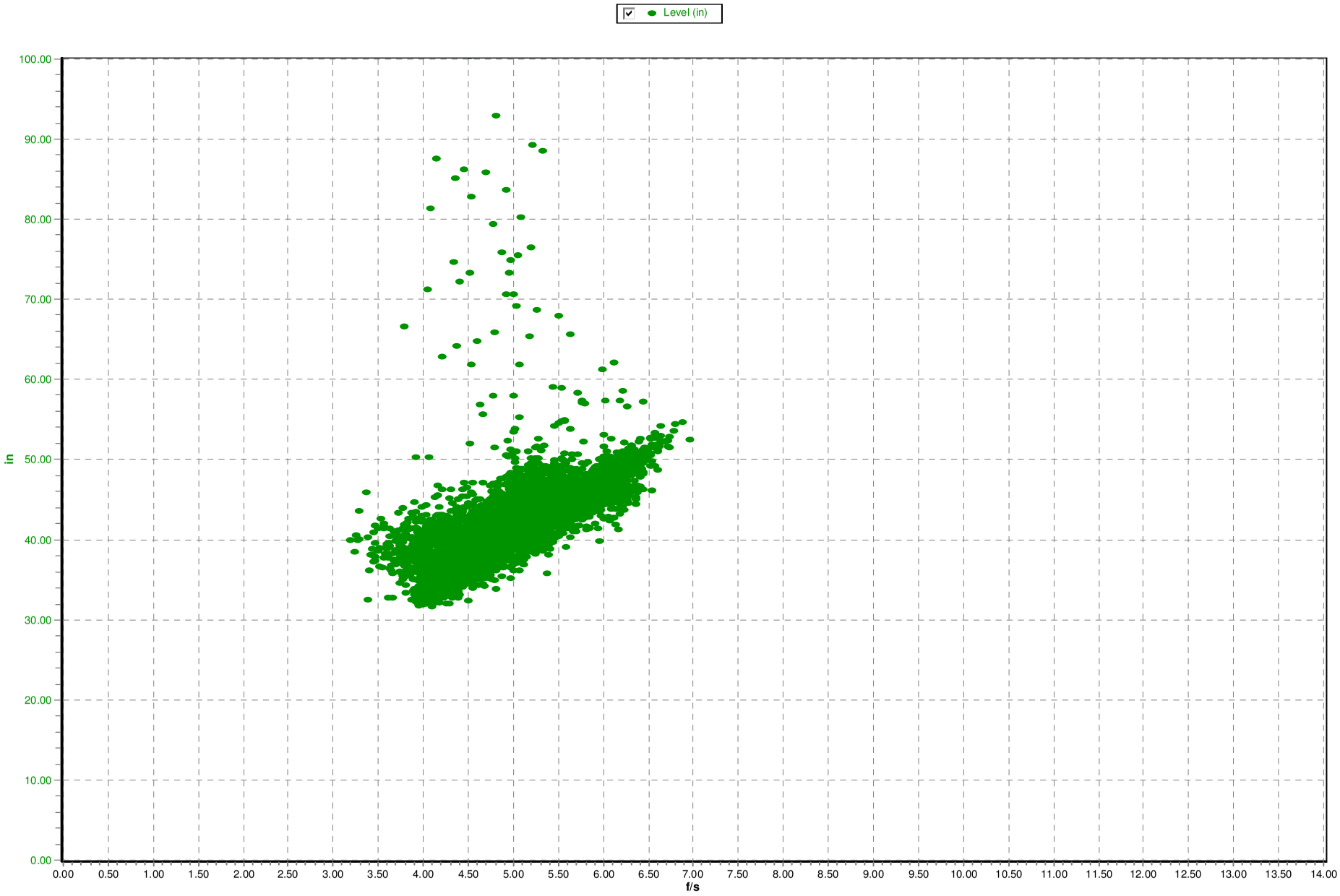
LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:47:13 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28_00-UPIRS-1.DWG

M-26


Level
Velocity
Flow Rate
Rainfall
150
100
50
in
8
6
4
ft/s
150
100
50
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-26 - Across from Canal Road NW at MacArthur Boulevard NW, in the park

Pipe Diameter (in): 84 (12/01/14 to 12/01/15)



M-26

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/25/2014	11:50	42.5	42.5	5.77	6.2	0		GM/LP	Install.
11/25/2014	11:55	42.5	42.5	6.43	6.4	0		GM/LP	
11/25/2014	12:00	42.56	42.5	6.63	6.3	0		GM/LP	
12/4/2014	11:20		43.5		5.5	0		LR/AP	
1/7/2015	14:07		42.5		6.8	0		LR/PD	
1/28/2015	12:26	45.14	45.25	5.26	5.6	0	9.07	LR/AM	
3/4/2015	13:22	44.7	44.5	5.86	6.1	0		AP/AM	
5/15/2015	12:08	41.7	41.5	5.84	6.1	0	11.8	LL/DW	
6/9/2015	13:15		44.75		5.7	0		LL/DW	
7/10/2015	10:28		42		4.1	0		LR/DW	
7/21/2015	14:23		45		5.9	0		LR/DW	
8/5/2015	11:48		39.5		5.2	0		CL/JC	
10/14/2015	13:26		41.75		5.3	0		LR/JC	
11/18/2015	13:30		42.5		5.3	0		LR/JC	
12/8/2015	10:15		41		4.9	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-28-1

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 049

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-28-1 measured excess flows from the East Rock Creek Diversion Sewer from Structure 70.

3. The weir formula was used to calculate a flow rate from these measurements. M- 28-1 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	0	0
Avg.	0.021	0.107
Max	54.775	451.254

Site Name/Manhole # M-28-1 Primary: [X] Alternate: [ ]

Investigation Date: 10/29/14 Time: 10:00 Crew Members: LR/PD/BC

Installation Date: 11/24/14 Time: 12:45 Crew Members: LR/CL/PD/SD

Address/Location: 17th Street NW and Piney Branch Parkway NW

Latitude: N 38°56,215' Longitude: W 77°02,367'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *NA*

Velocity ___ ft/sec

Depth ___ in

Turbulence Amplitude: *NA*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	10'		10'
Width	10'		10'
Material	Concrete		Concrete
Shape	Rectangle		Rectangle

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence: *NA*

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) ____ (condition)

Site Conditions

Site Access: *Access by opening wooden doors*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth ___

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

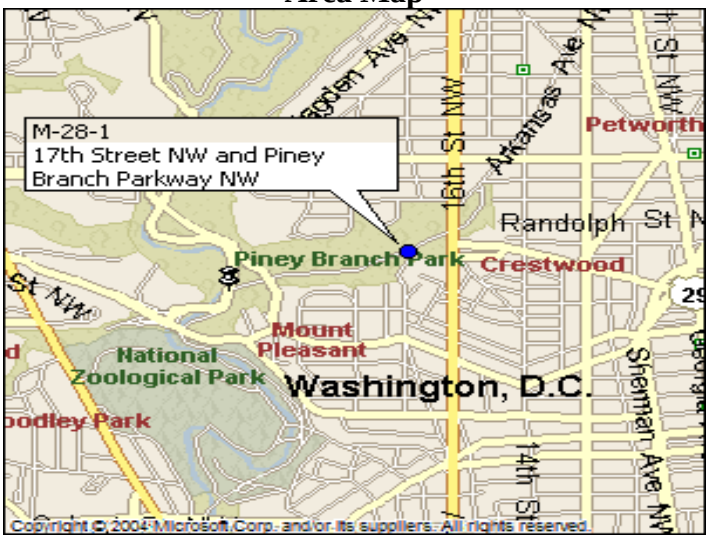
Sensor Configuration:

(Please include Serial Numbers when possible)

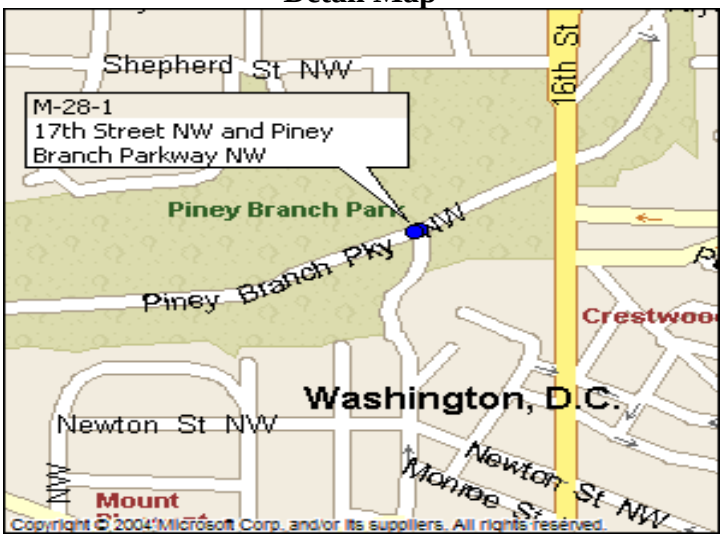
Level	Primary: Flowav
	Redundant: Ultrasonic
Velocity	Primary:
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



View from top of MH

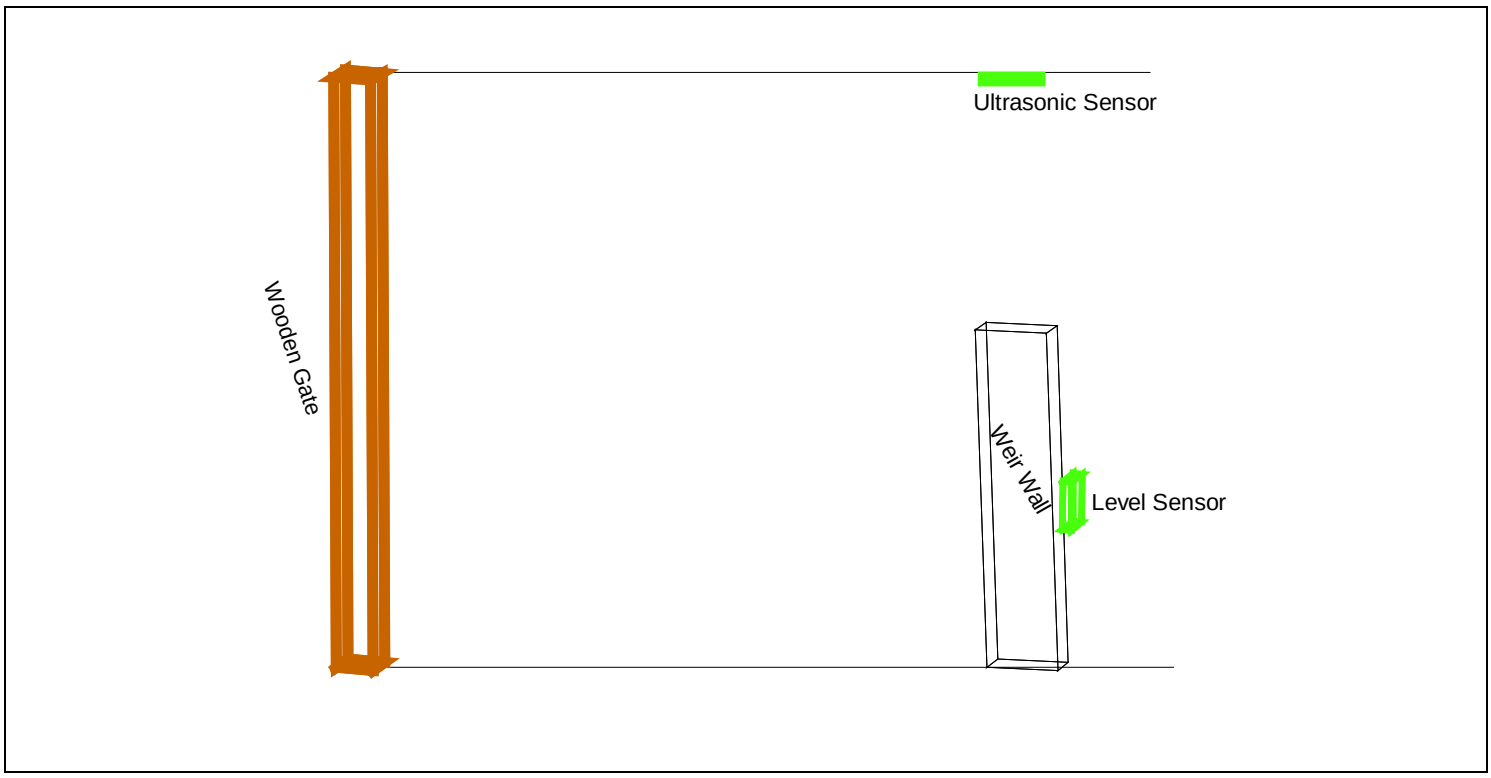
N/A

Site Overview

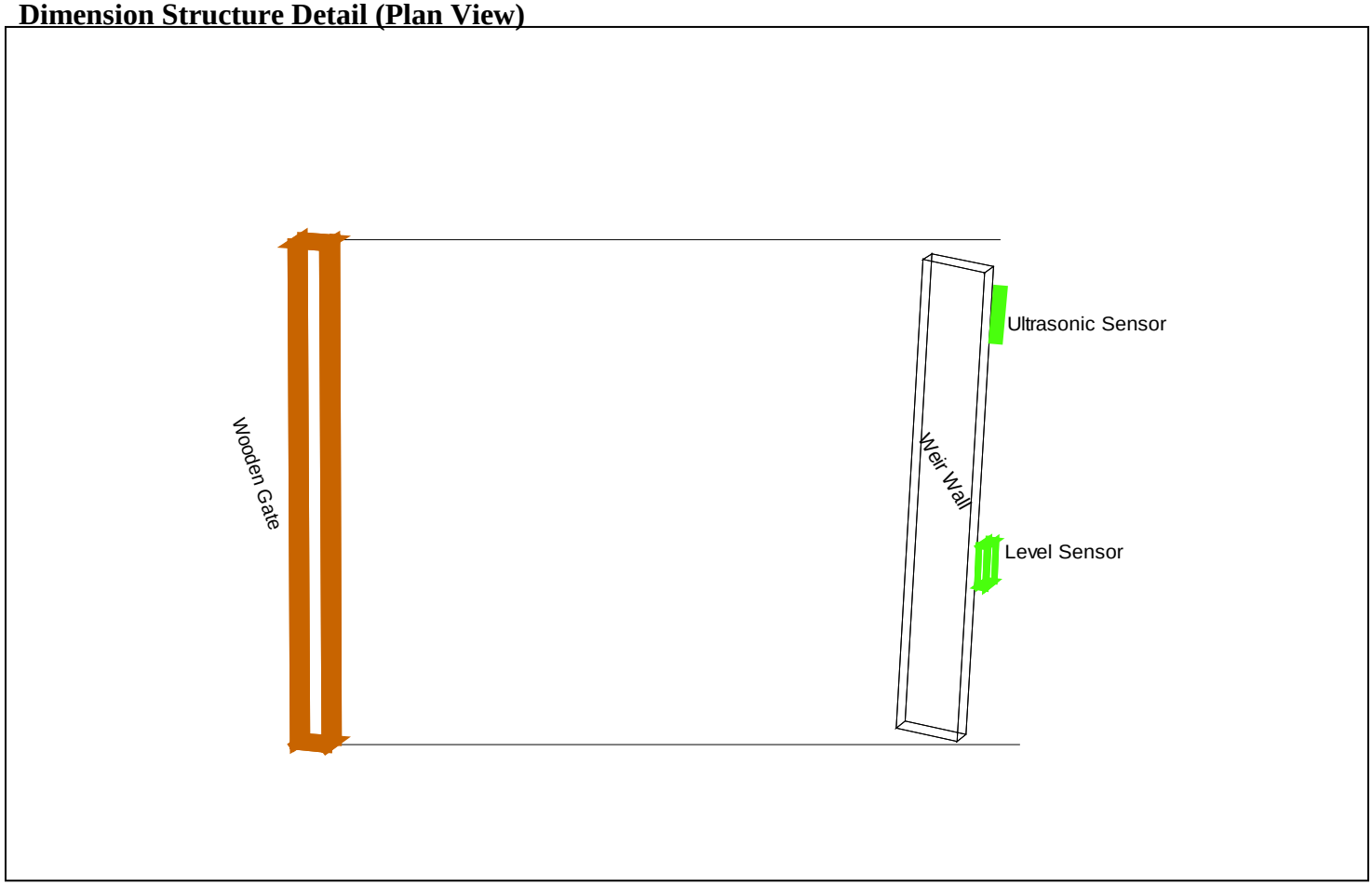
View of flow through influent line

View of flow through effluent line

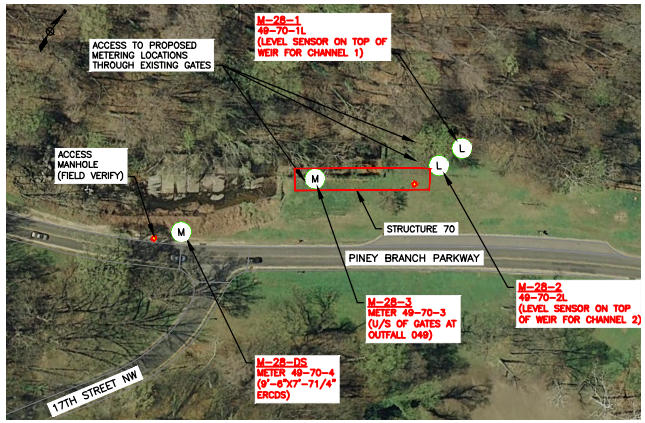
Dimensional Structure Profile View (profile sketch showing location of sensors)

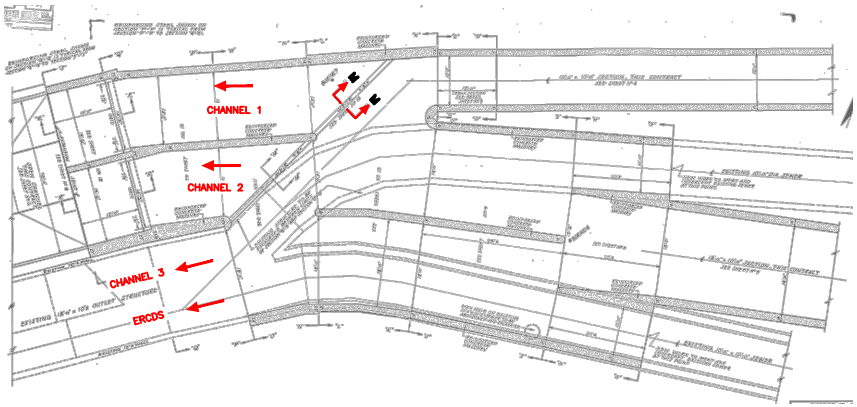


Dimension Structure Detail (Plan View)

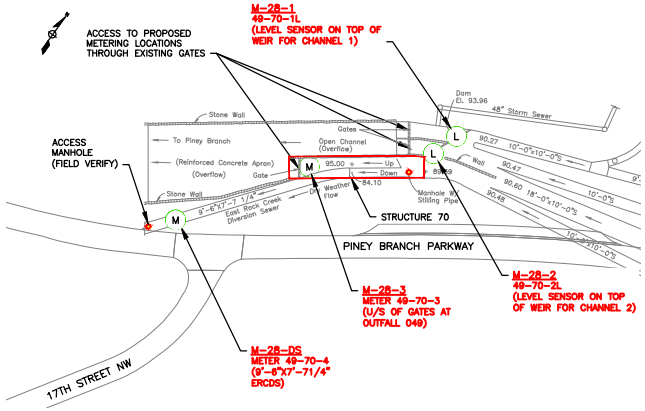


2 – FLOW METERS
2 – LEVEL SENSORS

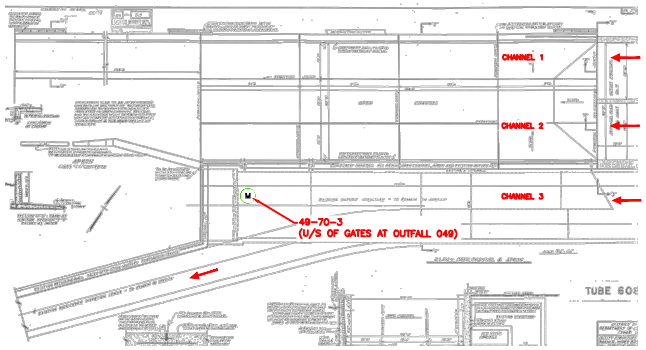




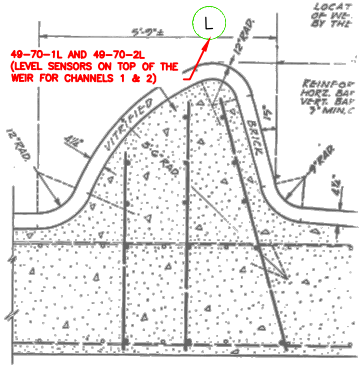
SECTIONAL PLAN
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



SECTIONAL PLAN
SCALE NTS



TYPICAL WEIR SECTION M-M
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

(L) LEVEL SENSOR LOCATION

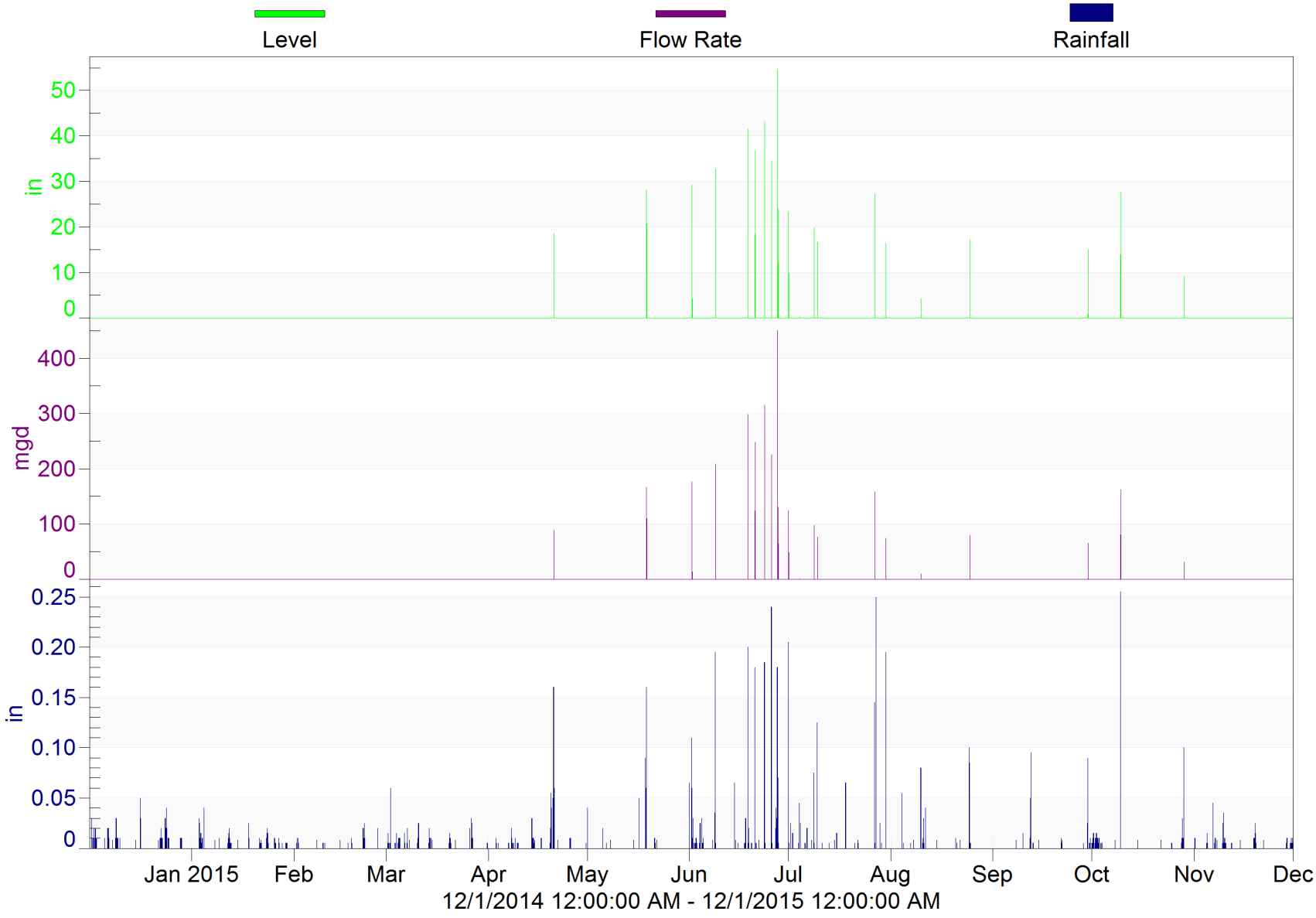
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
49-70-1L_2L_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014 | SITE 28

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:15:20 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28-29_49-70-1_2.DWG

M-28-1


Level
Flow Rate
Rainfall
in
50
40
30
20
10
0
mgd
400
300
200
100
0
in
0.25
0.20
0.15
0.10
0.05
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-28-1

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/24/2015	15:29		0			0		LR/LL	Install.
1/29/2015	16:00		0			0	6.12	LR/AM	CB Telog.
3/18/2015	17:00		0			0	6.07	AP/AM	CB Telog.
5/26/2015	14:24		0			0	-	LR/DW	
6/22/2015	13:43		0			0	5.98	LL/DW	CB Telog.
6/22/2015	13:54		0			0	10.58	LL/DW	
6/22/2015	14:02		0			0	10.72	LL/DW	
7/8/2015	13:46		0			0	5.98	LR/DW	CB Telog.
8/14/2015	9:24		0			0		CL/JC	CB Telog.
9/10/2015	14:07		0			0		LR/JC	CB Telog.
10/15/2015	13:49		0			0		LR/JC	
2/10/2016	11:13		0			0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-28-2

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 049

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-28-2 measured excess flows from the East Rock Creek Diversion Sewer from Structure 70.

3. The weir formula was used to calculate a flow rate from these measurements. M- 28-2 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	0	0
Avg.	0.017	0.087
Max	54.405	457.078

Site Name/Manhole # M-28-2 Primary: [X] Alternate: [ ]

Investigation Date: 10/29/14 Time: 10:00 Crew Members: LR/PD/BC

Installation Date: 11/24/14 Time: 15:40 Crew Members: CL/LR/SD/PD

Address/Location: 17th Street NW and Piney Branch Parkway NW

Latitude: N 38°56,215' Longitude: W 77°02,366''

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *NA*

Velocity ___ ft/sec

Depth ___ in

Turbulence Amplitude: *NA*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	10'		10'
Width	10'		10'
Material	Concrete		Concrete
Shape	Rectangle		Rectangle

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence: *NA*

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) ____ (condition)

Site Conditions

Site Access: *Access by opening wooden doors*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth ___

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *NA*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

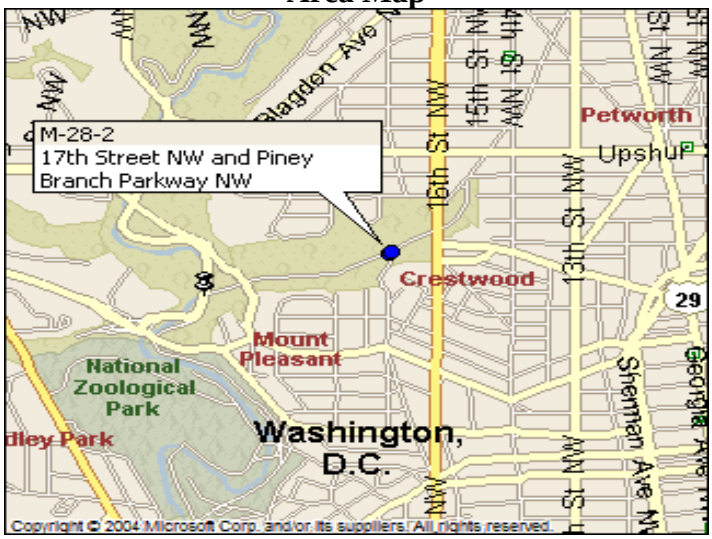
Sensor Configuration:

(Please include Serial Numbers when possible)

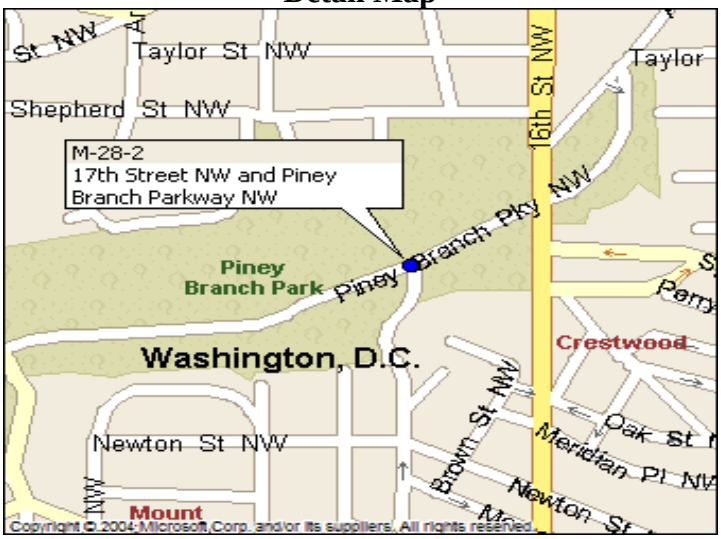
Level	Primary: Flowav
	Redundant: Ultrasonic
Velocity	Primary:
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



View from top of MH

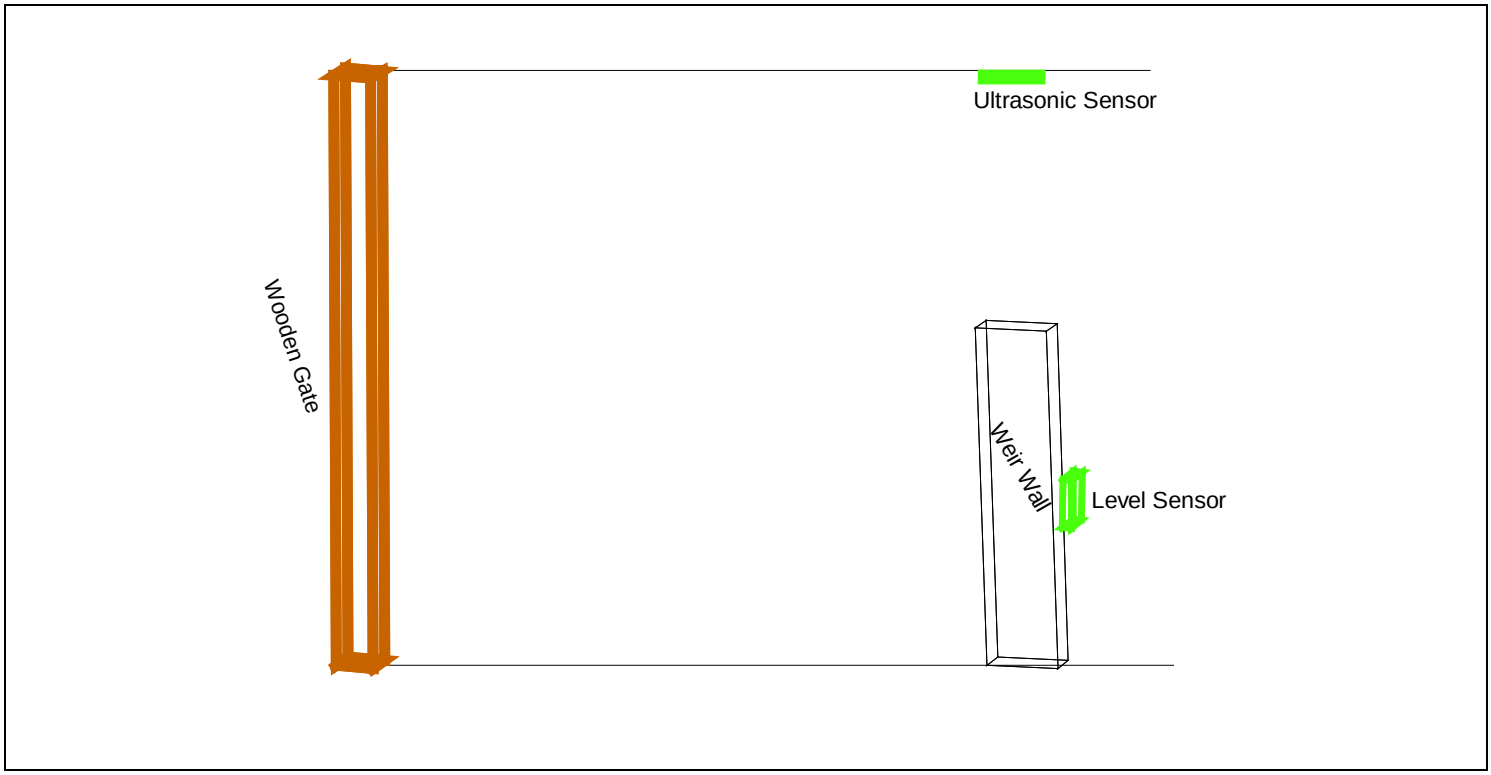
N/A

Site Overview

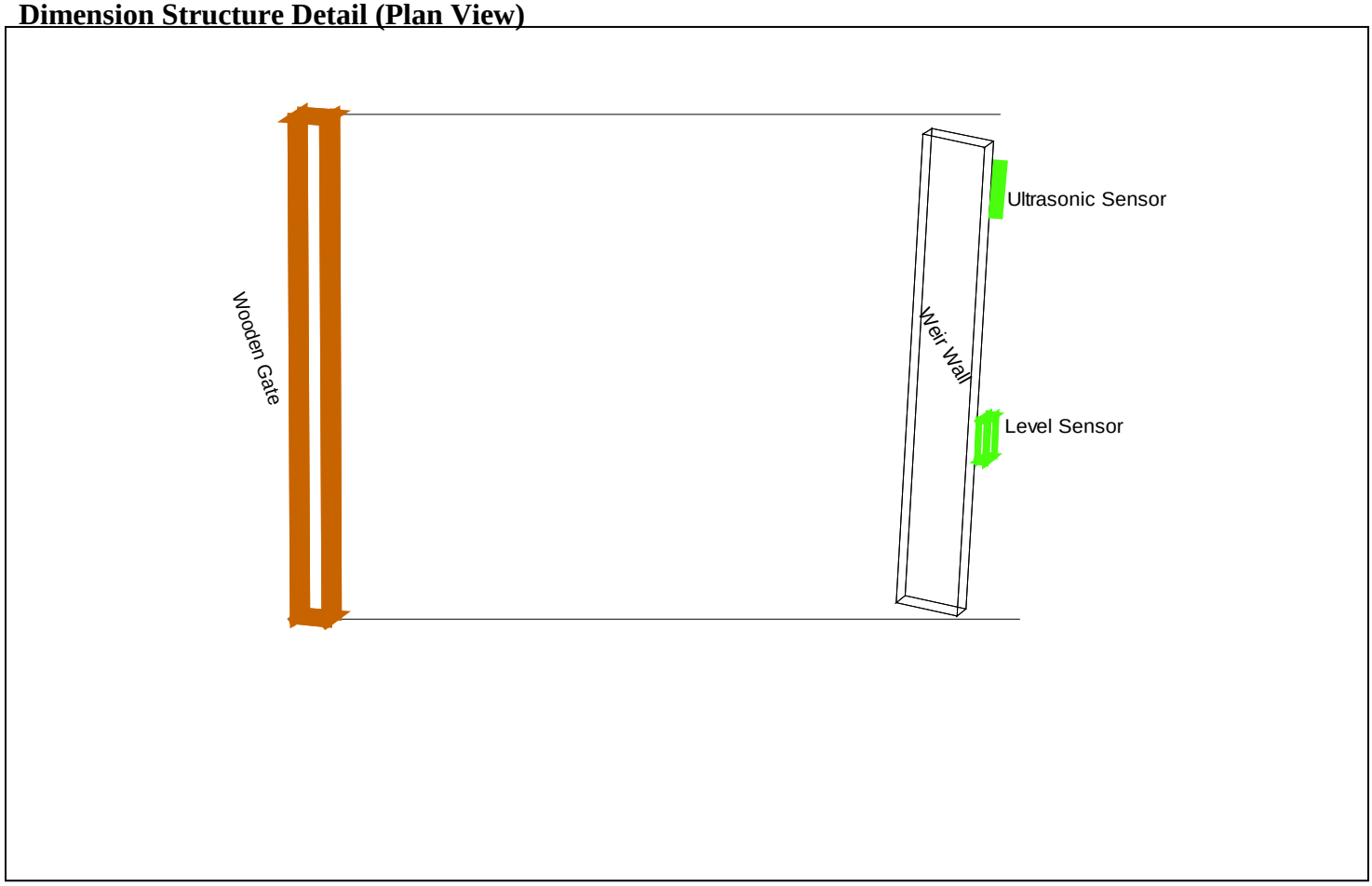
View of flow through influent line

View of flow through effluent line

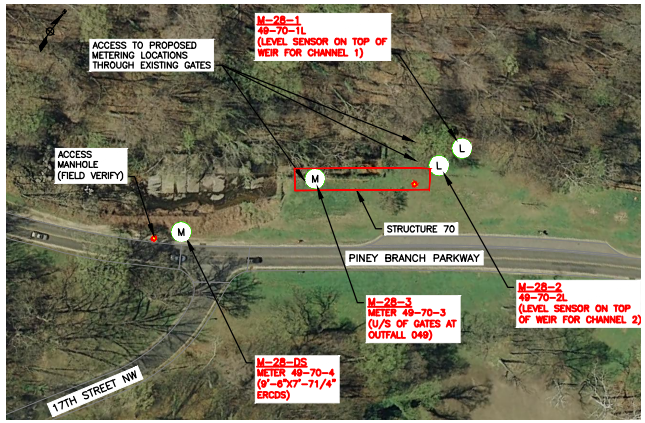
Dimensional Structure Profile View (profile sketch showing location of sensors)

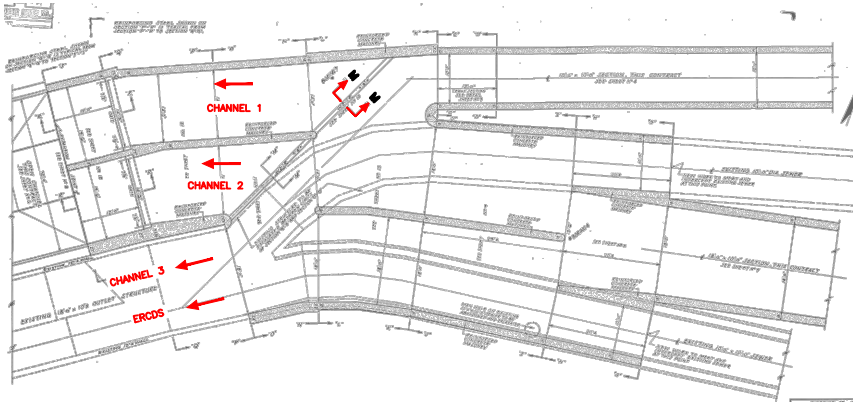


Dimension Structure Detail (Plan View)

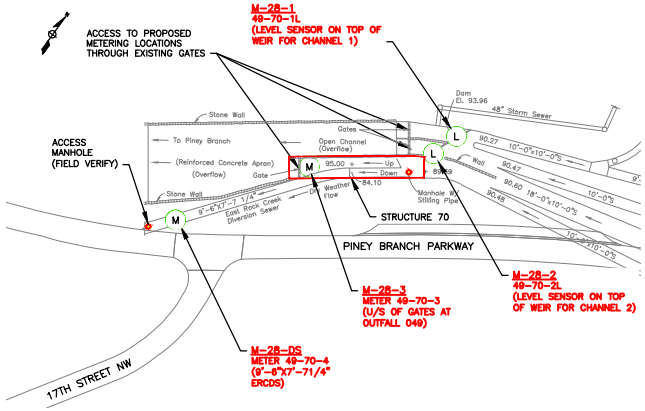


2 – FLOW METERS
2 – LEVEL SENSORS

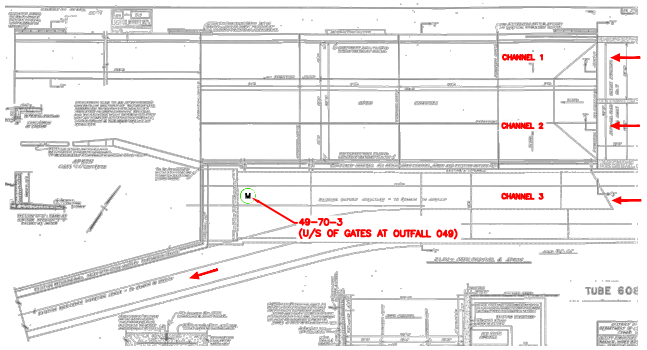




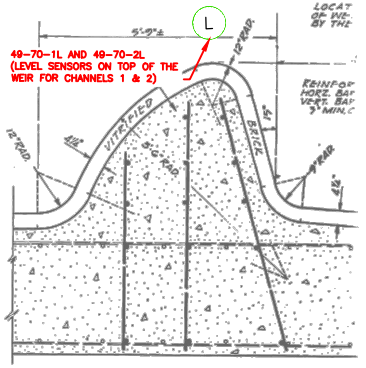
SECTIONAL PLAN
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



SECTIONAL PLAN
SCALE NTS



TYPICAL WEIR SECTION M-M
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

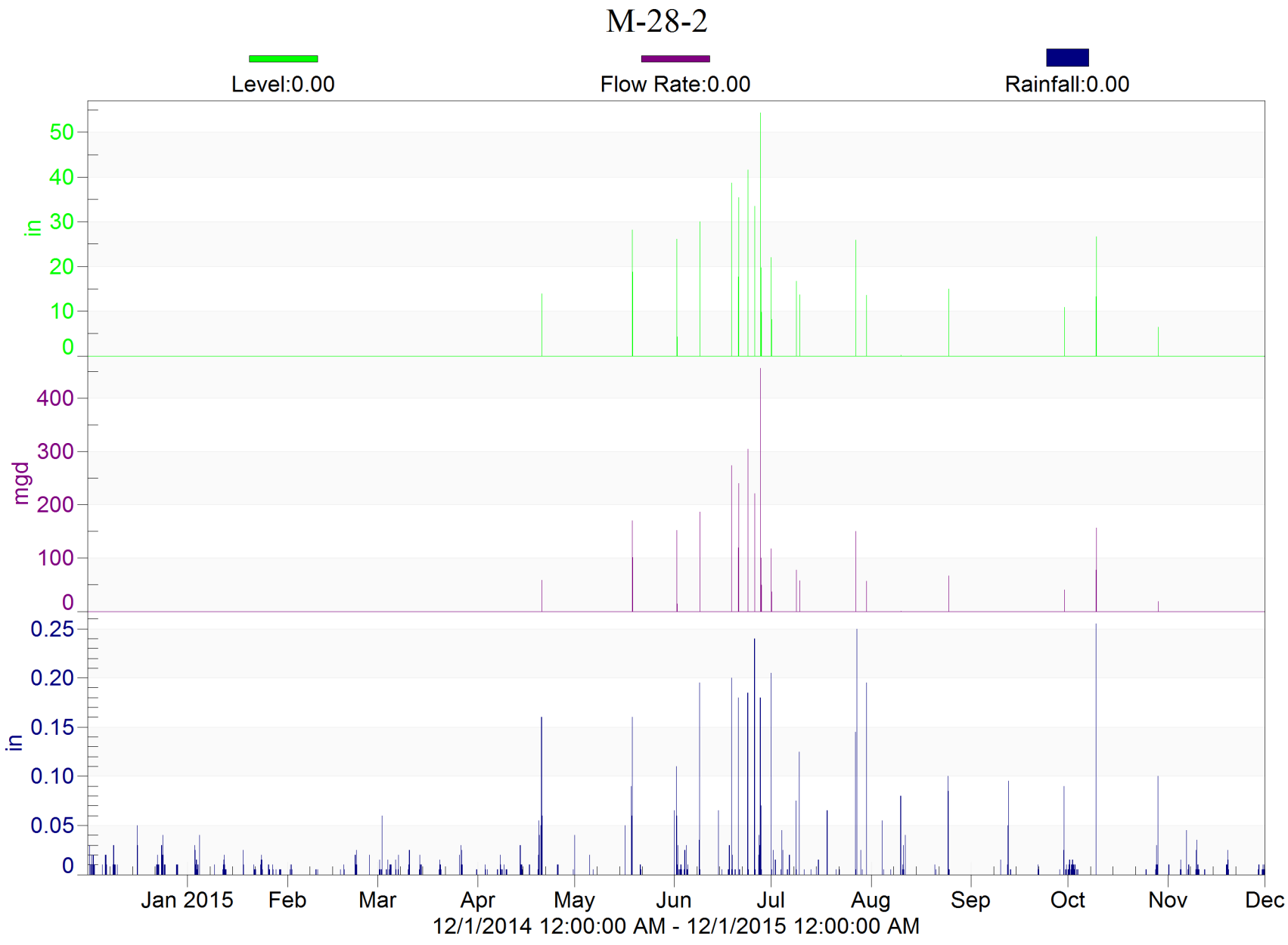
(L) LEVEL SENSOR LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
49-70-1L_2L_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 28

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:15:20 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28-28_49-70-1_2.DWG


M-28-2
Level:0.00
Flow Rate:0.00
Rainfall:0.00
in
50
40
30
20
10
0
mgd
400
300
200
100
0
in
0.25
0.20
0.15
0.10
0.05
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-28-2

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/24/2014	16:45		0			0		LR/LL	Install.
11/24/2014	16:55		0			0		LR/LL	
11/24/2014	17:03		0			0		LR/LL	
11/24/2014	17:07		0			0		LR/LL	
1/29/2015	16:00		0			0	6.07	LR/AM	CB Telog.
2/25/2015	18:00		0			0		AP/AM	CB Telog.
3/17/2015	13:00		0			0	6.07	AP/AM	CB Telog.
5/26/2015	14:50		0			0		LR/DW	
5/26/2015	15:00		0			0		LR/DW	
8/14/2015	9:52		0			0		CL/JC	CB Telog.
9/10/2015	14:22		0			0		LR/JC	CB Telog.
10/15/2015	14:21		0			0		LR/JC	
2/10/2016	12:34		0			0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-28-3

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 049

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-28-3 measured excess flows from the East Rock Creek Diversion Sewer from Structure 70.

3. The continuity equation was used to calculate a flow rate from these measurements. M-28-3 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	0	0	0
Avg.	0.001	0.003	0.008
Max	10.602	14.323	134.185

Site Name/Manhole # M-28-3 Primary: [X] Alternate: [ ]

Investigation Date: 10/29/14 Time: 10:00 Crew Members: LR/PD/BC

Installation Date: 11/21/14 Time: 17:35 Crew Members: LR/CL/SD/PD

Address/Location: 17th Street NW and Piney Branch Parkway NW

Latitude: N 38°56,215' Longitude: W 77°02,366'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity ___ ft/sec *not measured or NA*

Depth ___ in

Turbulence Amplitude: *NA*

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	96"		96"
Width	215"		215"
Material	Concrete w/ Brick Bottom		Concrete w/ Brick Bottom
Shape	Rectangle		Rectangle

Sediment Present:

☐ Yes Hard packed: _____ in. deep

☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence: *NA*

- ☐ No evidence visible
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) ____ (condition)

Site Conditions

Site Access: *Access by opening wooden doors*

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth ___

Structural Integrity of Manhole:

☐ (Good) ☐ Fair ☐ Poor

Pipe Bends: *NA*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

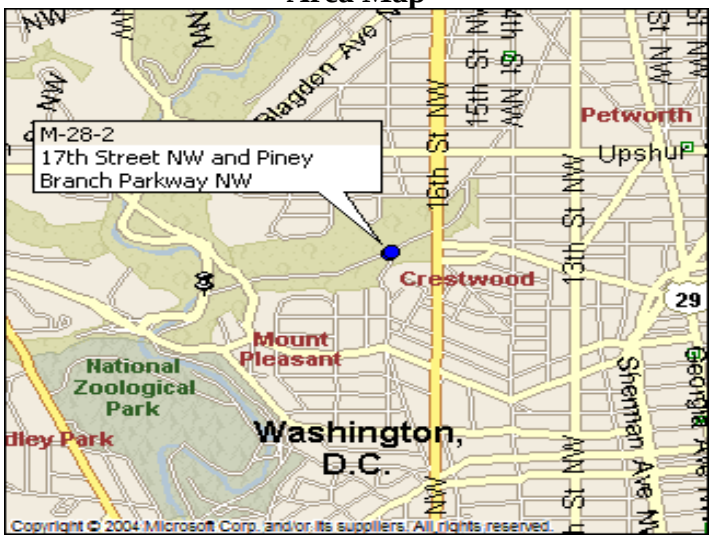
Sensor Configuration:

(Please include Serial Numbers when possible)

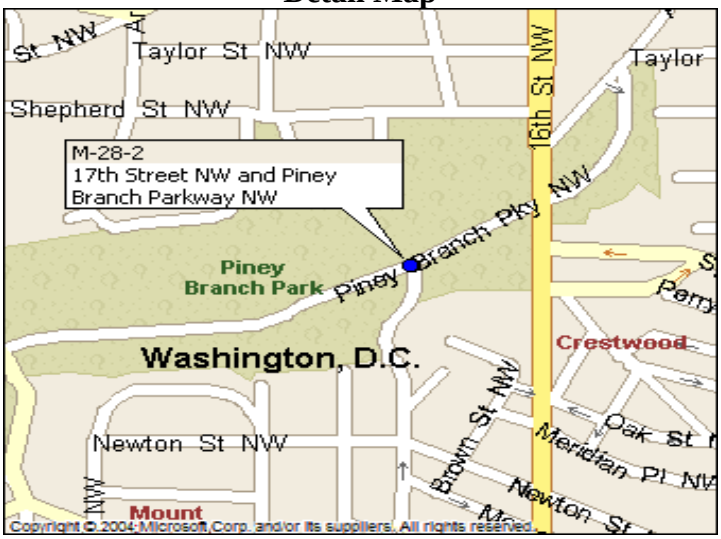
Level	Primary: Isco A/V
	Redundant: Flowav
Velocity	Primary: Isco A/V
	Redundant: Flowav
Meter Logger	Telog

Comments: 3 - *man crew needed*

Area Map



Detail Map



View from top of MH

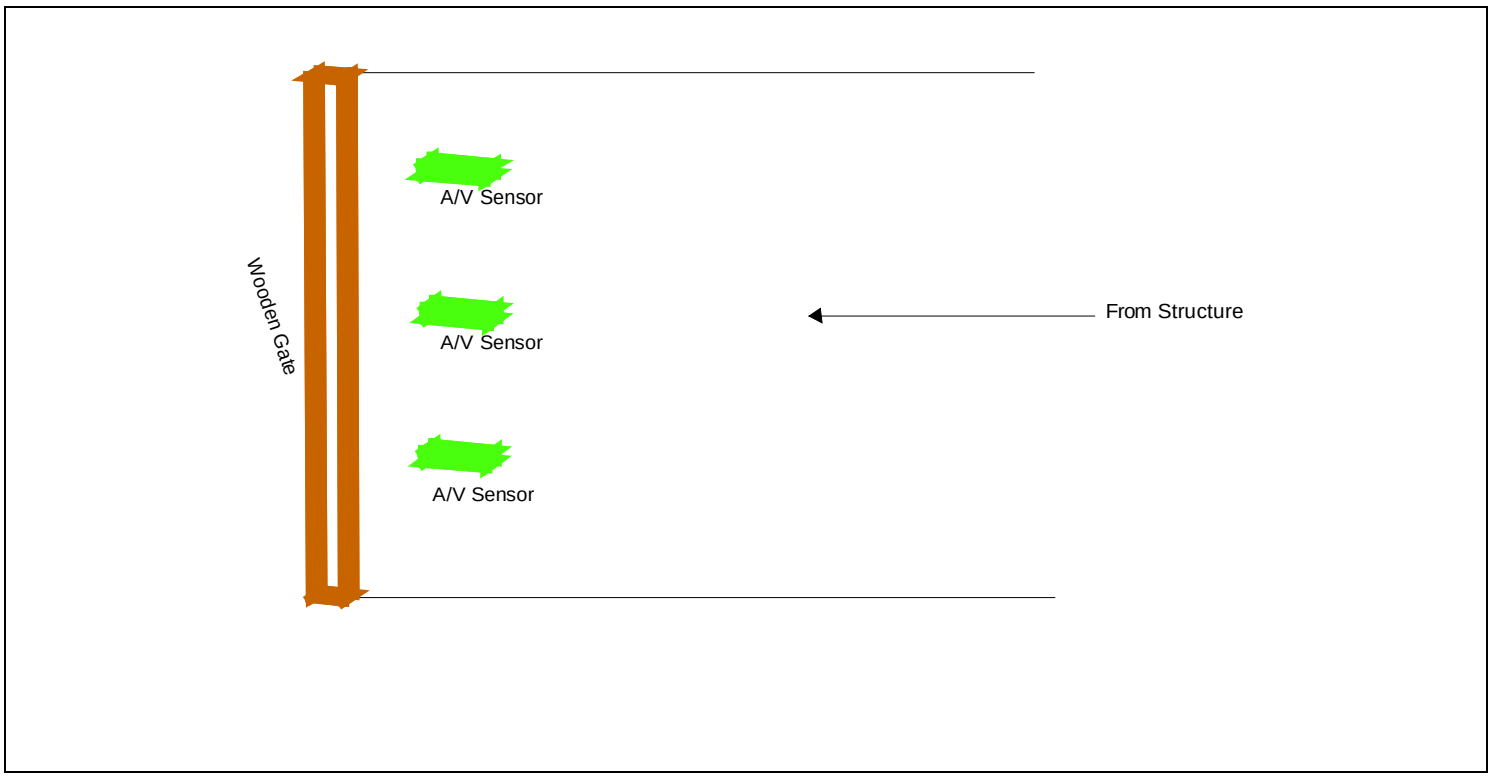
NA

Site Overview

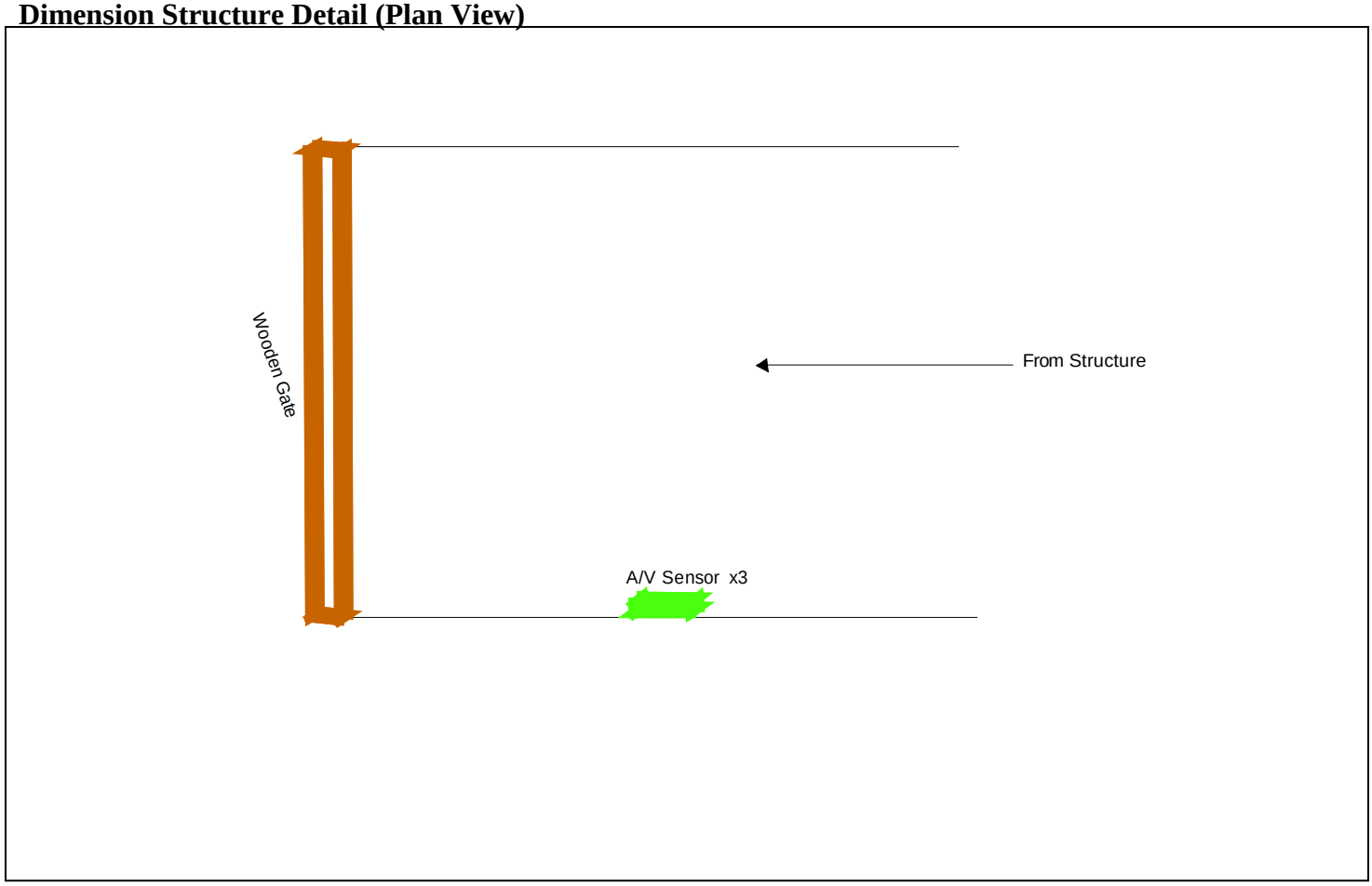
View of flow through influent line

View of flow through effluent line

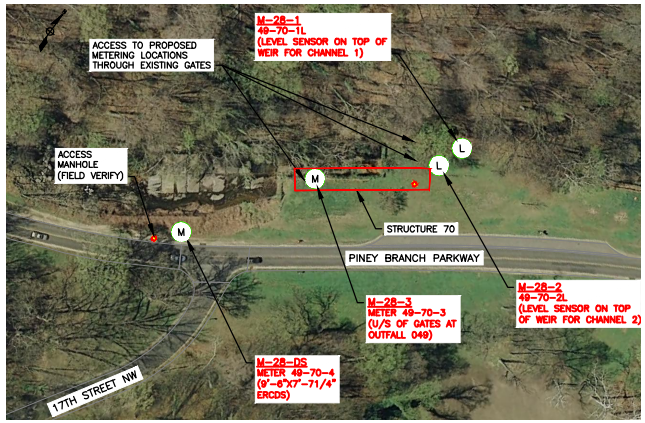
Dimensional Structure Profile View (profile sketch showing location of sensors)

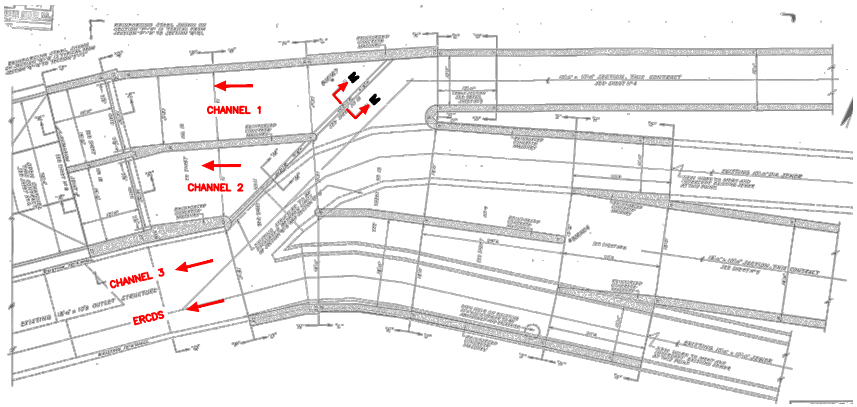


Dimension Structure Detail (Plan View)

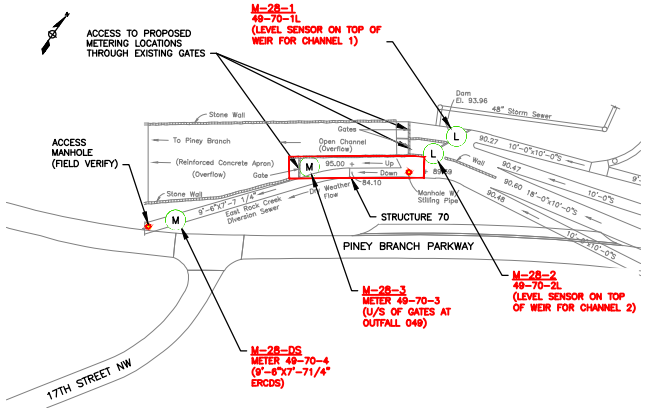


2 – FLOW METERS
2 – LEVEL SENSORS

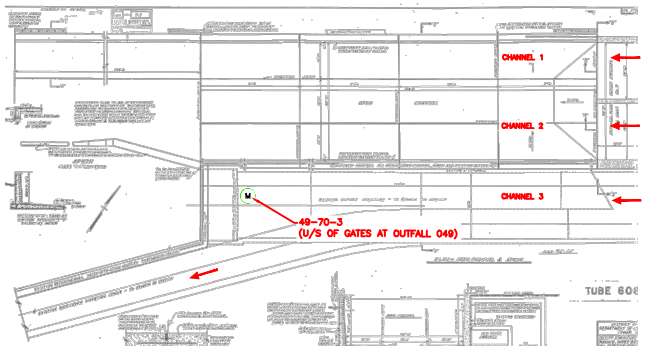




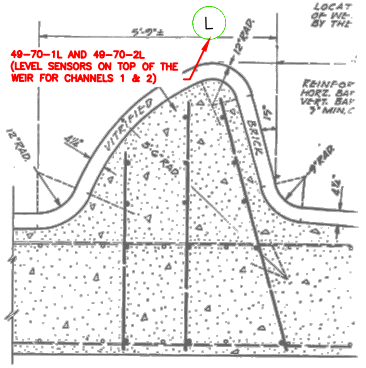
SECTIONAL PLAN
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



SECTIONAL PLAN
SCALE NTS



TYPICAL WEIR SECTION M-M
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

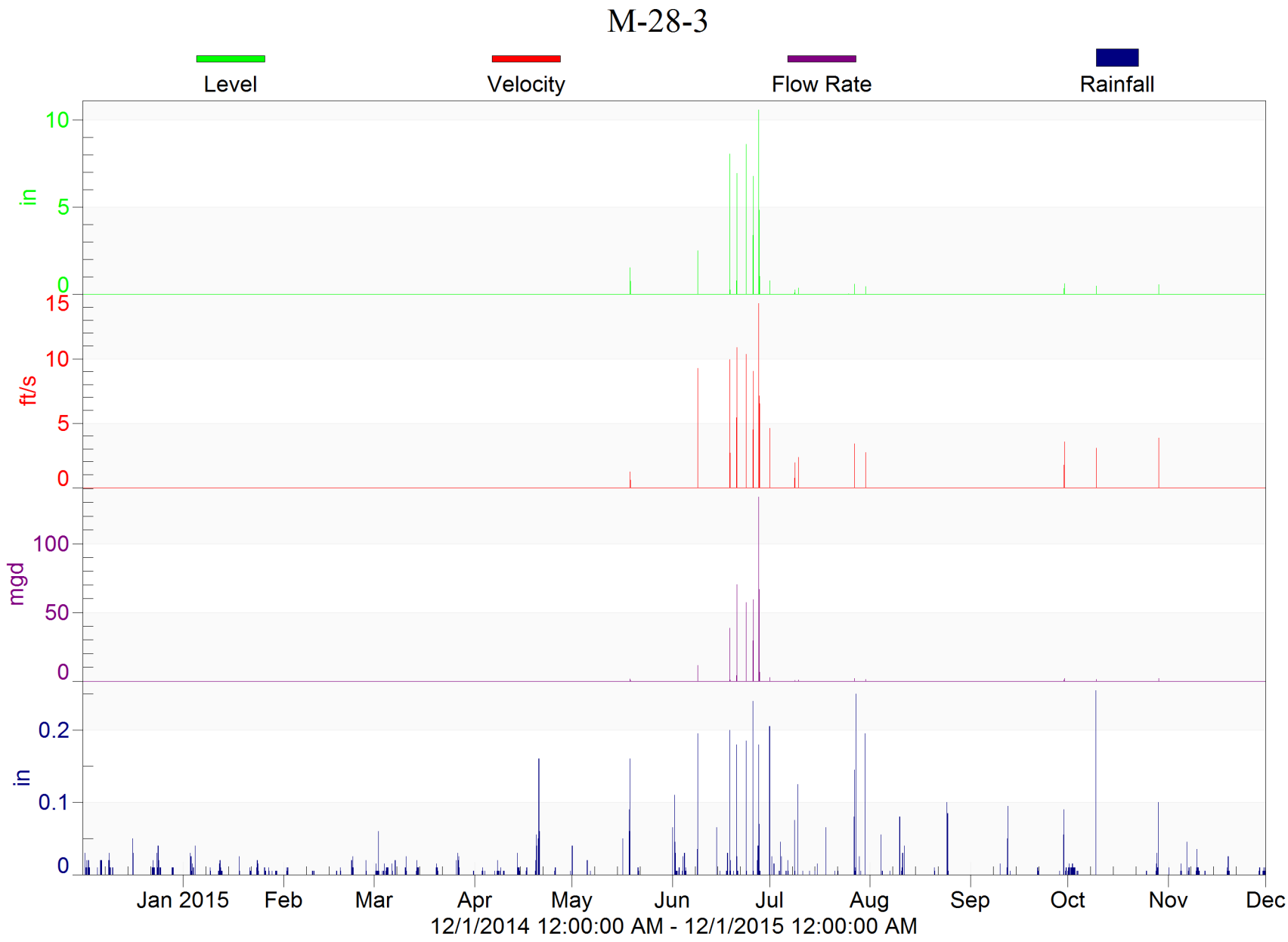
(L) LEVEL SENSOR LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
49-70-1L_2L_3_4
METER LOCATION AND TYPICAL CROSS SECTION

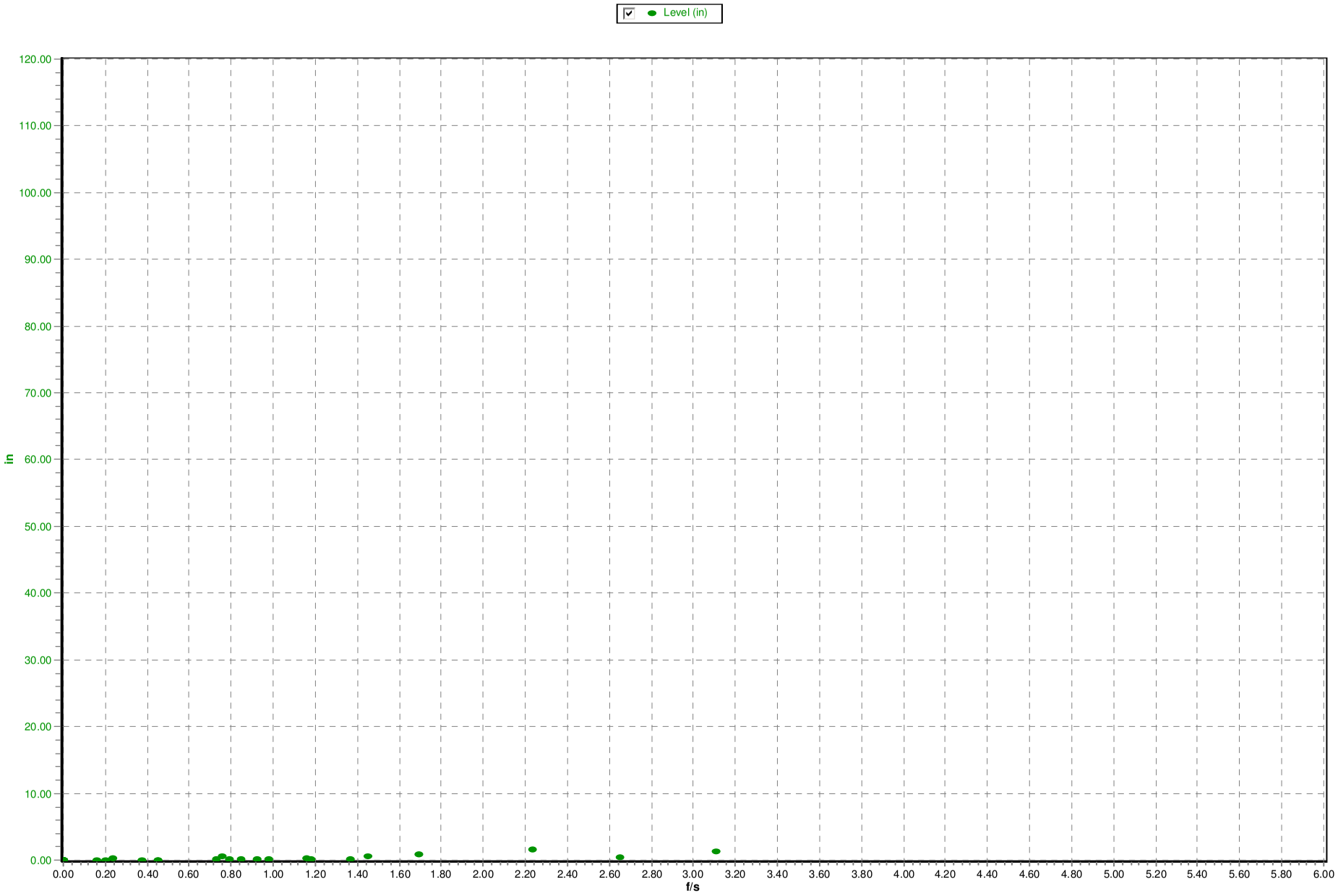
DATE: OCTOBER 2014	SITE 28

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:15:20 AM
DRAWING ID: L:\LTDP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28-28_49-70-1_2.DWG


M-28-3
Level
Velocity
Flow Rate
Rainfall
in
10
5
0
ft/s
15
10
5
0
mgd
100
50
0
in
0.2
0.1
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-28-3 - 7th Street NW and Piney Branch Parkway NW

Pipe Diameter (in): 96 H X 215 W (12/01/14 to 12/01/15)



M-28-3

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/21/2014	15:00		0		0	0		LR/SD	Install.
12/10/2014	12:13		0		0	0	5.76	LR/LL	CB Telog.
1/15/2015	13:57		0		0	0		LL/AM	
2/12/2015	13:00		0		0	0	6.07	LR/AM	CB Telog.
2/20/2015	12:34		0		0	0	5.98	AP/GH	
2/27/2015	13:00		0		0	0	5.98	AP/AM	CB Telog.
3/17/2015	11:00		0		0	0	6.03	AP/AM	CB Telog.
5/26/2015	15:34		0		0	0		LR/DW	CB Telog.
7/8/2015	13:07		0		0	0		LR/DW	
8/14/2015	10:38		0		0	0		CL/JC	CB Telog.
9/10/2015	14:39		0		0	0		LR/JC	CB Telog.
10/15/2015	14:50		0		0	0		LR/JC	
2/10/2016	13:32		0		0	0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-28-DS

SEWER: EAST ROCK CREEK DIVERSION SEWER

OUTFALL: 049

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-28-DS measured flows on the East Rock Creek Diversion Sewer downstream of Sturcture 70.

3. The continuity equation was used to calculate a flow rate from these measurements. M-28-DS is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	2.5	2.124	3.321
Avg.	5.903	5.822	10.027
Max	59.114	16.479	260.950

Site Name/Manhole # M-28 DS Primary: [X] Alternate: [ ]

Investigation Date: 10/28/14 Time: 14:50 Crew Members: LR/PD

Installation Date: 11/19/14 Time: 13:12 Crew Members: CL/PD

Address/Location: 17th Street NW and Piney Branch Parkway NW, in the grass by the creek

Latitude: N 38°56,228' Longitude: W 77°02,329'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 7.34 ft/sec

Depth 4.5 in

Turbulence Amplitude:

- ☐ Less than 0.25"
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	108"		108"
Width	108"		108"
Material	Concrete/Brick Bottom		Concrete/Brick Bottom
Shape	Round		Round

Sediment Present:

- ☐ Yes Hard packed: _____ in. deep
- ☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ (No evidence visible)
- ☐ Remains in pipe
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

- ☐ Good (no problems accessing site)
- ☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____

Manhole depth 18'4"

Structural Integrity of Manhole:

☐ Good ☐ (Fair) ☐ Poor

Pipe Bends: *To the right*

☐ Influent ☐ (Effluent) ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

☐ (Yes) ☐ No ☐ Maybe

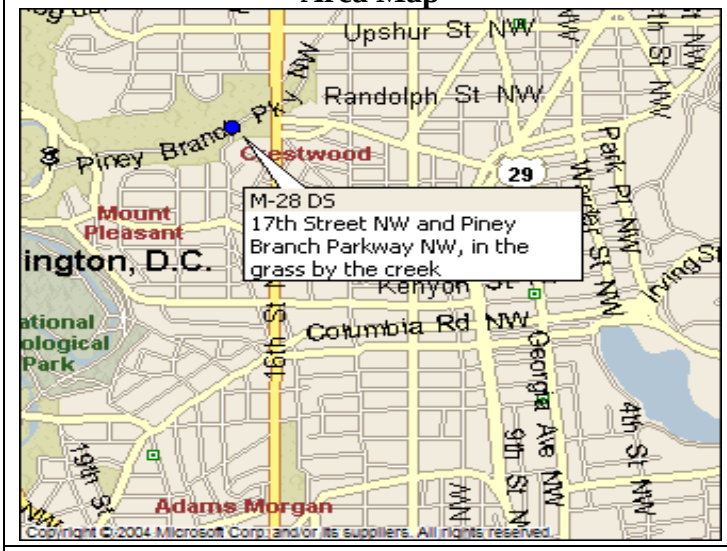
Sensor Configuration:

(Please include Serial Numbers when possible)

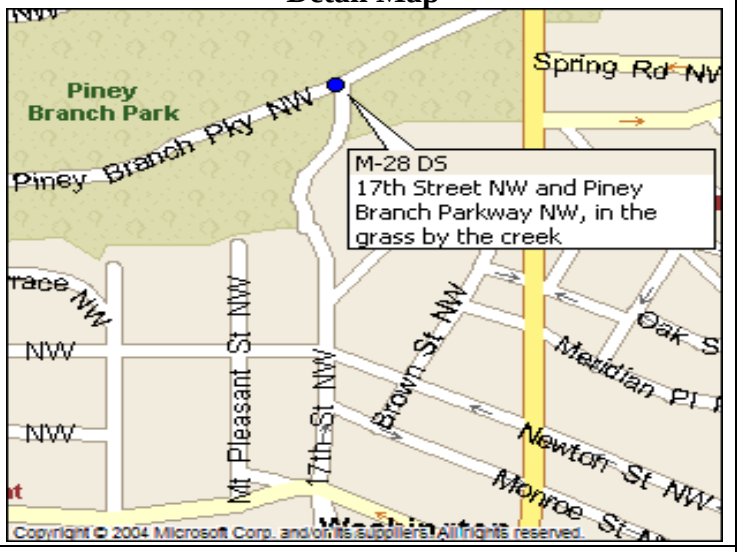
Level	Primary: Flowav
	Redundant: Flowav
Velocity	Primary: Flowav
	Redundant: Flowav
Meter Logger	Telog

Comments: *Previously metered*

Area Map



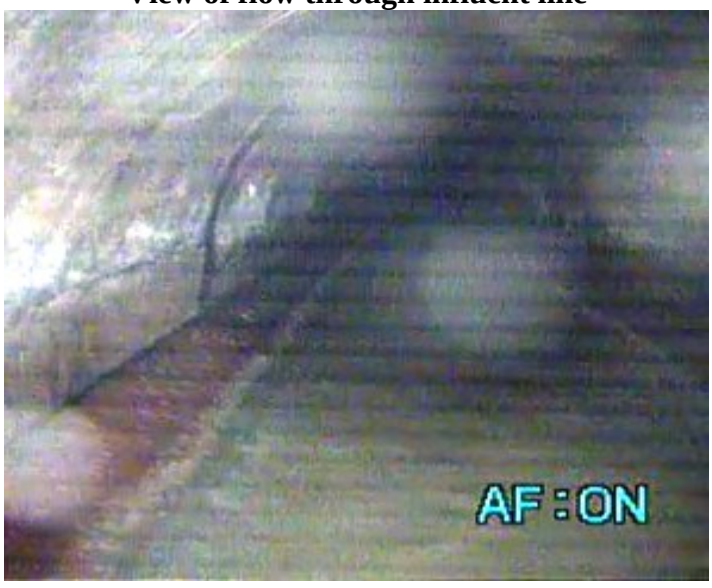
Detail Map



View from top of MH

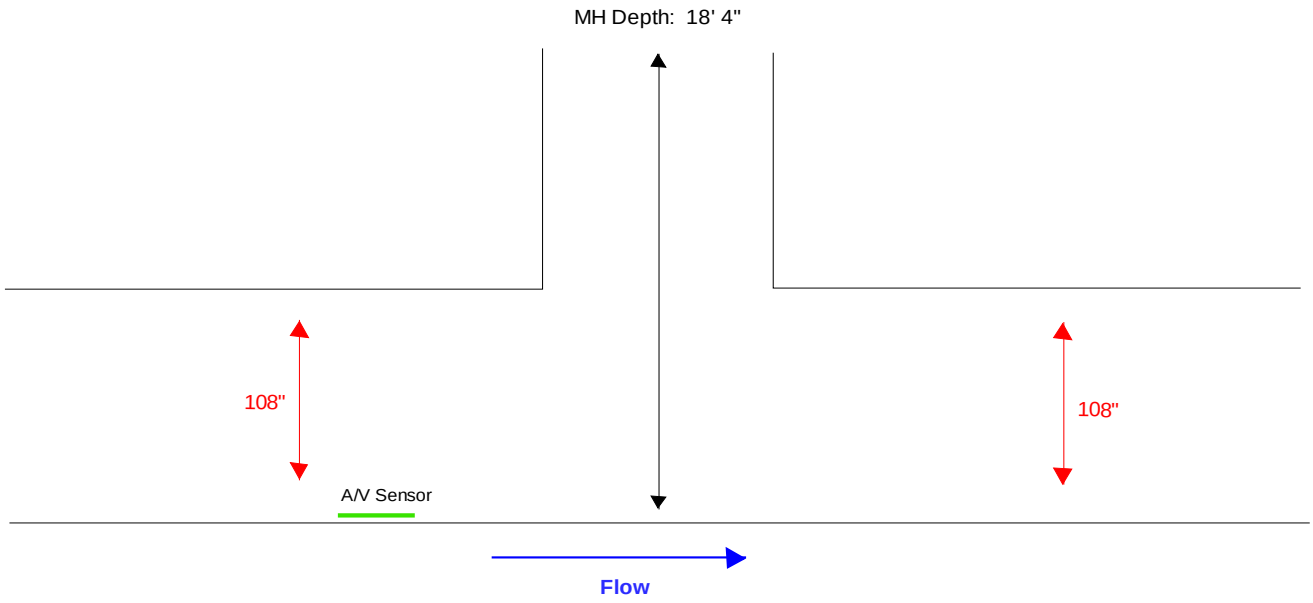
Site Overview

View of flow through influent line

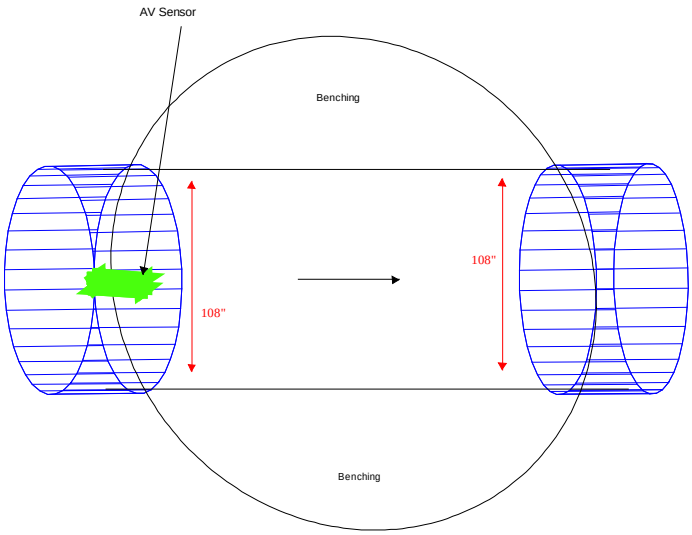


View of flow through effluent line

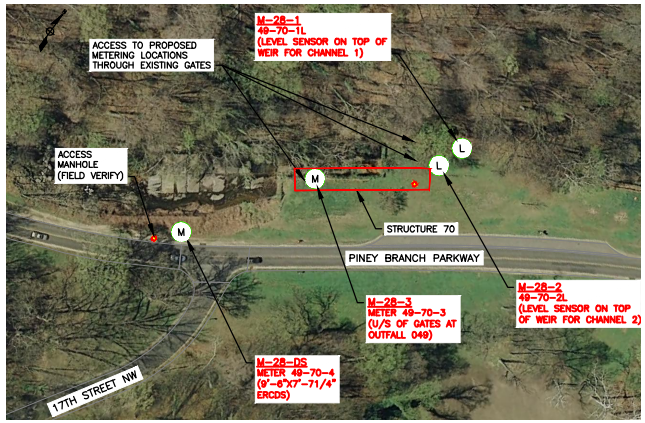
Dimensional Structure Profile View (profile sketch showing location of sensors)

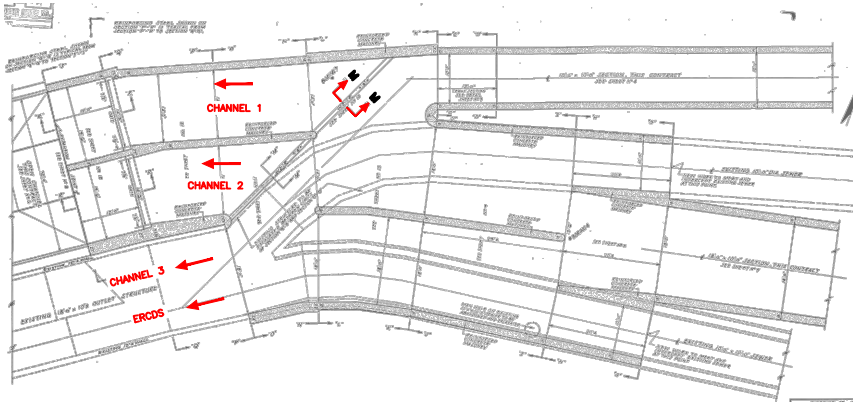


Dimension Structure Detail (Plan View)

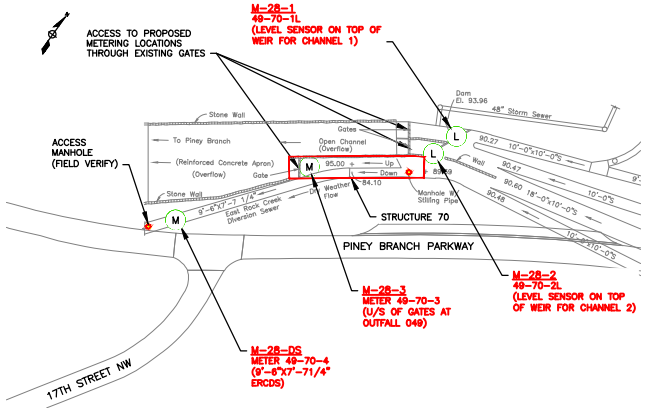


2 – FLOW METERS
2 – LEVEL SENSORS

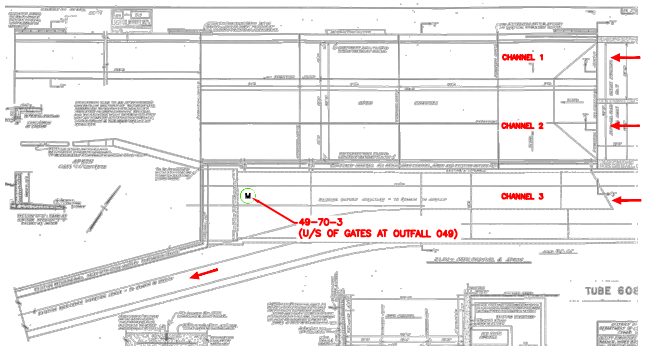




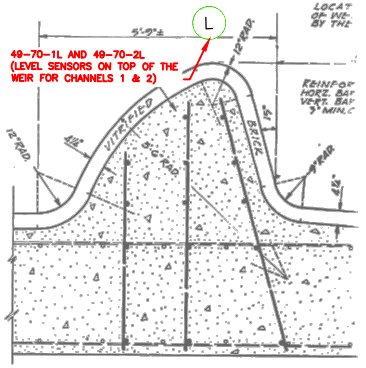
SECTIONAL PLAN
SCALE NTS



FLOW METER LOCATION PLAN
SCALE: NTS



SECTIONAL PLAN
SCALE NTS



TYPICAL WEIR SECTION M-M
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

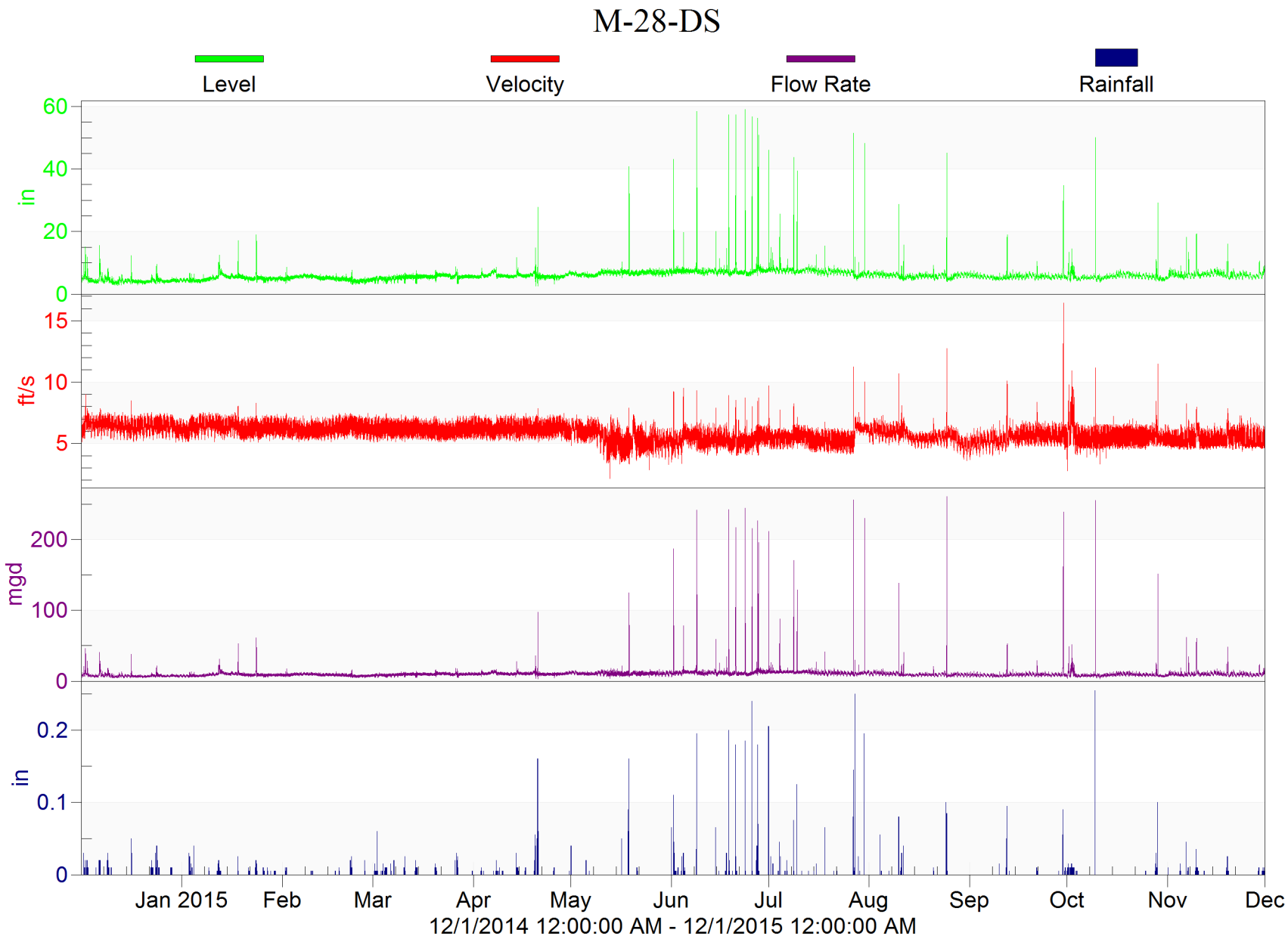
(L) LEVEL SENSOR LOCATION

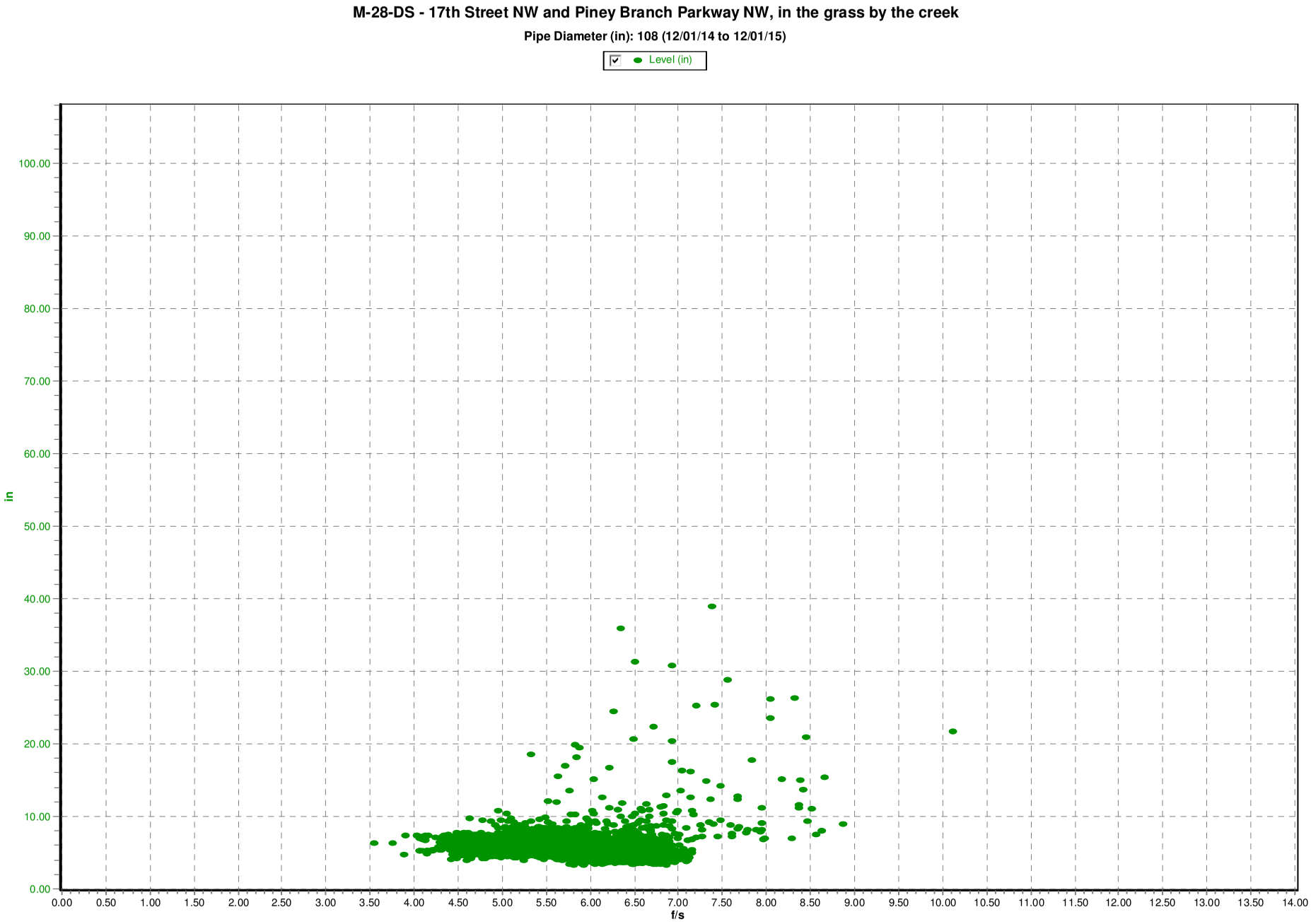
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
49-70-1L_2L_3_4
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 28

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 11:15:20 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\28-28_49-70-1_2.DWG


M-28-DS
Level
Velocity
Flow Rate
Rainfall
60
40
20
0
in
15
10
5
ft/s
200
100
0
mgd
0.2
0.1
0
in
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM


M-28-DS - 17th Street NW and Piney Branch Parkway NW, in the grass by the creek
Pipe Diameter (in): 108 (12/01/14 to 12/01/15)
Level (in)
in
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00 6.50 7.00 7.50 8.00 8.50 9.00 9.50 10.00 10.50 11.00 11.50 12.00 12.50 13.00 13.50 14.00
f/s

M-28-DS

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/19/2014	15:18	4.27	4.5	6.9	7.34	0		LR/PD	Install.
12/16/2014	15:23							LR/AP	CB Telog.
1/7/2015	15:58		6		6.9	0		AP/AM	
1/29/2015	14:40		5.25		7.01	0	5.76	LR/AM	CB Telog.
2/12/2015	10:56		5.25		6.75	0	6.07	LR/AM	CB Telog.
2/24/2015	14:08						6.03	AP/AM	CB Telog.
3/17/2015	10:28		5.5		6.5	0		AP/AM	CB Telog.
4/3/2014	15:32						6.03	AP/AM	CB Telog.
4/30/2015	13:40	6.43	6.5	5.8	6.2	0	6.16	LL/DW	CB Telog.
5/26/2015	13:19		7		5.72	0		LR/DW	
6/4/2015	13:40		8.5		5.6	0		LR/DW	
6/22/2015	14:35		6.5		5.1	0		LL/DW	CB Telog.
7/8/2015	15:34		7.25		5.67	0		LL/DW	
7/16/2015	13:33		7		5.51	0		LL/DW	
8/11/2015	14:30		5.5		6.7	0		CL/JC	
9/16/2015	10:27		6		5.9	0		LR/JC	
10/5/2015	10:23							LR/JC	CB Telog.
11/4/2015	11:15		7		5.5	0		LR/JC	
12/21/2015	17:10		6.5		5.7	0		BR/PC	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-30

SEWER: DC SEWER TRUNK LINE

OUTFALL: 003

DURATION: 12/1/14 - 12/1/15

1. CSL installed sensors to measure level only. Tidal intrusion was not found at this location.

2. M-30 measured excess flows from the combined sewer on JBAB before flowing in to the Potomac River through CSO 003 downstream of Structure 2.

3. The weir formula was used to calculate a flow rate from these measurements. M-30 is an overflow pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Flow (MGD)
Min	0	0
Avg.	0.003	0.001
Max	3.733	5.881

Site Name/Manhole # M-30 Primary: [X] Alternate: [ ]

Investigation Date: 12/18/13 Time: 13:55 Crew Members: LR/JS

Installation Date: 11/19/14 Time: 10:15 Crew Members: LR/SD

Address/Location: Bolling AFB, at Eglin Way SW & McGuire Ave.

Latitude: N 38° 49.951' Longitude: W 77° 1.283'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow: *Standing water*

Velocity 0.0 ft/sec

Depth 0 in

Turbulence Amplitude:

- (Less than 0.25")
- ☐ 0.25" to 0.75"
- ☐ 0.75" to 1.5"
- ☐ 1.5" to 3"
- ☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Influent 3	Effluent
Height	9'	12'3"	10'	9'
Width	6'6"	11'5"	11'5"	6'6"
Material	Concrete	Concrete	Concrete	Concrete
Shape	Igloo	Igloo	Igloo	Igloo

Sediment Present:

☐ Yes Hard packed: _____ in. deep

(No) Soft: _____ in. deep

Surcharge / Backwater Influence:

- ☐ No evidence visible
- (Remains in pipe)
- ☐ _____ft from rim
- ☐ Reaches Rim (potential meter damage)
- ☐ Evidence unclear: _____ft from rim

Gas Investigation:

(Good) 20.9 (condition)

Site Conditions

Site Access:

- (Good (no problems accessing site))
- ☐ Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site)
- ☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
- ☐ Traffic Control only (Requires extra traffic control
- ☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes (No)

Height above ground ____

Manhole depth 14'

Structural Integrity of Manhole:

☐ Good (Fair) ☐ Poor

Pipe Bends: *None within camera view*

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to bend:____ft

Pipe Size/Geometry/Material Change:

☐ Influent ☐ Effluent ☐ Manhole

Approx Distance to change:_____ft

(detail is comments)

Crew Member: Can you maintain this site?

(Yes) ☐ No ☐ Maybe

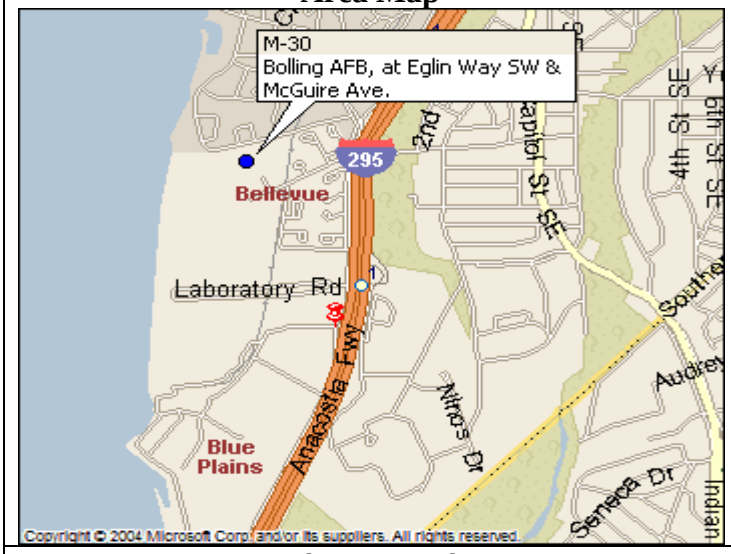
Sensor Configuration:

(Please include Serial Numbers when possible)

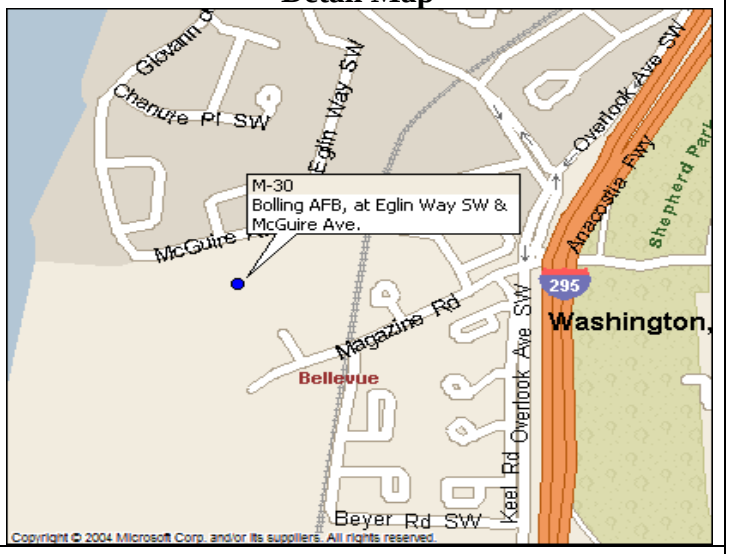
Level	Primary: Flowav
	Redundant:
Velocity	Primary: Flowav
	Redundant:
Meter Logger	Telog

Comments:

Area Map



Detail Map



View from top of MH

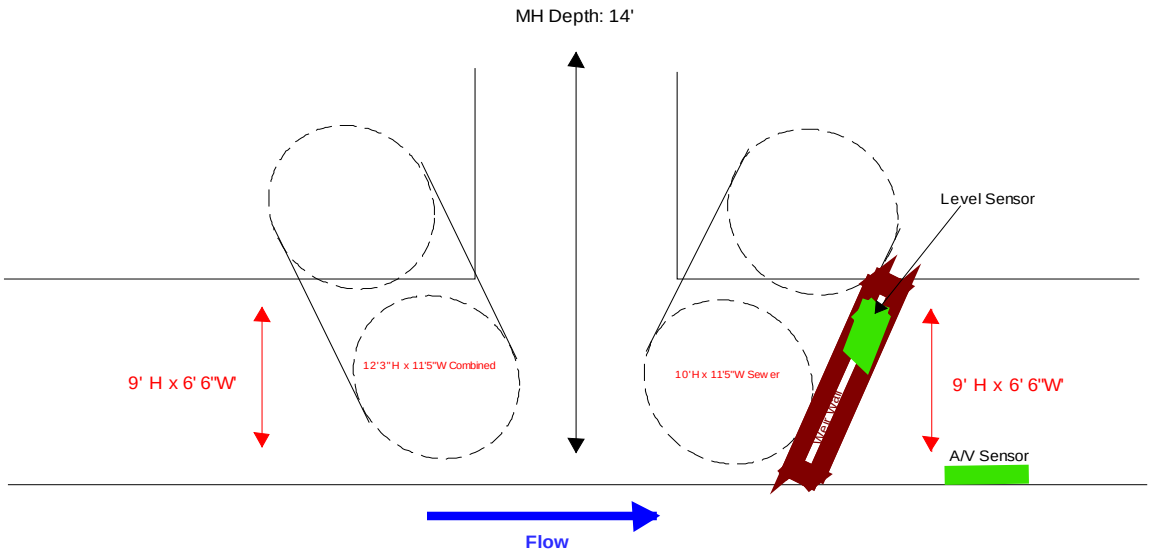
Site Overview

View of flow through influent line

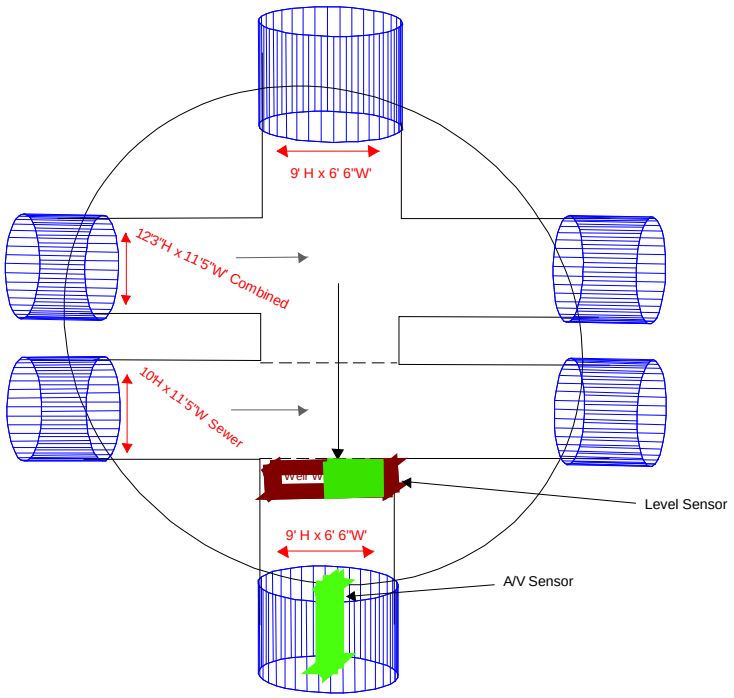
NA

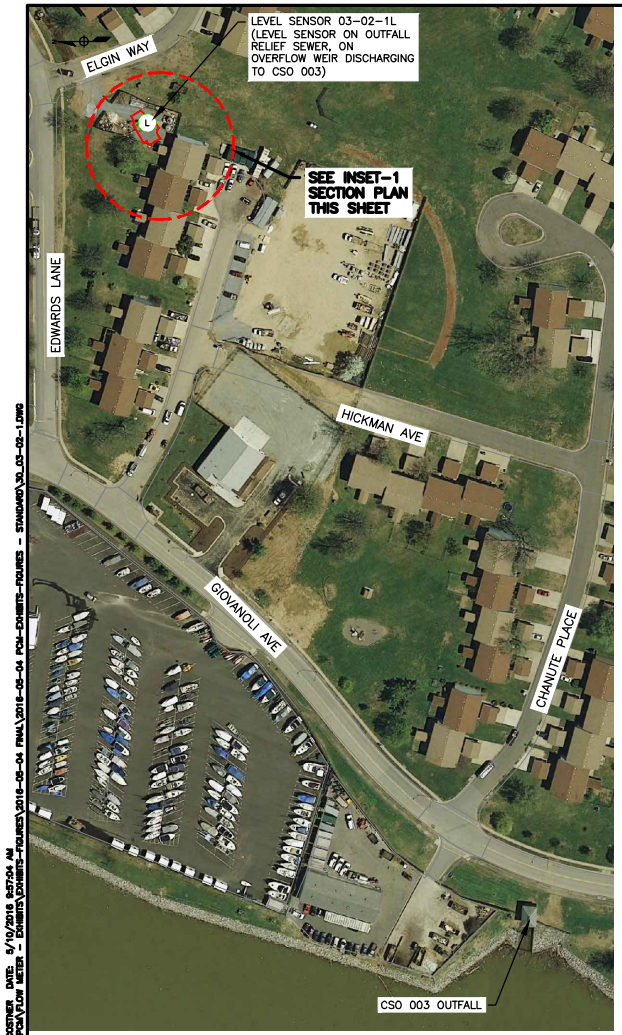
View of flow through effluent line

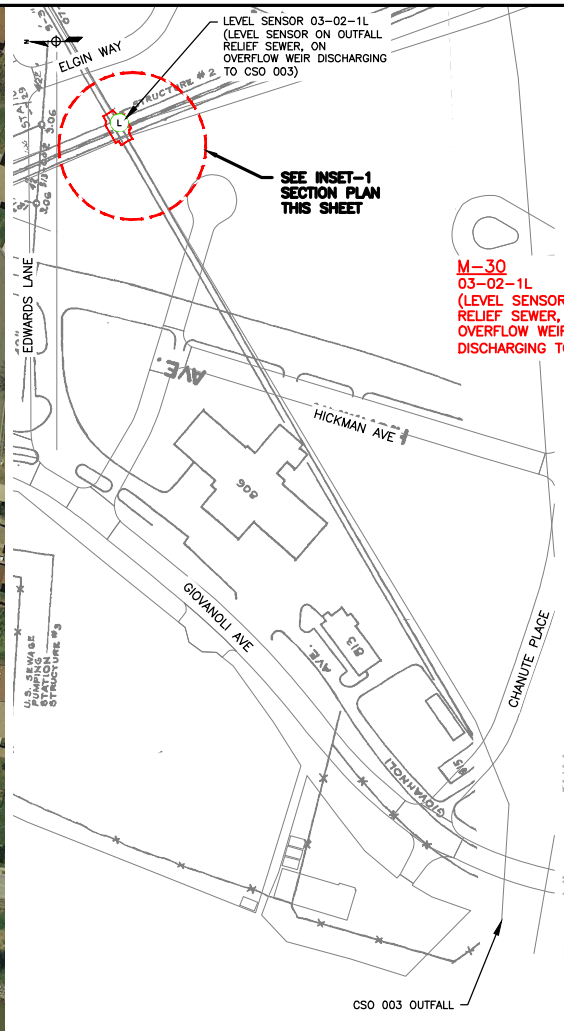
Dimensional Structure Profile View (profile sketch showing location of sensors)



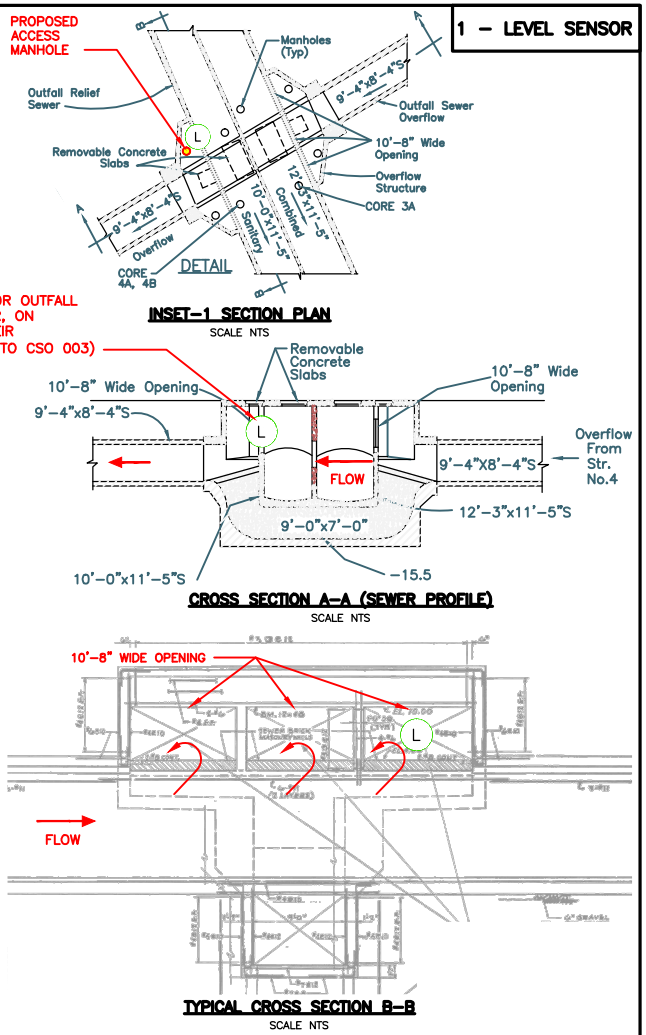
Dimension Structure Detail (Plan View)







FLOW METER LOCATION PLAN
SCALE: 1"=30'



LEGEND

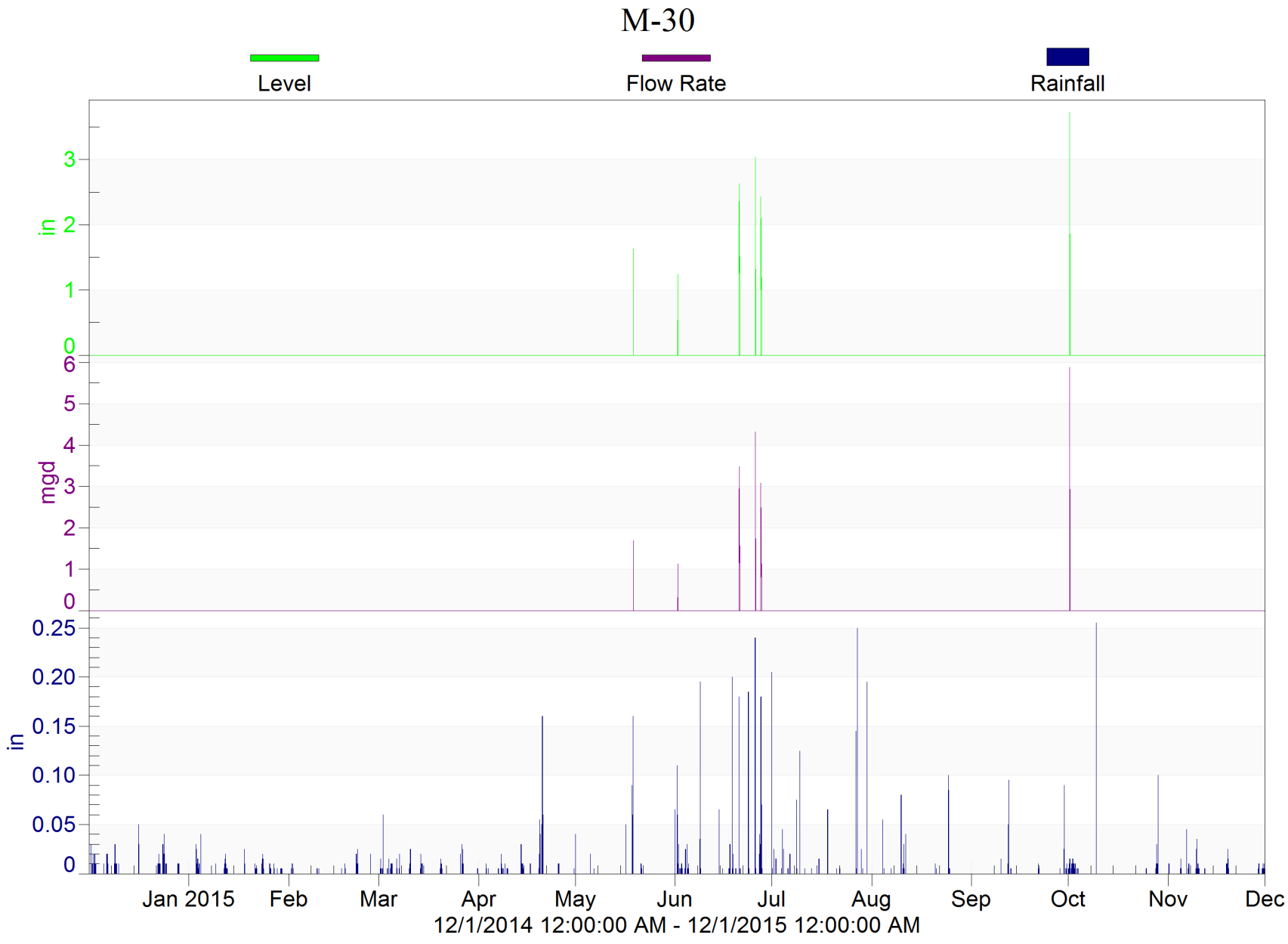
L LEVEL SENSOR LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
03-02-1L
METER LOCATION AND TYPICAL CROSS SECTION

DATE: OCTOBER 2014	SITE 30

LAST SAVED BY: STEFAN COSTNER DATE: 5/10/2016 8:57:04 AM
DRAWING ID: L:\LTCP\PDA\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\2016-05-04 FINAL\2016-05-04 PDA-EXHIBITS-FIGURES - STANDARD\M_03-02-1.DWG


M-30
Level
Flow Rate
Rainfall
in
3
2
1
0
mgd
6
5
4
3
2
1
0
in
0.25
0.20
0.15
0.10
0.05
0
Jan 2015
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
12/1/2014 12:00:00 AM - 12/1/2015 12:00:00 AM

M-30

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
11/19/2014	11:35	0	0			0		LR/SD	Install.
11/19/2014	11:40	0	0			0		LR/SD	
11/19/2014	11:45	0	0			0		LR/SD	
12/17/2014	8:54	0	0			0		LR/AP	CB Telog.
1/8/2015	14:30	0	0			0		LR/AM	CB Telog.
1/8/2015	14:37	0	0			0		LR/AM	
1/8/2015	14:44	0	0			0		LR/AM	
1/16/2015	14:39	0	0			0		LL/AM	
2/12/2015	10:00		0			0	6.03	LR/AM	CB Telog.
3/13/2015	13:00		0			0	6.03	AP/AM	CB Telog.
4/8/2015	13:00		0			0		AP/AM	CB Telog.
7/7/2015	7:55	0	0			0	4.8	LR/DW	Install redundant meter.
7/7/2015	9:36	0	0			0	6.12	LR/DW	CB Telog / V2 Remote
9/23/2015	9:29		0			0		LR/JC	CB Telog.
2/25/2015	10:00		0			0		LL/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

Site Summary

METER: M-33

SEWER: UPPER POTOMAC INTERCEPTOR RELIEF SEWER

OUTFALL: n/a

DURATION: 8/1/15 - 12/1/15

1. CSL installed sensors to measure level and velocity. Tidal intrusion was not found at this location.

2. M-33 measured flows on the Upper Potomac Interceptor Relief Sewer downstream of the diversion to the Upper Potomac Interceptor.

3. The continuity equation was used to calculate a flow rate from these measurements. M-33 is a sewer pipe.

4. The properties of the flow were found to be as follows:

	Depth (in.)	Velocity (ft/s)	Flow (MGD)
Min	45.669	1.855	31.177
Avg.	64.138	3.478	60.262
Max	185.761	4.874	105.207

Site Name/Manhole # M-33 Primary: ☐ Alternate: ☐

Investigation Date: 7/1/15 Time: 16:14 Crew Members: LR/BC/DW/JC

Installation Date: 7/22/15 Time: 13:43 Crew Members: LR/KE

Address/Location: Across from 3401 K St NW (facing rental bike rack, on right. in parking lane)

Latitude: N 38°54.209' Longitude: W 77°04.057'

Weather Conditions: Wet (Dry)

Hydraulic Conditions

Influent Flow:

Velocity 4.28 ft/sec

Depth 71.5 in

Turbulence Amplitude:

☐ Less than 0.25"
☐ (0.25" to 0.75")
☐ 0.75" to 1.5"
☐ 1.5" to 3"
☐ Greater than 3"

Sewer Line Characteristics:

	Influent 1	Influent 2	Effluent
Height	114"		114"
Width	60"		60"
Material	Concrete		Concrete
Shape	Rectangle		Rectangle

Sediment Present:

☐ Yes Hard packed: _____ in. deep
☐ (No) Soft: _____ in. deep

Surcharge / Backwater Influence:

☐ No evidence visible
☐ Remains in pipe
☐ _____ft from rim
☐ (Reaches Rim (potential meter damage))
☐ Evidence unclear: _____ft from rim

Gas Investigation:

☐ (Good) 20.9 (condition)

Site Conditions

Site Access:

☐ Good (no problems accessing site)
☐ (Fair (minor traffic control, truck accessible off-road site, can safely carry equipment to site))
☐ Poor (remote areas, steel embankments, No safe place to park, elevated MH >3 ft)
☐ Traffic Control only (Requires extra traffic control
☐ Unusable (Document in Comments section)

Manhole Information:

Elevated Manhole: ☐ Yes ☐ (No)

Height above ground ____
Manhole depth 220"
Structural Integrity of Manhole:
☐ Good ☐ (Fair) ☐ Poor

PPipe Bends:

☐ (Influent) ☐ (Effluent) ☐ Manhole
Approx Distance to bend: *2' influent, 7' effluent*

Pipe Size/Geometry/Material Change:

☐ Influent ☐ (Effluent) ☐ Manhole

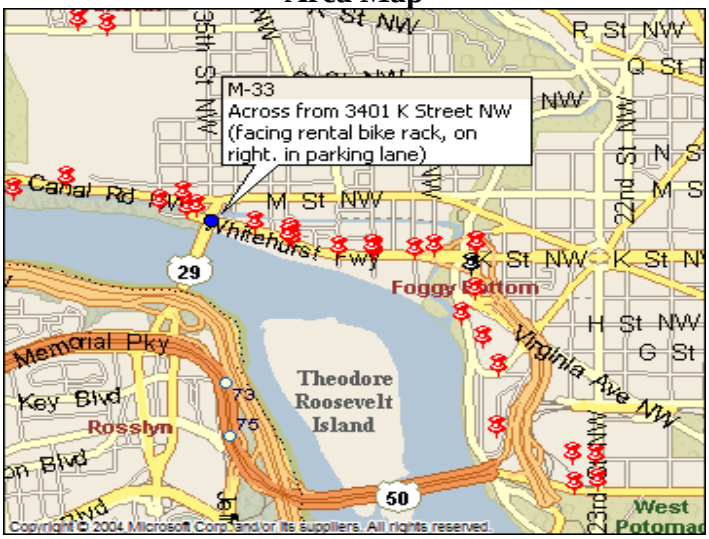
Crew Member: Can you maintain this site?
☐ (Yes) ☐ No ☐ Maybe

Sensor Configuration:
(Please include Serial Numbers when possible)

Level	Primary: ADS Surface Combo
	Redundant:
Velocity	Primary: ADS Surface Combo
	Redundant:
Meter Logger	Triton

Comments: *Bolted down. Upstream chamber turns at MH and transitions to a round pipe DS*

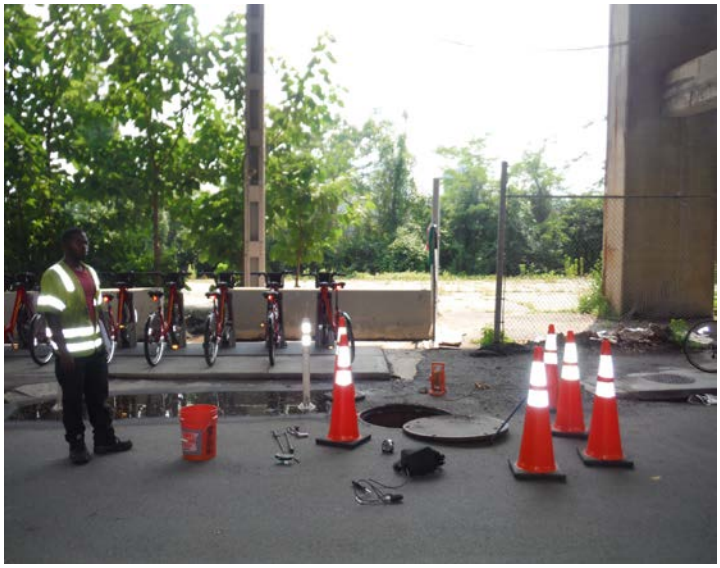
Area Map



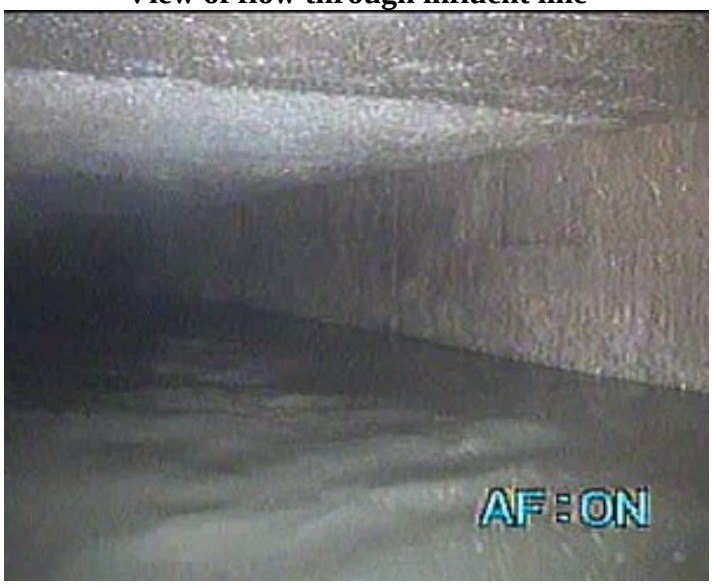
Detail Map

View from top of MH

Site Overview

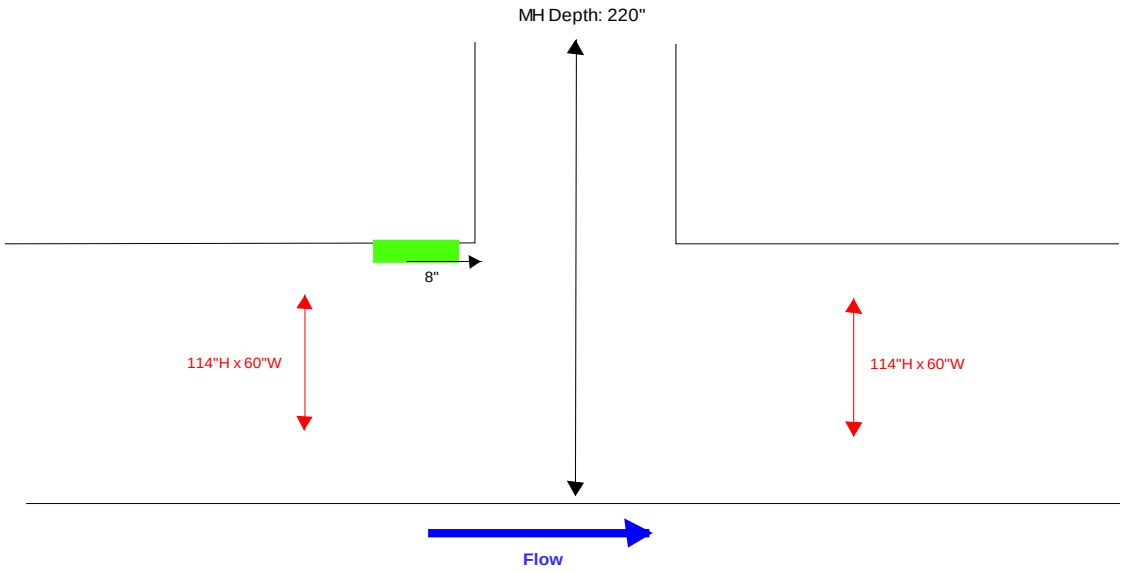


View of flow through influent line

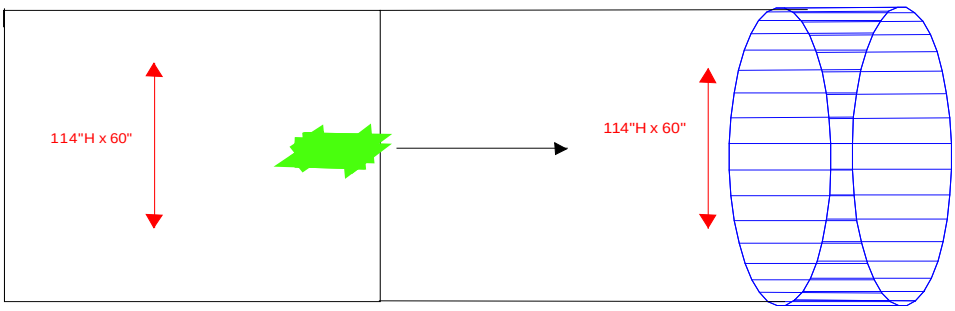


View of flow through effluent line

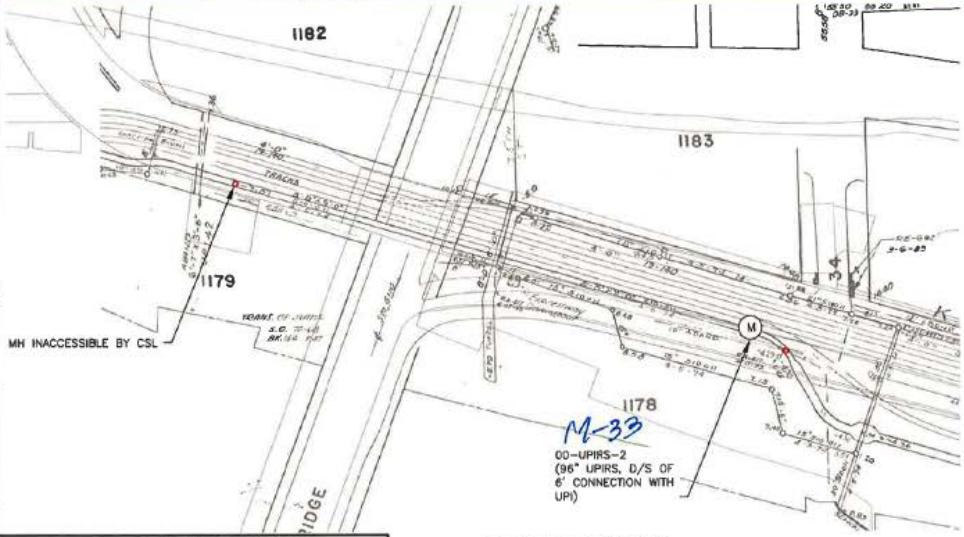
Dimensional Structure Profile View (profile sketch showing location of sensors)



Dimension Structure Detail (Plan View)



1 – FLOW METER



METER LOCATION PLAN
SCALE: NTS

dc clean RIVERS PROJECT
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WATER AND SEWER AUTHORITY
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WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

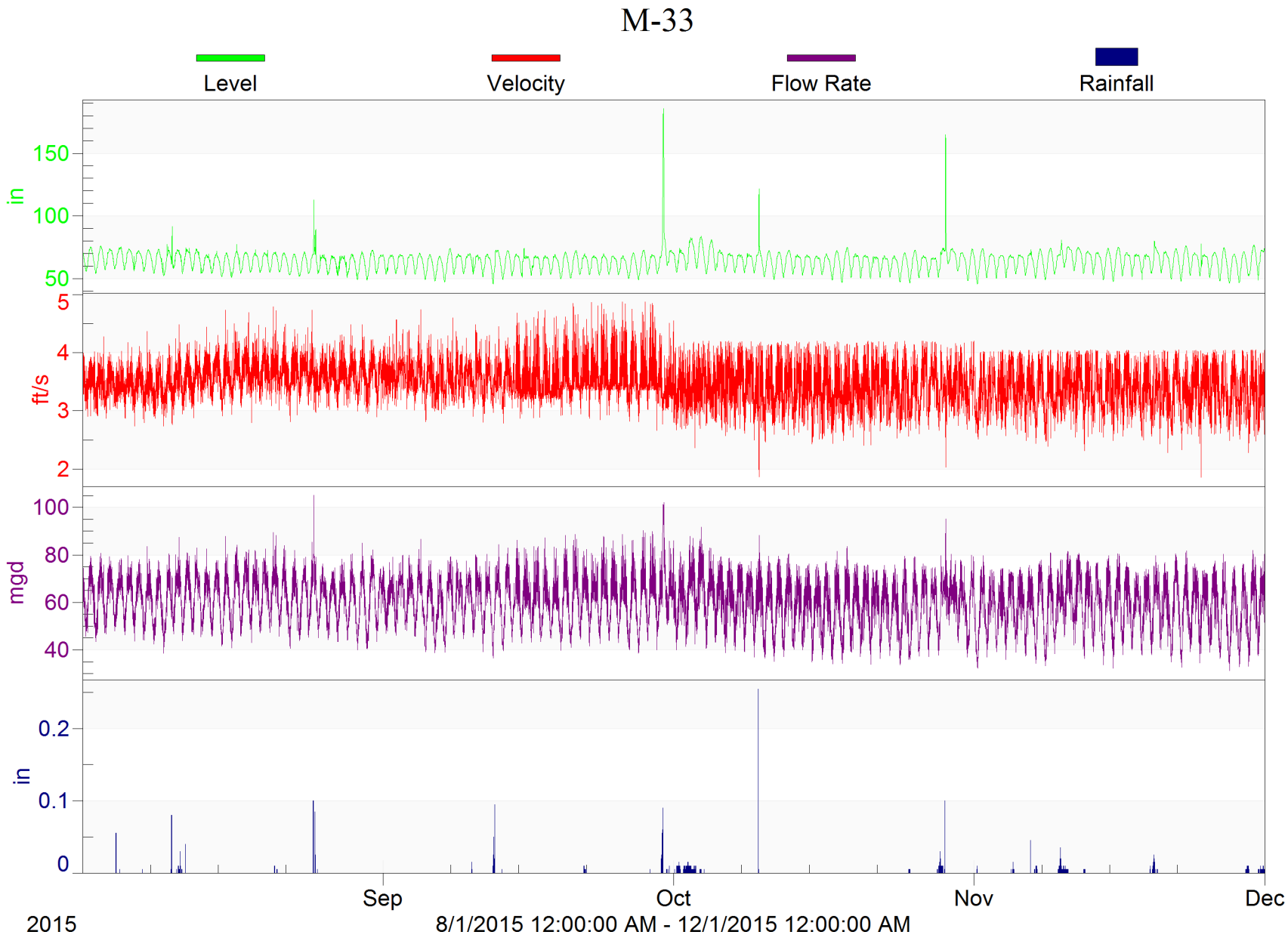
LEGEND

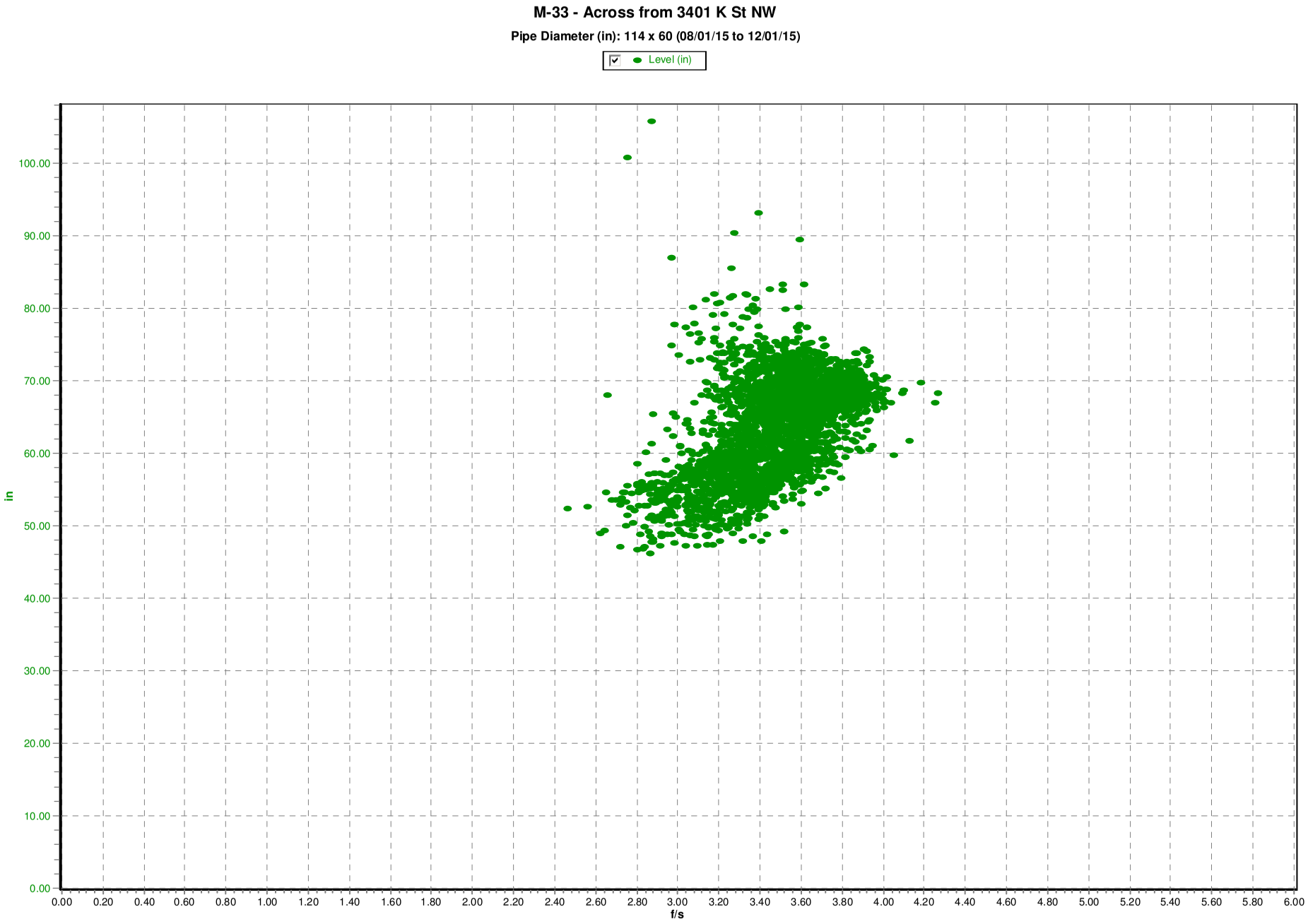
(M) LEVEL SENSOR LOCATION

NATIONAL PARK SERVICE AREA

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS
00-UPIRS-2
METER LOCATION MAP

DATE: OCTOBER 2014,Rev. 7/'15 | SITE 33


M-33
Level
Velocity
Flow Rate
Rainfall
150
100
50
in
5
4
3
2
ft/s
100
80
60
40
mgd
0.2
0.1
0
in
Sep
Oct
Nov
Dec
2015
8/1/2015 12:00:00 AM - 12/1/2015 12:00:00 AM


M-33 - Across from 3401 K St NW
Pipe Diameter (in): 114 x 60 (08/01/15 to 12/01/15)
Level (in)
in
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80 3.00 3.20 3.40 3.60 3.80 4.00 4.20 4.40 4.60 4.80 5.00 5.20 5.40 5.60 5.80 6.00
f/s

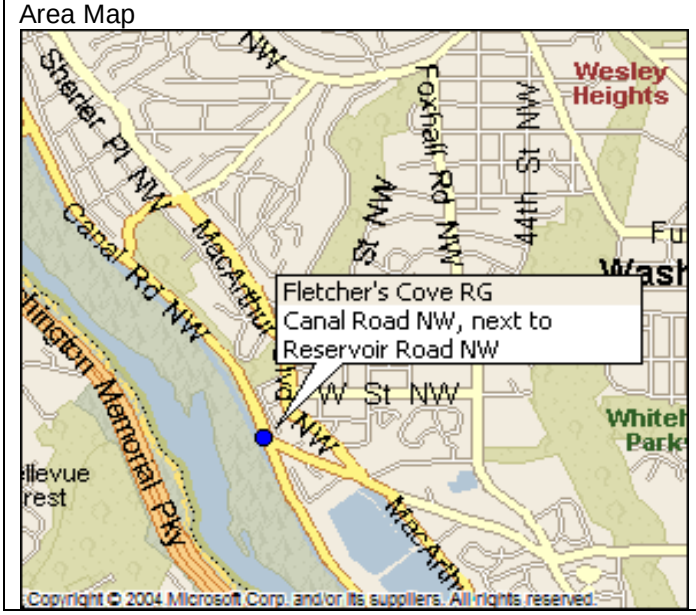
M-33

Date	Time	Meter 1 Depth	Field Depth	Meter 1 Vel.	Field Vel.	Silt	Battery	Initials	Service Comments
7/22/2015	14:20	71.62	71.5	4.08	4.28	0		LR/KE	Install.
7/27/2015	12:33	67.7	68	4.15	4.07	0		LR/KE	
9/3/2015	11:18		60		3.3	0		LR/JC	
9/14/2015	14:26		67		3.4	0		LR/JC	
11/18/2015	14:04		68		3.6	0		LR/JC	
12/10/2015	8:50		54.75		3.94	0		KE/MH	Remove.
A blank cell denotes no confirmation performed in the field.									

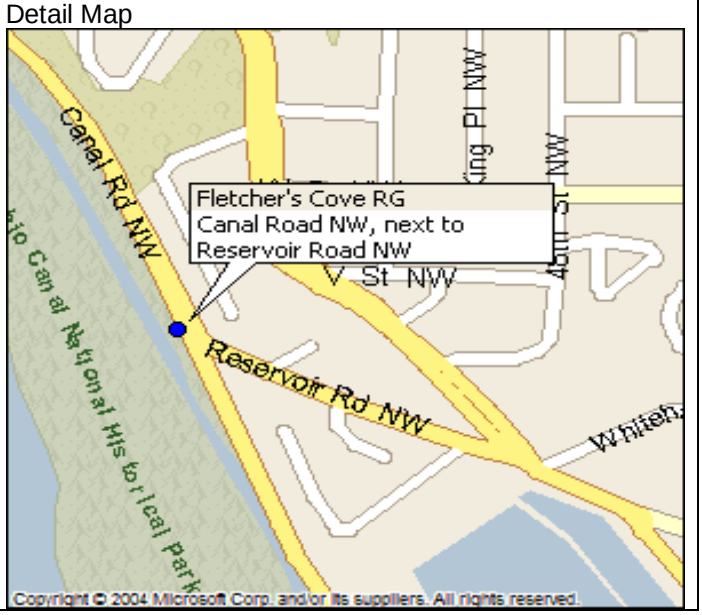
Project: DC Water CSO's Temporary Flow Metering Study		Date: 10/29/14	Name: L. Radico
Manhole #: Fletcher's Cove RG		Time: 8:49	Town: Washington
Address/Location: Canal Road NW, next to Reservoir Road NW			
Latitude: N 38°55.174'	Longitude: W 77°06.052'	Access: Drive	
Telog: 293642	Rain Gauge Serial: 51832-612		

Site Comments, if any:

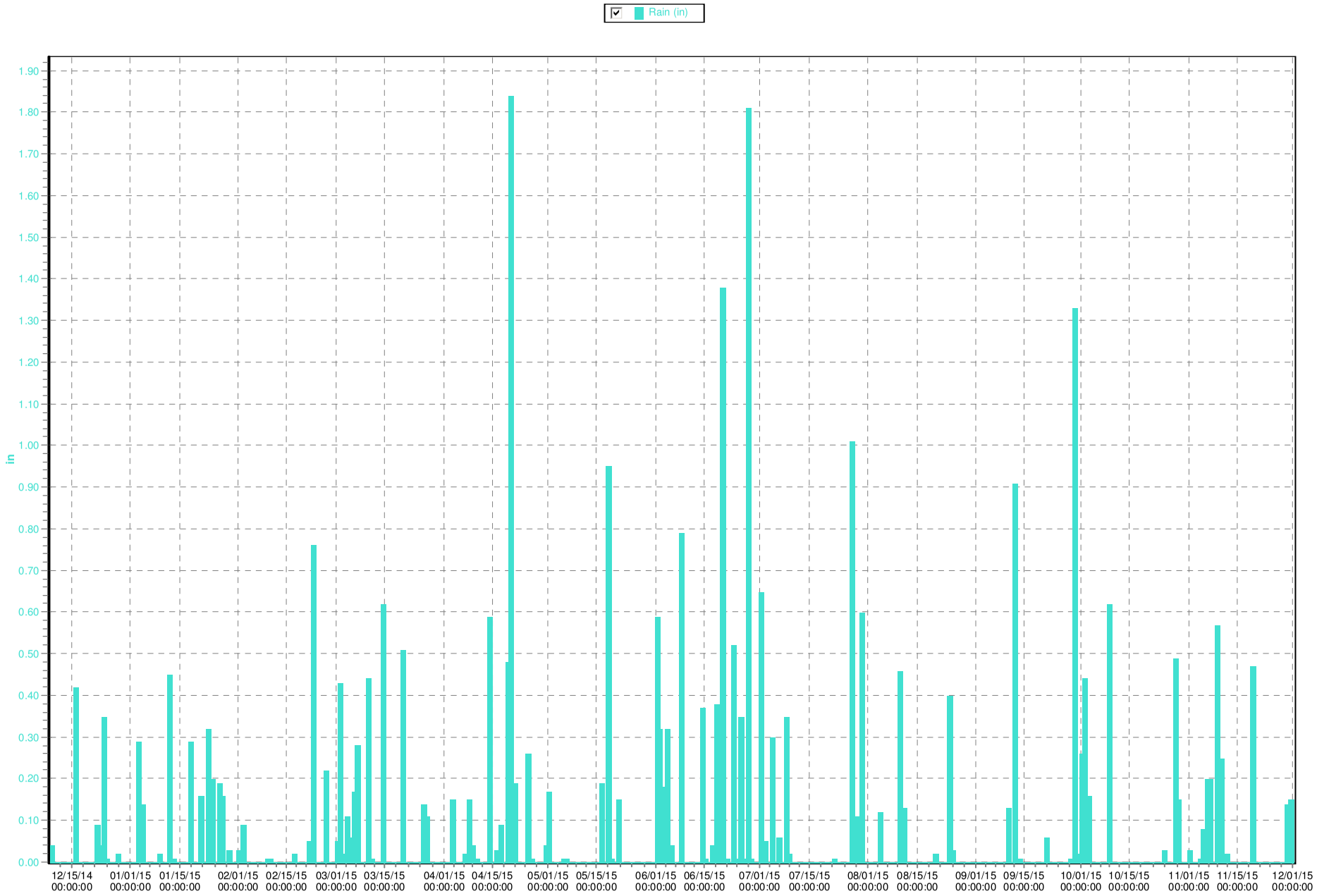
Area Map



Detail Map



Fletchers Cove RG (12/09/14 to 12/01/15)



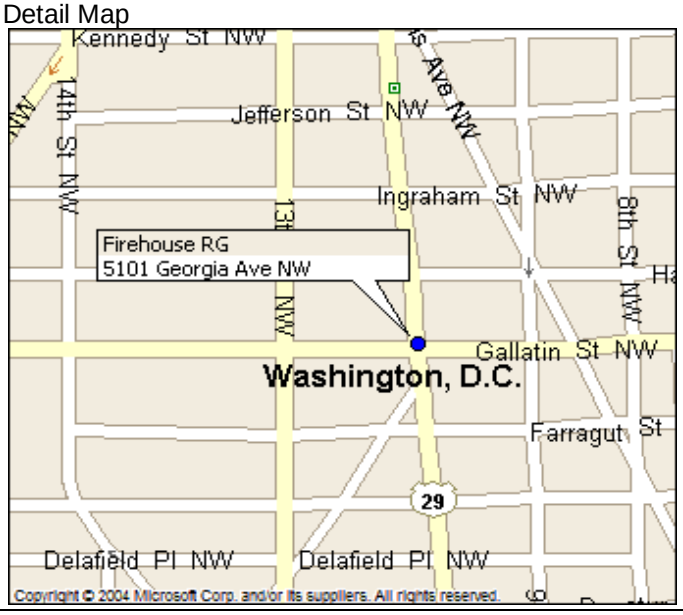
Fletcher's Cove RG				
Date	Time	Battery	Initials	Service Comments
12/4/2015	9:32		LR/LL	Install.
3/10/2015	14:23		AP/AM	Inspection.
12/21/2015	12:54		SD/LR	Remove.

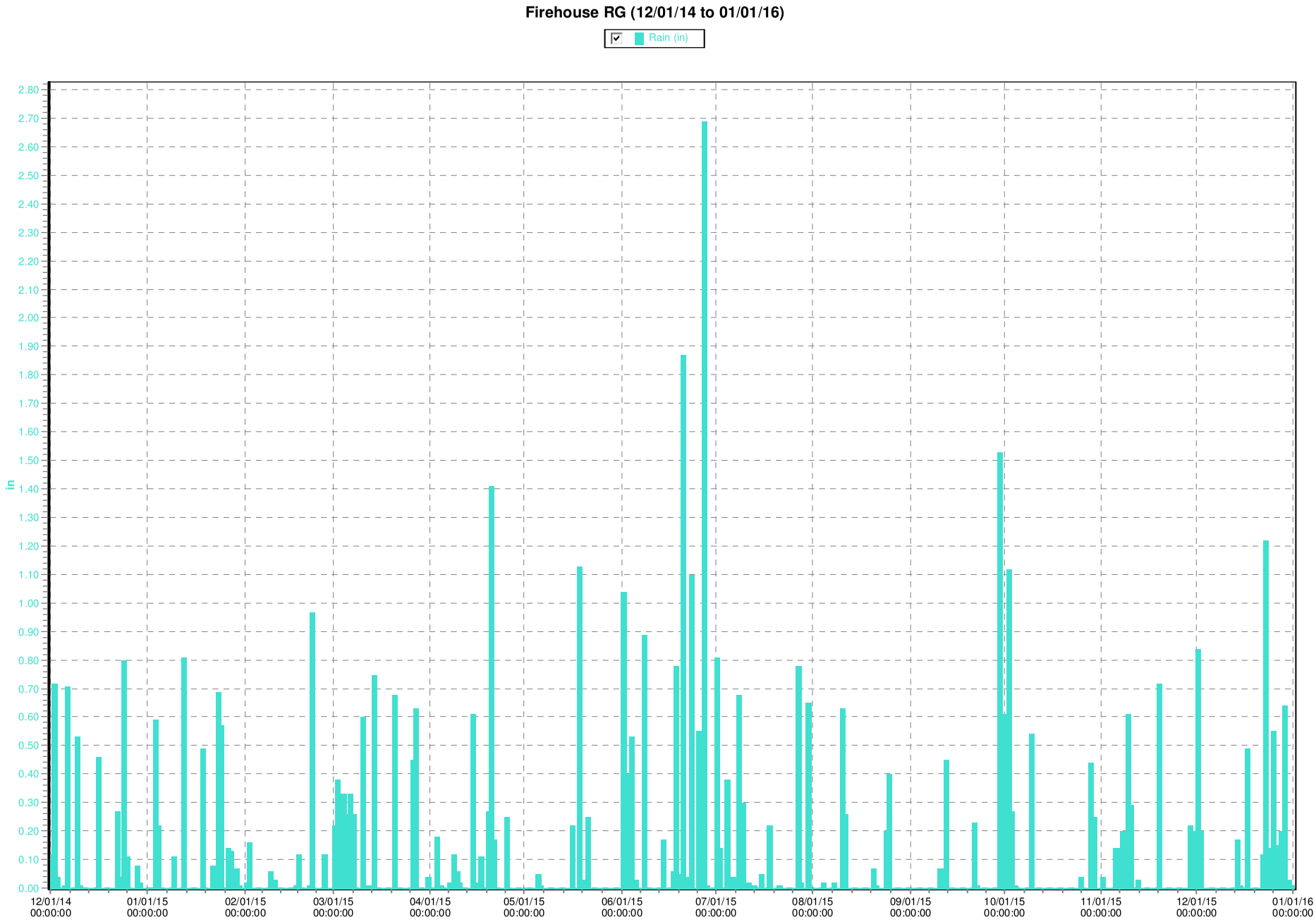
Project: DC Water CSO's Temporary Flow Metering Study	Date: 10/29/14	Name: L. Radico
Manhole #: Firehouse RG	Time: 14:32	Town: Washington
Address/Location: 5101 Georgia Avenue NW		
Latitude: N 38°57,150'	Longitude: W 77°01,594'	Access: Drive
Telog: 371910	Rain Gauge Serial:	

Site Comments, if any:

Area Map

Detail Map




Firehouse RG (12/01/14 to 01/01/16)
Rain (in)
in
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
12/01/14 00:00:00
01/01/15 00:00:00
02/01/15 00:00:00
03/01/15 00:00:00
04/01/15 00:00:00
05/01/15 00:00:00
06/01/15 00:00:00
07/01/15 00:00:00
08/01/15 00:00:00
09/01/15 00:00:00
10/01/15 00:00:00
11/01/15 00:00:00
12/01/15 00:00:00
01/01/16 00:00:00

Firehouse RG				
Date	Time	Battery	Initials	Service Comments
11/6/2014	12:45		LR/PD	Install.
3/10/2015	3:22		AP/AM	Inspection.
2/24/2016	15:20		LL/MH	Remove.

Appendix F Data Report for CSO Overflow Sampling

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

PHASE I- POST CONSTRUCTION MONITORING PROGRAM

Data Report for CSO Overflow Sampling

July 2016

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

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1.2 NPDES Permit Requirements- Phase I 1

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B. Laboratory Reported Results & Chain of Custody forms

1 Introduction

1.1 Purpose

The District of Columbia Water and Sewer Authority's (DC Water's) National Pollutant Discharge Elimination System Permit (NPDES Permit) requires conducting post construction monitoring in three phases after various elements of the CSO control program are implemented. Part III, Section D of the permit specifies the required post construction monitoring phases as follows:

- **Phase 1 Monitoring** – Following the placement in operation of the inflatable dams and pumping stations rehabilitation. This program will be conducted for a period of one year in each receiving waters (Anacostia and Potomac Rivers).

Replacement of the inflatable dams was completed in 2004 and rehabilitation of the last pumping station (Potomac Pumping Station) was completed in October 2013. As the system improvements have been completed, DC Water has conducted the first phase of monitoring from December 2014 to February 2016. The permit requires the monitoring to consist of at least the elements in Table 1-5.

This report presents the results from CSO Overflow sampling work conducted by the personnel from DC Clean Rivers Project (DCCR). All samples were analyzed at Martel Laboratory in Baltimore, Maryland.

Table 1. NPDES Permit Requirements - Phase 1

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	• 1 gauge in Northeast Boundary • 1 gauge in Tiber Creek	• 1 gauge in Slash Run	• Continuous
CSO Overflow (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary	n/a	• 4 storms minimum approximately 1 hr sample interval for each storm
Receiving Water Monitoring- Dissolved Oxygen (4)	• Continuous DO Monitors	• Continuous DO Monitors	• Approximately 30 minute intervals
Receiving Water Monitoring- Bacteria, Field Parameters (2) (4)	• Bacteria Samples	• Bacteria Samples	• 4 storms minimum

(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for fecal Coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.
(4) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

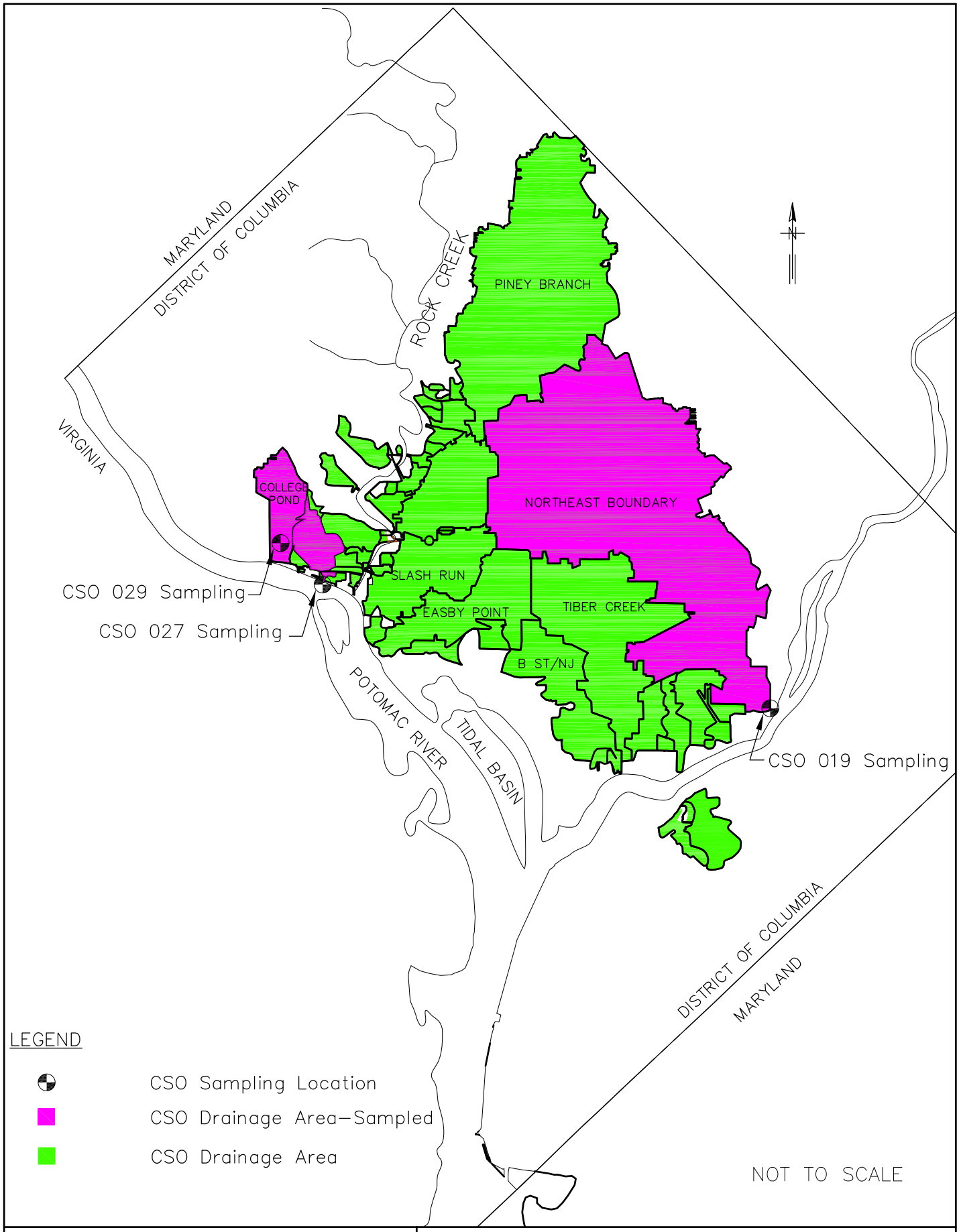
2 CSO Overflow Sampling

Sampling of CSO overflows was conducted at three (3) locations to characterize the nature of cso Overflows. The drainage areas sampled are shown in Table 3-3 and Figure 1. The sampling location maps for each site are provided as Figures 2, 3 and 4.

The sampling location for Northeast Boundary (NEB) drainage area was at the influent to the NEB Swirl (CSO 019) which represents CSO before treatment by the Swirl facility. The sampling location for College Pond (CSO 029) drainage area was at the downstream of the weir at Structure 47. The sampling location for Georgetown (CSO 027) was at the overflow manhole downstream of Structure 43a.

Table 2. CSO Monitoring – Sampling

Monitoring Type	Anacostia River	Potomac River	Frequency
CSO Overflow Sampling	• 1 sampling station at Northeast Boundary		• 4 storms per year • Approx 1 hour sample interval for each storm
		1 sampling station in College Pond	• 1 storm • Approx 1 hour sample interval
		1 sampling station in Georgetown	• 1 storm • Approx 1 hour sample interval



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DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE–I

CSO SAMPLING LOCATION MAP

DATE: JULY 2016 | FIGURE 1

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 6/3/2016 12:04:08 PM
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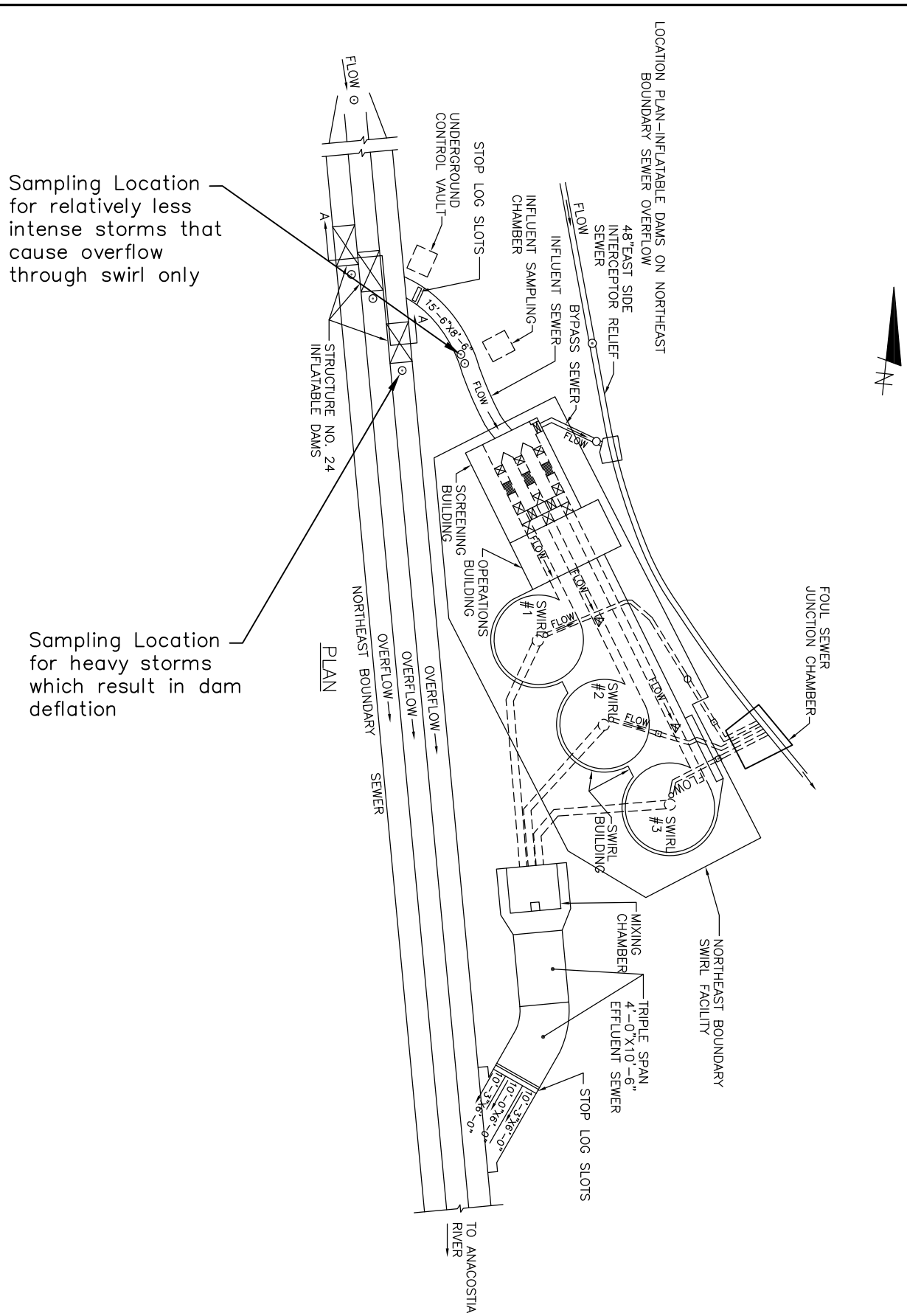

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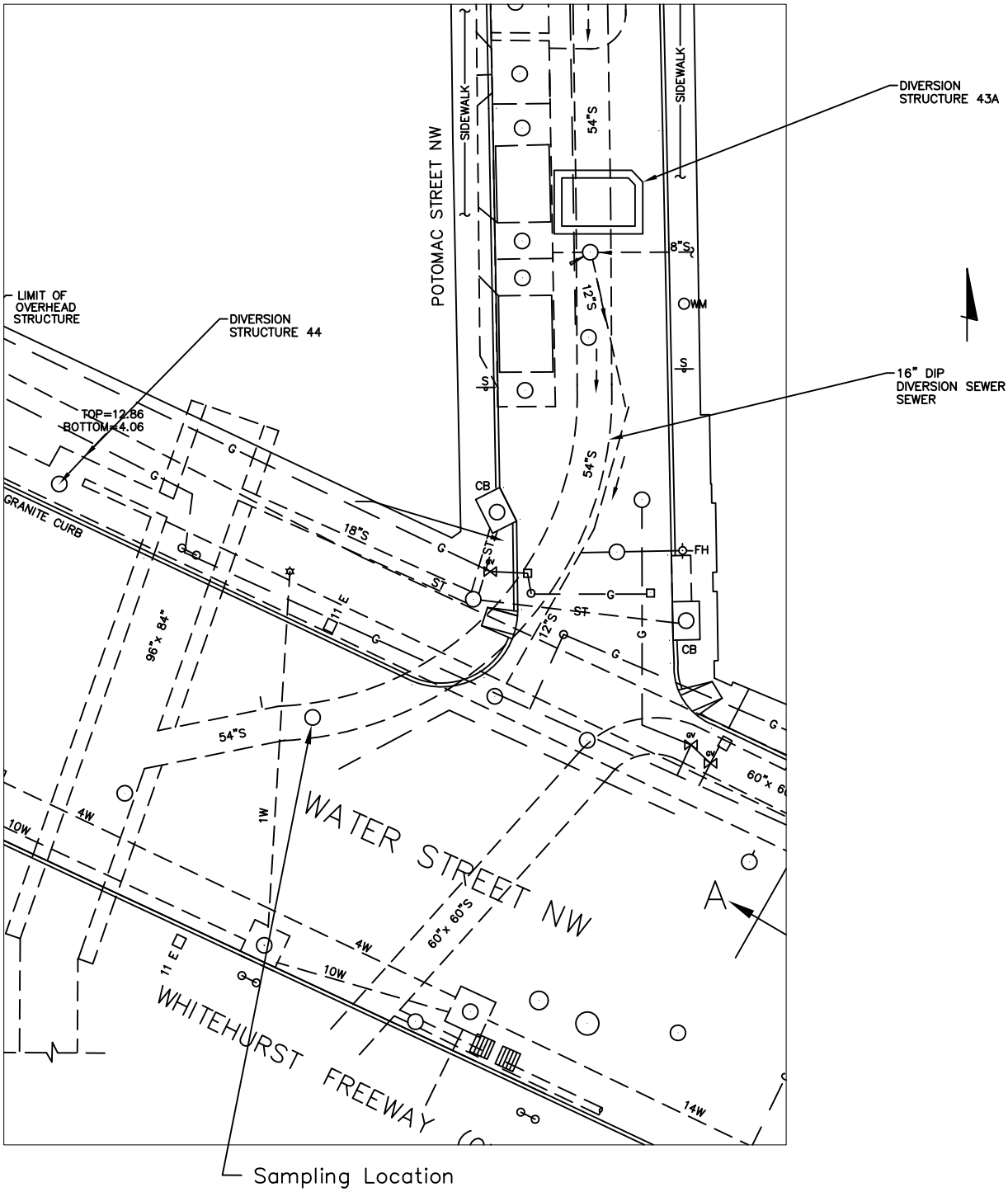
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE-I

CSO 019- SAMPLING LOCATION MAP

DATE: JULY 2016 | FIGURE 2



NOT TO SCALE

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
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WASHINGTON, DC 20032
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DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE–I

CSO 027– SAMPLING LOCATION MAP

DATE: JULY 2016 | FIGURE 3

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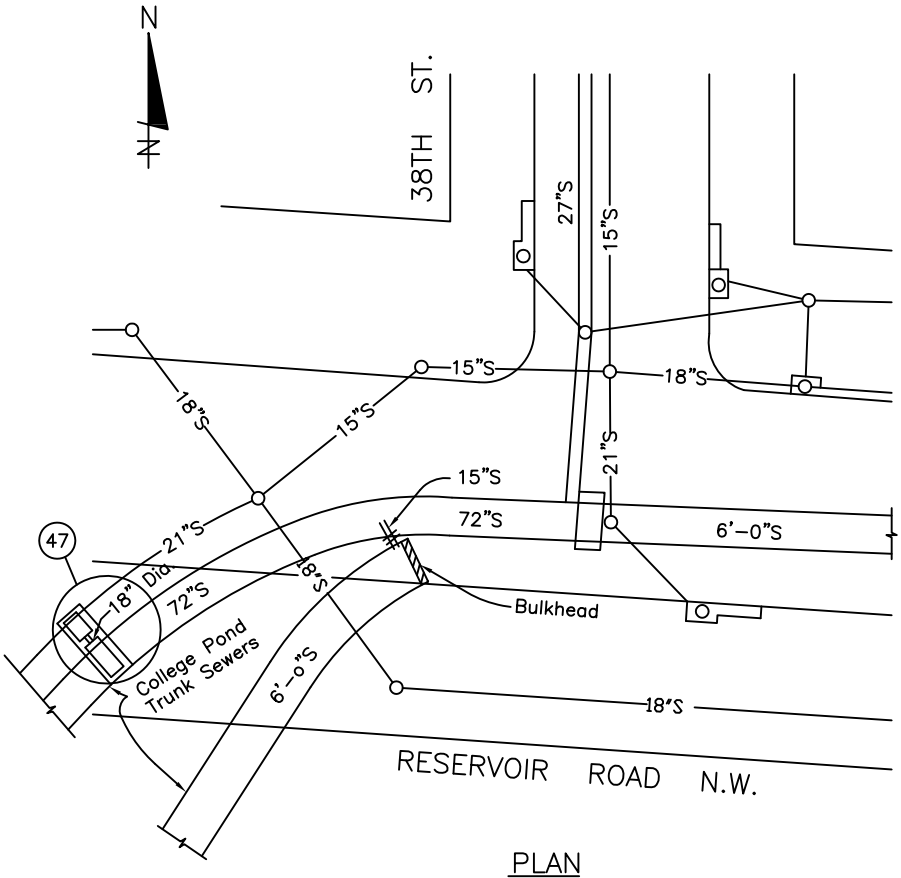
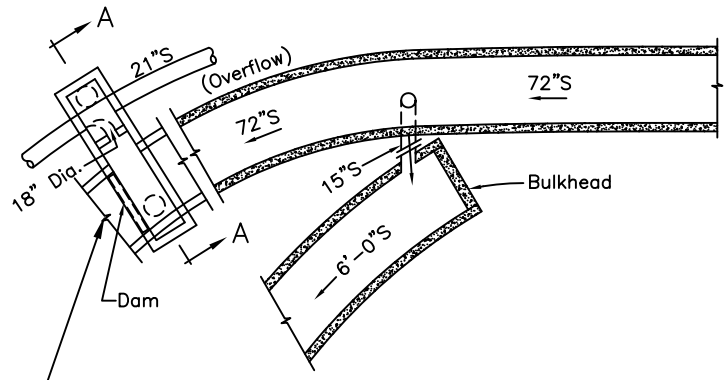


PLAN



DETAIL

Sampling Location–
Downstream of the
dam

NOT TO SCALE

LAST SAVED BY: RAMAKRISHNA JEEDIGUNTA DATE: 6/3/2016 9:49:17 AM
DRAWING ID: E:\PROJECTS\POST CONSTRUCTION MONITORING\03 - CSOSAMPLING\STR-47.DWG

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WATER AND SEWER AUTHORITY
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WASHINGTON, DC 20032
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FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE–I

CSO 029– SAMPLING LOCATION MAP

DATE: JULY 2016 | FIGURE 4

2.1 Sample Collection Frequency

Manual grab sampling was performed during four storms at a frequency of 1 sample per hour for first 8 hours and then 1 sample every 8 hours for up to a total 40 hours per storm event and for a maximum of 12 samples per storm. Based on flow meter data, samples were mathematically composited to determine event mean concentrations. Samples were analyzed for the parameters shown in Table 1-3. Samples were collected to characterize the nature of CSO overflows.

Table 3. Analytical Methods

Parameter	Analysis Method (1)
Field Parameters	PH – SM 4500 H-B Temperature – EPA 170.1 Dissolved Oxygen – SM 4500 – G
Fecal Coliform	SM 9221 – E (A1-Medium)
	SM 9221 – E (EC-Medium)
E. coli	SM 9223 B-94 (Quantitray)
	SM 9221 –F (EC-MUG)
CBOD5 (total)	SM 5210 B -01
TSS	SM 2540 D -97
Chlorophyll a	SM 10200 - H

Notes:

(1) SM= Standard Methods

2.2 Analysis Summary

In general, the samples collected were analyzed successfully. However, there was some data that was were qualified as unusable. Summary of the samples analyzed are shown in Table 1-4 and the data qualified as unusable is presented in Table 1-5.

Table 4. Analysis Summary

Site	Date	Sample No	Analysis Method	Field Duplicate	Field Blank	Equipment Blank	Temperature Blank
				QC Samples			
CSO 019	4/20/2015	04202015-NEB-1	Table 2				a
	4/20/2015	04202015-NEB-2	Table 2				a
	4/20/2015	04202015-NEB-3	Table 2				a
	4/20/2015	04202015-NEB-4	Table 2				a
	4/20/2015	04202015-NEB-5	Table 2				a
	4/20/2015	04202015-NEB-5D	Table 2	X			
CSO 019	6/01/2015	06012015-NEB-1	Table 2				a
	6/01/2015	06012015-NEB-2	Table 2				a
	6/01/2015	06012015-NEB-3	Table 2				a
	6/01/2015	06012015-NEB-4	Table 2				a
	6/01/2015	06012015-NEB-5	Table 2				a
	6/01/2015	06012015-NEB-5D	Table 2	X			a
	6/01/2015	06012015-NEB-6	Table 2				a
	6/01/2015	06012015-NEB-7	Table 2				a
	6/01/2015	06012015-NEB-8	Table 2				a
CSO 019	9/29/2015	09292015-NEB 1	Table 2				a
	9/29/2015	09292015-NEB 1D	Table 2	X			a
	9/29/2015	09292015- NEB 2	Table 2				a
	9/29/2015	09292015- NEB 3	Table 2				a
	9/29/2015	09292015-NEB 3D	Table 2	X			a
CSO 019	11/19/2015	11192015-NEB-1	Table 2				a
	11/19/2015	11192015-NEB-1D	Table 2	X			a
	11/19/2015	11192015-NEB-2	Table 2				a
CSO 019	2/3/2016	02032016-NEB-1	Table 2				a
	2/3/2016	02032016-NEB-LAB	Table 2				a
	2/3/2016	02032016-NEB-EB	Table 2			X	a
	2/3/2016	02032016-NEB-3	Table 2				a
	2/3/2016	02032016-NEB-3D	Table 2	X			a
	2/3/2016	02032016-NEB-2	Table 2				a
	2/3/2016	02032016-NEB-FB	Table 2		X		a
CSO 019	2/16/2016	02162016-NEB-1	Table 2				a
	2/16/2016	02162016-NEB-LD	Table 2				a
	2/16/2016	02162016-NEB-2	Table 2				a
	2/16/2016	02162016-NEB-2	Table 2				a
	2/16/2016	02162016-NEB-2D	Table 2	X			a
	2/16/2016	02162016-NEB-3	Table 2				a
	2/16/2016	02162016-NEB-FB	Table 2		X		a

Site	Date	Sample No	Analysis Method	Field Duplicate	Field Blank	Equipment Blank	Temperature Blank
				QC Samples			
CSO 027 & CSO 029	5/6/2016	05062016-027-EB	Table 2			X	a
	5/6/2016	05062016-027-1	Table 2				a
	5/6/2016	05062016-027-2	Table 2				a
	5/6/2016	05062016-029-1	Table 2				a
	5/6/2016	05062016-029-2	Table 2				a
	5/6/2016	05062016-FB	Table 2		X		a
	5/6/2016	05062016-029-LAB	Table 2				a

Note:

[a] One per Cooler

2.3 Data Qualifier Summary

Microbiological parameters which are analyzed outside of the 6 hour hold time are tabulated below. Note that the 24 hour hold time complies with Standard Methods, 20th Edition, Method 9060B for non-compliance purposes

Table 5. Data Qualifier Summary

Site	Date	Sample No	Analysis Method	Actual Hold Time (Hours)
CSO 019	6/01/2015	06012015-NEB-1	Fecal C (A1 Med)	20.4
	6/01/2015	06012015-NEB-2	Fecal C (A1 Med)	19.4
	6/01/2015	06012015-NEB-3	Fecal C (A1 Med)	18.4
	6/01/2015	06012015-NEB-4	Fecal C (A1 Med)	17.4
	6/01/2015	06012015-NEB-5	Fecal C (A1 Med)	16.4
	6/01/2015	06012015-NEB-6	Fecal C (A1 Med)	35.5
			Fecal C (EC Med)	35.6
			E.Coli (Quantitray)	35.3
			E.Coli (EC- Mug)	35.6
	6/01/2015	06012015-NEB-7	Fecal C (A1 Med)	34.9
			Fecal C (EC Med)	35.0
			E.Coli (Quantitray)	35.7
			E.Coli (EC- Mug)	35.0
	6/01/2015	06012015-NEB-8	Fecal C (A1 Med)	29.7
			Fecal C (EC Med)	30.2
			E.Coli (Quantitray)	29.5
			E.Coli (EC- Mug)	30.2

Appendix A Data Summary

Post Construction Monitoring- Phase I

CSO Overflow Sampling Summary

Row #	Sample ID		Sample Date (mm/dd/yy)	Laboratory Data (Analyzed By Martel)										DCCR QA/ QC- Remarks
				MPN/100 mL				mg/L	mg/L	mg/M3				
				SM 9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2				
				Fecal C. (A1 Med)	Fecal C. (EC-Med)	E. Coli (Quantitray)	E. Coli (EC-Mug)	TSS	CBOD5	Chlorophyll-a	Temp (°C)	pH	DO (mg/L)	
1	04202015-NEB-1	1	04/20/15	2,400	16,000	275,500	16,000	220	56	11	15.00	5.50	9.50	
2	04202015-NEB-2	2	04/20/15	16,000	16,000	118,700	16,000	190	32	29	15.00	5.78	8.76	
3	04202015-NEB-3	3	04/20/15	16,000	16,000	87,800	16,000	78	34	10	15.00	5.84	9.18	
4	04202015-NEB-4	4	04/20/15	16,000	16,000	231,000	16,000	46	24	8	15.00	5.83	7.84	
5	04202015-NEB-5	5	04/20/15	16,000	16,000	107,100	16,000	66	24	11	15.00	5.54	8.37	
6	04202015-NEB-5D	5-D	04/20/15	16,000	16,000	96,000	16,000	73	20	10	15.10	5.58	8.50	
7	06012015-NEB-1	1	06/01/15	79,000	33,000	65,700	22,000	240	62	13	25.31	6.55	-	DO instrument reported incorrect readings
8	06012015-NEB-2	2	06/01/15	490,000	23,000	22,800	13,000	140	25	10	24.73	7.22	-	
9	06012015-NEB-3	3	06/01/15	79,000	23,000	59,100	4,900	230	9	6	22.93	7.56	-	
10	06012015-NEB-4	4	06/01/15	33,000	31,000	26,200	23,000	190	16	6	23.13	7.50	-	
11	06012015-NEB-5	5	06/01/15	22,000	17,000	146,700	17,000	120	18	6	21.95	7.18	-	
12	06012015-NEB-5D	5-D	06/01/15	MP	MP	28,800	MP	110	10	40	21.95	7.18	-	Duplicate measurements for bacteria were not analyzed due to lab incident
13	06012015-NEB-6	6	06/02/15	23,000	7,000	78,900	4,600	47	18	8	21.58	7.52	-	
14	06022015-NEB-7	7	06/02/15	28,000	13,000	18,700	4,900	36	5	6	21.65	7.68	-	
15	06022015-NEB-8	8	06/02/15	7,000	23,000	38,400	2,800	42	2	6	21.65	7.68	-	
16	09292015-NEB-1	1	09/29/15		94,000		70,000	130	67	14	23.84	5.84	5.96	
17	09292015-NEB-2	2	09/29/15		94,000		21,000	95	10	6	23.50	6.30	6.50	
18	09292015-NEB-3	3	09/29/15		49,000		22,000	120	10	6	23.20	6.64	7.00	
19	09292015-NEB-3D	3-D	09/29/15		23,000		23,000	85	7	6	23.20	6.64	7.00	Martel verified the TSS duplicate value
20	11192015-NEB-1	1	11/19/15		17,000		13,000	150	59	12	18.38	6.39	4.03	
21	11192015-NEB-1D	1-D	11/19/15		23,000		23,000	150	70	11	18.60	6.39	4.37	
22	11192015-NEB-2	2	11/19/15		79,000		4,900	160	38	17	18.40	4.69	5.70	
23	02032016 - NEB - 1	1	02/03/16	49,000	490,000	2,419,600	220,000	1,100	94	20	6.71	7.19	12.74	Martel verified the TSS reading
24	02032016 - NEB - 2	2	02/03/16	79,000	130,000	60,900	130,000	140	13	16	6.77	7.11	12.64	
25	02032016 - NEB - 3	3	02/03/16	79,000	79,000	108,100	79,000	120	12	11	6.75	7.24	12.71	
26	02032016 - NEB - 3D	3-D	02/03/16		49,000		33,000	120	12	13	6.71	7.19	12.74	
27	02032016 - NEB - LAB		02/03/16		170,000		130,000							
28	02032016 - NEB - FB		02/03/16		1		1	1	2	6				
29	02032016 - NEB - EB		02/03/16		1		1	1	2	6				
30	02162016 - NEB - 1	1	02/16/16	280,000	170,000	387,300	110,000	210	41	6	6.77	7.29	12.94	
31	02162016 - NEB - 2	2	02/16/16	130,000	79,000	122,300	79,000	270	17	17	6.36	7.70	12.97	
32	02162016 - NEB - 2D	2D	02/16/16		79,000		49,000	290	20	12	6.77	7.29	12.97	
33	02162016 - NEB - 3	3	02/16/16	130,000	110,000	124,600	70,000	210	33	15	6.36	7.70	12.93	
34	02162016 - NEB - LD		02/16/16		460,000		460,000							

Row #	Sample ID		Sample Date (mm/dd/yy)	Laboratory Data (Analyzed By Martel)										DCCR QA/ QC- Remarks
				MPN/100 mL				mg/L	mg/L	mg/M3				
				SM 9221E-06	SM 9221E-06	SM9223 B-04	SM 9221F	SM 2540D	SM 5210 B-00	10200H2				
	Sample ID			Fecal C. (A1 Med)	Fecal C. (EC-Med)	E. Coli (Quantitray)	E. Coli (EC-Mug)	TSS	CBOD5	Chlorophyll-a	Temp (°C)	pH	DO (mg/L)	
35	02162016 - NEB - EB		02/16/16		1		1	3	2	6				
36	02162016 - NEB - FB		02/16/16		1		1	1	2	6				
37	05062016 - 027 - 1	1	05/06/16	17,000	130,000	93,200	130,000	27	24	15	13.98	7.14	10.53	
38	05062016 - 027 - 2	2	05/06/16	130,000	230,000	218,700	230,000	38	25	17	13.90	7.01	10.47	
39	05062016 - 027 - EB		05/06/16		2		2	1	2	6				
40	05062016 - 029 - 1	1	05/06/16	130,000	49,000	142,100	49,000	82	19	28	14.18	7.73	11.81	
41	05062016 - 029 - 2	2	05/06/16	79,000	130,000	137,400	130,000	130	17	36	14.08	6.71	10.55	
42	05062016 - 029 - LAB		05/06/16		170,000		110,000							
43	05062016 - FB		05/06/16		1		1	1	2	6				

Note:
Sampling analytical testing conducted by Martel Laboratories, Inc
MP = Measurement Problem/ Instrument Malfunction
Not included in scope

Appendix B Laboratory Reported Results & Chain of Custody Forms

MARTEL

D.C. Water and Sewer

Friday, May 8, 2015

5000 Overlook Ave. SW
Washington, DC 200325394

Attention: Ram Jeedigunta

Certificate of Analysis

FINAL

Report for Lab No: 20697.
Samples picked up by Martel.
Project Identification: CSO Sampling for PCM- Phase I, 4/20/15.

Samples analyzed according to method requirements and QC exceptions available.

MARTEL NO. 20697 000001 — CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-1 — Sample Date/Time: 04/20/2015 01:35

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	56	mg/l	SM 5210 B-00	2	04/20/2015 16:21 IHS
Solids (Suspended)	220	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	11	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	16000	mpn/100ml	SM 9221F	1	04/20/2015 08:15 JW
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 08:15 JW
MPN Fecal Coliforms (A1)	2400	mpn/100ml	SM 9221 E-06	2	04/20/2015 08:30 JW
Escherichia Coli, Quantitray	275500	mpn/100ml	SM 9223 B-04	1	04/20/2015 08:35 JW

MARTEL NO. 20697 000002 — CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-2 — Sample Date/Time: 04/20/2015 02:35

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	32	mg/l	SM 5210 B-00	2	04/20/2015 16:25 IHS
Solids (Suspended)	190	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	29	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	>=16000	mpn/100ml	SM 9221F	1	04/20/2015 08:15 JW
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 08:15 JW
MPN Fecal Coliforms (A1)	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 08:30 JW
Escherichia Coli, Quantitray	118700	mpn/100ml	SM 9223 B-04	1	04/20/2015 08:35 JW

MARTEL NO. 20697 000003 — CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-3 — Sample Date/Time: 04/20/2015 03:35

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	34	mg/l	SM 5210 B-00	2	04/20/2015 16:30 IHS
Solids (Suspended)	78	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	10	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	16000	mpn/100ml	SM 9221F	1	04/20/2015 09:40 MA
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:40 MA
MPN Fecal Coliforms (A1)	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:27 MA
Escherichia Coli, Quantitray	87800	mpn/100ml	SM 9223 B-04	1	04/20/2015 09:56 MA

MARTEL NO. 20697 000004 | CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-4 | Sample Date/Time: 04/20/2015 04:35

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	24	mg/l	SM 5210 B-00	2	04/20/2015 16:40 IHS
Solids (Suspended)	46	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	8	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	>=16000	mpn/100ml	SM 9221F	1	04/20/2015 09:40 MA
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:40 MA
MPN Fecal Coliforms (A1)	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:27 MA
Escherichia Coli, Quantitray	231000	mpn/100ml	SM 9223 B-04	1	04/20/2015 09:56 MA

MARTEL NO. 20697 000005 | CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-5 | Sample Date/Time: 04/20/2015 05:30

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	24	mg/l	SM 5210 B-00	2	04/20/2015 16:45 IHS
Solids (Suspended)	66	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	11	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	>=16000	mpn/100ml	SM 9221F	1	04/20/2015 09:40 MA
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:40 MA
MPN Fecal Coliforms (A1)	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:27 MA
Escherichia Coli, Quantitray	107100	mpn/100ml	SM 9223 B-04	1	04/20/2015 09:56 MA

MARTEL NO. 20697 000006 | CLIENT SAMPLE IDENTIFICATION: 04202015-NEB-5D | Sample Date/Time: 04/20/2015 05:30

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	20	mg/l	SM 5210 B-00	2	04/20/2015 16:50 IHS
Solids (Suspended)	73	mg/l	SM 2540 D-97	1	04/24/2015 11:25 CB
Chlorophyll (a)	10	mg/m3	SM 10200H2	6	04/29/2015 16:05 BMC
Escherichia coli	>=16000	mpn/100ml	SM 9221F	1	04/20/2015 09:40 MA
MPN Fecal Coliforms	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:40 MA
MPN Fecal Coliforms (A1)	>=16000	mpn/100ml	SM 9221 E-06	2	04/20/2015 09:27 MA
Escherichia Coli, Quantitray	96000	mpn/100ml	SM 9223 B-04	1	04/20/2015 09:56 MA

Martel Laboratories *JDS* **Inc.**

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

APR30L0

DCDPW

Notes and references:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

Extended dilutons were peformed on all samples for bacteria. However, a further extension is required for methods 9221 E and 9221 F. The additional extension will raise upper limit to 160,000 mpn/100ml. Method 9223 B has a higher range when diluted (up to 2,420,000 mpn/100ml). Presence of E. coli by this method on these samples indicate that one dilution for 9221 may be insufficient.

All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

D.C. Water and Sewer

Friday, May 8, 2015

5000 Overlook Ave. SW
Washington, DC 200325394

Report Attachment

Report for Lab No: 20697.
Samples picked up by Martel.
Project Identification: CSO Sampling for PCM- Phase I, 4/20/15.

Samples were filtered for chlorophyll-a analysis on:
20697 - 4/20/15 @ 11:45

20697-Pg 1 of 6

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEEDIGUNTA, 202-787-4724)

Client Address 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM - PHASE I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-1	CSO	HDPE / NONE	N	1	04/20/15	1:35 AM	$CBOD_5$
	SS-04202015-NEB-1	CSO	HDPE / NONE	N	1	04/20/15	1:35 AM	TSS
	CHLOROA-04202015-NEB-1	CSO	AMBER BOTTLE/NONE	N	1	04/20/15	1:35 AM	CHLOROPHYLL-A
	ECOLI Q-04202015-NEB-1	CSO	POP TOP / SOD. THIO	N	1	04/20/15	1:35 AM	ECOLI Q-ENZYME
	FECALA-04202015-NEB-1	CSO	POP TOP / SOD. THIO	N	1	04/20/15	1:35 AM	FECAL - A1 MEDIA
	ECOLI-04202015-NEB-1	CSO	POP TOP / SOD. THIO	N	1	04/20/15	1:35 AM	ECOLI - EC MUG
	FECAL-04202015-NEB-1	CSO	POP TOP / SOD. THIO			04/20/15	1:35 AM	FECAL - EC MED

Transferred by:	Received by:	Date	Time
Transferred by:	Received by:	04/20/15	0830
Transferred by:	Received by:	4/20/15	0750
		Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 3.0

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: AYE Date: 4/20/15

20697 2of6

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEEDIGUNTA, 202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM-PHASE I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-2	CSO	HDPE / NONE		1	04/20/15	2:35 AM	CBODs
	SS-04202015-NEB-2	CSO	HDPE / NONE		1	04/20/15	2:35 AM	TSS
	CHLOROA-04202015-NEB-2	CSO	AMBER / NONE		1	04/20/15	2:35 AM	CHLOROPHYLL-A
	ECOLIQ-04202015-NEB-2	CSO	POP TOP / SOD. THIO		1	04/20/15	2:35AM	ECOLI Q-ENZYME
	FECALA-04202015-NEB-2	CSO	POP TOP / SOD. THIO		1	04/20/15	2:35AM	FECAL - AI MEDIA
	ECOLI-04202015-NEB-2	CSO	POP TOP/SOD. THIO		(1)	04/20/15	2:35 AM	ECOLI - EC MUG
	FECAL-04202015-NEB-2	CSO	POP TOP/SOD THIO			04/20/15	2:35 AM	FECAL-EC MED

Transferred by: Ram J.	Received by:	Date 04/20/15	Time 0630
Transferred by:	Received by:	Date 04/21/15	Time 0750
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 3.0

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: AZE Date: 4/20/15

20697: 3026

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEED/GUNA, 202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM-PHASE I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-3	CSO	HDPE / NONE		1	04/20/15	3:35 AM	CBODs
	SS-04202015-NEB-3	CSO	HDPE / NONE		1	04/20/15	3:35 AM	TSS
	CHLOROA-04202015-NEB-3	CSO	AMBER / NONE		1	04/20/15	3:35 AM	CHLOROPHYLL-A
	ECOLIQ-04202015-NEB-3	CSO	POP TOP / SOD. THIO		1	04/20/15	3:35 AM	ECOLI Q-ENZYME
	FECALA-04202015-NEB-3	CSO	POP TOP / SOD. THIO		1	04/20/15	3:35 AM	FECAL-A1 MEDIA
	ECOLI-04202015-NEB-3	CSO	POP TOP / SOD. THIO		(1)	04/20/15	3:35 AM	ECOLI-ECMUG
	FECAL-04202015-NEB-3	CSO	POP TOP / SOD THIO			04/20/15	3:35 AM	FECAL-EC MED

Transferred by: Ram J.	Received by:	Date 04/20/15	Time 0630
Transferred by:	Received by:	Date 4/20/15	Time 0752
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 3.0

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: VK Date: 4/20/15

20697 #1/10

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEED/GUNA, 202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM-PHASE I

Contract/P.O Number LTCP-429-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-4	CSO	HDPE/NONE		1	04/20/15	4:35 AM	CBODs
	SS-04202015-NEB-4	CSO	HDPE/NONE		1	04/20/15	4:35 AM	TSS
	CHLOROA-04202015-NEB-4	CSO	AMBER/NONE		1	04/20/15	4:35 AM	CHLOROPHYLL-A
	ECOLIG-04202015-NEB-4	CSO	POP TOP/SOD.THIO		1	04/20/15	4:35 AM	ECOLI G-ENZYME
	FECALA-04202015-NEB-4	CSO	POP TOP/SOD.THIO		1	04/20/15	4:35 AM	FECAL-AI MEDIA
	ECOLI-04202015-NEB-4	CSO	POP TOP/SOD.THIO		(1)	04/20/15	4:35 AM	ECOLI-EC MUG
	FECAL-04202015-NEB-4	CSO	POP TOP/SOD.THIO			04/20/15	4:35 AM	FECAL-EC MED

Transferred by:	Received by:	Date 04/20/15	Time 0630	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by:	Date 04/20/15	Time 0775	Sufficient ice? - (Yes)/No If No, temp.= 3.0
Transferred by:	Received by:	Date	Time	Sample containers pres'd? - (Yes)/No If No, explain
				Custody Seal present/intact? - Yes/No NA
				Initials: AYC Date: 4/20/15

20697 5070

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEED/GUNTA, 202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM-PHASE I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-S	CSO	HDPE / NONE		1	04/20/15	5:30 AM	CBODs
	SS-04202015-NEB-S	CSO	HDPE / NONE		1	04/20/15	5:30 AM	TSS
	CHLOROA-04202015-NEB-S	CSO	AMBER / NONE		1	04/20/15	5:30 AM	CHLOROPHYLL-A
	ECOLIQ-04202015-NEB-S	CSO	POP TOP / SOD. THIO		1	04/20/15	5:30 AM	ECOLI Q-ENZYME
	FECALA-04202015-NEB-S	CSO	POP TOP / SOD. THIO		1	04/20/15	5:30 AM	FECAL - AI MEDIA
	ECOLI-04202015-NEB-S	CSO	POP TOP / SOD. THIO		(1)	04/20/15	5:30 AM	ECOLI - EC MUG
	FECAL-04202015-NEB-S	CSO	POP TOP / SOD THIO			04/20/15	5:30 AM	FECAL - EC MED

Transferred by:	Received by:	Date 04/20/15	Time 0630
Transferred by:	Received by:	Date 04/21/15	Time 0750
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 3.0

Sample containers pres'd? - (Yes)/No If No, explain NA

Custody Seal present/intact? - Yes/No

Initials: aye Date: 4/20/15

20697-6MR

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 20697 Client Code

Client Name/Phone/FAX DCWATER (RAM JEEDIGUNTA, 202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ/GM

Project Name/# CSO SAMPLING for PCM-PHASE I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-04202015-NEB-SD	CSO	HDPE/NONE		1	04/20/15	5:30 AM	CBODs
	SS-04202015-NEB-SD	CSO	HDPE/NONE		1	04/20/15	5:30 AM	TSS
	CHLOROA-04202015-NEB-SD	CSO	AMBER/NONE		1	04/20/15	5:30 AM	CHLOROPHYLL-A
	ECOLIQ-04202015-NEB-SD	CSO	POP TOP/SOD.THIO		1	04/20/15	5:30 AM	ECOLI Q-ENZYME
	FECALA-04202015-NEB-SD	CSO	POP TOP/SOD.THIO		1	04/20/15	5:30 AM	FECAL-AI MEDIA
	ECOLI-04202015-NEB-SD	CSO	POP TOP/SOD.THIO		(1)	04/20/15	5:30 AM	ECOLI-EC MUG
	FECAL-04202015-NEB-SD	CSO	POP TOP/SOD.THIO			04/20/15	5:30 AM	FECAL-EC MED

Transferred by:	Received by:	Date 04/20/15	Time 0630
Transferred by:	Received by:	Date 04/21/15	Time 0720
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 3-0

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: aye Date: 4/20/15

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394
Attention: Ram Jeedigunta

Monday, June 22, 2015

Certificate of Analysis
FINAL

Report for Lab No: 21402, 21411, 21412, 21410.
Samples picked up by Martel.
P.O. Number: LTCP-420-2015-2
Project Identification: CSO Sampling for PCM Phase 1, 6/1-2/15.

Samples analyzed according to method requirements and QC exceptions available.

MARTEL NO. 21402 000001 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-1 — Sample Date/Time: 06/01/2015 17:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	62	mg/l	SM 5210 B-00	2	06/03/2015 16:15 IHS
Solids (Suspended)	240	mg/l	SM 2540 D-97	1	06/05/2015 15:10 CB
Chlorophyll (a)	13	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	65700	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW
MPN Fecal Coliforms (A1)	79000	mpn/100ml	SM 9221 E-06	2	06/02/2015 13:50 JCW
Escherichia coli	22000	mpn/100ml	SM 9221F	1	06/01/2015 23:00 JCW
MPN Fecal Coliforms	33000	mpn/100ml	SM 9221 E-06	2	06/01/2015 23:00 JCW

MARTEL NO. 21402 000002 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-2 — Sample Date/Time: 06/01/2015 18:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	25	mg/l	SM 5210 B-00	2	06/03/2015 16:17 IHS
Solids (Suspended)	140	mg/l	SM 2540 D-97	1	06/05/2015 15:10 CB
Chlorophyll (a)	10	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	22800	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW
MPN Fecal Coliforms (A1)	490000	mpn/100ml	SM 9221 E-06	2	06/02/2015 13:50 JCW
Escherichia coli	13000	mpn/100ml	SM 9221F	1	06/01/2015 23:00 JCW
MPN Fecal Coliforms	23000	mpn/100ml	SM 9221 E-06	2	06/01/2015 23:00 JCW

MARTEL NO. 21402 000003 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-3 — Sample Date/Time: 06/01/2015 19:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	9	mg/l	SM 5210 B-00	2	06/03/2015 16:20 IHS
Solids (Suspended)	230	mg/l	SM 2540 D-97	1	06/05/2015 15:10 CB
Chlorophyll (a)	<6	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	59100	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW
MPN Fecal Coliforms (A1)	79000	mpn/100ml	SM 9221 E-06	2	06/02/2015 13:50 JCW
Escherichia coli	4900	mpn/100ml	SM 9221F	1	06/01/2015 23:00 JCW
MPN Fecal Coliforms	23000	mpn/100ml	SM 9221 E-06	2	06/01/2015 23:00 JCW

MARTEL NO. 21402 000004 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-4 — Sample Date/Time: 06/01/2015 20:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	16	mg/l	SM 5210 B-00	2	06/03/2015 16:22 IHS
Solids (Suspended)	190	mg/l	SM 2540 D-97	1	06/08/2015 10:00 CB
Chlorophyll (a)	<6	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	26200	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW
MPN Fecal Coliforms (A1)	33000	mpn/100ml	SM 9221 E-06	2	06/02/2015 13:50 JCW
Escherichia coli	23000	mpn/100ml	SM 9221F	1	06/01/2015 23:00 JCW
MPN Fecal Coliforms	31000	mpn/100ml	SM 9221 E-06	2	06/01/2015 23:00 JCW

MARTEL NO. 21402 000005 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-5 — Sample Date/Time: 06/01/2015 21:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	18	mg/l	SM 5210 B-00	2	06/03/2015 16:25 IHS
Solids (Suspended)	120	mg/l	SM 2540 D-97	1	06/08/2015 11:10 CB
Chlorophyll (a)	<6	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	146700	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW
MPN Fecal Coliforms (A1)	22000	mpn/100ml	SM 9221 E-06	2	06/02/2015 13:50 JCW
Escherichia coli	17000	mpn/100ml	SM 9221F	1	06/01/2015 23:00 JCW
MPN Fecal Coliforms	17000	mpn/100ml	SM 9221 E-06	2	06/01/2015 23:00 JCW

MARTEL NO. 21402 000006 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-5D — Sample Date/Time: 06/01/2015 21:25

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	10	mg/l	SM 5210 B-00	2	06/03/2015 16:27 IHS
Solids (Suspended)	110	mg/l	SM 2540 D-97	1	06/08/2015 11:10 CB
Chlorophyll (a)	40	mg/m3	SM 10200H2	6	06/16/2015 11:55 BMC
Escherichia Coli, Quantitray	28800	mpn/100ml	SM 9223 B-04	1	06/01/2015 23:50 JCW

MARTEL NO. 21411 000001 — CLIENT SAMPLE IDENTIFICATION: 06012015-NEB-6 — Sample Date/Time: 06/02/2015 01:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	18	mg/l	SM 5210 B-00	2	06/03/2015 18:12 IHS
Solids (Suspended)	47	mg/l	SM 2540 D-97	1	06/09/2015 09:55 CB
Chlorophyll (a)	8	mg/m^3	SM 10200H2	6	06/18/2015 13:45 BMC
Escherichia Coli, Quantitray	78900*	mpn/100ml	SM 9223 B-04	1	06/03/2015 13:10 MA
MPN Fecal Coliforms (A1)	23000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 13:19 MA
Escherichia coli	4600*	mpn/100ml	SM 9221F	1	06/03/2015 13:28 MA
MPN Fecal Coliforms	7000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 13:28 MA

MARTEL NO. 21412 000001 — CLIENT SAMPLE IDENTIFICATION: 06022015-NEB-7 — Sample Date/Time: 06/02/2015 03:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial

MARTEL

Certificate of Analysis

MARTEL NO.		CLIENT SAMPLE IDENTIFICATION	Sample Date/Time
21412	000001	06022015-NEB-7	06/02/2015 03:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	5	mg/l	SM 5210 B-00	2	06/03/2015 18:15 IHS
Solids (Suspended)	36	mg/l	SM 2540 D-97	1	06/09/2015 09:55 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	06/18/2015 13:45 BMC
Escherichia Coli, Quantitray	18700*	mpn/100ml	SM 9223 B-04	1	06/03/2015 13:43 MA
MPN Fecal Coliforms (A1)	28000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 13:54 MA
Escherichia coli	4900*	mpn/100ml	SM 9221F	1	06/03/2015 14:00 MA
MPN Fecal Coliforms	13000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 14:00 MA

MARTEL NO.		CLIENT SAMPLE IDENTIFICATION	Sample Date/Time
21410	000001	06022015-NEB-8	06/02/2015 06:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	06/03/2015 18:10 IHS
Solids (Suspended)	42	mg/l	SM 2540 D-97	1	06/08/2015 14:55 CB
Chlorophyll (a)	6	mg/m^3	SM 10200H2	6	06/18/2015 13:45 BMC
Escherichia Coli, Quantitray	38400*	mpn/100ml	SM 9223 B-04	1	06/03/2015 12:19 MA
MPN Fecal Coliforms (A1)	7000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 12:29 MA
Escherichia coli	2800*	mpn/100ml	SM 9221F	1	06/03/2015 13:01 MA
MPN Fecal Coliforms	23000*	mpn/100ml	SM 9221 E-06	2	06/03/2015 13:01 MA

SMPLOG03

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

stddl.frx

Notes and references:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

*Samples analyzed out of holding time.

All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Monday, June 22, 2015

Report for Lab No: 21402, 21411, 21412, 21410.
Samples picked up by Martel.
P.O. Number: LTCP-420-2015-2
Project Identification: CSO Sampling for PCM Phase 1, 6/1-2/15.

Narrative Report

*	21402	000001	06012015-NEB-1	Solids (Suspended)

* - Indicates that the laboratory duplicate analysis was not within control limits.

*	21402	000001	06012015-NEB-1	Chlorophyll (a)

* - Indicates that the laboratory duplicate analysis was not within control limits.

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Monday, June 22, 2015

Report Attachment

Report for Lab No: 21402, 21411, 21412, 21410.
Samples picked up by Martel.
P.O. Number: LTCP-420-2015-2
Project Identification: CSO Sampling for PCM Phase 1, 6/1-2/15.

Samples were filtered for chlorophyll-a:

21402 - 6/2/15 @14:00
21410- 6/2/15 @ 14:08
21411- 6/2/15 @ 14:08
21412- 6/2/15 @ 14:08

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 21402 Client Code

Client Name/Phone/FAX DCwater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-1	CSO	HDPE Bottle / Noore		1	06/1/15	5:25PM	CBOD
	SS-06012015-NEB-1	CSO	HDPE Bottle / Noore		1	06/1/15	5:25PM	SS
	CHLORA-06012015-NEB-1	CSO	Amber Bottle		1	06/1/15	5:25PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-1	CSO	Pop Top / Sod. Thio		1	06/1/15	5:25PM	E Coli Q
	FECALA-06012015-NEB-1	CSO	Pop Top / Sod. Thio		1	06/1/15	5:25PM	Fecal A1 Medium
	ECOLI-06012015-NEB-1	CSO	Pop Top / Sod. Thio		1	06/1/15	5:25PM	E Coli - EC Mug
	FECAL-06012015-NEB-1	CSO	Pop Top / Sod. Thio		1	06/1/15	5:25PM	Fecal EC Medium

Transferred by:	Received by:	Date 6-1	Time 9:55
Transferred by:	Received by:	Date 6-1	Time 11:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 2.5

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: AJL Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 21402 **Client Code**

Client Name/Phone/FAX DCwater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-2	CSO	HDPE Bottle / Noor		1	06/1/15	6:25 PM	CBOD
	SS-06012015-NEB-2	CSO	HDPE Bottle / Noor		1	06/1/15	6:25PM	SS
	CHLORA-06012015-NEB-2	CSO	Amber Bottle		1	06/1/15	6:25 PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-2	CSO	Pop Top / Sod. Thio		1	06/1/15	6:25 PM	E Coli Q
	FECALA-06012015-NEB-2	CSO	Pop Top / Sod. Thio		1	06/1/15	6:25 PM	Fecal A1 Medium
	ECOLI-06012015-NEB-2	CSO	Pop Top / Sod. Thio	1	1	06/1/15	6:25 PM	E Coli - EC Mug
	FECAL-06012015-NEB-2	CSO	Pop Top / Sod. Thio			06/1/15	6:25 PM	Fecal EC Medium

Transferred by:	Received by:	Date 6-1	Time 9:45
Transferred by:	Received by:	Date 6-1	Time 11:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? (Yes)/No If No, temp.= 2.5

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: AJL Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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Client Name/Phone/FAX DCwater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-3	CSO	HDPE Bottle / Noor		1	06/1/15	7:25 PM	CBOD
	SS-06012015-NEB-3	CSO	HDPE Bottle / Noor		1	06/1/15	7:25 PM	SS
	CHLORA-06012015-NEB-3	CSO	Amber Bottle		1	06/1/15	7:25 PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-3	CSO	Pop Top / Sod. Thio		1	06/1/15	7:25 PM	E Coli Q
	FECALA-06012015-NEB-3	CSO	Pop Top / Sod. Thio		1	06/1/15	7:25 PM	Fecal A1 Medium
	ECOLI-06012015-NEB-3	CSO	Pop Top / Sod. Thio		1	06/1/15	7:25 PM	E coli - EC Mug
	FECAL-06012015-NEB-3	CSO	Pop Top / Sod. Thio		1	06/1/15	7:25 PM	Fecal EC Medium

3

Transferred by:	Received by:	Date 6-1	Time 9:45
Transferred by:	Received by:	Date 6-1	Time 11:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 2.5

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: RJC Date: 6/2/15

21402

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 21402 **Client Code**

Client Name/Phone/FAX DCwater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-4	CSO	HDPE Bottle / Noor		1	06/1/15	8:25 PM	CBOD
	SS-06012015-NEB-4	CSO	HDPE Bottle / Noor		1	06/1/15	8:25PM	SS
4	CHLORA-06012015-NEB-4	CSO	Amber Bottle		1	06/1/15	8:25 PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-4	CSO	Pop Top / Sod. Thio		1	06/1/15	8:25 PM	Ecoli Q
	FECALA-06012015-NEB-4	CSO	Pop Top / Sod. Thio		1	06/1/15	8:25 PM	Fecal A1 Medium
	ECOLI-06012015-NEB-4	CSO	Pop Top / Sod. Thio		1	06/1/15	8:25PM	Ecoli - EC Mug
	FECAL-06012015-NEB-4	CSO	Pop Top / Sod. Thio		1	06/1/15	8:25PM	Fecal EC Medium

Transferred by:	Received by:	Date 6-1	Time 9:45	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by:	Date 6-1	Time 11:20	Sufficient ice? (Yes)/No If No, temp.= 2.5
Transferred by:	Received by:	Date	Time	Sample containers pres'd? (Yes)/No If No, explain
				Custody Seal present/intact? - Yes/No NA
				Initials: aye Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 21402 **Client Code**

Client Name/Phone/FAX DCWater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-5	CSO	HDPE Bottle / Noor		1	06/1/15	9:25PM	CBOD
	SS-06012015-NEB-5	CSO	HDPE Bottle / Noor		1	06/1/15	9:25PM	SS
	CHLORA-06012015-NEB-5	CSO	Amber Bottle		1	06/1/15	9:25PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-5	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	E Coli Q
	FECALA-06012015-NEB-5	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	Fecal A1 Medium
	ECOLI-06012015-NEB-5	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	E Coli - EC Mug
	FECAL-06012015-NEB-5	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	Fecal EC Medium

5

Transferred by:	Received by:	Date 6-1	Time 9:45
Transferred by:	Received by:	Date 6-1	Time 11:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 2.5

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: aje Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

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MARTEL Log # 21402 **Client Code**

Client Name/Phone/FAX DCWater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-SD	CSO	HDPE Bottle / Noor		1	06/1/15	9:25PM	CBOD
	SS-06012015-NEB-SD	CSO	HDPE Bottle / Noor		1	06/1/15	9:25PM	SS
	CHLORA-06012015-NEB-SD	CSO	Amber Bottle		1	06/1/15	9:25PM	Chlorophyll-a
	ECOLIQ-06012015-NEB-SD	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	E Coli Q
	FECALA-06012015-NEB-SD	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	Fecal A1 Medium
	ECOLI-06012015-NEB-SD	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	E Coli - EC Mug
	FECAL-06012015-NEB-SD	CSO	Pop Top / Sod. Thio		1	06/1/15	9:25PM	Fecal EC Medium

Transferred by:	Received by:	Date 6-1	Time 9:45
Transferred by:	Received by:	Date 6-1	Time 11:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 2.5

Sample containers pres'd? (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: AYC Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 21411 Client Code

Client Name/Phone/FAX DCWater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06012015-NEB-6	CSO	HDPE Bottle / NOOR		1	06/2/15	1:50 AM	CBOD
	SS-06012015-NEB-6	CSO	HDPE Bottle / NOOR		1	06/2/15	1:50 AM	SS
	CHLOROA-06012015-NEB-6	CSO	Amber Bottle		1	06/2/15	1:50 AM	Chlorophyll-a
	ECOLIQ-06012015-NEB-6	CSO	Pop Top / Sod. Thio		1	06/2/15	1:50 AM	E Coli Q
	FECALA-06012015-NEB-6	CSO	Pop Top / Sod. Thio		1	06/2/15	1:50 AM	Fecal A1 Medium
	ECOLI-06012015-NEB-6	CSO	Pop Top / Sod. Thio		1	06/2/15	1:50 AM	E Coli - EC Mug
	FECAL-06012015-NEB-6	CSO	Pop Top / Sod. Thio		1	06/2/15	1:50 AM	Fecal EC Medium

Transferred by: Ramalinga Raju	Received by:	Date 6/2/15	Time 10:20
Transferred by:	Received by:	Date 6/2/15	Time 1116
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 2.0

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: TB Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 21412 **Client Code**

Client Name/Phone/FAX DCWater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RT / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06092015-NEB-T	CSO	HDPE Bottle / Noor		1	06/2/15	3:00 AM	CBOD
	SS-06092015-NEB-T	CSO	HDPE Bottle / Noor		1	06/2/15	3:00 AM	SS
	CHLOROA-06092015-NEB-T	CSO	Amber Bottle		1	06/2/15	3:00 AM	Chlorophyll-a
	ECOLIQ-06092015-NEB-T	CSO	Pop Top / Sod. Thio		1	06/2/15	3:00 AM	E Coli Q
	FECALA-06092015-NEB-T	CSO	Pop Top / Sod. Thio		1	06/2/15	3:00 AM	Fecal A1 Medium
	ECOLI-06092015-NEB-T	CSO	Pop Top / Sod. Thio		1	06/2/15	3:00 AM	E Coli - EC Mug
	FECAL-06092015-NEB-T	CSO	Pop Top / Sod. Thio		1	06/2/15	3:00 AM	Fecal EC Medium

Transferred by: Pamela Hedgepeth	Received by: C	Date 6/2/15	Time 10:20
Transferred by: C	Received by:	Date 6/2/15	Time 1116
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? Yes/No If No, temp.= 1.0

Sample containers pres'd? Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: CB Date: 6/2/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 21410 **Client Code**

Client Name/Phone/FAX DCWater / Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC

Invoice Address Same as ABOVE

Sampler RJ / GM

Project Name/# CSO Sampling for PCM - Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-06022015-NEB-8	CSO	HDPE Bottle / NOOR		1	06/2/15	3:50 AM	CBOD
	SS-06022015-NEB-8	CSO	HDPE Bottle / NOOR		1	06/2/15	3:50 AM	SS
	CHLORO A-06022015-NEB-8	CSO	Amber Bottle		1	06/2/15	3:50AM	Chlorophyll-a
	ECOLIQ-06022015-NEB-8	CSO	Pop Top / Sod. Thio		1	06/2/15	3:50AM	E Coli Q
	FECALA-06022015-NEB-8	CSO	Pop Top / Sod. Thio		1	06/2/15	3:50AM	Fecal A1 Medium
	ECOLI-06022015-NEB-8	CSO	Pop Top / Sod. Thio	~~1~~	(1)	06/2/15	3:50AM	E Coli - EC Mug
	FECAL-06022015-NEB-8	CSO	Pop Top / Sod. Thio			06/2/15	3:50AM	Fecal EC Medium

Transferred by: Ramakrishnan	Received by:	Date 6/2/15	Time 10:20
Transferred by:	Received by:	Date 6/2/15	Time 1116
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? ~~Yes~~/No If No, temp.= 2.0

Sample containers pres'd? ~~Yes~~/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: TB Date: 6/2/15

MARTEL

ESTABLISHED 1968

VELAP ID 460017

NELAP ACCREDITED TNI LABORATORY

Certificate of Analysis

Thursday, December 3, 2015

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Attention: Ram Jeedigunta

FINAL

Report for Lab No: 24045.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Identification: CSO Sampling for PCM Phase 1 - 11/19/15

MARTEL NO. 24045 000001 — CLIENT SAMPLE IDENTIFICATION: 11192015-NEB-1 — Sample Date/Time: 11/19/2015 14:40

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	59	mg/l	SM 5210 B-00	2	11/20/2015 18:28 BMC
Solids (Suspended)	150	mg/l	SM 2540 D-97	1	11/23/2015 12:10 CB
Chlorophyll (a)	12	mg/m^3	SM 10200H2	6	11/24/2015 09:50 BMC
Escherichia coli	13000	mpn/100ml	SM 9221F	1	11/19/2015 20:40 MA
MPN Fecal Coliforms	17000	mpn/100ml	SM 9221 E-06	2	11/19/2015 20:40 MA

MARTEL NO. 24045 000002 — CLIENT SAMPLE IDENTIFICATION: 11192015-NEB-1D — Sample Date/Time: 11/19/2015 14:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	70	mg/l	SM 5210 B-00	2	11/20/2015 18:32 BMC
Solids (Suspended)	150	mg/l	SM 2540 D-97	1	11/23/2015 12:10 CB
Chlorophyll (a)	11	mg/m^3	SM 10200H2	6	11/24/2015 09:50 BMC
Escherichia coli	23000	mpn/100ml	SM 9221F	1	11/19/2015 20:40 MA
MPN Fecal Coliforms	23000	mpn/100ml	SM 9221 E-06	2	11/19/2015 20:40 MA

MARTEL NO. 24045 000003 — CLIENT SAMPLE IDENTIFICATION: 11192015-NEB-2 — Sample Date/Time: 11/19/2015 15:15

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	38	mg/l	SM 5210 B-00	2	11/20/2015 18:36 BMC
Solids (Suspended)	160	mg/l	SM 2540 D-97	1	11/23/2015 12:10 CB
Chlorophyll (a)	17	mg/m^3	SM 10200H2	6	11/24/2015 09:50 BMC
Escherichia coli	4900	mpn/100ml	SM 9221F	1	11/19/2015 20:40 MA
MPN Fecal Coliforms	79000	mpn/100ml	SM 9221 E-06	2	11/19/2015 20:40 MA

MARTEL

Martel Laboratories *JDS* **Inc.**

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

DCDPW

All Procedures used are in accordance with the following methods:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

*Samples analyzed out of holding time.

As a NELAP accredited laboratory, Martel certifies that all applicable test results meet NELAC requirements.
All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 24045 Client Code

Client Name/Phone/FAX DCWATER / RAM J (202-787-4724)

Client Address 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ / GM

Project Name/# CSO SAMPLING for PCM - PHASE I

Contract/P.O Number LTCP-420-2015-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-11192015-NEB-1	CSO	HDPE BOTTLE/NONE		1	11/19/15	2:40PM	CBOD
	SS-11192015-NEB-1	CSO	HDPE BOTTLE/NONE		1	11/19/15	2:40PM	SS
	CHLOROA-11192015-NEB-1	CSO	AMBER BOTTLE		1	11/19/15	2:40PM	CHLOROPHYLL-A
	ECOLI-11192015-NEB-1	CSO	POPTOP/SOD. THIO		(1)	11/19/15	2:40PM	ECOLI-EC MUG
	FECAL-11192015-NEB-1	CSO	POP TOP / SOD. THIO			11/19/15	2:40PM	FECAL-EC MED
	ECOLI-11192015-NEB-1 FECAL-11192015-NEB-1	CSO	POP TOP/ SOD. THIO		(1)	11/19/15	2:40PM	LAB DUPLICATE
	ECOLI-11192015-NEB-1D FECAL-11192015-NEB-1D	CSO	POP TOP/SOD.THIO		(1)	11/19/15	2:45PM	BACTERIA DUPLICATES
	CBOD-11192015-NEB-1D	CSO	HDPE BOTTLE/NONE		1	11/19/15	2:45PM	CBOD
	SS-11192015-NEB-1D	CSO	HDPE BOTTLE/NONE		1	11/19/15	2:45PM	SS
	CHLOROA-11192015-NEB-1D	CSO	HDPE BOTTLE/NONE		1	11/19/15	2:45PM	CHLOROPHYLL-A

Transferred by:	Received by:	Date 11/19/15	Time 1655
Transferred by:	Received by: Mary Adelman	Date 11/19/15	Time 2016
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= -0.5°C

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: MA Date: 11/19/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 24045 Client Code

Client Name/Phone/FAX DCWATER / RAM J (202-787-4724)

Client Address 5000 OVERLOOK AVE SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ / GM

Project Name/# CSO SAMPLING for PCM - PHASE I

Contract/P.O Number LTCP-420-2016-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-11192015-NEB-9	CSO	HDPE BOTTLE/NONE		1	11/19/15	3:15PM	CBOD
	SS-11192015-NEB-9	CSO	HDPE BOTTLE/NONE		1	11/19/15	3:15PM	SS
	CHLORA-11192015-NEB-9	CSO	AMBER BOTTLE		1	11/19/15	3:15PM	CHLOROPHYLL-A
	ECOLI-11192015-NEB-9	CSO	POP TOP/STD. MH0		1	11/19/15	3:15PM	ECOLI-EC MUG
	FECAL-11192015-NEB-9	CSO	POP TOP/STD. MH0			11/19/15	3:15PM	FECAL-EC MED
	~~ECOLI-11192015-NEB~~ ~~FECAL-11192015-NEB~~							

Transferred by: Received by: Date 11/19/15 Time 1650

Transferred by: Received by: Mary Adelmann Date 11/19/15 Time 2016

Transferred by: Received by: Date Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= -0.5°C

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 11/19/15

MARTEL

ESTABLISHED 1968

VELAP ID 460017

Certificate of Analysis

Thursday, October 15, 2015

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Attention: Ram Jeedigunta

FINAL

Report for Lab No: 23271.
Samples picked up by Martel.
P.O. Number: LTCP-420-2015-2
Project Identification: CSO Sampling for PCM Phase 1, 9/30/15.

MARTEL NO. 23271 000001 — CLIENT SAMPLE IDENTIFICATION: 09292015-NEB-1 — Sample Date/Time: 09/29/2015 20:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	67	mg/l	SM 5210 B-00	2	09/30/2015 17:00 BMC
Solids (Suspended)	130	mg/l	SM 2540 D-97	1	10/02/2015 13:15 CB
Chlorophyll (a)	14	mg/m^3	SM 10200H2	6	10/12/2015 16:42 BMC
Escherichia coli	70000	mpn/100ml	SM 9221F	1	09/30/2015 03:22 MA
MPN Fecal Coliforms	94000	mpn/100ml	SM 9221 E-06	2	09/30/2015 03:22 MA

MARTEL NO. 23271 000002 — CLIENT SAMPLE IDENTIFICATION: 09292015-NEB-1 - Lab Duplicate — Sample Date/Time: 09/29/2015 20:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Escherichia coli	49000	mpn/100ml	SM 9221F	1	09/30/2015 03:22 MA
MPN Fecal Coliforms	49000	mpn/100ml	SM 9221 E-06	2	09/30/2015 03:22 MA

MARTEL NO. 23271 000003 — CLIENT SAMPLE IDENTIFICATION: 09292015-NEB-2 — Sample Date/Time: 09/29/2015 21:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<10	mg/l	SM 5210 B-00	10	09/30/2015 17:04 BMC
Solids (Suspended)	95	mg/l	SM 2540 D-97	1	10/02/2015 13:15 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	10/12/2015 16:42 BMC
Escherichia coli	21000	mpn/100ml	SM 9221F	1	09/30/2015 03:22 MA
MPN Fecal Coliforms	94000	mpn/100ml	SM 9221 E-06	2	09/30/2015 03:22 MA

MARTEL NO. 23271 000004 — CLIENT SAMPLE IDENTIFICATION: 09292015-NEB-3D — Sample Date/Time: 09/29/2015 22:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	7	mg/l	SM 5210 B-00	2	09/30/2015 17:07 BMC
Solids (Suspended)	85	mg/l	SM 2540 D-97	1	10/02/2015 13:15 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	10/12/2015 16:42 BMC
Escherichia coli	23000	mpn/100ml	SM 9221F	1	09/30/2015 03:22 MA
MPN Fecal Coliforms	23000	mpn/100ml	SM 9221 E-06	2	09/30/2015 03:22 MA

MARTEL

MARTEL NO.		CLIENT SAMPLE IDENTIFICATION	Sample Date/Time
23271	000005	09292015-NEB-3	09/29/2015 22:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	10	mg/l	SM 5210 B-00	2	09/30/2015 17:10 BMC
Solids (Suspended)	120	mg/l	SM 2540 D-97	1	10/02/2015 13:15 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	10/12/2015 16:42 BMC
Escherichia coli	22000	mpn/100ml	SM 9221F	1	09/30/2015 03:22 MA
MPN Fecal Coliforms	49000	mpn/100ml	SM 9221 E-06	2	09/30/2015 03:22 MA

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

All Procedures used are in accordance with the following methods:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

As a NELAP accredited laboratory, Martel certifies that all applicable test results meet NELAC requirements.
All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Thursday, October 15, 2015

Report Attachment

Report for Lab No: 23271.
Samples picked up by Martel.
P.O. Number: LTCP-420-2015-2
Project Identification: CSO Sampling for PCM Phase 1, 9/30/15.

Samples were filtered for chlorophyll-a:
23256 - 9/28/15 @17:00
23271 - 9/30/15 @16:15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 23271 **Client Code**

Client Name/Phone/FAX: DCWATER / RAM J (202-787-4724)

Client Address: 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address: SAME AS ABOVE

Sampler: RJ / GMG

Project Name/#: CSO SAMPLING for PCM-Phase I

Contract/P.O Number: LTCP-420-2015-2

Sample Turnaround Time:

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-09292015-NEB-1	CSO	HDPE BOTTLE/NONE		1	09/29/15	8:45PM	CBOD
	SS-09292015-NEB-1	CSO	HDPE BOTTLE/NONE		1	09/29/15	8:45PM	SS
	CHLORDA-09292015-NEB-1	CSO	AMBER BOTTLE		1	09/29/15	8:45PM	CHLOROPHYLL-A
	ECOLI-09292015-NEB-1	CSO	POP TOP/SOD. THIO		1	09/29/15	8:45PM	ECOLI - EC MUG
	FECAL-09292015-NEB-1	CSO	POP TOP/SOD. THIO		1	09/29/15	8:45PM	FECAL - EC MED
	ECOLI-09292015-NEB-1 FECAL-09292015-NEB-1	CSO	POP TOP/SOD. THIO		1	09/29/15	8:45PM	LAB DUPLICATE

Transferred by:	Received by:	Date 9-30	Time 12:00
Transferred by:	Received by: Mary Adelman	Date 9-30	Time 15:00
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 0.5°C

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: MA Date: 9/30/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 23271 **Client Code**

Client Name/Phone/FAX DCWATER / RAM J (202-787-4724)

Client Address 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ / GMG

Project Name/# CSO SAMPLING for PCM-Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-09292015-NEB-2	CSO	HDPE BOTTLE/NONE		1	09/29/15	9:45PM	CBOD
	SS-09292015-NEB-2	CSO	HDPE BOTTLE/NONE		1	09/29/15	9:45PM	SS
	CHLOROA-09292015-NEB-2	CSO	AMBER BOTTLE		1	09/29/15	9:45PM	CHLOROPHYLL-A
	ECOLI-09292015-NEB-2	CSO	POP TOP/SOD. THIO		1	09/29/15	9:45PM	ECOLI - EC MUG
	FECAL-09292015-NEB-2	CSO	POP TOP/SOD. THIO			09/29/15	9:45PM	FECAL - EC MED

Transferred by:	Received by:	Date 9:30	Time 12:00
Transferred by:	Received by: Mary Adelman	Date 9-30	Time 8:00
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - (Yes)/No If No, temp.= 0.5°C

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: MA Date: 9/30/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 23271 **Client Code**

Client Name/Phone/FAX: DCWATER / RAM J (202-787-4724)

Client Address: 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address: SAME AS ABOVE

Sampler: RJ / GM

Project Name/#: CSO SAMPLING for PCM-Phase I

Contract/P.O Number: LTCP-420-2015-2

Sample Turnaround Time:

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-09292015-NEB-3D	CSO	HDPE BOTTLE/NONE		1	09/29/15	10:45pm	CBOD
	SS-09292015-NEB-3D	CSO	HDPE BOTTLE/NONE		1	09/29/15	10:45pm	SS
	CHLOROA-09292015-NEB-3D	CSO	AMBER BOTTLE		1	09/29/15	10:45pm	CHLOROPHYLL-A
	ECOLI-09292015-NEB-3D	CSO	POP TOP/SOD. THIO		(1)	09/29/15	10:45pm	ECOLI - EC MUG
	FECAL-09292015-NEB-3D	CSO	POP TOP/SOD. THIO			09/29/15	10:45pm	FECAL - EC MED

Transferred by:	Received by:	Date 9.30	Time 12:00	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by: Mary Adelman	Date 9:30	Time 1:00	Sufficient ice? - (Yes)/No If No, temp.= 0.5°C
Transferred by:	Received by:	Date	Time	Sample containers pres'd? - (Yes)/No If No, explain
				Custody Seal present/intact? - Yes/No NA
				Initials: MA Date: 9/30/15

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 23271 **Client Code** _____

Client Name/Phone/FAX DCWATER / RAM J (202-787-4726)

Client Address 5000 OVERLOOK AVE, SW, WASHINGTON, DC

Invoice Address SAME AS ABOVE

Sampler RJ / GM

Project Name/# CSO SAMPLING for PCM-Phase I

Contract/P.O Number LTCP-420-2015-2

Sample Turnaround Time _____

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-09292015-NEB-3	CSO	HDPE BOTTLE/NONE		1	09/29/15	10:45 pm	CBOD
	SS-09292015-NEB-3	CSO	HDPE BOTTLE/NONE		1	09/29/15	10:45pm	SS
	CHLOROA-09292015-NEB-3	CSO	AMBER BOTTLE		1	09/29/15	10:45 pm	CHLOROPHYLL-A
	ECOLI-09292015-NEB-3	CSO	POP TOP/SOD. THIO		1	09/29/15	10:45pm	ECOLI - EC MUG
	FECAL-09292015-NEB-3	CSO	POP TOP/SOD. THIO		1	09/29/15	10:45 pm	FECAL - EC MED

Transferred by:	Received by:	Date 9:30	Time 12:00
Transferred by:	Received by:	Date 9:30	Time 1:00
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 0.5c

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: MA Date: 9/30/15

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394
Attention: Ram Jeedigunta

Thursday, February 18, 2016

Certificate of Analysis
FINAL

Report for Lab No: 24944.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Identification: CSO Sampling for PCM Phase 1 - 02/03/16

Samples analyzed according to method requirements and QC exceptions available.

MARTEL NO. 24944 000001 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - 1 — Sample Date/Time: 02/03/2016 13:40

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	94	mg/l	SM 5210 B-00	2	02/04/2016 17:10 BMC
Solids (Suspended)	1100	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB
Chlorophyll (a)	20	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	220000	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	490000	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA
Escherichia Coli, Quantitray	>=2419600	mpn/100ml	SM Coliler MPN	1	02/03/2016 19:54 MA
MPN Fecal Coliforms (A1)	49000	mpn/100ml	SM 9221 E-06	2	02/03/2016 19:44 MA

MARTEL NO. 24944 000002 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - LAB — Sample Date/Time: 02/03/2016 13:40

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Escherichia coli	130000	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	170000	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA

MARTEL NO. 24944 000003 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - EB — Sample Date/Time: 02/03/2016 13:30

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	02/04/2016 17:14 BMC
Solids (Suspended)	<1	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	<1	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	<1	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA

MARTEL NO. 24944 000004 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - 3 — Sample Date/Time: 02/03/2016 14:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	12	mg/l	SM 5210 B-00	2	02/04/2016 17:21 BMC
Solids (Suspended)	120	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB

MARTEL NO. 24944 000004 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - 3 — Sample Date/Time: 02/03/2016 14:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Chlorophyll (a)	11	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	79000	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	79000	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA
Escherichia Coli, Quantitray	108100	mpn/100ml	SM Coliler MPN	1	02/03/2016 19:54 MA
MPN Fecal Coliforms (A1)	79000	mpn/100ml	SM 9221 E-06	2	02/03/2016 19:44 MA

MARTEL NO. 24944 000005 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - 3D — Sample Date/Time: 02/03/2016 14:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	12	mg/l	SM 5210 B-00	2	02/04/2016 17:25 BMC
Solids (Suspended)	120	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB
Chlorophyll (a)	13	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	33000	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	49000	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA

MARTEL NO. 24944 000006 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - 2 — Sample Date/Time: 02/03/2016 14:15

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	13	mg/l	SM 5210 B-00	2	02/04/2016 17:28 BMC
Solids (Suspended)	140	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB
Chlorophyll (a)	16	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	130000	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	130000	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA
Escherichia Coli, Quantitray	60900	mpn/100ml	SM Coliler MPN	1	02/03/2016 19:54 MA
MPN Fecal Coliforms (A1)	79000	mpn/100ml	SM 9221 E-06	2	02/03/2016 19:44 MA

MARTEL NO. 24944 000007 — CLIENT SAMPLE IDENTIFICATION: 02032016 - NEB - FB — Sample Date/Time: 02/03/2016 14:15

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	02/04/2016 17:31 BMC
Solids (Suspended)	<1	mg/l	SM 2540 D-97	1	02/09/2016 10:30 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	02/16/2016 13:53 BMC
Escherichia coli	<1	mpn/100ml	SM 9221F	1	02/03/2016 20:25 MA
MPN Fecal Coliforms	<1	mpn/100ml	SM 9221 E-06	2	02/03/2016 20:25 MA

Martel Laboratories *JDS* **Inc.**

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

SMPLOG03

DCDPW

Notes and references:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

*Samples analyzed out of holding time.

All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Thursday, February 18, 2016

Report for Lab No: 24944.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Identification: CSO Sampling for PCM Phase 1 - 02/03/16

Narrative Report

G	24944	000003	02032016 - NEB - EB	Solids (Suspended)

G - Volume less than 1000 ml or residue less than 2.5 mg.

G	24944	000007	02032016 - NEB - FB	Solids (Suspended)

G - Volume less than 1000 ml or residue less than 2.5 mg.

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 24944 Client Code DCDPW

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number ___ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
✓	CBOD-02032016 -NEB-[redacted]1	CSO	HDPE BOTTLE/ NONE		1	2/3/16	1:40PM	CBOD
✓	SS-02032016 -NEB-[redacted]1	CSO	HDPE BOTTLE/ NONE		1	2/3/16	1:40pm	SS
✓	CHLOROA- 02032016-NEB-[redacted]1	CSO	AMBER BOTTLE/ NONE		1	2/3/16	1:40pm	CHLOROPHYLL-A
✓	ECOLI-02032016 -NEB-[redacted]1	CSO	POP TOP/ SOD. THIO.		1	2/3/16	1:40pm	ECOLI- EC MUG
✓	FECAL-02032016 -NEB-[redacted]1	CSO	POP TOP/ SOD. THIO.			2/3/16	1:40pm	FECAL- EC MED
✓	ECOLIQ-02032016 -NEB-1	CSO	POP TOP/ SOD. THIO.		1	2/3/16	1:40pm	ECOLI- QUANTITRAY
✓	FECALA-02032016 -NEB-1	CSO	POP TOP/ SOD. THIO.		1	2/3/16	1:40pm	FECAL- A1 MED
✓	ECOLI-02032016 -NEB-LAB	CSO	POP TOP/ SOD. THIO.		1	2/3/16	1:40pm	LAB DUPLICATE (EC-MUG)
✓	FECAL-02032016 -NEB-LAB	CSO	POP TOP/ SOD. THIO.			2/3/16	1:40pm	LAB DUPLICATE (EC-MED)
✓	ECOLI-02032016-NEB- EB	DI	POP TOP/ SOD. THIO.		1	2/3/2016	1:30pm	EQUIPMENT BLANK (EC-MUG)
✓	FECAL-02032016-NEB- EB	DI	POP TOP/ SOD. THIO.		1	2/3/2016	1:30pm	EQUIPMENT BLANK (EC-MED)
✓	CBOD-02032016-NEB - EB	DI	HDPE BOTTLE/ NONE		1	2/3/2016	1:30pm	EQUIPMENT BLANK
✓	SS- 02032016-NEB - EB	DI	HDPE BOTTLE/ NONE		1	2/3/2016	1:30pm	EQUIPMENT BLANK
✓	CHLOROA-02032016-NEB-EB	DI	AMBER BOTTLE/ NONE		1	2/3/2016	1:30PM	EQUIPMENT BLANK

Transferred by: [signature]	Received by: [signature]	Date 2-3	Time 5:48	Cooler Receipt Information
Transferred by: [signature]	Received by: Mary Adelman	Date 2-3	Time 7:20	Sufficient ice? - (Yes)/No If No, temp.= -1.5°C Sample containers pres'd? - (Yes)/No If No, explain Custody Seal present/intact? - Yes/No
Transferred by:	Received by:	Date	Time	Initials: MA Date: 2/3/16

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 24944 Client Code

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number ___ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
✓	CBOD- 02032016 -NEB-3	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:50 pm	CBOD
✓	SS- 02032016 -NEB-3	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:50 pm	SS
✓	CHLOROA-02032016-NEB-3	CSO	AMBER BOTTLE/ NONE		1	2/3/16	2:50 pm	CHLOROPHYLL-A
✓	ECOLI-02032016 -NEB-3	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:50 pm	ECOLI- EC MUG
✓	FECAL-02032016 -NEB- 3	CSO	POP TOP/ SOD. THIO.			2/3/16	2:50 pm	FECAL- EC MED
✓	ECOLIQ-02032016-NEB-3	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:50 pm	ECOLI- QUANTITRAY
✓	FECALA-02032016-NEB-3	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:50 pm	FECAL- A1 MED
✓	ECOLI- 02032016 -NEB-3D	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:50 pm	FIELD DUPLICATE (EC-MUG)
✓	FECAL- 02032016 -NEB-3 D	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:50 pm	FIELD DUPLICATE (EC-MED)
✓	CBOD-02032016 -NEB -3 D	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:50 pm	FIELD DUPLICATE
✓	SS- 02032016 -NEB -3 D	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:50 pm	FIELD DUPLICATE
✓	CHLOROA-02032016-NEB 3D	CSO	AMBER BOTTLE/ NONE		1	2/3/16	2:50 pm	FIELD DUPLICATE

Transferred by:	Received by:	Date 2-3	Time 5:10
Transferred by:	Received by: Mary Adelman	Date 2-3	Time 7:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information

Sufficient ice? (Yes/No) If No, temp.= 1.5°C

Sample containers pres'd? (Yes/No) If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 2/3/16

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 24944 Client Code

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number ___ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
✓	CBOD- 02032016 -NEB- 2	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:15 pm	CBOD
✓	SS-02032016 -NEB- 2	CSO	HDPE BOTTLE/ NONE		1	2/3/16	2:15pm	SS
✓	CHLOROA- 02032016 -NEB- 2	CSO	AMBER BOTTLE/ NONE		1	2/3/16	2:15pm	CHLOROPHYLL-A
✓	ECOLI- 02032016 -NEB- 2	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:15pm	ECOLI- EC MUG
✓	FECAL- 02032016 -NEB- 2	CSO	POP TOP/ SOD. THIO.			2/3/16	2:15pm	FECAL- EC MED
✓	ECOLIQ- 02032016 -NEB- 2	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:15pm	ECOLI- QUANTITRAY
✓	FECALA- 02032016 -NEB- 2	CSO	POP TOP/ SOD. THIO.		1	2/3/16	2:15 pm	FECAL- A1 MED
✓	ECOLI- 02032016 -NEB- FB	DI	POP TOP/ SOD. THIO.		1	2/3/16	2:15 pm	FIELD BLANK (EC-MUG)
✓	FECAL- 02032016 -NEB- FB	DI	POP TOP/ SOD. THIO.		1	2/3/16	2:15 pm	FIELD BLANK (EC-MED)
✓	CBOD- 02032016 -NEB - FB	DI	HDPE BOTTLE/ NONE		1	2/3/16	2:15pm	FIELD BLANK
✓	SS- 02032016 -NEB - FB	DI	HDPE BOTTLE/ NONE		1	2/3/16	2:15pm	FIELD BLANK
✓	CHLOROA- 02032016 NEB-FB	DI	AMBER BOTTLE/ NONE		1	2/3/16	2:15pm	FIELD BLANK

Transferred by:	Received by:	Date 2/3	Time 5:40
Transferred by:	Received by: Mary Adelman	Date 2-3	Time 7:20
Transferred by:	Received by:	Date	Time

Cooler Receipt Information

Sufficient ice? - Yes/No If No, temp.= 1.5°C

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 2/3/16

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394
Attention: Ram Jeedigunta

Wednesday, March 2, 2016

Certificate of Analysis
FINAL

Report for Lab No: 25114.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Identification: CSO Sampling for PCM Phase 1 - 02/16/16

Samples analyzed according to method requirements and QC exceptions available.

MARTEL NO. 25114 000001 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - 1 — Sample Date/Time: 02/16/2016 09:10

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	41	mg/l	SM 5210 B-00	2	02/17/2016 15:05 BMC
Solids (Suspended)	210	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB
Chlorophyll (a)	6	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	110000	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	170000	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA
Escherichia Coli, Quantitray	387300	mpn/100ml	SM Coliler MPN	1	02/16/2016 14:34 MA
MPN Fecal Coliforms (A1)	280000	mpn/100ml	SM 9221 E-06	2	02/16/2016 14:20 MA

MARTEL NO. 25114 000002 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - LD — Sample Date/Time: 02/16/2016 09:10

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Escherichia coli	460000	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	460000	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA

MARTEL NO. 25114 000003 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - EB — Sample Date/Time: 02/16/2016 09:10

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	02/17/2016 15:15 BMC
Solids (Suspended)	3	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	<1	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	<1	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA

MARTEL NO. 25114 000004 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - 2 — Sample Date/Time: 02/16/2016 10:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	17	mg/l	SM 5210 B-00	2	02/17/2016 15:18 BMC
Solids (Suspended)	270	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB

MARTEL NO. 25114 000004 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - 2 — Sample Date/Time: 02/16/2016 10:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Chlorophyll (a)	17	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	79000	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	79000	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA
Escherichia Coli, Quantitray	122300	mpn/100ml	SM Coliler MPN	1	02/16/2016 14:34 MA
MPN Fecal Coliforms (A1)	130000	mpn/100ml	SM 9221 E-06	2	02/16/2016 14:20 MA

MARTEL NO. 25114 000005 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - 2D — Sample Date/Time: 02/16/2016 10:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	20	mg/l	SM 5210 B-00	2	02/17/2016 15:11 BMC
Solids (Suspended)	290	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB
Chlorophyll (a)	12	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	49000	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	79000	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA

MARTEL NO. 25114 000006 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - 3 — Sample Date/Time: 02/16/2016 10:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	33	mg/l	SM 5210 B-00	2	02/17/2016 15:21 BMC
Solids (Suspended)	210	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB
Chlorophyll (a)	15	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	70000	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	110000	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA
Escherichia Coli, Quantitray	124600	mpn/100ml	SM Coliler MPN	1	02/16/2016 14:34 MA
MPN Fecal Coliforms (A1)	130000	mpn/100ml	SM 9221 E-06	2	02/16/2016 14:20 MA

MARTEL NO. 25114 000007 — CLIENT SAMPLE IDENTIFICATION: 02162016 - NEB - FB — Sample Date/Time: 02/16/2016 10:50

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	02/17/2016 15:24 BMC
Solids (Suspended)	<1	mg/l	SM 2540 D-97	1	02/18/2016 15:10 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	03/01/2016 14:24 BMC
Escherichia coli	<1	mpn/100ml	SM 9221F	1	02/16/2016 15:26 MA
MPN Fecal Coliforms	<1	mpn/100ml	SM 9221 E-06	2	02/16/2016 15:26 MA

Martel Laboratories *JDS* **Inc.**

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

SMPLOG03

DCDPW

Notes and references:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

*Samples analyzed out of holding time.

All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

MARTEL

D.C. Water and Sewer
Laboratory Pretreatment
5000 Overlook Ave. SW
Washington, DC 200325394

Wednesday, March 2, 2016

Report for Lab No: 25114.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Identification: CSO Sampling for PCM Phase 1 - 02/16/16

Narrative Report

*	25114	000001	02162016 - NEB - 1	Solids (Suspended)

* - Indicates that the laboratory duplicate analysis was not within control limits.

G	25114	000007	02162016 - NEB - FB	Solids (Suspended)

G - Volume less than 1000 ml or residue less than 2.5 mg.

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 25114 Client Code DCDPW

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number _____ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
✓	CBOD-02162016-NEB- 1	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	9:10 Am	CBOD
✓	SS-02162016-NEB- 1	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	9:10Am	SS
✓	CHLOROA-02162016NEB- 1	CSO	AMBER BOTTLE/ NONE		1	2/16/2016	9:10 Am	CHLOROPHYLL-A
S ✓	ECOLI-02162016 -NEB-1	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	ECOLI- EC MUG
2 ✓	FECAL-02162016 -NEB-1	CSO	POP TOP/ SOD. THIO.			2/16/2016	9:10 Am	FECAL- EC MED
✓	ECOLIQ-02162016-NEB-1	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	ECOLI- QUANTITRAY
✓	FECALA-02162016 -NEB- 1	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	FECAL- A1 MED
S ✓	ECOLI-02162016 -NEB-LD	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	LAB DUPLICATE
2 ✓	FECAL-02162016 -NEB- LD	CSO	POP TOP/ SOD. THIO.			2/16/2016	9:10 Am	LAB DUPLICATE
✓	ECOLI-02162016-NEB- EB	DI	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	EQUIPMENT BLANK
✓	FECAL-02162016-NEB- EB	DI	POP TOP/ SOD. THIO.		1	2/16/2016	9:10 Am	EQUIPMENT BLANK
✓	CBOD-02162016-NEB - EB	DI	HDPE BOTTLE/ NONE		1	2/16/2016	9:10 Am	EQUIPMENT BLANK
✓	SS-02162016-NEB - EB	DI	HDPE BOTTLE/ NONE		1	2/16/2016	9:10 Am	EQUIPMENT BLANK
✓	CHLOROA-02162016NEB-EB	DI	AMBER BOTTLE/ NONE		1	2/16/2016	9:10 Am	EQUIPMENT BLANK

Transferred by: Received by Fed-ex	Received by:	Date 02/16/16	Time 23:59
Transferred by:	Received by: Leah Hensley	Date 2-16	Time 13:45
Transferred by:	Received by:	Date	Time

Cooler Receipt Information

Sufficient ice? - Yes/No If No, temp.= 6 °C

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: LH Date: 2/16/16

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 25114 Client Code

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number _____ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-02162016 -NEB-2	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10:00 Am	CBOD
	SS-02162016 -NEB-2	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10:00Am	SS
	~~CHLOROA-02162016 -NEB-2~~	~~CSO~~	~~AMBER BOTTLE/ NONE~~		1	~~2/16/2016~~		~~CHLOROPHYLL-A~~
	ECOLI-02162016 -NEB-2	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:00 Am	ECOLI- EC MUG
	FECAL- 02162016 -NEB-2	CSO	POP TOP/ SOD. THIO.			2/16/2016	10:00Am	FECAL- EC MED
	ECOLIQ- 02162016 -NEB-2	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:00am	ECOLI- QUANTITRAY
	FECALA-02162016-NEB-2	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:00 Am	FECAL- A1 MED
	ECOLI- 02162016 -NEB-2D	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:00 Am	FIELD DUPLICATE
	FECAL-02162016 -NEB-2 D	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:00 Am	FIELD DUPLICATE
	CBOD-02162016 -NEB-2 D	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10:00 Am	FIELD DUPLICATE
	SS- 02162016 -NEB-2D	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10.00 Am	FIELD DUPLICATE
	~~CHLOROA-0 -NEB-1D~~	~~CSO~~	~~AMBER BOTTLE/ NONE~~		1	~~2/16/2016~~		~~FIELD DUPLICATE~~
	CHLOROA-02162016-NEB-2	CSO	HDPE BOTTLE/NONE		1	2/16/2016	10:00Am	CHLOROPHYLL-A
	CHLOROA-02162016-NEB-2D	CSO	HDPE BOTTLE/NONE		1	2/16/2016	10:00Am	CHLOROPHYLL-A

Transferred by: Ramadhiya Gadigatti	Received by:	Date 02/16/16	Time 13:00
Transferred by:	Received by: Leah Hewson	Date 2/16	Time 13:45
Transferred by:	Received by:	Date	Time

Cooler Receipt Information

Sufficient ice? - (Yes)/No If No, temp.= 6°C

Sample containers pres'd? - (Yes)/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: CA Date: 2/16/16

CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

MARTEL Log# 25114 Client Code

Client Name/Phone/FAX DC Water/ Ram J (202-787-4724)

Client Address 5000 Overlook Ave SW Washington, DC 20032

Invoice Address same as above

Sampler RJ /GM

Project Name/ # CSO SAMPLING FOR PCM- PHASE I

Contract/P.O Number _____ LTCP- 420-2016-1

Sample Turnaround Time Normal (2 - 3 weeks)

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
✓	CBOD-02162016 -NEB-3	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10:45 am	CBOD
✓	SS-02162016 -NEB-3	CSO	HDPE BOTTLE/ NONE		1	2/16/2016	10:45 Am	SS
✓	CHLOROA-02162016 -NEB-3	CSO	AMBER BOTTLE/ NONE		1	2/16/2016	10:45Am	CHLOROPHYLL-A
✓	ECOLI- 02162016 -NEB-3	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:45Am	ECOLI- EC MUG
✓	FECAL-02162016 -NEB-3	CSO	POP TOP/ SOD. THIO.			2/16/2016	10:45Am	FECAL- EC MED
✓	ECOLIQ-02162016-NEB- 3	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:45 am	ECOLI- QUANTITRAY
✓	FECALA-02162016 -NEB-3	CSO	POP TOP/ SOD. THIO.		1	2/16/2016	10:45Am	FECAL- A1 MED
✓	CBOD-02162016-NEB-FB	DI	HDPE BOTTLE/NONE		1	2/16/2016	10:50 Am	CBOD
✓	SS-02162016-NEB-FB	DI	HDPE BOTTLE/NONE		1	2/16/2016	10:50 Am	SS
✓	CHLOROA-02162016-NEB-FB	DI	POP TOP / NONE		1	2/16/2016	10:50 Am	CHLOROPHYLL-A
✓	ECOLI-02162016-NEB-FB	DI	POP TOP / ~~NONE~~ SOD. THIO.		1	2/16/2016	10:50 Am	ECOLI-EC MUG
✓	FECAL-02162016-NEB-FB	DI	POP TOP / ~~NONE~~ SOD. THIO.		1	2/16/2016	10:50Am	FECAL-EC MED

Transferred by: [signature] Received by: [signature] Date 2-16 Time 13:00

Transferred by: [signature] Received by: [signature] Date 2-16 Time 12:45

Transferred by: Received by: Date Time

Cooler Receipt Information

Sufficient ice? - Yes/No If No, temp.= 6°C

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No NA

Initials: CH Date: 2/16/16

MARTEL

Sensible Scientific

Solutions

Sample Receipt Checklist

Client:_____ Project Name:_____ Project # _____

Samples arrived via: _____ Tracking #:_____ Date opened:_____

No of coolers:_____ Date Received:_____ Lot and Control Numbers 25114

		Y	NA	N
1.	Where appropriate, is an intact custody seal present on transporting container?			
2.	Is chain-of -custody present upon receipt of samples?			
3.	Where applicable, indicate location of custody seals on cooler. What sample or samples were preserved?			
4.	Is the following COC information complete: a) client name, project name, project number ?			
	b) client contact, client address, phone #, (PM info)			
	c) sample collectors name and date collected ?			
	d) samples appropriately preserved ? Acid used and amount for preservation?			
	e) each sample ID, date and time of sampling, matrix, requested analysis, number of sample containers and TAT?			
5.	Is each sample and label intact, no breakage or leakage, labels are legible?			
6.	Where required is there an intact custody seal on each sample?			
7.	Does each sample label match the sample information on the C-O-C?			
8.	Does matrix of samples received agree with label/C-O-C?			
9.	If more than one analysis is to be performed on a sample container, are the analyses compatible?			
10.	Was sufficient ice used?			
11.	Is each sample in an appropriate container with proper preservative, where required?			
12.	Is each sample received within proper holding time?			
13.	Is sufficient sample aliquot provided? For paint chip analysis, is at least one gram of sample received?			
14.	Were air bubbles present in VOA samples? If so list ID's.			
15.	Were samples screened for radioactivity (if required)?			
16.	Did you sign custody papers in appropriate place?			
17.	For dust wipe analysis, is blank wipe media provided by the client?			

Comments: Missing CHLOROA samples: #4, 5, 7. Test were done from plastic bottles instead

Project Manager contacted (if necessary): _____

Client Notified by Project Manager (if necessary):_____

Logged in by: Leah Heusen Date : 2/16/16

M:\Login Docs\cooler receipt 2004.doc

DC Water
5000 overlook Ave SW

Washington, DC 20032

Attention: Ramakrishna Jeedigunta

Wednesday, May 18, 2016

Certificate of Analysis

FINAL

Report for Lab No: 26224.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Name: CSO sampling for PCM-Phase I - 05/06/16

Samples analyzed according to method requirements and QC exceptions available.

MARTEL NO. 26224 000001 — CLIENT SAMPLE IDENTIFICATION: 05062016-029-2 — Sample Date/Time: 05/06/2016 13:15

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	17	mg/l	SM 5210 B-00	2	05/07/2016 16:53 BMC
Solids (Suspended)	130	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	36	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	130000	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
Escherichia Coli, Quantitray	137400	mpn/100ml	SM Colilert MPN	1	05/06/2016 20:03 MA
MPN Fecal Coliforms	130000	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA
MPN Fecal Coliforms (A1)	79000	mpn/100ml	SM 9221 E-06	2	05/06/2016 19:49 MA

MARTEL NO. 26224 000002 — CLIENT SAMPLE IDENTIFICATION: 05062016-027-EB — Sample Date/Time: 05/06/2016 13:40

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	05/07/2016 16:59 BMC
Solids (Suspended)	<1	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	<6	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	2	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
MPN Fecal Coliforms	2	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA

MARTEL NO. 26224 000003 — CLIENT SAMPLE IDENTIFICATION: 05062016-027-1 — Sample Date/Time: 05/06/2016 13:45

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	24	mg/l	SM 5210 B-00	2	05/07/2016 17:02 BMC
Solids (Suspended)	27	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	15	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	130000	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
Escherichia Coli, Quantitray	93200	mpn/100ml	SM Colilert MPN	1	05/06/2016 20:03 MA
MPN Fecal Coliforms	130000	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA
MPN Fecal Coliforms (A1)	17000	mpn/100ml	SM 9221 E-06	2	05/06/2016 19:49 MA

MARTEL NO. 26224 000004 — CLIENT SAMPLE IDENTIFICATION: 05062016-FB — Sample Date/Time: 05/06/2016 13:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	<2	mg/l	SM 5210 B-00	2	05/07/2016 17:06 BMC
Solids (Suspended)	<1	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	11	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	16	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
MPN Fecal Coliforms	16	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA

MARTEL NO. 26224 000005 — CLIENT SAMPLE IDENTIFICATION: 05062016-029-1 — Sample Date/Time: 05/06/2016 13:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	19	mg/l	SM 5210 B-00	2	05/07/2016 17:09 BMC
Solids (Suspended)	82	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	28	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	49000	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
Escherichia Coli, Quantitray	142100	mpn/100ml	SM Coliler MPN	1	05/06/2016 20:03 MA
MPN Fecal Coliforms	49000	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA
MPN Fecal Coliforms (A1)	130000	mpn/100ml	SM 9221 E-06	2	05/06/2016 19:49 MA

MARTEL NO. 26224 000006 — CLIENT SAMPLE IDENTIFICATION: 05062016-029-LAB — Sample Date/Time: 05/06/2016 13:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Escherichia coli	110000	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
MPN Fecal Coliforms	170000	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA

MARTEL NO. 26224 000007 — CLIENT SAMPLE IDENTIFICATION: 05062016-027-2 — Sample Date/Time: 05/06/2016 14:00

Compound	Test Value	Test Unit	Method	Detection Limit	Analysis Date/Time/Initial
Carbonaceous BOD, 5 day	25	mg/l	SM 5210 B-00	2	05/07/2016 17:13 BMC
Solids (Suspended)	38	mg/l	SM 2540 D-97	1	05/12/2016 12:15 CB
Chlorophyll (a)	17	mg/m^3	SM 10200H2	6	05/13/2016 17:18 BMC
Escherichia coli	230000	mpn/100ml	SM 9221F	1	05/06/2016 20:36 MA
Escherichia Coli, Quantitray	218700	mpn/100ml	SM Coliler MPN	1	05/06/2016 20:03 MA
MPN Fecal Coliforms	230000	mpn/100ml	SM 9221 E-06	2	05/06/2016 20:36 MA
MPN Fecal Coliforms (A1)	130000	mpn/100ml	SM 9221 E-06	2	05/06/2016 19:49 MA

Martel Laboratories *JDS* **Inc.**

1025 Cromwell Bridge Road - Baltimore, Maryland 21286
PH 410-825-7790 FAX 410-821-1054 EMAIL: martel@martellabs.com

SMPLOG03

GREEDC

Notes and references:

40CFR136=U.S. "Code of Federal Regulations", Title 40, Protection of the Environment, Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. SM="Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, and Water Environment Federation. Year in method code is approved date.

All samples tested were in acceptable condition, unless otherwise noted.
The results presented herein relate only to the samples or items tested.

Project Manager

MARTEL

DC Water
5000 overlook Ave SW

Wednesday, May 18, 2016

Washington, DC 20032

Report for Lab No: 26224.
Samples picked up by Martel.
P.O. Number: LTCP-420-2016-1
Project Name: CSO sampling for PCM-Phase I - 05/06/16

Narrative Report

X	26224	000001	05062016-029-2	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			
G	26224	000002	05062016-027-EB	Solids (Suspended)
	G - Volume less than 1000 ml or residue less than 2.5 mg.			
X	26224	000002	05062016-027-EB	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			
X	26224	000003	05062016-027-1	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			
G	26224	000004	05062016-FB	Solids (Suspended)
	G - Volume less than 1000 ml or residue less than 2.5 mg.			
X	26224	000004	05062016-FB	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			
X	26224	000005	05062016-029-1	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			
X	26224	000007	05062016-027-2	Filter for chlorophyll-a
	Sample was not filtered within 24 hours.			

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 26224 Client Code GREEDC

Client Name/Phone/FAX DCWATER / RAMJ (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC 20032

Invoice Address Same as Above

Sampler RJ / GM

Project Name/# CSO sampling for PCM-phase I

Contract/P.O Number LTCP-420-2016-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-05062016-029-2	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:15pm	CBOD
	SS-05062016-029-2	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:15pm	SS
	CHLOROA-05062016-029-2	CSO	AMBER BOTTLE/NONE		1	05/06/16	1:15pm	CHLOROPHYLL-A
	ECOLI-05062016-029-2	CSO	POP TOP/SOD. THIO	1	1	05/06/16	1:15pm	ECOLI - EC MUG
	FECAL-05062016-029-2	CSO	"				1:15pm	FECAL - EC MED
	ECOLIQ-05062016-029-2	CSO	"		1	05/06/16	1:15pm	ECOLI - QUANTITRAY
	FECALA-05062016-029-2	CSO	"		1	05/06/16	1:15pm	FECAL - A1 MED
	CBOD-05062016-027-EB	DI	HDPE/NONE		1	05/06/16	1:40pm	EQUIPMENT BLANK
	SS-05062016-027-EB	DI	HDPE/NONE		1	05/06/16	1:40pm	EQUIPMENT BLANK
	CHLOROA-05062016-027-EB	DI	AMBER/NONE		1	05/06/16	1:40pm	EQUIPMENT BLANK
	ECOLI-05062016-027-EB	DI	POP TOP/SOD. THIO		1	05/06/16	1:40pm	EQUIPMENT BLANK - (EC MUG)
	FECAL-05062016-027-EB	DI	"		1	05/06/16	1:40pm	EQUIPMENT BLANK - (EC MED)

Transferred by:	Received by:	Date 5/6	Time 1630
Transferred by:	Received by:	Date 5/6/16	Time 1915
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 1.0°C

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 5/6/16

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 26224 Client Code

Client Name/Phone/FAX DCWATER / RAMJ (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC 20032

Invoice Address Same as Above

Sampler RJ / GM

Project Name/# CSO Sampling for PCM-Phase I

Contract/P.O Number LTCP-420-2016-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-05062016-0274	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:45pm	CBOD
	SS-05062016-0274	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:45pm	SS
	CHLOROA-05062016-0274	CSO	AMBER BOTTLE/NONE		1	05/06/16	1:45pm	CHLOROPHYLL-A
	ECOLI-05062016-0274	CSO	POP TOP/SOD. THIO		1	05/06/16	1:45pm	ECOLI - EC MUG
	FECAL-05062016-0274	CSO				5/6/16	1:45 Pm	FECAL - EC MED
	ECOLIQ-05062016-0274	CSO	"		1	05/06/16	1:45 pm	ECOLI - QUANTITRAY
	FECALA-05062016-0274	CSO	"		1	05/06/16	1:45pm	FECAL - A1 MED
	CBOD-05062016-FB	DI	HDPE/NONE		1	05/6/16	1:00 Pm	CBOD
	SS-05062016-FB	DI	HDPE/NONE		1	5/6/16	1:00 Pm	SS
	CHLOROA-05062016-FB	DI	AMBER/NONE		1	5/6/16	1:00 Pm	CHLOROPHYLL-A
	ECOLI-05062016-FB	DI	POP TOP/SOD. THIO		1	5/6/16	1:00 Pm	EC MUG
	FECAL-05062016-FB	DI	"		1	5/6/16	1:00 Pm	EC MED

		Date	Time
Transferred by:	Received by:	5/6	1636
Transferred by:	Received by:	5/6/16	1915
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? Yes/No If No, temp.= 1.0°C

Sample containers pres'd? Yes/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 5/6/16

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 26224 Client Code

Client Name/Phone/FAX DCWATER / RAMJ (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC 20032

Invoice Address Same as Above

Sampler RJ / GM

Project Name/# CSO sampling for PCM-phase I

Contract/P.O Number LTCP-420-2016-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-05062016-029-1	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:00pm	CBOD
	SS-05062016-029-1	CSO	HDPE BOTTLE/NONE		1	05/06/16	1:00pm	SS
	CHLOROA-05062016-029-1	CSO	AMBER BOTTLE/NONE		1	05/06/16	1:00pm	CHLOROPHYLL-A
	ECOLI-05062016-029-1	CSO	POP TOP/SOD. THIO	4	1	05/06/16	1:00pm	ECOLI - EC MUG
	FECAL-05062016-029-1	CSO	"				1:00pm	FECAL - EC MED
	ECOLIQ-05062016-029-1	CSO	"		1	05/06/16	1:00pm	ECOLI - QUANTITRAY
	FECALA-05062016-029-1	CSO	"		1	05/06/16	1:00pm	FECAL - A1 MED
	ECOLI-05062016-029-LAB	CSO	"		1	05/06/16	1:00pm	LAB DUPLICATE (EC MUG)
	FECAL-05062016-029-LAB	CSO	"			05/06/16	1:00pm	LAB DUPLICATE (EC MED)

Transferred by: Ramjee Gupta	Received by:	Date 5/6/16	Time 1630
Transferred by:	Received by: Mary Adelman	Date 5/6/16	Time 1915
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 1.0°C

Sample containers pres'd? Yes/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 5/6/16

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # 26224 Client Code

Client Name/Phone/FAX DCWATER / RAMJ (202-787-4724)

Client Address 5000 Overlook Ave SW, Washington, DC 20032

Invoice Address Same as Above

Sampler RJ / GM

Project Name/# CSO sampling for PCM-phase I

Contract/P.O Number LTCP-420-2016-1

Sample Turnaround Time

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments
	CBOD-05062016-027-2	CSO	HDPE BOTTLE/NONE		1	05/06/16	2:00 pm	CBOD
	SS-05062016-027-2	CSO	HDPE BOTTLE/NONE		1	05/06/16	2:00 pm	SS
	CHLOROA-05062016-027-2	CSO	AMBER BOTTLE/NONE		1	05/06/16	2:00 pm	CHLOROPHYLL-A
	ECOLI-05062016-027-2	CSO	POP TOP/SOD. THIO		1	05/06/16	2:00 pm	ECOLI - EC MUG
	FECAL-05062016-027-2	CSO					2:00 pm	FECAL - EC MED
	ECOLIQ-05062016-027-2	CSO	"		1	05/06/16	2:00 pm	ECOLI - QUANTITRAY
	FECALA-05062016-027-2	CSO	"		1	05/06/16	2:00 pm	FECAL - A1 MED

Transferred by: Courier	Received by:	Date 5/6/16	Time 1630
Transferred by:	Received by:	Date 5/10/16	Time 1915
Transferred by:	Received by:	Date	Time

Cooler Receipt Information **(LAB USE ONLY)**

Sufficient ice? - Yes/No If No, temp.= 1.0 °C

Sample containers pres'd? - Yes/No If No, explain

Custody Seal present/intact? - Yes/No

Initials: MA Date: 5/6/16

Appendix G Quality Assurance Project Plan

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

POST CONSTRUCTION MONITORING - PHASE 1

QUALITY ASSURANCE PROJECT PLAN

December 2014

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

Quality Assurance Project Plan:

Post Construction Monitoring - Phase I for DC Water's Long Term Control Plan

Prepared by:
Program Consultants Organization
5000 Overlook Avenue, SW
Washington, DC 20032

December 2014
Version 0

This quality assurance project plan has been prepared according to guidance provided in EPA/240/B-01/003 Requirements for Quality Assurance Project Plans (EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Management Staff, Washington, DC, Final, March 2001) to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use.

Approvals:

Mohsin Siddique — Date

Mohsin Siddique
District of Columbia Water and
Sewer Authority

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B. Martel's Quality Assurance Manual
C. CSL's QA/ QC Procedures

DISTRIBUTION LIST

The final version of this document will be distributed to the following DC Water and MWCOG staff who are instrumental in conducting the post construction monitoring work:

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Mohsin Siddique	Project Supervisor	202.787.2634(w)	mohsin.siddique@dcwater.com
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*****Primary contacts to inform for all Routine Sampling and Wet Weather Events.			

1 Project Management

1.1 Purpose

The District of Columbia Water and Sewer Authority's (DC Water's) National Pollutant Discharge Elimination System Permit (NPDES Permit) requires conducting post construction monitoring in three phases after various elements of the CSO control program are implemented.

This Quality Assurance Project Plan (QAPP) has been prepared for DC Water to address the first phase of post construction monitoring that is required after rehabilitation of the sewage pumping stations and replacement of the inflatable dams. This document is prepared to meet the EPA Requirements for Quality Assurance Project Plans (EPA/240/B-01/003, EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Management Staff, Washington, DC, Final, March 2001) to document the type and quality of data needed, and the procedures required to assure that the data is collected and managed in a manner consistent with applicable requirements and generally accepted and approved quality assurance objectives.

The monitoring under this first phase consists of the following principal elements:

- Rainfall Monitoring- monitor rainfall data in the District of Columbia (District)
- CSO Overflow (Flow and volume) - monitoring of the combined sewer system (CSS) in the District.
- CSO Overflow Sampling- collect CSO samples from influent of Northeast Boundary Swirl facility.
- Receiving Water Monitoring- Monitor dissolved oxygen, conduct regular sampling and wet weather sampling for the three receiving waters in the District: Anacostia River, Potomac River, and Rock Creek.

Please note that a standalone QAPP prepared for Receiving Water Monitoring effort is included as Appendix A. Hence, for the purpose of brevity, only overview of Receiving Water Monitoring is provided as appropriate under Sections 1 thru 4 of this QAPP.

1.2 Project/ Task Organization

The organizations involved in each of these activities are shown on Figure 1-1, and are described in detail below:

Client

DC Water - Operates the combined and separate sanitary sewer systems in the District. The key DC Water participant is:

- Dr. Mohsin Siddique, Project Supervisor - Dr. Siddique is responsible for general oversight of the monitoring. Dr. Siddique, in consultation with others at DC Water, is the decision maker for the monitoring.

Program Management

DC Clean Rivers (DCCR) - Engineering firms providing professional engineering services to DC Water in support of the Long Term Control Plan (LTCP) effort via a program management contract known as

Program Consultant Organization (PCO) or DC Clean Rivers team (DCCR). The key DCCR participants are:

- John Cassidy & Angela Essner, Project Manager - The Project Manager will have general oversight over the entire monitoring effort. As part of the QA/QC responsibilities, the Project Manager will provide overall direction to fulfill the objectives of the monitoring.

- Ram Jeedigunta, Project Coordinator/ QA Manager – The Project Coordinator will be responsible for maintaining a definition of and adherence to the scope, schedule, budget, and quality for the monitoring. The Project Coordinator will provide for QA/QC oversight for all aspects of the monitoring and will also be responsible for maintaining the QAPP.

  The QA Manager is responsible for independent QA/QC activities. The QA Manager will review data generated by the monitoring to confirm that required QA/QC activities such as duplicates, blanks, etc. have been performed. The QA Manager will assess whether these activities meet the requirements of the QAPP.

Rainfall Monitoring, CSO Overflow Monitoring

CSL Services (CSL) - CSL is the firm retained to install, maintain, operate and provide data from the rain gages and flow monitors in the CSS. Harry Clark and Brandon Cohen are the project managers at CSL responsible for all aspects of the work.

CSO Overflow Sampling & Laboratory Analysis

PCO- PCO personnel will perform manual collection of samples.

Martel Laboratories (Martel)- Martel has been retained to perform analytical work on CSO samples. Martel will also be responsible for transporting samples from sample location to the laboratory for analysis. Joe Wolfkill is the lab coordinator at Martel responsible for all aspects of the laboratory's work.

Receiving Water Monitoring & Laboratory Analysis

Metropolitan Washington Council of Governments (MWCOG) - supports a Regional Monitoring Subcommittee (RMS) that coordinates the local monitoring efforts of federal, state, and local government agencies in Maryland, Virginia, and the District of Columbia. MWCOG maintains a centralized database and performs processing, analysis, and disbursement of ambient monitoring data.

COG is an intergovernmental organization under contract to DC Water to perform receiving water monitoring of the Anacostia River, Potomac River and Rock Creek. The key COG personnel on this project is:

- Tanya Spano, Project Manager - The Project Manager will have general oversight over the receiving water monitoring effort.

Versar- Versar is the firm retained by MWCOG to install, operate and maintain continuous DO monitors and conduct water quality sampling (wet weather sampling and regular sampling) for the receiving waters (Anacostia River, Potomac River and Rock Creek). The key Versar participants are:

- William Burton, Project Manager - The Project Manager will serve as the primary contact for handling contract level management issues such as budgeting, scheduling, and ensuring the quality of the work.

- David Wong, Project Coordinator – The Project Coordinator oversees all aspects of field work and bears the responsibility of assuring that field work, laboratory analysis, data management, data analysis, and ensure reporting is successfully completed.

- Tom Jones and Nancy Roth, QA Officers - QA Officers will be reviewing the collected data, data analysis results, and the annual report.

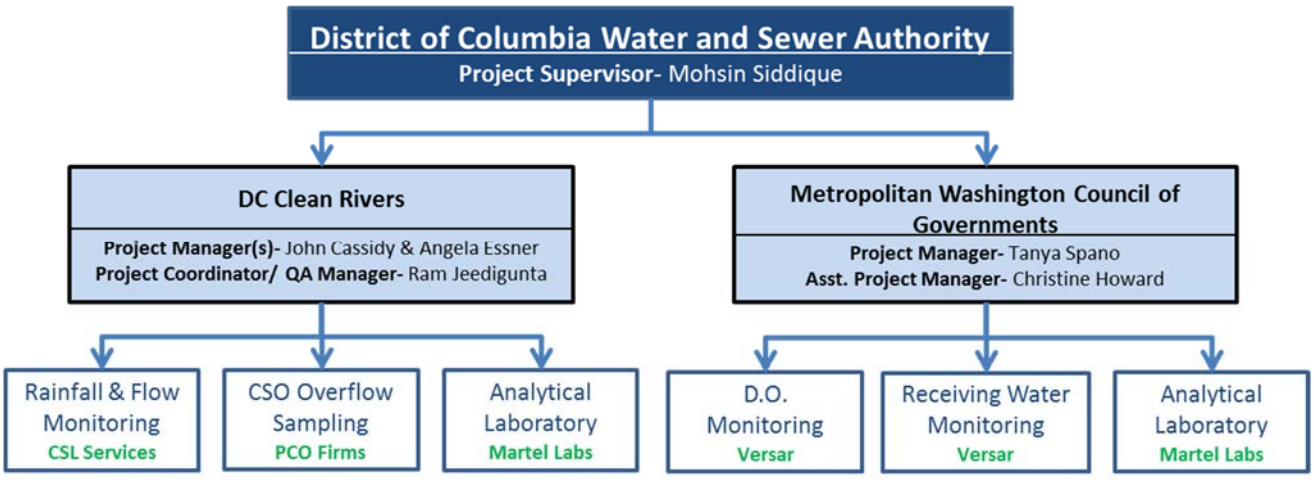
Martel Laboratories (Martel)- Martel is the laboratory retained to perform analytical work on water quality samples collected from receiving waters. Amber A. Confer is the lab coordinator at Martel responsible for all aspects of the laboratory's work.
A summary of the project organization is included in Table 1-1 and a chart illustrating the proposed team for post construction monitoring is presented as Figure 1-1.

Table 1-1. Summary of Project Organization

Task	Client	Project Management	Field Sampling/ Instrument Operation	Laboratory Analysis
Rainfall Monitoring	DC Water	DCCR	CSL	
CSO Overflow (Flow and Volume)	DC Water	DCCR	CSL	
CSO Overflow Sampling	DC Water	DCCR	DCCR	Martel
Receiving Water Monitoring- Dissolved Oxygen	DC Water	MWCOG	Versar	
Receiving Water Monitoring- Bacteria, Field Parameters	DC Water	MWCOG	Versar	Martel

The final end-users of the data is DC Water. DC Water will use the data to develop models for the CSS and will use the data to run and improve receiving water models to assess the effectiveness of Phase I CSO controls.

Figure 1-1. Organizational Chart



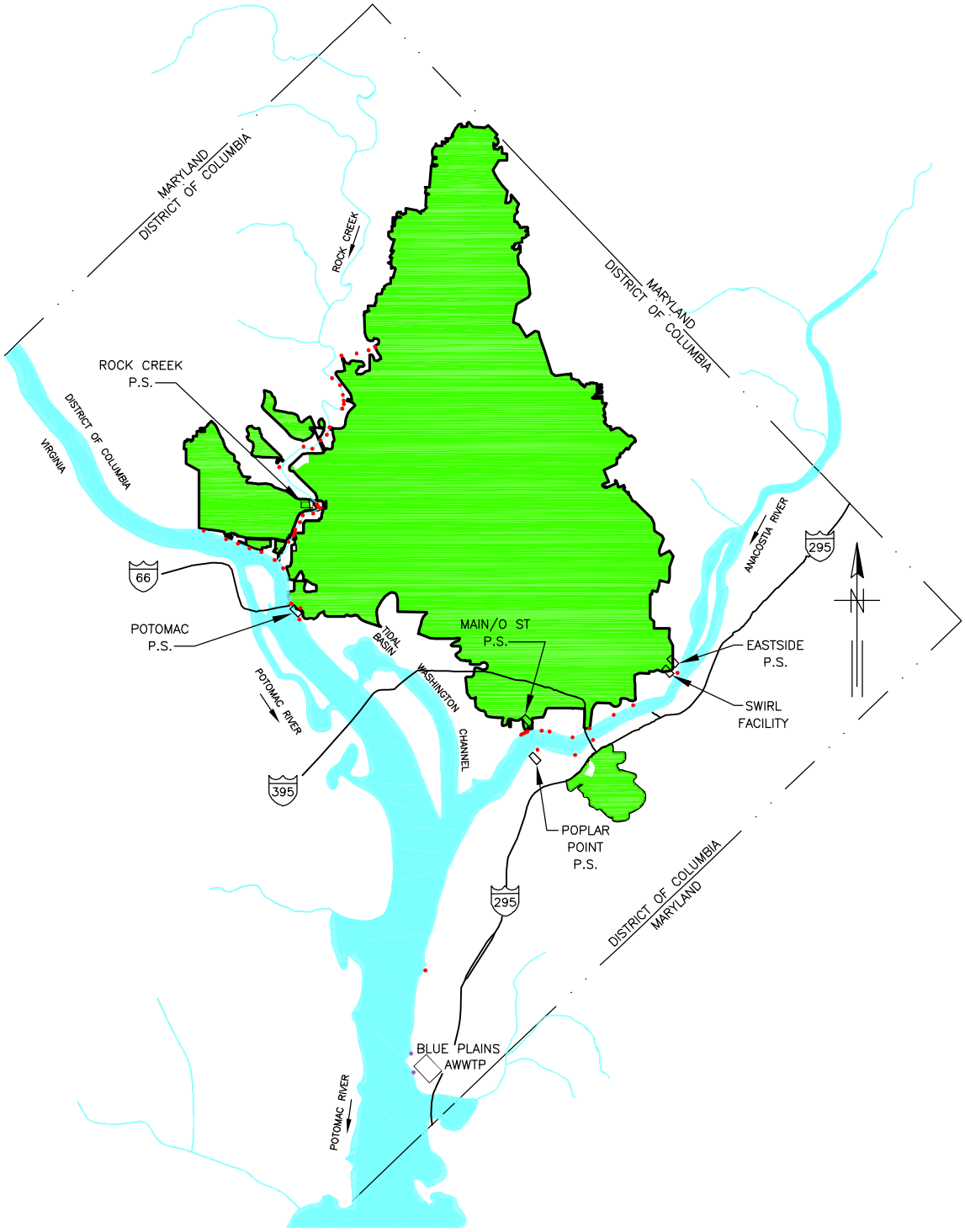
1.3 Problem Definition/ Background

1.3.1 Long Term Control Plan

The DC Water operates a wastewater collection system comprised of separate and combined sewers. Parts of the District are served by separate storm and sanitary sewers. In the combined sewer system (CSS), there is a single sewer to convey storm water and sanitary wastes. The area served by combined sewers comprises about 12,436 acres (about 33 percent) of the District, and is shown on Figure 1-2.

During dry weather, sanitary wastes collected in the CSS are conveyed to the District's advanced wastewater treatment plant at Blue Plains (BPAWWTP or the Blue Plains AWWTP). During periods of rainfall, the capacity of a combined sewer may be exceeded and the excess flow, which is a mixture of storm water and sanitary wastes, is discharged directly through outfalls to the Anacostia River, Rock Creek or the Potomac River or tributary waters. There are a total of 53 active combined sewer overflow (CSO) outfalls listed in DC Water's existing NPDES Permit issued by the United States Environmental Protection Agency (EPA).

In accordance with the CSO Policy and its NPDES permit requirements, DC Water submitted a Draft Long Term Control Plan (LTCP or DC Clean Rivers Project), to EPA in 2001. After an extensive public participation program which generated over 2,300 comments, DC Water submitted a Final LTCP to the EPA in 2002. The D.C. Department of the Environment (formerly Department of Health) Water Quality Division (DDOE) and the EPA approved the Final LTCP and determined that CSOs remaining after implementation of the plan would not cause or contribute to the exceedance of water quality standards, subject to post construction monitoring. It was also determined that the CSOs remaining after implementation of the plan would comply with total maximum daily loads (TMDLs) established for the receiving waters.



LEGEND

- CSO OUTFALL
- WWTP OUTFALL
- COMBINED SEWER AREA
- EXISTING PUMPING STATION

SCALE: 1"=10,000'

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE-I

COMBINED SEWER AREA

DATE: FEBRUARY 2014 | FIGURE 1-1

LAST SAVED BY: CONSTANT A. NORTEY DATE: 2/12/2014 3:12:43 PM
DRAWING ID: L:\LTCP\PCM\REPORT-FIGURES\FIGURE 1-1 CSA.DWG

1.3.2 Total Nitrogen Removal/ Wet Weather Plan

On April 5, 2007, EPA issued a modification to DC Water's NPDES permit. The permit modification included a total nitrogen effluent limit for Blue Plains of 4.689 million pounds per year. The total nitrogen limit was developed by EPA to achieve the goals of the Chesapeake Bay Program for nutrient reductions. In addition to meeting the new effluent limit for total nitrogen, DC Water had existing NPDES Permit requirements for treating wet weather flows at Blue Plains. The latter requirement is part of DC Water's LTCP for the combined sewer system.

When the LTCP was finalized in 2002, there was no effluent limit for total nitrogen in DC Water's NPDES permit for Blue Plains and the LTCP. The imposition of the new total nitrogen limit could require a modification to the LTCP and its implementation schedule. DC Water conducted evaluations to assess the impact of adding the new total nitrogen effluent limit on top of the LTCP and existing NPDES permit requirements for treating wet weather flows. On October 12, 2007, DC Water submitted its Final Total Nitrogen Removal/Wet Weather Plan (TN/WW Plan) to EPA. The TN/WW Plan is provided as a companion document to the Consent Decree Modification.

Under the LTCP and the NPDES permit existing at the time, Blue Plains was rated for an annual average flow of 370 mgd. During wet weather events, flows up to 740 mgd receive complete treatment for up to 4 hours. After the first 4 hours, the complete treatment capacity is reduced to 511 mgd to protect the biological process. Additional flows of up to 336 mgd that exceed the complete treatment capacity of the plant receive excess flow treatment, which consists of screening, grit removal, primary treatment and disinfection before being discharged to the Potomac River. This provides a total treatment capacity of 1076 mgd for the first four hours and 847 mgd thereafter.

The TN/WW Plan modified the plant treatment capacities and the handling of flows during wet weather. The major components of the TN/WW Plan are as follows:

- Complete treatment capacity – Blue Plains will provide complete treatment up to 555 mgd for the first four hours and 511 mgd thereafter. In accordance with the existing NPDES permit, combined sewer system flow (CSSF) conditions (i.e., wet weather events) exist and start when plant influent flow is greater than 511 mgd. CSSF conditions stop four hours after plant influent flow drops below 511 mgd or 4 hours has elapsed since the start of CSSF conditions, whichever occurs last.

- Enhanced nitrogen removal (ENR) – ENR facilities will be constructed with capacity to provide complete treatment for the flow rates identified above and to meet the new total nitrogen effluent limit.

- Enhanced Clarification Facility (ECF) – A 225 mgd ECF facility will be constructed at Blue Plains.

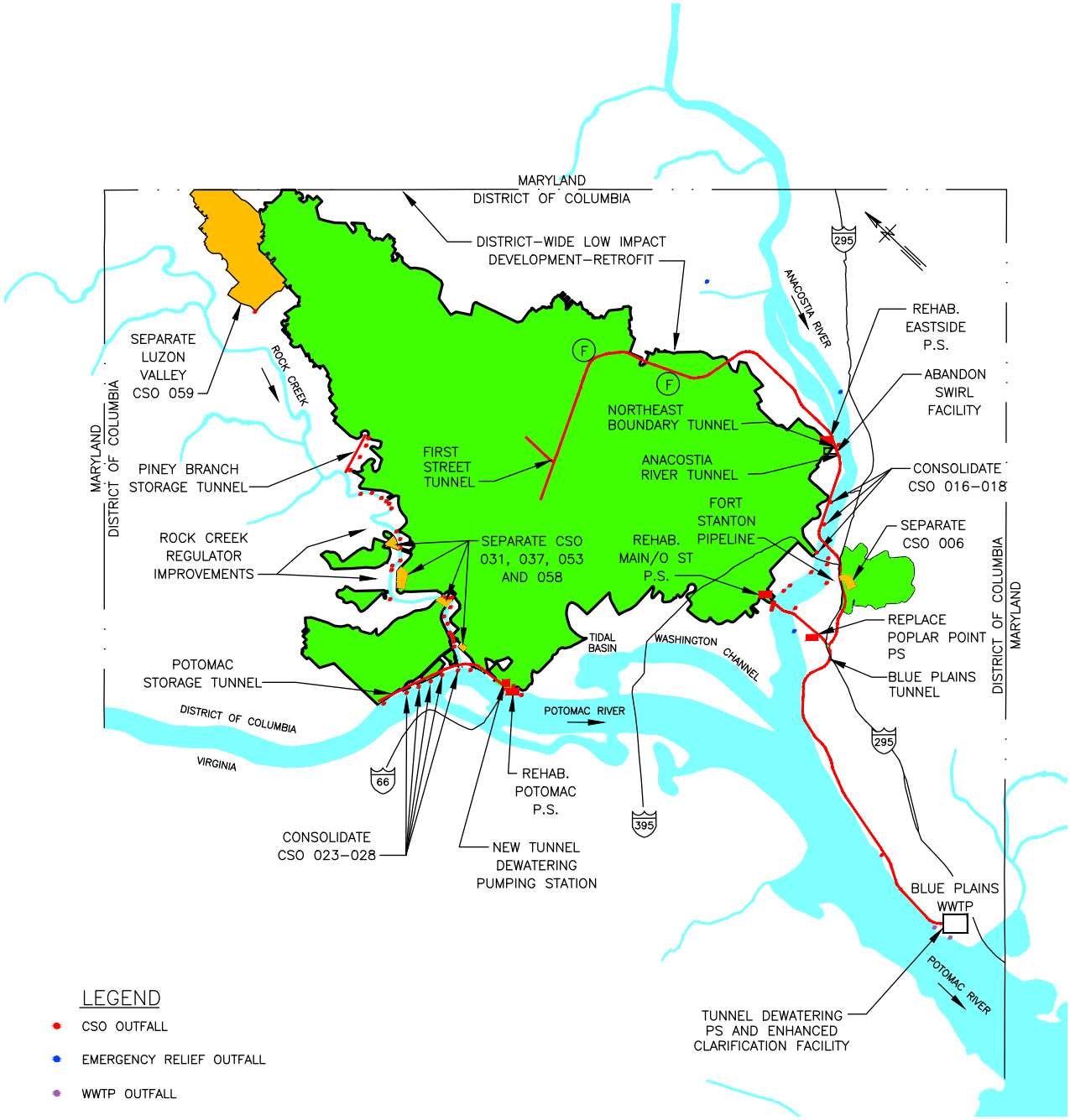
- Tunnel to Blue Plains and System Storage Volume – A new tunnel is being constructed from Poplar Point to Blue Plains. The total tunnels system storage volume will be increased from 126 mg to 157 mg. This new tunnel segment will not only serve as a flow equalization facility

but will also allow a reduction in the required capacity of the ECF and the peak flow rates that receive complete treatment at the Plant.

- Outfall Sewer Overflow to Blue Plains Tunnel – Connections between the existing Outfall sewers on the influent side of Blue Plains and the tunnel to Blue Plains will be constructed. These facilities will allow flow from the collection system that exceeds the complete treatment capacity of the plant to overflow into the tunnel.

- Tunnel Dewatering Pumping Station – Under the Final LTCP, a tunnel dewatering pumping station was proposed to be constructed at the tunnel terminus at Poplar Point. As part of the TN/WW plan, the same tunnel dewatering pumping station is relocated to the new terminus of the tunnel at Blue Plains. The pumping station will be sized to have a minimum firm capacity of 225 mgd, equal to the capacity of the ECF. In addition, the facility will have the ability to dewater the tunnel system up to the new ECF and be able to discharge ECF effluent to complete treatment and discharge at Outfall 002 or at Outfall 001. Figure 1-3 shows the TN/WW plan.

The major elements of the LTCP are shown on Figure 1-3.



dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

DC CLEAN RIVERS PROJECT

LONG TERM CONTROL PLAN

DATE: FEBRUARY 2014

FIGURE 1-2

LAST SAVED BY: JEEDIGUNTA, RAM DATE: 4/1/2014 4:07:18 PM
DRAWING ID: I:\POST CONSTRUCTION MONITORING\05 - REPORTING\FIGURES\FIGURE 1-2 LTCP ELEMENTS.DWG

1.3.3 NPDES Permit Requirements

The DC Water's NPDES Permit requires conducting post construction monitoring in three phases after various elements of the LTCP are implemented. Part III, Section D of the permit specifies the required post construction monitoring phases as follows:

- **Phase 1 Monitoring** – Following the placement in operation of the inflatable dams and pumping stations rehabilitation. This program will be conducted for a period of one year in each receiving waters (Anacostia and Potomac Rivers).

- **Phase 2 Monitoring** – Following the placement in operation of the Anacostia, Rock Creek and Potomac storage tunnels, respectively, as each tunnel is placed in operation. This program will be conducted for a period of one year in each receiving waters (Anacostia, and Potomac Rivers and Rock Creek).

- **Phase 3 Monitoring** – Following the placement in operation of the complete CSO tunnels storage system. This program will be conducted once every 5 years for each receiving waters (Anacostia and Potomac Rivers and Rock Creek).

Replacement of the inflatable dams was completed in 2004 and rehabilitation of the last pumping station (Potomac Pumping Station) was completed in October 2013. As a result, Phase 1 monitoring may begin. The permit requires the monitoring to consist of at least the elements in Table 1-2.

Table 1-2. NPDES Permit Requirements- Phase I

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	• 1 gauge in Northeast Boundary • 1 gauge in Tiber Creek	• 1 gauge in Slash Run	• Continuous
CSO Overflow (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary	n/a	• 4 storms minimum approximately 1 hr sample interval for each storm
Receiving Water Monitoring- Dissolved Oxygen (4)	• Continuous DO Monitors	• Continuous DO Monitors	• Approximately 30 minute intervals
Receiving Water Monitoring- Bacteria, Field Parameters (2) (4)	• Bacteria Samples	• Bacteria Samples	• 4 storms minimum

(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for fecal Coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.

(4) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

1.4 Project/ Task Description and Schedule

1.4.1 Monitoring Program Elements

This section provides a general overview of the monitoring to be conducted and the associated schedule. The following are the principal elements of the proposed monitoring:

- Rainfall Monitoring
  DC Water operates four existing rain gages in the CSS to collect data on rainfall. These existing gages are in the drainage areas required to be monitored and will be used for post construction monitoring. Two additional rain gages are proposed in the drainage areas that correspond with the major CSO outfalls which will be monitored. Collection of rainfall data will allow developing and modeling the correlation between rain events, CSO overflows and water quality impacts. Table 1-3 below provides the drainage areas and rainfall monitoring locations.

Table 1-3. Rainfall Monitoring Locations

Drainage Area	Gage		Site
	Req'd by Permit	Additional	
Anacostia River			
1 gage in Northeast Boundary	X		1. Bryant St PS- 2nd & 4th St NW 2. Brentwood Reservoir - Brentwood Parkway & New York Ave NE
1 gage in Tiber Creek	X		3. Main Pumping St – First St & O St SE
Potomac River			
1 gage in Slash Run	X		4. Rock Creek PS - Rock Creek Parkway N & K St NW
1 gage in Georgetown		X	5. Fletcher's Boat House- Site 1995 4940 Canal Road NW
Rock Creek			
1 gage in Piney Branch		X	6. Company 24 Fire St - Gallatin St & Georgia Ave NW
Other			
1 gage at National Airport		X	7. National Weather Service gage at Ronald Reagan National Airport
Total	**7**		

- CSO Overflow Monitoring
  Flow monitoring will be conducted by installing 50 meters in the combined sewer system. Thirty three of these meters are for CSO outfalls, while the remainder are internal system points and dry weather diversions in the CSS. Note that at some locations, more than one flow monitor is required due to the configuration of the sewers. For outfalls such as CSO 011a, 012, 020 that are influenced by tides, dual meters are proposed on the upstream and downstream side of the inflatable dams. Table 1-4 provides the drainage areas and flow monitoring locations.

Table 1-4. CSO Monitoring Sites and Meter Designations

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
Anacostia River					
B ST/ New Jersey Ave	CSO 010 - B ST/ NJ Ave Pumped Overflow	10-15-1	Structure 15, downstream of inflatable dam	In-system hydraulics	X
		10-15a-1L	Structure 15A, between weir and inflatable dam	In-system hydraulics	X
		10-15a-2L	10' sewer, next to weir at Structure 15A	In-system hydraulics	
	CSO- 011A	11a-11-1U	West conduit of B ST/ NJ Ave Sewer, upstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-1D	West conduit of B ST/ NJ Ave Sewer, downstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-2U	East conduit of B ST/ NJ Ave Sewer, upstream of Structure 11 & inflatable dams	CSO overflow	
		11a-11-2D	East conduit of B ST/ NJ Ave Sewer, downstream of Structure 11 & inflatable dams	CSO overflow	
	B St/ NJ Avenue Sewer	00-35A-1	Upstream of Structure 35A on B ST/ NJ Ave Sewer	Internal System Flow	
	B St/ NJ Avenue Sewer	00-35b-1	Downstream of Structure 35A on B ST/ NJ Ave Sewer	Internal System Flow	
Tiber Creek	CSO- 012	12-16-1U	West conduit of Tiber Creek Sewer, upstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-1D	West conduit of Tiber Creek Sewer, downstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-2U	East conduit of Tiber Creek Sewer, upstream of Structure 16 & inflatable dams	CSO overflow	
		12-16-2D	East conduit of Tiber Creek Sewer, downstream of Structure 16 & inflatable dams	CSO overflow	

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
Northeast Boundary	CSO 019	19-24-1	West conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-2	Middle conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-3	East conduit of Northeast Boundary Trunk Sewer (NEBTS), downstream of inflatable dam	CSO overflow	X
		19-24-4L	Top of weir in mixing tank at Swirl Facility	CSO overflow	X
Potomac River					
	CSO 003	03-02-1L	Downstream of Structure 2	CSO Overflow	
	CSO 020	20-34-1U	Upstream of Structure 34	CSO Overflow	
		20-34-1D	Between Outfall and Structure 34	CSO Overflow	
Slash Run	CSO 021	21-35-1	Slash Run Trunk Sewer Overflow	CSO overflow	X
		00-35-1	Slash Run Trunk Sewer Dry Weather Flow, upstream of Structure 35	Diverted flow	
	CSO 022	22-36-1	Downstream of Structure 36	CSO Overflow	
		22-36-2	27" Storm	Storm	
West Rock Creek Diversion Sewer	CSO 024	24-38a-1L	On the weir, downstream of Structure 38a	CSO overflow	X
		24-38a-2V	On the weir, downstream of Structure 38a	CSO overflow	X
		24-38a-3	30" CS connected to CSO 024 Outfall sewer	CSO overflow	X
		24-39b-1L	21", overflows from STR 39b to meter location 24-38a-3	CSO overflow	
		24-39a-1L	12", overflows from STR 39a to meter location 24-38a-3	CSO overflow	
	CSO 025	25-41-1	Downstream of Structure 41	CSO overflow	
		25-41c-1	Downstream of Structure 41c	CSO overflow	
		25-41b-1	Downstream of Structure 41b	CSO overflow	
	CSO 026	26-42-1	Downstream of Structure 42A	CSO overflow	
	CSO 027	27-43a-1	Downstream of Structure 43A	CSO overflow	
		27-44-1L	Level sensor on UPI at Structure 44	CSO overflow	
	CSO 028	28-45-1	Downstream of Structure 45	CSO overflow	
	CSO 029	29-46-1	21" SS, upstream, of Structure 46	Diverted flow	

Drainage Area	Site/ Outfall	Meter Designation	Location	Type of Metering	Permit Req'd
College Pond		29-47-1	6' CS, upstream of Structure 47	Diverted flow	
		29-47-2	6' CS, downstream of Structure 47	CSO overflow	X
		29-47-3	12" Storm, at Structure 47	Storm	
		29-47-4	18" Storm, at Structure 47	Storm	
	UPIRS	00-UPIRS-1	downstream of Rock Creek Siphon and Structure 37A	Internal System Flow	
		00-UPIRS-2	Downstream of flow diversion from UPIRS to UPI via 6' connection	Internal System Flow	
	UPI	00-UPI-1	Between Structure 38A and Rock Creek PS	Internal System Flow	
		00-UPI-2	UPI, downstream of 6' flow connection from UPIRS	Internal System Flow	
		00-UPI-3	UPI flows to Rock Creek PS	Internal System Flow	
Rock Creek					
Piney Branch	CSO 049	49-70-1L	On the weir, west conduit at Structure 70	CSO overflow	
		49-70-2L	On the weir, middle conduit at Structure 70	CSO overflow	
		49-70-3	East conduit, near Outfall 049 at Structure 70	CSO overflow	
		49-70-4	ERCDS, downstream of Structure 70	Diverted flow	

- CSO Overflow Sampling
  To characterize the nature of CSO overflows, sampling will be performed at one (1) CSO in the Northeast Boundary (NEB) drainage area at the influent to the NEB Swirl (CSO 019). The sampling location is representation of CSO before treatment by the Swirl facility. Manual grab sampling will be performed during four storms at a frequency of 1 sample per hour for first 8 hours and then 1 sample every 8 hours for up to a total 40 hours per storm event and for a maximum of 12 samples per storm. Samples will be analyzed for the parameters shown in Table 1- 5.

Table 1-5 – CSO Sampling Analysis

Analysis	Method (1)
Field Parameters	PH – SM 4500 H-B Temperature – EPA 170.1 Dissolved Oxygen – SM 4500 – G
Fecal Coliform	SM 9221 – E (A1-Medium)
	SM 9221 – E (EC-Medium)
E. coli	SM 9223 B-94 (Quantitray)
	SM 9221 –F (EC-MUG)
CBOD5 (total)	SM 5210 B -01
TSS	SM 2540 D -97
Chlorophyll a	SM 10200 - H

Notes:

(1) SM= Standard Methods

To check the characteristics of CSOs at other outfalls, sampling was performed at Potomac River CSOs (CS0 027 and CSO 029). Manual grab sampling was performed during one storm and were analyzed for the parameters shown in Table 1- 5.

1.4.2 Schedule

The first phase of post construction monitoring will be conducted from December 2014.

1.4.3 Summary of Project and Quality Records

The following general categories of records will be maintained:

- Field/Sampling Records - these records include items such as sampling logs, chain of custody documents, notations on weather conditions, the number of samples collected, any observed problems during sampling. These records will also include flow and rain fall data downloaded from the flow monitors and rainfall gages, respectively. Also included in these reports will be the results of field QA/QC checks, such as calibration results for field measurements and calibration data for flow monitors.
- Laboratory records - These records will include the results of laboratory analyses, and the results of QA/QC checks run by the laboratory including laboratory blanks, duplicates, matrix spike, laboratory quality control sample results, etc.
- QA/QC Reviews - The data received from the laboratory and the field crews will be reviewed by the QA Manager to confirm compliance with the QAPP and to identify quality problems with the data.

1.5 Quality Objectives and Criteria for Measurement Data

1.5.1 General

The monitoring activities described in this QAPP are part of the characterization effort necessary to assess the performance of Phase I CSO controls. The Data Quality Objectives (DQOs) of the monitoring program are as follows:

- To collect sufficient quantity of data over a sufficient length of time to characterize the CSS and receiving waters in a manner which allows for verifying the effectiveness of Phase I CSO controls.
- To collect data of adequate quality that is scientifically defensible and reliable.

1.5.2 Data Quality Indicators

There are five data quality indicators (DQI) used to judge whether the collected data is of adequate quality to meet the objectives. Each is described below:

Precision

Precision measures the degree of agreement among replicate measurements taken under prescribed similar conditions. Precision will be maximized by using consistent sampling and analytical procedures as established in the QAPP.

- Field instruments are instruments which measure pH, DO and temperature. The precision of field instruments will be assessed by periodically completing duplicate testing of samples in the field. The precision DQOs for these instruments are summarized in Table 1-6.
- The precision DQO for rain gages is presented in Table 1-6. Checking the precision of the rain gages installed at geographically different locations in the District is problematic. Depending on the storm, disparate areas in the District will likely receive varying amounts of rain, particularly during regional summer thunderstorms. However, during region-wide storms, it may be possible to compare the recorded rain amounts of the gages with each other, and with the National Weather Service gage at National Airport. It is unlikely that the comparison will be able to confirm precision to the degree the gage is actually capable of reproducing. However, the comparison should provide a method to check for significant errors.
- The precision DQO for flow monitors in the CSS is presented in Table 1-6. Again, because installation of parallel flow monitors in large conduits is not practical and because rain events will not produce identical CSO overflows, direct confirmation of the precision is not practical. However, the flow monitor depth and velocity measurements can be plotted on an x-y graph (scatter graph). The data should show the theoretical relationship between depth and velocity as described by Manning's equation. This has been used in the past to identify meters which are not working properly, or which develop problems after installation. This technique is proposed for this monitoring effort.
- Field sampling precision will be analyzed by collecting and analyzing duplicate samples. The frequency of each of these QC checks is described in Section 2 of this report. A DQO of a spread of ±20% has been established for field sampling and handling precision.
- Laboratory data precision will be assessed by using within-run duplicates, mixed control sample duplicates, control samples, and matrix spike duplicates as part of the approved analytical method. The DQO is for the laboratory to meet QC requirements specified by the analytical method. Analytical methods and the frequency of QC checks are included in Section 2 of this report.

Accuracy

Accuracy measures the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy will be assured as follows:

- In-situ measurement equipment consists of rain gages and flow monitors in the CSS. Field instruments are instruments which measure pH, DO, and temperature. The accuracy of these instruments will be assured through proper calibration in accordance with manufacturer's instructions. The DQO for accuracy is to have all instruments calibrated per manufacturer's instructions when used to collect data. The numeric DQO for these instruments is summarized in Table 1-6.
- Field sampling accuracy will be analyzed by collecting and analyzing equipment blanks, and combination trip/preservation blanks. The frequency of each of these QC checks is described in Section 2 of this report.
- Laboratory data accuracy will be assessed by using reference standards, matrix spikes, blank spikes, and surrogates as part of the analytical methods. The results will be reviewed for compliance with the control limits established for the approved analytical methods. The DQO for the laboratory is to meet QC requirements specified by the analytical method.

Table 1-6. Equipment and Instrument Data Quality Objectives

Instrument	Precision	Accuracy
Rain gage	0.01"	0.01"
pH	±0.01 units	±0.2 units
Temperature	±0.01° C	±0.5° C
Dissolved Oxygen	±0.01mg/L	±2% of reading or ±0.2 mg/L
Conductivity	±5%	±5%

Representativeness

Representativeness measures how well a certain parameter measured at the sampling location represents the value of the parameter at the site. Proper sampling protocols will be used to assure that samples collected from the site is representative of the media presented in the field. Sample handling protocols, including tasks such as storage, transportation, and preservation will be used to protect the representativeness of samples gathered during the CSO overflow monitoring. Proper documentation in the field and laboratory will establish that protocols designed to preserve the representativeness of the samples have been followed and that sample identification and integrity has been preserved.

Comparability

Comparability measures how well two different data sets can contribute to a common analysis and comparison. The use of consistent sampling and analytical methodology as presented in this QAPP will insure that comparability is maintained during the sampling effort under this program. Comparison of data sets often indicates that certain values are not consistent with the data as a whole. These values will be evaluated using statistical analysis, if necessary, to determine if the data should be included in the performance assessment of Phase I CSO controls.

Completeness

Completeness measures how much valid data was actually obtained compared to what was planned to be obtained. The amount of data proposed to be collected as summarized in this QAPP was established

based on the anticipated measurements and data required to accomplish the monitoring objectives. As a preliminary goal, a completeness level of 90% will be used as an initial guideline to gage the level of completeness in the data collection. However, since the required amount of valid data projected to be necessary prior to monitoring may not accurately reflect the amount actually necessary to evaluate the effectiveness of the Phase I CSO controls, the extent of completeness will be reviewed on a relative basis as the monitoring progresses.

1.6 Special Training Requirements/ Certifications

Installation and maintenance of flow monitors in the CSS will require entry into manholes and sewers. These areas are classified as confined spaces. As a result, confined space training and certification in accordance with 29 CFR 1910.146 is required. This work will be performed by CSL Services, Inc. CSL personnel will have the required training and certification to perform the work. Documentation of the training and certification will be maintained in CSL files.

1.7 Documentation and Records

The following will be included in all data reports:

Field Reports

- Sample collection records - at a minimum, this documentation shall include the following: names and signatures of persons conducting the activity, sample number, sample collection point, climatic conditions, notations of any unusual observations, notations indicating what methods were used in cases where general field practices or other standard procedures were violated.
- Copies of daily field logs.
- Copies of chain of custody documents.
- QC Records - documentation of any QC samples collected (e.g. duplicates, blanks, etc.).

Laboratory Reports

- Number of samples, date and time of analysis, initials of analyst, analysis results, and analysis methods.
- Copies of chain of custody documents.
- QA/QC reports to include laboratory blanks/duplicates results, matrix spike/matrix spike duplicate results, surrogate recovery data, chain-of-custody forms, laboratory control sample results, replicates, splits, and any other project specific information.
- Supporting documentation such as sample preparation logs, sample run logs, raw sample data, and raw calibration data that are necessary for data validation purposes.

Laboratory Turn-Around Time

The laboratory will submit a draft report with results no later than 30 days after receipt of samples.

Retention of Records

Data packages will be kept on file at DCCR's sharepoint (web application) for a minimum of 5 years after completion of the Phase I Post Construction Monitoring work.

2 Data Generation and Acquisition

2.1 Sampling Process Design

The principal program components, locations, sample matrices, measurement parameters, and frequency of sampling are summarized in Table 2-1. All measurements taken during the course of monitoring period will be critical to measure the effectiveness of Phase I CSO controls. Critical components of the sampling process design are described in the following sections.

Table 2-1. Summary of Phase I Monitoring (Excluding Receiving Water Monitoring)

Program Component	Locations	Sample Matrix	In- Situ Measurements	Lab Analyses	Frequency
Rainfall Monitoring	Six rain gages, one each in six principal CSS drainage areas	Not applicable	Rainfall	None	Continuously over 12 months
Flow Monitoring (Flow & Volume)	CSO Outfalls 003, 011a, 012, 019, 020, 021, 022, 024, 025, 026, 027, 028, 029 and 049	Not applicable	Flow	None	Continuously over 12 months
CSO Overflow Sampling	CSO 019, 027 & 029	water	pH, D.O., temp	Fecal coliform, E.coli, CBOD5, TSS, Chlorophyll-a	At least four storms over 12 months
Internal System Points in CSS for Model Calibration	See Table 1-4	water	Flow	None	Continuously over 12 months

2.2 Sampling Methods Requirements

Data and sample collection methods are summarized below:

In-situ Monitoring Equipment

- Rain Gages - Tipping bucket rain gages that measure rainfall in increments of 0.01" will be located in the six selected drainage areas. The rain gages have wireless modems. These gages call into and push the data to a remote server where the data is accessed and downloaded on continuous basis. If there is a modem communication issue, CSL will conduct field visit to download the data manually and fix the issue. Each rain gage will be visited every 15 days or earlier, if needed, for inspection and maintenance.

- Flow Meter - Flow monitors generally consist of a Doppler meter to measure the velocity and an ultrasonic/pressure sensor to measure depth of flow. Given the known geometry of the pipe section, the flow rate can be calculated. The flow monitors store associated depth and velocity measurements taken over time integral to the unit. All meters installed for this program have wireless modems. These meters call into and push the data to a remote server where the data is accessed and downloaded. If there is a modem communication issue, CSL will conduct field visit to download the data manually and fix the issue. Each flow meter will be visited every 15 days or earlier, if needed, for inspection and maintenance.

Field Procedures

- Manual Grab Samples - Manual grab samples will be collected and analyzed for parameters listed in Table 1-2 for the CSO Overflow Sampling. CSO overflow samples will be collected at the influent of the Northeast Boundary Swirl Facility. These samples will be collected with a sample bottle attached to a sampling pole. The bottle will be conditioned by rinsing the bottle in the effluent and then emptying prior to collecting sample. The samples will be collected during four storms at a frequency of 1 sample per hour for first 8 hours and then 1 sample every 8 hours for up to a total 40 hours per storm event, for a maximum of 12 samples collected per storm.

- Sample Bottles
  The appropriate container materials and preservatives as prescribed in 40 CFR 136 will be used. The sample volumes, and container types required for each different type of sample are shown in Tables 2-2. All sample bottles will be properly cleaned and decontaminated. Sample bottles will be labeled with waterproof labels containing enough information to ensure that each sample is unique. The information on the sample bottle labels will be recorded in the sampling notebook or report.

2.3 Sample Handling and Custody Requirements

Sample Hold Times

Hold times and preservation methods will be in conformance with 40 CFR Part 136. Allowable sample hold times and preservation methods are shown in Table 2-2.

Table 2-2. Sample Hold Times, Volumes, Container Types and Preservatives

Parameter	Hold Time	Min. Volume	Container Type	Preservative
Total Suspended Solids	7 days	1 liter	HDPE	None
Chlorophyll-a	24 hours	250 ml	HDPE or amber glass	None
CBOD5	48 hours	0.5 liter	HDPE	None
E.Coli	8 hours	100 ml	HDPE	Sodium Thiosulfate
Fecal Coliform	8 hours	100 ml	HDPE	Sodium Thiosulfate

Sample Handling and Custody Requirements

For samples collected under CSO Overflow Sampling effort, Martel Laboratories will arrange pickups to take the samples collected by DCCR personnel, put the samples in a cooler packed with ice and drive them to Martel Laboratories in Baltimore, Maryland.

Chain of custody documents will be used at each change of possession of the sample between time of collection and analysis. At each change of possession, both the relinquisher and receiver will sign and date the chain of custody to track movement of the samples. An example of a chain of custody form to be used for samples collected during the CSO overflow sampling activity is provided as Figure 2-1. A copy of the Martel's QA Manual is provided in Appendix B. The samples will be stored in accordance with 40 CFR Part 136 until analysis.

All samples will be stored for possible retesting within the maximum holding times or may be disposed of if directed by DCCR.

Figure 2-1. Sample Laboratory Chain-of-Custody Form

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories, JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log # _____ Client Code _____	Sampler _____
Client Name/Phone/FAX _____	Project Name/# _____
Client Address _____	Contract/P.O Number _____
Invoice Address _____	Sample Turnaround Time _____

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments

Transferred by:	Received by:	Date	Time	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by:	Date	Time	Sufficient ice? - Yes/No If No, temp.= _____
Transferred by:	Received by:	Date	Time	Sample containers pres'd? - Yes/No If No, explain Custody Seal present/intact? - Yes/No Initials: Date:

2.4 Analytical Methods Requirements

All methods used for the analysis of samples taken for the CSO Overflow Sampling will conform to 40 CFR Part 136. Table 2-2 lists all parameters to be analyzed, along with their respective analytical methods. Each analytical method must satisfy the performance requirements of its respective method citation. In the absence of any specific performance requirements in its method citation, an analytical method must be able to detect constituents down to its detection limit as shown in Table 1-6. Martel personnel will rectify any performance requirement failure by proper calibration, testing, and maintenance procedures. The required laboratory turnaround time will be thirty (30) days.

2.5 Quality Control Requirements

Quality control requirements and procedures for measuring devices, field procedures, and laboratory procedures are as follows:

Measuring Devices:

- Rain gages: As noted in Section 1, checking the precision of the rain gages installed at geographically different locations in the District is problematic. Depending on the storm, disparate areas in the District will likely receive varying amounts of rain, particularly during regional summer thunderstorms. However, during region-wide storms, it may be possible to compare the recorded rain amounts of the gages with each other, and with the National Weather Service gage at National Airport. It is unlikely the comparison will be able to confirm precision to the degree the gage is actually capable of reproducing. However, the comparison should provide a method to check for significant errors.

- Flow monitors: Because installation of parallel flow monitors is not practical and because rain events will not produce identical CSO overflows, direct confirmation of the precision is not practical. However, the flow monitor depth and velocity measurements can be plotted on a x-y graph (scatter graph). The data should show the theoretical relationship between depth and velocity as described by Manning's equation. This has been used in the past to identify meters which are not working properly, or which develop problems after installation. This technique is proposed for this project.

Field Procedures:

- Field duplicates: For each sampling event, enough sample volume will be collected in the field to perform each laboratory analysis twice. Field duplicates will be prepared by collecting a sample in two separate sample containers. The degree of agreement between field duplicates will determine the level of precision in sampling and handling techniques.

- Field blanks: For grab samples, the sample bottles containing the appropriate preservatives will be filled with deionized water in the field. These blanks will determine whether cross-contamination is occurring between different sample bottles or during sampling procedures.

- Equipment blanks: The sampling device (manual sampling bottle) will be thoroughly rinsed with deionized water. The rinsate deionized water will be analyzed for all laboratory analysis parameters. These blanks will determine whether cross-contamination between individual storm events is occurring.

- Trip blanks: Laboratory sample bottles containing deionized water and preservative will be carried into the field and handled in the same manner as the other sample collection bottles. At least one trip blank bottle will be placed in each cooler. These blanks will determine whether any contamination from sample handling procedures or the preservatives is occurring.

- Temperature blanks: A laboratory sample bottle containing deionized water will be added to each shipping container. The laboratory will measure the temperature of the water to ensure that the samples were at the minimum temperature required for cool preservation.

The aforementioned QC samples and blanks for sampling will be taken according to the schedule in Table 2-3.

Table 2-3. Summary of Field QC Activities

Type	Frequency
Temperature, pH, Dissolved Oxygen, Duplicate Measurements	1 per every 12/ event
Sample Duplicates	1 per 12/ event
Equipment Blank & Field Blank	1 per 20
Temperature Blank	1 per cooler

Laboratory Procedures:

- Calibration: Recognized calibration procedures from specific methods or manufacturers' instructions will be used.

- Method blanks (Laboratory reagent blanks): These will be performed a minimum of once per twenty samples, or once per batch, whichever is greater (method specific).

- Matrix spikes: These will be performed a minimum of once per twenty samples, or once per batch, whichever is greater (method specific).

- Laboratory control samples (LCS): These will be performed a minimum of once per twenty samples, or once per batch, whichever is greater (method specific). These will not be performed if matrix spikes have been successfully analyzed.

- Duplicates: These will be performed a minimum of once per twenty samples, or once per batch, whichever is greater (method specific).

- Outliers: Samples which appear to be outliers will be retested. Due to the short holding times, it will be rare when the lab could reanalyze within method specified holding times.

Copies of Quality Control checklists and standard operating procedures used by Martel Laboratories are provided in Appendix B. Duplicate, matrix spike, and matrix spike duplicate QC samples will be evaluated by calculating the relative percent differences and percent recoveries. Precision and accuracy

matrix spike duplicate QC samples will be evaluated by calculating the relative percent differences and percent recoveries. Precision and accuracy must be within limits established in the citations for each method. Any processes outside of specified control limits will be resolved using the tiered review procedure.

2.6 Instrument/ Equipment Testing, Inspection and Maintenance

Testing, inspection, and maintenance procedures for measuring devices, field instruments, and laboratory instruments are presented below.

Measuring Devices:

- Rain gages: Rain gages will be visited every 15 days for inspection and maintenance. The hyetographs of rainfall events will be examined every 15 days or earlier, if needed, for any indications of rain gage malfunctions or abnormalities. CSL personnel will address any detected equipment problems on-site.

- Flow monitors: Flow monitors will be visited every 15 days to inspect equipment, and perform any needed maintenance. The standard QA/QC procedures that CSL personnel will follow during each visit to the flow monitoring sites is included in Appendix C. An Electronic Field Book form that CSL personnel will fill out during these visits is also included in Appendix C. Any malfunctions or failures in monitoring equipment will be addressed by CSL personnel during regular site visits.

Field Procedures:

- Field Instruments measurements: The manual pH, D.O., temperature, and conductivity meters will be inspected and maintained according to manufacturers' recommendations before each use in field.

Laboratory Procedures:

- Laboratory instruments: Martel will provide required regular inspection and maintenance to laboratory instruments.

Critical information, including date, time, operator's initials, and inspection/maintenance performed, will be recorded for future reference each time an instrument is inspected or maintained. In addition, an inventory of critical spare parts will be maintained by CSL and Martel.

2.7 Instrument/ Equipment Calibration and Frequency

Calibration procedures for measuring devices, field instruments, and laboratory instruments are presented below.

Measuring Devices:

- Rain gages: The rain gages will be calibrated every 8 weeks.

- Flow monitors: The flow monitors will be calibrated after initial installation every 8 weeks using the manual flow measurement procedures described in Appendix C. The calibrations

will occur during rain events, or a fire hydrant may be used to produce enough water flow to perform the calibration.

Field Procedures:

- Field measurements: The manual pH, D.O., temperature, and conductivity meters will be calibrated according to manufacturers' recommendations before each use in the field.

Laboratory Procedures:

- Laboratory instruments: Martel will provide required regular calibration for laboratory instruments.

2.8 Inspection/Acceptance Requirements For Supplies and Consumables

Martel will provide review to assure standards and reagents meet acceptance criteria. Any supplies or consumables that are found defective by Martel will be sent back to the manufacturer.

2.9 Non-direct Measurements

Non-direct measurements include those measurements that are a) not directly measured by calibrated instrumentation that are designed for the purpose or b) based on observation and are subject to interpretation by technical staff. For the rainfall monitoring, CSO overflow monitoring and CSO overflow sampling, no such non-direct measurements will be required.

2.10 Data Management

There will be three distinct data management schemes for the data collected during post construction monitoring. They are as follows:

Rain Gage, Flow Meter, and CSO Overflow Sampling Data

- As mentioned previously, data from rain gage and flow monitor sites will be downloaded to a remote server on continuous basis. When there is modem communication issue, CSL will visit the site, fix the issue and manually download the data. The flow monitors have enough computer memory to store up to three months' worth of data.
- The data is downloaded at CSL's headquarters, where it is reviewed by an experienced data analyst. The raw field measurements (e.g. depth and velocity) are synthesized using Telog's Enterprise software to generate meaningful data (e.g flow rate as a function of time).
- CSL will use a Telog's Enterprise software to calculate flow rates in sewers using the continuity equation, Q = A*V where Q = flow rate, V = velocity, and A = cross-sectional area. In the case of weirs, the software will calculate the flow using the weir length and the head over the weir. Confirmation of the software output will be performed by manually computing flow rates for a selected number of velocity and depth measurements. Based on conduit geometry, depth can be correlated to flow area.
- An electronic copy of the data in the form of a Microsoft Excel table is forwarded to DCCR by e-mail on a monthly basis. In addition, a copy of the bi-weekly site visit forms are also emailed to DCCR.

- DCCR files the hard copy of the data in a master file system (SharePoint) that has been developed for all DC Clean Rivers projects. In addition, the electronic copy is loaded to a network drive, which is backed up at approximately one week intervals.

Laboratory Measured Data

- Martel picks up CSO samples and delivers at their Baltimore office.
- Martel logs the samples into their database.
- Martel performs the analyses, and subjects the data to a rigorous data validation process.
- Martel produces a laboratory analysis report, which will be mailed to DCCR (hard copy and electronic format). In addition, Martel also retains a hard copy and an electronic copy of the laboratory analysis report.
- DCCR files the hard copy of the data in a master file system (SharePoint) that has been developed for all DC Clean Rivers projects. In addition, the electronic copy is loaded to a network drive, which is backed up at approximately one week intervals.

Field-measured Data

- DCCR measures temperature, D.O., and pH at the influent sewer of Northeast Boundary Swirl Facility using grab samples. The data is recorded in a field log.
- The temperature, D.O., and pH data are taken to DCCR's office in Washington, DC, and is transcribed from the field log to a desktop computer.
- DCCR files the hard copy of the data in a master file system (SharePoint) that has been developed for all DC Clean Rivers projects. In addition, the electronic copy is loaded to a network drive, which is backed up in approximately one week intervals.

To ensure the proper transcription of all data, the DCCR QA Manager will check a representative number of database entries against the raw data, such as field log sheets or laboratory reports.

Locational data (latitude and longitude) for each monitoring and sampling location will be provided. In accordance with EPA Directive 2100, the locational data will be presented according to the following guidelines:

- Latitude/Longitude: These parameters will be expressed in the format +/- DD MM SS.SSSS.
- Method: The method used to measure the location will be specified.
- Description: A textual description of the physical location will be noted.
- Accuracy: The accuracy will be expressed as one-half of the most precise unit for which there is certainty of measurement (for example, +/- 0.5 seconds).

3 Assessments and Oversight

3.1 Assessments and Response Actions

Data assessment will be performed by DCCR as well as by laboratory and field personnel prior to reporting.

3.1.1 Data Assessment

The following data assessment activities are planned

- Surveillance - DCCR will regularly monitor the status of the data collection to ensure that the specified requirements are fulfilled.

- Field Data Assessment - Field data will be reviewed by the project coordinator for DCCR and project manager of CSL. Accuracy of field measurements will be assessed using daily instrument calibration, calibration checks and analysis of blanks where applicable. Precision will be assessed by comparing results from replicate measurements of a single sample. Completeness will be evaluated based on work done compared to that work which is scheduled. Review will occur prior to submittal of data to DCCR. The frequency of data submittal will depend somewhat on the amount of rain, but will be approximately monthly.

- Technical Systems Audit for Field Activities (TSA) - Two TSAs will be performed for the field activities by DCCR's QA Manager. One TSA will be performed near the beginning of the monitoring, while the other will be performed near the middle of the monitoring. The TSAs will consist of accompanying field crews on a sampling activity at or a flow meter maintenance activity at one site, observing and checking equipment, field procedures and record keeping for compliance with the QAPP. The TSA's will not include accompanying the samples to the lab.

- Laboratory Data Assessment - Laboratory data will be reviewed by the laboratory's QA Manager according to the laboratory's QA/QC Procedures.

- Program Manager's QA/QC Review - DCCR's QA Manager will review data packages to confirm compliance with the QAPP. Items to be reviewed include raw data, reported data, chain of custody forms, QA/QC checks, calibration records, and other relevant material. The frequency of review will depend on the frequency of data submitted, but will be approximately monthly.

If any data generation activities are suspected or determined to not meet the requirements of the QAPP or to be of suspect quality, the QA Manager will prepare a written summary memorandum to the Project Manager. The Project Manager and QA Manager will confer to achieve a resolution.

3.1.2 Corrective Action

Corrective action procedures for field and laboratory activities are followed whenever data quality objectives or the provisions of this QAPP are not met. Corrective actions include procedures to promptly investigate, document, evaluate, and correct any deficiencies in data quality.

If a condition is noted to have an adverse effect on data quality, corrective action will be taken to eliminate the reoccurrence of this condition. Condition identification, cause, and corrective action implemented will be documented and reported to the Project Manager.

Project and laboratory personnel will regularly monitor ongoing work performance in the normal course of daily responsibilities. Examples of situations that would require corrective action include the following:

- Standard operating procedures have not been properly performed.
- Pre-determined data acceptance standards are not maintained.
- Equipment and instrumentation is not in proper working order or properly calibrated.
- Samples and analytical results are not completely traceable.
- QC requirements are not met.
- Improper approvals.
- Deficiencies are discovered during system or performance audits.

Corrective action may include:

- Resampling and/or reanalyzing the samples;
- Evaluating and amending sampling procedures;
- Evaluating and amending analytical procedures; or
- Accepting data and acknowledging the level of uncertainty.

3.2 Reports to Management

On a monthly basis, the QA manager reviews data submissions and reports (included in invoices) submitted by sub consultant responsible for each monitoring element. Each report contains a description of monthly progress on each task and financial status. Data submissions include pertinent sampling event technical information or continuous data graphs. DCCR's QA Manager will review the reports, identify the following concerns and discuss them with the team for immediate resolution.

- Significant departures from the QAPP
- Significant QA/QC problems and recommended corrective actions
- Status of corrective actions which have been implemented to address previous problems, if any.

4 Data Validation and Usability

4.1 Data Review, Verification, and Validation Requirements

Throughout the monitoring program, data generated will be reviewed by the DCCR's QA Manager to determine if it meets QAPP objectives. The criteria for accepting, rejecting or qualifying the data are as follows:

- Adherence to QAPP requirements and recognized guidelines in the sampling, analysis, and data management activities
- Adherence to provisions, procedures, and requirements set forth in the monitoring program
- Reasonableness of data compared to available monitoring data and logical constraints due to the physical laws of nature.

Data which does not meet these requirements may be rejected or qualified, on a case by case basis by the DCCR's Project Manager.

4.2 Verification and Validation Methods

Verification refers to the process of determining whether the specified QC acceptance criteria have been met. The data will be verified by confirming adherence to QAPP requirements and recognized guidelines in sampling, analysis and data management.

Validation refers to the process of confirming that the data meet the requirements of the intended use. The data can be validated by confirming compliance with the post construction monitoring program's requirements for quantity of data, location of data collection, type of rain events collected, etc. There is some overlap in the methods for validation and verification. The procedures for validation and verification for each of aforementioned criteria are summarized below.

Adherence to QAPP requirements and guidelines in sampling, analysis, and data management activities

- Examination of chain-of-custody forms and verifying adherence to proper chain-of-custody procedures
- Review of field logs made by CSL and DCCR personnel to verify that the equipment is functioning properly and that sampling protocol is followed
- Verifying laboratory compliance with all QA/QC checks and guidelines
- Checking data that is correctly entered into databases against the original field log entries and the laboratory reported results
- Review of laboratory reported results for missing data, outliers, or nonsensical readings

Adherence to provisions and procedures set forth in the monitoring program

- Ensuring that enough rainfall events having suitable characteristics have been monitored and sampled
- Verifying that the "first flush" phenomenon of rainfall events has been adequately sampled and characterized (The "first flush" is the large concentration of pollutants that is washed out of a combined sewer during the first few minutes of a rainfall event, but which rapidly subsides thereafter)
- Verifying that CSO overflow sampling, rainfall monitoring and flow monitoring is being

conducted as required, and that laboratories are performing all required analyses
- Verifying that the sampling schedules outlined are properly followed

Reasonableness of data compared to available monitoring data and logical constraints due to the physical laws of nature.
- Comparing sampling data to available data from prior monitoring efforts.
- Comparing flow data to general trends and characteristics which should be expected due to the physical laws of nature. For example, dramatic spikes or undulating flow in a CSO overflow would not be an expected occurrence in a rain event that has gradual intensity variations.

If suspected data or deficiencies in sampling, monitoring, or analytical methods are discovered, DCCR's QA Manager will confer with the Project Manager to resolve any problems. Any relevant data validation or verification problems will be documented in a memo which will be bound with the data when it is provided to any end-user.

4.3 Reconciliation with User Requirements

The user requirements as described previously are:

- To collect a sufficient quantity of data over a sufficient length of time to characterize the CSS and receiving waters in a manner which allows for the evaluation of effectiveness by Phase I CSO controls and for the calibration of the predictive models
- To collect data of adequate quality that is scientifically defensible and reliable

As discussed previously, reconciling the quantity of data actually collected will be performed by calculating completeness. Note that the monitoring program as developed should provide for collection of sufficient data to perform the necessary evaluations, provided there is a reasonable amount of rainfall. Extension or revision of the program may be required if an adequate amount of rain of the type which produces CSO events does not occur.

The quality of the data will be assessed by confirming compliance with the QAPP and accepted field procedures. Deficiencies in the collected data may require qualifying the data or extending, adjusting, or supplementing the monitoring program.

Appendix A Versar's QAPP for Receiving Water Monitoring

Original - November 15, 2014
*Modified April 26, 2016

Quality Assurance Project Plan (QAPP)

Phase I Receiving Water Post Construction Monitoring for DC Water's Long Term Control Plan

Contract No. #15-004

Period of Performance: 1 December 2014–30 June 2016

Prepared by

Versar, Inc.
9200 Rumsey Road STE 100
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Quality Assurance Narrative for Task Order 15-004:
Phase I Receiving Water Post Construction Monitoring for DC Water's Long Term Control Plan

Prepared by:
Versar, Inc.
9200 Rumsey Road, STE 100
Columbia, MD 21045

15 November 2014
Version 0

This quality assurance project plan has been prepared according to guidance provided in EPA/240/B-01/003 Requirements for Quality Assurance Project Plans (EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Management Staff, Washington, DC, Final, March 2001) to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use.

Approvals:

Tanya Spano Metropolitan Washington Council of Governments	Date	Mohsin Siddique District of Columbia Water and Sewer Authority	Date

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DISTRIBUTION LIST

The final version of this document will be distributed to the following MWCOG and Versar staff who are instrumental in conducting the water chemistry monitoring task:

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Katherine Dillow	Versar Field Staff	Field staff can be reach via the Versar contact noted above.	
Ryan Corbin	Versar Field Staff		
Charles Tonkin	ERG Field Staff		
Neal Eshelman	ERG Field Staff		
Danielle Zaveta	Data Manager		
Nancy Roth	QA/QC		
Tom Jones	QA/QC		
*Primary contacts to inform for all Routine Sampling and Wet Weather Events.			

1.0 PROJECT MANAGEMENT

This document constitutes the quality assurance project plan (QAPP) for Metropolitan Washington Council of Governments (MWCOG) Contract No. 15-004. This document was prepared to meet the requirements of EPA/240/B-01/003 Requirements for Quality Assurance Project Plans (EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Management Staff, Washington, DC, Final, March 2001) and EPA/2440/B-01/002 Requirements for Quality Management Plans (EPA QA/R-2, U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC, Final, March 2001) to ensure that environmental and related data collected, compiled, and/or generated for this project are complete, accurate, and of the type, quantity, and quality required for their intended use and as a guide to aid in identifying the quality elements applicable to the task order.

Quality Assurance and Quality Control (QA/QC) are an ongoing and integral part of the project monitoring efforts. This QAPP was prepared by Versar to document QA/QC measures employed in the Phase I Post Construction Monitoring for DC Water's Long Term Control Plan. This document outlines QA project management policies and procedures, will serve as the manual for field and laboratory operations, and is consistent with EPA Guidance for Quality Assurance Project Plans (EPA 2002). Included are descriptions of the study site locations and the technical QA/QC procedures employed throughout the project to ensure data quality.

Versar will meet with MWCOG and DC Water staff at the initiation of this project to confirm logistics and sampling timing, and to share contact information for initiating each sampling event. Versar will also participate periodically in conference calls with MWCOG and DC Water to coordinate each sampling event. All submissions will be made directly to MWCOG, and MWCOG will coordinate transmittal to DC Water.

1.1 PROJECT/TASK ORGANIZATION

1.1.1 Project Staff Organization

Versar employs proven project management strategies and systems to ensure adherence to schedules and budgets. The Versar approach embodies the principles of integration, scope, time, cost, quality, human resources, communications, risk, procurement, and professional and social responsibility. The proposed Project Manager, Mr. William Burton has over 32 years of experience managing similarly sized programs. He is capable of simplifying the management of this project and ensuring his focus on key program objectives.

The organization of Versar's proposed team for this project is simple, and our management approach is straightforward, as illustrated in Figure 1-1. **William Burton, M.S.**, Senior Program Manager for Versar's Columbia, Maryland office has the authority to commit all necessary resources to the project and can address any issues that require senior-level attention and will serve as the primary point of contact with MWCOG for handling contract-level management issues such as budgeting, scheduling, and ensuring the quality of products.

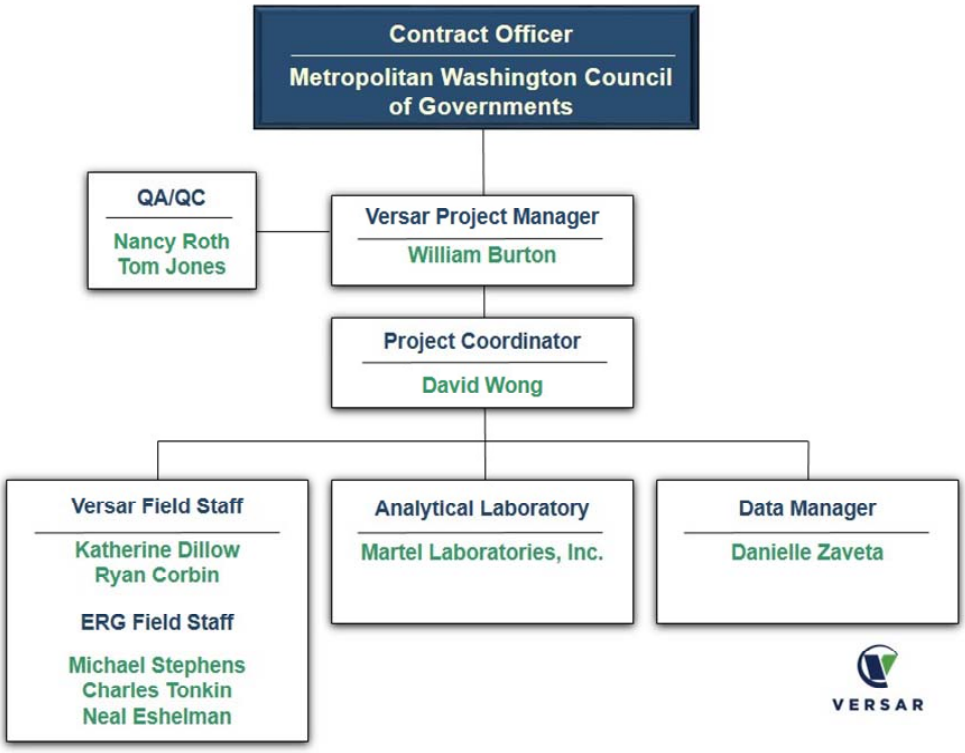

Figure 1-1. Organizational chart

Mr. David Wong, B.S., will serve as Versar's Project Coordinator. Mr. Wong will be supported by both Versar and ERG field staff for the project effort. He oversees all aspects of field work and bears the responsibility of assuring that field work, laboratory analysis, data management, data analysis, and reporting are successfully completed. **Tom Jones, B.A.** (Chemistry), and **Nancy Roth, M.S.** (Resource Ecology and Management), will serve as QA Officers (QAO) for the project by reviewing the collected data, data analysis results, and the annual report. Project data management will be undertaken by **Danielle Zaveta, M.S.**

Experienced technical staff and managers are committed to serve each of the designated roles on this project (Table 1-1). For this project, the primary Field Leader is Colby Hause. Presently there are at least five dedicated field technicians available to support field operations.

The Project Coordinator and Field Leader communicate regularly with Amber Confer, Joe Wolfkill, and Tim Brunner of Martel to discuss laboratory analysis requirements, coordinate sample transfer, and obtain analytical results. Ms. Confer oversees sample receipt, tracking, and preparation of analytical result reports. As needed, Versar's Project Manager assists in resolving any laboratory coordination concerns.

The Project Coordinator oversees day-to-day field operations for the water chemistry monitoring project. Most problems that may arise during field activities can be solved on-the-spot by field staff, but technical problems that cannot be solved by technical staff are brought to the

attention of the Project Manager. The Project Manager then works with the Project Coordinator to decide how best to resolve the problem. All major problems, particularly those requiring modifications of the scope, schedule, or budget, and steps taken to resolve them are discussed with MWCOG's Project Manager.

Table 1-1. Contact numbers of project staff

Name	Title	Contact
TECHNICAL STAFF		
William Burton	Project Manager	410-740-6086
David Wong	Project Coordinator	410-740-6082
Nancy Roth	QAO	410-740-6091
Thomas Jones	QC Coordinator	410-740-6073
Danielle Zaveta	Data Analyst	410-740-6046
Katherine Dillow	Field Staff	410-740-6116
Ryan Corbin	Field Staff	410-740-6071
Colby Hause	Field Leader	410-740-6042
Chester Lindley	Field Leader	410-740-6085
Neal Eshleman	Field Staff	410-740-6092
Charles Tonkin	Field Staff	410-740-6100
Colby Hause	Field Staff	410-740-6042
MARTEL LABORATORY		
Joe Wolfkill	Lab Coordinator	410-825-7790
Instrumentation TECHNICAL SUPPORT		
YSI	800-765-4974	
PME	760-727-0300	

1.1.2 Overview of Quality Assurance Policy and Procedures

Versar has used similar approaches to project management and quality assurance to successfully manage federal, state, and local government projects throughout the mid-Atlantic region for more than 30 years. Our centralized management procedures are outlined in Versar's Quality Assurance Manual and are implemented for all projects.

Versar has a reputation for providing high quality services in a timely fashion and at acceptable cost, even under varying workloads and working conditions. Elements that ensure appropriate quality assurance and quality control (QA/QC) are inherent in our management approach (in accordance with our Corporate and Division QA/QC programs).

Versar staff is dedicated to achieving, maintaining, and improving high standards of quality in accordance with Division and Corporate client-satisfaction policy. This goal is achieved by adhering to active QA procedures designed to ensure that services and deliverables are precise,

accurate, complete, technically superior, and are of a sufficient integrity that they are suitable for their intended use.

The Quality Assurance program is implemented at the project's onset and forms an integral part of each step in the work process, from initial planning (e.g., task definition and scoping), to equipment maintenance, to data validation, and to final report preparation and review. The QAO is a part of the management team, as illustrated above. Project performance standards designed to achieve quality objectives are detailed in this QAPP.

1.2 PROBLEM DEFINITION AND BACKGROUND

1.2.1 Goals and Objectives

The District of Columbia Water and Sewer Authority (DC Water or Authority) has a National Pollutant Discharge System Elimination Permit (NPDES) for the wastewater treatment plant at Blue Plains and the combined sewer system. The permit requires DC Water to conduct Phase I of post-construction monitoring after the inflatable dams have been replaced and the pumping station rehabilitations have been completed. The Phase I work is scheduled to begin in December of 2014 and be completed one year thereafter (final dates to be determined in consultation with MWCOG and DC Water).

The permit specifies the scope of the Phase I post-construction monitoring program. The program includes rainfall monitoring, combined sewer overflow (CSO) flow monitoring and sampling, and in-stream receiving water monitoring. DC Water will conduct the rainfall monitoring and CSO flow monitoring and sampling. Versar will supply all labor, equipment, material and services to conduct in-stream receiving water quality monitoring as described below.

1.3 PROJECT/TASK DESCRIPTION

1.3.1 Receiving Water Sampling

Versar will mount and deploy long-term dissolved oxygen and water quality meters at six fixed locations within the impact area of the CSO along the Potomac and Anacostia Rivers. The meters will be visited and calibrated throughout the year-long monitoring period to check instrument operability and data quality. Water sampling will be conducted five times per month at the same locations as above plus seven additional locations, totaling thirteen sampling stations (see Section 2.2.5). DC Water will direct receiving water sampling efforts based on projected weather conditions with a goal of collecting samples on both dry and wet weather days. Samples will be analyzed for fecal coliform, *E. coli*, carbonaceous chemical oxygen demand ($CBOD_5$; total), total suspended solids (TSS), and chlorophyll-*a*. Due to the short hold time of bacteria samples, Versar will closely coordinate sampling teams and transfer to the analytical laboratory.

1.3.2 40-Hour Storm Event Sampling

Versar will monitor four, 40-hour storm events during the year-long monitoring period. During 40-hour storm events, sampling will be performed at each station six times at eight-hour intervals.

1.3.3 Parameters and Constituents Measured

The parameters and constituents measured for the project are:

- pH
- specific conductivity
- water temperature
- dissolved oxygen (DO)
- total suspended solids (TSS)
- chlorophyll-*a*
- fecal coliform
- *E. coli*
- $CBOD_5$ (total)

Constituents measured and sample analysis methods match the constituents, standards, and lab methods required in 40CFR136.

1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data quality objectives (DQOs) are qualitative and quantitative statements that clarify project objectives, define the appropriate type of data needed to support those objectives, and specify tolerable limits of uncertainty that will be used as the basis for establishing the quality of data needed to support decisions (EPA 2000). Measurement performance criteria are stated in terms of the desired level of uncertainty in data that will be used to address the study objectives. Quantitative statements such as analytical precision, bias, and method detection limits are examples of measurement performance criteria. Qualitative criteria may also be used. Principal indicators of data quality and examples relevant to this water chemistry monitoring project are listed in Table 1-2.

Table 1-2. Data Quality Indicators. Definitions are based on EPA guidance (EPA 2002). Examples relevant to this project are listed.

Indicator	Definition	Example Techniques
Precision	The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions	Laboratory splits Laboratory duplicates Field duplicates
Bias	The systematic or persistent distortion of a measurement process that causes errors in one direction	Laboratory analysis of reference standards, spiked matrix samples, or blanks
Accuracy	A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations	Analysis of reference material; usually expressed as percent recovery or percent bias
Representativeness	A qualitative term that expresses "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process conditions, or an environmental condition" (ANSI/ASQC 1995, as cited in EPA 2002)	Qualitative determination of whether water quality samples are collected in such a manner that the resulting data appropriately reflect baseflow and storm event conditions
Comparability	A qualitative term expressing the degree of confidence that one data set can be compared to another and can be combined to support decision-making	Use of standard sample collection and handling methods, sample preparation, analytical procedures, holding times, consistent and well-maintained instrumentation, and adherence to QA protocols
Completeness	A measure of the amount of valid data needed to be obtained through data collection	Comparisons of the number of valid samples collected or analyzed with the number targeted to meet project objectives
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest	Noting the minimum concentration that can be measured by a method (method detection limit) or by an instrument (instrument detection limit)

1.4.1 Project Quality Objectives

This monitoring project is designed to meet the goals and objectives and to address the questions discussed in Section 1.2. Data collected will be used in analyses to evaluate effectiveness of CSO controls in improving water quality conditions in receiving waters of Rock Creek along with the Anacostia and Potomac Rivers in Washington, DC. As CSO Controls are implemented during the construction process, receiving water quality is expected to improve; water quality monitoring and sampling will be used as a gauge of progress of receiving water health improvement.

The data quality requirements for this project include field, laboratory, and database management processes to reduce sources of error. Data types are listed in Table 1-3. The methods and protocols detailed in this QAPP were designed to reduce the measurement error. General features of the project's QA program which continually help to achieve project quality objectives include the use of standardized, repeatable data and sample collection procedures, as well as the use of trained personnel to perform all data collection and analyses.

Table 1-3. Types of environmental data to be collected in this project.

Data Type	Units
Site Information Parameters	
Photo-documentation	Digital photographs of sampling sites
Odor	Not specified
Tide	Low/high/falling/rising
Chemical Parameters	
pH	standard units
Specific Conductivity	mS/cm^2
Temperature	C
Dissolved Oxygen	mg/L
Total Suspended Solids	mg/L
$CBOD_5$	mg/L
Chlorophyll-*a*	mg/L
Fecal Coliform (ASTM 9221E- A1 Medium)	MPN/100 mL
E. coli (ASTM 9223B- Quantitray)	MPN/100 mL
Fecal Coliform (ASTM 9221E- EC Med)	MPN/100 mL
E. coli (ASTM 9221F- EC MUG)	MPN/100 mL
Physical and Hydrological Parameters	
Secchi depth (during daylight hours)	meters

Chemical parameters will be analyzed in the contract laboratory. For these chemical parameters, project quality objectives to support the Scope of Work (SOW) are as follows:

- Laboratory analyses will follow standard, approved methods with associated method detection limits as described in 40CFR136;

- Field and laboratory quality control samples will be collected and analyzed as detailed in this plan; and

- Accuracy of data entry will be ensured by 100% hand-checking of all values.

- Laboratory analysis of bacteria should be carried out for initial samples by preparing an extended dilution to identify which stations and which circumstances are likely to result in concentrations above the range of non-diluted analysis (2 to 2,400 MPN/ 100 mL). Identification of stations with chronically high bacteria counts is designed to meet a goal of obtaining non-qualified concentrations.

Certain water quality parameters (pH, specific conductivity, temperature, dissolved oxygen) will be measured directly using a multiparameter sonde. Project quality objectives for these parameters to support the SOW are the following:

- Water quality measurements will follow approved methods; and

- Calibration of instruments (e.g., YSI sonde water quality meters) will be within an acceptable range as per manufacturer's specifications.

Project quality objectives for physical and hydrological parameters consist of:

- Calibration of field staff non-direct measurements (e.g., Secchi disk).

1.4.2 Measurement Performance Criteria

Measurement performance criteria are quantitative statistics, used to interpret the degree of acceptability or utility of the data to the user. Measurement performance criteria include limits on analytical imprecision, bias, and method detection limits. Specific measurement performance criteria for water chemistry and other parameters are listed in Table 1-4. In some cases, further details are provided in Section 2.5.

Table 1-4. Measurement Performance Criteria for selected techniques to evaluate Data Quality Indicators.

Data Quality Indicator	Techniques	Target Measurement Performance Criteria
Precision (See Section 2.5 for details)	Laboratory duplicates Field duplicates	When analyzed value is > 5 times the method detection limit, analyzed value must be < 20% relative percent difference (RPD). When the analyzed value is <5 times the method detection limit, duplicate value must agree within 50% of the applicable reporting limit.
Bias (See Section 2.5 for details)	Laboratory analysis of reference standards or spiked matrix samples Laboratory method, laboratory calibration, field, & blank Laboratory calibration verification standards	The analyzed recovery value must be within 75-125% of the known value. The analyzed value must be less than the method detection limit or applicable reporting limit. The analyzed recovery value for the calibration verification standards must be within 80-120% of the known value.
Accuracy (See Section 2.5 for details)	Laboratory analysis of reference material Direct measurements using calibrated sonde	Analyzed recovery value must be within 80-120% of the known value Instrument tolerances: pH ± 0.2 units Specific Conductivity ± 5%
Representative-ness	Qualitative determination of whether water quality samples are collected in such a manner that the resulting data accurately reflect base flow and storm event conditions	Observation and notation of secondary measures of presence of stormflow (e.g., presence of floatables and turbidity)
Comparability	Use of standard sample collection and handling methods, sample preparation, analytical procedures, holding times, stability issues, and adherence to QA protocols	Strict adherence to all standards and protocols. Any deviations noted in project records.

Table 1-4. (Continued)

Data Quality Indicator	Techniques	Target Measurement Performance Criteria
Completeness	Tracking of:	
	Any receiving water sampling events	95%
	Continuously logging water quality	90%
	Laboratory results for submitted samples	100%
Sensitivity	Method detection limits	Reportable detection limit should be at or below values shown in Table 2-2, as determined by method detection limit and instrument detection limit.

1.5 SPECIAL TRAINING AND CERTIFICATION REQUIREMENTS

1.5.1 Technical Training Procedure

Versar water chemistry monitoring staff will be specifically trained in sampling protocols by participating in in-house training sessions and field QA audits conducted by the Project Coordinator and QA Officer. Staff is presently trained in the SOPs that have been developed specifically by Versar for NPDES storm water monitoring, riverine water quality monitoring, and related activities.

Several individuals are trained in field procedures at any one time to provide redundancy in case of limited availability or termination. Training covers proper maintenance, calibration, and operation of equipment as well as data collection, data management, and recordkeeping. The Versar Project Coordinator reviews the QAPP and SOPs with each Field Leader and technician to ensure that all steps are understood and will be followed.

Personnel training will be divided into four parts: (1) verbal or written instruction of the procedure, (2) demonstration of the procedure, and (3) performance of the procedure by the trainee with the instructor's guidance. Training is provided by the Project Coordinator (or qualified designee) through verbal instruction, study of written SOPs, and field demonstration. New technicians work under the supervision of experienced staff to gain experience and familiarity with procedures. The employee is allowed to perform the procedure independent of supervision once an acceptable level of proficiency has been demonstrated.

Operation of small boats for the purpose of station visitation and sampling will be conducted using a minimum of a two-person crew. Direct operation of the boat will be undertaken by a licensed Captain or assistant who has successfully completed minimum United States Coast Guard boat operation safety training.

1.5.2 Documentation of Training

Reviews of maintenance, monitoring, and recordkeeping procedures are accomplished by mandatory attendance of annual technical training sessions and/or seminars. Retraining of individuals on specific aspects of monitoring procedures is carried out on an as-needed basis. Records of successful completion of training, refresher seminars, and retraining sessions are maintained by the Project Coordinator.

1.5.3 Laboratory Training and Certification

Martel Laboratories maintains a staff with specialized training on all aspects of required water chemistry analysis. Martel is an EPA-certified laboratory, and maintains such certification by meeting rigorous standards, including periodic inspections as required under Federal guidelines. At the request of DC Water, Martel Laboratories will obtain VELAP certification for EC MUG analysis of *E.Coli* for non-potable water.

1.6 DOCUMENTS AND RECORDS

Thorough documentation of all field activities is critical to ensure proper handling of samples and maintain the integrity of project data. Field measurements, equipment maintenance, chain-of-custody, and other records are kept continuously throughout the project using custom, pre-printed data sheets. Field data sheets include:

- Weekly Station Inspection Form,
- Receiving Waters Data Sheet,
- 40-hour Storm Event Monitoring Data Sheets, and
- Chain-of-Custody Record.

Example field data sheets are attached to Versar's SOPs.

Forms are maintained in a 3-ring binder that serves as a field notebook dedicated to the project. All project data that are in hard copy format, including completed field data sheets, reside in the field notebook until the notebook's capacity is exceeded. Field data sheets that are removed are retained in the Project Coordinator's office.

Any QC reports, such as inspections, training, and corrective action reports are filed in the Project Coordinator office in Versar's Columbia, MD, office. Electronic versions of such reports are filed in the Project Coordinator home drive space.

The Project Manager and Project Coordinator maintain supporting files, as hard copy or electronic form, as appropriate, as a record of information and data used in the preparation of reports and documents. The following information is included:

- Reports prepared
- Contract and task order information
- QA Project Plan
- Results of technical reviews, data quality assessments, and audits, and
- Communications (memoranda, notes, emails, meeting minutes, and written correspondence among the project team personnel).

Field and laboratory personnel document their activities in a project file. The file is a thorough accounting of their involvement in the project and includes meetings, telephone conversations, field activities, data collection, analytical results, and report information. Periodically, the Project Coordinator performs audits of proper procedures and documentation.

Water Quality and Water Chemistry Data Reporting

Versar will electronically deliver the continuous water quality data for each of the six monitoring stations in a Microsoft Excel spreadsheet format on a monthly schedule. Water chemistry data from weekly monitoring events and 40-hour storm events are delivered to MWCOG in Microsoft Access database format on a monthly basis.

The data format will be agreed upon by Versar and MWCOG with the requirement that the data presented to MWCOG will be in a format that is readily usable, understandable, logically organized as to station and with time and date stamps, and translatable into other data formats that MWCOG and DC Water may require to perform data analysis to achieve project goals.

Upon completion of the sampling period, a summary water quality dataset will be electronically delivered containing the entire data collected presented in the same format as above.

Other hard copy items and notes from the data management process and report preparation process are stored in the Project Coordinator's office and Versar's Document Production archive.

Long-term databases and supporting documentation are retained for at least 10 years at Versar in order to provide an audit trail in the event that certain activities need to be reviewed. Electronic data files and spreadsheets reside on the home drive space of the Project Coordinator.

The current, approved QAPP will be distributed to project staff (as listed on the distribution list) in either hard copy or electronic format. Changes to the QAPP will be discussed within the project management team (Versar QAO, Project Manager, and Project Coordinator), then issued as an advisory e-mail when a revision to the QAPP is warranted. Revisions of specific items in the QAPP usually will not warrant republication of the entire QAPP; the QAPP will be revised upon advice by the QAO. If the QAPP is revised in its entirety, then copies of the new QAPP will be distributed to those on the distribution list. Copies will be maintained in the Versar Project Manager's, Project Coordinator's, and Field Leader's offices, and on file at MWCOG and DC Water. The most recent version of the QAPP will also be available electronically on Versar's Columbia, MD, office shared computer drive.

2.0 DATA GENERATION AND ACQUISITION

2.1 SAMPLING DESIGN

2.1.1 Outline of Sampling Design

Water chemistry and water quality are being monitored at fixed stations in the CSO impact area. The data that are collected under varying weather conditions will be analyzed to characterize effectiveness of the CSO controls. As such, the design is targeted, rather than probability-based.

2.1.2 Schedule for Sampling and Analytical Activities & Number of Samples

To amass an analyzable, long-term water chemistry and water quality database, routine receiving waters continuous water quality monitoring and weekly water chemistry sampling will be conducted over a period of 12 months starting upon installation of field equipment (scheduled for December 2014). A 40-hour storm event will be conducted (for a total of four precipitation events sampled and analyzed) four times as directed by DC Water. Continuous logging will take place at six sites; 40-hour storm event sampling and weekly water chemistry will be conducted at thirteen sites.

Samples are transported to Martel in a stabilized (on ice) condition and within applicable hold times.

2.1.3 Potential Sources of Variability

Sampling Coordination. Due to the coordination rigor required to obtain all samples and deliver them within the 8-hour hold time to the laboratory for analysis, variability may be caused by certain samples exceeding hold if the samples are not delivered to the laboratory within the prescribed window. The delivery window time period is governed by the time of collection of the first sample. Serial collection of water chemistry samples at each station will reduce the size of the window depending on sampling and sample delivery efficiency. Should the first samples of the event exceed hold times by a maximum of two hours, the samples will be run, but will be flagged by the laboratory.

Sampling Depth and Position. In particular for the land-based sampling effort, sample results variability may result if the position in the water column of the sampler is not consistent due to existing stage at the time of collection. Since pollutant concentration varies within the water column and lateral position in the stream, variability may be introduced if the two-dimensional position of the sampling point (i.e., upstream vs. downstream, distance from right vs. left bank) is not consistent. Variability in sample results from boat-accessible stations may result based on tide

and lateral position of the sampling station. For the purpose of monitoring, water at boat-accessible sampling stations will be assumed to be well-mixed.

Time of Year of Sampling Effort. Since bacteria and chlorophyll-*a* concentrations vary with time of year (i.e., higher concentrations of bacteria and chlorophyll-*a* during warmer months), variability in sample results may result. Such time-of-year variability may be accounted for by using a control station.

Weather Patterns**.** Variations in weather patterns will be a major determining factor in performance of interval sampling. Summer pattern sampling typically consists of high intensity events with short duration. Winter pattern storm sampling is characterized by an abundance of well-organized storm systems that may last over a day in rainfall duration. Due to the requirements of monitoring for 40-hours, only major, systemic storms will be targeted.

2.2 SAMPLING METHODS

General monitoring and sampling methods are found in SOPs utilized regularly by project staff. Versar has prepared detailed SOPs for individual components of various water chemistry monitoring projects. The SOPs are tools in our QA/QC program that ensure a high quality of work. The SOPs outline the specifics for a number of technical data collection activities defined in the project as well as supplemental activities, such as lab and field preparatory work and equipment maintenance. Specific SOPs for this project which are patterned after fixed site water quality monitoring and sampling procedures include:

- Weekly Station Inspections,
- Water Sampling From Streams and Tidal Rivers,
- Storm Event Monitoring,
- Calibration of Field Water Quality Monitoring Equipment (Sondes),
- Water Quality Measurements Using Individual Instruments, and
- Chain of Custody Procedure.

Copies of the individual SOPs are kept on file at Versar. Subcontractor laboratory analytical methods and SOPs are kept on file at Versar and at Martel Laboratories.

Each staff member is responsible for obtaining and following the SOPs relevant to his/her task. At a minimum, field personnel are familiar with the SOPs for health and safety considerations, operations/oversight, QA/QC procedures, sampling equipment use and calibration, sample collection, sample transport, and chain of custody procedures.

2.2.1 Description of Water Quality Equipment

Versar proposes to sample most of the sites using our 21-foot Boston Whaler clearly marked with the word “SURVEY” on both sides. The sampling boat is outfitted with a GPS

Guidance system, VHF Radio, depth finder, mechanical arm, and a 150 HP Johnson Outboard engine. The boat is a stable platform for sampling and has been used on multiple projects in the Chesapeake Bay and its tidal tributaries. The boat has a relatively shallow draft which would allow ready access to most of the locations.

For the long-term dissolved oxygen (DO) monitoring and water quality measurements, six (6) YSI EXO2 logging sondes equipped with optical dissolved oxygen, temperature, and an extended deployment wiper system (EDS) will be deployed to record at 30-minute intervals. The use of the EX02 unit is ideal for this project due to its rugged nature, ease of field calibration, and self-cleaning wiper system. We also purchased six (6) PME MiniDOT logging systems equipped with DO and temperature for emergency back-ups. These MiniDOT loggers are a stand-alone system with no wiper and are factory calibrated. A handheld YSI Pro-plus multi-parameter sonde, or similar device, will be used for in-situ spot water quality readings at the thirteen stations for the field parameters identified in the SOW: temperature, pH, conductivity, and dissolved oxygen.

Receiving water samples at stations accessible by boat will be collected using a submersible pump while the land-based samples will be collected using a Niskin bottle sampler deployed from adjacent bridges.

2.2.2 Receiving Water Sampling

Sampling will be conducted at a minimum of five times a month, in a pattern of once during the first week and then twice the second week, followed by once during the third week and twice again during the fourth week or during 40-hour events that will take place quarterly, both with direction, coordination, and guidance from MWCOG and DC Water.

During a sampling event, Versar will dispatch both a land and water crew to collect samples. The boat crew will be responsible for collecting samples from seven of the thirteen locations. The Bladensburg, MD, Benning Road Bridge locations, and the four Rock Creek stations will be sampled by a land-based crew. The use of the land-based crew is necessitated because the Anacostia River is non-navigable at points above the Benning Road bridge and Rock Creek is accessible only from land. For 40-hour storms, Versar teams will work in shifts to be sure that boat-based and land-based teams are adequately staffed and sampling activities proceed. The Project Coordinator or designee will coordinate staffing and scheduling for 40-hour storm event monitoring (Table 2-1).

Table 2-1. Example sampling schedule for 40-hour storm events.

	Team 1 (Water)	Team 1 (Land)	Team 2 (Water)	Team 2 (Land)
0:00				
1:00				
2:00				
3:00				
4:00				
5:00				
6:00	Travel			
7:00		Travel		
8:00	Ana/Pot Sample 1	Rock Creek 1		
9:00				
10:00				
11:00	Sample Transfer (Internal)			
12:00		Upper Anacostia 1		
13:00		Travel (Martel Transfer)		
14:00				
15:00	Round 2 Prep	Travel		
16:00	Ana/Pot Sample 2	Rock Creek 2		
17:00				
18:00				
19:00	Sample Transfer (Internal)			
20:00	Team Switchover	Upper Anacostia 2		
21:00		Travel (Martel Transfer) - Team Switchover	Team Switchover	Team Switchover
22:00			Travel	
23:00			Travel / Round 3 Prep	Travel
0:00			Ana/Pot Sample 3	Rock Creek 3
1:00				
2:00				
3:00			Sample Transfer (Internal)	
4:00				Upper Anacostia 3
5:00				Travel (Martel Transfer)
6:00				
7:00			Round 4 Prep	Travel
8:00			Ana/Pot Sample 4	Rock Creek 4
9:00				

Table 2-1. (Continued)

	Team 1 (Water)	Team 1 (Land)	Team 2 (Water)	Team 2 (Land)
10:00				
11:00			Sample Transfer (Internal)	
12:00			Team Switchover	Upper Anacostia 4
13:00	Team Switchover	Team Switchover		Travel (Martel Transfer) - Team Switchover
14:00	Travel			
15:00	Round 5 Prep	Travel		
16:00	Ana/Pot Sample 5	Rock Creek 5		
17:00				
18:00				
19:00	Sample Transfer (Internal)			
20:00		Upper Anacostia 5		
21:00		Travel (Martel Transfer)		
22:00				
23:00	Round 6 Prep	Travel		
0:00	Ana/Pot Sample 6	Rock Creek 6		
1:00				
2:00				
3:00	Sample Transfer (Internal)			
4:00	WRAP-UP	Upper Anacostia 6		
5:00		Travel (Martel Transfer) - Wrap-up		
6:00				
7:00				

Upon arrival at a sampling location, Versar staff will secure the boat to an existing structure or anchor the boat outside of the navigational channel. Site conditions will be observed and noted. These conditions include time, date, tide, weather, Secchi depth and any additional observations (muddy flow, logs jams, surface sheen, odors, etc.). After recording these observations, a pre-calibrated multi-parameter sonde and submersible pump will be lowered one meter below the surface of the water. Samples will be collected in pre-labelled sterile containers provided by the laboratory and stored on ice in coolers after collection. Prior to sample collection, ambient water will be pumped through the hose for a period of one minute to remove any excess water from previous locations and eliminate cross-contamination. The time and date of collection will be noted on both the containers and field data sheet. Water quality parameters (temperature, pH, specific conductivity, dissolved oxygen) will also be physically recorded on a field data sheet as well as electronically logged.

The land-based crew will follow similar site evaluation and sampling procedures upon arrival at each location. Water samples will be collected from bridge walkways, using a pre-cleaned and disinfected Niskin bottle. The sampler will be lowered one meter below the surface, closed with a messenger, and then decanted into the collection containers. If the depth of the water is less than one meter, the sample will be taken in the water column halfway between the surface and bottom. If the stream is wadeable (applies to Rock Creek stations), then sampling will be performed by wading to the thalweg of the stream and then, after allowing turbidity to clear, performing the Niskin bottle sample collection method above.

Due to the short hold times on fecal coliform and *E. coli* bacteria, land and boat crews will closely coordinate sampling efforts and will meet at a pre-determined location on the river after sampling. The samples that were taken by boat will then be transferred to the land crew and transported to the laboratory for analysis of fecal coliform, *E. coli*, $CBOD_5$ (total), total suspended solids (TSS), and chlorophyll-*a*.

2.2.3 Continuous Water Quality Monitoring

The water quality meters provide continuous data recording; all raw continuous data may be stored onsite in the instrumentation's memory for weeks or months, depending on instrument configuration. Data download from the instrumentation is performed bi-weekly to a field-compatible laptop PC.

2.2.4 Sample Containers and Sizes

During routine receiving water monitoring, all samples are collected using a submersible pump or Niskin bottle. Water samples are then transferred to the required laboratory submittal bottle. Required bottle types and sample sizes are given in Table 2-2.

Table 2-2. Bottle types and volume requirements for Receiving Water Post-Construction Monitoring project

Parameter	Hold Time	Min. Volume	Bottle Type & Preservative
Total Suspended Solids	7 days	1 liter	HDPE, none
Chlorophyll-*a*	24 hours	250 mL	HDPE or amber glass, none
$CBOD_5$ (total)	48 hours	0.5 liter	HDPE, none
E. coli	8 hours	100 mL	HDPE, none
Fecal coliform	8 hours	100 mL	HDPE, none

2.2.5 Instrumentation, Enclosures, and Support

Long-term water quality monitoring instrumentation will be enclosed within a stationary mooring system designed to anchor and secure the equipment in place. The mooring will secure

the equipment against theft, tampering, or accidental impact by floating matter. Where applicable, signage will be posted indicating the purpose of the water quality meter. The mooring system will be designed so that the water quality sonde may be retrieved, downloaded, inspected, calibrated, and serviced.

Prior to deployment, all instrumentation will be inspected, checked out, and calibrated in Versar's water quality laboratory. Identifiers will be affixed to all equipment to inform the public of the nature of the equipment that is deployed (Figure 2-1).

Figure 2-1. Informational decal for monitoring equipment

Installation of the long-term monitoring stations will utilize a combination of moorings in the center channels and fixed attachment to already existing structures for all remaining locations (bridges, piers, docks, navigational buoys, etc.). Evaluation of each location will be made by physical inspection prior to the installation trips.

Versar's mooring system will consist of a 4" diameter vented PVC tube. The in-line tube will be suspended from a marked fluorescent float approximately 1 meter from the surface and secured to the bottom using a 75 lb. metal base attached to 25 ft. of chain and a #13 Danforth anchor. At locations where structures already exist, sondes will be attached using a similar vented PVC tube secured with ¼" stainless steel wire and a 25 lb. weight to maintain a vertical orientation. When required, permits will be obtained from landowners or government agencies that control access to the structures and waterways.

Under the assumption of a mild winter, and free-flowing conditions, and stable moorings and anchoring, servicing can be performed every three to four weeks. Continuous water quality meters will be deployed at the six stations shown in Table 2-3 and Figure 2-2. Maps of the locations can be found in the Appendices.

Table 2-3. Continuous Dissolved Oxygen Monitoring Stations

Tributary	In-situ Meter Location	Coordinates	Comments
Anacostia River	1. Bladensburg, MD	38°56'2.79"N 76°56'21.15"W	Upstream of CSO area; Fixed elevation
	2. Pennsylvania Avenue Bridge (Seafarer's Yacht Club)	38°52'43.66"N 76°58'22.72"W	After Northeast Boundary CSO discharge; Fixed elevation
	3. South Capitol Street Bridge	38°52'6.11"N 77° 0'18.29"W	Downstream of CSO area; Fixed elevation
Potomac River	4. Chain Bridge	38°54'49.21"N 77° 6'8.96"W	Upstream of CSO area; Float Buoy
	5. 14th Street Bridge	38°52'37.18"N 77° 2'27.34"W	Downstream of CSO area; Fixed Elevation
	6. Woodrow Wilson Bridge	38°48'24.46"N 77° 2'1.37"W	Boundary condition; Float Buoy

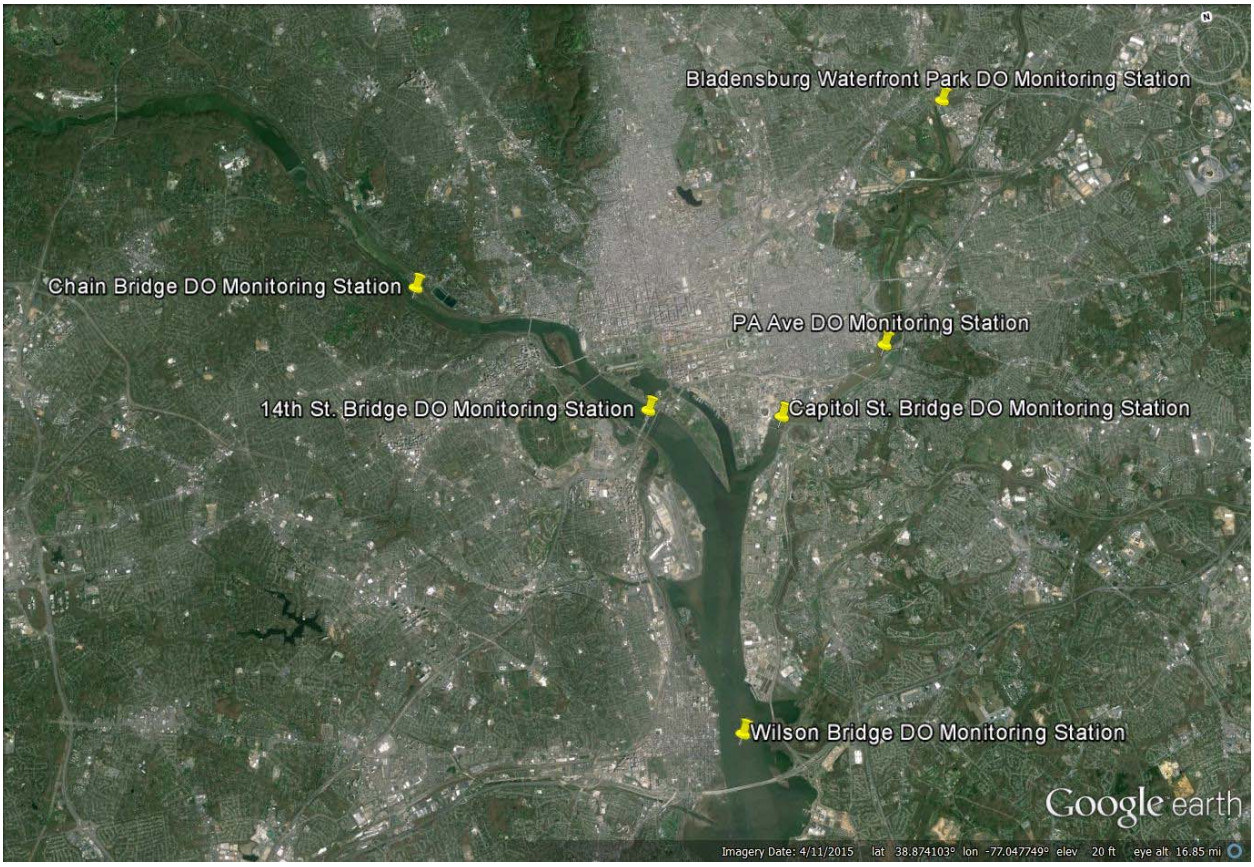

Figure 2-2. Locations of long-term water quality monitoring stations. Detailed maps of these locations and sampling locations can be found in Appendix B

Sampling events will be conducted at the locations provided in Table 2-4.

Table 2-4. Receiving Water Quality Monitoring Stations- Regular and Wet Weather

Tributary	Station Number	Description	Coordinates
Anacostia	1	Bladensburg Waterfront Park	38°56'2.68"N 76°56'21.16"W
	1U	Bladensburg WP (Upstream) (Temporary)	See Section 4.4
	1D	Bladensburg WP (Downstream) (Temporary)	See Section 4.4
	2	Benning Road Bridge	38°53'48.93"N 76°57'43.86"W
	3	PA Ave / Seafarers Yacht Club	38°52'36.38"N 76°58'41.11"W
	4	South Capitol St Bridge	38°52'7.27"N 77° 0'19.45"W
	5	Haines Point	38°51'16.51"N 77° 1'14.40"W
Potomac	6	Three Sisters	38°54'11.00"N 77° 4'51.83"W
	7	Upstream of Rock Creek	38°53'57.38"N 77° 3'33.04"W
	8	14th St Bridge	38°52'37.98"N 77° 2'29.87"W
	9	Woodrow Wilson Bridge	38°47'46.22"N 77° 1'53.03"W
Rock Creek	10	Boundary Bridge	38°59'11.63"N 7° 3'11.17"W
	11	Tilden St / Pierce's Mill	38°56'27.05"N 77° 3'3.86"W
	12	Porter St	38°56'3.19"N 7° 2'55.97"W
	13	PA Ave/Thompson's Boat House	38°54'13.33"N 77° 3'24.29"W

2.2.6 Laboratory Coordination

Versar and Martel Laboratories personnel have established a system of coordination that ensures timely and accurate sample analysis and reporting of analytical results. Versar works closely with lab personnel to implement a sampling schedule, bottle delivery routine, and chain of custody procedures that are satisfactory to all parties and which meet project objectives. Versar coordinates with Martel on such details as preparation of sampling bottles and providing the lab with correct sample volumes. Such efforts minimize both field sampling and laboratory errors, further ensuring quality data.

Given the high number of bacteria samples that are anticipated for the project during storms, Versar will provide notice to the laboratory 24 hours in advance prior to the event. Since large storms are more easily predicted, this 24-hour notification can easily be achieved but will be crucial to allow Martel to prepare for the samples coming in. DC Water, Versar, and MWCOG will closely monitor storm event development and coordinate during monthly calls to discuss anticipated times of storm flow monitoring. The Project Coordinator or designee will be the point of contact between Versar and Martel for the purpose of providing notice of storms.

To maximize the probability that bacteria samples will be analyzed within the hold time for this task, the laboratory will, within 10 to 15 minutes of arrival, place media in the sample prior to incubation which officially ends the hold time.

2.2.7 Transportation

Versar maintains a fleet of vehicles to conduct field sampling. A Vehicle Coordinator is responsible for the maintenance of the company trucks; logbooks are maintained for each vehicle to document mileage, fuel and fluid use, project charge number, and problems observed during use. The Coordinator regularly inspects the logbooks to note problems and arrange for maintenance or repairs as needed. Scheduled preventive maintenance such as oil changes and radiator flushing are performed according to manufacturer's specifications or as needed.

Versar's primary research vessel for this project is an 18-foot Boston Whaler Outrage, with a 150 HP Evinrude VRO motor. Our secondary vessel is a 23-foot Privateer with a Yamaha 150 HP 4-stroke motor. Both vessels have new lower units that were installed in October 2014. Both vessels are equipped with all of the U.S. Coast Guard-required safety equipment including a B-II fire extinguisher, hand flares, horn, Type II PFDs and a Type IV throwable life ring. All of our vessels are equipped with VHF marine radios and our captain and crew monitor channel 16 at all times. Additionally, both vessels have Furuno 1850 GPS units, depth finders, and we carry a backup GPS unit on our sampling trips.

All of our research vessel crew have the ability to safely operate our vessels and are Maryland Safe Boating certified. Oil levels are checked bi-weekly, and the engines are inspected monthly for any maintenance problems. The battery is charged the day before each sampling event

is to occur. Additionally, we carry spare oil and gas, as well as a battery charger in the work truck in case any problems arise.

Versar's primary sampling work boat will be stored and anchored at a marina local to the study site so that time is not taken from a given monitoring effort to trailer, launch, and retrieve the boat from waterways.

2.2.8 Contingency Plans, Documenting Corrective Actions

Guidance is provided to field personnel for special situations as follows.

- Water Quality instrument failure. In this context, an instrument failure means that any or all of the following has occurred and repairs cannot be accomplished in the field: 1) instrument is not communicative, 2) sonde has been damaged via accident or by vandalism, 3) data loss has occurred, or 4) electronic component has failed. For each of these problems, the prudent course of action is to remove the instrument from the field and replace it with a PME MiniDOT logger. The problem instrument can then be evaluated by Versar staff under controlled conditions (in the water quality laboratory) or by the manufacturer by shipping to the factory or discussing the problem with manufacturer technical support over the phone.
- Boat failure. Boat transportation failure may provide cause to abort the sampling since the use of the boat is necessary for access to sampling and monitoring stations. Versar's boat fleet includes a spare boat that can be outfit for service should the Boston Whaler work boat become inoperable.
- Sample delivery delay. In the event that traffic, accident, or some other eventuality causes sampling and sample delivery to be delayed and to risk sample analysis out of hold, field staff may transport samples between Washington, DC and Baltimore by MARC commuter train. Use of the train will require that a Martel courier meet staff at the passenger station in Baltimore.

Specific corrective actions for problems identified in the field are noted in the comments section of the field data sheet corresponding to the activity taking place (e.g., weekly inspection, base flow monitoring, storm event monitoring). The advantage of recording corrective actions here is that the problem and corrective action are located together in context and are available to the field staff in the field, for reference, should the problem or similar conditions arise again.

2.2.9 Cleaning and Decontamination of Equipment

Sampling Equipment. To prevent cross contamination between sampling stations during sampling events, sampling equipment (submersible pump, Niskin bottle) will be decontaminated between sampling stations by rinsing with deionized water. Prior to collection at each station, the pump/bottle will be rinsed with localized raw water three times before samples are taken. At the

end of each sampling day, the equipment will be cleaned in the laboratory using detergent, tap water, and distilled water.

Logger Anti-fouling. The water quality sondes that will be used for long-term water quality data collection are equipped with anti-fouling technology. Nonetheless, the sensors will be inspected during each weekly maintenance visit to ensure that no buildup is occurring. If buildup is noted, then the sensors will be cleaned using manufacturer recommended methods.

2.3 SAMPLE HANDLING AND CUSTODY

2.3.1 Temperature and Use of Preservatives

All samples are stored and transported on ice at 4 degrees Celsius in designated coolers.

2.3.2 Maximum Hold Time

The maximum hold time for analytes such as *E. coli* is 8 hours. A detailed listing of sample hold times is provided in Table 2-2 and can be found in EPA Regulation 40CFR 136. A copy of the section can be found in the Appendices.

2.3.3 Maintenance of Field Notebooks

As described above, field notebooks are maintained by the Project Coordinator and inspected/reviewed by the QAO.

2.3.4 Sample Identification

Sample bottles are labeled with sample ID in the following format:

AA-BB-T-MMDDYY-X-Z-, where:

AA = Parameter being analyzed
- FC – Fecal Coliform
- EC – E. coli
- CB – CBOD5
- TSS – Total Suspended Solids
- CHL – Chlorophyll a

BB = Station ID

System	Station	Station CODE
Anacostia	Bladensburg	01
Anacostia	Bladensburg (Upstream of Dredge) (Temporary)	1U
Anacostia	Bladensburg (Downstream of Dredge) (Temporary)	1D
Anacostia	Benning Road	02
Anacostia	PA Ave (Seafarers)	03
Anacostia	S. Capitol Street Bridge	04
Anacostia	Haines Point	05
Potomac	Three Sisters	06
Potomac	Rock Creek; Sequoia (Upstream)	07
Potomac	14th Street Bridge	08
Potomac	Wilson Bridge (Red Can 4)	09
Rock Creek	Boundary Bridge	10
Rock Creek	Tilden Street	11
Rock Creek	Porter Street	12
Rock Creek	PA Ave (@ C&0 Canal)	13
Land Team	Land Team Designation (Equipment Blanks)	LE
Boat Team	Boat Team Designation (Equipment Blanks)	BE
Land Team	Land Team (Field Blanks)	LF
Boat Team	Boat Team (Field Blanks)	BF

T – TEAM
L – Land
B – Boat
***Note this code is not needed if the sample is a blank

MMDDYY = Sample date

X = Type of event
R = regular
40 = 40-hour storm with the digit to the right of the decimal designating the sampling round number)
40.1 – Round 1
40.2 – Round 2
40.3 – Round 3
40.4 – Round 4
40.5 – Round 5
40.6 – Round 6

Z = Duplicate Sample denotation (when applicable)
D = Duplicate sample

The sample ID assigned to each bottle is recorded in the field notebook. The analytical results received from the laboratory are referenced to Versar's unique sample ID number. Each sample label will also contain the sampling teams code (L = Land, B = Boat) for the purpose of field blank comparisons conducted by Martel Laboratories.

2.3.5 Chain of Custody

Sample custody in the field is the responsibility of Field Leader. If samples are to be held overnight (non-bacteriological samples only), they are refrigerated and remain the responsibility of Field Leader.

Chain of custody (COC) forms, used for all samples, are a permanent record of transfer of sample custody (Figure 2-3). Custom COC forms for this project are preprinted with the analytes and partial laboratory numbers particular to the activity at hand (e.g., regular sampling, 40-hour sampling). Field staff need only to complete the laboratory numbers, complete the columns designated for other information, line out any samples that will not be submitted, then sign the form. The Martel courier, when picking up the samples for delivery to the laboratory, signs and dates the COC form in the "Received By" box and leaves a photocopy for Versar records. Detailed COC procedures are provided in Versar's internal SOPs.

MARTEL ***CHAIN OF CUSTODY / SAMPLE INFORMATION FORM***

Martel Laboratories, Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054 Email: vk@martellabs.com

MARTEL Log.# _____ Client Code _____	Sampler _____
Client Name/Phone/FAX _____	Project Name/# _____
Client Address _____	Contract/P.O Number _____
Invoice Address _____	Sample Turnaround Time _____

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments

Transferred by:	Received by:	Date	Time	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by:	Date	Time	Sufficient ice? - Yes/No If No, temp.= _____
Transferred by:	Received by:	Date	Time	Sample containers pres'd? - Yes/No If No, explain
				Custody Seal present/intact? - Yes/No
				Initials: Date:

Figure 2-3. Example laboratory Chain-of-Custody Form

2.3.6 Sample Bottle Labeling

Blank labels for bottles that include spaces for entering sample ID, sample date and time, and parameters are provided by Martel Laboratories. All pertinent information about a sample is provided on the bottle label; no sample tag is required.

2.4 ANALYTICAL METHODS

Analytes, required detection limits, and analytical methods are listed in Table 2-5. Laboratory analysis is conducted by Martel Laboratories, Inc. of Towson, MD. EPA and Standard Method analytical procedures are strictly adhered to by the analytical laboratory. Specific laboratory SOPs and the laboratory's QA document (Martel 2014) are available upon request.

Table 2-5. Parameters and detection limits for Receiving Water Post-Construction Monitoring

Parameter	Detection Limit	Method
Total Suspended Solids	1 mg/L	SM 2540 D-97
Chlorophyll-*a*	6 mg/m^3	SM 10200H
$CBOD_5$ (total)	2 mg/L	SM 5210B
E. coli	1 MPN / 100 mL	SM 9221F-EC MUG
Fecal coliform	1 MPN / 100 mL	SM 9221E-EC Med

Martel Laboratories follows all standard analytical quality control procedures required to maintain their certification status. Martel currently is a Maryland Department of the Environment Water Supply Program-certified laboratory. Specific QA/QC protocols employed by Martel to ensure accuracy and precision are detailed below (see Section 2.5.2). The turnaround time for submittal of analytical result reports to Versar is 28 days.

Initial bacteria samples collected for this project will be run using extended dilutions to identify those stations and conditions that are likely to require dilutions due to chronically high bacteria concentrations (> 2,400 MPN/100 mL). The steps followed by the lab are as follows:

i. Initially all samples will receive extended dilutions, ensuring any number between lowest detection and 240,000 MPN/100 mL will be achievable.

ii. After the initial samples, samples from stations with very low numbers (less than 240) will be performed without additional dilutions, unless changes in the site are anticipated (e.g., sewage overflows).

iii. Following extended dilutions were used for bacteria analysis and for duplicates. These extended dilutions were not conducted for equipment blanks.

Analysis	Method	Reporting Limits, MPN/ 100 ml (See Note *)	Wet Weather Reporting Limits, MPN/ 100 ml
Fecal	9221 E (A1 Med)	2-16,000	2- 160,000
	9221 E (EC Med)	2-16,000	2- 160,000
E.Coli	9221 F (EC Mug)	2-16,000	2- 160,000
	9223 B (Quantitray)	2-2.4 Million	2- 2.4 Million (No Change)

Note *). Until May 28, 2015, the reporting limits for bacteria analysis for both regular and wet weather sampling

2.5 QUALITY CONTROL

2.5.1 Field Quality Control Checks

Duplicates and field blanks will also be collected in accordance with the specific quality control sampling requirements shown in Table 2-6. A schedule for the duplicates and field blanks are included in the appendices.

Table 2-6. Quality control samples

Type	Frequency
Temperature, pH, Dissolved Oxygen Duplicate Measurements	1 per every 10
Sample Duplicates	1 per 20
Equipment Blank	1/Crew/sampling day
Field / Preservation Blank	1/Crew/third trip
Temperature Blank	1 per shipping container

Water quality duplicate measurements. Duplicate spot checks of water quality parameters will be taken at a 10% frequency during sampling events. The water quality sonde will be deployed twice (e.g., when arriving at a station and then prior to leaving) and both sets of data recorded.

Sample duplicates. A duplicate sample will be taken at 5% of the station visits during sampling events.

Equipment blank. One equipment blank will be obtained from each team during the sampling event to verify decontamination techniques. Equipment blanks will be obtained by passing distilled deionized water through decontaminated collection equipment prior to sampling and then into sample bottles for analysis.

Trip blank. A trip blank will be introduced into the sample set on every third deployment of each sampling team. The trip blank will be check of contamination and sample integrity. A trip blank will be defined as decanting distilled deionized water from a sterile sealed container into sample bottles while in the field and then running the samples for analysis.

Temperature blank. The temperature blank is a small container that is transported in the same coolers as project samples. The temperature of the blank contents are measured to verify that sample stabilization procedures have been followed.

Multiparameter Sonde Calibration. After each probe is calibrated, the post-calibration value (along with the pre-calibration value) is recorded in the sonde calibration notebook. Inordinate slowness in calibration or persistent "calibration out of range" messages are signals that the probe in question requires maintenance or replacement.

Should any of the blank samples described above show non-zero pollutant concentrations, cleanliness procedures are reviewed and the analytical results for the most recent batch of samples are modified to take the contamination into account. The QC check that failed is performed again at the next sampling and repeated until non-detectible results are obtained.

2.5.2 Laboratory Quality Control Checks

Martel Laboratories employs standard quality control checks in accordance with its EPA and Maryland certification. Quality control samples are analyzed with each analytical batch where applicable and available. Quality control data that is associated with a sample batch are entered into the laboratory information system along with field sample analytical results. Quality control data that do not meet the method-specified acceptance criteria must be brought to the attention of laboratory supervisor. If quality assurance data do not meet the method-specified acceptance criteria, analytical results for that sample batch will be flagged by the QA/QC Officer. The sample(s) will be reanalyzed if possible and results resubmitted for review. Typical QA/QC protocols are described below.

2.5.2.1 Method Blanks

Method blanks will be analyzed once per analytical batch or at a frequency of 10% of the sample population, whichever is greater (i.e., blank #1, 1-10 samples; blank #2; 11-20 samples, etc.). The analyzed value must be less than the method detection limit or applicable reporting limit.

2.5.2.2 Initial and Continuing Instrument Calibration Blanks

For instrument analysis, an instrument calibration blank will be analyzed prior to sample analysis. Continuing instrument calibration blanks will be analyzed once per analytical batch or

at a frequency of 10% of the sample population, whichever is greater. The analyzed value must be less than the method detection limit or applicable reporting limit.

2.5.2.3 Initial and Continuing Calibration Verification Standards

At a minimum, calibration verification standards will be analyzed at a frequency of 10% of the sample population. The analyzed recovery value for the calibration verification standards must be within 80-120% of the known value. The correlation coefficient for calibration curves must be > 0.995 for the majority of inorganic analyses.

2.5.2.4 Laboratory Duplicates

Laboratory duplicates (matrix duplicates) are analyzed at a frequency of 10% of the sample population, whichever is greater (sample volume permitting). When the analyzed value is < 5 times the method detection limit, duplicate value must agree within 50% of the applicable reporting limit. When the analyzed value is > 5 times the method detection limit, the duplicate value must agree with < 20% of the relative percent difference.

2.5.2.5 Matrix Spikes

Matrix spikes (where applicable) are analyzed at a frequency of 5% of the sample population, (i.e., 1-20 samples, spike #1; 20-40 samples, spike #2; etc.) Certain methods or parameters require matrix spikes at a frequency of 10%. The analyzed recovery value must be within 75-125% of the known value.

2.5.2.6 Reference/LCS Standards

Reference/LCS standards are analyzed at a frequency of 10% per analytical batch, when available. The analyzed recovery value must be within 80-120% of the known value. When available, the recovery limits that are specified by the source of the reference standard (EPA, NIST, etc.) are used.

2.6 INSTRUMENT / EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Proper care and use of equipment is an essential part of the quality assurance program for laboratory and field operations. Versar's quality assurance program for field sampling and laboratory equipment operation combines an intensive personnel training regimen with rigorous maintenance and calibration procedures for all equipment to ensure valid data. Versar's Equipment Manager is responsible for the overall security, maintenance, and inventory of all equipment. The Project Coordinator and Field Leader are responsible for daily maintenance, inventory, and proper

storage of project field equipment. Dedicated storage space at Versar, accessible by coded lock, is used for field gear, samples, laboratory equipment, spare equipment, and calibration standards. Monthly inventories are performed of all major sampling and monitoring equipment.

Laboratory and field water quality testing equipment, such as multiparameter sondes, benchtop pH meters, and benchtop conductivity meters, are calibrated and maintained in good condition to ensure accurate and reproducible data. All water quality measurement instrumentation (e.g., data sondes and benchtop meters) used in the field and in laboratories are serviced as needed and are maintained according to the manufacturer's specifications. Minor maintenance and repair tasks are performed by qualified Versar personnel; major repairs and preventive maintenance are performed by the vendor.

2.6.1 Multiparameter Sonde Maintenance Plan

During weekly sampling events, each YSI will be visually inspected and cleaned when necessary. Factory guidelines suggest calibration of the probe every 4-6 weeks and replacement of the optical membrane every 6 months. The optical probe and mechanical wiping system on a YSI EXO2 sonde requires minimal maintenance and weekly checks should prevent any additional build-up of algal growth and fouling. Excessive calibration may affect the lifetime accuracy of the probe. During every third week of deployment, each unit will be thoroughly inspected, cleaned, and downloaded. To evaluate probe accuracy, the retrieved unit will be placed in a bucket with a pre-calibrated YSI. Side by-side readings will be recorded on a calibration field datasheet and evaluated for drift. If no drift is observed (e.g., measurements are within 5% of each other), meters will be returned to the water. If drift is observed, the sonde will be field calibrated under factory guidelines and returned to the water. Crews will carry additional optical DO probes during servicing and will replace the probes as needed. If the logging sonde fails and requires factory repair during the deployment period, crews will replace the YSI with a PME MiniDOT optical DO logger for the duration of factory repair.

During weekly servicing, each mooring system and wire harness will also be inspected for corrosion or other damage and repaired or replaced as necessary.

2.6.2 Documentation of Maintenance and Inspections

Maintenance and equipment inspection is performed weekly at each of the six long-term water quality monitoring locations. A weekly inspection data sheet is completed for each visit at each site. Information recorded on the data sheet includes site conditions immediately around the mooring, condition of the mooring, physical condition of the equipment and results of electronic equipment checkout, battery voltage level, and current water quality readings. Activities such as performance of data download, sampling, cleaning, or battery change are also noted. These notations allow subsequent field teams to refer back to earlier instrument and site conditions should a situation arise that requires corrective action and more diagnostic information from previous visits is desired that may shed light on the cause of a particular equipment/apparatus problem.

Not only are electronic equipment conditions noted, but ancillary apparatus such as security of the instrumentation enclosure and anchoring of the mooring in the waterway of interest. Other non-instrumentation problems that may warrant notice or corrective action are vandalism damage to the instrumentation or mooring, or imminent hazards to the apparatus.

2.6.3 Re-inspections to Document Corrective Actions

Since maintenance inspections are conducted weekly on YSI field equipment, documentation of the effectiveness of specific corrective actions is made on the subsequent visit. In this fashion, if data loss occurs, then the data loss is minimized. In the case of instrumentation problems that result in data loss or decrease in data quality, should the problem reoccur after the corrective action, then the YSI sonde responsible is immediately removed from field use and replaced with a spare of the same manufacture or a PMI MiniDOT optical DO logger. Usually one week is ample time for a determination to be made whether a corrective action is adequate. Nonetheless, weekly inspections continue throughout the project, so many opportunities exist for intercepting and correcting field instrumentation problems in a timely manner.

2.6.4 Location of Spare Parts

Spare parts for YSI equipment, such as O-rings, sensors, lubrication grease, port caps, and batteries are located in the Project Coordinator's office, Field Leader's office, or in the designated YSI maintenance and calibration area storage in Versar's water quality laboratory.

Spare mooring components are stored in Versar's Columbia Office loading dock in the designated marine science storage area unless parts need to be purchased.

2.7 INSTRUMENT / EQUIPMENT CALIBRATION AND FREQUENCY

Field technicians are trained in the proper care, calibration method, and calibration frequency of in-field YSI water quality instrumentation. Calibration instructions are provided in the appendix (YSI 2014).

All calibrations are performed using manufacturer-recommended calibration solutions and buffers. Calibration activities are noted in the sonde calibration logbook that is maintained in Versar's water quality laboratory. Any out of specification calibration results are noted in the log. Cleaning and probe fill liquid replacement will be performed on sensors that fail calibration. Should the probe continue to fail calibration, the probe is immediately removed and a spare mounted in its place. The same calibration procedure is then performed on the new probe. The problem probe is returned to the factory for service or replaced with a new probe as warranted.

2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field staff is instructed to assure that adequate supplies of consumables are available for the water chemistry monitoring task. Items considered consumable include but are not limited to:

- Parameter-Specific Bottles – Fresh bottles received from the laboratory should be checked to be sure that the caps are screwed on tightly to ensure: (1) preservative does not leak out and cause a hazard, and (2) contaminants do not enter.

- Batteries – YSI sondes run on commercially available D-size batteries. A supply of sufficient size should be available in Versar's water quality laboratory for the purpose of field replacement on an as-needed basis. Batteries generally have shorter life during cold weather, therefore sufficient supply must be maintained during winter months.

- pH Calibration Standard Solution – Several projects within Versar utilize the three pH calibration solutions (pH values 4, 7, and 10), so diligence is required to assure that pH solution(s) are not exhausted to the point that no solution will be available during the time that the solution are reordered. When reordering solution, a 20-liter container is obtained to provide sufficient supply for multiple projects. The expiration date for solutions already in use is noted: when the expiration date draws near (i.e., within a month), a new solution is ordered immediately. Responsibility for assuring the availability of adequate quantities of pH solution is the responsibility of the Project Coordinator. Supplies of pH calibration reagent are ordered from VWR Scientific who typically ship within a reasonable time.

- Conductivity Calibration Standard Solution – As is the case with pH calibration solution, conductivity calibration solution is to be maintained in sufficient quantity. When the last 4-liter bottle of reagent is half-empty, restocking occurs. The vendor for conductivity calibration solution is VWR Scientific. In the event that the vendor places the solution on backorder, a 1-liter supply of calibration solution can be prepared from solid KCl on hand. Only a chemist or a trained technician will prepare this solution. The Project Coordinator will be responsible for assuring an adequate supply of this reagent.

2.9 NON-DIRECT MEASUREMENTS

Non-direct measurements include those measurements that are a) not directly measured by calibrated instrumentation that are designed for the purpose or b) based on observation and are subject to interpretation by technical staff. Such measurements are considered secondary to the continuous water quality and chemical concentration data accumulation task at hand. Non-direct measurements cannot be assigned a DQO and rely on the professional judgment of staff. Variability in non-direct measurements can be minimized by reviewing standard procedures and calibrating field staff who will be making observations.

Non-direct measurements for this task include the following:

- Secchi Depth,
- Odor,
- Surface Sheen, and
- Tide.

Secchi Depth. Water clarity in a water column using this method is indirectly determined by observation of the depth at which a Secchi disk disappears from view during daylight hours. Secchi Depth is a standard clarity value representing the maximum depth at which features can be distinguished. The depth is determined by observation by field staff and may be influenced by acuity of the observer, ambient lighting, and distance between the observer and the water surface. A Secchi Depth SOP, on file at Versar, will be reviewed by the Project Coordinator with technical staff.

Odor. Odor is another non-directly measured parameter that may be influenced by the observer. The types of odors usually associated with environmental assessments include: sulfurous, rancid, chemical, musty, or none. The observer's experiences and technical background may influence the accuracy of this measurement.

Surface Sheen. Surface sheen is floating layer of material on the surface of water that may be petrochemical or biological in origin. Petrochemical causes of sheen are usually assumed when streaks of different colors are observed or if the sheen does not break up when disturbed by a probing instrument. Sheen that results from biological processes tends to break up when disturbed; an inventory of biological processes should be reviewed with staff if data more than specific than presence/absence will be recorded.

Tide. Local tide can be determined by observing shoreline features in combination with tide tables. Determination of tide is influenced by the observational powers and experiences of the observer. Determination of tide status should be standardized amongst technical staff participating on the project.

2.10 DATA MANAGEMENT

Raw data deliverables for this project are gathered from two sources: (1) continuous monitoring data from field instrumentation (e.g., continuous water quality sonde), and (2) laboratory analytical results. All are converted from their native formats to formats useful to the client, quality checked, and delivered to MWCOG in spreadsheets and databases, or as mutually agreed to by Versar and MWCOG.

2.10.1 Data/Information Handling and Storage

A Microsoft Access database will be created to manage all data collected during the monitoring period. Laboratory analysis data that are received electronically from the lab will be uploaded to the database. Observed water quality readings will be entered by staff into the database and then compared with electronic logs to ensure the integrity of the data. All additional field data will also be entered and checked.

After completion of the QA/QC of the data, Versar will provide MWCOG with monthly data in Microsoft Excel format or a format of their choosing. Written progress reports will also be provided monthly for the duration of the contract period.

At the completion of the project, Versar will draft and submit 15 hard copies and 1 electronic copy of a summary report which will consist of the following sections:

1. Cover Letter
2. Project Introduction
3. Methods / Sampling Summary
4. Laboratory Results / Data Summary
5. QA/QC Documentation
6. (Electronic - CD) Final Microsoft Access database containing all data.

Versar will also provide a scanned copy of all field datasheets in PDF format to DC Water during monthly reports.

Continuous monitoring data are downloaded weekly from field instrumentation directly to a ruggedized field laptop PC (e.g., "Durabook"). The continuous data are archived (i.e., "backed up") from the field laptop PC to archive files on Versar server drive space. The data files are organized by station location, data type (continuous water quality, spot water quality, weekly sampling event, 40-hour sampling event), and date on the server. An archive copy is also created on the Project Coordinator's password protected home account. Continuous data are organized in YSI .dtf files and are readable, using YSI's proprietary software. Archived .dtf files are stored on a) dedicated server drive space for the Project Coordinator as described above and b) shared drive space accessible to the Field Leader and others for general use. Both storage areas are backed up daily and the backups stored offsite by company information technology personnel. Continuous data pertinent to the reporting month are extracted and saved in Microsoft Excel format files. The extracted continuous data are formatted in preparation for electronic submittal to MWCOG on a monthly schedule.

Results of sample analysis for this project are obtained from hard copy and electronic reports submitted to Versar by Martel Laboratories. Analytical laboratory results are stored in electronic format in both Versar's shared drive space and the Project Coordinator's own home drive space. Data preparation performed by the Field Leader in assisting the Project Coordinator are copied to the Project Coordinator's drive space.

Field data sheets are stored in a three-ring loose-leaf binder dedicated to field use. All field sheets for activities are kept in the binder in order to maintain a historical record for field staff for reference while in the field. The binder is divided into sections for weekly inspections/ maintenance, weekly sampling events, and 40-hour storm events. When field sheets are removed from the binder (due to age or exceeding the capacity of the binder), they are scanned and stored in a file cabinet in the Project Coordinator's or Field Leader's office.

Calibration data maintained in the Sonde Calibration Book near the calibration station benchtop are kept in the loose-leaf binder for two years, and then archived to long-term storage in the Project Coordinator's office.

Analytical laboratory certificates of analysis that are received in electronic format (CSV and PDF formats) are stored in the Project Coordinator's home drive space and Versar's shared drive space.

2.10.2 Company Standard Record-Keeping Procedure

Versar's Columbia office keeps project records for 10 years or longer, depending on project requirements. Physical records (logbooks, notes, project-specific procedure manuals, and deliverables) of recently completed projects are maintained in the office of either the Project Coordinator or the Project Manager (or their designee) for a minimum of five years. Afterwards, the records are moved to an archival area within the office's operational space at the custodian's (*i.e.,* Project Coordinator, Project Manager) discretion.

Electronic data are likewise stored for 10 years or longer. The analytical results spreadsheets and continuous field data are retained by the Project Coordinator. Continuous field data are retained by the Project Coordinator on the Columbia office server, either on home accounts on the server drive or on a limited-rights access server drive.

2.10.3 Data Loss Detection

The continuous water quality data are graphed and examined in the field on the laptop PC to verify instrument functionality, stability, and accuracy. Any gross instrumentation problems evident from data examination are remedied in the field, when possible and practical. Problems requiring in-depth diagnostics are reported to the Project Coordinator immediately so that troubleshooting can be performed or repairs arranged. Continuous data are inspected monthly in the office to note data loss or deterioration in data quality. Because changes in data quality are frequently far from abrupt, chronic conditions that may impact data quality may not be apparent unless examined in whole month increments. Conditions that may impact long-term continuous data quality are biological and chemical fouling of sensors, which interfere with sensitive surface contact with the water column. Corrective actions initiated as a result of monthly graph examination are transmitted to Field Leaders and Field Technicians so that the equipment responsible for the sub-quality data can be examined and adjusted as necessary. Data loss and

invalidation as a result of power loss or damage to sensors due to accident or vandalism is documented and reported to management. Electronic data exported from continuously logging equipment in preparation for submittal to the client are imported into a spreadsheet program where they are checked again to assure the entire month has been extracted. Continuous data that are determined to be invalid are omitted from the record so that calculations using the continuous data are not affected by data of poor quality.

Accompanying the analytical results from Martel are quality control packages that demonstrate the laboratory's adherence to their internal quality assurance plan. Any quality irregularities in laboratory analytical results (either missing data or qualified data) are noted in the comment section of the water chemistry database file. Data packages are review by Versar upon receipt from Martel.

2.10.4 Hardware and Software Performance Requirements

The laptop field PC should be maintained in a state of charged readiness. Since laptop PC batteries have a finite lifetime, PC performance should be observed during field use. In the eventuality that the PC is unable to maintain sufficient charge during routine field use on a weekly basis, Versar's MIS Department shall be notified so that a replacement rechargeable battery can be procured. If a field PC is rendered unusable due to inadequate power supply or for other reasons, the laptop will be taken out of service for repair at the manufacturer and a comparable unit used in its place. The replacement PC shall be equipped with the same software packages and port accesses as the field PC designated for this project.

Electronic data, such as continuous water quality data to be submitted to MWCOG must conform to the format requirement that is agreeable to Versar and to MWCOG. The data format must be easily exportable into other formats. Once a standard format is agreed upon, it shall be adhered to for all submittals to maintain consistency and compatibility with work processes derived therefrom.

3.0 ASSESSMENTS AND OVERSIGHT

Assessments and evaluations are employed to determine whether elements of the QAPP are being properly implemented, to increase confidence in data, and to determine suitability of data for its intended use.

3.1 ASSESSMENTS AND RESPONSE ACTIONS

The QA Program under which this program operates includes performance audits with independent checks of data obtained from monitoring, sampling, and analysis activities. Versar will follow the established QA protocols specified in this QAPP. Should suspected problems arise while conducting QA activities, key steps in resolving performance issues include:

- Identifying a problem,
- Assigning responsibility for investigating the nature and cause of the problem,
- Assigning responsibility for implementing appropriate corrective action,
- Implementing corrective action, and
- Verifying that the corrective action has solved the problem.

Most technical problems that may arise during field activities can be solved on-the-spot by field staff. For example, minor maintenance of field apparatus may be performed in the field. Immediate corrective actions are part of normal operating procedures and are documented in project records. Problems that cannot be solved by technical staff are brought to the attention of the Project Coordinator or Project Manager for further investigation, determination of appropriate corrective actions, and implementation of these actions to resolve the problem. All major problems encountered and steps taken to resolve them are documented, reported, and discussed with the MWCOG Project Manager.

The Versar Project Coordinator reviews the long-term monitoring and water chemistry sampling task monthly. Technical, financial, manpower, and schedule commitments are also reviewed with the Project Manager, and action items are assigned, as necessary, to maintain project progress and solve or prevent problems. The Versar Project Manager is a senior staff member with the authority to stop work, require additional corrective measures, and direct or redirect staff assignments as necessary. Audits of staff adherence to field procedures are conducted every three months by the Project Coordinator. Retraining of field technicians in proper field techniques is provided as necessary should a QA issue arise.

The goal of periodic assessments of project performance is to assure that the data generated continue to be valid and usable. Weekly inspections of field stations provide frequent evaluation of equipment functionality and data quality. Reviews of weekly inspection records are useful in determining the origin of long-term problems and steps taken to resolve them. Monthly data assessments are described in Section 2.10 and are an effective means to perform QC, as some data problems are not apparent unless examining monthly continuous data. For example, inspections of monthly data may detect problems such as electronic noise or drift.

At the end of the project, the project data are reviewed and summarized. The project's Project Coordinator is responsible for drafting QA report text, which is part of the final deliverable. A draft is reviewed by the Versar Project Manager prior to submittal to MWCOG.

3.2 REPORTS TO MANAGEMENT

Versar's management QA procedures include monthly reviews of progress and financial reports. These summary progress reports are submitted by Versar's Project Manager to MWCOG's Project Manager. Each report contains a description of monthly progress on each task, an indicator of any current problems that may impede performance and proposed corrective action, and a discussion of services to be performed during the next reporting period. Reports include pertinent sampling event technical information, such as continuous data graphs. The monthly report is the official historical record of the project activities and provides a valuable summary of events (both work accomplishments and problems encountered) that take place during any given month. MWCOG's Project Manager is asked to review the reports and discuss any concerns with the Versar Project Manager for immediate resolution.

4.0 DATA VALIDATION AND USABILITY

Through the procedures described above, steps are implemented throughout the project to ensure data quality. This section includes additional information on data review, verification, and validation procedures and how those procedures support data usability for intended purposes.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Throughout the project, data review and verification measures are conducted regularly providing, for example, ongoing checks of completeness in the continuous data record, completeness of laboratory results received for each sampling event, and verification of continuous data accuracy.

In preparation for compilation of the deliverables, a comprehensive inventory of analytical activities is performed. Data review and verification is conducted to assess completeness and adequacy for meeting contractual and project objectives. The greater the completeness of the data, along with good accuracy and precision, the higher the probability of providing results and conclusions with minimized uncertainty.

Another criterion for evaluating analytical laboratory data quality employs the results of analysis of field QC samples submitted to the analytical laboratory (as well as laboratory QC checks). Analytical laboratory results accompanied by blank QC sample data showing non-zero results are flagged as being of increased uncertainty and adjusted to factor out the effects of blank contamination.

To assure that analytical laboratory concentration data are of high quality and usable for their intended purpose, the data packages must reflect this. The analytical data as reported from Martel to Versar, must also be present and accounted for (i.e., for each monitoring event there must also be a corresponding laboratory report). Transcription, either by electronic or manual means, must also be 100% accurate.

Field data sheets must be completely filled out to include date and time of sampling, water quality measurements, and non-direct measurements. Comments by field staff recorded on the field data sheets during field activities are reviewed monthly in order to determine whether acute or chronic problems exist in the functioning of field equipment. The review of data in total during compilation of the deliverable is also a good time to gain additional perspective to verify field equipment functionality.

Data deliverables are reviewed for completeness, making sure that all required fields contain entries and that the entries are correct representations of the data that MWCOG requires.

4.2 VERIFICATION AND VALIDATION METHODS

Continuous water quality data (pH, specific conductivity, temperature, dissolved oxygen) are archived in the Field Leader's shared account, as described above, to meet monthly reporting requirements and other requirements defined in this QAPP. The continuous data, in order to be transferred from the field laptop PC, are archived to an archive file (.dtf). The archive file is then copied to the Field Leader's shared account. The archive file is also restored to the Project Coordinator's home account on the server. All of these activities take place using YSI's propriety software. Any data gaps identified by the Field Leader during this process should be investigated by checking the data record on the field laptop PC.

Laboratory analytical results are verified by reviewing each report from Martel to evaluate QC acceptability (reviewing report QC packet and reviewing field QC samples submitted to the laboratory). Analytical data are examined for outliers during the 100% transcription verification process. For verification, data are entered (or transferred from .CSV files) to the project Access database by two different scientists. A program is then run on the data to identify discrepancies which are then investigated by the Project Coordinator. Flagged analytical results data are evaluated by the Project Coordinator to determine appropriate adjustments to the analytical data.

Field data (e.g., spot water quality measurements), as transcribed from field data sheets, undergo at least 20% validation by the Project Coordinator.

4.3 RECONCILIATION WITH USER REQUIREMENTS

The goal of the monitoring task is to report the results of weekly and 40-hour storm event monitoring to DC Water and to provide an evaluation of data quality in the narrative portion of the final deliverable. The dataset is required to be of sufficient size to support statistical testing. Any limitations of the data are reported in the final report.

Since this is a relatively small-scale monitoring task, no specific statistical testing is performed on the compiled field and laboratory data to determine cumulative error. Quality control provisions for data acquisition and evaluation processes have been found to be sufficient for determining data suitability.

5.0 REFERENCES

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GLOSSARY

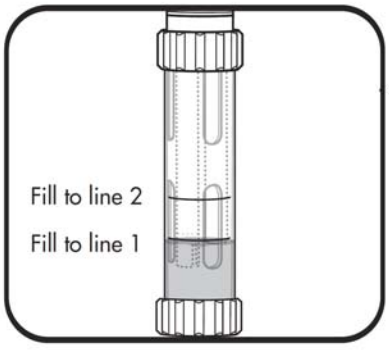
BMPs	Best management practices
$CBOD_5$	Carbonaceous biochemical oxygen demand
Initial and Continuing Calibration Verification Standards	A known concentration of an analyte that is used to evaluate laboratory instrumentation performance
Initial and Continuing Instrument Calibration Blanks	A distilled water (or other neutral analyte) used in the establishment of a laboratory instrumentation calibration curve
Laboratory duplicate	A duplicate sample that is used to evaluate the repeatability of analytical tests
Matrix Spikes	Fortification of a sample with a known quantity of analyte of interest in order to evaluate laboratory instrumentation performance
Method Blank	A distilled water sample taken through the collection and sample delivery process in order to evaluate cleanliness of the sample containers and goodness of the sampling technique
MWCOG	Metropolitan Washington Council of Governments
QA/QC	Quality Assurance and Quality Control
Reference/LCS Standards	A standard concentration of analyte provided by EPA or NIST that is analyzed in order to evaluate laboratory instrumentation performance
SOPs	Standard Operating Procedures

APPENDIX A
YSI CALIBRATION PROCEDURES

5.1 Calibration Basic

EXO sensors (except temperature) require periodic calibration to assure high performance. Calibration procedures follow the same basic steps with slight variations for particular parameters. Conduct calibrations in a temperature-controlled lab.

Calibration set-up.



For accurate results, thoroughly rinse the EXO calibration cup with water, and then rinse with a small amount of the calibration standard for the sensor you are going to calibrate. Two to three rinses are recommended. Discard the rinse standard, then refill the calibration cup with fresh calibration standard. Fill the cup to approximately the first line with a full sensor payload or the second line with small sensor payload. Volumes will vary, just make certain that the sensor is submerged. Be careful to avoid cross-contamination with other standards.

Begin with a clean, dry probe installed on the EXO sonde. Install the clean calibration guard over the probe(s), and then immerse the probe(s) in the standard and tighten the calibration cup onto the EXO sonde. We recommend using one sonde guard for calibration procedures only, and another sonde guard for field deployments. This ensures a greater degree of cleanliness and accuracy for the guard used in the calibration procedure.

Basic calibration in KOR software.

Go the Calibrate menu in KOR software. This menu's appearance will vary depending on the sensors installed in the sonde. Select the sensor you are going to calibrate from the list. Next select the parameter for the sensor you are going to calibrate. Some sensors have only one parameter option, while other sensors have multiple options.

In the next menu, select a 1-, 2-, or 3-point calibration, depending on your sensor. Enter the value of the standard you are using. Check that the value you enter is correct and its units match the units at the top of the menu (e.g., microSiemens versus milliSiemens). You may also enter optional information for type of standard, manufacturer of standard, and lot number.

Click the Start Calibration button. This action initiates the probe's calibration in the standard; initially the data reported will be unstable and then they will move to stable readings. Click the Graph Data button to compare the pre-cal and post-cal values in graph form. Users should confirm that the value is within their acceptable margin of error. Once readings are stable, click Apply to accept this calibration point. Repeat the process for each calibration point. **Click Complete when all points have been calibrated.**

A calibration summary appears with a QC score. View, export, and/or print the calibration worksheet. If a calibration error appears, repeat the calibration procedure.

5.2 Calibration Conductivity / Temperature

Clean the conductivity cell with the supplied soft brush before calibrating *(see section 6.14)*.
Also, review the basic calibration description in section 5.1.

This procedure calibrates conductivity, non-linear function (nLF) conductivity, specific conductance, salinity, and total dissolved solids.

Place the correct amount of conductivity standard into a clean and dry or pre-rinsed calibration cup. A variety of standards are available based on the salinity of your environment. Select the appropriate calibration standard for your deployment environment; we recommend using standards greater than 1 mS/cm (1000 µS/cm) for greatest stability.

Carefully immerse the probe end of the sonde into the solution, making sure the standard is above the vent holes on the conductivity sensor. Gently rotate and/or move the sonde up and down to remove any bubbles from the conductivity cell.

Allow at least one minute for temperature equilibration before proceeding.

In the Calibrate menu, select Conductivity and then a second menu will offer the options of calibrating conductivity, nLF conductivity, specific conductance, or salinity. Calibrating any one option automatically calibrates the other parameters. After selecting the option of choice (specific conductance is normally recommended), enter the value of the standard used during calibration. Be certain that the units are correct and match the units displayed in the second window at the top of the menu.

Click Start Calibration. Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

- If the data do not stabilize after 40 seconds, gently rotate the sonde or remove/reinstall the cal cup to make sure there are no air bubbles in the conductivity cell.

Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

Rinse the sonde and sensor(s) in tap or purified water and dry.

5.3 Calibration Dissolved Oxygen

First review the basic calibration description in section 5.1.

ODO % sat and ODO % local – 1-point

Place the sonde with sensor into either saturated air or saturated water:
(a) Saturated air: Ensure there are no water droplets on the DO sensor or the thermistor. Place into a calibration cup containing about 1/8 inch of water that is vented by loosening the threads. (Do not seal the cup to the sonde.) Wait 10-15 minutes before proceeding to allow the temperature and oxygen pressure to equilibrate. Keep out of direct sunlight.
(b) Saturated water: Place into a container of water which has been continuously sparged with an aquarium pump and air stone for one hour. Wait approximately 5 minutes before proceeding to allow the temperature and oxygen pressure to equilibrate.

In the Calibrate menu, select ODO, then select ODO % sat or ODO % local. Calibrating in ODO % sat automatically calibrates ODO mg/L and ODO % local and vice versa.

Enter the current barometric pressure in mm of Hg (Inches of Hg x 25.4 = mm Hg).

NOTE: Laboratory barometer readings are usually "true" (uncorrected) values of air pressure and can be used "as is" for oxygen calibration. Weather service readings are usually not "true", i.e., they are corrected to sea level, and therefore cannot be used until they are "uncorrected". An approximate formula for this "uncorrection" (where the BP readings MUST be in mm Hg) is:
True BP = [Corrected BP] – [2.5 * (Local Altitude in ft above sea level/100)]

Click 1 Point for the Calibration Points. Enter the standard value (air saturated).

Click Start Calibration. Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

mg/L – 1-point

Place the sonde with sensor in a container which contains a known concentration of dissolved oxygen in mg/L and that is within ±10% of air saturation as determined by one of the following methods:

- Winkler titration
- Aerating the solution and assuming that it is saturated
- Measurement with another instrument

⚠ Carrying out DO mg/L calibrations at values outside the range of ±10 % of air saturation is likely to compromise the accuracy specification of the EXO sensor. For highest accuracy, calibrate in % saturation.

In the Calibrate menu, select ODO, then select ODO mg/L. Calibrating in ODO mg/L automatically calibrates ODO % sat and vice versa.

Click 1 Point for Calibration Points. Enter the known mg/L concentration for the standard value. Click Start Calibration. Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point. Click Complete.

Rinse the sonde and sensor(s) in tap or purified water and dry.

ODO % sat, ODO % local or mg/L – 2-point (or zero point)

Normally it is not necessary to perform a 2-point calibration for the DO sensor, and the procedure is not recommended unless (a) you are certain that the sensor does not meet your accuracy requirements at low DO levels and (b) you are operating under conditions where you are certain to be able to generate a medium which is truly oxygen-free.

For ODO % sat or ODO % local, calibrate your sonde at zero oxygen and in water-saturated air or air-saturated water. For ODO mg/L, calibrate your sonde at zero oxygen and a known concentration of oxygen within ±10% of air-saturation. The key to performing a 2-point calibration is to make certain that your zero-oxygen medium is truly oxygen-free:

- If you use nitrogen gas for the zero-point calibration, make certain that the vessel you use has a small exit port to prevent back diffusion of air and that you have completely purged the vessel before confirming the calibration.
- If you use sodium sulfite solution for the zero-point calibration, prepare the solution at a concentration of approximately 2 g/L at least two hours prior to use and keep it sealed in a bottle which does not allow diffusion of oxygen through the sides of the container. Transfer the sodium sulfite solution rapidly from its container to the calibration cup, fill the cup as full as possible with solution to minimize head space, and seal the cup to the sonde to prevent diffusion of air into the vessel.

Place the sonde with DO and temperature sensors in a zero-oxygen medium.

In the Calibrate menu, select ODO, then select either ODO % sat, ODO % local or ODO mg/L.

Click 2 Point for the Calibration Points. Enter Zero Point as the value of the first standard.

Click Start Calibration. Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

- If you used sodium sulfite solution as your zero calibration medium, you must thoroughly remove all traces of the reagent from the probes and wiper prior to proceeding to the second point. We recommend that the second calibration point be in air-saturated water if you use sodium sulfite solution.

Next place the sensors in the medium containing a known oxygen pressure or concentration and wait at least 10 minutes for temperature equilibration. Click Proceed in the pop-up window. Then enter either the barometer reading in mm Hg (for ODO %) or the actual concentration of oxygen which was probably determined from a Winkler titration (for ODO mg/L). Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point.

Click Complete. View the Calibration Summary screen and QC score. Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

⚠ Carrying out DO mg/L calibrations at values outside the range of ±10 % of air saturation is likely to compromise the accuracy specification of the EXO sensor. For highest accuracy, calibrate in % saturation.

Rinse the sonde and sensor(s) in tap or purified water and dry.

5.4 Calibration Depth and Level

NOTE: This calibration option is available only if your sonde is equipped with an integral depth sensor or a vented level sensor.

For the calibration, make certain that the depth sensor or vented level sensor is in air and not immersed in any solution. *Also, review the basic calibration description in section 5.1.*

In the Calibrate menu, select Port D-Depth, then select Depth or Level from the second menu.

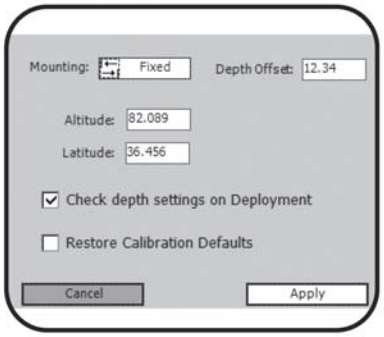
Click 1 Point for the Calibration Points. Enter 0 or go to the Advanced menu to enter a known sensor offset.

- If a depth offset is entered, the output value will shift by the value of the offset. Users may use an offset if referencing a water elevation against a known datum.

Click Start Calibration. Observe the readings under Current and Pending data points and when they are Stable (or data shows no significant change for approximately 40 seconds), click Apply to accept this calibration point. This process zeros the sensor with regard to current barometric pressure.

Click Exit to return to the sensor calibration menu, and then the back arrows to return to main Calibrate menu.

For best performance of depth measurements, users should ensure that the orientation of the sonde remains constant while taking readings. This is especially important for vented level measurements. Keep the sonde still and in one position while calibrating.



Advanced

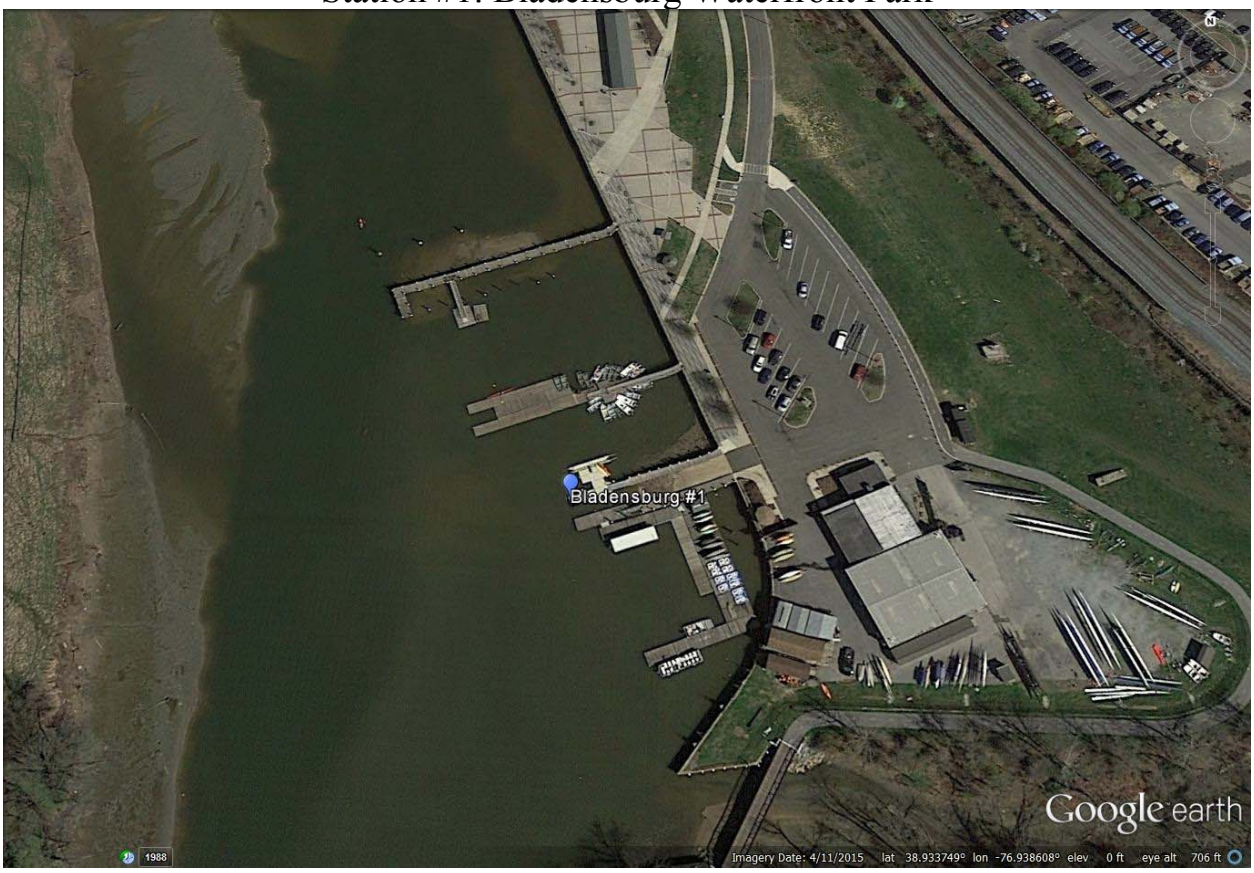
Mounting: Use the Advanced menu to select if a sonde will be mounted in a moving/profiling deployment instead of a fixed location.

Depth Offset: Enter a datum or barometric pressure offset at time of calibration. Barometric pressure offset allows the depth data to be post-processed for barometric pressure changes over the course of the deployment.

Altitude/Latitude: Enter the coordinates for the local altitude (in feet, relative to sea level) and latitude (in degrees) where the sonde is sampling. Latitude values are used in the calculation of depth or level to account for global variations in the gravitational field.

APPENDIX B
RECEIVING WATER QUALITY MONITORING STATIONS- REGULAR AND WET WEATHER

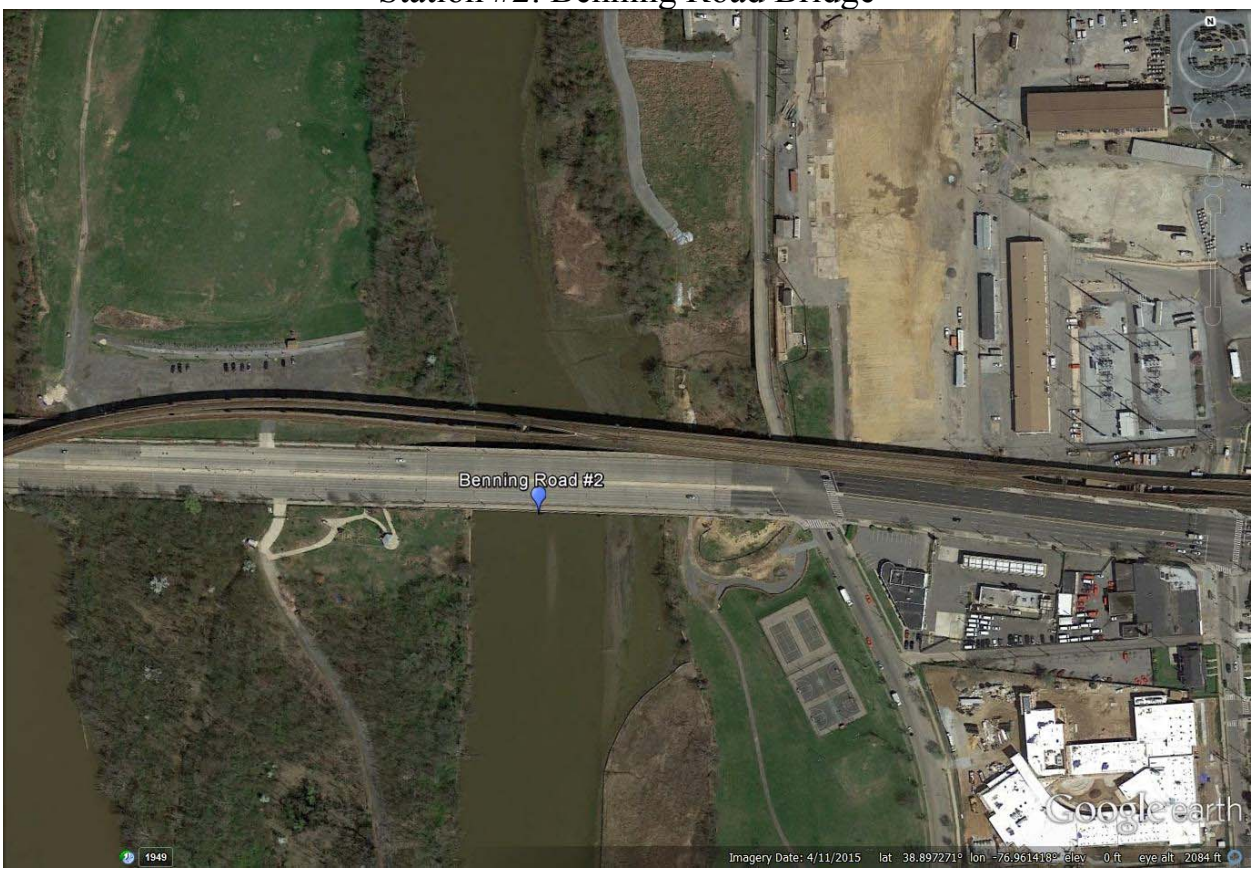
Station #1: Bladensburg Waterfront Park



(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

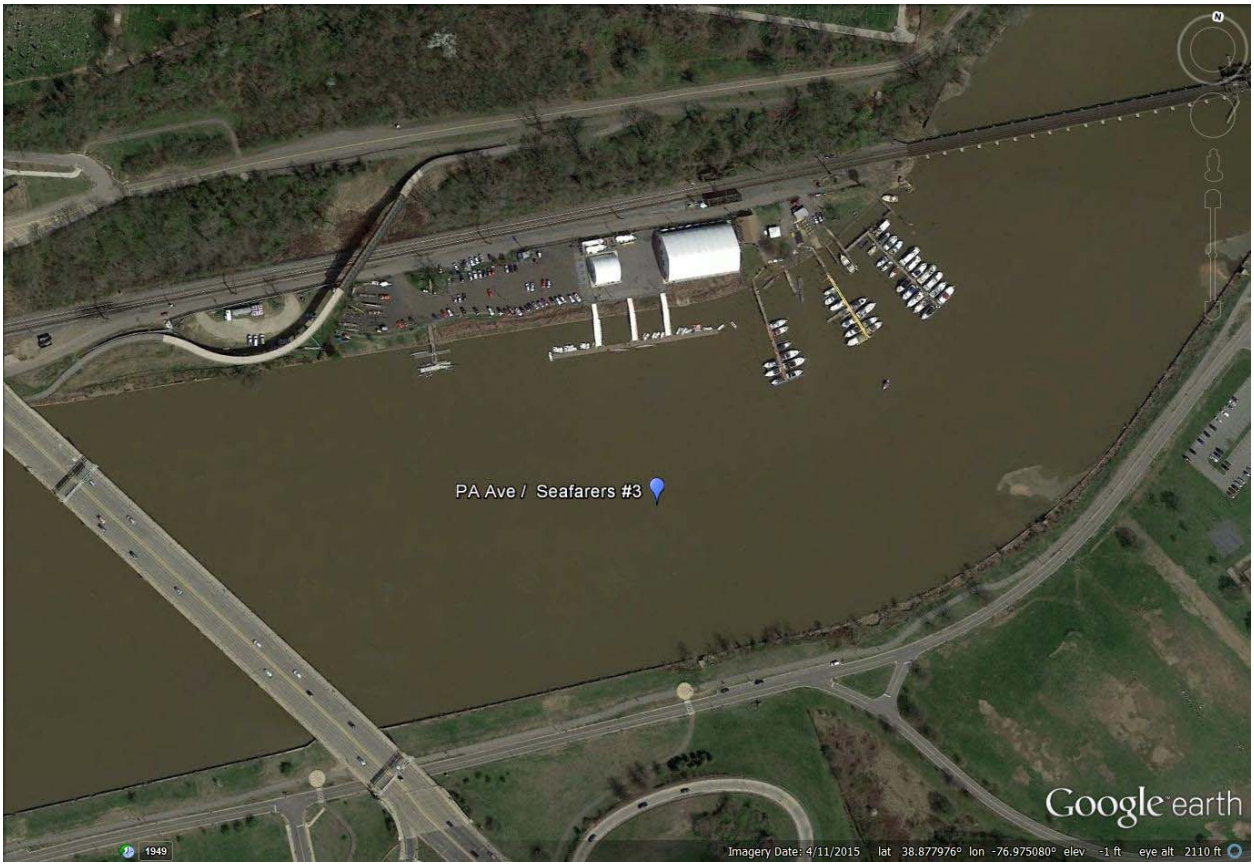
Station #2: Benning Road Bridge



(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

Station #3: PA Ave/ Seafarers Yacht Club



(Image courtesy of Google Maps)

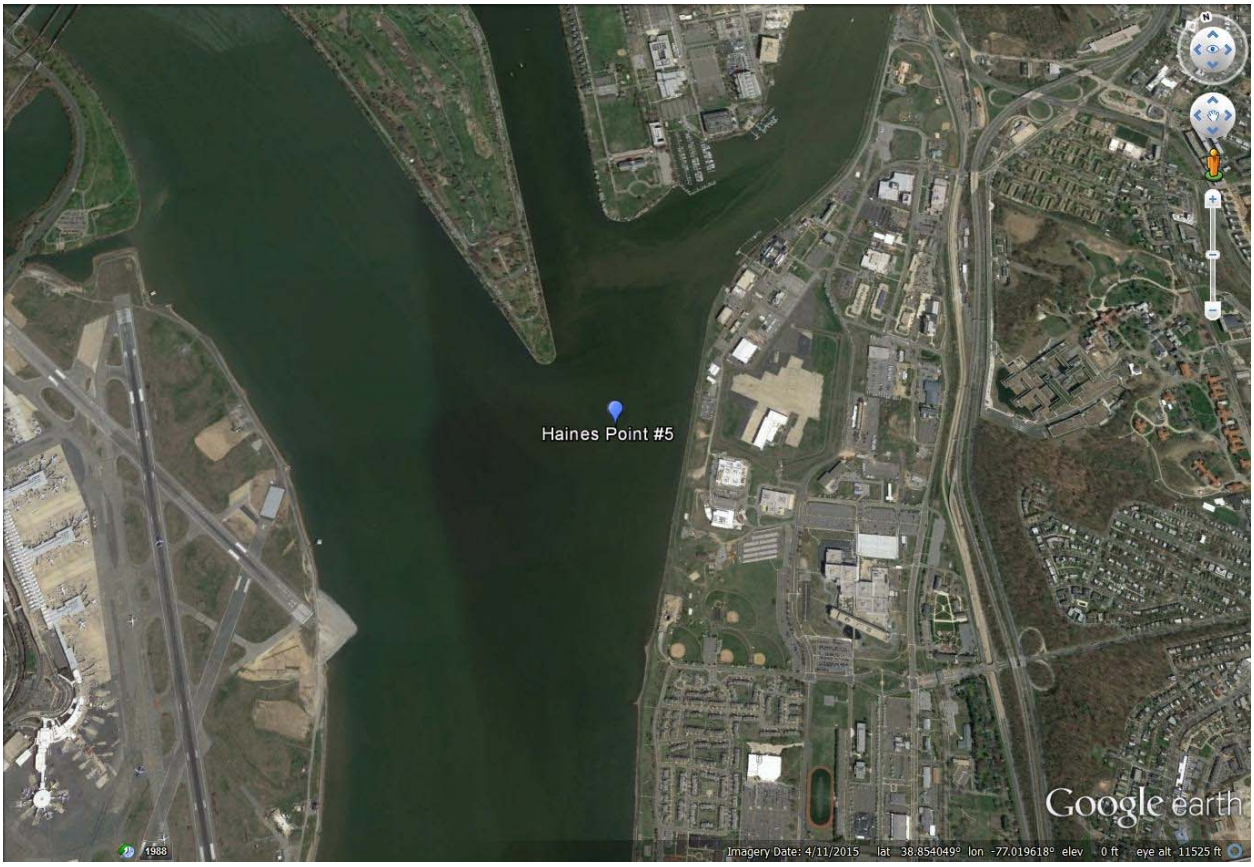
(Image courtesy of Google Maps)

Station #4: South Capitol St. Bridge

(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

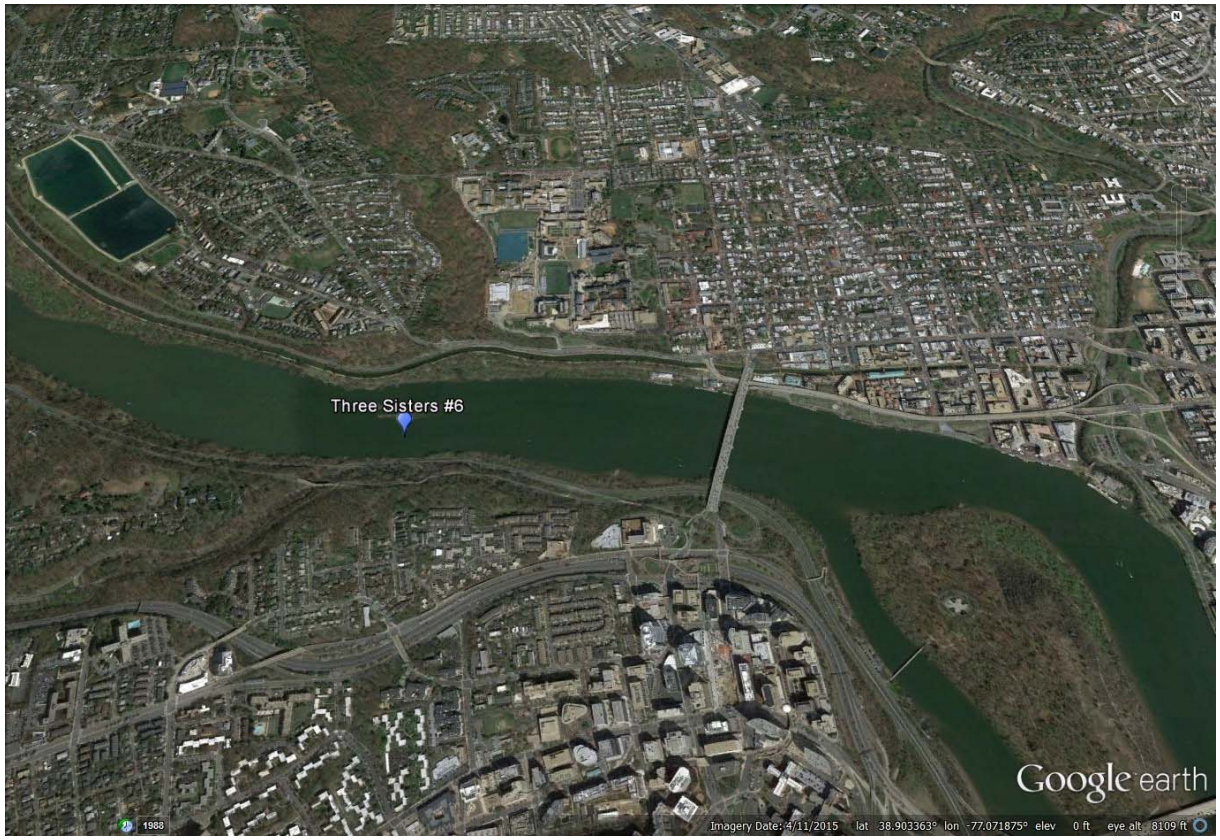
Station #5: Haines Point



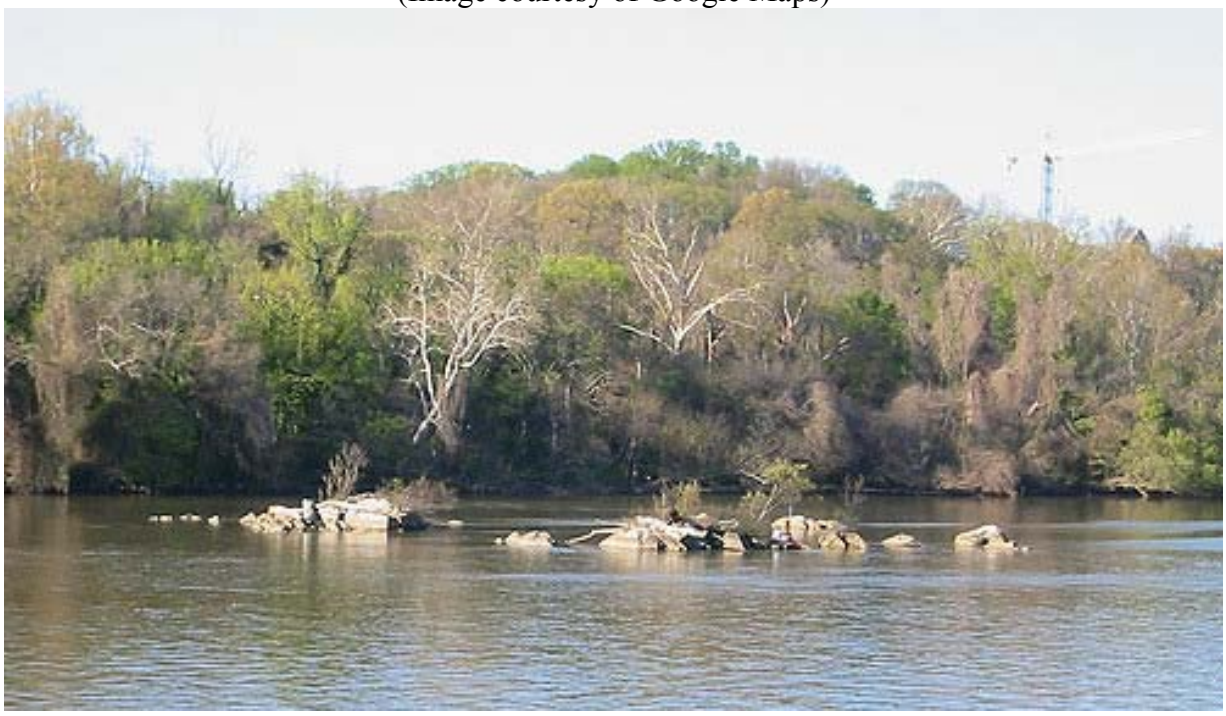
(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

Station #6: Three Sisters

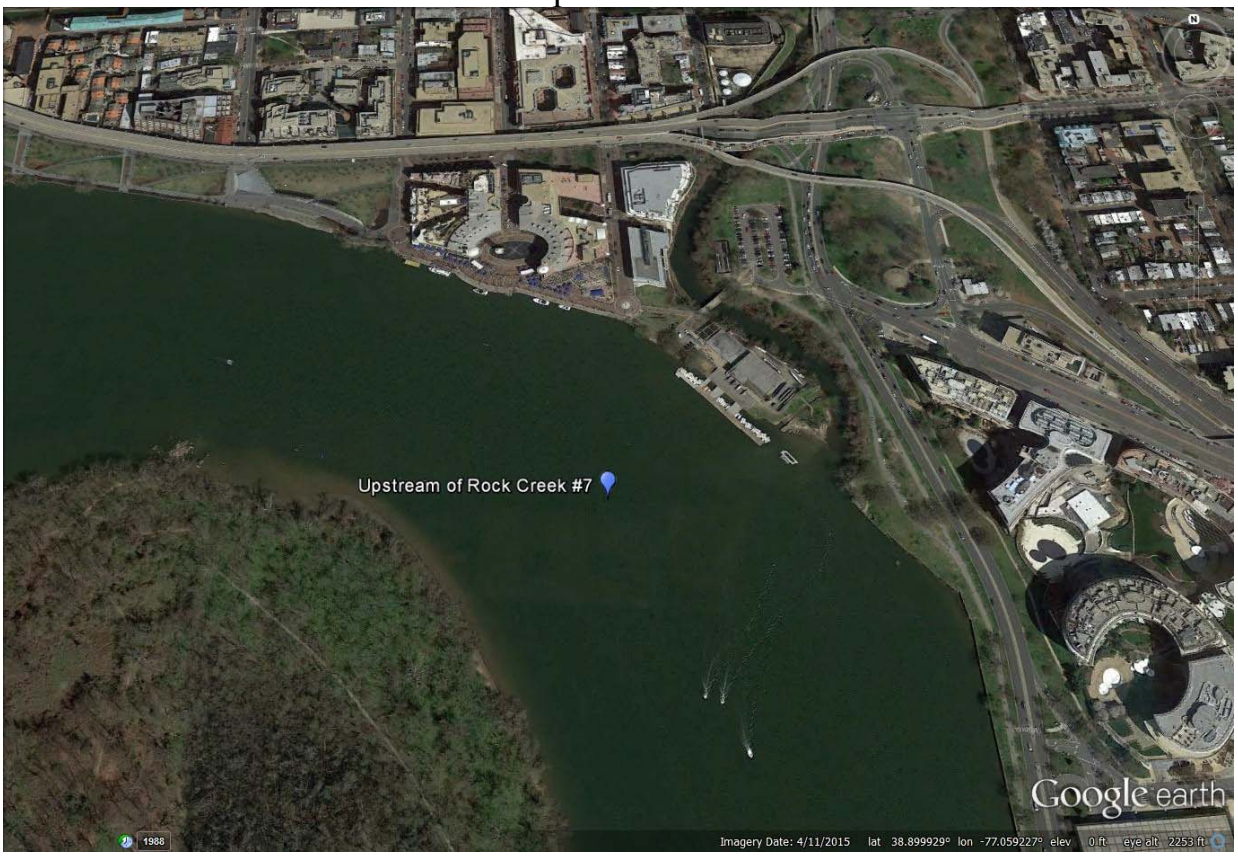


(Image courtesy of Google Maps)



(Image courtesy of Creative Commons)

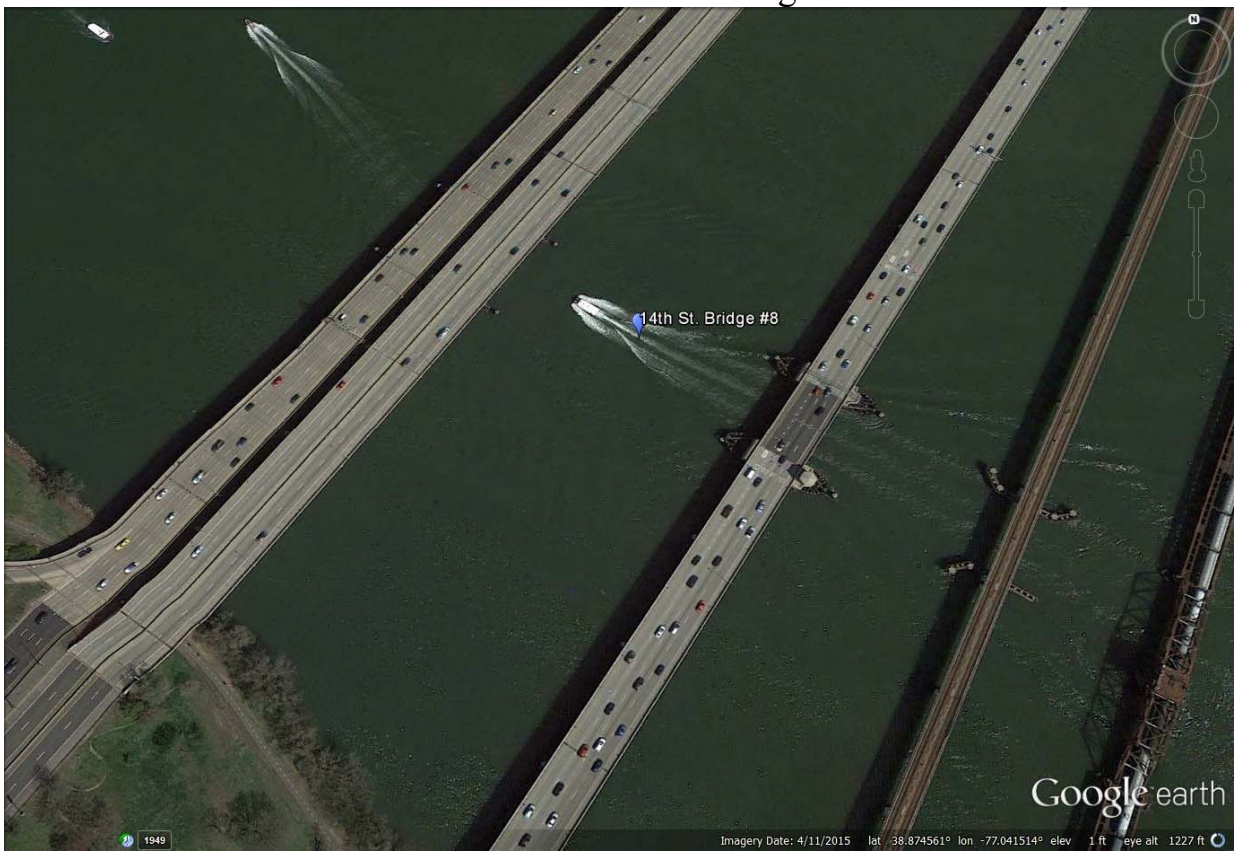
Stations #7: Upstream of Rock Creek



(Image courtesy of Google Maps)

(Image courtesy of Versar, Inc)

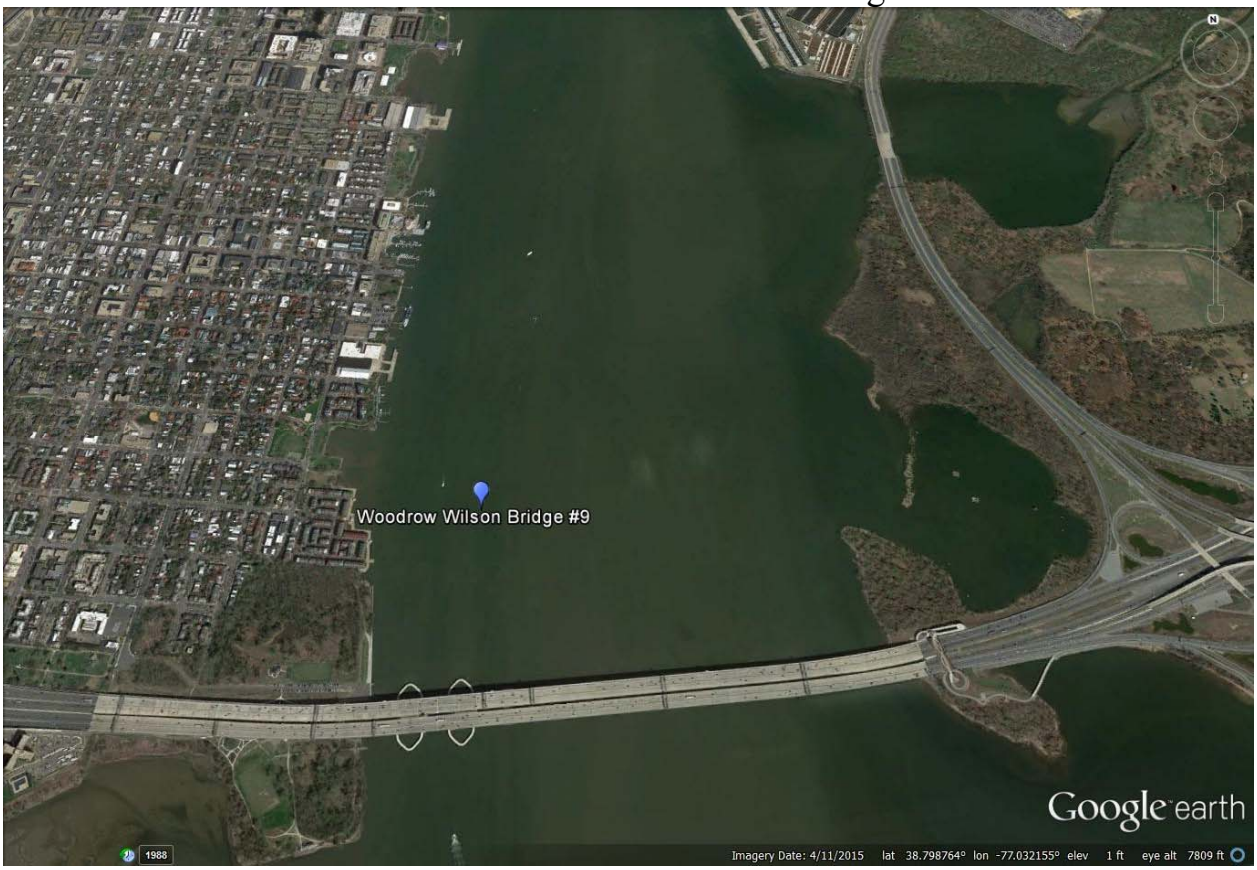
Station #8: 14th St. Bridge



(Image courtesy of Google Maps)

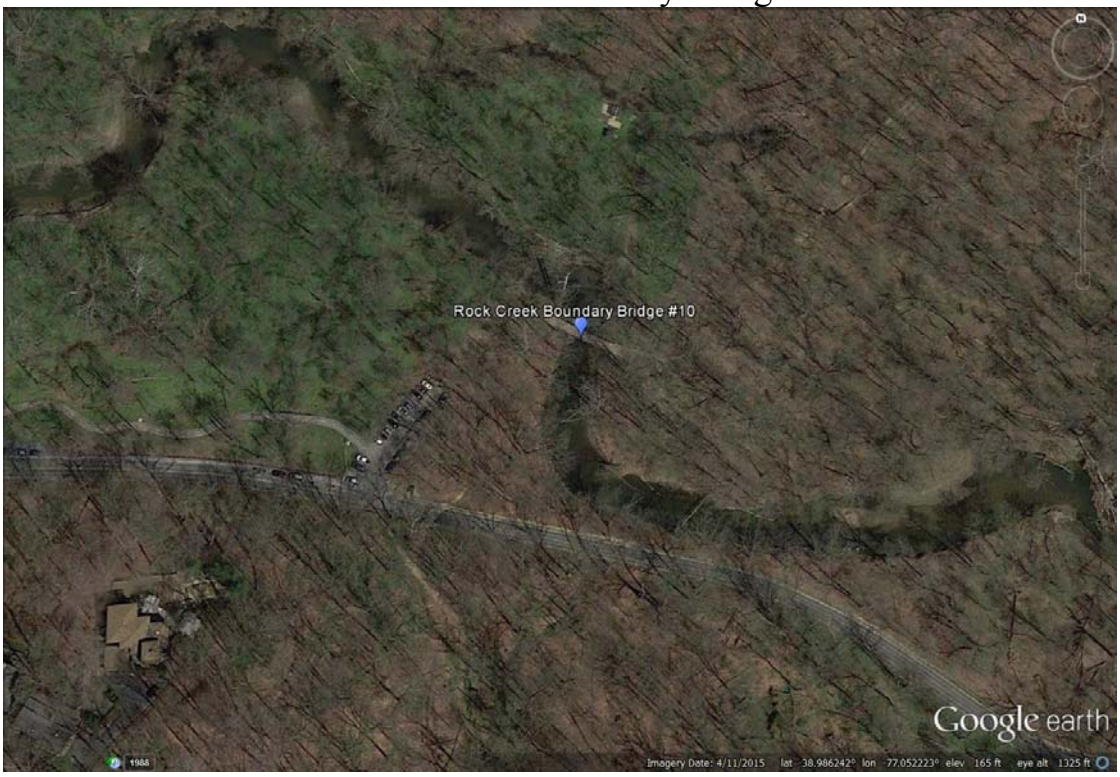
(Image courtesy of Google Maps)

Station #9: Woodrow Wilson Bridge



(Image courtesy of Google Maps)

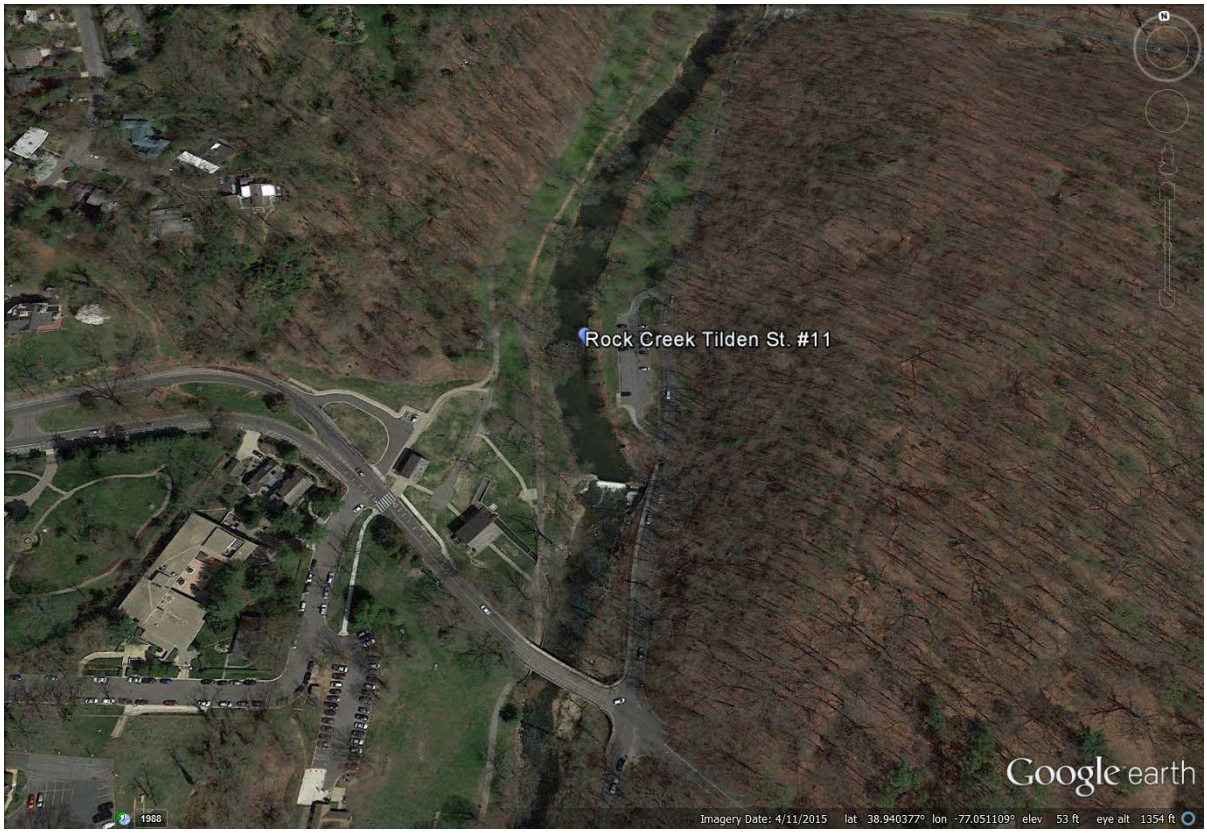
Station # 10: Boundary Bridge



(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

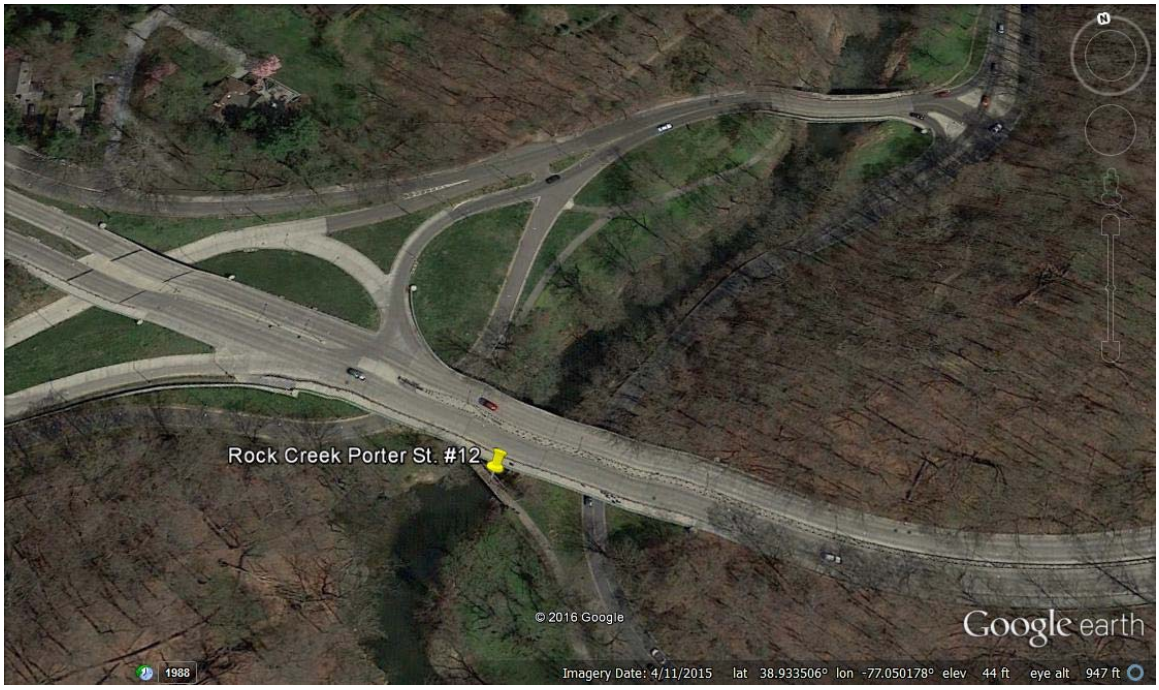
Station #11: Tilden St./ Pierce's Mill



(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

Station #12: Porter St.



(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

Station #13: PA Ave/ Thompson's Boat House

(Image courtesy of Google Maps)

(Image courtesy of Google Maps)

DISSOLVED OXYGEN AND WATER TEMPERATURE MONITORING STATIONS

Station #1: Bladensburg Waterfront Park DO Monitoring Station

(Image courtesy of Google Maps)

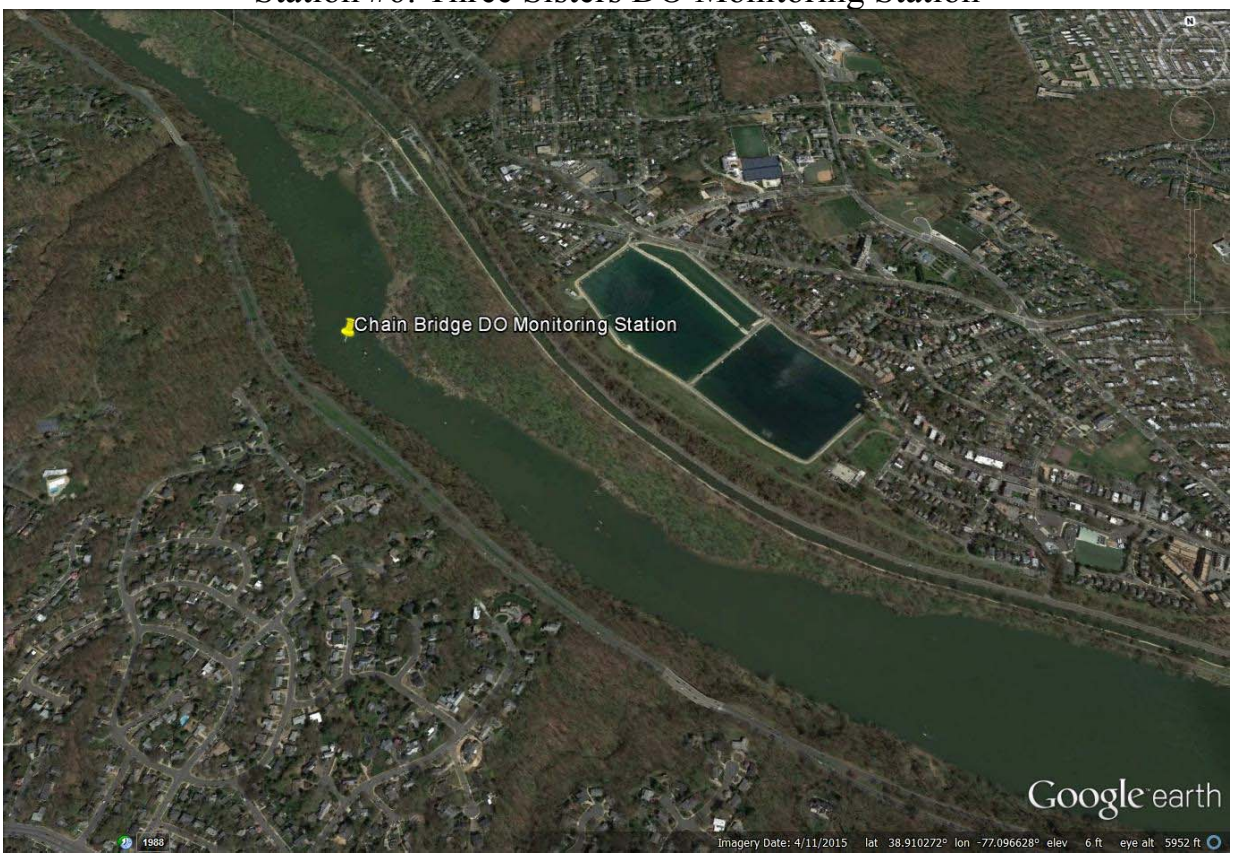
Station #3: PA Ave/ Seafarers Yacht Club DO Monitoring Station

(Image courtesy of Google Maps)

Station #4: South Capitol St. Bridge DO Monitoring Station

(Image courtesy of Google Maps)

Station #6: Three Sisters DO Monitoring Station

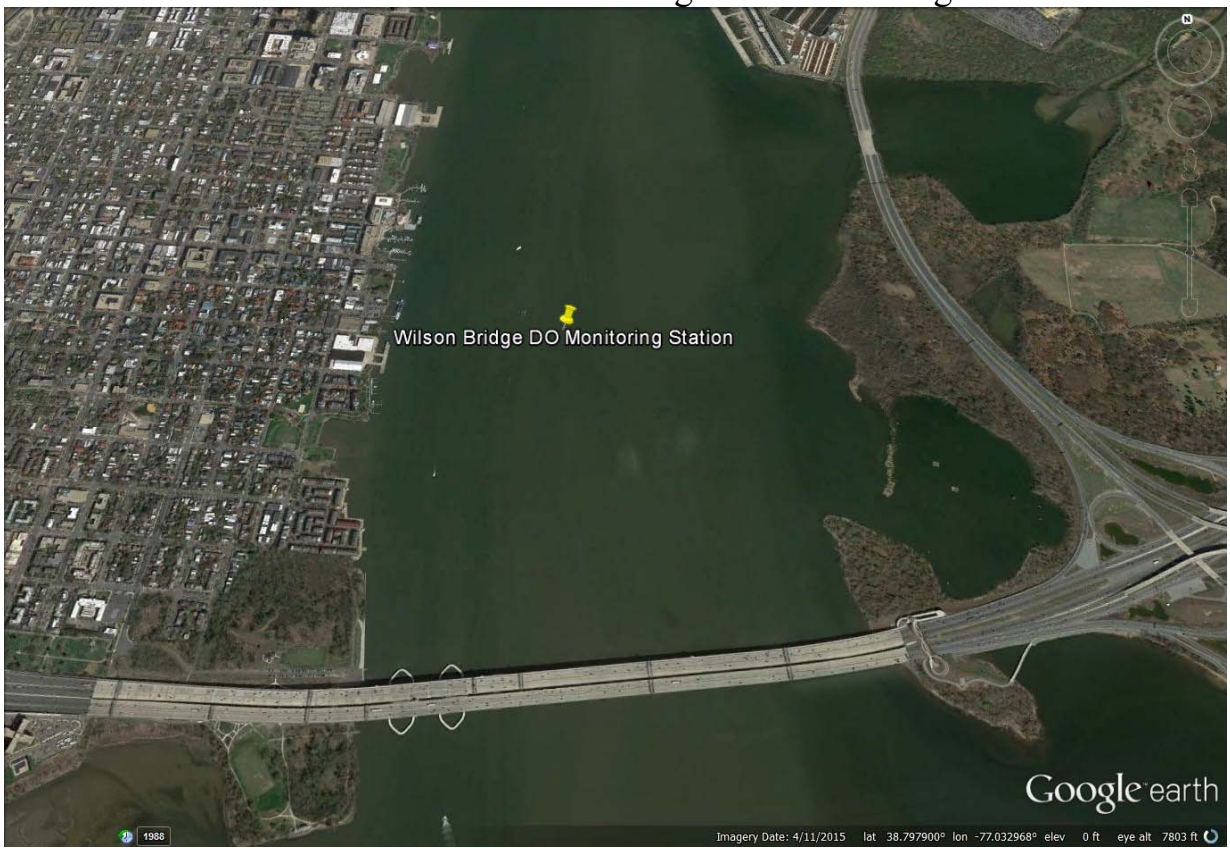


(Image courtesy of Google Maps)

Station #8: 14th St. Bridge DO Monitoring Station

(Image courtesy of Google Maps)

Station #9: Woodrow Wilson Bridge DO Monitoring Station



(Image courtesy of Google Maps)

APPENDIX C
BACTERIA HOLD TIME REQUIREMENTS

Test Procedure (ATP) Program Coordinator or the permitting authority in the Region in which the discharge will occur. Sufficient data should be provided to assure such changes in sample preservation, containers or holding times do not adversely affect the integrity of the sample. The Regional ATP Coordinator or permitting authority will review the application and then notify the applicant and the appropriate State agency of approval or rejection of the use of the alternate test procedure. A decision to approve or deny any request on deviations from the prescribed Table II requirements will be made within 90 days of receipt of the application by the Regional Administrator. An analyst may not modify any sample preservation and/or holding time requirements of an approved method unless the requirements of this section are met.

TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter number/name	Container [1]	Preservation [2,3]	Maximum holding time [4]
Table IA—Bacterial Tests:			
1–5. Coliform, total, fecal, and *E. coli*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22,21]
6. Fecal streptococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
7. Enterococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
8. *Salmonella*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$ [5].	8 hours.[22]
Table IA—Aquatic Toxicity Tests:			
9–12. Toxicity, acute and chronic	P, FP, G	Cool, ≤6 °C [16]	36 hours.
Table IB—Inorganic Tests:			
1. Acidity	P, FP, G	Cool, ≤6 °C [18]	14 days.
2. Alkalinity	P, FP, G	Cool, ≤6 °C [18]	14 days.
4. Ammonia	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
9. Biochemical oxygen demand	P, FP, G	Cool, ≤6 °C [18]	48 hours.
10. Boron	P, FP, or Quartz	HNO_3 to pH <2	6 months.
11. Bromide	P, FP, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous.	P, FP G	Cool, ≤6 °C [18]	48 hours.
15. Chemical oxygen demand	P, FP, G	Cool, ≤6 °C [18], H_2SO_4 to pH <2.	28 days.
16. Chloride	P, FP, G	None required	28 days.
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes.
21. Color	P, FP, G	Cool, ≤6 °C [18]	48 hours.
23–24. Cyanide, total or available (or CATC) and free.	P, FP, G	Cool, ≤6 °C [18], NaOH to pH >10 [5,6], reducing agent if oxidizer present.	14 days.
25. Fluoride	P	None required	28 days.
27. Hardness	P, FP, G	HNO_3 or H_2SO_4 to pH <2.	6 months.
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes.
31, 43. Kjeldahl and organic N	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH <2.	28 days.
Table IB—Metals: [7]			
18. Chromium VI	P, FP, G	Cool, ≤6 °C[18], pH = 9.3–9.7 [20].	28 days.
35. Mercury (CVAA)	P, FP, G	HNO_3 to pH <2	28 days.
35. Mercury (CVAFS)	FP, G; and FP-lined cap [17].	5 mL/L 12N HCl or 5 mL/L BrCl [17].	90 days.[17]
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO_3 to pH <2, or at least 24 hours prior to analysis [19].	6 months.
38. Nitrate	P, FP, G	Cool, ≤6 °C [18]	48 hours.
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH <2.	28 days.
40. Nitrite	P, FP, G	Cool, ≤6 °C [18]	48 hours.
41. Oil and grease	G	Cool to ≤6 °C[18], HCl or H_2SO_4 to pH <2.	28 days.

[7] For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), filter the sample within 15 minutes after completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (e.g., by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] If the sample is not adjusted to pH 2, then the sample must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity (*i.e.*, use all necessary preservatives and hold for the shortest time listed). When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 12, 13 (regarding the analysis of benzidine).

[12] If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 30 days at < 0 °C.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[16] Place sufficient ice with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature. Aqueous samples must not be frozen. Hand-delivered samples used on the day of collection do not need to be cooled to 0 to 6 °C prior to test initiation.

[17] Samples collected for the determination of trace level mercury (<100 ng/L) using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

[18] Aqueous samples must be preserved at ≤ 6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of "≤ °C" is used in place of the "4 °C" and "< 4 °C" sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures (1/100th of 1 degree); rather, three significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[19] An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this footnote supersede the preservation and holding time requirements in the approved metals methods.

[20] To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium methods, unless this supersession would compromise the measurement, in which case requirements in the method must be followed.

[21] Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field.

[22] Sample analysis should begin as soon as possible after receipt; sample incubation must be started no later than 8 hours from time of collection.

[23] For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB–EC) or 1681 (A–1): Class A composted, Class B aerobically digested, and Class B anaerobically digested.

[24] The immediate filtration requirement in orthophosphate measurement is to assess the dissolved or bio-available form of orthophosphorus (*i.e.*, that which passes through a 0.45-micron filter), hence the requirement to filter the sample immediately upon collection (*i.e.*, within 15 minutes of collection).

[38 FR 28758, Oct. 16, 1973]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting §136.3, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and at *www.fdsys.gov*.

§ 136.4 Application for and approval of alternate test procedures for nationwide use.

(a) A written application for review of an alternate test procedure (alternate method) for nationwide use may be made by letter via email or by hard copy in triplicate to the National Alternate Test Procedure (ATP) Program Coordinator (National Coordinator), Office of Science and Technology (4303T), Office of Water, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave. NW., Washington, DC 20460. Any application for an alternate test procedure (ATP) under this paragraph (a) shall:

(1) Provide the name and address of the responsible person or firm making the application.

APPENDIX D
FIELD DUPLICATE, BLANK, AND MODIFICATION SCHEDULES

Table D-1. Routine sampling dates and stations codes

Routine Sampling Dates and Station Codes

	Date of Sampling		Date of Sampling
Trip 1	12/8/2014	**Trip 37**	7/13/2015
Trip 2	12/11/2014	**Trip 38**	7/20/2015
Trip 3	12/15/2014	**Trip 39**	7/23/2015
Trip 4	12/22/2014	**Trip 40**	7/27/2015
Trip 5	12/29/2014	**Trip 41**	8/3/2015
Trip 6	1/5/2015	**Trip 42**	8/10/2015
Trip 7	1/20/2015	**Trip 43**	8/13/2015
Trip 8	1/22/2015	**Trip 44**	8/17/2015
Trip 9	1/26/2015	**Trip 45**	8/24/2015
Trip 10	1/27/2015	**Trip 46**	8/27/2015
Trip 11	2/3/2015	**Trip 47**	8/31/2015
Trip 12	2/5/2015	**Trip 48**	9/8/2015
Trip 13	2/9/2015	**Trip 49**	9/10/2015
Trip 14	3/12/2015	**Trip 50**	9/14/2015
Trip 15	3/16/2015	**Trip 51**	9/21/2015
Trip 16	3/19/2015	**Trip 52**	9/28/2015
Trip 17	3/23/2015	**Trip 53**	10/5/2015
Trip 18	3/26/2015	**Trip 54**	10/8/2015
Trip 19	3/30/2015	**Trip 55**	10/13/2015
Trip 20	4/6/2015	**Trip 56**	10/19/2015
Trip 21	4/9/2015	**Trip 57**	10/22/2015
Trip 22	4/13/2015	**Trip 58**	10/26/2015
Trip 23	4/23/2015	**Trip 59**	11/2/2015
Trip 24	4/27/2015	**Trip 60**	11/5/2015
Trip 25	5/4/2015	**Trip 61**	11/9/2015
Trip 26	5/7/2015	**Trip 62**	11/16/2015
Trip 27	5/11/2015	**Trip 63**	11/19/2015
Trip 28	5/18/2015	**Trip 64**	11/30/2015
Trip 29	5/21/2015	**Trip 65**	12/3/2015
Trip 30	5/26/2015	**Trip 66**	12/7/2015
Trip 31	6/8/2015	**Trip 67**	12/14/2015
Trip 32	6/15/2015	**Trip 68**	12/17/2015
Trip 33	6/18/2015	**Trip 69**	12/28/2015
Trip 34	6/22/2015	**Trip 70**	1/4/2016
Trip 35	7/7/2015	**Trip 71**	1/7/2016
Trip 36	7/9/2015		

System	Station	Station CODE
Anacostia	Bladensburg	01
Anacostia	Benning Road	02
Anacostia	PA Ave (Seafarers Yacht Club)	03
Anacostia	S. Capitol Street Bridge	04
Anacostia	Haines Point	05
Potomac	Three Sisters	06
Potomac	Upstream of Rock Creek	07
Potomac	14th Street Bridge	08
Potomac	Wilson Bridge (Red Can 4)	09
Rock Creek	Boundary Bridge	10
Rock Creek	Tilden Street	11
Rock Creek	Porter Street	12
Rock Creek	PA Ave (Thompson's Boathouse)	13

Table D-2. Water chemistry duplication requirements

			Sampling Parameters				
	Duplication Schedule		1:20	1:20	1:20	1:20	1:20
System	Station	Station CODE	Fecal Coliform	E. coli	CBOD5	TSS	Chl-A
Anacostia	Bladensburg	01	x	x	x	x	x
Anacostia	Benning Road	02	x	x	x	x	x
Anacostia	PA Ave (Seafarers)	03	x	x	x	x	x
Anacostia	S. Capitol Street Bridge	04	x	x	x	x	x
Anacostia	Haines Point	05	x	x	x	x	x
Potomac	Three Sisters	06	x	x	x	x	x
Potomac	Upstream of Rock Creek	07	x	x	x	x	x
Potomac	14th Street Bridge	08	x	x	x	x	x
Potomac	Wilson Bridge (Red Can 4)	09	x	x	x	x	x
Rock Creek	Boundary Bridge	10	x	x			
Rock Creek	Tilden Street (Pierce's Mill)	11	x	x			
Rock Creek	Porter Street	12	x	x			
Rock Creek	PA Ave (@ Thompson's Boat House)	13	x	x	x	x	
		Total Samples per Trip	13	13	10	10	9

Table D-3. In-situ water quality duplication requirements

			In-situ WQ				
	Duplication Schedule		1:10	1:10		1:10	
System	Station	Station CODE	Temp	pH	Cond	DO	Secchi
Anacostia	Bladensburg	01	x	x	x	x	x
Anacostia	Benning Road	02	x	x	x	x	
Anacostia	PA Ave (Seafarers)	03	x	x	x	x	x
Anacostia	S. Capitol Street Bridge	04	x	x	x	x	x
Anacostia	Haines Point	05	x	x	x	x	x
Potomac	Three Sisters	06	x	x	x	x	x
Potomac	Upstream of Rock Creek	07	x	x	x	x	x
Potomac	14th Street Bridge	08	x	x	x	x	x
Potomac	Wilson Bridge (Red Can 4)	09	x	x	x	x	x
Rock Creek	Boundary Bridge	10	x	x	x	x	
Rock Creek	Tilden Street (Pierce's Mill)	11	x	x	x	x	
Rock Creek	Porter Street	12	x	x	x	x	
Rock Creek	PA Ave (@ Thompson's Boat House)	13	x	x	x	x	
		Total Samples per Trip	13	13		13	

Table D-4. Water chemistry duplication schedule

Field Duplicate Schedule for 71-trips of Weekly Water Chemistry

	Fecal coliform	E. coli	CBOD5	TSS	Chl-A
Trip 1					
Trip 2	1	2	3	4	
Trip 3					5
Trip 4	2	3	4	5	
Trip 5	3	4			6
Trip 6			5	6	
Trip 7	4	5			7
Trip 8	5	6	6	7	
Trip 9					8
Trip 10	6	7	7	8	
Trip 11	7	8			
Trip 12			8	9	9
Trip 13	8	9			
Trip 14	9	10	9	13	1
Trip 15					
Trip 16	10	11	13	1	2
Trip 17	11	12			
Trip 18			1	2	3
Trip 19	12	13			
Trip 20	13	1	2	3	4
Trip 21					
Trip 22	1	2	3	4	
Trip 23					5
Trip 24	2	3	4	5	
Trip 25	3	4			6
Trip 26			5	6	
Trip 27	4	5			7
Trip 28	5	6	6	7	
Trip 29					8
Trip 30	6	7	7	8	
Trip 31	7	8			
Trip 32			8	9	9
Trip 33	8	9			
Trip 34	9	10	9	13	1
Trip 35					
Trip 36	10	11	13	1	2
Trip 37	11	12			

System	Station	Station CODE
Anacostia	Bladensburg	01
Anacostia	Benning Road	02
Anacostia	PA Ave (Seafarers Yacht Club)	03
Anacostia	S. Capitol Street Bridge	04
Anacostia	Haines Point	05
Potomac	Three Sisters	06
Potomac	Upstream of Rock Creek	07
Potomac	14th Street Bridge	08
Potomac	Wilson Bridge (Red Can 4)	09
Rock Creek	Boundary Bridge	10
Rock Creek	Tilden Street	11
Rock Creek	Porter Street	12
Rock Creek	PA Ave (Thompson's Boathouse)	13

Table D-4. Continued)

Trip 38			1	2	3
Trip 39	12	13			
Trip 40	13	1	2	3	4
Trip 41					
Trip 42	1	2	3	4	
Trip 43					5
Trip 44	2	3	4	5	
Trip 45	3	4			6
Trip 46			5	6	
Trip 47	4	5			7
Trip 48	5	6	6	7	
Trip 49					8
Trip 50	6	7	7	8	
Trip 51	7	8			
Trip 52			8	9	9
Trip 53	8	9			
Trip 54	9	10	9	13	1
Trip 55					
Trip 56	10	11	13	1	2
Trip 57	11	12			
Trip 58			1	2	3
Trip 59	12	13			
Trip 60	13	1	2	3	4
Trip 61					
Trip 62	1	2	3	4	
Trip 63					5
Trip 64	2	3	4	5	
Trip 65	3	4			6
Trip 66			5	6	
Trip 67	4	5			7
Trip 68	5	6	6	7	
Trip 69					8
Trip 70	6	7	7	8	
Trip 71	7	8			

Table D-4. (Continued)

		Fecal coliform	E. coli	CBOD5	TSS	Chl-A
Number of field duplicates for weekly sampling over the course of the entire project.	Station 1	4	3	3	3	3
	Station 2	4	4	3	3	3
	Station 3	4	4	4	3	3
	Station 4	4	4	4	4	3
	Station 5	4	4	4	4	4
	Station 6	4	4	4	4	4
	Station 7	4	4	4	4	4
	Station 8	3	4	3	4	4
	Station 9	3	3	3	3	3
	Station 10	3	3	0	0	0
	Station 11	3	3	0	0	0
	Station 12	3	3	0	0	0
	Station 13	3	3	3	3	0

Table D-5. In-situ water quality duplicaiton schedule

Water Quality Duplication Sampling over the 71-Trip Sampling Period

	Date of Sampling	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11	Station 12	Station 13
Trip 1		x												
Trip 2			x											
Trip 3				x										
Trip 4					x	x								
Trip 5							x							
Trip 6								x						
Trip 7									x	x				
Trip 8											x			
Trip 9												x		
Trip 10													x	x
Trip 11		x												
Trip 12			x											
Trip 13				x										
Trip 14					x	x								
Trip 15							x							
Trip 16								x						
Trip 17									x	x				
Trip 18											x			
Trip 19												x		
Trip 20													x	x
Trip 21		x												
Trip 22			x											
Trip 23				x										
Trip 24					x	x								
Trip 25							x							
Trip 26								x						
Trip 27									x	x				
Trip 28											x			
Trip 29												x		
Trip 30													x	x
Trip 31		x												
Trip 32			x											
Trip 33				x										
Trip 34					x	x								
Trip 35							x							
Trip 36								x						
Trip 37									x	x				
Trip 38											x			
Trip 39												x		
Trip 40													x	x
Trip 41		x												
Trip 42			x											
Trip 43				x										
Trip 44					x	x								
Trip 45							x							
Trip 46								x						
Trip 47									x	x				
Trip 48											x			
Trip 49												x		
Trip 50													x	x
Trip 51		x												
Trip 52			x											
Trip 53				x										
Trip 54					x	x								
Trip 55							x							
Trip 56								x						
Trip 57									x	x				
Trip 58											x			
Trip 59												x		
Trip 60													x	x
Trip 61		x												
Trip 62			x											
Trip 63				x										
Trip 64					x	x								
Trip 65							x							
Trip 66								x						
Trip 67									x	x				
Trip 68											x			
Trip 69												x		
Trip 70													x	x
Trip 71		x												

System	Station	tation COD
Anacostia	Bladensburg	01
Anacostia	Benning Road	02
Anacostia	PA Ave (Seafarers Yacht Club)	03
Anacostia	S. Capitol Street Bridge	04
Anacostia	Haines Point	05
Potomac	Three Sisters	06
Potomac	Upstream of Rock Creek	07
Potomac	14th Street Bridge	08
Potomac	Wilson Bridge (Red Can 4)	09
Rock Creek	Boundary Bridge	10
Rock Creek	Tilden Street	11
Rock Creek	Porter Street	12
Rock Creek	PA Ave (Thompson's Boathouse)	13

Table D-6. Equipment and field blank schedule

	Equipment Blank	Field/Preservation Blank	Temperature Blank
	(1 per team)	(1 per team / every third trip)	
Trip 1	2		1 per cooler
Trip 2	2		1 per cooler
Trip 3	2	**2**	1 per cooler
Trip 4	2		1 per cooler
Trip 5	2		1 per cooler
Trip 6	2	**2**	1 per cooler
Trip 7	2		1 per cooler
Trip 8	2		1 per cooler
Trip 9	2	**2**	1 per cooler
Trip 10	2		1 per cooler
Trip 11	2		1 per cooler
Trip 12	2	**2**	1 per cooler
Trip 13	2		1 per cooler
Trip 14	2		1 per cooler
Trip 15	2	**2**	1 per cooler
Trip 16	2		1 per cooler
Trip 17	2		1 per cooler
Trip 18	2	**2**	1 per cooler
Trip 19	2		1 per cooler
Trip 20	2		1 per cooler
Trip 21	2	**2**	1 per cooler
Trip 22	2		1 per cooler
Trip 23	2		1 per cooler
Trip 24	2	**2**	1 per cooler
Trip 25	2		1 per cooler
Trip 26	2		1 per cooler
Trip 27	2	**2**	1 per cooler
Trip 28	2		1 per cooler
Trip 29	2		1 per cooler
Trip 30	2	**2**	1 per cooler
Trip 31	2		1 per cooler
Trip 32	2		1 per cooler
Trip 33	2	**2**	1 per cooler
Trip 34	2		1 per cooler
Trip 35	2		1 per cooler
Trip 36	2	**2**	1 per cooler
Trip 37	2		1 per cooler
Trip 38	2		1 per cooler
Trip 39	2	**2**	1 per cooler
Trip 40	2		1 per cooler
Trip 41	2		1 per cooler
Trip 42	2	**2**	1 per cooler
Trip 43	2		1 per cooler
Trip 44	2		1 per cooler
Trip 45	2	**2**	1 per cooler

Table D-6. (Continued)

Trip 46	2		1 per cooler
Trip 47	2		1 per cooler
Trip 48	2	**2**	1 per cooler
Trip 49	2		1 per cooler
Trip 50	2		1 per cooler
Trip 51	2	**2**	1 per cooler
Trip 52	2		1 per cooler
Trip 53	2		1 per cooler
Trip 54	2	**2**	1 per cooler
Trip 55	2		1 per cooler
Trip 56	2		1 per cooler
Trip 57	2	**2**	1 per cooler
Trip 58	2		1 per cooler
Trip 59	2		1 per cooler
Trip 60	2	**2**	1 per cooler
Trip 61	2		1 per cooler
Trip 62	2		1 per cooler
Trip 63	2	**2**	1 per cooler
Trip 64	2		1 per cooler
Trip 65	2		1 per cooler
Trip 66	2	**2**	1 per cooler
Trip 67	2		1 per cooler
Trip 68	2		1 per cooler
Trip 69	2	**2**	1 per cooler
Trip 70	2		1 per cooler
Trip 71	2		1 per cooler

Table D-7. Routine sampling bacterial modification schedule

		Routine Sampling (All Stations)				Reference Blanks (Field and Equipment)				Bladensburg Dredging Modification				*Added Requirement	*Added Requirement
	Date	Fecal Coliform		*E. coli*		Fecal Coliform		*E. coli*		Fecal Coliform		*E. coli*			
		9221E - A1 Medium	9221E - EC Med	9223B - Quantitray	9221F - EC MUG	9221E - A1 Medium	9221E - EC Med	9223B - Quantitray	9221F - EC MUG	9221E - A1 Medium	9221E - EC Med	9223B - Quantitray	9221F - EC MUG	Extended Bacteria Dilutions (All)	Extra Extended Bacteria Dilutions	Hold Time Flagging
Trip 1	12/8/2014	x		x		x		x						x		
Trip 2	12/11/2014	x		x		x		x						x		
Trip 3	12/15/2014	x		x		x		x						x		
Trip 4	12/22/2014	x		x		x		x						x		
Trip 5	12/29/2014	x		x		x		x						x		
Trip 6	1/5/2015	x		x		x		x		x		x		x		
Trip 7	1/20/2015	x		x		x		x		x		x		x		
Trip 8	1/22/2015	x	x	x	x	x		x		x	x	x	x	x		
Trip 9	1/26/2015	x	x	x	x	x		x						x		
Trip 10	1/27/2015	x	x	x	x	x		x						x		
Trip 11	2/3/2015	x	x	x	x	x		x						x		
Trip 12	2/5/2015	x		x		x		x						x		
Trip 13	2/9/2015	x		x		x		x						x		
Trip 14	3/12/2015	x	x	x	x	x		x						x		
Trip 15	3/16/2015	x	x	x	x	x		x						x		
Trip 16	3/19/2015	x	x	x	x	x		x						x		
Trip 17	3/23/2015	x	x	x	x	x		x						x		
Trip 18	3/26/2015	x	x	x	x	x		x						x		
Trip 19	3/30/2015	x	x	x	x	x		x						x		
Trip 20	4/6/2015	x	x	x	x	x		x						x		
Trip 21	4/9/2015	x	x	x	x	x		x						x		
Trip 22	4/13/2015	x	x	x	x	x		x						x		
Trip 23	4/23/2015	x	x	x	x	x		x						x		
Trip 24	4/27/2015	x	x	x	x	x		x						x		
Trip 25	5/4/2015	x	x	x	x	x		x						x		
Trip 26	5/7/2015	x	x	x	x	x		x						x		
Trip 27	5/11/2015	x	x	x	x	x		x						x		
Trip 28	5/18/2015	x	x	x	x	x		x						x		
Trip 29	5/21/2015	x	x	x	x	x		x						x		
Trip 30	5/26/2015	x	x	x	x	x		x						x		
Trip 31	6/8/2015	x	x	x	x	x		x						x	x	
Trip 32	6/15/2015	x	x	x	x	x		x						x	x	
Trip 33	6/18/2015	x	x	x	x	x		x						x	x	
Trip 34	6/22/2015	x	x	x	x	x		x						x	x	x
Trip 35	7/7/2015	x	x	x	x	x		x						x	x	x
Trip 36	7/9/2015		x		x		x		x					x	x	x
Trip 37	7/13/2015		x		x		x		x					x	x	x
Trip 38	7/20/2015		x		x		x		x					x	x	x
Trip 39	7/23/2015		x		x		x		x					x	x	x
Trip 40	7/27/2015		x		x		x		x					x	x	x
Trip 41	8/3/2015		x		x		x		x					x	x	x
Trip 42	8/10/2015		x		x		x		x					x	x	x
Trip 43	8/13/2015		x		x		x		x					x	x	x
Trip 44	8/17/2015		x		x		x		x					x	x	x
Trip 45	8/24/2015		x		x		x		x					x	x	x
Trip 46	8/27/2015		x		x		x		x					x	x	x
Trip 47	8/31/2015		x		x		x		x					x	x	x
Trip 48	9/8/2015		x		x		x		x					x	x	x
Trip 49	9/10/2015		x		x		x		x					x	x	x
Trip 50	9/14/2015		x		x		x		x					x	x	x
Trip 51	9/21/2015		x		x		x		x					x	x	x
Trip 52	9/28/2015		x		x		x		x					x	x	x
Trip 53	10/5/2015		x		x		x		x					x	x	x
Trip 54	10/8/2015		x		x		x		x					x	x	x
Trip 55	10/13/2015		x		x		x		x					x	x	x
Trip 56	10/19/2015		x		x		x		x					x	x	x
Trip 57	10/22/2015		x		x		x		x					x	x	x
Trip 58	10/26/2015		x		x		x		x					x	x	x
Trip 59	11/2/2015		x		x		x		x					x	x	x
Trip 60	11/5/2015		x		x		x		x					x	x	x
Trip 61	11/9/2015		x		x		x		x					x	x	x
Trip 62	11/16/2015		x		x		x		x					x	x	x
Trip 63	11/19/2015		x		x		x		x					x	x	x
Trip 64	11/30/2015		x		x		x		x					x	x	x
Trip 65	12/3/2015		x		x		x		x					x	x	x
Trip 66	12/7/2015		x		x		x		x					x	x	x
Trip 67	12/14/2015		x		x		x		x					x	x	x
Trip 68	12/17/2015		x		x		x		x					x	x	x
Trip 69	12/28/2015		x		x		x		x					x	x	x
Trip 70	1/4/2016		x		x		x		x					x	x	x
Trip 71	1/7/2016		x		x		x		x					x	x	x

Table D-8. Wet weather sampling bacterial modification schedule

		Storm Sampling			
		Fecal Coliform		*E. coli*	
	Dates of Sampling	9221E - A1 Medium	9221E - EC Med	9223B - Quantitray	9221F - EC MUG
Wet Weather Event 1	4/19/2015 to 4/21/2015	x	x	x	x
Wet Weather Event 2	5/31/2015 to 6/2/2015	x	x	x	x
Wet Weather Event 3	6/27/2015 to 6/28/15	x	x	x	x
Wet Weather Event 4	10/1/2015 to 10/2/2015		x		x

		Reference Blanks (Field and Equipment)			
		Fecal Coliform		*E. coli*	
	Dates of Sampling	9221E - A1 Medium	9221E - EC Med	9223B - Quantitray	9221F - EC MUG
Wet Weather Event 1	4/19/2015 to 4/21/2015	x		x	
Wet Weather Event 2	5/31/2015 to 6/2/2015	x		x	
Wet Weather Event 3	6/27/2015 to 6/28/15	x		x	
Wet Weather Event 4	10/1/2015 to 10/2/2015		x		x

			*Added Requirement	*Added Requirement
	Dates of Sampling	Extended Bacteria Dilutions (All)	Extra Extended Bacteria Dilutions	Hold Time Flagging
Wet Weather Event 1	4/19/2015 to 4/21/2015	x		
Wet Weather Event 2	5/31/2015 to 6/2/2015	x		x
Wet Weather Event 3	6/27/2015 to 6/28/15	x	x	x
Wet Weather Event 4	10/1/2015 to 10/2/2015	x	x	x

Appendix B Martel's Quality Assurance Manual

MARTEL

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QUALITY ASSURANCE MANUAL

M Sefton — Technical Director — 02/11/14 — Date

Laboratory Manager — 2-12-14 — Date

President — 2/12/14 — Date

Manual Correction MSS 07/07/14

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1.0 QUALITY POLICY

1.1 It is Martel Laboratories JDS, Inc.'s policy to provide its clients with timely, accurate, technically valid and legally defensible analytical data of known quality that meets or exceeds the client's requirements. This is accomplished through strict adherence by all employees to the policies and procedures described in this Quality Manual, which is based on National Environmental Laboratory Accreditation Conference (NELAC) standards as well as International Standard Organization (ISO) 17025:2005, and is the basis of the quality system.

1.1.1 The laboratory maintains accreditation through the Maryland Department of Environment (MDE), the National Environmental Laboratory Accreditation Program (NELAP) and the American Association for Laboratory Accreditation (A2LA) to support client's regulatory and contract requirements. The laboratory's lists of accredited parameters and accreditation certificates are available upon request, and the current summary is provided in Appendix D, List of Accredited Methods.

1.1.2 All laboratory personnel are responsible for familiarity and adherence with this Quality Manual and must follow its requirements and implement its policies. Commonly used acronyms and definitions are provided in Appendices E and F, respectively.

1.1.3 Day to day laboratory activities are governed by a number of administrative and technical Standard Operating Procedures (SOPs) that incorporate the principles of this Quality Manual as well as the operating methods and technical requirements described in the various analytical methodologies used at Martel Laboratories JDS, Inc. These documents are reviewed annually to ensure that they are up to date, and reflect the most recent method updates and operational procedures. A list of the laboratory's SOPs is maintained by the laboratory and available upon request.

1.2 The management of Martel Laboratories is committed to insuring the integrity of its data and to meeting the needs of its clients. In pursuit of these goals we pledge to conduct business according to the following principles:

- Always act professionally
- Produce data that is objective, technically sound and scientifically defensible
- Have a clear understanding of client needs, to communicate those needs to employees, and to do our utmost to meet those needs
- Obey all relevant federal, state, and local laws and regulations
- Perform all services in an honest, confidential, and candid manner free from any conflicts of interest
- Provide employees with guidance and training regarding ethics, data integrity and Martel's standards of quality
- Require employees to perform all work in strict accordance with Standard Operating Procedures and client requirements
- Operate in a manner that ensures that employees are free from any undue pressures that may compromise the quality of their work
- Encourage open, stress free communications between employees and managers regarding any client, quality, or other issues of importance to the business
- Operate in a manner that protects the environment as well as the health and safety of Martel employees and the public

- Deal fairly, openly, and honestly in all relationships with clients, employees and the public
- Comply with the requirements of NELAC and ISO 17025:2005
- Continually strive to improve the quality of our data and services

2.0 ORGANIZATION

2.1 Martel Laboratories JDS, Inc. operates as a single entity, and is a private commercial laboratory providing environmental sampling and testing services. All analysts and technicians responsible for data production report to the Laboratory Manager, who reports directly to the President. The organization also has a number of personnel whose function it is to support various lab activities as described below. The company's current organization chart is attached as Appendix A, which contains position titles. A copy of the organizational chart that includes staff names is available upon request.

2.2 The President is ultimately responsible for all activities that occur at the facility, and he is the final authority and decision maker on all issues. He is responsible for staffing, for providing a safe, comfortable workplace, and for all payroll and insurance issues. He is the company liaison with financial institutions and is responsible for approving vendors, and for procuring supplies and instruments, negotiating prices, paying invoices, etc.

2.3 The IT Services Manager is responsible for maintaining the LIMS system, for all computer programming, and the proper functioning of all computers, printers, and related hardware and software.

2.4 The Laboratory Manager makes sure that the laboratory is functioning properly with adequate resources and training, and in compliance with this Quality Manual. S/he ensures that turnaround times are met, QA procedures followed, technicians properly trained, data thoroughly reviewed and reported, waste managed and disposed, and adequate supplies available, etc. The lab manager should have at least a B.S. degree in chemistry or biology and several years of environmental laboratory experience.

2.5 The Technical Director's primary responsibility is management of the quality system with complete access to all laboratory information, personnel and resources, and the authority to implement policies, and revise procedures to conform to accreditation requirements. The Technical Director reports directly to the president. The Technical Director monitors the laboratory for adherence to the Quality Manual, and is Martel's principal contact with accrediting agencies and clients regarding quality issues. Responsibility includes managing PT studies, internal and external audits, oversight of corrective actions, and the training program. With input from the analysts and the lab manager, the Technical Director ensures all SOPs are current with method and regulatory requirements, and reflect laboratory practice. The Technical Director also serves as the Data Integrity Officer, responsible for ensuring that inappropriate or questionable activities are not tolerated. The Technical Director assists laboratory personnel in resolving any technical difficulties that may arise. The minimum qualifications for this position are a B.S. degree in chemistry or a scientific discipline and at least 5 years experience in an environmental laboratory. The current Technical Director serves as deputy to the President and the Laboratory Manager. A deputy to the Technical Director is trained to assume all routine duties during the Technical Director's absence.

2.6 The Client Services personnel (aka Project Managers) report to the President. They should have at least 2 years of science education and 1 year of laboratory experience. Production staff serve as liaisons between Martel and clients, and are the primary contacts with clients in all matters. They

are responsible for documenting project requirements, coordinating activities with clients, insuring that project requirements are met, documenting and resolving any client issues that arise, and ensuring that data deliverables are complete and accurate

2.7 Laboratory Analysts must have a minimum of a two year degree in a scientific discipline or 2 years experience in an analytical laboratory; Laboratory Technicians must have at least a high school education, a working knowledge of analytical techniques, and must meet specific criteria for their position. Analysts and technicians are responsible for the day to day performance of their job functions, i.e. digestions, extractions, analyses, log-in, etc. They must be sure that the appropriate SOPs are properly followed, and that data is properly documented, reviewed, and correctly entered into the LIMS. They are also responsible for maintaining a clean and safe working environment.

2.8 Sampling Technicians should have a high school education and a driver's license. They are responsible for the timely and proper collection, preservation, and transportation of samples to the laboratory. This includes set-up and download of on site pH meters and flow meters. They must also ensure that Chain of Custody forms and any other paperwork pertaining to the samples is properly filled out.

3.0 FACILITIES AND EQUIPMENT

3.1 Facilities

3.1.1 Martel Laboratories JDS, Inc. is located at 1025 Cromwell Bridge Road, Baltimore, Maryland, next to the Baltimore Beltway and easily accessible from interstate highways. The facility is owned by the company, who is its sole occupant. Two parking lots adjacent to the building provide ample parking for employees, visitors, and delivery vehicles. The building is a two story structure. The laboratory is on the first floor, an area of approximately 7500 square feet. (Appendix B is the Laboratory Floor Plan.) The upper floor is about 3300 square feet, and consists of offices, a reception area, and a lunch room.

3.1.2 The building is fully heated and air conditioned, with sufficient utilities to continually perform all necessary functions without affecting the result of any measurement. Compressed gas cylinders are stored in a covered enclosure outside the building, along with a large refillable liquid argon tank that supplies the ICP and ICP/MS. The volatile organics analysis room is kept under positive pressure to prevent cross contamination by vapors from adjoining areas. Exposure to chemical fumes is minimized by storing solvents and volatile chemicals in vented cabinets underneath fume hoods, and by working with these chemicals only in fume hoods. Refrigerators and freezers are used for sample storage, chemicals, standards, and extracts. Housekeeping is maintained by a contracted service provider.

3.1.3 Full access to all laboratory areas is granted only to employees, all of whom are issued keys to the building. The keys are numbered and tracked by the President. Interior doors through which access into the lab may be obtained from an exterior entrance have combination locks to prevent unauthorized access. Non-employees are granted access to the building on an as needed basis, and only to areas in which their attendance is required. Visitors are escorted or observed by an employee at all times.

3.1.4 Laboratory Security protocols are discussed in SOP 02S03. This SOP discusses the security measures for the building, company confidential information, and analytical data.

3.2 Equipment

Martel Laboratories JDS, Inc. purchases and maintains all appropriate equipment necessary for to perform the analytical methods. A list of instruments and major equipment is attached as Appendix C. All equipment is of adequate quality and sensitivity to meet method requirements, and is used only by Martel employees who have been properly trained. Instruments are maintained in good working order, and maintenance is performed as required by the manufacturers at the recommended intervals, as discussed in the Equipment Installation and Maintenance SOP 02E01. In case of instrument failure that is beyond a technician's ability to repair, the manufacturer is consulted, and if necessary, a service call is arranged. Emergency Contingency Plans are discussed in SOP 02C03. A malfunctioning instrument is never used to analyze samples. All instruments are checked for proper performance and calibration before use as described in the referenced SOPs. Instrument manuals are readily available for reference whenever necessary.

4.0 EMPLOYEE QUALIFICATIONS AND TRAINING

Martel Laboratories JDS, Inc.'s employees are hired on the basis of their education, training, and experience. Hiring authority rests with the President and/or Laboratory Manager, and only the most qualified candidates are considered for employment. Once hired, employees undergo a training regimen consisting of an initial orientation and a demonstration of technical competence.

4.1 Employee training procedures and documentation is discussed in the DOC and Employee Training SOP 02C01.

4.2 New employee orientation consists of initial orientation, and on the job training by and under the observation of the Laboratory Manager or senior employee in the specific job function(s) (s)he was hired to perform. Training is documented on the Technician Training Checklist and covers all aspects of the employee's job responsibilities, e.g. balance use, data recording procedures, etc. Initial and on-going training is demonstrated through analysis of quality control samples and documented on Demonstration of Capability (DOC) forms.

4.3 Training files are maintained for current and former staff by the Technical Director. Also included in the training files are job descriptions and authorizations of all employees who manage, perform or verify work affecting the quality of environmental tests. Job descriptions are updated as needed.

4.4 Employees undergo a performance evaluation annually. Laboratory technicians are reviewed by the Laboratory Manager, while office and management personnel are reviewed by the company President. The employees' future goals and training needs are discussed during these meetings, and a mutually acceptable program is instituted to aid the employee to meet the agreed upon goals.

5.0 REQUESTS, TENDERS, AND CONTRACTS

5.1 Initial contact with a client regarding an upcoming project or contract usually occurs via phone or electronic mail, and the procedures taken are described in the Project Management Coordination SOP 02P01. Public sector contracts normally arrive via mail. In both cases, a Request for Proposal (RFP) is normally required. Project or contract coordination begins on first contact with the client, and starts with a review of all pertinent information by a member of the production staff. The requirements are often described in a Statement of Work (SOW) or similar document, but for small projects they may be specified verbally. The SOW is reviewed confirming that all sampling, analytical, data quality objectives, turnaround times, and reporting specifications can be

met, if subcontracting is required, if any equipment purchases, special laboratory accommodations or personnel hires are necessary, etc.

5.2 Special purchases for clients testing requirements are discussed in the Purchasing of Materials for Clients SOP 02P02. This information is summarized on the Project Form (02P01F01) and, if necessary, reviewed with the lab manager and President to ensure that Martel has the resources to successfully perform the project. If necessary, the client is contacted to resolve any issues or answer any questions that may arise, such as obsolete or inappropriate tests, the need for subcontracting, etc. Records of all client contacts and meetings are maintained. Once the scope of the project or contract is completely understood, the RFP is filled out and submitted to the client along with the cost proposal. If the technical and cost proposals are acceptable, the contract is signed, and work may begin (for small projects a verbal proposal and acceptance by the client is sufficient).

5.3 Prior to the start of the project, a meeting may be held with the sample custodian and the appropriate sampling and analytical technicians in order to get the laboratory ready to receive the samples. Any special supplies or equipment is ordered at this time. The project manager in charge of the project coordinates any bottle shipment that may be required, prepares and customizes Chain of Custody (COC) Forms to insure that the proper field activities take place, and, when the samples arrive, reviews the sample receipt and log-in process, making sure that the COC forms are correctly filled out.

5.4 Upon completion of the analyses, the project manager reviews the report for completeness and to make sure client requirements and data quality objectives are met. Any issues are discussed with the client. If the client requests a change in the scope of the contract, it must be documented. If the change is significant enough, it may be necessary to go through the review process described above. If a deviation from the contract is requested, the client must be consulted for approval, which must also be documented.

5.5 Martel uses subcontractors for analyses that cannot be performed by its laboratory due to lack of capability, instrument downtime, etc. Requirements and procedures for utilizing subcontractors are detailed in SOP 02S07. Whenever possible, subcontracting work is assigned to laboratories that have the appropriate certifications (State, NLLAP, NELAP, etc.) and that can supply all the appropriate QC and other required documentation. Analyses for which Martel is NELAP certified are always subcontracted to other NELAP laboratories that are certified for those parameters, and NLLAP work is always subcontracted to NLLAP laboratories. Clients are always informed whenever a test is subcontracted, and Martel assumes responsibility for the subcontracted work unless the client or a regulatory agency specifies the subcontractor. A list of subcontractors and their qualifications is maintained by the Technical Director.

6.0 PROCUREMENT

6.1 All purchases made by Martel Laboratories are authorized by the President or designee, usually the Laboratory Manager, and are made using a Purchase Order (PO) system, according to SOP 02P05. The employee requesting an item fills out a requisition form describing the item, quantity desired, catalog number and price, and gives it to the Laboratory Manager, who enters the request into the SBT accounting system and generates a detailed purchase order. Each item ordered is saved in a database creating an easily accessible history of approved supplies and vendors. The President (or designee) then approves the PO, and the Laboratory Manager places the order, giving a copy of the requisition form to the sample custodian. Some items, such as office supplies, tools or miscellaneous equipment may be purchased from a local retail store as needed by the President (or designee), and the PO system bypassed. Technical services such as balance

calibrations or instrument repair are also ordered via the PO system. Non-technical professional services such as plumbing or refrigerator repair are done on an as needed or emergency basis, in which case the PO system can be bypassed, and a phone call made to the appropriate serviceman by the President (or designee).

6.2 All deliveries are received in the log-in area. The sample custodian is responsible for unpacking, inspecting, and distributing the supplies to the appropriate employees. Packing slips are checked against the appropriate requisition forms for errors and completeness. If an error is discovered, it is brought to the attention of the Laboratory Manager or President, who contacts the supplier for resolution. The packing slips are forwarded to administration for entry into the SBT system for accounting and cross-checking against the appropriate PO. When the PO is complete, it is ready for payment. Professional services are acknowledged as having been completed upon signature of the service report by the appropriate employee. Copies of the requisition forms and POs are kept on file.

6.3 The sample custodian also performs an inspection of all items received, and assigns a unique identification number to all reagents and reference materials, documenting it in the Reagent Logbook, along with all information pertaining to the reagent, such as manufacturer's name, description, lot number, date received, and expiration date. The ID number, date of receipt, and the expiration date are also written on each bottle of reagent. Certificates of analysis that accompany reagents are given to the Laboratory Manager and kept in the appropriate binders.

6.4 Technicians are trained to verify the identity and quality of the reagent or reference material prior to use, and to document the dates of receipt, opening, and expiration of the reagent or reference material on the container.

6.5 Supplies and technical services are purchased only from vendors that have been evaluated and approved by the President or designee. Approval is based on quality (ISO 17025 or A2LA certification, traceability to NIST, etc.), level of service (delivery time, response to problems, etc.), and price. An approved vendor list is kept in the SBT system.

7.0 REAGENTS AND REFERENCE MATERIALS

7.1 Martel uses only reagents and reference materials of the appropriate, or better, quality than required by the method used in the analysis. In general ACS Grade or Reagent Grade materials are satisfactory, but in some cases (e.g. organics extractions or environmental lead analysis), it is better to use a higher quality reagent in order to avoid possible contamination problems. All reagents are purchased from reputable suppliers, preferably ISO certified, who can provide Certificates of Analysis or other quality documentation, as well as traceability to NIST. According to the Reagent Control SOP 02R01, reagents are visually inspected upon receipt by the sample custodian, and again by the end user to make sure the correct material was received and that it is of the proper grade. Every bottle of reagent is identified by a unique identification number assigned by the sample custodian at the time of receipt, along with the date of receipt and the expiration date. The expiration date assigned is normally 2 years, unless an earlier expiration date is assigned to the reagent by the manufacturer. A reagent is never used after the manufacturer's expiration date, however, the assigned date may be extended provided that the reagent is tested to verify that it is still of acceptable quality for its intended use. The date that a container of reagent is first opened is also written on the container by the technician. Whenever the reagent is used its assigned identification number is documented in the appropriate logbook or bench sheet. Any Certificates of Analysis that accompany reagents are filed in the appropriate binders.

7.2 If possible, Certified Reference Materials used for instrument calibration or QC purposes must be obtained from A2LA certified vendors, with values traceable to NIST, and documented. Documentation should include an estimate of uncertainty. If traceable standards do not exist, traceability may be met by using certified reference materials provided by a competent supplier who can provide a reliable characterization of the material. These procedures are discussed in the Reference Materials Traceability SOP 02S02. Performance Testing samples that have undergone a laboratory study may also be used as reference materials. Any and all data pertaining to calibration materials must be documented.

7.3 Storage of all laboratory reagents, standards and solutions must be in accordance with manufacturer's recommendations, as well as any method or laboratory specific requirements. Conditions to consider include temperature, humidity, container type, and exposure to light. Organics standards are never stored in the proximity of sample extracts. All storage must comply with Good Laboratory Practices and Martel's Chemical Hygiene Plan, SOP 02C08.

7.4 Reagent water used in the laboratory is generated by a system consisting of deionization, activated carbon filtration, and filtration through a 0.2 micron filter. This process produces ASTM Type II quality water of adequate quality for all laboratory applications. A monitoring light on the system provides a continuous indication of water quality, which is confirmed by daily conductivity checks. Suitability of the water for micro-biological applications is confirmed by monthly sterility checks, as discussed in the Reagent Water Monitoring SOP 02R02.

8.0 SAMPLING

8.1 Martel maintains a staff of trained, certified technicians whose primary job function is to collect, preserve, and transport samples to the laboratory in a timely manner. By using its own technicians Martel is assured that samples are representative of the matrix from which they are collected, and that they are properly preserved and documented. Samplers are trained in all sampling techniques, equipment, and requirements, which include:

A. Knowing the proper sample containers and amounts to collect.
B. Collecting grab samples of wastewaters, drinking waters, soils, and sludges for various parameters.
C. Composite sampling of wastewaters using automated equipment and subsequent sub-sampling.
D. Sampling of waters and soils for volatile organics.
E. Installing on-site pH meters and flow meters and downloading collected data.
F. Performing required field tests: pH, temperature, available chlorine, and dissolved oxygen.
G. Obtaining any required QC samples such as trip and field blanks, duplicates, etc.
H. Accurately filling out Chain of Custody forms and properly documenting any relevant information that may affect subsequent analyses, data quality, or reporting.
I. Properly preserving all samples in accordance with EPA and Standard Methods requirements.
J. Transporting samples to the laboratory in a safe, timely manner, maintaining sample integrity.

8.2 All samplers are required to obtain and maintain certification to collect drinking water samples by the Maryland Department of the Environment Water Supply Program.

8.3 In many cases, clients prefer to collect samples themselves using containers supplied by Martel. In such cases the bottles are appropriately preserved and labeled by Martel employees. For dust wipe samples for the Environmental Lead Program Martel supplies clients with clean digestion tubes and ASTM approved "Ghost Wipes".

8.4 All sampling, preservation and container requirements are performed in accordance with established EPA or Standard Methods procedures, adhering to any applicable permit requirements and client requests, and outlined in the Sample Preservation and Container Requirements SOP 02S05. COC Forms are usually customized by the project managers for each project, thereby ensuring that the correct sampling, preservation, and field activities are performed. Any issues or deviations from the sampling plan or instructions that were agreed upon during initial project negotiations are discussed with the project manager, the client, and/or the permit issuing authority for resolution. All discussions and deviations are documented on the Project Form; changes in the sampling plan are reported on the Certificate of Analysis that is sent to the client. Procedures for preparing subsamples are included in SOP 02S06.

9.0 SAMPLE LOG-IN, STORAGE, AND CHAIN OF CUSTODY

9.1 Sample Log-In

9.1.1 Samples are logged-in as soon as possible after delivery to the laboratory. The Sample Custodian checks all containers for integrity and inventories the samples, making sure they match the accompanying Chain of Custody (COC), according to the Sample Receiving and Custody SOP 02L01. Any discrepancies or preservation issues are documented on the Sample Receipt Checklist and brought to the attention of the appropriate project manager, who contacts the client for resolution of the problem. Samples improperly collected or preserved are usually rejected unless the client insists that the analysis takes place. In these cases the results are flagged as estimated or suspect with an explanation of the reason. If everything is in order, the log-in process begins with the filling out of the Sample Receipt Logbook with the following information:

A. The consecutively assigned laboratory control (i.e. ID) number
B. The client's name
C. The date and time of receipt
D. The sample type or matrix (WAW, DRW, OIL, WIP, SFW, WAS, SOI, CHP)
E. The number of bottles having that control number. Each bottle is assigned a number corresponding to the information on the Chain of Custody
F. The initials of the Sample Custodian receiving the samples
G. The location/refrigerator where the sample will be stored

9.1.2 Sample containers are labeled with the sample control number and container number using indelible ink or a computer printed label, and placed in the appropriate storage location. COCs for samples requiring a fast turnaround time are immediately brought to the analyst. The samples are then logged into the LIMS database. For each control number the Sample Custodian enters the client code, date and time of receipt, the number of samples, turnaround time, and other pertinent information. The matrix, sampling date and time, site information, and analytical parameters requested are then entered separately for each sample. At the end of each workday the Custodian uploads all samples entered into the LIMS into Martel's main database, and a Log-In Sheet is printed out for each control number which contains the information entered by the Custodian. The Log-In Sheet and COC are reviewed to verify that the log-in was complete and accurate. These, the Sample Receipt Form, and any other documents that came with the samples are stapled together and given to the production staffer in charge of the project, who verifies that the project requirements are met. Log-in packages are kept in a bin in the office area while the analyses are in progress.

9.2 Sample Storage

9.2.1 Sample storage procedures and requirements are discussed in SOP 02S04. Most environmental samples require storage at .6° C. Martel has five large refrigerators and two small ones for this purpose. As much as possible samples are segregated according to their preservation and/or analysis, i.e. sulfuric acid preserved samples are stored in one refrigerator, caustic preserved in another, organics analysis samples in a third, etc. Volatile organics samples are stored in a separate refrigerator in the VOA room, and microbiological samples are stored in their own separate refrigerator. Samples are never stored in the same refrigerators as reagents, standards, or extracts, and samples that are expected to be highly contaminated are kept segregated from other samples. Samples that do not require refrigeration are stored on shelves in the sample storage room, except for lead wipes, which are brought directly to the metals lab because they usually require a quick turnaround time.

9.2.2 When a technician is ready to perform an analysis, (s)he removes the appropriate samples from the refrigerator and, after taking the required aliquots, returns them so that other analyses or re-analysis may be performed. Samples may be disposed of after their holding times expire, according to the Waste Disposal SOP 02W01. Holding times as well as turnaround times are tracked by the LIMS.

9.3 Chain of Custody

Chain of Custody (COC) is the process by which ownership (i.e. the responsibility for the care and integrity) of a sample is tracked and documented. The COC process starts when the sample is collected. The sampling technician fills out a COC Form which documents all the information pertaining to the sample, including the results of any tests performed in the field, and any QC samples collected. COC Forms are customized for each project by the project manager, thereby insuring that the proper sampling and other field activities are performed. Then the sample is brought to the laboratory, the form is signed by the sampler and by the Sample Custodian (or designee), noting the date and time of transfer. This transfers ownership of the sample from the sampling technician to the laboratory. In cases where multiple transfers take place, each must be documented. Internal COC is maintained via Sample Transfer Logbooks which the technicians are required to fill out when removing or replacing samples from their storage areas.

10.0 ANALYTICAL METHODS

10.1 Published Methods

10.1.1 Normally, Martel Laboratories uses commonly accepted methods published by nationally recognized reputable organizations such as EPA, ASTM, NIOSH, AWWA (i.e. Standard Methods), AOAC, etc. Any modifications to the published methods are documented and, if necessary, validated as described below. Sometimes technical advances prompt equipment or instrument manufacturers to publish alternate methodologies or improvements to existing methods before the changes may be incorporated into the official methods. The new methodologies or modifications may be used provided that they are properly documented and that a demonstration of capability is performed.

10.1.2 If a sample is received for which a standard method or the method specified by the client is not applicable, the client is notified, and the alternatives discussed. Usually modification of the method or adaptation of another standard method may resolve the problem, but sometimes this is not possible, and the sample must be rejected or subcontracted (with the client's approval). Any changes in methodology are documented on the project form, bench sheet, and on the report of analysis. If possible, the modified method is validated by performing various QC procedures on the sample, such as analyzing matrix spikes, duplicates, etc. which will provide an indication of

the validity of the changes. If the modified procedure is needed for a long term project or one involving many samples the method must be fully validated by the procedures described below.

10.2 Method Validation

Method validation is the process whereby the laboratory establishes that the analytical method meets the client's performance requirements. Typically, the validation procedure consists of the following determinations:

A. Accuracy – this is defined as the closeness of the analytical result to the true value, and may be determined by the analysis of standard reference materials (SRM) over the range of the method.

B. Precision – this is a measure of the amount of agreement between analyses, and is determined by repeated analyses of SRM over the range of the method.

C. Specificity – this is the ability to analyze for the analyte of interest in the matrix intended in the presence of the expected interferences. The best way to show method specificity is by measuring the recoveries of matrix spikes.

D. Method Detection Limit – the MDL is the smallest amount of analyte in the matrix that may be detected, but not necessarily quantitated. MDLs are calculated from the analysis of at least 7 replicates of a clean matrix at a level 3-5 times the expected MDL. When required, drinking water MDL studies are performed over a several day period. If the client has project specific detection limits, the study should be performed at the specified level. The lowest amount of analyte that can be reliably quantitated in a particular matrix is the Practical Quantitation Limit (PQL), which is often, but not always, the lowest calibration standard. These procedures are provided in the Method Detection Limit Study SOP 02M01.

E. Linearity and Range – linearity means that the quantitative parameter measured in the analytical process is directly proportional to its concentration; the range is the span of the interval between the upper and lower limits of the test in which acceptable accuracy and precision are achieved. These can be determined by analyzing in replicate LCS samples or spiked samples over a wide concentration range and plotting or statistically analyzing the data.

F. Ruggedness and Robustness are measures of a test method's variability when performed under a variety of environmental or operational conditions that reflect normal laboratory variability, such as different analysts, instruments, reagent manufacturers, temperatures, etc.

G. Measurement Uncertainty – in the chemistry laboratory this is normally defined as two times the standard deviation of the percent recoveries of at least 20 LCS determinations. It is most easily determined from control limits.

11.0 MEASUREMENT TRACEABILITY

11.1 It is Martel's policy to comply with A2LA Policy P113 on measurement traceability. Traceability is defined as "the property of a measurement whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty". This applies to both reference standards, (i.e. physical standards such as balance weights and thermometers), as well as reference materials, which are consumables used for calibrating instruments.

11.2 Martel requires that calibrations of reference standards be performed by calibration laboratories accredited to ISO 17025 by A2LA or another recognized accrediting body. In addition, Martel requires that, whenever possible, all reference materials, (i.e. chemical calibration solutions such as those used in the metals or organics laboratories for instrument calibration), be obtained from vendors that are accredited to ISO Guide 34 and to ISO 17025.

11.3 Certificates of Analysis are required from all vendors of calibration reference standards, as well as purchased certified reference materials. Calibration certificates or reports should include the name of the accrediting body, certification number, the measurement uncertainties (where applicable), and a traceability statement. Certificates of Analysis should comply with ISO Guide 31 and reference a recognized accreditation body such as A2LA. All pertinent documentation is kept on file.

11.4 In cases where traceable standards do not exist, traceability requirements may be met by using certified reference materials provided by a competent supplier who can provide a reliable characterization of the material. Performance Testing samples that have undergone an interlaboratory study may also be used as reference materials.

12.0 MEASUREMENT UNCERTAINTY

12.1 ISO 17025 and NELAC require that laboratories maintain estimates of measurement uncertainty. Uncertainty is defined as "the parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement"[1]. Uncertainty estimates are useful in judging how good a test result is, and in allowing the end data user to properly interpret the data. The laboratory's procedure for Estimating Measurement Uncertainty are provided in SOP 02U01.

12.2 A2LA Document G104 – "A2LA Guide for Estimation of Measurement Uncertainty in Testing" provides guidance for performing this procedure.

13.0 QUALITY CONTROL

13.1 The term Quality Control (QC) refers to a set of measurements that test whether the analytical procedure is operating within specified parameters. QC requirements are specified in the in the individual EPA methods and in the introduction to Standard Methods. Martel, at a minimum, performs the required elements. The elements assess instrument calibration, analytical batches, preparation batches, and sample recovery, where possible, for blank, accuracy and precision through the analysis of calibration standards, blanks, blank spikes, matrix spikes, and duplicates. Acceptance criteria for the various QC parameters are often specified in the reference methods. In those cases when they are not specified, they may be determined from preparation of historical results using control charts, according to the Control Chart SOP 02C02. All QC data is documented and archived in computerized instrument files or as hard copy files, and is traceable to the original samples and standards. Each referenced analytical SOP discusses the method's QC requirements and the laboratory's practice, the following QC measurements are discussed as an overview.

13.2 Blanks

13.2.1 There are various types of blanks that are commonly employed in the field sampling activities.

A. Trip Blanks consist of reagent water in the same type of container as the sample, appropriately preserved, that are filled in the laboratory, transported to the sampling site(s) and returned to the lab. These are used to measure any contamination that may have occurred during sample transport and storage.

B. Field Blanks are prepared by filling sample bottles with reagent water and preserving them at the sampling site. These provide an indication of any contamination that may have occurred during sample collection as well as sample transport and storage. Drinking water VOA sampling requires that Trip and Field Blanks be taken.

C. Rinse Blanks are sometimes required for projects in which multiple samples must be collected using the same equipment, to show equipment cleanliness before sampling, or between sample collections. These are taken by cleaning all the equipment that comes into contact with the sample, then rinsing with reagent water and collecting the rinsate. These are useful in judging if any if any cross contamination has occurred between samples.

13.2.2 Laboratory blanks are used to measure for any contamination that may occur in the lab.

A. Instrument Blanks, a.k.a. Initial Calibration Blank (ICB), or Continuing Calibration Blank (CCB), are used to check for instrument cleanliness prior to sample analysis. The ICB is run after instrument calibration before sample analysis; CCBs are run every 10 or 20 samples and at the end of the batch. If a CCB shows a background concentration above the method reporting limit for any analyte of interest, all the samples that were analyzed since the last clean CCB must be reanalyzed. In addition to these minimum requirements, blanks may be run at any time that instrument contamination is suspected. For example, one or more blanks may be run after a particularly dirty sample has been analyzed to avoid cross-contaminating subsequent samples. This can be an especially acute problem in gas chromatographic analyses.

B. Method Blanks consist of reagent water or a certified blank standard reference material that is taken through the same, entire analytical procedure as a sample. These are used to measure the total amount of contamination that may have occurred in the lab during the sample preparation process. Typically a Method Blank is required every 20 samples, and the result must be less than the laboratory's reporting limit.

13.3 Standards

13.3.1 Standards are used to calibrate instruments, to check instrument calibrations, and to measure the accuracy and precision of laboratory analyses. Martel employs a variety of standards, which includes the following.

A. Calibration standards are a series of solutions containing analytes at known concentrations that are used to calibrate and to establish the working range of an instrument. Whenever possible, calibration standards are NIST traceable or are purchased as certified solutions from reputable, accredited vendors. Calibration requirements vary widely among methods, and the individual SOPs must be consulted for guidance and acceptance criteria. Calibration types and evaluation equations are discussed in Section 14.0.

B. Calibration verification standards, also known as an Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) standards, are used to check the accuracy of the calibration curve. The laboratory analyzes a second source standard, which may be a ICV. The ICV is analyzed immediately after the curve is generated, and it must be from a different

vendor than the supplier of the calibration standards, or at least a different lot number than the calibration standard. CCV standards are analyzed periodically, usually every 10 or 20 samples, and at the end of the run. They are usually at a concentration around the middle of the calibration curve, and may be the same solution as the ICV, or one of the calibration standards. The accuracy of CCVs is determined through the calculation of percent difference or percent recovery:

$$\text{Percent Difference (\%)} = \frac{C - E}{E} \times 100$$

$$\text{Percent Recovery (\%)} = \frac{C}{E} \times 100$$

Where: C = Calculated concentration
E = Expected concentration

C. Tuning Standards are solutions used in mass spectral analysis to check instrument response and resolution prior to analysis.

D. Interference Check Solutions (ICS) are used in ICP and ICPMS analyses to check for interferences and to provide a test of any corrections that were applied. These solutions consist of known quantities of metals that are analyzed at the beginning and end of every analytical run.

13.3.2 Acceptance criteria for these standards are discussed in the referenced SOPs.

13.4 Accuracy Assessments – Accuracy is the quality control indicator which measures the degree of agreement between an observed value and an accepted reference value. Accuracy is calculated as percent recovery. Accuracy close to the accepted value indicates a process is in control; low or high accuracy indicates a process may be out of control.

13.4.1 Spikes are used to evaluate method and matrix performance through the assessment of accuracy.

A. The Laboratory Control Sample (LCS), also known as a Blank Spike (BS) or Laboratory Fortified Blank (LFB), is a clean matrix spiked with known amounts of analytes that is taken through the entire analytical process. The source of the spike solution may be different from the source of the calibration compounds. An LCS is analyzed at least once per batch or every 20 samples. The concentration of the LCS is usually at the mid-range of the calibration. It is used to measure analyte recovery in an interference free matrix, thereby evaluating method performance on that day.

B. The Limit of Quantitation (LOQ) verification, also known as a Reporting Level Standard, or Low Level Quantitation standard, is clean matrix spiked with known amounts of analytes, at 1-2 times the reporting limit concentration, that is taken through the entire analytical process. The Reporting Level Standard is analyzed each day of analysis for each matrix, and acceptance criteria are 50-150% recovery, unless stated in the referenced SOP. It is used to measure analyte recovery in an interference free matrix, thereby evaluating method performance at the reporting limit. Results of the LOQ analyses may be used to evaluate the MDL.

C. Matrix Spikes (MS), also known as Laboratory Fortified Matrix (LFM) samples, are project samples to which known amounts of analytes are added and taken through the entire analytical process in order to determine if there are any problems due to matrix interference. The concentration of the MS is usually at the same concentration as the LCS, but should be 5x

the concentration of the target analyte in the sample, if prior determination is possible. A MS should be analyzed at least once with every batch, every 20 samples or as specified in the method.

13.4.2 Accuracy is determined through the calculation of percent recovery for LCS by:

$$\text{LCS Percent Recovery (\%)} = \frac{S}{C} \times 100$$

Where: S = Spiked sample concentration calculated
C = Spike concentration added

13.4.3 Accuracy is determined through the calculation of percent recovery for MS by:

$$\text{MS Percent Recovery (\%)} = \frac{S - X}{C} \times 100$$

Where: S = Spiked sample concentration calculated
X = Unspiked sample concentration calculated
C = Spike concentration added

13.4.4 For methods that have long lists of target analytes NELAC allows for a representative number to be chosen. The analytes selected should be representative of all the analytes reported. The number of analytes required is as follows:

A. For methods that have 1-10 analytes, spike all compounds.
B. For 11-20 analytes spike at least 10 or 80%, whichever is greater.
C. For methods with more than 20 analytes, spike at least 16 components.

13.4.5 The lab must ensure that all target compounds are included in the spike mixture over a 2 year period. The % recovery of each LCS component must meet method mandated criteria. If there are no established criteria the lab must use internally generated criteria obtained from control charts.

13.4.6 If a large number of analytes are included in the LCS standard, it becomes statistically likely that a few will be outside the control limits. This may not indicate that the system is out of control, and therefore corrective action may not be necessary. In these cases upper and lower Marginal Exceedance (ME) limits can be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits which are between 3 and 4 standard deviations around the mean. Marginal exceedances should be monitored to insure that they are random events. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must then be located and corrective action taken

13.4.7 The number of allowable marginal exceedances is based on the number of analytes in the LCS. If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. The number of allowable MEs is as follows:

A. For >90 analytes in LCS, 5 analytes allowed as ME
B. For 71-90 analytes in LCS, 4 allowed as ME
C. For 51-70 analytes in LCS, 3 allowed as ME
D. For 31-50 analytes in LCS, 2 allowed as ME
E. For 11-30 analytes in LCS, 1 allowed as ME
F. For <11 analytes in LCS, 0 allowed as ME

13.4.8 Surrogate Standards (SS) are used in organics analyses to measure the efficacy of sample preparation and analysis. SS compounds are analytes not expected to be found in nature that are added at a known concentration to samples prior to extraction. After analysis, the percent recoveries of SS are used to evaluate method performance, and for control charting purposes. The calculation of surrogate percent recovery is:

$$\text{Surrogate Percent Recovery (\%)} = \frac{C}{A} \times 100$$

Where: S = Surrogate concentration calculated
C = Surrogate concentration added

13.4.9 Internal Standards (IS) in organics analysis are compounds not expected to be found in nature that are added in known amounts to sample extracts prior to instrumental analysis, and to all calibration standards. They are used to measure the relative responses of all the analytes and surrogates in the method. In ICPMS analysis IS are metal isotopes not expected to be found in the sample that are used to monitor and correct for instrument drift. IS responses must also be monitored during a run to check for instrument problems such as a blockage or change in tuning.

13.5 Precision Assessments – Precision is the quality control indicator which measures the degree of agreement between replicate measurements. Precision is calculated as percent difference, relative percent difference, or relative standard deviation. Low precision indicates good reproducibility; high precision indicates that a process may be out of control.

13.5.1 Replicate measurements are used to evaluate method and matrix performance through the assessment of precision.

A. Duplicates consist of two aliquots of a sample that are analyzed individually in order to evaluate the precision of the method. In the case of dust wipes, where duplicate samples cannot be taken, the LCS is analyzed twice. The EPA in SW-846 allows an MS/MSD pair to be substituted for a duplicate and MS.

B. Matrix Spike Duplicates (MSD) are replicates of the MS and are used to evaluate method precision. The MS and MSD are usually analyzed as a pair once per batch or every 20 samples. Results of MS/MSD analyses are expressed as relative percent difference (RPD), and are compared to the acceptance criteria in the test methods (usually 20%) or to laboratory established criteria.

13.5.2 Precision is determined through the calculation of relative percent difference (RPD) of the duplicate analyses by:

$$RPD = \frac{|X_1 - X_2|}{\bar{x}} \times 100$$

Where: X_1 = Concentration calculated for first sample
X_2 = Concentration calculated for second sample
$\bar{x}$ = Average of X_1 and X_2

13.5.3 Frequency and acceptance criteria for precision assessments are discussed in the referenced SOPs.

13.6 Instrument/Method Sensitivity

13.6.1 Method Detection Limit (MDL) studies, also known as Limit of Detection (LOD), are performed and verified at least annually, as required by the reference methods, or whenever there is a change in the test method that may affect the sensitivity of the analysis. The procedures and acceptance of MDL studies are discussed in SOP 02M01, current revision.

13.6.2 Practical Quantitation Limits (PQL), also known as Reporting Limits (RL) or Limits of Quantitation (LOQ). These are sometimes requested by clients and are included on Certificates of Analysis. The Limit of Quantitation is at or above the lowest point on a calibration curve, or, the LOQ may be set as a multiple of the LOD rounded up to a whole number. LOQs are always higher than LODs.

13.6.3 Linear Calibration Ranges (LCR), also known as Linear Dynamic Range (LDR), are required to be determined or verified by several methods, e.g. EPA 300.0, on a semi-annual or annual basis. Since the laboratory analyzes calibration curves that define the instrument and quantitation range for all applicable methods, the laboratory will perform this study, if requested for client's projects. The EPA has approved this method deviation.

13.6.4 Instrument Detection Limit (IDL) studies are discussed in several methods, e.g., 200.7, however, the frequency and acceptance for these evaluations are not discussed. The laboratory does not report results according to an IDL, unless requested. If requested for a specific project, the laboratory will perform an IDL study and provide the results.

13.7 Proficiency Testing

13.7.1 Martel participates in several single blind Proficiency Testing (PT) studies throughout the year that evaluate laboratory performance for all the methods and analytes for which Martel is certified (see Appendix D). These are considered single blind because the laboratory is aware that the samples are submitted, and has no knowledge of concentrations. Procedures for testing and reporting PT Studies are discussed in SOP 02P03. Studies that the laboratory typically participates include:

A. Semi-annual Water Supply (WS) studies of drinking water for inorganic chemicals, metals, and organic chemicals.

B. Semi-annual drinking water studies for microbiological parameters (MS).

C. Semi-annual Water Pollution (WP) studies for non-potable water inorganics, organics, and metals. The laboratory also participates in the EPA's Discharge Monitoring Report Quality Assurance (DMR-QA) PT study for wastewater facilities.

D. Semi-annual non-potable water studies for microbiological parameters (MP).

E. Quarterly ELPAT Studies of dust wipes, paint, and soils for the EPA National Lead Laboratory Accreditation Program (NLLAP).

13.7.2 PT studies are logged in and analyzed as part of Martel's routine operating procedures. All study results are automatically forwarded to the accrediting authorities (i.e. the states or A2LA) by the PT provider. If necessary, any non-acceptable results are documented, investigated, and resolved via the Corrective Action process, and make-up study samples are ordered and analyzed to confirm the efficacy of the corrective actions. Corrective action documentation is sent to the appropriate accrediting authorities when required. In the case of DMRQA studies corrective actions are sent to the affected clients who forward it to the state DMRQA Coordinator.

13.7.3 Unused sample from previous PT studies may be used for training for evaluating technician performance, or for QC purposes.

13.7.4 Double Blind PT Samples are samples that may be submitted by clients to check laboratory performance. These are considered double blind because the laboratory has no knowledge that the samples are submitted, and has no knowledge of concentrations.

14.0 INSTRUMENT CALIBRATION AND MAINTENANCE

All analytical instrumentation is kept in good working order, and is used only by properly trained technicians. All instruments are calibrated, or calibrations are checked, before each use. Blanks are run to verify system cleanliness before running samples and periodically during the run.

14.1 Instrument Calibrations

14.1.1 Analytical instruments are calibrated and calibrations are verified at the concentrations and frequency specified in each referenced analytical SOP. If a method does not contain specific calibration instructions, then the calibration model from a similar method is utilized for calibration procedures and frequency. All calibrations are documented, either in the logbook or the log sheet for each procedure, or on computer/instrument print-outs.

14.1.2 Calibration and verification of support equipment is discussed in technical SOPs. Records of support equipment calibration are maintained by each Section. Deviations from acceptance criteria are noted and corrective action taken and documented.

A. Balances are calibrated daily using ASTM Class 3 weights, as discussed in the Balance Use and Calibration SOP 02B03. In addition, balances undergo maintenance and calibration by an outside contractor annually.

B. The weights used for daily balance calibrations are checked against NIST traceable reference weights semi-annually. The reference weights are certified by an A2LA ISO 17025 accredited facility every 5 years.

C. All thermometers used in the laboratory are calibrated against a NIST traceable thermometer annually. The NIST thermometer is itself calibrated by an ISO 17025 certified facility every 5 years. These procedures are outlined in the Thermometer Calibration SOP 02T01.

D. Mechanical volumetric pipets are calibrated quarterly, included in SOP 02V01.

E. Refrigerated support equipment are calibrated as discussed in SOP 02T02.

14.1.3 Various of types of calibration curve models may be used to evaluate the analytical instrument's response to target compound concentrations, and concentration and acceptance criteria are discussed in the referenced SOPs.

14.1.3.1 Calibration or Response Factor

Equations for Curve Coefficients:

$RF = ((A_x)(C_{is}))/((A_{is})(C_x))$

$CF = (A_x)/(C_x)$

Where: A_x = Area of the compound
C_x = Concentration of the compound
A_{is} = Area of the internal standard
C_{is} = Concentration of the internal standard

Average Response Factor:

$RF_{AVE} =$ ERF_i / n n = number of pairs of data

Where: RF_i = Response Factor (or other determined value)
E = the sum of all the individual values

Equations for Evaluation:
Standard Deviation:

$$s = \sqrt{\frac{\sum\left(x_i - \bar{x}\right)^2}{(n-1)}}$$

Where: n = number of pairs of data
x_i = Response Factor at each level
$\bar{x}$ = Average of all the response factors
E= the sum of all the individual values

Relative Standard Deviation:

$RSD = s / RF_{AVE}$

Equations for Concentration:

Concentration $C_x =$ $((A_x)(C_{is}))/((A_{is})(RF_{AVE}))$

Concentration $C_x =$ $(A_x)/(CF_{AVE})$

14.1.3.2 Inverse Linear Regression

Equations for Curve Coefficients:

$y = mx + b$ Where: y = Response (Area) Ratio A_x/A_{is}
x = Concentration Ratio C_x/C_{is}
m = slope
b = intercept

Slope (m) of a Linear Regression:

$m = [(E\ wxy * E\ w) - (Ewx * E\ wy)] / [(E\ w * Ewx^2) - (Ewx * Ewx)]$

Where: x_i = individual values for independent variable
y_i = individual values for dependent variable
w = weighting factor, for equal weighting w=1
E = the sum of all the individual values

Intercept (b) of a Linear Regression:

$b = y_{AVE} - m*(x_{AVE})$
or $b = [(E\ wx^2 * Ewy) - (E\ wx * Ewxy)] / [(E\ w * E\ wx2) - (E\ wx * Ewx)]$

Equations for Evaluation:

$CC\ (r) = \{ E((x_i-x_{ave})*(y_i-y_{ave})) \} / \{ \sqrt{((E(x_i-x_{ave})^2)*(E(y_i-y_{ave})^2))} \}$

or CC(r)= $[(Sw * E wxy) - (E Swx * E Swy)] /$
$(\sqrt{(([(E w * E wx^2) - (E wx * E wx)] * [(E w * ESwy^2) - (Ewy * Ewy)]))}$

Where: x_i = individual values for independent variable
y_i = individual values for dependent variable
x_{ave} = average of the x values
y_{ave} = average of the y values
w = weighting factor, for equal weighting w=1
E = the sum of the values indicated

COD (r^2) = CC*CC

Equations for Concentration:
$x = (y - b)/m$

14.1.3.3 Normal Linear Regression

Equations for Curve Coefficients:
$y = (1/m*x) + (-b/m)$ Where: y = Response (Area) Ratio A_x/A_{is}
x = Concentration Ratio C_x/C_{is}
m = slope
b = intercept

Equations for Evaluation:
(Same as Inverse Linear Regression Above)

Equations for Concentration:
$x = my + b$

14.1.3.4 Quadratic Regression

Equations for Curve Coefficients:

$y = ax^2 + bx + c$ Where: y = Response (Area) Ratio A_x/A_{is}
x = Concentration Ratio C_x/C_{is}
a = x^2 coefficient
b = x coefficient
c = intercept

$a = S_{(x2y)}S_{(xx)}-S_{(xy)}S_{(xx2)} / S_{(xx)}S_{(x2x2)}-[S_{(xx2)}]^2$
$b = S_{(xy)}S_{(x2x2)}-S_{(x2y)}S_{(xx2)} / S_{(xx)}S_{(x2x2)}-[S_{(xx2)}]^2$
$c = [(Eyw)/n] - b*[(Exw)/n] - a*[E(x^2w)/n]$
Where: n = number of replicate x,y pairs
x = x values
y = y values
$w = S^{-2} / (E S^{-2}/n)$

$S_{(xx)} = (E\, x^2w) - [E\, xw)^2 / n]$
$S_{(xy)} = (E\, xyw) - [(E\, xw)*(E\, yw) / n]$
$S_{(xx2)} = (E\, x^3w) - [(Exw)*(E\, x^2w) / n]$
$S_{(x2y)} = (E\, x^2yw) - [(Ex^2w)*(E\, yw) / n]$
$S_{(x2x2)} = (E\, x^4w) - [(E\, x^2w)^2 / n]$

$S_{(x2x2)} = (Ex^4w) - [E\, x^2w)^2 / n]$

Equations for Evaluation:
(Same as Inverse Linear Regression Above)

Equations for Concentration:
$x = [(+\sqrt{(b^2-(4*a*(c-y)))}-b)/(2*a)] * C_{is}$

14.1.4 Calibrations will be evaluated to meet the method requirements, as defined in the referenced SOPs. The laboratory will utilize the most simple calibration model, starting with linear regression, and proceeding to quadratic regression.

14.1.5 The laboratory will use, at least, the minimum number of points required for each type of curve or as specified in each SOP. Linear regressions three or more concentrations, and quadratic regressions require five or more concentration levels.

14.1.6 Quadratic curves will be visually inspected to insure they are monotonic (one calculated concentration per response value).

14.1.7 For calibration for organic analysis, the laboratory will progressively use response factors, linear regression and quadratic equations. Analyst's experience is utilized in determining curve fit.

14.1.8 Calibration points from the middle of the calibration curve will not be dropped, unless a reason is technically justified and reviewed.

14.1.9 Calibration points from the upper end of the curve may be removed, with technical justification and review.

14.1.10 Calibration points from the lower end of the curve may be removed, as long as the lowest calibration level is at or below the reporting limit for that compound, with technical justification and review.

14.1.11 Technical justification for rejection of a data point may be documented by evidence of analytical or instrument error (such as an autosampler injection error demonstrated through low recovery of all compounds and internal standards).

14.2 Manufacturer's manuals are consulted for routine and preventive maintenance. Instrument maintenance is recorded in maintenance logbooks prepared for each instrument.

15.0 DATA RECORDING, VALIDATION, AND REPORTING

15.1 The laboratory's analytical records are documented manually in benchsheets and logbooks, and captured through electronic acquisition. Results may be manually entered in LIMS or may be uploaded from electronic files.

15.2 Data Recording

15.2.1 Data generated manually is recorded in various technical and support function logbooks covering all aspects of the laboratory operation (the laboratory maintains a list of logbooks, which is available upon request). Technicians are trained in proper data recording and correcting procedures. If a mistake is made, the error is corrected by a single line through the data with the correct value entered alongside. Alterations are initialed and dated by the person making the correction. All data is recorded in indelible ink and never overwritten or made illegible. Pencils and whiteout may not be used in laboratory documents. Manual changes to electronic data are discussed in the Manual Integration Protocol SOP 02M02. Logbooks are issued under the SOP "Lab Notebooks, Use, Review and Control", 02B02, and are uniquely and sequentially numbered. Logbooks are prepared from bench sheets that are discussed in the Bench Sheet Preparation SOP 02B01. Among the logbooks routinely used at Martel are:

A. The Sample Receipt Logbook, in which the sample custodian fills in sample data during log-in. It contains the sequentially assigned laboratory control number, client name, date of sample receipt, type/matrix of samples, the number of samples received, and the initials of the sample custodian or designee. Additional information provided with the samples may be documented on the Chain of Custody or other document that is attached to the log-in file.

B. Sample Preparation Logbooks used for documenting sample digestions or extractions, including all QC samples required by the methods. Lot numbers of the reagents, standards, matrix spikes, etc. that are used for that sample preparation are recorded in these books.

C. Reagent and Standard Preparation Logbooks are used to document the preparation of all reagents, standards, surrogates, spiking solutions, and reference materials. The following minimum information is recorded: Date of preparation, initials of the analyst preparing the solution, concentration and identification of the stock solution, final volume of the solution being prepared, final concentration of the solution being prepared, the I.D. of the standard, and expiration date.

D. A number of Sample Analysis Logbooks are used for documenting all information used for performing the analyses and calculating the final analytical results. The logbooks can either be parameter specific or pertain to several related parameters. The following information may be required as specified in the appropriate SOP:

1. Parameter and method
2. Date and time of analysis
3. Initials of the analyst performing the analysis
4. Laboratory sample I.D.
5. Sample aliquot
6. Dilution factors and final dilution volumes
7. Concentrations of reagents and standards
8. Calibration data
9. Sample calculation
10. Final sample concentrations
11. Required quality control information
12. ID numbers of Reagents and Standards

13. Any applicable explanatory comments

Quality control information must be thoroughly documented for each analytical sample batch. This information must be clearly documented to allow data reviewers, the QA/QC officer, and auditors to spot-check calculations and verify analytical results. Data is recorded in the same order in which it was analyzed. Any unusual observations noted during analysis should be documented in the laboratory logbook and brought to the attention of the Laboratory Manager or Technical Director.

E. Instrument Run Logbooks are used to keep an accurate record of all calibrations standards, field samples, and quality control samples processed during an analytical batch. Data is recorded in chronological order based on the actual analytical run sequence used.

F. Instrument Maintenance Logbooks are kept for each major instrument. The logbook is kept near the instrument and is used to record the dates and times of all repairs and routine maintenance. The following minimum information should be included:

1. Instrument manufacturer and model number
2. I.D. or serial number (if applicable)
3. Laboratory I.D. (if used)
4. Service contract information, including the phone number and name of the service representative.
5. A record of the maintenance that was performed, including the date and time.

If a non-routine maintenance procedure or repair requires instrument downtime, the reason and date when the instrument was removed from service must be recorded. A service representative must be contracted and a copy of the repair order stapled to a page in the notebook. Either the analyst or the service representative should record the service and repair information in the logbook. Indicate the type of repair or non-routine maintenance that was performed, date, and service representative's name.

G. Support Equipment Logbooks are maintained to document various technical activities, such as Balance Calibration, Refrigerator Temperatures, Autoclave Temperature, etc., in support of laboratory operations.

H. A number of logbooks are maintained in the Microbiology Laboratory that document all the necessary aspects of that operation, including Incubator temperatures, Media Preparation, Water Quality, and results of all analyses run by the laboratory.

15.2.2 The Laboratory Manager and/or the Technical Director review logbooks on a periodic basis to ensure that the applicable analytical procedure is being correctly followed and that the logbook entries are complete and correct, including all applicable QC data. Each page in a logbook is referred to as the Bench Sheet. One of these must be initiated on each day that an analysis takes place. When the analysis or set of analyses is completed, the data is peer reviewed, and entered into the computer system. A copy of the Bench Sheet(s) is made and attached to a printout of the entered data, along with a printout of the samples that needed to be analyzed. This package is then permanently filed.

15.2.3 Electronic data generated by instruments that are connected to the computer network is uploaded by the analyst after peer review, and no bench sheet is required. Software and hardware procedures are discussed in the Automated Laboratory Operations SOP 02A01, and the Backup of Electronic Records SOP 02B04. The hard copy data package may then consist of the instrument

download summary, extraction sheets, surrogate recoveries, peer reviews, sample list, instrument data etc. Data that has been uploaded into the LIMS is backed up every night; data stored in instrument files is backed up on a regular basis.

15.3 Data Review and Validation

15.3.1 All analytical data generated by the laboratory is reviewed and validated prior to reporting, according to SOP 02D01. Laboratory data is entered into LIMS according to SOP 02D03. The review process incorporates all areas of data generation and is performed at least three levels:

A. Analyst Review – The analyst who generates the analytical data has the primary responsibility for the correctness and completeness of their work. Each analyst must review his/her work, i.e. bench sheet or instrument printout to insure that it is reported correctly in LIMS, and is documented on the signature line on the bench sheet.

B. Peer Review – Secondary review is performed by another analyst who has documented acceptable performance or training in the area of review. This review is designed to eliminate transcription errors, omissions and calculation errors, and adherence to the SOP and the QC protocols. Peer Review is documented on the signature line of the bench sheet attached to the raw data.

C. Administrative Review – A project manager performs the final review of the data that has been uploaded into the LIMS for reporting. This consists of making sure that the data is reasonable (such as TKN>Ammonia, the units are correct, etc.), complete, and consistent with historical data. If any discrepancies are noted, they are documented on a Corrective Action Form, and submitted to the Technical Director for resolution.

15.3.2 QA Review is performed by the Technical Director on 10% of the data as an additional check of the QC system for completeness and accuracy. Any internally generated spreadsheet calculations are periodically verified during this review, which also serves as a software validation function.

15.4 Reporting

15.4.1 Once the data has been validated, it is ready for reporting as described in the SOP for Report Generation, 02R03 (Lead Wipe Reports are discussed in SOP 02R05 and Client Reporting for Micro Violations is discussed in SOP 02C07). Reports are normally generated by the project managers, and include the following information:

A. The title "Certificate of Analysis"
B. Martel's name and address
C. The client's name, address, name of contact
D. Martel's unique laboratory identification number
E. The Purchase Order number and project identification
F. Sampling information (who took the sample, date and time)
G. Sample identification
H. Analytical results, units, and methods
I. Analyst initials and dates and times of analyses
J. Any deviations from the test methods or QC requirements, and any notes that pertain to the sample
K. Any interpretations or statements of compliance or non-compliance, if applicable
L. The signature of a person authorized to sign the report; these are the company President, the Technical Director, a project manager, and the Laboratory Manager.

M. The A2LA Accreditation number for reports involving lead wipes, lead paint, or lead in soils under NLLAP.
N. A description of the condition of the sample.
O. A statement that the results apply only to the samples tested.
P. A statement that the results meet NELAC requirements.
Q. Identification of analytes for which Martel is not accredited by NELAP.

15.4.2 Analytical results are reported to at least two significant figures, and rounding practices are performed as discussed in SOP 02R03.

15.4.3 If requested by the client, a partial report may be provided. It must be labeled "Draft" in order to make it clear to the client that the report is not complete and may not by fully validated. When the report is completed and finalized it must be re-issued and labeled as "Final". Any report that requires correction or modification must be labeled "Amended". Amended reports documented on a Corrective Action Form, and copies of both reports are filed in the client's project folder.

15.4.4 Reports are normally sent via e-mail to the contact person identified in the Project Form, contract, or Chain of Custody, or designee. If requested by the client, a report may by provided via FAX or USPS mail. In accordance with Martel's confidentiality policy, reports are never sent to or discussed with third parties without the client's permission. The only exceptions to this policy are investigations by state or other legal agencies in which records are subpoenaed, or in instances in which third parties already have a copy of the report in their possession.

15.4.5 To protect customers' confidential information and proprietary rights in the electronic transmission of results, a confidentiality notice is added to the signature block of outgoing email.

16.0 DATA INTEGRITY

16.1 It is Martel's policy to incorporate the highest standards of ethics and quality in all administrative and analytical procedures, as outlined in the Ensuring Data Integrity SOP 02E02. Laboratory staff sign the Ethical Conduct and Data Integrity Agreement, Form 02E02F01, annually. The Ethic's Agreement outlines the Laboratory's policy and pledges agreement to performing their duties in accordance with established procedures and SOPs. Any inappropriate or unjustified deviations will be investigated and dealt with appropriately, up to and including termination of employment at Martel Laboratories, debarment, or civil/criminal prosecution.

16.2 Any employee who suspects that unethical behavior is occurring is encouraged to report it to the Laboratory Manager, the Technical Director, or to the company President. All such reports are confidential, and no reprisals will be taken against the reporting staff member. If anonymity is desired, a comment box is maintained for this purpose.

16.3 In some cases there may be legitimate scientific or technical reasons for manual integrations or departures from SOPs. These must first be discussed with and approved by the Laboratory Manager, the Technical Director, or the President, keeping in mind client requirements and data quality objectives. All deviations must be thoroughly documented. If necessary the client should be made aware of the problem and the report of analysis should be appropriately qualified.

16.4 The best way to discover improper activities or questionable data is through supervision and data review. Martel has a robust data review program in which all data is reviewed at least three times (see the chapter on data recording, validation, and reporting) before being released to the client. If any potential data integrity issues are discovered, they are kept confidential until a full investigation is completed and the issues are resolved. All ethics violations, including

disciplinary actions, must be documented and kept of file by the Technical Director for at least five years.

17.0 DOCUMENT CONTROL

17.1 QA/QC System Documents

17.1.1 Martel Laboratories maintains a system to control all documents and records that pertain to the quality system, according to SOP 02D02. This includes internally generated documents such as the Quality Control Manual, Standard Operation Procedures (SOP), Internal Audits, Management Reviews, etc., as well as external documents such as regulations, guidance documents and new methodologies. The system insures that all such documents are written, reviewed, approved, and distributed by authorized personnel in a controlled manner so that only the most recent traceable version of a document exists at the point of use. Elements of the system include the following:

A. Allowing only authorized individuals (Laboratory Manager, Technical Director, or President) to approve controlled documents. While an SOP may be written or revised by any employee as an uncontrolled document, final approval must be done by an authorized individual.
B. Assigning a unique tracking number, including a revision number to all controlled documents.
C. Maintaining a list of currently approved SOPs, including their revision numbers.
D. Identifying the changes in altered documents.
E. Maintaining a distribution list of controlled documents.
F. Removing obsolete documents from their points of use as soon as possible.
G. Archiving and retaining obsolete documents for a period of at least 5 years for legal or reference purposes.

17.1.2 Quality Assurance Records for Training Files, PT Reports, Demonstrations of Capability (DOC), MDL Studies, etc. are maintained by the Technical Director in dedicated files. Supporting documentation may be filed in central files or laboratory files in appropriate locations and is readily accessible.

17.1.3 Maintaining document control is the responsibility of the Technical Director or deputy. Paper copies of all controlled SOPs are filed in the Technical Director's office and controlled copies are distributed at applicable laboratory stations. Document procedures are outlined in SOP 02D02, and SOPs Preparation and Use are discussed in SOP 02S01.

17.2 Data and Records

17.2.1 Analytical reporting packages are maintained in the central files for all samples and projects. The files are labeled alphabetically by client codes or analytical procedure designations. Instrument data may be maintained in laboratory files as long as it is easily accessible and retrievable. If available, the following information is normally kept in the central files:

A. Chain-of-custody or other documentation supplied by the client.
B. Sample receipt, project management forms, copies of all client correspondence.
C. Purchase orders and invoicing information (bids, job quotes, etc.)
D. Any Corrective Action reports that may have been generated.
E. Copies of the Certificates of Analysis and quality assurance reports as delivered to the client.
F. Invoices

17.2.2 Electronic Data is recorded, stored and archived in accordance with SOP 02B04. All computers are located in areas to which access is controlled; security is maintained by granting access only to

authorized employees based on their needs via a password system. The network is not Internet accessible, preventing data invasion from outside sources. The computer system is protected by the use of an uninterruptable power supply (UPS), anti-static materials, and surge protectors. All developed and purchased computer code is subjected to testing for completeness, accuracy and precision prior to bringing on-line. This process is coordinated between the IT Manager, the Technical Director, and the Laboratory Manager. The code itself gets compiled and secured to prevent tampering. All data is backed up each working day onto a disk and stored off-site for added insurance in case of a disaster at Martel. Electronic data specific to a report is captured in a separate data file when the report is generated. If necessary, the data in this file can be checked against the raw laboratory data, thereby adding an additional level of security against data tampering. All data files are Visual-Fox pro types with secured access.

17.2.3 All records and documents are stored on-site at Martel Laboratories for a period of at least 5 years. An access log is maintained to document the person, reason, and locations of any documents that are removed. Due to advances in technology older electronic data may be difficult to retrieve because the systems that can recall the data in the proper formats may no longer exist. Therefore, the systems for data retrieval must also be archived, if possible. All regulatory requirements, including federal, state, local, or financial are strictly followed. Public drinking water systems are required to maintain records of microbiological analyses of compliance samples for five years (40 CFR 141.33), records of chemical analyses of compliance samples for 10 years, and lead and copper records for 12 years (40CFR 141.91). The laboratory must maintain records for five years or until the next certification data audit is complete, whichever is longer. The client water system should be notified before disposing of records so that they may request copies, if needed. This includes all raw data, calculations, and quality control data.

17.2.2 In the unlikely event that Martel is about to go out of business, all clients will be informed well ahead of time, and all records and data will be transferred to the clients upon request.

18.0 NONCONFORMING WORK AND CORRECTIVE ACTIONS

18.1 Laboratory policy is to report data that is scientifically defensible and that meets all method quality control requirements. The laboratory will attempt not to report data until the cause of a problem is identified and corrected, or the data will be qualified, when it is impossible or impractical to reanalyze the samples.

18.2 Nonconforming work, such as departures from policies, procedures, or QC specifications must be documented and investigated, as discussed in the Corrective Action SOP 02C06. All employees are required to initiate a Corrective Action Report, Form 02C06F01, when a nonconforming work is observed. The deviation may involve any part of Martel's operations, including log-in, sample preparation, methodology, analytical results, reporting, etc. The form is brought to the Technical Director or designee, who evaluates the significance of the nonconformance, decides if the nonconforming work is acceptable, and assigns investigation and corrective actions as necessary. The corrective actions must be taken as soon as possible after the nonconformance is identified. If data quality is affected, the affected client is notified of the problem. If the evaluation indicates that the nonconforming work is a recurring problem or that there is a significant noncompliance with policies or procedures, then formal corrective action is necessary.

18.3 The corrective action process consists of a number of steps, all of which must be documented on the Corrective Action Form.

A. The nature of the problem must be stated and described in detail.

B. The root cause of the problem must be investigated and identified, if possible. This is the most difficult part of the process. Potential causes could include the nature of the samples, client requirements or specifications, technician training, and method or equipment problems. In tracing the cause of unsatisfactory analytical performance, all aspects of the procedure need to be evaluated, including calculation or transcription errors, sample homogeneity and preparation, instrument calibration, reagent and standard quality, etc.

C. Corrective actions must be must be determined and implemented. If the initial attempt was unsuccessful, other solutions must be tried until the problem is resolved.

D. Once the nonconformance is resolved it must be monitored to check the effectiveness of the corrective actions.

E. If follow-up shows that the actions were successful, the process is closed out for this event.

18.4 Corrective actions are most often initiated as a result of observations by the laboratory technicians who note a problem with an analysis or a QC issue. However, they may also occur as a result of internal or external audits, management reviews, or client complaints. Corrective action reports are maintained on file by the Technical Director, and are reviewed at least annually in order to identify any long term trends or recurring problems, and are part of the annual management review.

18.5 Stop Work Policy – When circumstances prevent the laboratory from performing a method (e.g., lack of trained personnel, equipment out of service, lack of accreditation, or insufficient sample load), the President, in consultation with the Technical Director and Lab Manager, will make a decision to officially Stop Work. The President or Project Managers will notify clients. Samples will either be rejected upon receipt, or sent to an approved subcontract laboratory. Work will be resumed when all circumstances are corrected, and the laboratory has the ability to perform the method as required.

^as approved by the President or Technical Director. MH 07/07/14

19.0 PREVENTIVE ACTIONS

19.1 Preventive actions are proactive procedures taken to prevent future nonconforming work, client complaints, or other quality issues, and are documented according to SOP 02C06. Most preventive actions start with technicians adhering to good laboratory practices, which may be defined as those procedures and precautions that minimize the possibility that an analytical result may become biased as a result of the technicians' activities. These are usually common sense procedures that every trained chemist should know, such as using clean glassware, covering vessels during sample preparation to avoid cross contamination, using fresh reagents and standards, calibrating balances before use, performing instrument maintenance before the instrument failure occurs, etc.

19.2 Preventive actions are identified through:

A. Training – insufficient or inadequate training is often the root cause of many corrective action investigations. Martel technicians receive training in all aspects of their job functions, and must show Demonstrations of Capability when they are hired, and when they are given new responsibilities. In addition, their training is verified annually by the performance of PT studies or Continuing Demonstrations of Capability.

B. Performance Testing (PT) studies are excellent ways to evaluate whether an analytical process (i.e. the technician, instrument, etc.) is functioning properly, and Martel participates in several

PT studies annually. These serve not only as independent assessments of the QC system, but also as training tools, and, by analysis of the data, as indicators of any potential problems.

C. Internal and external audits may reveal issues that may lead to non-conformances. Martel undergoes a comprehensive internal audit and external audits are performed by each accrediting authority according to their requirements (A2LA, MDE, VELAP).

D. Control charting often provides an early warning of potential problems by exhibiting trends that may otherwise be overlooked. Update of control limits is the responsibility of the Technical Director. Review of control charts is the responsibility of the analyst, who reviews the charts with each batch of samples reported. The preparation and use of control charts is discussed in SOP 02C02.

E. Equipment Maintenance – maintaining instruments and equipment in good working order is one of the best ways of avoiding potential problems. Martel technicians are trained in the proper care and maintenance procedures of all equipment for which they are responsible.

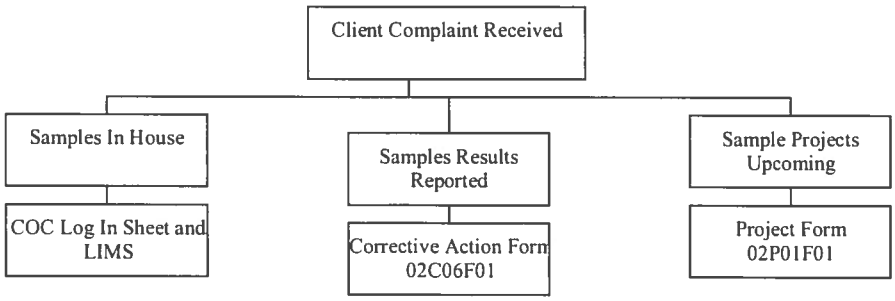
F. Management Review – preventive action opportunities are identified and reviewed during the annual management review process.

19.3 In addition, employees are encouraged to share ideas or suggestions for improvements or avoidance of potential problems. Suggestions could be taken directly to the Laboratory Manager, or, if the employee prefers anonymity, a suggestion box is provided for this purpose. All ideas and suggestions are evaluated by the Technical Director, Laboratory Manager, and/or President and receive a verbal or written response. If the idea is a good one it is implemented and monitored for a period of time to judge its effectiveness, and then adopted as standard operating procedure.

19.4 Preventive actions are documented during revisions to SOPs, in instrument maintenance logs, and as corrective action responses to audit findings.

20.0 CLIENT SERVICE AND COMPLAINTS

20.1 Exceptional client service is paramount importance at Martel Labs, and, although every effort is expended in providing timely and accurate data to clients, issues or questions may sometimes arise regarding a project, in-house samples or previously reported data. The project manager in charge of the client's project is responsible for documenting the questions, changes and informing all personnel involved with the project (samplers, sample custodian, analysts, and managers). Documentation of client issues and complaints are completed according to the following decision tree:



20.2 Issues that require significant changes to the project or contract Statement of Work are documented on the Project Form as described in the Requests, Tenders, and Contracts section of this Quality Assurance Manual.

20.3 For issues pertaining to samples already in-house, all information may be recorded on the Log-In Sheet or Chain of Custody Form.

20.4 Whenever the client's complaint or question involves a report that has already been provided, the response process is documented on the Corrective Action Form, as discussed in the Corrective Action Process SOP 02C06. The initiator of the form, usually a project manager, describes the question or problem, and attaches a copy of the report and any relevant data, and forwards the information to the laboratory manager or the technical director for resolution of the problem.

20.5 In the specific case of the EPA Environmental Lead Program (dust wipes, paint chips, or soils), Section 4.8 of the requirement states that "Any complaint about the quality of reported results may be referred to the accrediting authority if such complaints cannot be resolved directly with the customer". In other words, if a dispute regarding the quality of a result cannot be settled with the client, it may be referred to A2LA for resolution. The laboratory's current A2LA contact is Ms Atefeh Fathi, at 301-644-3248.

21.0 INTERNAL AUDITS

21.1 Martel's quality system undergoes a comprehensive internal audit at least once a year, as outlined in the Internal Audit SOP 02I01. Audits are the responsibility of the Technical Director, and are based on requirements and checklists from various sources, including ISO 17025-2005, A2LA, NELAC, Standard Methods, and EPA methods. Audit results are used to monitor the overall status of the QA/QC system and to identify any deficiencies so that they may be corrected. Normally the laboratory audit is conducted at the end of the year, however, additional audits may be conducted at other times as a follow-up to a corrective action, in preparation for an external audit, or if a problem is suspected. The annual audit covers both the managerial and technical aspects of the operation.

21.2 In addition to the internal audit, Martel undergoes various external audits on a regular basis. These are conducted by certifying agencies such as A2LA, or the States of Maryland or Virginia, as well as by some clients. These audits usually track the elements of the management audit described above, however the technical aspects are centered around the particular areas of interest to the accrediting bodies or clients.

22.0 MANAGEMENT REVIEWS

22.1 Martel's management conducts a comprehensive annual review of all laboratory operations and support functions and policies, according to the Management Review SOP 02M03. This is normally done at the beginning of a calendar year and covers the previous year's activities. It is used as a tool to help in planning goals and action plans for the year. The review covers the quality system as well as testing activities to ensure their suitability and effectiveness as well as to troubleshoot and correct problems or deficiencies and suggest ideas for improvement.

22.2 Weekly production meetings are performed to discuss and identify administrative, quality assurance, laboratory operations, project management, and project contract priorities, changes and opportunities. These meetings are used to coordinate laboratory needs, training opportunities, and management goals.

23.0 REFERENCES

The Laboratory's policies and procedures are developed and written to comply with the requirements of the following rules references.

23.1 Code of Maryland Regulations, Chapter 26, Subtitle 8, Chapter 5 (COMAR 26.08.05), Certification of State Water Quality Laboratories.

23.2 Virginia Environmental Laboratory Accreditation Program, Virginia Administrative Code, Title 1, Agency 30, Chapter 46 (VELAP 1VAC30-46), Accreditation for Commercial Environmental Laboratories, 01/01/2009.

23.3 The National Environmental Laboratory Accreditation Conference (NELAC), 2003 Standards, EPA/600/R-04/003, 06/05/2003.

23.4 American Association for Laboratory Accreditation (A2LA).

23.5 American National Standard, General Requirements for the Competence of Testing and Calibration Laboratories, ANSI/ISO/IEC 17025-2005(E), August 2005.

23.6 EPA National Lead Laboratory Accreditation Program (NLLAP), Laboratory Quality System Requirements, Revision 3.0, 07/05/2007.

23.7 EPA Code of Federal Regulations, Protection of the Environment, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, Title 40, Part 136 (40CFR136), current version.

23.8 EPA Code of Federal Regulations, Protection of the Environment, National Primary Drinking Water Regulations, Title 40, Part 141 (40CFR141), Subpart C, current version.

23.9 Office of Ground Water and Drinking Water Technical Support Center, EPA, Publication Number EPA 815-R-05-004, Manual for the Certification of Laboratories Analyzing Drinking Water: Criteria and Procedures Quality Assurance, 5th Edition January 2005; and Supplement 1 to the Fifth Edition of the Manual for the Certification of Laboratories Analyzing Drinking Water, EPA Publication Number 815-F-08-006, June 2008.

23.10 American Public Health Association et al., Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

23.11 EPA Office of Solid Waste and Emergency Response, EPA, Pub. No. SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Update IV, July 2005.

24.0 CHANGES NARRATIVE

24.1 Added reference to laboratory's Chemical Hygiene Plan 02C08 to Section 7.3, and Data Entry SOP 02D03 to Section 15.3.1.

24.2 Added reference to the Control Charting SOP 02C02 to Section 12.3.

24.3 Changed acceptance criteria for LOQ in Section 13.4.1.B to be 50-150% recovery "unless" stated in the referenced SOP.

24.4 Removed use of Grubbs' Test for documentation of rejecting a calibration point in Section 14.1.11.

24.5 Added reference to Corrective Preventive Action SOP 02C06 to Section 19.1.

24.6 Added Section 15.4.2 to discuss rounding and significant figures.

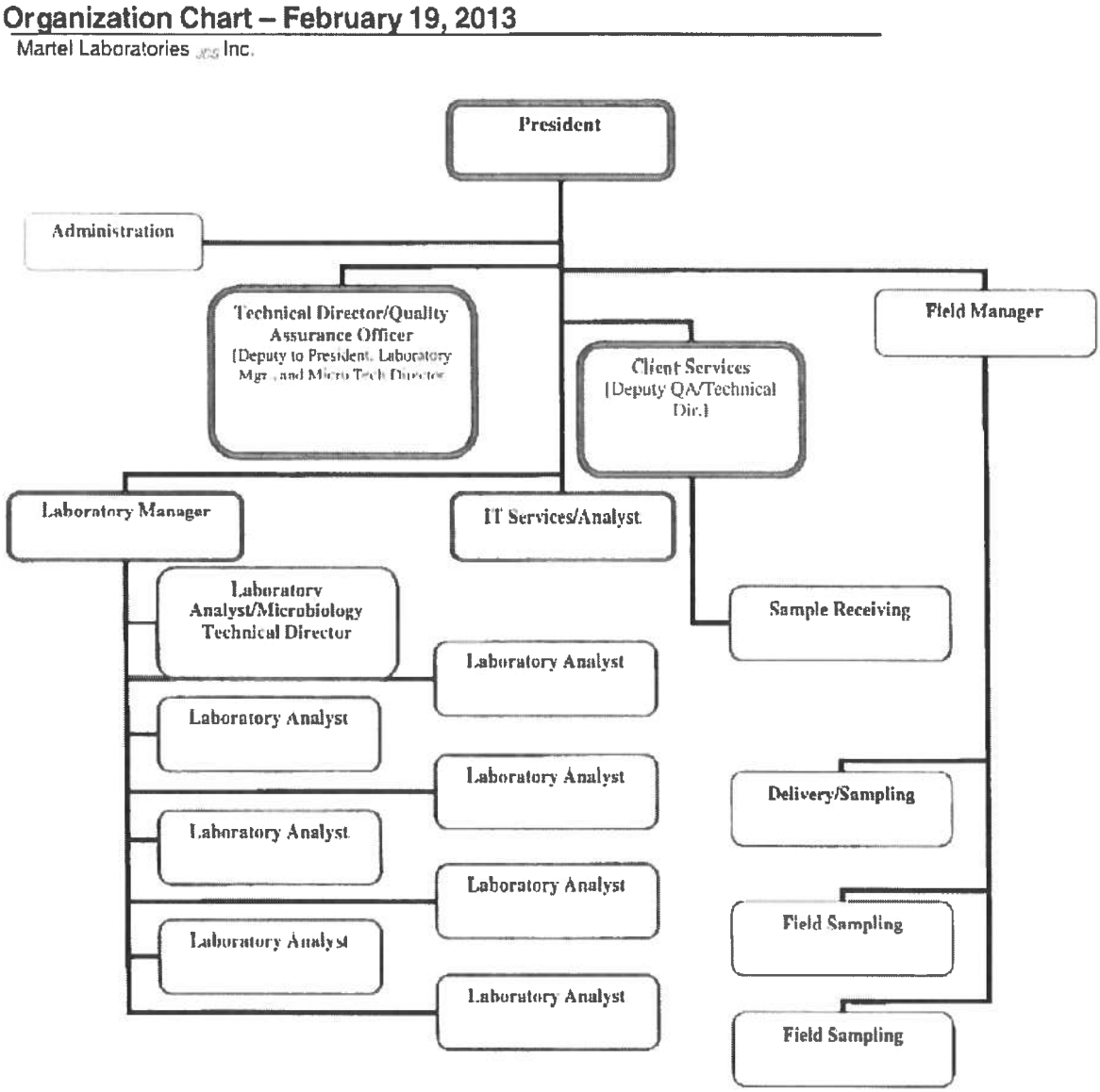
24.7 Updated Appendix D with current accreditation status.

24.8 Changed sample storage temperature from 4°C to .6°C, Section 9.2.1.

MARTEL

APPENDIX A

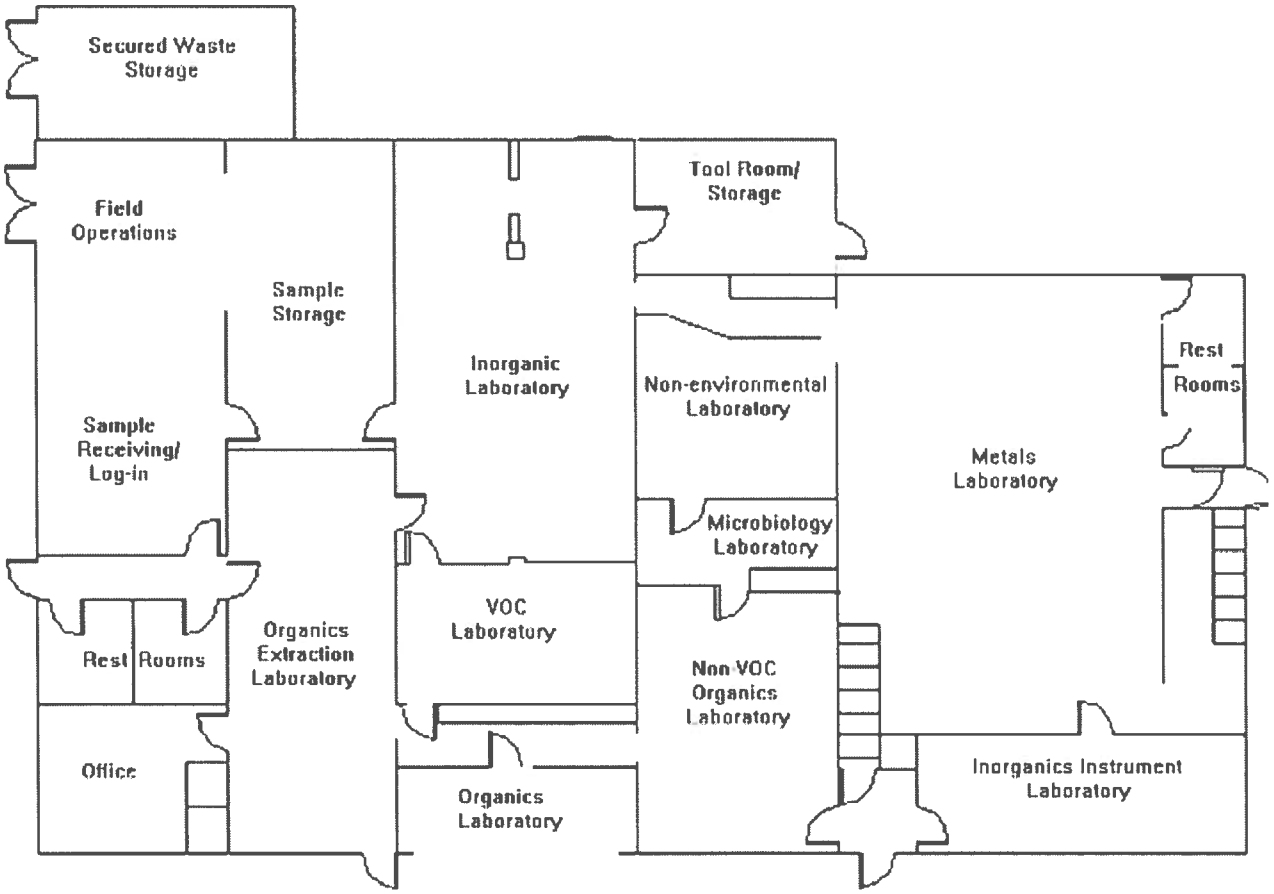
ORGANIZATION CHART



Note: The Laboratory's current organizational chart, which includes employee names, is available upon request.

APPENDIX B

LABORATORY FLOOR PLAN



APPENDIX C

LIST OF MAJOR EQUIPMENT

1. **Metals Laboratory**
   - A Inductively Coupled Plasma Spectrophotometer – Leeman Prodigy with autosampler, Lytron MCS cooling system, and associated computer system running SALSA Version 3.000 SP1 software
   - B. Inductively Coupled Plasma Mass Spectrometer – Thermo X1 with Cetac ASX-510 Autosampler, Neslab Chiller and associated hardware, with computer system running PlasmaLab Version 2.5.9.300 software
   - C. Mercury cold vapor AA – Leeman Hydra AA Automated Mercury Analysis System with autosampler and computer using WinHg Runner 1.5 Rev 0.12 software
   - D. HotBlock digesters (2), 54 place, Environmental Express

2. **Wet Laboratory**
   - A. Automated colorimetric analysis system – TRAACS 800 with computer system using New Analyzer Program Version 3.10
   - B. Technicon colorimetric autoanalyzer system with printer
   - C. Total Organic Carbon Analyzer – Shimadzu TOC-5000A TOC Analyzer with autosampler and computer system running TOC PC Control software Version 1.05
   - D. Chemical Oxygen Demand Reactor - Hach
   - E. UV-Visible Spectrophotometer – Thermo Spectronic Genesys 10
   - F. Total Kjeldahl Nitrogen and ammonia distillation apparatus – Foss Kjeltec 2200
   - G. Biochemical Oxygen Demand incubators (2), AMBI Hi-Lo
   - H. Dissolved Oxygen and pH meter – Orion 4 Star
   - I. pH meters (2) – Fisher Scientific Accumet Model 50, and Thermo Orion 550A
   - J. Turbidity meter – HF Scientific Micro 100
   - K. Chlorine Meters – Hach

3. **Organics Laboratory**

A. Extractions

   - **a.** Extract concentration apparatus – Caliper TurboVap II
   - b. TCLP agitation apparatus (2) – Environmental Express 10 place and Associated Design and Manufacturing 6 place, with 6 TCLP VOA extractors
   - c. Soxhlet Extractors – four 6 place units

B. Volatiles Analysis

   - a. Agilent 5890 Series II GCMS with Tekmar/Dohrman Stratum Concentrator and Archon Autosampler
   - b. Agilent 6890N GCMS system with Tekmar/Dohrman 3100 Concentrator and Archon Autosampler
   - c. Agilent 5890 Series II GC with PID and FID detectors, LSC 2000 Concentrator, and ALS 2016 Autosampler

C. **Semi-Volatiles Analysis**
   a. Agilent 6890N GCMS System with autosampler
   b. Agilent 5890 GC with FID and ECD detectors and autosampler
   c. Agilent 5890 Series II GC with NPD and FID detectors and autosampler
   d. Agilent 5890 Series II GC with FID detector and autosampler
   e. Agilent 5890 Series II GC with dual ECD detectors
   f. All 5890 instruments run Agilent EnviroQuant ChemStation G1701BA software, Version B.01.00
   g. All 6890 instruments run Agilent EnviroQuant ChemStation G1701DA software, Version D.01.02

4. **Microbiology Laboratory**
   A. Media dispenser – Scientific Equipment Products
   B. American Optical Colony Counter
   C. Incubators (3) – Precision Scientific, Blue M, and Lab Line Imperial II
   D. Water Bath - Blue M
   E. Autoclave – Market Forge Instruments
   F. QuantiTray sealer

5. **Petroleum Laboratory**
   A. Horiba SLFA-2100 Sulfur in oil analyzer
   B. Parr Adiabatic Oxygen Bomb Calorimeter
   C. Schott Titro Line Karl Fisher Titrimeter
   D. Precision Scientific HAD 620 Distillation Apparatus
   E. Wheaton Automatic Dilution Dispenser
   F. Precision Scientific Penske Martins Flash Point Tester
   G. Perkin Elmer 1600 FTIR Spectrometer running Used Oil Program software Version 5.0
   H. Hiac Royco 8000A Particle Counter running Logger Version 1.5 software
   I. Houillon Automated Viscometer running software Version 5.6

6. **Sampling Equipment**
   A. ISCO composite samplers (6)
   B. ISCO discreet samplers (2)
   C. Recording pH meters (4) – Sigma 950/ISCO PAL 1110/1101
   D. Bubbler flowmeter – ISCO 4230
   E. Ultrasonic flowmeter – ISCO 4210

7. **Miscellaneous**
   A. Analytical balances (3) – Mettler AE 160 (1), Radwag AS220/C/2, Ohaus Explorer Pro
   B. Top loading balances (3) – Mettler PC 4400 and PE 3600, Sartorious CP3202S
   C. Drying ovens (3) – Thelco, Thermo, Fisher
   D. High temperature oven – Blue M
   E. Vacuum oven – Fisher
   F. Refrigerators (10) – five large and five small
   G. Freezers (4) – one large and three small
   H. Assorted thermometers, hydrometers, and mechanical pipettors

APPENDIX D

LIST OF ACCREDITED TEST METHODS

Method Title	Method Number	Matrix	MDE*	VELAP*	A2LA*
Alkalinity as CaCO3	SM 2320 B-1997	NPW		X	
Ammonia as N	SM 4500-NH3 C-1997	NPW		X	
Biochemical Oxygen Demand (BOD) and CBOD	SM 5210 B-2001	NPW		X	
Chemical Oxygen Demand (COD)	SM 5220 D-1997	NPW		X	
Conductivity (Specific Conductance)	SM 2510 B-1997	SDW			
Chloride	SM 4500-Cl E-1997	NPW		X	
Cyanide (CN)	EPA 335.4, 1.0	NPW		X	
Cyanide (CN)	EPA 335.4, 1.0	SDW	X	X	
Fluoride (F)	SM 4500 FC-1997	SDW	X	X	
Hardness (Calculation)	SM 2340 B-1997	NPW			
Hexavalent Chromium	SM 3500-Cr B-2009	NPW			
Nitrate (NO3) as N	SM 4500 NO3D-2000	SDW	X	X	
Nitrate/Nitrite (NO3/NO2)	SM 4500-NO3 H-2000	NPW		X	
Nitrite (NO2)	SM 4500 NO2B-1995	SDW	X		
Total and Ortho Phosphate	SM 4500-P E-1999	NPW		X	
Total Organic Carbon (TOC)	SM 5310 B-2000	NPW		X	
Turbidity	SM 2130 B-2001	NPW			
Kjeldahl Nitrogen Total (TKN)	SM 4500-NH3 C-1997	NPW		X	
Total Phenolics	EPA 420.4, 1.0	NPW		X	
Hexane Extractable Material (HEM) (TPH and Oil and Grease)	EPA 1664 A	NPW		X	
Residue-Nonfilterable (TSS)	SM 2540 D-1997	NPW		X	
Residue-Filterable (TDS)	SM 2540 C-1997	NPW		X	
Mercury (Hg)	EPA 245.1, 3.0	SDW	X	X	
Mercury (Hg)	EPA 245.1, 3.0	NPW		X	
Metals by ICP/AES	EPA 200.7, 4.4	NPW		X	
Metals by ICP/AES	EPA 6010 C	NPW			
Metals by ICP/AES	EPA 6010 C	Soil, Paint Chips, Dust Wipes			X
Metals by ICP/MS	EPA 200.8, 5.4	NPW		X	
Metals by ICP/MS	EPA 200.8, 5.4	SDW	X	X	
Metals by ICP/MS	EPA 6020 A	NPW			

Method Title	Method Number	Matrix	MDE*	VELAP*	A2LA*
Lead in Paint and Surface Coatings	CPSC-CH-E1003-09.1	Paint Chips			X
Lead in Children's Metal Jewelry	CPSC-CH-E1001-08.2	Metal Jewelry			X
Coliforms by Colilert P/A	SM 9223 B-1995	SDW	X	X	
Coliforms by Colilert Quantitray	SM 9223 B-1998	SDW	X	X	
Coliforms by Colilert Quantitray	SM 9223 B-1998	NPW		X	
Coliforms by Multiple Tube - MPN	SM 9221 BEF-1995	SDW	X		
Coliforms by Multiple Tube - PA	SM 9221 BEF-1995	SDW	X		
Coliforms by Multiple Tube - MPN	SM 9221 BEF-1995	NPW			
Heterotrophic Plate Count	SM 9215 B-1995	SDW	X		
Fecal Coliforms by Multiple Tube, A1	SM 9221 E-2006	NPW			
Fecal Coliforms by Multiple Tube, A1	SM 9221 E-1995	SDW	X		
Fecal Streptococci	SM 9230 B-1995	NPW			
Enterococci	SM 9230 B-1995	NPW			
Enterococci by Enterolert Quantitray	SM 9230 D-2007	NPW			
Diesel Range Organics (DRO) by GC/FID	EPA 8015 B	NPW		X	
Gasoline Range Organics (GRO) by GC/FID	EPA 8015 B	NPW			
Haloacetic Acids	EPA 552.2, 1.0	SDW	X		
PCBs by GC/ECD	EPA 8082 A	NPW			
Pesticides by GC/ECD	EPA 8081 B	NPW			
Pesticides/PCBs by GC/ECD	EPA 608	NPW			
Semivolatile Organics by GC/MS	EPA 625	NPW		X	
Semivolatile Organics by GC/MS	EPA 8270 D	NPW			
Volatile Organics by GC/MS	EPA 8260 B	NPW			
Volatile Organics by GC/MS	EPA 624	NPW		X	
Volatile Organics by GC/MS	EPA 524.2, 4.1	SDW	X		

* Accreditation Certifications and List of Accredited Parameters/Methods are available upon request.

APPENDIX E

ACRONYMS

Acronym	Description
A2LA	American Association for Laboratory Accreditation
ASTM	American Society of Testing and Materials
BOD	Biochemical Oxygen Demand
CAR	Corrective Action Report
CBOD	Carbonaceous Biochemical Oxygen Demand
CCB	Continuing Calibration Blank
CCCS	Continuing Calibration Check Standards
CCV	Continuing Calibration Verification
CHP	Chemical Hygiene Plan
CF	Calibration Factor
CFU	Colony-Forming Units
COA	Certificate of Analysis
COC	Chain of Custody
COD	Chemical Oxygen Demand
COD	Coefficient of Determination (R^2 or r^2)
DMRQA	Discharge Monitoring Report Quality Assurance
DOC	Dissolved Organic Carbon
DOC	Demonstration (or Documentation) of Capability
DOC	Demonstration (or Documentation) of Continued Proficiency
DPO	Departmental Purchase Order
DQO	Data Quality Objective
ECD	Electron Capture Detector
FB	Field Blank
FD	Field Duplicates
FOA	Fields of Accreditation
GALP	Good Automated Laboratory Practices
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GLP	Good Laboratory Practices
HAA	Haloacetic Acids
HEM	Hexane Extractable Material (aka Oil and Grease)
HPC	Heterotrophic Plate Count
IC	Ion Chromatography
ICCS	Initial Calibration Check Standard
ICP	Inductively Coupled Plasma
ICP/AES	Inductively Coupled Plasma/Atomic Emission Spectrometry
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
ICV	Initial Calibration Verification
ID	Identification
IDC	Initial Demonstration of Capability
IDP	Initial Demonstration of Performance
IDL	Instrument Detection Limit
IPC	Instrument Performance Check
IPC	Initial Performance Check

Acronym	Description
IPR	Initial Precision and Recovery Standards
IR	Infrared
ISO	International Organization for Standardization
IT	Information Technology
LCR	Linear Calibration Range
LCS	Laboratory Control Sample
LD	Laboratory Duplicate
LDR	Linear Dynamic Range
LFB/LFBD	Laboratory Fortified Blank/Laboratory Fortified Blank Duplicate
LFM/LFMD	Laboratory Fortified Matrix/Laboratory Fortified Matrix Duplicate
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation
LPC	Laboratory Performance Check Solution
LRB	Laboratory Reagent Blank
MDE	Maryland Department of the Environment
MDL	Method Detection Limit
MPN	Most Probable Number
MS	Mass Spectrometer
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
MRL	Minimum Reporting Level
MTF	Multiple Tube Fermentation
MU	Measurement Uncertainty
NA	Not Available
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NLLAP	National Lead Laboratory Accreditation Program
NPDES	National Pollutant Discharge Elimination System
NPW	Non-Potable Water (aka wastewater)
NTU	Nephelometric Turbidity Units
OSHA	Occupational Safety and Health Administration
P/A	Presence/Absence
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
pH	Potential of Hydrogen (measurement of acidity or basicity)
PO	Purchase Order
PPB	Parts Per Billion (µg/L, µg/kg)
PPE	Personal Protective Equipment
PPM	Parts Per Million (mg/L, mg/kg)
PQL	Practical Quantitation Limit
PT	Performance or Proficiency Test
QA	Quality Assurance
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC or QCS	Quality Control Sample

Acronym	Description
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RF	Response Factor
RT	Retention Time
SDR	Safe Drinking Water (LIMS matrix code)
SDW	Safe Drinking Water
SDWA	Safe Drinking Water Act
SGT-HEM	Silica Gel Treated - Hexane Extractable Material (aka TPH)
SIC	Spectral Interference Check
SM	Standard Methods
S/N	Signal-to-Noise Ratio
SOP	Standard Operating Procedure
SPC	Standardized Plate Count
SOP	Standard Operating Procedure
SVOA	Semi-Volatile Organic Analysis
SVOC	Semi-Volatile Organic Compound(s)
TB	Trip Blank
TDS	Total Dissolved Solids
THM	Trihalogenated Methane(s)
TTHM	Total Trihalogenated Methane(s)
TKN	Total Kjeldahl Nitrogen
TNI	The NELAC Institute
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
VELAP	Virginia Environmental Laboratory Accreditation Program
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound(s)
WAS	Waste (LIMS matrix code)
WAW	Wastewater (LIMS matrix code)
WP	Water Pollution
WS	Water Supply
WW	Wastewater

APPENDIX F

DEFINITIONS

Accuracy – The quality control indicator which measures the degree of agreement between an observed value and an accepted reference value. Accuracy is calculated as percent recovery. Accuracy close to the accepted value indicates a process is in control; low or high accuracy indicates a process may be out of control.

Annual – Recurring, done or performed within a calendar year.

Batch – A group of project samples and associated QC samples that are prepared and/or analyzed with the same batch or reagents together. The number of field samples allowed in a batch varies by method, but is generally limited to 20 samples, which are initiated during on day. "Preparation" batches are prepared/processed/extracted/digested together. "Analytical" batches are analyzed together.

Blank – A QC sample used to monitor contamination during sampling, transport, storage, preparation and/or analysis. See Calibration Blank, Field Blank, Instrument Blank, Laboratory Reagent Blank, Trip Blank.

Blank Spike (BS) – A QC sample used to monitor accuracy (recovery) within a batch of samples processed together. Known amounts of target analytes are added to an aliquot of laboratory reagent blank matrix during preparation or analysis. See LCS or LFB.

Calibration – To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device.

Calibration Blank (CALBLK, CB) – A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards or surrogate analytes. The calibration standard may be a zero standard and/or used to auto-zero the instrument and evaluate instrument stability.

Calibration Curve – The mathematical correlation between the known values, such as concentrations, of a series of calibration standards and the instrument's measure of response/height of those standards. The range of the known values must bracket the sample measurement, and the lowest concentration must be at or below the reporting limit. Various types of calibration curve models may be used: linear regression, calibration factor, or quadratic regression. A calibration curve may use internal standards or external standards.

Calibration Factor (CF) – A factor that measures the response of the detector (usually organic instruments) to the concentration of standard analyzed, used to calculate concentrations of target compounds in project samples. The CF has become interchangeably used as a "Response Factor" in the environmental industry; however Response Factor usually involves the use of internal standards.

Coefficient of Determination (COD, R^2, r^2) – The square of the correlation coefficient represents the proportion of common variation in the two variables

Continuing Calibration Verification (CCV) – A mid-level calibration standard prepared from the same source as the calibration standards which is used to verify that the initial calibration of instrument meets a defined set of performance criteria during the analysis.

Correlation Coefficient (CC, R, r) – A statistic used for evaluate the association between variable inputs and outputs of an initial calibration. It ranges from +1 (perfect positive correlation: higher input goes with higher output) to -1 (perfect negative correlation: higher input goes with lower output).

Direct Analysis – Samples analyzed directly without sample treatment or digestion, referred to in metals analytical methods.

Data Quality Objectives – DQOs are qualitative and quantitative statements specified to ensure that data of known and appropriate quality are obtained for a specific project, and defined in a QAPP.

Demonstration of Capability (DOC) – An evaluation of method performance by an analyst using a new method or new equipment. The process usually consists of the analysis of four replicate LFBs. For each analyte, the mean recovery and standard deviation of the readings must meet preset criteria.

Duplicates – A quality control measurement of precision between the analysis of two separate samples. Duplicates may be Field Duplicates, Blank Spike Duplicate, Matrix Spike Duplicates.

External Calibration – Uses the response of the analyte in direct relationship to the concentration or amount introduced onto the instrument.

Field Blank (FB) – An aliquot of reagent water that is placed in a sample container and treated as a sample in all respects, including shipment to the sampling site, exposure to the sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FB is to determine if method analytes or other interferences are present in the field environment.

Internal Standard – Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution in mass spectrometry analyses for metals or organics. The internal standard must not be a method target compound or expected in an indigenous sample.

Instrument Blank – An aliquot of reagent water (without surrogate standard) that is analyzed as any other sample, and used to determine if method analytes or other interferences are present in the analysis system.

Instrument Detection Limit (IDL) – The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the same wavelength.

Laboratory Control Sample (LCS) – See Blank Spike.

Laboratory Fortified Blank (LFB) – See Blank Spike.

Laboratory Fortified Matrix (LFM) – An aliquot of a project sample to which known quantities of the method analytes are added in the laboratory. The LFM is prepared and analyzed to determine whether the sample matrix contributes bias to the analytical results. See Matrix Spike.

Laboratory Reagent Blank (LRB) – An aliquot of reagent water or other blank matrices that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with samples. The LRB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or apparatus.

Limit of Detection (LOD) – The minimum concentration of a target compound in a sample that an analytical process can reliably detect. Also known as the MDL.

Limit of Quantitation (LOQ) – The minimum concentration of a target compound in a sample that can be quantitatively determined with acceptable precision and accuracy. This defined concentration can be no lower than the concentration of the lowest calibration standard. Also known as the MRL, PQL, or RL.

Linear Calibration – A calibration model using a least square regression. A linear regression may be a "normal" or "inverse" model.

Linear Calibration Range (LCR) – The concentration range over which the instrument response is linear. Also known as Linear Dynamic Range.

Linear Dynamic Range (LDR) – See Linear Calibration Range.

Matrix – The substrate of a test sample. Laboratory matrices include safe drinking water aqueous (SDW or DRW), non-potable water aqueous (NPW or WAW), surface water (SFW), soil (SOI), wipe (WIP), oil (OIL), paint chip (CHP), solid waste, such as sludge (WAS). Other matrices may be defined as necessary.

Matrix Spike (MS) – See LFM.

Material Safety Data Sheet (MSDS) – Written information provided by vendors concerning a chemical's toxicity, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions.

May – This action, activity, or procedural step is allowed but not required.

May Not – This action, activity, or procedural step is prohibited.

Measurement Uncertainty (MU) – An estimation of error associated with potentially all aspects of the analytical procedure, including weights, volumes, standards, analytical procedures, analyst bias and practice, environmental conditions, and matrix effects.

Method Detection Limit (MDL) – See LOD.

Minimum Reporting Level (MRL) – See LOQ.

Must – This action, activity, or procedural step is required.

Non-Linear Calibration – A calibration model, quadratic or second order polynomial calibration requires at least four (six for organics) standards. The "goodness of fit" of a polynomial equation is evaluated by calculating the Coefficient of Determination, r^2.

Percent Recovery – A calculation performed on blank spikes, sample spikes, and surrogates to determine the accuracy in these QA analyses..

Practical Quantitation Limit (PQL) – The lowest concentration of analyte that can be reported for a sample. This value must be greater that or equal to the MDL, and must be greater than or equal to the lowest standard in the calibration curve. Also known as Reporting Limit.

Precision – The quality control indicator which measures the degree of agreement between replicate measurements. Precision is calculated as percent difference, relative percent difference, or relative standard deviation. Low precision indicates good reproducibility; high precision indicates that a process may be out of control.

Proficiency Evaluation (PE) Sample – Concentration of sample is unknown to all laboratory personnel. External proficiency samples are used for licensure requirements. Also known as PT Sample.

Proficiency Test (PT) Sample – See Proficiency Evaluation Sample.

Quality Assurance Project Plan (QAPP) – A document describing in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria for a specific project.

Quarterly – Recurring, done or performed at least every three months.

Reagent Water – Water demonstrated to be free of the analyte of interest. It is usually prepared from 18 megohm ultrapure, deionized water, also called E-Pure water.

Relative Percent Difference (RPD) – A measure of precision between the results of two samples.

Relative Standard Deviation (RSD) – A measure of precision for a population of results greater than two.

Reporting Level/Limit (RL) – See Practical Quantitation Limit.

Response Factor (RF) – See Calibration Factor.

Secondary Standard – A standard prepared from another source independent of the primary standard, which was used to prepare the initial calibration standard.

Shall – This action, activity, or procedure is required.

Should – This action, activity, or procedure is required.

Spike – A known concentration of target analyte added to a blank matrix or sub-sample to determine accuracy for quality control purposes.

Standard – 1) The document describing the elements of laboratory procedures, and accreditation that set the basis for laboratory practices, i.e., the NELAC standard.

2) A solution of target analyte(s) that is prepared to be analyzed as a calibration or spike for quality control purposes.

Standard Operating Procedure (SOP) – The written procedure used by the laboratory for administrative, quality assurance, technical or analytical activities that are followed by staff.

Stock Standard– A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source.

Surrogate – A pure analyte which is extremely unlikely to be found in any sample, which is added to a sample aliquot in a known amount before extraction or other processing and is measured with the same procedures used to measure other sample components. The purpose of the surrogate is to monitor the method performance for each sample.

Trip Blank (TB) – An aliquot of reagent water that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical interferences are present in the field environment.

MARTEL LABORATORIES JDS, INC.
Standard Operating Procedure

TITLE: Biochemical Oxygen Demand (5 Day BOD) and Carbonaceous BOD

METHOD: SM 5210-B – 2001

LIMS:	BOD, CBOD
FORMS:	06B01BA, 06B01BB
REPORTING LIMIT:	1 mg/L
MATRIX:	NPW

Prepared By: _____
Laboratory Analyst

Approved By: _____
Laboratory Manager

Approved By: _____
Technical Director

COMPANY CONFIDENTIAL

1. Method Summary

Samples of wastewater, waste, polluted water or other material, or an appropriate dilution is incubated for 5 days at 20°C in the dark. The reduction in dissolved oxygen concentration during the incubation period yields a measure of the biochemical oxygen demand.

2. Scope and Application

This procedure uses an empirical test for the determination of biochemical oxygen demand (BOD) and carbonaceous biochemical oxygen demand (CBOD) to determine the relative oxygen requirements of wastewaters, effluents, and polluted waters. Application of the test allows calculation of the effects that discharging these materials will have on the oxygen resources of the receiving waters. These calculations are used in the development of engineering criteria for the design and construction of wastewater treatment plants. The range of this procedure is 1 to 100,000 mg/l with a detection limit of 1 mg/L, if an undiluted sample is analyzed, or 2 mg/L , if a 2x dilution of a sample is analyzed.

3. Safety, Waste Handling, and Pollution Prevention

All procedures performed in the laboratory require basic laboratory safety procedures. Safety glasses, laboratory coats, aprons, gloves, long pants, and closed-toed shoes are required for all operations. The analyst should be familiar with the laboratory's Chemical Hygiene Plan and the appropriate material safety data sheets (MSDS). Analysts shall maintain the Laboratory's chemical segregation and storage policies as outlined in the Quality Manual and Chemical Hygiene Plan. Dispose of any remaining reagent, standard, sample or extract thereof according to the guidelines in the Chemical Hygiene Plan and Hazardous Waste Management Plan. Report all major spills and injuries to the Laboratory Manager or Chemical Hygiene Officer immediately.

NOTE: This procedure may use components that are biological hazards, use caution.

4. Definitions

General definitions and acronyms are included in the laboratory's QA Manual, 02Q02, current revision.

5. Interferences

1. Since this is a biological analysis most of the interferences are those that would impact the growth of the bacteria.
2. Chlorine or any other disinfectant and heavy metals will destroy biological activity and therefore impact the analysis negatively.
3. Positive interference can come from organic and nutrients that the analysis procedure adds to the test matrix. For example, sodium sulfite, the chemical used for dechlorination, has a BOD value. Dilution water, if improperly prepared, can have a positive BOD value.
4. Toxicity from organic or inorganic materials can cause calculated BOD values to be low due to depressed depletion of oxygen. Toxicity is noted when, a) the value of subsequent dilutions increases dramatically (e.g. 500 dilution =>550 mg/l and the 1000 dilution => 1100 mg/l) or, b) if the depletion is the same for subsequent dilution. An RSD of >50 % is a guideline for the occurrence of toxicity.
5. All glassware is washed with hot soapy water and rinsed with hot water prior to use.

6. Equipment and Supplies

Identification of instrument model and serial numbers, and documentation of instrument maintenance is documented in the assigned instrument maintenance logbook, according to SOP 02E01.

1. Incubation bottles - 300ml capacity with ground glass stoppers and caps to prevent evaporation.

2. BOD incubator - Temperature controlled at 20 +/- 1 °C.
3. Graduated cylinders, 100, 250, 500, 1000 ml
4. Beaker, 600 ml.
5. Dissolved oxygen meter with probe
6. pH meter, or narrow range pH paper.
7. Stirring bars and magnetic stirrer
8. Analytical Balance
9. Weighted water aerator
10. Plastic Transfer Pipet (disposable)
11. Chlorine test strips
12. Narrow Range pH paper, pHydrion Vivid ph 6-8, or equivalent, with increments of 6.0, 6.4, 6.8, 7.0, 7.2, and 8.0; or equivalent

7. Reagents and Standards

Preparation and traceability of reagents and standards are documented according to SOP 02R01 and 02S02.

1. Phosphate buffer solution - 8.5g KH2PO4, 21.75g K2HPO4, 33.4g Na2HPO4.7H2O, 1.7g NH4Cl in 1 liter DIW. The pH of this solution should be 7.2.
2. Magnesium sulfate solution - 22.5g MgSO4.7H2O to 1 L DIW.
3. Calcium chloride - 27.5g CaCl2•2H2O to 1 L water.
4. Ferric chloride solution - 0.25g FeCl3.6H2O to 1 L DIW.
5. BOD Nutrient Buffer Pillows, Hach Cat No. 14862-66 or equivalent may also be used in lieu of the four solutions described above.
6. Acidic/alkali solutions - 1N H2SO4 and NaOH, 28ml conc. H2SO4/L DIW , 40g NaOH/L DIW.
7. Sodium sulfite - 1.575g Na2SO3 to 1 L DI water. Prepare fresh whenever necessary for dechlorination.
8. TCMP (2-chlor-6-(trichloro methyl) pyridine) - Hach #2579-24 (2.2% TCMP)
9. Glucose-glutamic acid solution – Ricca Cat. No. 3255-16 or equivalent. This may also be prepared as follows: Dry reagent grade glucose and glutamic acid at 103 degrees C for 1 hour. Add 150mg glucose and glutamic acid to 1 L DIW. Dispense 5ml into a culture tube, loosely capped, autoclave at 120 deg C for 10 minutes. Allow to cool, tighten cap and store in 4 deg C refrigerator until needed. Storage up to 6 months. One tube is used per batch. Dispense the standard directly into a BOD bottle then treat as a sample. Dilution factor is 60 fold. True value 198 mg/L. Preparation date and time will be recorded on the BOD bench sheet.
10. Deionized chlorine free water.
11. Freshly collected/prepared seed material – Seed may be collected from Baltimore's Back River Wastewater Treatment Plant. Alternately Polyseed, Thomas Cat. No. 9855D20 may be used.

8. Sample Handling and Preservation

1. Sample handling shall follow the guidelines in the SOP Sample Storage, 02S04, appropriate revision. Sample preservation and holding time requirements are outlined in SOP 02S05. Sample aliquots and extraneous materials are processed according to SOP 02S06, Sub-sampling Procedures.

2. Refer to the QA/QC Data Review checklist at the end of this SOP for sample preservation, storage, and holding time requirements.

9. Sample Preparation

1. Preparation of dilution water

    a. Fill a 18 liter Carboy container with DI water, place in an incubator at 20 deg C, and aerate for no more than 24 hours before use.

b. Add phosphate buffer, magnesium sulfate, calcium chloride, and ferric chloride at the rate of 1 ml per liter. Add buffers one at a time directly to the water in the carboy. Do not co-mix with the other buffers. Purchased buffers may also be used as described in the manufacturer's instructions. Store buffered carboy at room temperature, and aerate for no more than 24 hours.
c. Clean after each use and store upside down to dry before each use.

2. Seeding

a. Seed source - Samples must have a population of microorganisms capable of oxidizing the biodegradable organic mater in the sample. A sample of these organisms must be maintained and replenished frequently. The preferable seed source is a domestic wastewater, un-chlorinated effluent from biological waste treatment plants. Martel acquires this seed source weekly from the Back River (Baltimore City) wastewater treatment plant, which is collected by City staff. This is a reliable, consistent seed source. If this is not available, a synthetic seed (Polyseed) is available from scientific supply houses (see below).
b. Seed control - Determine the BOD of the seed material as any other sample and use this information to determine the amount of seed to put into BOD bottles during the procedure when seeding is required. Procedure: Put 3 ml, 6 ml, and 9 ml of well shaken seed source material with date of acquisition into bottles, fill with dilution water, and incubate for 5 days. Calculate depletions of each bottle using the "ratio" method to determine seed correction per ml of seed. Calculate the mg/ml by divided the depletion by amount of ml added; then average all results that have a depletion of 2 mg/l and a final DO of at least 1 mg/l.
c. Seed Check – Each day of analysis, prepare one seeded blank, with the amount of seed added to each sample added as determined from the Seed Control analysis.

3. Sample pretreatment

a. The sample must be warmed to 20±3 °C before analysis. Warming can be performed by warming an aliquot of the sample in warm water. Use of microwave is not permitted.
b. The pH of the sample must be between 6 and 8. If it is not, adjust with the appropriate acid or alkali solution. The initial dilution may be used for the pH measurement and adjustment. Refer to the Orion 4 Star Meter User Manual for the correct calibration and measurement procedures. Use either pH meter or Narrow Range pH paper.
c. Samples containing residual chlorine must be dechlorinated with sodium sulfite that has been freshly made that day. Test with chlorine test strips.
d. If CBOD is requested, then add TCMP, the nitrification inhibitor to each bottle at the prescribed rate recommended by the manufacturer. The Hach reagent comes with a dispenser and a recommendation of two additions per BOD bottle.
e. Samples having a DO >9.21 at 20°C (the oxygen saturation at Baltimore's average atmospheric pressure of 30.3" Hg) must be aerated to remove excess oxygen. Do this by shaking vigorously.

4. Dilution technique

a. Dilutions that result in a residual DO of at least 1 mg/l and a DO uptake of at least 2 mg/l, including the seed, must be used. Several dilutions are normally required based on the appearance or other characteristics of the sample. Prior knowledge of the sample source is most helpful in determining the correct dilution range to use. Serial dilutions are made by placing the appropriate amount of sample into a container or the 300 ml BOD bottle and adding the appropriate amount of dilution water. If an initial dilution is required, a minimum of 100 ml of sample is use in the dilution. At least three dilutions of each sample must be incubated to assure that the sample range is not missed by over or under dilution.

Serial dilutions should be performed according to the following procedure:

Shake sample well to ensure mixing. Carefully pour 50 to 100 ml aliquots into 100 ml graduate. Pour contents into 500 ml graduate. Do not rinse the contents of the 100 ml graduate into the 500 ml graduate.

Add dilution water to volume (300 to 500 ml) in a 500 ml graduate. To mix, pour the contents of the 500 ml graduate into a closeable container. Either stir to mix or pour back and forth to mix. If initial dilution is to be used, pour into the BOD bottle. Otherwise, pour into the 100 ml graduate that has been rinsed with tap and deionized water, an appropriate amount of the first dilutions. Rinse out the 500 ml graduate and the closeable container, and drain the rinsate. Add the first dilution in the 100 ml graduate into the 500 ml graduate and continue as above. All dilutions must be well mixed. Fill BOD bottles to overflowing and tap the sides to dislodge any entrapped air bubbles.

b. Several dilution schemes can be used to accurately prepare the sample for analysis. The following are four scenarios that are routinely used:

Clean water - 1x - straight mixed sample(S) + seed, bottle 1
2x - 250ml(S) + 250ml dilution water = (A) fill bottle, bottle 2
8x – 125ml (A) + 375 dilution water = bottle 3
The range of values for clean water under this scenario is 2 to 80 mg/l. A detection limit of 1 mg/l can be estimated if the DO uptake is only 1 mg/l for the undiluted sample. This should be used only if it is a client specific requirement.

Moderate - 5x - 100ml(S) to 500 ml= (A) fill bottle, bottle 1
20x - 125 ml (A) to 500ml= (B) fill bottle, bottle 2
80x - 75 ml (B) + remainder dilution water, bottle 3
The range of values for moderate water under this scenario is 10 to 320 mg/l.

Average - 50x - 100ml(S) to 500 ml = (A), 50 ml (A) to 500 ml= (B) fill bottle, bottle 1
200x - 125 ml (B) to 500 ml= (C) fill bottle, bottle 2
800x - 75 ml (C) + remainder dilution water, bottle 3
The range of values for average waters under this scenario is 100 to 3200 mg/l.

Dirty water - 500x - 100ml(S) to 500ml= (A), 50ml(A) to 500ml= (B), 50ml(B) to 500ml= (C), bottle 1
2000x - 125ml(C) to 500ml= (D), bottle 2
8000x – 125ml(D) + remainder dilution water, bottle 3
The range of values for dirty waters under this scenario is 1000 to 32000 mg/l.

If there is no history on the sample a broader range of dilutions must be used in order to cover a broader range of BOD values (such as 2, 20, 200 and 2000). The experience of the analyst is invaluable in determining which range to use.

The analyst selects dilutions based on the following criteria:

1) Sample history. If samples from the same source and description have been performed repeatedly, then the same dilutions are performed.
2) Appearance. If the sample looks particularly clean or has noticeably high organics solids different dilutions are selected.
3) Sample description. Frequently samples are identified as "WWTP effluent" or "final effluent", or "manhole number 2".
4) Odor. High odor, (particularly sulfide odor) usually indicates high dilutions are required.
5) Client instructions. Clients will indicate a range in which the result may be found.

c. If the pH of the undiluted sample has not been checked and adjusted to 6.0 – 8.0, be sure to check and correct the pH of the sample or the initial dilution prior to making the serial dilutions, as discussed in Section 9.3.a.

5. Procedure using seed (the majority of our samples are seeded)

Calculate the amount of seed to add to each BOD bottle (usually 1 to 3 ml). Add as a minimum in ml (0.6/Derived seed control average). (e.g. , if seed control (sc) is 0.6 mg/ml, minimum to add is 1 ml, max would be 1.6 ml).

10. Sample Analysis

1. Calibrate the Dissolved Oxygen probe on the Orion 4 Star Meter as described in the User Manual. Replace the electrolyte dilution daily, gently clean the probe every two weeks, replace membrane when it is visibly damaged or otherwise compromised. Probe should be stored over damp but not very wet sponge in calibration tube.

2. Determination of the initial DO - The initial DO is measured as soon as possible after the dilution phase is completed.
   a. Insert the DO probe into the BOD bottle and start the stirrer.
   b. Take the reading as described in the user manual.
   c. Insert the ground glass stopper and cover with an evaporation cap. Care must be taken to assure that there is a water seal above the ground glass stopper cap. This assures that no oxygen can pass into the bottle.
   d. Measure all dilutions for all samples including quality control.
   e. This value is recorded for the calculation of the BOD after the 5 day incubation period.

3. Incubation - Cap and water seal all bottles immediately after initial DO readings are taken. Place all samples and QC into the temperature controlled incubator and leave for 5 days.

4. Determination of the final DO - The final DO is measured at the end of the 5 day incubation period, plus or minus 6 hours. This procedure is the same as 2 above. This value is recorded and used in the calculation of the BOD.

11. Calculation and Data Reporting

1. Results of testing are reported using LIMS, according to SOP 02D03.

2. Report BOD if nitrification has not been inhibited. Report CBOD if nitrification inhibitor is used.

3. When the water is not seeded:

   BOD (mg/l)= (Initial DO – Final DO) x Dilution Factor

4. When dilution water is seeded:

   BOD (mg/l) = ((Initial DO - Final DO) - (Seed Control Value Added)) x Dilution Factor

   Where: Seed Control Value Added = S x Vs, where S is seed control value in mg/l, and Vs is the volume of seed added to the bottle.

5. Values that meet the following requirements are averaged and the average reported:
   a. the sample has at least 1 mg/l residual DO
   b. the DO uptake is at least 2 mg/l including the seed
   c. the dilution must not exhibit toxicity at higher concentrations, or show any other anomaly to be included

6. Values that do not meet the requirements in Section 4 are reported (less than or greater than) and qualified as follows:

a. If the residual or final DO for all dilutions of a sample is less than 1mg/L, report greater than (>) the BOD value calculated using the initial DO value from the highest dilution (or smallest sample volume):

BOD (mg/L) > ((Initial DO - 1.0 mg/L) - (Seed Control Value Added)) x Dilution Factor

Qualify the report stating "sample analyses did not meet the method criteria for residual dissolved oxygen greater than 1mg/L."

b. If the uptake or difference or depletion DO for all dilutions of a sample is less than 2mg/L, report less than (<) the BOD value calculated:

BOD (mg/L) < (2.0 mg/L) x Lowest Dilution Factor

If the initial dilution of the sample is 1x or 2x, the data does not need to be qualified. Otherwise, qualify the report stating "sample analyses did not meet the method criteria for oxygen uptake greater than 2mg/L."

c. If the uptake or difference or depletion DO for all dilutions of a sample is less than 2mg/L, AND the residual or final DO for all dilutions of a sample is less than 1mg/L, then the value is reported estimated as the range between the calculated value of the highest dilution that :

(BOD (mg/L) > ((Initial DO - 1.0 mg/L) - (Seed Control Value Added)) x Dilution Factor)
TO
(BOD (mg/L) < (2.0 mg/L) x Lowest Dilution Factor)

12. Quality Control, Acceptance Criteria, and Corrective and Preventive Action

1. Refer to the QA/QC Data Review checklist at the end of this method; the bench sheet(s) and the QA Manual for quality control frequency and acceptance criteria requirements. Qualify results that do not meet the requirements in the QAQC Data Review Checklist.

2. Control limits are prepared, maintained, and evaluated according to SOP 02C02, current revision.

3. QC results that do not meet method acceptance criteria, deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet, and corrective and preventive actions are documented according to SOP 02C06.

4. Corrective actions for an analysis that cannot be repeated due to holding times are used to qualify the data and correct procedures for future tests. The analyst monitors the quality control requirements to observe trends that indicate consistent failure, and due to the 5-day analysis and multiple analytical variables of this method, identifying root cause may be difficult. For example if the dilution water depletion exceeds 0.2 mg/l the report will contain a note explaining that and new dilution water will be made up for the next batch. Corrective Actions shall be documented according to the Corrective Action SOP. The following quality control activities are monitored by the analyst to actions may be taken to identify correct quality control failures.

5. Dilution water check - If the depletion exceeds 0.2 mg/l the DI water used for dilution water must be replaced. Dilution water is currently prepared and checked daily.

6. Glucose-Glutamic acid check (GGA) – Compare laboratory generated control limits to the acceptable range of 198mg/l +/- 30.5 mg/l. If control limits are outside the range, re-evaluate the control limits and investigate the source of the problem. New seed will be obtained and the dilution water replaced.

7. Replication - If the RPD is unacceptable, the dilution with the largest depletion should be reported. If toxicity is exhibited, the highest dilution with a valid result should be reported. If the RPD is >30%, then the associated sample results in that batch must be qualified.

8. Seed control - The acceptance range for this value is between 0.6 and 1.0 mg/l. If the value is outside this range the source of the seed and the frequency of collection must be checked. A new seed control study will be conducted to determine the amount of seed to be added to the new batch of dilution water.

9 Supersaturation - Initial DO < 9.21 at 20 C. Sample is considered supersaturated if the initial DO > 9.21.

   a. Samples with DO > 9.21 at 20 °C should have the excess removed prior to setup and incubation. This can be achieved by shaking and allowing air to escape or purging the sample with air until the DO reading is no longer supersaturated as stated elsewhere in the method.

   b. Samples supersaturated with DO are often the result of temperatures below 20 deg C. Storage at 4 degrees C is often a cause. Sample temperature at setup must be 20 +/- 3 deg C. If a sample is > 9.21, then the temperature will be recorded, and the Solubility of Oxygen in Water Table below will be consulted, and the initial DO is acceptable if less than the DO:

Pressure (inches Hg)	17.0 dC	18.0 dC	19.0 dC	20.0 dC	21.0 dC	22.0 dC	23.0 dC
30.3	9.79 mg/L	9.59 mg/L	9.40 mg/L	9.21 mg/L	9.03 mg/L	8.86 mg/L	8.69 mg/L

   c. Samples that are undergoing photosynthesis may be causing excessive oxygen production which results in initial DO >9.21. Prepare greater dilutions of that sample.

10. If DO probe readings are unexpected and unstable. Recalibrate probe. Replace membrane. Replace probe.

11. Perform troubleshooting and corrective action according to manufacturer's instructions and as discussed in the referenced method.

13. Method Performance

1. Initial and ongoing method performance is demonstrated by demonstration of capability, according to SOP 02C01, method detection limit studies, SOP 02D01, and performance evaluation studies, SOP 02P03.

2. Initial and ongoing analyst performance is demonstrated according to SOP 02C01.

14. Records and Documentation

All electronic and manually recorded data are maintained in bound laboratory notebooks or data file folders maintained by the assigned analyst, and is stored in archives after final review and reporting, according to SOP 02B01 and 02B02. Analyst shall review and flag data according to SOP 02D01, Data Review. Any deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet. The data and systems are backed up and archived in accordance with SOP 02A01, Automated Laboratory Operations.

15. References

1. Martel Quality Assurance Manual, 02Q02, current revision.

2. "Standard Methods for the Examination of Water and Wastewater," Method 5210-B, Approved 2001.
3. "Orion Star and Star Plus Meter User Guide", Rev B, 2008, Thermo Scientific.
4. "A Bug's Eye View of the BOD Test", Perry Brake, May 2012.
5. "Standard Methods for the Examination of Water and Wastewater," Method 4500-O G, Approved 2001.

16. Significant Changes and Method Exceptions

1. Added Method Performance Section.
2. Added reference to control limits.
3. Minor format changed.
4. Added glassware cleaning procedures.

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BOD/CBOD (biochemical oxygen demand)
QA/QC DATA REVIEW CHECKLIST

Analysis Date: _____

QC Parameter	Frequency	Conc.(mg/l)	Acceptance Criteria	Analyst	Review
Analysis Holding Time	Every Sample		≤ 48 hrs (regulatory) required ≤ 24 hours (method)		
Sample Preservation	Every Sample		< 2hrs, none, 4°C (method), ≤ 6°C (regulatory)		
Sufficient Sample	Every Sample		500 ml		
Sample pH	Every Sample		pH 6-8, or adjust to 7.0-7.2		
Initial DO	Every Sample, each dilution		Initial DO < 9.21, unless Sample Temp < 20°C		
Blank	1/carboy		< 0.2 mg/L		
Glucose-Glutamic Acid for BOD	1/day	198 mg/l	BOD 167.5-228.5 mg/l CBOD 167.5-228.5 mg/l		
Seed Control – to determine seed amount added and calculations	Each new seed source		0.6-1.0 mg/l Use value for calculations		
Seed Check	Each day		0.6-1.0 mg/l		
Sample Duplicate	1/20 Samples	Both samples at same dilutions	RPD ≤ 30%		
Sample Results	Every dilution		DO Depletion > 2.0 mg/L, DO Residual > 1.0 mg/L		
Sample Results	Every dilution		5 days ± 6 hours		
Calculations Verified					
Transcriptions/Error Corrections	All		Single line, Initialed and Dated		
Control Charts	Each Batch		Trending up or down		
Support Equipment (Storage Refrigerator, Balances, Pipettes, etc.)	Each Day		Checked, Initialed and Dated		
Data Sheets	Each Batch		Checked, Initialed and Dated		
Data Qualified	Each Batch		Completed		

Comments: _____

_____

_____

_____

Analyst/Date: _____ Reviewer/Date: _____

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MARTEL LABORATORIES JDS, INC.
Standard Operating Procedure

TITLE: CHLOROPHYLL A and PHEOPHYTIN A

METHOD: SM 10200-H

Prepared By:_____
Technical Manager

Approved By:_____
Laboratory Manager

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1. Method Summary:

The concentration of chlorophyll *a*, a photosynthetic pigment, is determined spectrophotometrically at 750,664, 647, and 630nm after maceration and extraction with acetone. This is called the trichromatic method which determines chlorophyll *a* that is uncorrected for pheophytin *a*, which is a degradation product of chlorophyll *a*. It is determined by acidification of the chlorophyll *a* extract with HCl and measurement of absorbances at 665 and 750nm. The chlorophyll *a* determined this way is the pheophytin corrected chlorophyll *a*.

2. Scope and Application:

Phytoplankton (microscopic algae) are often used as indicators of water quality. Since all phytoplankton contain chlorophyll *a*, the concentration of chlorophyll *a* extracted from a groundwater sample can be used to assess its quality

3. Safety, Waste Handling and Pollution Prevention Procedures:

All procedures performed in the laboratory require basic laboratory safety procedures. Safety glasses, laboratory coats, aprons, gloves, long pants, and closed-toed shoes are required for all operations. The analyst should be familiar with the laboratory's Chemical Hygiene Plan and the appropriate material safety data sheets (MSDS). Analysts shall maintain the Laboratory's chemical segregation and storage policies as outlined in the Quality Manual and Chemical Hygiene Plan. Dispose of any remaining reagent, standard, sample or extract thereof according to the guidelines in the Chemical Hygiene Plan and Hazardous Waste Management Plan. Report all major spills and injuries to the Laboratory Manager or Chemical Hygiene Officer immediately.

NOTE: Materials used in this procedure are highly/moderately flammable, use caution in handling and keep away from a flame.

4. Definitions:

General definitions are included in Standard Methods.

5. Interferences:

Light will degrade chlorophyll *a*, use opaque containers or wrap with aluminum foil.

6. Apparatus:

1. Tissue grinder
2. Centrifuge tubes, 50 ml graduated, screw cap.
3. Glass fiber filters (0.45 µm porosity, 47-mm diameter)
4. Vacuum filtration set-up
5. Genesys spectrophotometer
6. Glass cuvettes 1 cm path length

7. Reagents / Materials:

1. 90% acetone- add 100 ml of deionized water to 900 ml of acetone, mix and store in amber bottle.
2. 100 mg/m^3 standard – pre-made, (Sigma-Aldrich C5753-1MG).

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8. Sample Handling / Preservation:

1. Filter the sample as soon as possible after collection. If processing must be delayed, hold samples on ice or at 4°C and protect from exposure to light
2. Use opaque bottles because even brief exposure to light during storage will alter chlorophyll values
3. Samples on filters taken from water having pH 7 or higher may be wrapped in foil, placed in airtight plastic bags and stored frozen for 3 weeks.

9. Sample Preparation Procedure:

Sample aliquots shall be obtained according to SOP 02S06, Sub-sampling Procedures. Extraneous materials shall be processed according to SOP 02S06.

10. Sample Analysis Procedure:

A. Pheophytin Uncorrected Chlorophyll *a* – Trichromatic Method:

1. Filter 100ml of the sample through a 0.45 micron glass fiber filter. Larger amounts may be filtered in order to reduce the detection limit.

2. Once the sample has been filtered, place filter in a tissue grinder, cover with 2 to 3 ml 90% acetone solution, and macerate at 500 rpm for 1 min.

3. Transfer sample to a screw-cap centrifuge tube, rinse grinder with a few milliliters of 90% acetone, and add the rinsate to the extraction slurry. Adjust total volume to 10 ml with 90% acetone. Use solvent sparingly and avoid excessive dilution of pigments. Steep samples for at least 2 h at 4°C in the dark.

4. Clarify by filtering through a solvent-resistant disposable filter, or by centrifuging in closed tubes for 20 min at 500 g.

5. Analyze samples on the spectrophotometer at 630nm, 647nm, 664nm, and 750nm using a 1cm light path:
   a. Turn on and select test.
   b. Select multi wavelength
   c. From Stored Tests, select Chloroa
   d. Enter number of samples.

B. Pheophytin *a* and Pheophytin-Corrected Chlorophyll *a*:

1. Filter 100ml of sample through a 0.45 micron glass fiber filter. Larger amounts may be filtered in order to reduce the detection limit.

2. After filtration place the filter in a tissue grinder, cover with 2 or 3 ml of 90% acetone solution and macerate at 500 rpm for 1 min.

3. Transfer the sample to a screw-cap centrifuge tube, rinse the grinder with a few ml of acetone solution, and add the rinsates to the centrifuge tube. Adjust the volume to 10 ml with 90% acetone solution, and steep the sample for at least 2 hours at 4°C in the dark.

4. Clarify the sample by filtration or by centrifuging for 20 min at 500g (2500rpm).

5. Measure the absorbances of the sample at 750 and 664nm in a 1cm sample cell.

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6. Add 0.1ml of 0.1 N HCl to the cuvette and stir gently.

7. Wait exactly 90 seconds (this step is time sensitive) and measure the absorbances at 750 and 665nm.

11. Calculations and Data Reporting:

A. Uncorrected Chlorophyll *a:*

1. All wavelength readings are used to calculate the final chlorophyll *a* results in mg/m^3 or ug/L. Chlorophyll *a* results are calculated by entering in the wavelength data in to a spreadsheet located in the directory M:\WetChem\Chloroa. Results are reported in mg/cubic meter, and are valid for default values of 10ml of extract, 100ml of sample filtered, and a 1cm path length.

2. If done manually, the calculation is as follows:

   a. Subtract the optical density (OD) at 750u from the other three readings. (The reading at 750u is a turbidity correction.)

   b. $Ca = 11.85(OD664) - 1.54(OD647) - 0.08(OD630)$

   c. Chlorophyll *a* (mg/cubic meter) = $Ca \times \frac{\text{Volume of Extract}}{\text{Volume Filtered}}$

B. Pheophytin *a* and Corrected Chlorophyll *a*:

1. Subtract the absorbance at 750nm from the absorbances at 664 and 665nm (Turbidity correction).

2. Corrected Chlorophyll *a* (ug/L or mg/M^3) = $26.7\ (664B - 665A) \times \frac{\text{Volume of Extract}}{\text{Volume Filtered}}$

3. Pheophytin *a* (ug/L or mg/M^3) = $26.7(1.7[665A] - 664B) \times \frac{\text{Volume of Extract}}{\text{Volume Filtered}}$

Where: 664B = Corrected absorbance at 664nm before acidification
665A = Corrected absorbance at 665nm after acidification

12. Quality Control:

1. A method blank must be run with each sample batch.
2. An initial calibration standard of 100 mg/m^3 is analyzed prior to analyzing samples.
3. Laboratory replicates are analyzed at a frequency of once per batch or 10% of the sample population, whichever is greater.

13. Acceptance Criteria and Troubleshooting/ Corrective Action:

All method acceptance criteria and laboratory control limits shall be documented on the bench sheet. Out-of-control data shall be documented according to SOP 02N01, Nonconforming Work. Corrective action shall be initiated according to SOP 02C06, Corrective Action, when required. Contingencies for handling out-of-control or unacceptable data are included in the SOP 02C03, Equipment/ Personnel Contingency.

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14. Records and Documentation:

All written data are kept in bound laboratory notebooks or standards preparation books maintained by the appropriate analyst. Analyst shall review data according to SOP 02D01, Data Review. This review shall be documented and shall include checks for transcription errors, omissions, and mistakes. Any deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet. All case narratives shall be recorded on the bench sheets. Narratives must contain enough information (date, analyst signature, sample identification) to uniquely link back to the data. Data shall be flagged according to the guidelines established in SOP 02D01, Data Review. A copy of this bench sheet and any other raw date such as strip charts and computer printouts are kept in a secure file room. The bench sheets are self-explanatory with appropriate instruction noted on each sheet. These documents are maintained and archived in both onsite and offsite secure storage facilities. The data and systems are backed up and archived in accordance with SOP 02A01, Automated Laboratory Operations, and its references.

15. References:

"Standard Methods for the Examination of Water and Wastewater," 19th Edition, 1995, Method 10200-H.

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MARTEL LABORATORIES JDS, INC.
Standard Operating Procedure

TITLE: ENZYME SUBSTRATE (COLILERT) TOTAL COLIFORM AND E. COLI ANALYSIS - ENUMERATION USING THE IDEXX QUANTI-TRAY PROCEDURE

METHOD: SM 9223B-2004

LIMS:	ECOLIQ, COLIQ
REPORTING LIMIT:	0.5 ug/L
MATRIX:	SDW, NPW

Prepared By: _____
Laboratory Analyst

Approved By: _____
Laboratory Manager

Approved By: _____
Technical Director

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1. Method Summary

The enzyme substrate test utilizes hydrolyzable substrates for the simultaneous detection of total coliform bacteria and Escherichia coli enzymes. When the enzyme technique is used, the total coliform group is defined as all bacteria possessing the enzyme β-D-galactosidase, which cleaves the chromogenic substrate, resulting in release of the chromogen and producing a yellow color. Escherichia coli are defined as bacteria giving a positive total coliform response and possessing the enzyme β-glucuronidase, which cleaves a fluorogenic substrate, resulting in the release of the fluorogen which fluoresces under ultraviolet light.

2. Scope and Application

The IDEXX Laboratories' Colilert Quanti-Tray procedure is used for the simultaneous detection, specific identification, confirmation, and enumeration of total coliforms and E. coli in potable and E.coli only in non-potable water. Results of the examination of Quanti-Tray wells and their dilutions are reported in terms of the Most Probable Number (MPN) of organisms present. Any and all Quanti-Tray wells that test positive for total coliforms must be checked for the presence of E. coli by looking for fluorescence under a long wavelength (365-366 nanometer) UV light. This method is required for enumeration of Escherichia coli in wastewater.

3. Safety, Waste Handling, and Pollution Prevention

All procedures performed in the laboratory require basic laboratory safety procedures. Safety glasses, laboratory coats, aprons, gloves, long pants, and closed-toed shoes are required for all operations. The analyst should be familiar with the laboratory's Chemical Hygiene Plan and the appropriate material safety data sheets (MSDS). Analysts shall maintain the Laboratory's chemical segregation and storage policies as outlined in the Quality Manual and Chemical Hygiene Plan. Dispose of any remaining reagent, standard, sample or extract thereof according to the guidelines in the Chemical Hygiene Plan and Hazardous Waste Management Plan. Report all major spills and injuries to the Laboratory Manager or Chemical Hygiene Officer immediately. All microbiology samples must be autoclaved prior to disposal.

NOTE: This procedure may use components that are biological hazards, use caution.

4. Definitions

General definitions and acronyms are included in the laboratory's QA Manual, 02Q02, current revision.

5. Interferences

There are no apparent interferences however if the sample is not adequately shaken prior to analysis, the MPN value can result in an underestimate of the bacteria present.

6. Equipment and Supplies

Identification of instrument model and serial numbers, and documentation of instrument maintenance is documented in the assigned instrument maintenance logbook, according to SOP 02E01.

1. Long wavelength UV light, 365 - 366 nm.
2. IDEXX Quanti-Tray Sealer, Model 2X

7. Reagents and Standards

Preparation and traceability of reagents and standards are documented according to SOP 02R01 and 02S02. Prepare reagents as stated in SOP 06P01.

1. 120ml sterile vessels w/ Sodium Thiosulfate IDEXX cat # WV120STSB-200, or equivalent
2. Color and Fluorescence (c/f) comparator P/A IDEXX cat # WP104, or equivalent
3. Sterile dilution water, non buffered
4. IDEXX Quanti-Tray/2000 cat # WQT2K
5. IDEXX Colilert Media cat # WP200I

8. Sample Handling and Preservation

1. Sample handling shall follow the guidelines in the SOP Sample Storage, 02S04, appropriate revision. Sample preservation and holding time requirements are outlined in SOP 02S05. Sample aliquots and extraneous materials are processed according to SOP 02S06, Sub-sampling Procedures.

2. Samples are to be collected in sterile containers, transported on ice, stored ≤6°C, and analyzed as soon as possible.

3. For nonpotable water for compliance purposes, the 40CFR136 holding time is 8 hours. Some headspace is necessary to permit the shaking of sample prior to inoculation.

4. For drinking water for compliance purposes, the holding time is 30 hours. Some headspace is necessary to permit the shaking of sample prior to inoculation.

5. Sodium thiosulfate is added to containers provided by Martel prior to sterilization. This compound reduces chlorine and other halogens, which inhibits further bacterial growth in the sample, during transport and storage. Residual chlorine is checked prior to analysis.

9. Sample Preparation

1. Shake the sample and, if necessary, adjust the volume to 100 mL

2. Add one Colilert packet to the sample, cap and shake the bottle until the Colilert powder dissolves.

3. For an undiluted sample the Quanti-Tray/2000 has a range of <1 – 2419.6 MPN. This may be extended to 2,419,600 MPN by a 1000X dilution with sterile dilution water. This is done as follows:

   a. Shake the sample well.
   b. Pipet 0.1 mL of sample into 100 mL of sterile, non-buffered dilution water.
   c. Shake the diluted sample, and proceed starting with sample analysis.

10. Sample Analysis

1. Turn on the Quanti-Tray Sealer and allow it to warm up. This may take up to 10 minutes. The Sealer will not operate until both the amber power light and the green ready lights are illuminated.

2. Use one hand to hold the Quanti-Tray upright with the well side facing the palm.

3. Squeeze the upper part of the Quanti-Tray so that the Tray bends toward the palm.

4. Gently pull the foil tab to separate the foil from the tray. Avoid touching the inside of the foil or tray.

5. Pour the sample mixture into the Quanti-Tray, avoiding contact with the foil tab. Tap the small wells 2-3 times to release any air bubbles. Allow the foam to settle.

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6. Place the sample-filled Quanti-Tray onto the rubber insert of the Quanti-Tray Sealer with the well side of the tray facing down. Make sure the tray is properly seated with each well of the tray in its corresponding rubber insert hole.

7. Slide the rubber insert and tray into the Sealer (small wells in first) until the motor grabs the insert and begins to draw it into the Sealer.

8. In approximately 15 seconds the tray will be sealed and partially ejected from the rear of the sealer. Remove the rubber insert and tray.

9. Incubate the Quanti-Tray at 35 +/-0.5 °C for 24 hours.

10. After the appropriate incubation period remove the sample from the incubator and compare it to the c/f comparator. If the sample is lighter in color than the comparator the result is negative. If the sample is the same or darker than the comparator, the Total Coliform result is positive. Count the large and small positive (yellow) wells and refer to the appropriate Quanti-Tray MPN Table to find the MPN for total coliform.

11. Confirm the positive wells for E.coli by viewing them in a darkened room under a long wavelength (365-366 nm) UV light. If a well fluoresces it is positive for E.coli.

12. Count the large and small wells that fluoresce and refer to the Quanti-Tray MPN Table to find the MPN for E. coli.

11. Calculation and Data Reporting

1. Results of testing are reported using LIMS, according to SOP 02D03.

2. Count the number of large and small wells, including the large one on the top of the Tray that test positive for total coliform and refer to the IDEXX MPN Table located in SOP 06M02. Do the same for the wells that test positive for E. coli.

   NOTE: Positive results for drinking water must be reported to the project manager so that the affected client can be notified immediately. If that manager is not available, the Technical Director and/or Project Operations Director must be notified. If they are not available the technician must fax the client using form 02C07F01 – Positive Microbiological Information Fax Form to inform the client of the positive result. The notification procedures outlined in SOP 02C07, Client Notification Procedures for Microbiology Violations must be followed.

12. Quality Control, Acceptance Criteria, and Corrective and Preventive Action

1. Refer to the QA/QC Data Review checklist in SOP 06B02 and the QA Manual for quality control frequency and acceptance criteria requirements. Perform corrective action and qualify results that do not meet the requirements.

2. QC results that do not meet method acceptance criteria, deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet, and corrective and preventive actions are documented according to SOP 02C06.

3. Color comparator must be stored in the dark and used within its expiration date.

4. Perform media performance test on each new lot of Colilert media using the presence/absence procedure (SOP 06C08). Inoculate with three control bacteria: Escherichia coli, a total coliform other than E. coli

(Enterobacter aerogenes) and a noncoliform (Psuedemonas sp., nonfluorescent). Avoid using a heavy inoculum, and set up a sterile water control. Proceed as described in SOP 06C08.

5. Prior to use of each batch of sterile dilution water, the dilution water must be tested for sterility according to SOP 06P01, Media and Dilution Water Preparation. The results are recorded, and if any growth is observed that particular batch is invalidated. Dilution water is also checked for pH.

6. Each lot of sample bottles is checked for sterility by filling a randomly selected bottle with 50 ml of Tryptic Soy broth, incubating at 35°C, and checking for turbidity after 24 and 48 hours. None should be detected.

7. The 100 mL line of each lot of sample bottles is checked for accuracy by filling a 100 mL graduated cylinder to the mark with water, transferring the entire volume to the sample bottle, and comparing the level of the meniscus with the line on the sample bottle. The tolerance is +/- 2%.

8. The Quanti-Tray Sealer should be checked monthly by adding a dye (e.g. bromcresol purple) to reagent water, transferring the colored water to a Quanti-Tray, and passing it through the Sealer. If dye is observed outside the wells, sealer maintenance must be performed.

9. Perform troubleshooting and corrective action according to manufacturer's instructions and as discussed in the referenced method.

13. Method Performance

1. Initial and ongoing method performance is demonstrated by demonstration of capability, according to SOP 02C01, and performance evaluation studies, SOP 02P03.

2. Initial and ongoing analyst performance is demonstrated according to SOP 02C01.

14. Records and Documentation

All electronic and manually recorded data are maintained in bound laboratory notebooks or data file folders maintained by the assigned analyst, and is stored in archives after final review and reporting, according to SOP 02B01 and 02B02. Analyst shall review and flag data according to SOP 02D01, Data Review. Any deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet. The data and systems are backed up and archived in accordance with SOP 02A01, Automated Laboratory Operations.

15. References

1. Martel Quality Assurance Manual, 02Q02, current revision.
2. Martel Microbiology QAQC SOP, 06B02, current revision.
2. IDEXX Colilert and Quanti-Tray information contained on the website www.idexx.com.
3. "Standard Methods for the Examination of Water and Wastewater", Method 9223B, approved 2004.

16. Significant Changes and Method Exceptions

1. Changed method reference to 2004 approved.

MARTEL LABORATORIES JDS, INC.
Standard Operating Procedure

TITLE: MULTIPLE-TUBE FERMENTATION TECHNIQUE FOR FECAL COLIFORM USING A-1 MEDIUM

METHOD: SM 9221E-2006

LIMS:	FECALA
REPORTING LIMIT:	2 MPN/100mL
MATRIX:	NPW

Prepared By: _____
Analyst

Approved By: _____
Laboratory Manager

Approved By: _____
Technical Director

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1. Method Summary

This procedure using A-1 broth is a single-step method for determination of fecal coliforms. A confirmation phase is not required. This test is performed as a multiple-tube procedure.

2. Scope and Application

This procedure is applicable to source water, seawater, and treated wastewater.

3. Safety, Waste Handling, and Pollution Prevention

All procedures performed in the laboratory require basic laboratory safety procedures. Safety glasses, laboratory coats, aprons, gloves, long pants, and closed-toed shoes are required for all operations. The analyst should be familiar with the laboratory's Chemical Hygiene Plan and the appropriate material safety data sheets (MSDS). Analysts shall maintain the Laboratory's chemical segregation and storage policies as outlined in the Quality Manual and Chemical Hygiene Plan. Dispose of any remaining reagent, standard, sample or extract thereof according to the guidelines in the Chemical Hygiene Plan and Hazardous Waste Management Plan. Report all major spills and injuries to the Laboratory Manager or Chemical Hygiene Officer immediately.

NOTE: This procedure may use components that are biological hazards, use caution.

4. Definitions

General definitions and acronyms are included in the laboratory's QA Manual, 02Q02, current revision.

5. Interferences

There are no apparent interferences. However, if the sample is not adequately shaken prior to analysis, the MPN value can result in an underestimate of the bacteria present.

6. Equipment and Supplies

Identification of instrument model and serial numbers, and documentation of instrument maintenance is documented in the assigned instrument maintenance logbook, according to SOP 02E01.

1. Durham tubes (Thomas, 9187-L21 and Fisher, 14-958A or equivalent)
2. Test tubes (Thomas, 9187-L99 and Fisher, 14-961-32 or equivalent)
3. Pipettes - sterile, disposable 10 mL and 1.1 mL (Thomas, 7529-B20 and 7553-f48 or equivalent)
4. Incubator, capable of maintaining temperatures 35 +/- 0.5 °C and 44.5 +/- 0.2 °C
5. Test tube racks

7. Reagents and Standards

Preparation and traceability of reagents and standards are documented according to SOP 02R01 and 02S02.

1. A-1 medium- (Fisher, DF1823-17-4 or equivalent), or may be prepared as stated in the referenced method.
   a. Double strength – 63.0 grams powder dilute to 1 L
   b. Single strength – 31.5 grams powder dilute to 1 L
2. Sterile water, prepared according to SOP 06P01, Media and Dilution Water Preparation
3. Prepare medium at the desired concentration, dispense into fermentation tubes with an inverted vial to cover inverted vial at least on-half to two thirds after sterilization, close with cap, and sterilize by autoclaving at

121°C for 10 minutes. Ensure inverted vials are free of air bubbles. Store prepared medium in the dark for no longer than 7 days. Ignore any precipitate that may appear.

8. Sample Handling and Preservation

1. Sample handling shall follow the guidelines in the SOP Sample Storage, 02S04, appropriate revision. Sample preservation and holding time requirements are outlined in SOP 02S05. Sample aliquots and extraneous materials are processed according to SOP 02S06, Sub-sampling Procedures.

2. Samples are collected in sterile containers, stored ≤6°C, and analyzed within 8 hours of collection.

3. Sodium thiosulfate is included in the sterile containers provided by Martel. This compound inhibits further bacterial growth during transport and neutralizes halogens, if present, within the sample.

9. Sample Preparation

1. Shake sample vigorously about 25 times immediately prior to transferring to inoculate media.

2. Check sample to ensure residual chlorine is not present.

10. Sample Analysis

1. In a test tube rack, set up tubes of A-1 medium according to the guidelines in SOP 06M02, MPN Tube Selection and Interpretation of Results.

2. Label tubes with log number and sample ID. Record this information on bench sheet as well.

3. Transfer sample to inoculate the media. **Never allow pipette to draw sample lower than 2 cm. from sample surface.** Inoculate media tubes with the appropriate sample volumes (refer to SOP 06M02, MPN Tube Selection and Interpretation of Results).

4. Shake the test tube rack gently then incubate in large incubator maintained at 35 +/- 0.5 °C for 3 hours. Transfer rack to a waterbath maintained at 44.5 +/- 0.2 °C for 21 hours +/- 2 hours. Total incubation time should be within 22 to 26 hours with no more than 23 hours incubation at 44.5 +/- 0.5 °C.

5. Examine Durham tubes for gas production. Positive gas production will cause media to become turbid and small bubbles to be produced after gently shaking.

6. Record the number of positive tubes in each row under the appropriate dilution factor, in the Fecal 10 ml lab manual or Fecal 1.0 ml manual if the MPN value was expected to exceed 2400 organisms/100 ml.

11. Calculation and Data Reporting

1. Results of testing are reported using LIMS, according to SOP 02D03.

2. Calculate MPN using the Tables in SOP 06M02. Ensure results take into account applicable dilutions (multiply result by dilution factor).

12. Quality Control, Acceptance Criteria, and Corrective and Preventive Action

1. Refer to the Microbiology QA/QC SOP; the bench sheet(s) and the QA Manual for quality control frequency and acceptance criteria requirements. Perform corrective action and qualify results that do not meet the requirements.

2. QC results that do not meet method acceptance criteria, deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet, and corrective and preventive actions are documented according to SOP 02C06.

3. Perform troubleshooting and corrective action according to manufacturer's instructions and as discussed in the referenced method.

4. Prior to using each lot of media, the media must be tested for sterility. A portion of media is incubated as outlined in SOP 06P01, Media and Dilution Water Preparation, and recorded. Any growth is noted and results related to that particular batch are invalidated.

5. Deionized water used in microbiological testing is tested monthly for Heterotrophic Plate Count, chlorine and conductivity, according to SOP 02R02.

6. Prior to use, dilution water must be tested for sterility according to SOP 06P01, Media and Dilution Water Preparation. If any growth is observed that batch is invalidated.

7. Each new batch of media is inoculated with known positive and negative controls. The tests are carried out through the procedure along with a blank. If the positives are not positive and the negatives are not negative the data is invalidated.

8. A duplicate analysis should be performed every 20 samples if sufficient sample is available. The results are recorded on the laboratory bench sheet and in the QC system.

13. Method Performance

1. Initial and ongoing method performance is demonstrated by demonstration of capability, according to SOP 02C01, method detection limit studies, SOP 02D01, and performance evaluation studies, SOP 02P03.

2. Initial and ongoing analyst performance is demonstrated according to SOP 02C01.

14. Records and Documentation

All electronic and manually recorded data are maintained in bound laboratory notebooks or data file folders maintained by the assigned analyst, and is stored in archives after final review and reporting, according to SOP 02B01 and 02B02. Analyst shall review and flag data according to SOP 02D01, Data Review. Any deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet. The data and systems are backed up and archived in accordance with SOP 02A01, Automated Laboratory Operations.

15. References

1. Martel Quality Assurance Manual, 02Q02, current revision.
2. Martel Microbiology QA/QC SOP, 06B02, current revision.
3. Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition, January, 2005.
4. "Standard Methods for the Examination of Water and Wastewater", Method 9221, approved 2006.

16. Significant Changes and Method Exceptions

1. Added Method Performance Section.
2. Minor format changed.
3. Added method specific corrective action procedures.
4. Updated reference from 9221-1994 approved to 92212006 approved.
5. Added references to the Reagent Water SOP, 02R02, and the Microbiology QA/QC SOP 06B02.
6. Added LIMS method code, reporting limit, and matrix.
7. Changed holding time from 6 to 8 hours, per 40CFR136, and storage temperature to $\leq 6^{\circ}C$.
8. Added discussion of inverted vial during preparation and sterilization of media.
9. Added incubator and test tube racks to equipment section.

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MARTEL LABORATORIES JDS, INC.
Standard Operating Procedure

TITLE: Total Suspended Solids (Non-Filterable Residue)

METHOD: SM 2540 D-1997

LIMS:	SS
FORMS:	06R03BA1, 06R03BA2, 06R09BA1
SPREADSHEET:	<SS Calc.xls> and <VSS Calc.xlsx>
REPORTING LIMIT:	1 mg/L
MATRIX:	NPW

Prepared By: _____
Laboratory Analyst

Approved By: _____
Laboratory Manager

Manual Changes MSB 04/30/14

Approved By: _____
Technical Director

1. Method Summary

A well-mixed sample is filtered through a weighed standard glass-fiber filter. The residue retained on the filter is dried to a constant weight at 103 to 105°C. The increase in weight of the filter represents the total suspended solids. If the suspended material clogs the filter and prolongs filtration, it may be necessary to increase the diameter of the filter or decrease the sample volume. The filtrate from this method may be used for dissolved solids analysis using SOP 06R02.

2. Scope and Application

This method is applicable to drinking, surface, and wastewaters. The practical range of the determination is 1 mg/l to 200 mg/l, although this range may be extended by adjusting the sample size. Solids analyses are important in the control of biological and physical wastewater treatment processes and for assessing compliance with regulatory agency wastewater effluent limitations.

3. Safety, Waste Handling, and Pollution Prevention

All procedures performed in the laboratory require basic laboratory safety procedures. Safety glasses, laboratory coats, aprons, gloves, long pants, and closed-toed shoes are required for all operations. The analyst should be familiar with the laboratory's Chemical Hygiene Plan and the appropriate material safety data sheets (MSDS). Analysts shall maintain the Laboratory's chemical segregation and storage policies as outlined in the Quality Manual and Chemical Hygiene Plan. Dispose of any remaining reagent, standard, sample or extract thereof according to the guidelines in the Chemical Hygiene Plan and Hazardous Waste Management Plan. Report all major spills and injuries to the Laboratory Manager or Chemical Hygiene Officer immediately.

NOTE: Caution should be used due to the high temperatures required in this procedure.
NOTE: This procedure may use components that are biological hazards, use caution.

4. Definitions

General definitions and acronyms are included in the laboratory's QA Manual, 02Q02, current revision.

5. Interferences

1. Filtration apparatus, filter material, pre-washing, post-washing, and drying temperature are specified because these variables have been shown to affect the results. Samples high in dissolved solids, such as saline waters, brines and some wastes, may be subject to a positive interference. Care must be taken in selecting the filtering apparatus so that washing of the filter and any dissolved solids in the filter minimizes this potential interference. Because excessive residue on the filter may form a water-entrapping crust, the sample size should be limited to that yielding no more than 200 mg of residue.

2. Glassware should be cleaned with hot soapy water, rinsed with DI water prior to use.

6. Equipment and Supplies

Identification of instrument model and serial numbers, and documentation of instrument maintenance is documented in the assigned instrument maintenance logbook, according to SOP 02E01.

1. Filter support apparatus w/reservoir and a fritted disc
2. Suction flask, 1000 ml
3. Drying oven, 103-105°C, with temperature monitored using a calibrated thermometer.

4. Desiccator, with drierite dessicant
5. Dessicant, Drierite (change when blue turns pink)
6. Balance capable of weighing to 0.1 mg, calibrated before use.
7. Water faucet equipped with an aspirator
8. Glass filter discs without organic binder – pre-weighed, (Environmental Express Pro Weigh 47mm 1.5 micron or equivalent).

7. Reagents and Standards

Preparation and traceability of reagents and standards are documented according to SOP 02R01 and 02S02.

1. Standard (LCS): NSI QCI-056L, or equivalent. Prepare as directed.
2. DI water

8. Sample Handling and Preservation

1. Sample handling shall follow the guidelines in the SOP Sample Storage, 02S04, appropriate revision. Sample preservation and holding time requirements are outlined in SOP 02S05. Sample aliquots and extraneous materials are processed according to SOP 02S06, Sub-sampling Procedures.

2. Refer to the QA/QC Data Review checklist at the end of this SOP for sample preservation, storage, and holding time requirements.

9. Sample Preparation

1. Shake the sample vigorously and measure out a volume that yields at least 1 mg, but within 2.5 – 200 mg of dried residue. If the volume filtered fails to meet the minimum amount of residue, increase the sample volume filtered up to 1 L. If filtration takes more than 10 min, decrease the sample volume. The experience of the analyst is essential in determining the correct sample size to filter. If one liter of sample is unavailable, and a minimum of 2.5 mg of residue is not achievable on the sample size available, raise detection limit appropriately, and qualify the results in LIMS to indicate "insufficient volume provided". Therefore a 250 ml sample size has a detection limit of 10 mg/l. The detection limit on a 100 ml sample is therefore 25 mg/l.

2. Prepare Method Blank using 1000mL reagent water.

3. Prepare LCS at 951 mg/L using reagent water, as directed above.

10. Sample Analysis

1. Assemble filtration apparatus and turn on water faucet to provide suction. At this point, the filter should be handled with forceps only!

2. Place filter in apparatus wrinkled side up.

3. Seat by rinsing with small volume of DI water. Continue suction to remove all traces of water. Discard rinsate.

4. Measure adequate sample volume to achieve minimum residue of 2.5 mg and transfer to filter apparatus. If filtration takes more than 10 min, decrease the sample volume.

5. Filter the sample, and rinse the cylinder to ensure complete transfer into the filtration apparatus.

6. Wash the filter with three 10mL volumes of DI water, and continue suction for an additional 3 minutes.

7. Carefully remove the filter from the filter support and place it back in the original tin. Dry at least one hour at 103-105 °C.

8. Cool in a desiccator and weigh to constant weight by returning the sample to the oven and then to the desiccator and re-weighing. The difference between successive weight determinations must be less than 4% or 0.5mg, whichever is less. During periods of high humidity, filters may require additional time in the desiccator and weighing must be performed immediately upon removal from the desiccator. Record the final weight on the bench sheet.

11. Calculation and Data Reporting

1. Results of testing are reported using LIMS, according to SOP 02D03.

2. Calculate suspended solids as follows using the spreadsheet found in:<My Computer\M Drive\ WetChem\Suspended Solids\SS Calc.xls7 or <VSS Calc.xls7.

MLG 04/30/14

TSS mg/L = [(A-B) x 1,000] / C

Where: A = final dry weight in milligrams of filter and residue
B = weight of filter in milligrams
C = ml of sample filtered

3. If residue weight is less than 2.5 mg and sample volume is at least 1L, then the result in LIMS must be qualified to state estimated result.

4. If residue weight is less than 2.5 mg and sample volume is less than 1L, then the result in LIMS must be qualified to state estimated result.

12. Quality Control, Acceptance Criteria, and Corrective and Preventive Action

1. Refer to the QA/QC Data Review checklist at the end of this method; the bench sheet(s) and the QA Manual for quality control frequency and acceptance criteria requirements.

2. Control limits are prepared, maintained, and evaluated according to SOP 02C02, current revision.

3. QC results that do not meet method acceptance criteria, deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet, and corrective and preventive actions are documented according to SOP 02C06.

4. Perform corrective action as discussed in the referenced method.

5. If QC does not meet criteria, reanalyze the samples and QC. If reanalysis fails, reanalyze the sample batch, if additional sample is available. Recalibrate and reanalyze. Prepare new standards. If they are still out of control, try using fresh reagents, cleaning the glassware, etc. until satisfactory results are obtained.

13. Method Performance

1. Initial and ongoing method performance is demonstrated by demonstration of capability, according to SOP 02C01, method detection limit studies, SOP 02D01, and performance evaluation studies, SOP 02P03.

2. Initial and ongoing analyst performance is demonstrated according to SOP 02C01.

14. Records and Documentation

All electronic and manually recorded data are maintained in bound laboratory notebooks or data file folders maintained by the assigned analyst, and is stored in archives after final review and reporting, according to SOP 02B01 and 02B02. Analyst shall review and flag data according to SOP 02D01, Data Review. Any deviations from this SOP, explanation of anomalous results and corrective actions taken are noted in the case narrative section of the bench sheet. The data and systems are backed up and archived in accordance with SOP 02A01, Automated Laboratory Operations.

15. References

1. Martel Quality Assurance Manual, 02Q02, current revision.
2. "Standard Methods for the Examination of Water and Wastewater", Method 2540 D-1997.
3. "Residue, Non-Filterable (Gravimetric, Dried at 103-105°C)", EPA Method 160.2, 1971.

16. Significant Changes and Method Exceptions

1. Changed Reporting Limit to 1 mg/L, based on EPA Method 160.2, Section 7.2, which states to determine weight to at least 1 mg.
2. Added that results will be reported as estimated if weight less than 2.5 mg, as stated in SM 2540D.
3. Added reference to EPA Method 160.2.
4. Changed Method Blank acceptance criteria to less than the reporting limit of 1 mg/L.

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SS (suspended solids)
QA/QC DATA CONTROL CHECKLIST

Excel File: _____

QC Parameter	Frequency	Conc.(mg/l)	Acceptance Criteria	Analyst	Review
Analysis Holding Time	Every Sample		< 7 days		
Sample Preservation	Every Sample		No preservative, cool <6C		
Sufficient Sample	Every Sample	2.5-200mg	100 ml to 1000 ml, if available Sample weight 2.5-200mg		
Method Blank (NELAC Req)	Every 20 samples		1000mL volume		
Method Blank (NELAC Req)	Every 20 samples		≤ MRL (1 mg/L)		
Sample Duplicate	Every 20 samples		±5% RPD		
LCS (NELAC Req)	Every 20 samples	950	70-130% Rec		
Constant Weight	Every Sample		Weigh back (not calc value) ≤5mg or ±4% of average of two values		
Calculations Verified					
Transcriptions/Error Corrections	All		Single line, Initialed and Dated		
Control Charts	Each Batch		Trending up or down		
Support Equipment (Storage Refrigerator, Balances, Pipettes, etc.)	Each Day		Checked, Initialed and Dated		
Data Sheets	Each Batch		Checked, Initialed and Dated		
Data Qualified	Each Batch		Completed		

Comments: _____

_____

_____

Analyst/Date: _____ Reviewer/Date: _____

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Appendix C CSL's QA/ QC Procedures

Revised 4/8/2014

CSL Data QA/QC Procedure

General:

The purpose of the QA/QC procedure is to ensure the data quality of finalized data. Finalized data is that data which has been verified as accurate and suitable to submission to the client. The finalization process should encompass all aspects of the data collection process. Those areas include but are not limited to:

- Data quality and adherence to known hydraulic conditions
- Repeatability of the collected data
- Field Confirmations compared to the collected data
- Historic trending of a given site as well as trending relative to other sites in the same drainage shed
- Collected flow totals as compared to expected flows based on EDU counts

The key personnel involved in this process include the data analyst, the data manager, the project engineer, and the project manager. All data goes through a three-tiered QA/QC procedure. These data QA/QC reviews ensure that the data provided is the most accurate and that any concerns such as systematic and random errors are flagged with proposed corrections.

Data Preparation:

Prior to the commencement of review process, the data analyst must ensure that all data has been processed and is ready for review. These tasks include:

- All data loaded and present in the correct databases
- All field information updated in the electronic field book
- All field points entered into the database
- Basic edits to the data, which includes single point pops and drops
- Preliminary flow numbers entered into the historic spreadsheet

Once this process is complete, the analyst will alert the data manager.

Primary Review:

The primary review of the data involves an appraisal of every site in the project for data quality, an evaluation of any field verifications, an evaluation of the historical trend of each site and also the trending of the average daily flows. The primary reviewer, may it be the data manager, project manager

or the project engineer, documents the review and notifies the next that their review has been completed.

Key responsibilities of the primary review:

- Review every site for data quality and direct analyst to make repairs.
- Evaluate field verifications, impact of equipment changes.
- Evaluate trending of each site in the context of both 3 month and longer term.
- Evaluate trending of flow total or average daily flow.
- Evaluation of flows compared to the number of EDUs contributing to the metered flow.
- Direct analyst to add any sites of concern to the service list.
- Documents the review and hands off to the secondary reviewer. The primary reviewer should be confident in the data being ready for submission subject to the downstream reviews with the exception of any noted sites.

Secondary Review:

During the secondary review, any comments left by the primary reviewer are evaluated and edits are recommended to the data analyst. An evaluation of the average daily flows from all of the sites is also completed by the secondary reviewer. Once they have completed and documented their review, it is passed on to the final reviewer.

Key responsibilities of the secondary reviewer:

- Review 10% of the sites at random for billing projects and all sites for temp projects for data quality and trending.
- Review in detail any sites included in the review from the primary reviewer and direct analyst to make any additional changes.
- Evaluate the flow total/average daily flow for all sites.
- Evaluation of flows compared to the number of EDUs contributing to the metered flow.
- Documents the review and hands off to the final reviewer. The secondary reviewer should be confident in the data being ready for submission subject to the downstream reviews with the exception of any noted sites.

Final Review:

The third and final reviewer looks at all changes that have been made to the raw data at any sites, evaluates how those changes may impact adjacent sites and makes a final determination as to what previous edits will be incorporated and if any additional edits are needed. All changes are documented.

Key responsibilities of the final reviewer:

- Review in detail any sites included in the review form from the secondary reviewer and direct analyst to make any additional changes.
- For billing sites, facilitate the review of the flow totals/average daily flows between all reviewers and the analyst.
- Evaluation of flows compared to the number of EDUs contributing to the metered flow.
- Confirm that all open issues are closed and inform the data manager that the data may be posted or sent to the client.

Data Submission:

Once the data has been finalized and all three reviewers have formally approved the data with a signature and date, the analyst should prepare the reports to be submitted to the client. To prepare the reports, the analyst will ensure that all sites have been calculated and then the flow numbers can be reported in spreadsheet, tabular or other client specified format.

Before submission of the reports to client or to a web based portal, each reviewer will ensure that the report is in agreement with the changes made during the review and finalization process. This check should include identification of data entry errors, or any agreed upon changes that haven't been incorporated.

Revisions to this Procedure:

Should this document require revision due to personnel reorganization, a change in scope, or a perceived shortcoming or correction, a review by all members of the project team is necessary. Once a change is published, the data manger will be responsible for all communication regarding the new process and the method and timing of implementation.

Revised 7/11/13

CSL Field Calibration/Verification Procedure

As part of the operation of flow meters, verifications of meter accuracy are to be performed on a regular basis. Regular can be defined by an interval agreed upon with the client or some other interval based on the length of the project or frequency of site visits. Generally, long term projects should be verified at least quarterly and short term projects, monthly.

Below is the procedure for performing meter calibrations. This procedure only defines the required result and any specific equipment function issues should be referred to the equipment manual or the manufacturer technical support department.

Field Measurements

Field measurements are gathered at the site in order to compare them with the collected meter data. It is critical that measurements are taken in the proper location. As a general rule of thumb, depth should be measured in the place where the velocity sensor is firing into the flow. Velocity should be measured in the flow cross section in front of the velocity sensor.

Depth Measurements:

a) *Direct Measurement:*
Place a carpenter's ruler into the flow such that it touches the bottom of the pipe. Record the depth of the flow. Be careful to not base the measurements off of the flow disturbance immediately in front or behind the ruler but rather the undisturbed surface of the flow.

b) *Indirect Measurement:*
The depth of flow can be calculated by measuring the range of air. This technique can be more accurate at sites that are very deep and/or fast. Measure from the crown of the pipe down to the surface of the flow with a ruler. Subtract this measurement from the pipe height to determine the depth of flow.

Note:
If silt is present, it must be measured as well. If the silt is uniform, measure the depth of silt in the same place where the depth of flow measurement was taken. If it is not uniform, profile the silt by measuring at various points. (Loose silt should be cleared and pushed downstream as much as possible of the sensor so as not to interfere with the velocity sensor.)

Velocity Measurements:

a) *Point Measurement:*
A point measurement is designed to find the peak velocity reading in the flow. Using an electromagnetic velocity probe, move the probe through the flow cross section until a peak reading is found.

b) *Velocity Profile:*
Provided that the depth is sufficient, a velocity profile can be preformed. Measure the velocity in the left, center, and right sides of the flow and measure as many tiers down through the flow in the same fashion for up to 9 total points. These values can then be averaged to determine the average velocity of the flow.

Manually Downloaded Meters

This method should be used for any meter that cannot be interrogated remotely by the data analyst. The field technician should use the *Daily Field Download Sheet* for recording the calibration results.

- Record the date
- Record the field time, which is the local time
- Record the meter time
- Measure the depth of flow
- Record the instantaneous depth reading from the meter
- Measure the peak the velocity
- Record the instantaneous average or peak, whichever is applicable
- Note any service performed at the site, included sensor scrubbing

The resulting meter readings should be within 0.25" for depth and within 10% for peak-to-peak or average-to-average for velocity. Should be readings be outside these guidelines, troubleshoot per the manufacturer guidelines. Should this not resolve the discrepancy, notify the data manager.

Remote Connection Meters

This method should be used for any meter that can be interrogated from the office. The data analyst should use the *Daily Field Download Sheet* for single depth and velocity meters or the *Multi- Sensor Calibration Sheet* for meter types that record multiple depth and/or velocity readings.

- Fill all site visit information fields on form
- Have the field tech measure the depth of flow and record with time
- Record the time and instantaneous depth reading from the meter or fire the depth sensor, whichever is applicable. All available depth sensors should be fired and compared to the field measurement.
- Have the field tech measure the peak the velocity or have them perform a velocity profile if the depth is sufficient and record with time
- Record the time and instantaneous velocity reading from the meter or fire the velocity sensor, whichever is applicable. All available velocity sensors should be fired and compared to the field measurement.
- Note any service performed at the site, included sensor scrubbing

The resulting meter readings should be within 0.25" for depth and within 10% for peak-to-peak or average-to-average for velocity. Should be readings be outside these guidelines, troubleshoot per the manufacturer guidelines. Should this not resolve the discrepancy, notify the data manager.

Special Cases

- Blind Verifications
  A blind verification is when a field technician's only role is to measure the depth and velocity of the flow and report the values to the data analyst. In these cases, the crew is "blind" to what the meter is reading. The data analyst will then compare the readings to current/recent data or live readings. Should the blind verification be out of tolerance, the analyst can direct the crew to perform additional blind verifications, or perform a conventional verification and/or troubleshoot as necessary.

- Installations/Removals
  When installing or removing meters, the above calibration method should be used except that 3 consecutive verifications should be performed at 5 minute intervals.

- Third Party Audit
  When performing a calibration at a meter that is not maintained by CSL and where CSL is to verify the meter function, the CSL Audit report should be used.

General Crew Coverage Overview:

1. Receives call from crew stating location and confirms tasks with crew for site

2. Records site in DA Dailys log.

3. Imports data from ftp site if needed

4. Reviews data for:
    - Data quality: The diurnal pattern is reasonable, repeating, and logical
    - Trending with the site's average depth, velocity, and flow compared to historical
    - Battery voltage

5. Receives call from the crew with cals for site

6. Reviews cals to determine if they are in line with:
    - Instantaneous meter readings
    - Site's historical cals

7. Cals:
    - If OK, crew can move on
    - If not OK, DA and crew troubleshoot

8. DA summarizes work complete at a site in their Dailys log. This includes battery changes, desiccant change, and equipment changes as well as trouble-shooting that was done. This must be kept up-to –date as sites are completed.

Notes:

- Crews are supposed to call back to the office if waiting for 10 minutes and have not heard back from the DA.

CSL's Electronic Field Book Template

Site#										
Pipe Diameter:										
Date	Time	Meter Time	Meter Depth	Field Depth	Meter Vel.	Field Vel.	Silt	Battery	Initials	Service Comments

Appendix H Post Construction Monitoring Plan

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

POST CONSTRUCTION MONITORING PLAN - PHASE 1

May 2014

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

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List of Appendices

A. National Pollutant Discharge Elimination System (NPDES) Permit
B. Flow Meter Location Maps

1 Introduction

1.1 Purpose

The District of Columbia Water and Sewer Authority's (DC Water's) National Pollutant Discharge Elimination System Permit (NPDES Permit) requires conducting post construction monitoring in three phases after various elements of the CSO control program are implemented. The first phase of post construction monitoring is required after rehabilitation of the sewage pumping stations and replacement of the inflatable dams is completed. These system improvements have been completed and this report describes the first phase of monitoring that will be conducted.

1.2 Long Term Control Plan

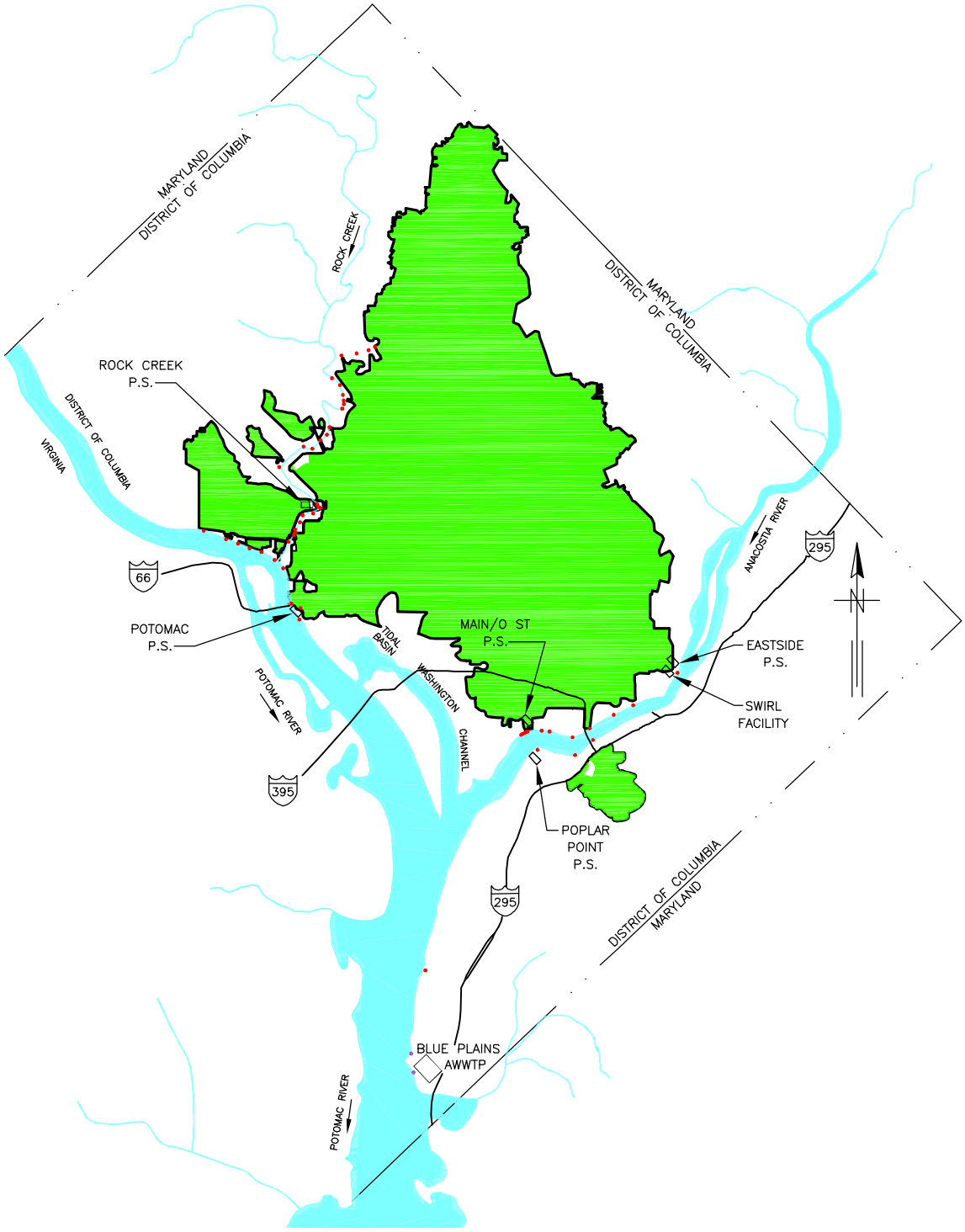
The District of Columbia Water and Sewer Authority (DC Water or Authority) operates a wastewater collection system comprised of separate and combined sewers. Parts of the District are served by separate storm and sanitary sewers. In the combined sewer system (CSS), there is a single sewer to convey storm water and sanitary wastes. The area served by combined sewers comprises about 12,436 acres (about 33 percent) of the District, and is shown on Figure 1-1.

During dry weather, sanitary wastes collected in the CSS are conveyed to the District's advanced wastewater treatment plant at Blue Plains (BPAWWTP or the Blue Plains AWWTP). During periods of rainfall, the capacity of a combined sewer may be exceeded and the excess flow, which is a mixture of storm water and sanitary wastes, is discharged directly through outfalls to the Anacostia River, Rock Creek or the Potomac River or tributary waters. There are a total of 53 active combined sewer overflow (CSO) outfalls listed in DC Water's existing National Pollutant Discharge Elimination System (NPDES) Permit issued by the United States Environmental Protection Agency (EPA).

In accordance with the CSO Policy and its NPDES permit requirements, DC Water submitted a Draft Long Term Control Plan (LTCP or DC Clean Rivers Project , DCCR), to EPA in 2001. After an extensive public participation program which generated over 2,300 comments, DC Water submitted a Final LTCP to the EPA in 2002. The D.C. Department of the Environment (formerly Department of Health) Water Quality Division (DDOE) and the EPA approved the Final LTCP and determined that CSOs remaining after implementation of the plan would not cause or contribute to the exceedance of water quality standards, subject to post construction monitoring. It was also determined that the CSOs remaining after implementation of the plan would comply with total maximum daily loads (TMDLs) established for the receiving waters.

1.3 Total Nitrogen Removal/ Wet Weather Plan

On April 5, 2007, EPA issued a modification to DC Water's NPDES permit. The permit modification included a total nitrogen effluent limit for Blue Plains of 4.689 million pounds per year. The total nitrogen limit was developed by EPA to achieve the goals of the Chesapeake Bay Program for nutrient reductions. In addition to meeting the new effluent limit for total nitrogen, DC Water had existing NPDES Permit requirements for treating wet weather flows at Blue Plains. The latter requirement is part of DC Water's LTCP for the combined sewer system.



LEGEND

- CSO OUTFALL
- WWTP OUTFALL
- COMBINED SEWER AREA
- EXISTING PUMPING STATION

SCALE: 1"=10,000'

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DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING PHASE-I

COMBINED SEWER AREA

DATE: FEBRUARY 2014 | FIGURE 1-1

LAST SAVED BY: CONSTANT A. NORTEY DATE: 2/12/2014 3:12:43 PM
DRAWING ID: L:\LTCP\PCM\REPORT-FIGURES\FIGURE 1-1 CSA.DWG

When the LTCP was finalized in 2002, there was no effluent limit for total nitrogen in DC Water's NPDES permit for Blue Plains and the LTCP. The imposition of the new total nitrogen limit could require a modification to the LTCP and its implementation schedule. DC Water conducted evaluations to assess the impact of adding the new total nitrogen effluent limit on top of the LTCP and existing NPDES permit requirements for treating wet weather flows. On October 12, 2007, DC Water submitted its Final Total Nitrogen Removal/Wet Weather Plan (TN/WW Plan) to EPA. The TN/WW Plan is provided as a companion document to the Consent Decree Modification.

Under the LTCP and the NPDES permit existing at the time, Blue Plains was rated for an annual average flow of 370 mgd. During wet weather events, flows up to 740 mgd receive complete treatment for up to 4 hours. After the first 4 hours, the complete treatment capacity is reduced to 511 mgd to protect the biological process. Additional flows of up to 336 mgd that exceed the complete treatment capacity of the plant receive excess flow treatment, which consists of screening, grit removal, primary treatment and disinfection before being discharged to the Potomac River. This provides a total treatment capacity of 1076 mgd for the first four hours and 847 mgd thereafter.

The TN/WW Plan modified the plant treatment capacities and the handling of flows during wet weather. The major components of the TN/WW Plan are as follows:

- Complete treatment capacity – Blue Plains will provide complete treatment up to 555 mgd for the first four hours and 511 mgd thereafter. In accordance with the existing NPDES permit, combined sewer system flow (CSSF) conditions (i.e., wet weather events) exist and start when plant influent flow is greater than 511 mgd. CSSF conditions stop four hours after plant influent flow drops below 511 mgd or 4 hours has elapsed since the start of CSSF conditions, whichever occurs last.

- Enhanced nitrogen removal (ENR) – ENR facilities will be constructed with capacity to provide complete treatment for the flow rates identified above and to meet the new total nitrogen effluent limit.

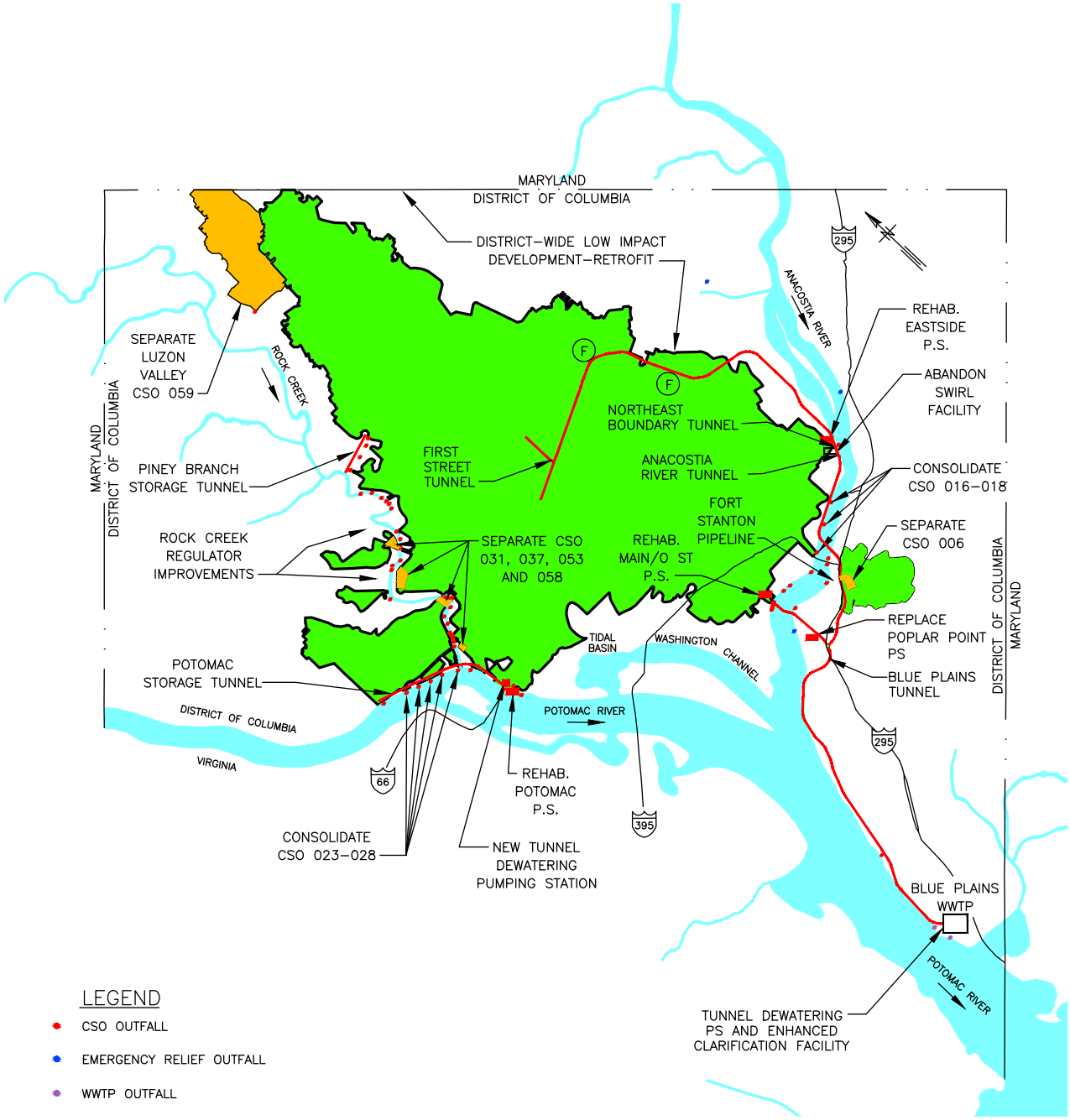
- Enhanced Clarification Facility (ECF) – A 225 mgd ECF facility will be constructed at Blue Plains.

- Tunnel to Blue Plains and System Storage Volume – A new tunnel is being constructed from Poplar Point to Blue Plains. The total tunnels system storage volume will be increased from 126 mg to 157 mg. This new tunnel segment will not only serve as a flow equalization facility but will also allow a reduction in the required capacity of the ECF and the peak flow rates that receive complete treatment at the Plant.

- Outfall Sewer Overflow to Blue Plains Tunnel – Connections between the existing Outfall sewers on the influent side of Blue Plains and the tunnel to Blue Plains will be constructed. These facilities will allow flow from the collection system that exceeds the complete treatment capacity of the plant to overflow into the tunnel.

- Tunnel Dewatering Pumping Station – Under the Final LTCP, a tunnel dewatering pumping station was proposed to be constructed at the tunnel terminus at Poplar Point. As part of the TN/WW plan, the same tunnel dewatering pumping station is relocated to the new terminus of the tunnel at Blue Plains. The pumping station will be sized to have a minimum firm capacity of 225 mgd, equal to the capacity of the ECF. In addition, the facility will have the ability to dewater the tunnel system up to the new ECF and be able to discharge ECF effluent to complete treatment and discharge at Outfall 002 or at Outfall 001. Figure 1-2 shows the TN/WW plan.

The major elements of the LTCP are shown on Figure 1-2.



dc clean RIVERS PROJECT

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DC CLEAN RIVERS PROJECT

LONG TERM CONTROL PLAN

DATE: FEBRUARY 2014

FIGURE 1-2

LAST SAVED BY: JEEDIGUNTA, RAM DATE: 4/1/2014 4:07:18 PM
DRAWING ID: I:\POST CONSTRUCTION MONITORING\05 - REPORTING\FIGURES\FIGURE 1-2 LTCP ELEMENTS.DWG

1.4 Implementation Status

1.4.1 Anacostia River Projects

DC Water and the District of Columbia entered into the Long Term Control Plan Consent Decree (Civil Action No. 1:CV00183TFH). The CD was entered by the court on March 23, 2005, and provides a schedule for implementation of the LTCP.

The Anacostia River Project components included in the LTCP Consent Decree are summarized in Table 1-1.

Table 1-1. Anacostia River Projects in LTCP Decree

Component	Description
Anacostia River	
Storage Tunnel from Poplar Point to Northeast Boundary Outfall	49 million gallon storage tunnel between Poplar Point and Northeast Boundary. Tunnel will intercept CSOs 009 through 019 on the west side of the Anacostia. Project includes new tunnel dewatering pump station and low lift pumping station at Poplar Point.
Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer	77 million gallon storage/conveyance tunnel parallel to the Northeast Boundary Sewer. Also includes side tunnels from main tunnel along West Virginia and Mt. Olivet Avenues NE and Rhode Island and 4th St NE to relieve flooding. Abandon Northeast Boundary Swirl Facility upon completion of main tunnel.
Outfall Consolidation	Consolidate the following CSOs in the Anacostia Marina area: CSO 016, 017 and 018
Separate CSO 006	Separate this CSO in the Fort Stanton Drainage Area
Ft Stanton Interceptor	Pipeline from Fort Stanton to Poplar Point to convey CSO 005, 006 and 007 on the east side of the Anacostia to the storage tunnel.

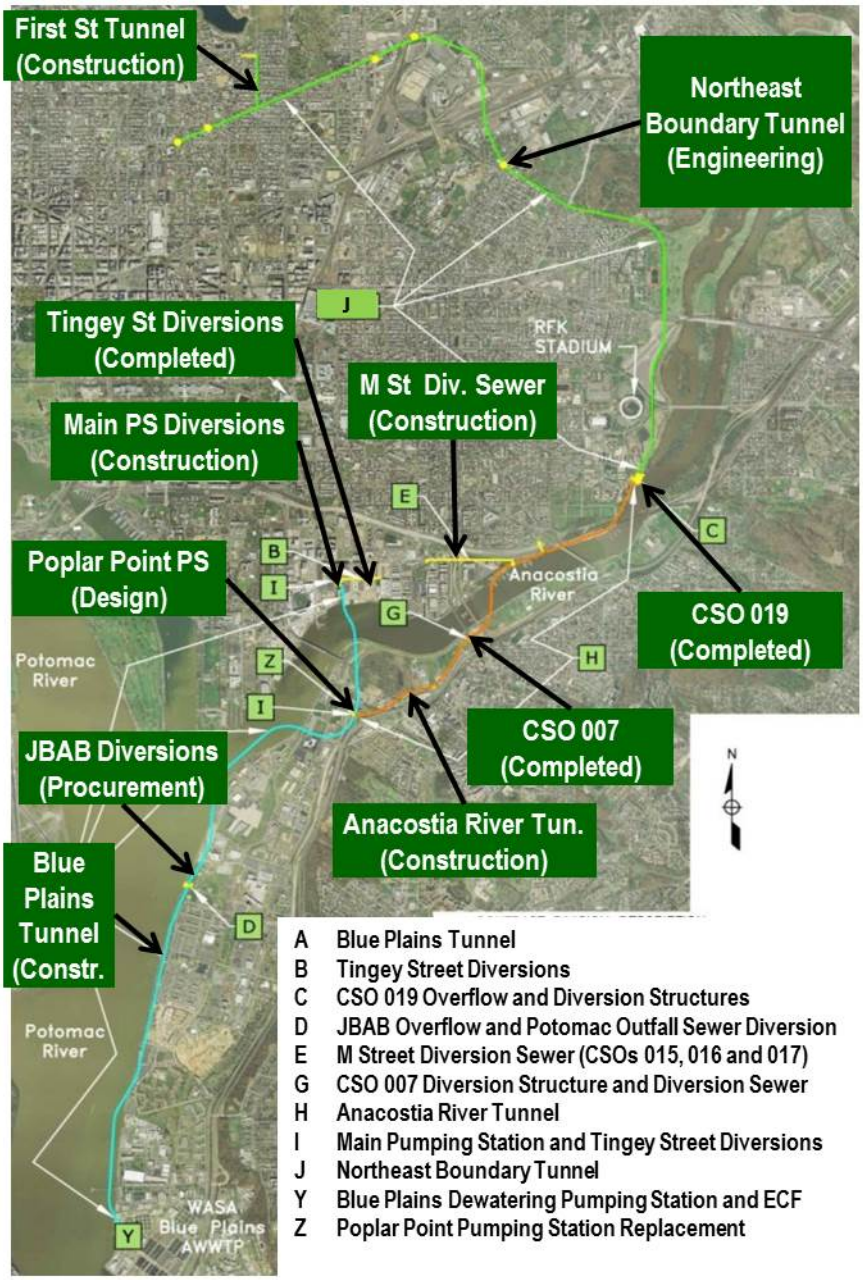
As a result of the TN/WW Plan, DC Water has added 31 mg of storage to the Anacostia Tunnel system for a total of 157 mg of storage. This was accomplished by extending the tunnel from Poplar Point to Blue Plains and constructing the tunnel dewatering pumping station at Blue Plains in lieu of Poplar Point. These and other changes to the LTCP are not reflected in the LTCP Decree. DC Water is proposing to modify the LTCP to conform it to the TN/WW Plan.

Based on the current level of planning, the Anacostia River Projects have been divided into various contract divisions to facilitate implementation. There is one contract division proposed for each of the three major tunnel segments and their associated shafts. The other contract divisions are comprised of near-surface diversion structures, associated diversions, junction sewers and the tunnel overflow structures. The planned contract divisions are listed in Table 1-2. Figure 1-3 shows the contract divisions and the current status of implementation.

Table 1-2. Planned Contract Divisions for Anacostia River Projects

Contract Division	Description
A	Blue Plains Tunnel
B	Tingey Street Diversion Sewer for CSOs 013 and 014
C	CSO 019 Overflow and Diversion Structures
D	Joint Base Anacostia-Bolling Overflow and Diversion Structures
E	M Street Diversion Sewer (CSOs 015, 016, and 017)
G	CSO 007 Diversion Sewer
H	Anacostia River Tunnel
I	Main Pumping Station Diversions and Main Outfall Sewers Diversion
P	First Street Tunnel
J	Northeast Boundary Tunnel
Y	Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility
Z	Poplar Point Pumping Station Replacement

Figure 1-3. Anacostia River Project Status (as of May 2014)



1.4.2 Potomac River Projects

The control measures selected for the Potomac River are predicted to limit overflows to four events per average year. The principal control measures include rehabilitation of the Potomac Pumping Station and construction of a storage tunnel from west of the Key Bridge, along the Potomac River waterfront parallel to Georgetown, and terminating at Potomac Pumping Station. The tunnel will intercept the Georgetown CSOs and the large CSOs downstream of Rock Creek. A new pumping station would be constructed to dewater the tunnel. In addition, the LTCP will consolidate and close all CSOs between the Key Bridge and Rock Creek to remove the impact of these CSOs from the Georgetown waterfront area.

The major elements of the Final LTCP for the Potomac River Projects are summarized in Table 1-3 and are shown on Figure 1-4.

Table 1-3. Potomac River Projects

Component	Description	Status (as of May 2014)
Potomac River		
Replace Inflatable Dams (1)	Replace inflatable dams at Potomac River CSOs where these are installed	Completed
Rehabilitate Potomac Pumping Station (1)	Rehabilitate station to firm 460 mgd pumping capacity	Completed
Outfall Consolidation (2)	Consolidate CSOs 023 through 028 in the Georgetown Waterfront Area.	Future work
Potomac Storage Tunnel (2)	58 million gallon storage tunnel from Georgetown to Potomac Pumping Station. Includes tunnel dewatering pumping station	Future work

Notes:
(1) Required by Three Party Consent Decree
(2) Required by LTCP Consent Decree

Figure 1-4. Potomac River Projects

1.4.3 Rock Creek Projects

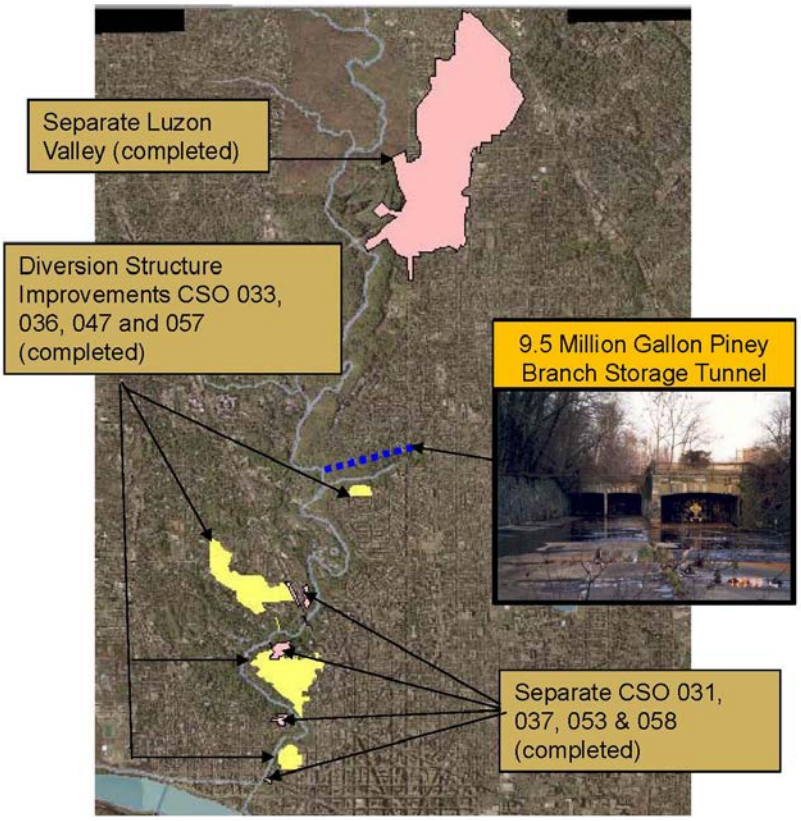
The control measures in the LTCP for Rock Creek are predicted to limit Piney Branch overflows to one per average year. The remaining overflows in Rock Creek will be controlled to 4 events per average year. The principal control measures include separation of four CSOs, construction of a storage tunnel at Piney Branch, and monitoring and regulator improvements to four CSOs south of Piney Branch.

The major elements of the Final LTCP for Rock Creek are summarized in Table 1-4 and are shown on Figure 1-5.

Table 1-4. Rock Creek Projects

Component	Description	Status (as of May 2014)
Rock Creek		
Separate Luzon Valley	Separation CSO 059	Completed
Separation	Separate CSOs 031, 037, 053, and 058.	Completed
Monitoring at CSO 033, 036, 047 and 057	Conduct monitoring to confirm prediction of overflows. If overflows confirmed, then perform the following: • Regulator Improvements: Improve regulators for CSO 033, 036, 047 and 057. • Connection to Potomac Storage Tunnel: Relieve Rock Creek Main Interceptor to proposed Potomac Storage Tunnel when it is constructed	Completed
Storage Tunnel for Piney Branch (CSO 049)	9.5 million gallon storage tunnel	Future work

Figure 1-5. Rock Creek Projects



1.4.4 System-Wide Improvements

The LTCP also includes the following system-wide improvements:

- Low Impact Development Retrofit (LID-R) at DC Water Facilities – the Decree requires DC Water to construct $3 M of LID at DC Water facilities and to evaluate the effectiveness of these measures. The projects have been completed.

- Excess Flow Treatment Improvements at Blue Plains – the Decree requires the addition of four new primary clarifiers and improvement to the excess flow treatment control and operations. Because of the TN/WW plan, these improvements have been deleted and are scheduled to be replaced by a new 225 mgd enhanced clarification facility (ECF).

1.5 NPDES Permit Requirements

Part III, Section D of the permit specifies the required post construction monitoring phases as follows:

- **Phase 1 Monitoring** – Following the placement in operation of the inflatable dams and pumping stations rehabilitation. This program will be conducted for a period of one year in each receiving waters (Anacostia and Potomac Rivers).

- **Phase 2 Monitoring** – Following the placement in operation of the Anacostia, Rock Creek and Potomac storage tunnels, respectively, as each tunnel is placed in operation. This program will be conducted for a period of one year in each receiving waters (Anacostia, and Potomac Rivers and Rock Creek).

- **Phase 3 Monitoring** – Following the placement in operation of the complete CSO tunnels storage system. This program will be conducted once every 5 years for each receiving waters (Anacostia and Potomac Rivers and Rock Creek).

Replacement of the inflatable dams was completed in 2004 and rehabilitation of the last pumping station (Potomac Pumping Station) was completed in October 2013. As a result, Phase 1 monitoring may begin. The permit requires the monitoring to consist of at least the elements in Table 1-5.

Table 1-5. NPDES Permit Requirements- Phase I

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	• 1 gauge in Northeast Boundary • 1 gauge in Tiber Creek	• 1 gauge in Slash Run	• Continuous
CSO Overflow (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary	n/a	• 4 storms minimum approximately 1 hr sample interval for each storm
Receiving Water Monitoring- Dissolved Oxygen (4)	• Continuous DO Monitors	• Continuous DO Monitors	• Approximately 30 minute intervals
Receiving Water Monitoring- Bacteria, Field Parameters (2) (4)	• Bacteria Samples	• Bacteria Samples	• 4 storms minimum

(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for fecal Coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.
(4) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

No monitoring is required in Rock Creek because the inflatable dams and pumping station rehabilitation are not predicted to have a measurable effect on these CSOs. Each of the above listed plan elements is described in detail in the followings sections of this monitoring plan.

1.6 Organizations Involved in Monitoring

The following organizations are involved in this monitoring phase:

- DC Water - Operates the combined and separate sanitary sewer systems in the District.
- DCCR- Engineering firms providing professional engineering services to DC Water in support of the LTCP effort via a program management contract known as Program Consultant Organization (PCO).
- Metropolitan Washington Council of Governments (MWCOG) - supports a Regional Monitoring Subcommittee (RMS) that coordinates the local monitoring efforts of federal, state, and local government agencies in Maryland, Virginia, and the District of Columbia. MWCOG maintains a centralized database and performs processing, analysis, and disbursement of ambient monitoring data.

2 Rainfall Monitoring

2.1 General

The EPA's CSO Control Policy (1994) requires the effectiveness of CSO controls to be evaluated on a "system-wide, annual average basis." Data on rainfall is necessary to analyze the response of the CSS to rainfall and the associated impact on the receiving waters.

2.2 Permit Requirements

The rainfall monitoring required by the permit is shown in Table 2-1.

Table 2-1 Rainfall Monitoring – Permit Requirements (1)

River	Frequency (2)
Anacostia River	
1 gage in Northeast Boundary	Continuous
1 gage in Tiber Creek	Continuous
Potomac River	
1 gage in Slash Run	Continuous

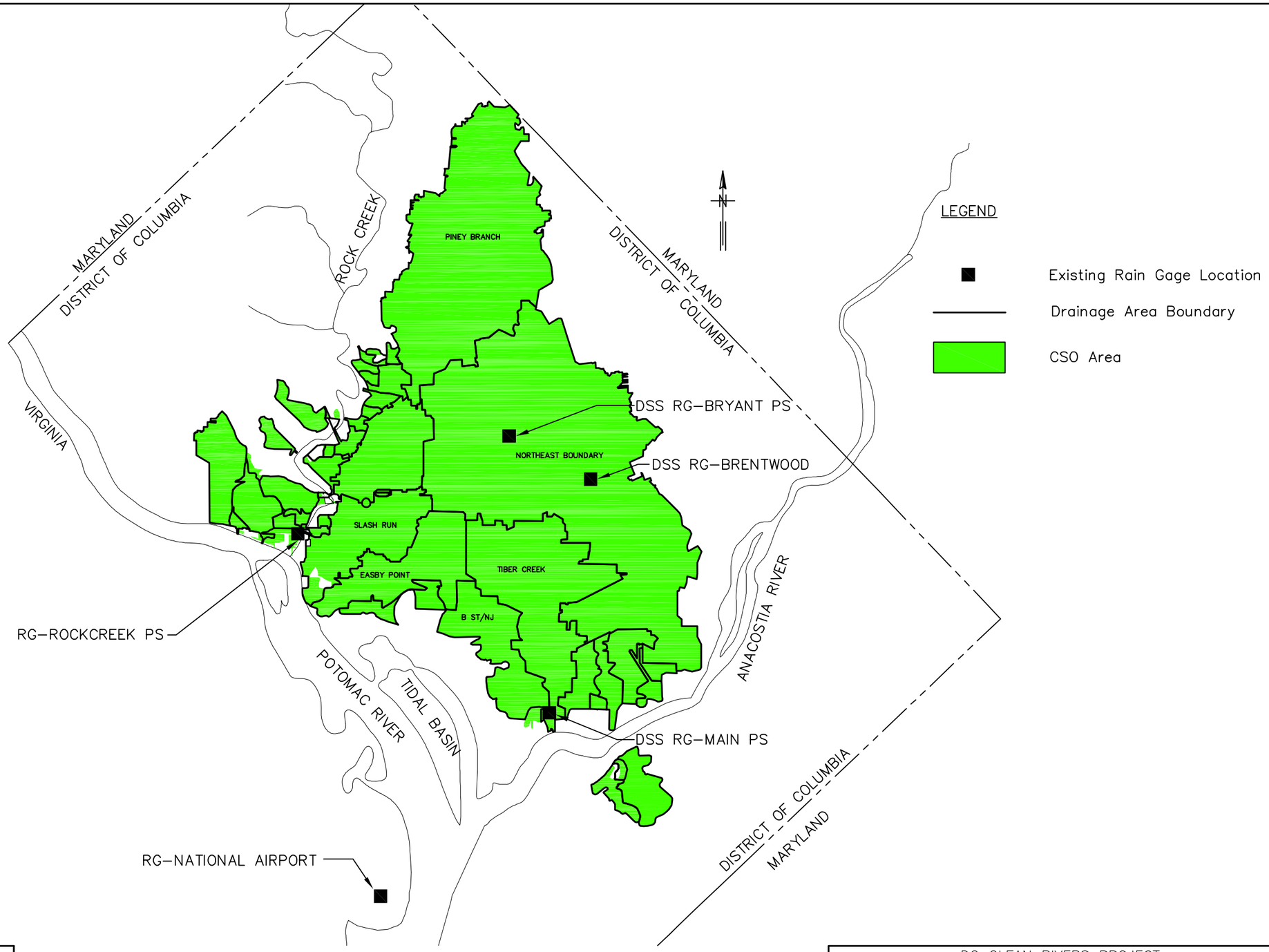
(1) Temporary gauges, meters and samplers to be installed.
(2) Monitoring shall be conducted for a continuous period of 12 months.

2.3 Proposed Monitoring

DC Water operates four existing rain gages in the CSS to collect data on rainfall. These existing gages are in the drainage areas required to be monitored and will be used for post construction monitoring. The rain gage locations are shown in Table 2-2 and presented in Figure 2-1.

Table 2-2 Rainfall Monitoring – Proposed Locations

Drainage Area	Gage		Site
	Req'd by Permit	Other	
Anacostia River			
1 gage in Northeast Boundary	X		• Existing DC Water gage at Bryant St PS- 2nd & 4th St NW • Existing DC Water gage at Brentwood Reservoir - Brentwood Parkway & New York Ave NE
1 gage in Tiber Creek	X		• Existing DC Water gage at Main Pumping St – First St & O St SE
Potomac River			
1 gage in Slash Run	X		• Existing DC Water gage at Rock Creek PS - Rock Creek Parkway N & K St NW
Other			
1 gage at National Airport		X	• Existing National Weather Service gage at Ronald Reagan National Airport



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POST CONSTRUCTION MONITORING
PHASE–I

RAINFALL MONITORING LOCATION MAP

DATE: FEBRUARY 2014 | FIGURE 2–1

LAST SAVED BY: CONSTANT A. NORTEY DATE: 2/12/2014 3:24:45 PM
DRAWING ID: L:\LTCP\PCM\REPORT–FIGURES\FIGURE 2– 1RAIN GAGE LOCATIONS MAP.DWG

2.4 Data from Other Sources

The hourly rain gage data available at Ronald Reagan Washington National airport and the four DC Water rain gages located in the required drainage areas will be used to measure rainfall in the combined sewer drainage areas. Hourly rainfall data is available at Ronald Reagan Washington National Airport (National Airport) from the period 1949 to the present.

The existing DC Water rain gages are of the tipping bucket design, capable of recording rain in 0.01-inch increments. Data from gages will be obtained by visiting the sites approximately weekly. The rain gages will be used for the 12 month duration of the proposed flow monitoring in the associated CSO drainage area.

3 Combined Sewer Overflow (CSO) Monitoring

3.1 General

Monitoring of the Combined Sewer System (CSS) is proposed to characterize the frequency, duration, flow rate, volume and pollutant concentrations of CSO discharges. The information collected will assist with the assessing the impact of the implemented Phase I controls on CSO volume and water quality. Monitoring will consist of:

- Flow and volume measurement of selected CSO overflows
- Sampling and analysis of the water quality of one (1) selected CSO outfall

3.2 Permit Requirements

The CSO monitoring required by the permit is tabulated below.

Table 3-1 CSO Monitoring – Permit Requirements

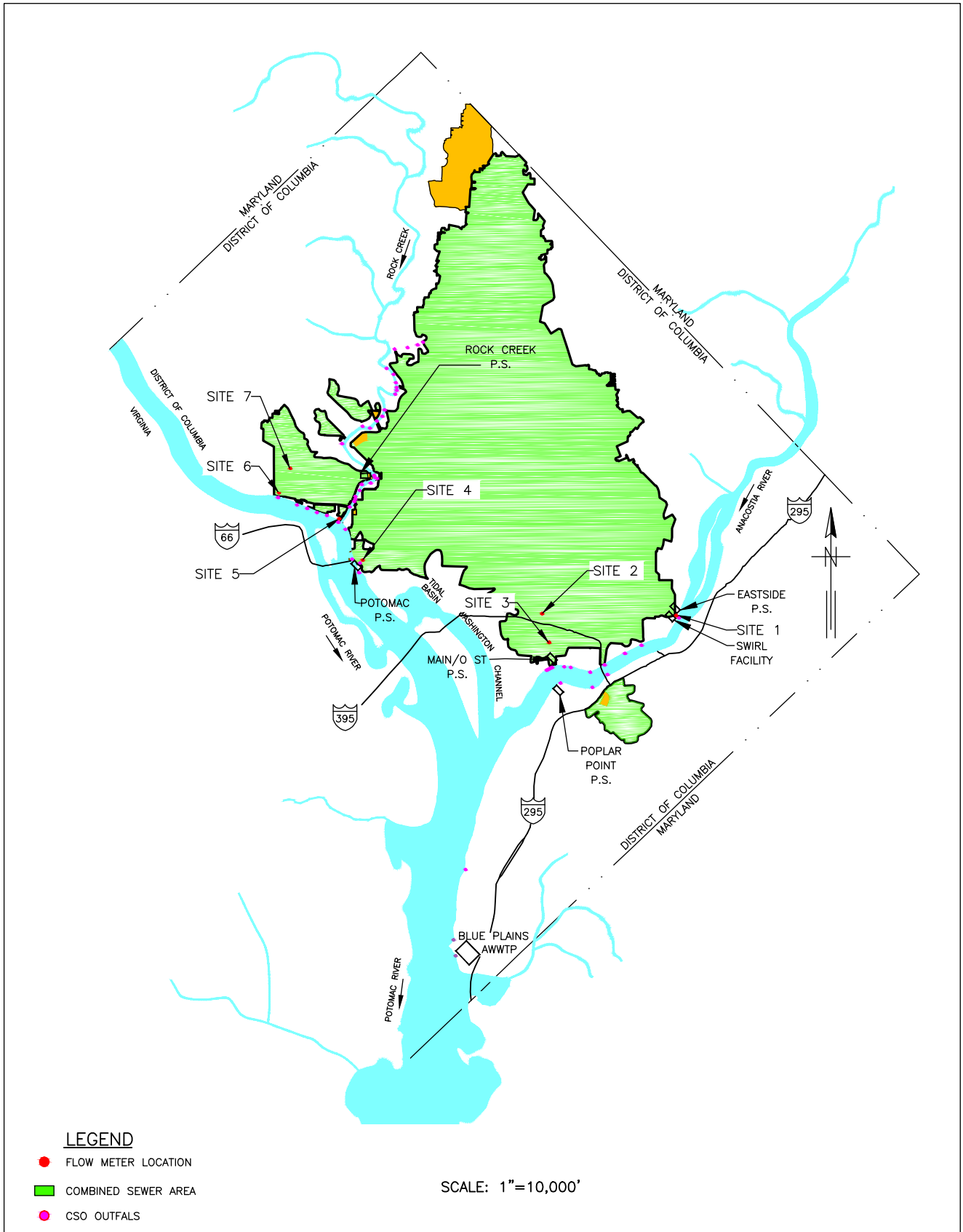
Monitoring Type	Anacostia River	Potomac River	Frequency (3)
CSO Overflow Monitoring (Flow and Volume) (1)	• Northeast Boundary CSO 019 • B ST/ NJ Ave Pumped Overflow CSO 010	• Potomac Pumping Station CSO 021 • College Pond • CSO 024	• Continuous
CSO Overflow Sampling (2)	• 1 sampling station at Northeast Boundary		• 4 storms per year • Approx 1 hour sample interval for each storm

(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for Fecal Coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.

3.3 Proposed Monitoring

3.3.1 CSO Flow Monitoring

Flow monitoring will be conducted at the locations required by the NPDES Permit. Flow monitoring will be conducted for 12 months at each site. The proposed flow monitoring locations are listed in Table 3-2 and presented in Figure 3-1. Detailed location maps for each monitoring site are provided as Appendix B.



LAST SAVED BY: JEEDIGUNTA, RAM DATE: 4/2/2014 11:11:51 AM
DRAWING ID: I:\POST CONSTRUCTION MONITORING\05 - REPORTING\FIGURES\FIGURE 3-1 FLOW METERS_OVERALL.DWG

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DC CLEAN RIVERS PROJECT

OVERALL FLOW METER MAP

DATE: APRIL 2014

FIGURE 3-1

Table 3-2 CSO Monitoring (Flow and Volume) – Proposed Monitoring

Metering Location	Flow Meter Location	SITE ID
Anacostia River		
CSO 019- Northeast Boundary	3- 1 each in three barrels of NEBTS, downstream of inflatable dams	SITE 1
CSO 010 - B ST/ NJ Ave Pumped Overflow	1-Structure 15, downstream of inflatable dam 1-Structure 15A, downstream of inflatable dam	SITE 2 SITE 3
Potomac River		
CSO 021	1-Downstream of Structure 35	SITE 4
CSO 024	1-Downstream of Structure 38a	SITE 5
CSO 029- College Pond	1-On 86" sewer, Upstream of Structure 46 1-On 21" sewer, Upstream of Structure 46 1-On 6' sewer, Upstream of Dam 1-On 6' sewer, Downstream of Dam	SITE 6
	1-Upstream of Structure 47 1-Downstream of Structure 47	SITE 7

Notes:

1. Complex sewer diversions require more than one (1) flow meter per site as listed above.

3.3.2 CSO Overflow Sampling

Sampling of CSO overflows is proposed at one (1) CSO in the Northeast Boundary (NEB) drainage area at the influent to the NEB Swirl (CSO 019). The sampling location is representation of CSO before treatment by the Swirl facility.

Table 3-3 CSO Monitoring – Proposed Sampling

Monitoring Type	Anacostia River	Potomac River	Frequency
CSO Overflow Sampling	• 1 sampling station at Northeast Boundary		• 4 storms per year • Approx 1 hour sample interval for each storm

3.3.2.1 Sample Collection Frequency and Analytical Work

Manual grab sampling will be performed at approximately one hour intervals. Based on flow meter data, samples will mathematically composited to determine event mean concentrations. Samples will be analyzed for the parameters shown in Table 3- 4.

Table 3-4 CSO Monitoring – Proposed Sampling Analysis

Parameter	Analysis Method (1)
Field Parameters	PH – SM 4500 H-B Temperature – EPA 170.1 Dissolved Oxygen – SM 4500 – G Conductivity– SM 2510 –B Chlorophyll a – SM 10200 - H
Fecal Coliform	SM 9221 - E
E. coli	SM 9223 B-94
CBOD5 (total)	SM 5210 B -01
TSS	SM 2540 D -97

Notes:

(1) SM= Standard Methods

3.4 Sample Procedure and Quality Control

The sample procedure and quality control measures are provided as follows.

a. Analyze, preserve and handle all samples in accordance with 40CFR Part 136.
b. Lab shall be accredited by EPA or its approved programs
c. Develop and submit procedures for DC Water's approval for the following:
   i. Sample collection
   ii. Sample labeling
   iii. Sample bottles and preservation
   iv. Chain of custody forms and procedures
   v. Analytical methods
d. Perform quality control sampling at the following minimum frequencies:

Type	Frequency
Temperature, pH, D.O.	Duplicate 1 per 10
Field Duplicates	1 per 20
Equipment Blank	One/crew/sampling day
Field/Preservation Blank	One/crew/third trip
Temperature Blank	One/shipping container

3.5 Program Operation

In the early stages of collecting samples from CSO events, weather forecasts will be monitored to help coordinate sampling activities. Samples will be collected for a maximum of 24 hours for any rain event. Once the sampling is complete, the samples will be delivered to the lab within the holding time limit for sample analysis and with the proper preservation techniques as specified in 40 CFR 136.3.

4 Receiving Water Monitoring

4.1 General

The objective of receiving water monitoring is to collect a sufficient amount of water quality data to quantify impacts associated with Phase I CSO controls. Although greatly reduced under the recommended LTCP, combined sewer overflows will be discharged to the Anacostia River, Potomac River, Rock Creek and tributaries, under certain storm conditions.

4.2 Permit Requirements

The receiving water monitoring required by the permit is tabulated below.

Table 4-1 Receiving Water Monitoring – Permit Requirements

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Receiving Water Monitoring-Dissolved Oxygen (1)	Continuous D.O. monitors	Continuous D.O. monitors	Approximately 30 minute intervals
Receiving Water Monitoring-Bacteria, Field Parameters (1) (2)	Bacteria Samples	Bacteria Samples	4 storms Minimum

(1) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.
(2) Samples shall be analyzed for fecal Coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.

4.3 Proposed Monitoring

The proposed locations for receiving water monitoring in the Anacostia and Potomac Rivers are presented in Figures 4-1 and 4-2. DC Water has retained Metropolitan Washington Council of Governments (MWCOG or COG) to perform receiving water monitoring. A summary of monitoring effort is provided as follows.

4.3.1 Dissolved Oxygen (D.O.) Monitoring

Dissolved oxygen (D.O.) monitoring will be performed on the Anacostia and Potomac Rivers in the locations as indicated in Table 4-3. The D.O. meters will collect data at minimum 30 minute intervals. COG will propose a depth below the water surface to set the probe for and DC Water will review the proposed depth. D.O. data for the locations will be collected for 12 continuous months.

Table 4-2 D.O. Metering for Receiving Water

Receiving Water	Station ID	D.O. Meter Location	Location Rationale	Data Source
Anacostia River	DO-BR	Benning Road Bridge	Upstream of CSO area	New Monitor
	DO-PA	Pennsylvania Avenue Bridge (Seafarer's Yacht Club)	After Northeast Boundary CSO discharge	New Monitor
	DO-SC	South Capitol Street Bridge	Downstream of CSO area	New Monitor
Potomac River	DO-CB	Chain Bridge	Upstream of CSO area	New Monitor
	DO-14ST	14th Street Bridge	Downstream of CSO area	New Monitor
	DO-WB	Wilson Bridge	Downstream of Blue Plains AWWTP	New Monitor

4.3.2 Regular Sampling

COG will perform regular sampling at the locations listed in Table 4-3, by collecting five (5) samples per month for water quality testing.

The monitoring data will determine the impact of implemented CSO Controls on water quality. In the Potomac and Anacostia Rivers, the sampling days will be scheduled each week, based on projected weather, to make sure that both the dry and wet weather days are sampled. This will allow DC Water to capture at least four (4) storms required by the permit. Sampling will be conducted while flow monitors are installed on the CSOs and the D.O. meters are operating on the receiving water.

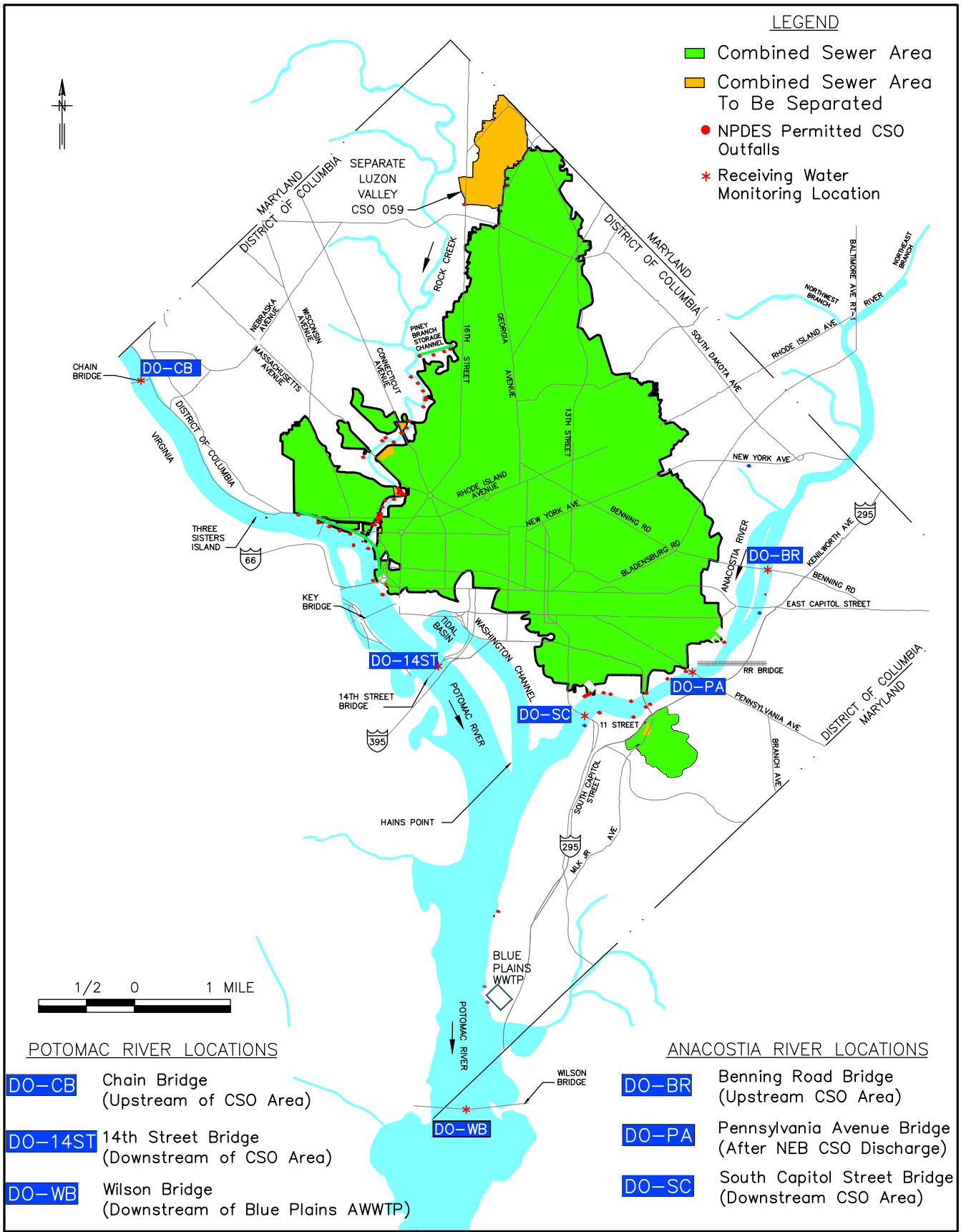
Table 4-3 Regular Sampling Locations

Receiving Water	Station ID	Sample Stations	Rationale	Notes
Anacostia River	B-BL	Bladensburg, MD	Boundary condition	
	B-BR	Benning Road Bridge	Upstream of CSO area	
	B-PA	Pennsylvania Avenue Bridge	After Northeast Boundary CSO discharge	
	B-SC	South Capitol Street Bridge	Downstream of CSO area	
	B-HP	Hains Point	Confluence with Potomac	
Potomac River	B-CB	Chain Bridge	Boundary condition	Use Data from COG's Ongoing Monitoring
	B-TS	Three Sisters Island	Upstream of CSO area	
	B-URC	Upstream of Rock Creek	After Georgetown CSOs	
	B-14ST	14th Street Bridge	Downstream of CSO area	
	B-WB	Wilson Bridge	Boundary Condition	

COG will analyze each sample for Fecal Coliform, E. coli, $CBOD_{5,}$ Total Suspended Solids, Chlorophyll a and field parameters (temperature, D.O., pH, conductivity and secchi depth) at the locations listed above. The sampling will be conducted over a 12 month monitoring period.

The purpose of boundary condition monitoring is to assess the pollutant load in the receiving waters at the District Boundaries, both upstream and downstream of CSO area.

For the Potomac River, COG currently operates an existing monitoring system at Chain Bridge. Samples collected at this station are tested for many parameters, including: temperature, DO, pH, conductivity, TSS, turbidity, dissolved organic carbon, TKN, ammonia, alkalinity, BOD, fecal Coliform, total Coliform, chlorophyll, alkalinity, and hardness. The fecal data is collected approximately once per month.



dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

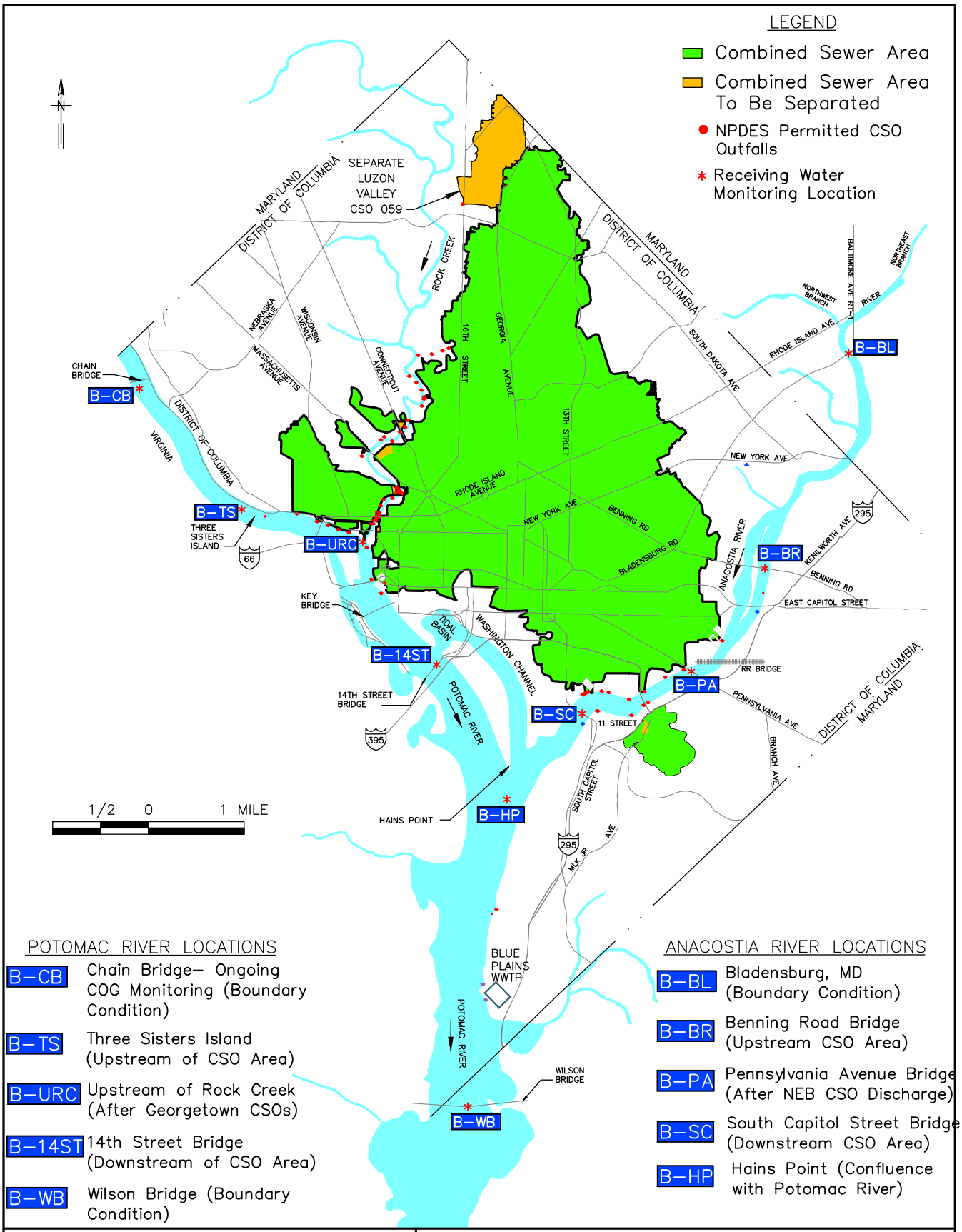
DC CLEAN RIVERS PROJECT

RECEIVING WATER MONITORING – D.O. FOR POTOMAC AND ANACOSTIA RIVERS

DATE: APRIL 2014

FIGURE 4–1

LAST SAVED BY: JEEDIGUNTA, RAM DATE: 4/2/2014 5:08:05 PM
DRAWING ID: I:\POST CONSTRUCTION MONITORING\05 – REPORTING\FIGURES\FIGURE 4–1 RIVER SAMPLING–DO.DWG



POTOMAC RIVER LOCATIONS

- B-CB — Chain Bridge– Ongoing COG Monitoring (Boundary Condition)
- B-TS — Three Sisters Island (Upstream of CSO Area)
- B-URC — Upstream of Rock Creek (After Georgetown CSOs)
- B-14ST — 14th Street Bridge (Downstream of CSO Area)
- B-WB — Wilson Bridge (Boundary Condition)

ANACOSTIA RIVER LOCATIONS

- B-BL — Bladensburg, MD (Boundary Condition)
- B-BR — Benning Road Bridge (Upstream CSO Area)
- B-PA — Pennsylvania Avenue Bridge (After NEB CSO Discharge)
- B-SC — South Capitol Street Bridge (Downstream CSO Area)
- B-HP — Hains Point (Confluence with Potomac River)

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
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DC CLEAN RIVERS PROJECT

RECEIVING WATER MONITORING – BACTERIA FOR POTOMAC AND ANACOSTIA RIVERS

DATE: FEBRUARY 2014

FIGURE 4–2

LAST SAVED BY: JEEDIGUNTA, RAM DATE: 4/2/2014 5:09:13 PM
DRAWING ID: I:\POST CONSTRUCTION MONITORING\05 – REPORTING\FIGURES\FIGURE 4-2 RIVER SAMPLING – BACTERIA.DWG

4.4 Sample Procedure and Quality Control

The sample procedure and quality control measures are provided as follows.

e. Analyze, preserve and handle all samples in accordance with 40CFR Part 136.
f. Lab shall be accredited by EPA or its approved programs
g. Develop and submit procedures for DC Water's approval for the following:
    i. Sample collection
    ii. Sample labeling
    iii. Sample bottles and preservation
    iv. Chain of custody forms and procedures
    v. Analytical methods
h. Perform quality control sampling at the following minimum frequencies:

Type	Frequency
Temperature, pH, D.O.	Duplicate 1 per 10
Field Duplicates	1 per 20
Equipment Blank	One/crew/sampling day
Field/Preservation Blank	One/crew/third trip
Temperature Blank	One/shipping container
Continuous D.O. Monitors	Weekly calibration

4.5 Data from Other Sources

Several ongoing receiving water quality monitoring programs will provide water quality data that can be useful in quantifying the benefits of the implemented controls.

4.5.1 Metropolitan Washington Council of Governments

MWCOG conducts monitoring efforts that provide data which will be valuable as provided below.

Fall Line monitoring at Chain Bridge on the Potomac has been supported by MWCOG since the early 1980s. Because the bridge is located approximately at the fall line and head of tide, the measurements are indicative of the quality and quantity of upstream inputs into the estuary. Grab samples are taken on a weekly basis and more often during storm events. The automated sampler measures river stage. When the river level is high, the samples are taken at timed intervals until the water level recedes. This wet-weather sampling is done to characterize the loads when they are expected to be the highest. Samples from the Chain Bridge Station are tested for many parameters, including: temperature, DO, pH, conductivity, TSS, turbidity, dissolved organic carbon, TKN, ammonia, alkalinity, BOD, fecal coliform, total coliform, chlorophyll, alkalinity, and hardness.

4.6 Program Operation

COG will manage and coordinate receiving water sampling and analysis. COG will incorporate the resulting data into their existing regional monitoring database and will provide the results to DC Water for use in assessing the efficacy of the CSO controls.

Appendix A National Pollutant Discharge Elimination System (NPDES) Permit

Permit No. DC0021199

Effective Date: September 30, 2010
Expiration Date: September 30, 2015

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, 33 U.S.C. # 1251 et seq. (the "Act"),

District of Columbia Water and Sewer Authority

is authorized to discharge from the wastewater system and the facility located at

5000 Overlook Avenue, SW
Washington, D.C. 20032

to receiving waters named Potomac and Anacostia Rivers, Rock Creek, and tributary waters in accordance with effluent limitations, monitoring requirements and other conditions set forth in parts I, II and III, herein.

Signed this 31st day of August, 2010

Jon M. Capacasa, Director
Water Protection Division
U.S. Environmental Protection Agency
Region III

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Part I.EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

SECTION A. DEFINITIONS

When used in this permit, unless otherwise indicated, the following terms shall mean the following:

1. "**Blue Plains**" or "**plant**" or "**POTW**" or "**facility**" means the District of Columbia advanced wastewater treatment plant located at 5000 Overlook Avenue, S.W., Washington, DC, 20032.

2. "**Blue Plains Tunnel**" or "**BPT**" means the tunnel that is part of the CSS which is included in the LTCP and which terminates on the Blue Plains site.

3. "**Combined Sewer System**" or "**CSS**" means the pipelines pumping stations, treatment facilities, and appurtenances in the District of Columbia which are designed to convey wastewater and storm water through a single pipe system to combined sewer overflow outfalls and/or the POTW. The system also includes the selected CSO controls included in the LTCP and all supplements thereto, which are being implemented under the Consent Decree in Consolidated Civil Action No. 1:00CV00183TFH and all amendments thereto.

4. "**Combined Sewer System Flow**" or "**CSSF**" means the conditions that begin when the Influent Flow rate to receive complete treatment at the POTW is greater than 511 mgd. CSSF conditions shall be deemed to cease 4 hours after the Influent Flow rate drops to a rate less than 511 mgd or a period of 4 hours has lapsed since the start of the CSSF conditions, whichever occurs later.

5. "**Complete Treatment**" means passage of all flows through any combination of conveyance and treatment downstream of primary sedimentation that ultimately discharges effluent from Outfall 002, in accordance with the limitations set forth for Outfall 002 found at Part I.B. of this permit.

6. "**Disinfection**" means treatment to reduce E. coli. Disinfection by chlorination shall be followed by dechlorination.

7. "**Dry Weather Flow**" or "**DWF**" means the flow from sewers that convey collection system flow to Blue Plains when such flow is not greater than a rate of 511 mgd.

8. "**Enhanced Clarification**" means the treatment process that provides improved performance over that typically obtained from plain sedimentation, which process includes the recirculation of solids removed from the process or recirculation of other media together with the addition of coagulants.

9. "**Enhanced Clarification Facility**" or "**ECF**" means the combination of process units located on the end of the BPT, designed to empty the BPT and distribute flow from

the BPT to Complete Treatment and to disinfection prior to discharge from Outfall 001; such distribution to be under an operating routine described at Part I.C. footnote (1). These facilities are being constructed under the LTCP.

10. "**Excess Flow Treatment**" or "**EFT**" means treatment of Influent Flow during CSSF conditions, in East Primary Sedimentation followed by disinfection and dechlorination, for flow rates that exceed the rates required to receive Complete Treatment, up to a maximum rate of 336 mgd. As part of placing the ECF in operation, the EFT facilities shall be permanently disconnected from Outfall 001.

11. "**Influent Flow**" means the following:

    a. **Influent Flow** to receive complete treatment means the sum of metered flows from sewers that convey collection system flow to Blue Plains and flow emptied from the BPT.

    b. Prior to placing the ECF in operation, the **Influent Flow** discharged from Outfall 001 means the component of metered flow from sewers that convey collection system flow to Blue Plains and receives EFT.

    c. After the ECF is placed in operation, the **Influent Flow** discharged from Outfall 001 means the component of flow emptied from the BPT that receives treatment in the ECF and disinfection and dechlorination.

12. "**Long Term Control Plan**" or "**LTCP**" means the recommended plan for the CSS included in the Combined Sewer System Long Term Control Plan, Final Report, July 2002 prepared by the permittee pursuant to the 1994 CSO Policy and Section 402(q) of the CWA and any supplements thereto. The LTCP Final Report, July 2002, was submitted to EPA and the DC Department of Health, later DC Department of the Environment.

13. "**Measured Flow Rates**" means flows measured to determine rates to be treated and discharged under CSSF conditions. Flow rates shall be metered and rates recorded at intervals not to exceed one (1) hour. An average rate shall be calculated from the metered rate. An average rate means the rate calculated, for the total time that CSSF conditions are in effect, by dividing the sum of the metered rates by the number of rates recorded. Average rates shall be calculated or recorded directly from metered rates. The permittee shall be in compliance with the treatment and discharge requirements for CSSF conditions when average rates are within the following:

    a. Not less than 0.90 times the rate required to receiveComplete Treatment;

    b. Not greater than 1.1 times the maximum rate permitted to be discharged from Outfall 001.

14. **"Place in Operation"** means to achieve steady state operation and to operate consistently in such a way as to accomplish the intended function, even though all construction close-out activities (such as completion of a punch list and resolution of contract disputes or close-outs) may not yet be complete.

15. **"Wet Weather Event"** means the condition that occurs as a result of storm water runoff, including snowmelt, entering or being conveyed in the CSS.

16. **"Grab Sample"** - An individual sample collected in less than 15 minutes.

17. **"At Outfall XXX"** - A sample location before the effluent joins or is diluted by any other waste stream, body of water, or substance or as otherwise specified.

18. **"Estimate"** - To be based on a technical evaluation of the sources contributing to the discharge including, but not limited to pump capabilities, water meters and batch discharge volumes.

19. **"i-s"** (immersion stabilization) - A calibrated device is immersed in the effluent stream until the reading is stabilized.

SECTION B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS OUTFALL 002

Effluent limitations are based upon the design capacity of 370 mgd for Complete Treatment. During the period beginning on the effective date of the permit and lasting through the expiration date, the permittee is authorized to discharge from Outfall 002 to the Potomac River, subject to the following conditions, discharge limitations and monitoring requirements:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	(lb/day)		Other Units (specify)		Measurement Frequency	Sample Type
	Ave. Monthly	Ave. Weekly	Ave. Monthly	Ave. Weekly		
Flow/day (mgd) (1, 1a,)	N/A (2)	N/A	N/L (3)	N/L	Continuous	Measured
Carbonaceous Biological Oxygen Demand (5 day)	15,429	23,143	5.0 mg/l	7.5 mg/l	Daily	24-hour Composite
Total Suspended Solids (TSS)	21,600	32,400	7.0 mg/l	10.5 mg/l	Daily	24-hour composite
Total Phosphorus	555 (4)	1,080	0.18 mg/l (4)	0.35 mg/l	Daily	24-hour composite
Ammonia Nitrogen:						
Summer (5/1 – 10/31)	12,960	18,823	4.2 mg/l	6.1 mg/l	Daily	24-hour composite
Winter 1 (11/1 – 2/14)	34,253	45,670	11.1 mg/l	14.8 mg/l	Daily	24-hour composite
Winter 2 (2/15 – 4/30)	39,500	52,460	12.8 mg/	17.0 mg/l	Daily	24-hour composite
Dissolved Oxygen	5.0 mg/l minimum daily average. Not less than 4.0 mg/l at any time				Every 2 hours	
Total Residual Chlorine (mg/l) (6)	Non-detectable		Non-detectable		Every 2 hours	Grab
pH (s.u.) (7)	Within limits of 6.0 to 8.5 standard units				Continuous in-situ monitoring and recording	
Total Ortho-phosphate (mg/l)	N/A	N/A	N/L	N/L	Daily	24-hour composite
Alkalinity, total ($CaCO_3$) (mg/l)	N/A	N/A	N/L	N/L	Daily	24-hour composite
Hardness, total ($CaCO_3$) (mg/l)	N/A	N/A	N/L	N/L	Daily	24-hour composite
Nitrite (NO_2) (mg/l)	N/A	N/A	N/L	N/L	Daily	24-hour composite

Nitrate (NO_3) Total Kjeldahl	N/A	N/A	N/L	N/L	Daily	24-hour composite
Nitrogen (mg/l) (10)	N/A	N/A	N/L	N/L	Daily	24-hour composite
Total Nitrogen (mg/l) (10)					Daily	24-hour composite
Cadmium (dissolved) (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24-hours
Copper (dissolved (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24-hours
Iron (dissolved) (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24 hours
Mercury (total recoverable) (8)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24 hours
Lead (dissolved) (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24 hours
Nickel (dissolved) (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24 hours
Zinc (dissolved) (9)	N/A	N/A	N/L	N/L	Bimonthly	4 grabs/24 hours
PCBs (12)	N/A	N/A			2 wet and 2 dry weather samples quarterly	24-hour composite
E. coli (maximum 30-day geometric mean for 5 samples minimum)	N/A	N/A	126 cfu/100 ml Geometric mean	N/L	1 /day	Grab

(1)Conditions and limitations for flows discharged from Outfall 002 shall be as follows:

Flow Condition and Period	**Times**	**Measured Influent Flow Rates to Receive Complete Treatment**
A. DWF, through permit expiration date	**All times**	**Up to and including 511 mgd**
B. CSSF		
1. From effective date of permit and following placing ECF in operation unless otherwise authorized or approved by EPA	First 4 hours After 4 hours	Up to and including 555 mgd Up to and including 511 mgd
2. Until Completion of Nitrification Denitrification Facilities upgrade, but no later than March 1, 2011	First 4 hours After 4 hours	Up to and including 511 mgd Up to and including 450 mgd
3. During construction of improvements to existing nitrogen removal facilities, period(s) to be determined by permittee and EPA from completion of design and construction schedules for the length of time required for such construction, but no later than July 14, 2014.	First 4 hours After 4 hours	Up to and including 511 mgd Up to and including 450 mgd
4. During construction of the ECF and tie-ins to the existing facilities. Periods to be determined by permittee and EPA from completion of design and construction schedules.	First 4 hours After 4 hours	Up to and including 511 mgd Up to and including 450 mgd

(1a) Flows reported for locations required under this permit are based on flows metered by the Blue Plains metering system. This system produces information to report flows by direct metering or through calculations using the results from multiple meters.

(2) N/A Not Applicable

(3) N/L No Limit, monitoring only

(4) The phosphorus limitation of 0.18 mg/l is based on the Potomac Strategy Management Commission Agreement and the best technical information available at the time of permit issuance. In addition, based upon available data of full plant BNR process operation, the monthly average is expressed as a 12 month rolling average. In any 12 month period no one month may exceed a mass of 1080 lbs/day and 0.35 mg/l. During full plant BNR, the 12 month rolling average mass for a month shall be the total mass for the month plus the total mass for the previous eleven (11) months divided by the total number of days in the 12 month period. The 12 month rolling average concentration for a month shall be the total mass for the 12 month period divided by the average daily flow (in mgd) for the 12 month period times 8.34. No single month in any 12 month period used to calculate a 12 month rolling average shall exceed a monthly average limit of 490 kg/day (1080 lb/day) and 0.35 mg/l.

(5) Continuous in situ monitoring and recording of dissolved oxygen shall continue. The monitoring requirements shall be understood to require twelve (12) readings from the continuous recording per day.

(6) When the total residual chlorine (TRC) analysis of the final effluent at Outfall 002 results in a detectable measurement, the permittee shall take steps to achieve a non-detectable TRC concentration. See Special Condition Part IV Section C.

(7) The permittee is required to be in compliance with the pH limitations specified above for 99% of the time for any calendar month. The total excursion time allowed for any calendar month is 7 hours, 26 minutes and no individual excursion shall exceed 60 minutes.

(8) The permittee shall sample the effluent for mercury using the most sensitive test Method 1631 E. The method detection limit, and the method used to perform the mercury analysis shall be submitted with the discharge monitoring reports.

(9) The permittee shall monitor the effluent at Outfall 002 for the metals listed above in accordance with the conditions set forth below. Report results in micrograms per liter.

a. The permittee shall test for additional metals, and priority pollutants (Appendix A to 40 C.F.R. Part 423) twice in five (5) years during the term of this permit. One such testing shall be in the third year of the permit and the second shall be in the last year of the permit.

b. All analytical methods will be EPA approved methodologies found in 40 C.F.R. Part 136.

c. The quantification level (QL) shall be the lowest concentration used for the calibration of a measurement system when the calibration is in accordance with the procedures published for the required method. Usually, units for the QL are in micrograms per liter.

d. Permittee shall analyze each grab sample and report the average of the four samples. Alternatively, the permittee may prepare a composite of the grab samples in the laboratory by proportioning to flow and analyze the laboratory composite sample.

(10) As provided in Part IV Section D of this permit, the permittee shall operate the plant, including the nitrogen removal process to meet the total nitrogen effluent limit of not more than 4,377,580 pounds per year which is assigned to Outfall 002.

Total nitrogen concentration shall be the sum of organic nitrogen, ammonia nitrogen and (NO2 +NO3) - N concentrations (e.g., Total Nitrogen = Total Kjeldahl nitrogen + No_2 as N + No_3 as N).

The total nitrogen effluent for Outfall 002 shall be calculated on a daily basis as the mass load in pounds per day derived from the daily total nitrogen concentration from Outfall 002, times the associated daily flow. The daily total nitrogen mass load shall be summed during each calendar year to determine the annual mass load.

(11) The Permittee shall report any substantial changes in the volume or character of pollutants being introduced into the POTW.

(12) See Part IV.F, Special Conditions for additional PCB monitoring requirements.

PART I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

SECTION C. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS OUTFALL 001

Discharge from Outfall 001 to the Potomac River is approved as an anticipated bypass, provided the permittee is in compliance with the LTCP implementation schedule requirements of the March 23, 2005 Consent Decree entered into in United States v. DCWASA, et al, Consolidated Civil Action No. 1:CV00183TFH and any supplements or modifications thereto and subject to the following conditions, discharge limitations and monitoring requirements. Beginning from the effective date of this permit and lasting through the expiration date, Influent Flow discharged from Outfall 001 shall receive treatment as follows:

a. Excess Flow Treatment (EFT) until the ECF is placed in operation.

b. After the ECF is placed in operation, Influent Flow shall receive treatment in the ECF followed by disinfection and dechlorination.

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	Kg/day (lb/day)		Other Units (specify)		Measurement Frequency	Sample Type (6)
	Ave Monthly	Ave Weekly	Ave Monthly	Ave Weekly		
Flow/discharge (mgd) (1) (1a)	N/A	N/A (2)	N/L (3)	N/L	Continuous	Measured
Carbonaceous Biochemical Oxygen Demand (5-day)	N/A	N/A	N/L	N/L	Per discharge	Composite (4)
Total Suspended Solids (TSS)	N/A	N/A	N/L	N/L	Per discharge	Composite (4)
pH (s.u.)	N/A	N/A	N/L	N/L	Per discharge	Composite (4)
PCBs (9)					2 wet weather per quarter	Grab
E.coli – (cfu/100 ml)	N/A	N/A	N/L	N/L	Every 8 hours, not less than one sample per discharge	Grab
Total Residual Chlorine (mg/l) (5)	Non-detectable		Non-detectable		Every 2 hours, not less than one sample per discharge	Grab
Total Nitrogen (10)	N/A	N/A	N/L	N/L	Per discharge	Composite (4)
Total Phosphorus	N/A	N/A	N/L	N/L	Per discharge	Composite (4)

(1)Conditions and limitations for Influent Flow discharged from Outfall 001 shall be as follows:

FLOW CONDITION AND PERIOD	TIMES	MEASURED FLOW RATES FOR OUFALL 001
A. DWF	All times	No discharge permitted
B. CSSF		
1. From effective date of permit and lasting until ECF is placed in operation.	All times	Up to and including 336 mgd above rates to receive complete treatment under Part I.B for Outfall 002
2. Following ECF being placed in operation, for emptying the BPT under an operating routine that provides for:	All times	Up to a maximum of 225 mgd
a. Conveying flow from the BPT through the ECF or transfer to complete treatment;		
b. Regulating the discharge of ECF effluent to maintain a rate of 511 mgd through complete treatment while optimizing conditions for maintaining the availability of the storage volume in the BPT such as that the occurrence of CSOs is minimized;		
c. No discharge of flow from the BPT from Outfall 001 when DWF conditions exist; and		
d. Limiting discharge of ECF effluent from Outfall001 to a maximum rate of 225 mgd; provided that any discharge of ECF effluent from Outfall 001 shall not occur except for the purpose of maintaining the availability of storage volume in the BPT to the extent that the occurrence of CSOs is minimized.		

(1a) Flows reported for locations required under this permit are based on flows metered by the Blue Plains metering system. This system produces information to report flows by direct metering or through calculations using the results from multiple meters.

(2) N/A means not applicable.

(3) N/L means no Limit, monitoring only.

(4) Collect one grab sample every two (2) hours and flow composite samples during each calendar day discharge. Analyze and obtain the concentration of the composited sample obtained each calendar day. Determine the mass load discharged for each day using the daily

concentration and the average flow rate recorded for that calendar day. Sum the daily mass loads obtained each calendar year to obtain the total mass load discharged in the calendar year.

(5) See Part IV, Section C for additional Chlorination/Dechlorination monitoring requirements.

(6) All pollutant sampling shall commence no later than two (2) hours after a discharge has begun to occur at Outfall 001. Samples are not required for discharges lasting less than two (2) hours. The two hour delay does not apply to flow monitoring.

(7) Authorization of CSO-related bypasses under this provision may be modified or terminated when there is a substantial increase in the volume or character of pollutants being introduced into the POTW.

(8) Permittee shall provide notice to the permitting authority of the discharges for Outfall 001 within 24 hours of the commencement of the discharge.

(9) See Part IV, Section F for additional PCB monitoring and reduction requirements.

(10) After the ECF is placed in operation, the permittee shall evaluate performance in accordance with Part III.D.4.a. through e. The performance assessment for Outfall 001 shall be submitted with each application for permit reissuance.

SECTION D. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS OUTFALL 019[1]

Outfall 019 is the discharge from the Northeast Boundary Swirl Concentrator Facility to the Anacostia River. Treatment includes: screening, swirl concentration, chlorination and dechlorination. These effluent limitations and monitoring requirements become effective from issuance date through the expiration date of this permit. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	Kg/day (lb/day)		Other units (specify)		Measurement Frequency	Sample Type (6)
	Ave Monthly	Ave Weekly	Ave Monthly	Ave Weekly		
Flow/day (mgd)	N/A (2)	N/A	N/L (3)	N/L	Continuous	Measured
Total Suspended Solids (mg/l)	N/A	N/A	N/L	N/L	Per discharge	Composite (4)
E.coli (cfu/100 ml)	N/A	N/A	N/L	N/L	Every 8 hours, first sample within 2 hours of beginning of discharge	Grab
Total Residual Chlorine (mg/l) (5)	N/A	N/A	N/L	N/L	Every 2 hours	Grab
Nitrate(NO_3) Total Kjeldahl Nitrogen (7)	N/A	N/A	N/L	N/L	per discharge	24-hr. Composite (4)
Total Nitrogen	N/A	N/A	N/L	N/L	per discharge	24-hr. Composite (4)
Total Phosphorus	N/A	N/A	N/L	N/L	per discharge	24-hr. Composite (4)
Carbonaceous Biological Oxygen Demand	N/A	N/A	N/L	N/L	Per Discharge	Composite (4)

(2) The Northeast Boundary Swirl Facility operates during wet weather events that produce flows which exceed the capacity of the upstream Eastside Interceptor. The facility provides treatment for up to 400 mgd of combined sewer overflow. The facility provides screening of influent combined sewage, concentration of solids in the swirl tanks, and disinfection and

dechlorination of effluent. The concentrated, solids-bearing underflow from the swirl is pumped by the Eastside Pumping Station to the Blue Plains Wastewater Treatment Plant.

(2) N/A Not Applicable

(3) N/L No Limit, monitoring only

(4) Collect one grab sample every two (2) hours beginning within 2 hours of the start of the discharge, composite samples up to a maximum of 24 hours. Permittee shall analyze the composited sample. If the permittee is unable to collect the first sample within 2 hours of the start of the discharge permittee shall explain in writing why it was unable to collect the required sample. The monthly average shall be determined by dividing the daily average event or events concentration by the total number of days the event(s) occurred per month.

(5) See Part IV.C for additional Chlorination/Dechlorination monitoring requirements.

(6) All sampling shall commence no later than two (2) hours after a discharge has begun to occur at Outfall 019. Samples are not required for discharges lasting less than (2) two hours. The two hour delay does not apply to flow monitoring, which is required to be continuous.

(7) The permittee may either monitor for TKN or Ammonia, whichever sampling is currently being performed.

Note: The rate of flow necessary to trigger the Northeast Boundary Swirl is 15 mgd. The purpose of this facility is to achieve maximum diversion of flow at the Structure 24 Dams on the Northeast Boundary Sewer, and to concentrate the pollutants in that flow to a smaller flow which can be handled by the available capacity of the Eastside Pump Station. The North East Boundary Swirl Facility has a total design flow rate of 400 mgd.

PART II. STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and may result in an enforcement action; permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

2. Water Quality Standards Compliance

Consistent with the Clean Water Act, Section 301(b)(1)(C), the permittee may not discharge in excess of any limitation necessary to meet applicable water quality standards including those of the District of Columbia set forth in Chapter 21 of the District of Columbia Municipal Regulations, Chapter 11 (2006).

The limitations and conditions in this permit for the discharges from Blue Plains and the CSS are limitations that are necessary to meet the applicable water quality standards, including those of the District of Columbia referenced above.

3. Penalties for Violations of Permit Conditions

a. Criminal Penalties

i. Negligent Violations. Section 309(c) (1) of the Clean Water Act (CWA), 33 U.S.C. § 1319(c) (1), provides that any person who negligently violates any permit, condition or limitation implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA, is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year or both.

ii. Knowing Violations. Section 309(c)(2) of the CWA, 33 U.S.C. § 1319(c)(2), provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years or both.

iii. Knowing Endangerment. Section 309(c)(3) of the CWA, 33 U.S.C. § 1319(c)(3), provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA, and knows at the time that he is placing another person in imminent danger of death or serious bodily injury is subject to a fine of not more than $250,000, or by imprisonment for not more than 15 years or both.

iv. False Statement. Section 309(c)(4) of the CWA, 33 U.S.C. § 1319(c)(4), provides that any person who knowingly makes any false material statement, representation or certification in any application, record, report, plan or other document filed or required to be maintained under the Act or who knowingly falsifies, tampers with, or renders inaccurate, any monitoring device or method required to be maintained under the Act, shall upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than 2 years, or by both. If a conviction is for a violation committed after a first conviction of such person under this paragraph, punishment shall be by a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years or by both. False statements concerning matters with the jurisdiction of a federal agency are also punishable pursuant to 18 U.S.C. § 1001 by a prison term of up to five years, a fine imposed under Title 18, Crimes and Criminal Procedure, of the United States Code, or both.

b. Civil Penalties

i. The CWA provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 318 or 405 of the Act is subject to a civil judicial penalty not to exceed $37,500 per day for each violation.

c. Administrative Penalties.

i. The CWA provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the Act is subject to an administrative penalty as follows:

(a) Class I Penalty. Section 309(g)(2)(A) provides that a civil penalty shall not exceed $16,000 per violation nor shall the maximum amount exceed $37,500.

(b) Class II Penalty. Section 1319(g)(2)(A) provides that a civil penalty shall not exceed $16,000 per violation nor shall the maximum amount exceed $177,500.

4. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

5. Permit Actions

In accordance with 40 C.F.R. § 122.62, this permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge;

d. Information newly acquired by the Agency, and which was unavailable at the time of reissuance, and would have justified the application of different permit conditions at the time of issuance, including but not limited to the results of the studies, planning, or monitoring described and/or required by this permit;

e. Facility modifications, additions, and/or expansions;

f. Any anticipated change in the facility discharge, including any new significant industrial discharge or changes in the quantity or quality of existing industrial discharges that will result in new or increased discharges of pollutants; or

g. A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition. When a permit is modified, only conditions subject to modification are reopened.

6. Toxic Pollutants

Notwithstanding Section A.4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified.

The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Section B.2) and "Upsets" (Section B.3), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

8. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

9. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

10. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

11. Severability

The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

12. Transfer of Permit

In the event of any change in ownership or control of facilities from which the authorized discharge emanates, the permit may be transferred to another person if:

a. The current permittee notifies the EPA, in writing, of the proposed transfer at least 30 days in advance of the proposed transfer date;

b. The notice includes a written agreement, between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

c. The EPA does not notify the current permittee and the new permittee of intent to modify, revoke and reissue, or terminate the permit and require that a new application be submitted.

13. Construction Authorizations

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

14. Reopener Provision

This permit may be modified or revoked and reissued as provided pursuant to 40 CFR § 122.62 and § 124.5 to:

a. include new or revised conditions developed to comply with any State or Federal law or regulation that addresses CSOs that is adopted or promulgated subsequent to the effective date of this permit. This includes, but is not limited to: Water Quality Standards and Total Maximum Daily Loads (TMDLs);

b. to include new or revised conditions if new information, not available at the time of permit issuance, indicates that CSO controls imposed under the permit have failed to ensure the attainment of State WQS;

c. include new or revised conditions based on new information resulting from implementation of the Long Term Control Plan (LTCP) referenced at Part III.C of this permit.

d. include new or revised conditions based on the results of Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service (FWS, NMFS or collectively, the "Services").

In addition, this permit may be modified or revoked and reissued for any reason specified in 40 C.F.R. §122.62.

15. Endangered Species

The United States Fish and Wildlife Service (FWS) has indicated that there are no Federally listed threatened or endangered species subject to its jurisdiction downstream of the Blue Plains outfalls, in the vicinity of the Potomac River in the District of Columbia and Maryland. The National Marine Fisheries Service (NMFS) has indicated that the endangered shortnose sturgeon occurs in the Potomac River, including within the District of Columbia and that several species of endangered sea turtles (leather back sea turtles, loggerhead turtles, Kemp's ridley and green sea turtles),are known to be present in the Chesapeake Bay. Pursuant to Section 7 of the Endangered Species Act, EPA and NMFS have consulted on this permit and NMFS has concurred with EPA's determination that that issuance of the permit is "not likely to adversely affect" listed species under NMFS jurisdiction. Wastewater discharges, construction, or any other activity that adversely affects a federally listed endangered or threatened species are not authorized under the terms of this permit.

The permit limits and monitoring required by this permit will allow further evaluation of potential effects on the threatened and endangered species. EPA requires that the permittee submit to NMFS an annual compilation of the Discharge Monitoring Reports (DMRs), which may be used by NMFS to further assess effects on endangered or threatened species. If these data indicate it is appropriate, requirements of this NPDES permit may be modified to prevent adverse impacts on habitats or endangered and threatened species.

The set of DMRs for the calendar year are to be submitted by February 15 of the following year to:

The National Marine Fisheries Service
Protected Resource Division
1 Blackburn Drive
Gloucester, MA 01930
Attention: Danielle Palmer

DC Department of the Environment
Fisheries and Wildlife Division
1200 First, N.E. 5th floor
Washington, DC 20002
Attention: Sylvia Whitworth

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate, inspect and maintain all facilities and systems of treatment and control (and related appurtenances, including but not limited to, sewers, intercepting chambers, interceptors, combined sewer overflows, pumping stations and emergency bypasses) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation and maintenance of back-up or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit.

2. Bypass of Treatment Facilities

a. Definitions

i. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

ii. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

b. Bypass not exceeding limitations

i. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs c. and d. of this section.

c. Notice

i. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

ii. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D.6 (24-hour notice).

d. Prohibition of bypass.

i. Bypass is prohibited and the EPA may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under Paragraph 2.c of this section.

ii. The EPA may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraphs (a), (b), and (c) of this section.

3. Upset Conditions

a. Definition: "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset: An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of Paragraph 3.c of this section are met. Administrative determination by the Agency on upset claims of the permittee, made before commencement of an action for noncompliance, are not final administrative actions and therefore subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:

i. An upset occurred and that the permittee can identify the cause(s) of the upset;

ii. The permitted facility was at the time being properly operated;

iii. The permittee submitted notice of the upset as required in Section D.6; and

iv. The permittee complied with any remedial measures required under Section A.3.

d. Burden of proof: In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points as defined at Part II, Section C.11 of this permit. Monitoring points shall not be changed without notification to and the approval of the EPA.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 C.F.R. Part 136, unless other test procedures have been specified in this permit. Monitoring data required by this permit shall be summarized on an average monthly or 7 consecutive day basis or as indicated for Mercury in Part I.B. Calculations shall be based on the average daily flow.

4. Reporting of Monitoring Results

Monitoring results must be reported on a Discharge Monitoring Report (DMR)form(EPA No. 3320-1). DMRs shall be submitted to EPA on a monthly basis. Monitoring results obtained during the previous month shall be summarized and reported on a DMR form postmarked no later than the 28th day of the following month. Copies of DMRs signed and certified as required by Section D.10, and all other reports required by Part II, Section D, Reporting Requirements shall be submitted to the EPA and to the District of Columbia Department of the Environment (DC DOE) at the following addresses:

U.S. Environmental Protection Agency, Region III
NPDES Discharge Monitoring Reports (3WP31)
1650 Arch Street
Philadelphia, Pennsylvania 19103

and

DC Department of the Environment
Water Quality Division
1200 1st Street
N.E., 5th Floor,
Washington DC 20002

In addition, in accordance with Part II.A.14 above, by February 15 of the subsequent year, all DMRs for the previous year shall be sent to the NMFS.

5. Monitoring and Analytical Equipment Maintenance

The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals frequent enough to insure accuracy of measurements and shall insure that both calibration and maintenance activities will be conducted.

6. Analytical Quality Control

An adequate analytical quality control program, including the analyses of sufficient standards, spikes, and duplicate samples to insure the accuracy of all required analytical results, shall be maintained by the permittee or designated commercial laboratory.

7. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 C.F.R. 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR form. Such frequency shall also be indicated.

8. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. Records for sewage sludge monitoring shall be retained in accordance with Part IV, Section B of this permit. These periods may be extended by request of the EPA at any time.

9. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility activity is located or conducted, or where records must be kept under the conditions of this permit.

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit;

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. The permittee may submit to the permitting authority requests for modification of this provision in accordance with future promulgated regulations.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit is not transferable to any person except after notice to EPA as specified in Part II, Section A, Paragraph 11. EPA may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act. Any transfer must otherwise be in accordance with 40 C.F.R. §122.61.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Part II, Section C, Paragraph 4 (Reporting of Monitoring Results).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; the steps taken or planned to reduce, eliminate, prevent recurrence of the noncompliance, and the steps taken to minimize any adverse impact to navigable waters. The following shall be included as information which must be reported within 24 hours:

a. Any unanticipated bypass which exceeds any effluent limitation in the permit.

b. Any upset which exceeds any effluent limitation in the permit.

c. Violation of a maximum daily discharge limitation for any of the pollutants listed by EPA in the permit, to be reported to EPA within 24 hours.

The EPA may waive the written report on a case-by-case basis if the oral report has been received within 24 hours and the EPA determines that the noncompliance does not endanger health or the environment.

7. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under Section D, Paragraphs 1, 4, 5, and 6 at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph 6.

8. Duty to Provide Information

The permittee shall furnish to the EPA, within a reasonable time, any information which the EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the EPA, upon request, copies of records required to be kept by this permit.

9. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. 40 C.F.R. §122.21(d). The application shall be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date. In the event that a timely and complete reapplication has been submitted and the Director is unable, through no fault of the permittee, to issue a new permit before the expiration date of this permit, the terms and conditions of this permit are automatically continued and remain fully effective and enforceable.

10. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified as required by 40 C.F.R. 122.22. Knowingly making false statements, representations, or certifications is subject to penalty.

11. Availability of Reports

Unless a confidentiality claim is asserted pursuant to 40 C.F.R. Part 2, all reports submitted in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. If a confidentiality claim is asserted, the report will be disclosed only in accordance with the procedures in 40 C.F.R. Part 2. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

12. Penalties for Falsification of Reports

The Clean Water Act at Section 309 (c)(4), provides that any person who knowingly makes any false representation or certification in any record or other document filed or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon a first conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or by both. For a conviction of a person for a violation committed after a first conviction of such person, punishment shall be by fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

13. Correction of Reports

If the permittee becomes aware that it submitted incorrect information in any report to the Director, it shall promptly submit the correct information.

SECTION E. PUBLIC ACCOUNTABILITY

The permittee shall undertake an overall program of public accountability, including quarterly summary reports to inform all users of the sanitary system and local government officials and the general public of the extent of actual compliance with permit requirements and conditions. To facilitate public information, the permittee shall use available means such as posting quarterly summary reports on its website, inserts with water and sewer bills or other means to distribute this information to the public. In addition, the permittee shall include in this report information on the efficacy of all(on and off site) operations used in the disposal of sludge from the Blue Plains WWTP. Reports shall be provided to at least the following:

Secretary, Maryland Department of the Environment
Executive Director, Virginia Dept. of Environmental Quality
Director, DC Department of the Environment
Chief of Maintenance, National Park Service
Director, Interstate Commission of the Potomac River Basin
Director, Metropolitan Washington Council of Governments
Director, Water Protection Division, US EPA, Region III

PART III. COMBINED SEWER SYSTEM

SECTION A. GENERAL

The permittee operates a Combined Sewer System (CSS). The CSS includes the combined sewer overflow (CSO) and other Outfalls listed below as indicated by footnotes. During the period beginning with the permit effective date and lasting until the permit expiration date, the permittee is authorized to discharge from the CSOs listed below, as specified in the following paragraphs and sections.

Outfall (1)	Overflow Structure Location	Receiving Stream	Latitude and Longitude (approximate)
003	Bolling AFB	Potomac River	N 38 49 51 W 77 01 32
004 (2)	Emergency relief for Poplar Point Sewage Pumping Station, SE	Anacostia River, East Side	N 38 51 57 W 77 00 18
005	Chicago Street and Railroad Station, SE	Anacostia River, East Side	N 38 52 08 W 76 59 36
006	Good Hope Road, West Of Nichols Ave.,SE	Anacostia River, East Side	N 38 52 16 W 76 59 28
007	13th Street and Ridge Place,SE	Anacostia River, East Side	N 38 52 16 W 76 59 19
008 (2)	Anacostia Ave. west of Blaine St. NE – relief for Anacostia Main Interceptor	Anacostia River, East Side	N 38 53 29 W 76 57 46
009	2nd Street, 300 feet North of N Place, SE	Anacostia River, West Side	N 38 52 21 W 77 00 15
010	O Street Sewage Pumping Station, SE	Anacostia River, West Side	N 38 52 23 W 77 00 14
011	South of Main Sewage Pumping Station, SE (pumped overflow)	Anacostia River, West Side	N 38 52 22 W 77 00 17
011a	South of Main Sewage Pumping Station, SE (gravity overflow)	Anacostia River, West Side	N 38 52 22 W 77 00 17
012	North of Main Sewage Pumping Station, SE	Anacostia River, West Side	N 38 52 22 W 77 00 09

013	4th and N Streets, SE	Anacostia River, West Side	N 38 52 22 W 77 00 09
014	6th and M Streets, SE	Anacostia River, West Side	N 38 52 23 W 76 59 09
015	9th and M Streets, SE	Anacostia River	N 38 52 18 W 76 59 38
016	12th and M Streets, SE	Anacostia River, West Side	N 38 52 20 76 59 28
017	14th and M Streets, SE	Anacostia River	N 38 52 31 W 76 59 28
018	Barney Circle and Pennsylvania Ave, SE	Anacostia River	N 38 52 39 W 76 58 57
019	NE Boundary Trunk, Vic. Of 25th and E Sts., SE	Anacostia River, West Side	N 38 52 21 W 77 00 09
020	23rd Street, North of Constitution Ave, NW	Potomac River, East Side	N 38 53 10 W 77 03 03
021	Northeast of Roosevelt Bridge, NW	Potomac River, East Side	N 38 53 19 W 77 03 11
022	27th and K Streets, NW	Potomac River, East Side	N 38 53 52 W 77 03 27
023	Abandoned (Formerly 29th And K Streets, NW)	Potomac River, East Side	Not Available
024	30th and K Streets, NW	Potomac River, East Side	N 38 54 05 W 77 03 31
025	31st and K Streets, NW	Potomac River, East Side	N 38 54 03 W 77 03 44
026	Wisconsin Avenue and K St., NW	Potomac River, East Side	N 38 54 06 W 77 03 47
027	Water Street West of Street, NW	Potomac River, East Side	N 38 54 13 W 77 03 57
028	36th and M Streets, NW	Potomac River, East Side	N 38 54 13 W 77 04 18
029	Canal Road 1000 feet east of Rock Creek, NW	Potomac River, East Side	N 38 49 00 W 77 01 40
030	Abandoned (Formerly Foxhall and Canal Roads, NW)	Potomac River, East Side	Not Available
031	Pennsylvania Avenue, East Rock Creek, NW	Rock Creek, East Side	N 38 54 23 W 77 03 22
032	26th and M Streets, NW	Rock Creek, East Side	N 38 54 22 W 77 03 17
033	N Street extended West of 25th Street,NW	Rock Creek, East Side	N 38 54 26 W 77 03 18

034	23rd and O Streets, SW	Rock Creek, East Side	N 38 54 36 W 77 03 05
035	22nd Street south of Q Street, NW	Rock Creek, East Side	N 38 54 33 W 77 03 00
036	22nd Street South of Q Street, NW	Rock Creek, East Side	N 38 54 38 W 77 03 06
037	Northwest of Belmont and Rock Creek and Potomac Parkway	Rock Creek, East Side	N 38 55 02 W 77 03 04
038	North of Belmont Road, east of Kalorama Circle, NW	Rock Creek, East Side	N 38 55 08 W 77 03 05
039	Connecticut Avenue East of Creek, NW	Rock Creek, East Side	N 38 55 18 W 77 02 56
040	Biltmore Street extended east of Rock Creek, NW	Rock Creek, East Side	N 38 55 40 W 77 02 43
041	Ontario extended and Rock Creek Parkway	Rock Creek, East Side	N 38 55 40 W 77 02 43
042	Harvard Street and Rock Creek Parkway, NW	Rock Creek	N 38 55 42 W 77 02 43
043	Adams Mill Road South of Irving Street, NW	Rock Creek, East Side	N 38 55 42 W 77 02 42
044	Kenyon Street and Adams Mill Road, NW	Rock Creek East Side	N 38 55 44 W 77 02 44
045	Adams Mill Road and Lamont Street, NW	Rock Creek, East Side	N 38 55 50 W 77 02 49
046	Park Road south of Piney Branch Parkway, NW	Rock Creek, East Side	N 38 56 06 W 77 02 45
047	Ingleside Terrace extended and Piney Branch Parkway	Rock Creek, East Side	N 38 56 10 W 77 02 36
048	Mt. Pleasant Street extended and Piney Branch Parkway	Rock Creek, East Side	N 38 56 15 W 77 02 23
049	Piney Branch and Lamont Street, NW	Rock Creek, East Side	N 38 56 12 W 77 02 19
050	28th Street west of 16th Street, NW	Rock Creek, East Side	N 38 54 14 W 77 03 23
051	Olive Street extended and Rock Creek Parkway,NW	Rock Creek, East Side	N 38 54 32 W 77 03 11
052	O Street extended and Rock Creek Parkway, NW	Rock Creek, West Side	N 38 54 31 W 77 03 16
053	O Street west of Rock Creek Parkway, NW	Rock Creek, West Side	N 38 55 18 W 77 01 40

054	West Side of Rock Creek 300 ft. south of Mass.Ave, NW	Rock Creek, West Side	N 38 54 34 W 77 03 02
055	Abandoned		
056	Normanstone Drive extended west of Rock Creek, NW	Rock Creek, West Side	N 38 55 02 W 77 03 04
057	28th Street extended West of Rock Creek, NW	Rock Creek, West Side	N 38 55 18 W 77 03 09
058	Connecticut Avenue and Rock Creek Parkway, NW	Rock Creek, West Side	N 38 55 16 W 77 03 02
059	Luzon Valley [SEPARATED]	Rock Creek, West Side	N 38 57 54 W 77 02 13
060	P St and 26th St, NW	Rock Creek, West Side	Not Available
061 (2)	Hayes St. & Anacostia Ave NE – Emergency relief for Upper Anacostia Sewage Pumping Station	Tributary to Anacostia – East Side	Not Available
062 (2)	Earl Place, NE - Emergency relief for Earl Place Sewage Pumping Station	Tributary to Anacostia – West Side	Not Available

(1) All outfalls are CSO outfalls unless noted otherwise.

(2) These outfalls are recognized in the permit as emergency relief locations; they are not CSO Outfalls. Discharges are prohibited under Part III.B.1.e(i) and are reportable under Part III.B.1.e(iii) and Part II.D.2 and 7.

SECTION B. TECHNOLOGY-BASED CSS REQUIREMENTS

The permittee is required to control combined sewer overflows in accordance with the CSO Policy (April 1994). The permittee shall comply with the nine minimum technology-based conditions set forth below.

1. Nine Minimum Controls (NMC) Program

a. Operation and Maintenance - The permittee shall implement proper operation and maintenance programs for the sewer system and all CSO outfalls, in accordance with the program set forth below, with consideration given to the following: regular sewer inspections, sewer, catch basin and regulator cleaning; equipment and sewer collection system repair or replacement, where necessary; and disconnection of illegal connections.

i. Maintain a CSS inventory. Prepare an inspection plan and submit updated inventory information with each annual report as follows:

(a) List of CSO outfalls and emergency relief locations from Part III,Section A, COMBINED SEWER SYSTEM - GENERAL of this permit.

(b) Combined Sewer Overflow Structures. Include designation, location, description of operation, capacity and diagram or drawing of each structure. Include similar information for each inflatable dam.

(c) Outfall Structures. Include designation, location and description of each structure Include a diagram or drawing and a picture as available and practicable. Describe outfalls characteristic at high and low tide (e.g., submerged, partially submerged, not submerged). Identify whether or not each structure is equipped with a tide gate.

(d) Supervisory Control and Data Acquisition (SCADA) System. Include a functional description, and list of information provided by the SCADA system for the CSS.

(e) Rain Gages. List location and description of rain gauges installed Within the CSS.

ii. Inspect CSS control structures (regulator structures and tide gates) at least once per month.

iii. Inspect pumping stations at least once per month.

iv. Inspect Northeast Boundary Swirl Facility at least once per month.

v. Inspect inflatable dams and CSS SCADA system at least once per month.

vi. Develop an inspection program for the major combined sewers where each major combined sewer is inspected on a rotating schedule of sufficient frequency to maintain capacity requirements.

vii. Inspect outfall structures annually.

viii. Following rehabilitation, operate and maintain the Main, "O" Street, Potomac and Poplar Point and Eastside Pumping stations to provide firm pumping capacities of 240 MGD, 45 MGD, 460 MGD, 45 MGD and 45 MGD respectively.

b. Use Collection System for Storage

i. Operate and maintain inflatable dams to optimize storage in the CSS.

c. Pretreatment Program

i. Use pretreatment regulations to control any industrial discharges that may be identified as impacting CSOs.

ii. Use pretreatment regulations to require permitted significant industrial users (SIUs) discharging directly to the CSS to establish management practices to limit (e.g., use of control, detention or prohibition) batch discharges during wet weather conditions to the maximum extent feasible. Conduct an annual inspection of the above users to identify the existence of any batch discharges. Evaluate batch discharges identified to determine whether and to what extent limitations are appropriate during wet weather, taking into consideration volume, frequency, characteristics and the need to protect life and property.

d. Maximize Flow to Blue Plains

i. During wet weather, operate the pumping stations and collection system to deliver the maximum flow possible to Blue Plains within the constraints of the pumping stations, configuration and capacity of the collection system, and the capacity of the treatment plant. Develop a reporting system to show that operation of the pumping stations has been maximized during wet weather and that the maximum flow possible is being delivered to Blue Plains for treatment within the constraints of the pumping stations, collection system and treatment plant. Report such operations for each wet weather event.

ii. Maintain pumps to maximize flow to Blue Plains.

iii. The permittee shall ensure that the collection system has the capacity to convey flows at a rate totaling at least 1076 mgd to Blue Plains for treatment.

e. Eliminate Dry Weather Overflows (DWOs)

i. Dry weather overflows from CSO outfalls are prohibited. When the permittee detects a dry weather overflow, the permittee shall begin corrective action immediately. The permittee shall inspect the dry weather overflow each subsequent day until the overflow has been eliminated.

ii. Maintain a program to enlist public support for reporting DWOs.

iii. Receive reports of DWOs on a 24-hour basis. Each dry weather overflow confirmed by the Permittee shall be reported to District of Columbia Department of the Environment (DDOE) and EPA Region III within 24 hours.

f. Control Solid and Floatable Materials in CSOs

i. Screen pumped overflows at the Main and O Street Pumping Stations.

ii. Screen flow into the Northeast Boundary Swirl Facility.

iii. Operate and maintain end of pipe solid and floatable BMP demonstration controls until termination of the demonstrations at locations as follows:

(a) End of pipe netting system at CSO Outfall 018. Bar rack at CSO Outfall 041 at Structure Number 62.
(b) Bar rack at CSO Outfall 040 at Structure 61.
(c) Inspect BMP demonstration controls at least once per month. Clean BMPs following wet weather events on a schedule that maintains capture functions.

iv. Clean 85 percent of the 8200 catch basins in the combined sewer area at least annually. Inspect catch basins in CSO areas tributary to the Anacostia River at least 2 times per year and clean more frequently as identified by inspections.

The Anacostia River CSO areas inspection schedule is an interim schedule until permanent solids and floatable control facilities are placed in operation as part of the Long Term Control Plan. As permanent facilities are placed in operation, in each combined sewer area, the permittee may petition EPA to reduce the cleaning frequency to once per year in that area.

v. Operate the Anacostia River Floatable Debris Removal Program. This program comprises pick up of debris by skimmer and support boats on a regular weekly schedule, weather and river conditions permitting.

vi. Advise the D.C. Department of Public Works (DPW) and the National Park Service (NPS) in writing at least once per year on methods and systems to maximize litter control in the CSS, targeting neighborhoods that contribute disproportionate amounts of trash to the CSS. Document these efforts in quarterly CSO reports.

vii. Implement an ongoing, appropriate bi-lingual (English and Spanish) public education program aimed at reducing litter in the CSO sewershed, including public service announcements, public school presentations and stenciling programs.

viii. Prepare lesson plan materials to educate school children on the ways and means for citizens to assist in reducing the amount of solid and floatable materials in CSOs. Make the materials available to D.C. Public elementary schools for their use. Offer to make presentations to schools on the lesson plan and the CSO program at up to 6 occasions per year.

g. Pollution Prevention

i. Conduct regular public education programs to advise citizens of proper disposal of substances (e.g., household wastes, plastics, paper products, oils, leaves and the use of fertilizer).

ii. Conduct tours of Blue Plains to educate public on aspects of CSO control that can be enhanced with public assistance.

iii. Use the pretreatment program to encourage industrial waste reduction through recycling and improved housekeeping.

iv. Notify responsible agencies to enforce regulations that prohibit entrance into the CSS of any substance that may impair or damage the function and performance of collection and treatment systems.

v. Coordinate where feasible and practicable WASA's pollution prevention programs with those of D.C. government agencies such as the following partial list of pollutant prevention programs conducted by District of Columbia government agencies:

(a) Department of Public Works Programs
(i) Curbside recycling
(ii) Leaf pickup

(iii) Public trash receptacles
(iv) Household hazardous waste collection
(v) Residential bulk refuse collection and self-Service disposal
(vi) Campaign against rats
(vii) Support of community cleanup programs ("Helping Hand")
(viii) Enforcement of illegal dumping operations
(ix) Street cleaning and sweeping
(x) Public education for DPW Solid Waste Education And Enforcement Program ("SWEEP")

(b) Department of Environment Programs

(i) Public education and assistance
(ii) Enforcement of storm water and erosion/sedimentation control regulations

h. Public Notification

i. Operate a light on the Anacostia River and a light on the Potomac River to notify river users of CSO events. Lights will be operated by a signal from a epresentative CSO outfall on each river. A light (color A) will be illuminated during a CSO occurrence and a second light (color B) will be illuminated for 24 hours after a CSO has stopped.

ii. Maintain a website with information on: (a) nature of CSO discharges; (b) locations of CSOs; (c) potential health threats of CSOs; (d) record of CSO events by outfall with number, average duration and volume for the prior three month calendar quarter based on modeled results; (e) description of light system on the Anacostia River and Potomac River that advises river users of times that CSOs are actually occurring; and (f) nature and duration of conditions potentially harmful to users of receiving waters during and after a CSO event.

iii. Prepare and distribute semi-annually in sewer bills an informational pamphlet with information similar to that listed under h.ii above.

iv. Distribute a pamphlet semi-annually to locations (e.g., boathouses, marinas, water sports shops) frequented by receiving water users. The pamphlet shall include information similar to that listed under h.i above. Distribution will be to the extent permitted by owners of the locations.

v. Prepare and maintain an information bulletin to distribute to callers requesting information on the CSS and CSOs.

vi. Include updates and status of CSS and CSO plans and programs in information distributed under h. i, ii, iii, and iv above.

vii. Maintain warning signs at all CSOs.

i. Monitoring

i. Operate and maintain the SCADA system that monitors activation of selected CSO outfalls.

ii. Monitor and record the condition of the bar racks at the Main and O Street Pumping Stations storm,/CSO pumps to assess their ability to trap floatables.

iii. Monitor and record debris removed by the Anacostia River Floatable Debris Removal Program.

iv. Monitor and record flow, screenings removal and disinfection and dechlorination at the Northeast Boundary (NEB) Swirl Facility.

v. Monitor and record demonstration floatables removal; (a) at the end of pipe netting system at Outfall 018; (b) at bar rack at Outfall 041; and c) at the bar rack at Outfall 040 for the duration of the demonstration project.

vi. Monitor and record rainfall at a minimum of four 4) locations in the CSS. Locate rain gages at sites which are different from those used in the development of the LTCP. Report the number, volume and average duration of overflows for each active CSO outfall. The information shall be prepared using the latest model of the CSS, based on the measured storm event data and the operation of the inflatable dams for the previous calendar year.

SECTION C. Water Quality Based Combined Sewer System (CSS) Requirements

1. The Long Term Control Plan (LTCP) for the District of Columbia CSS including supplements thereto, provides for the control of CSO discharges to comply with the District of Columbia water quality standards in the Anacostia River, Rock Creek and its Piney Branch tributary and the Potomac River.

2. The permittee shall implement and effectively operate and maintain the CSO controls identified in the LTCP and any supplements thereto.

3. The LTCP for the District of Columbia CSS provides for the control of CSO discharges to the Anacostia River, Rock Creek and its Piney Branch tributary and the Potomac River. The LTCP facilities for controlling discharges to the above-named receiving waters include, among other things, diversion structures, a system of underground storage tunnels, pumping stations and outfall and overflow structures. The facilities shall, within the capacities provided, divert combined sewer flows to the storage tunnels, store combined sewer flow and convey stored combined sewer flow to Blue Plains for treatment.

4. The permittee shall effectively operate and maintain the LTCP CSO control facilities in accordance with the limitations and conditions set forth below.

5. Discharges from CSO Outfalls and tunnel overflow structures are prohibited except during wet weather events when one or more of the following conditions exist:

   a. The associated tunnels serving individual CSO outfalls and tunnel overflow structures are filled to their design capacities.

   b. Combined sewer flow is being transferred from individual CSO outfalls to the associated storage tunnel or diversion sewer at not less than minimum diversion rates listed below.

6. Solids and floatables capture shall be provided for all overflows prior to discharge to receiving waters.

7. All combined sewer flow stored in the Anacostia River, Northeast Boundary, Piney Branch and the Potomac River storage tunnels shall be emptied in such a manner as to maximize treatment of the stored flows through complete treatment at Blue Plains and to optimize conditions for maintaining the availability of storage volume in the tunnels system.

8. Storage tunnels shall have minimum design capacities as follows:

   a. Anacostia River and Northeast Boundary Tunnels - 157 million gallons
   b. Piney Branch Tunnel - 9.5 million gallons
   c. Potomac River Tunnel - 58 million gallons

9. Minimum diversion capacities from CSO outfalls to storage tunnels or interceptors and monitoring of diversions shall be as follows:

   a. Anacostia CSO Control Systems

CSO Outfall	**Drainage Area**	**Minimum Diversion Capacity For CSO Control (mgd)**	**Diversion to Tunnel or Diversion Sewer**	**Monitoring**
005	Fort Stanton	22	Tunnel	(2)
006	Fort Stanton	to be separated	n/a	n/a

007	Fort Stanton	44	Tunnel	(3)
009	Canal Street	21	Tunnel	(2)
010and011	B St/NJ Ave	180	Tunnel	(3)
012	Tiber Creek	221	Tunnel	(3)
013	Canal Street Sewer	17	Tunnel	(2)
014	Navy Yard/M St.; 6th St-7th St	61	Tunnel	(2)
015	Navy Yard/M St.; 9th St	22	Tunnel	(2)
016 (1)	Navy Yard/M St.; 12th St - 9th St.	86	Tunnel	(2)
017 (1)	Navy Yard/M St.; 14th St to Penn Ave	65	Tunnel	(2)
018	Barney Circle	57	Tunnel	(2)
019	Northeast Boundary	1,160	Tunnel	(3)

b. Potomac CSO Control Systems

CSO Outfall	**Drainage Area**	**Minimum Diversion Capacity for CSO Control (mgd)**	**Diversion To Tunnel or Diversion Sewer**	**Monitoring**
020	Easby Point	297	Tunnel	(3)
021	Slash Run	530	Tunnel	(3)
022	I St - 22nd St. NW	333	Tunnel	(3)
024 (1)	West of Rock Creek Diversion Sewer	66	Tunnel	(2)

025 [1]	31st & K St NW	3	Tunnel	(2)
026 [1]	Water St Dist (WRC)	0	Tunnel	(2)
027 [1]	Georgetown	92	Tunnel	(2)
028 [1]	37th St. Georgetown	9	Tunnel	(2)
029	College Pond	133	Tunnel	(3)

c. Rock Creek CSO Control Systems

CSO Outfall	Drainage Area	Minimum Diversion Capacity for CSO Control (mgd)	Diversion to Tunnel or Diversion Sewer	Monitoring
031	Penn Ave	to be separated	n/a	n/a
032	26th St - M St	6	Interceptor	(4)
033	N St - 25th	5	Interceptor	(3)
034	Slash Run	6	Interceptor	(4)
035	NW Boundary	290	Interceptor	(4)
036	Mass Ave & 24th St	29	Interceptor	(3)
037	Kalamora Circle West	to be separated	n/a	n/a
038	Kalamora Circle East	5	Interceptor	(4)
039	Belmont Rd	28	Interceptor	(4)
040	Biltmore Rd	12	interceptor	(4)
041	Ontario Rd	14	Interceptor	(4)
042	Quarry Rd	19	Interceptor	(4)
043	Irving St	35	Interceptor	(4)
044	Kenyon St	4	interceptor	(4)
045	Lamont St	8	Interceptor	(4)
046	Park Rd	9	Interceptor	(4)
047	Ingleside Terr	10	Interceptor	(3)
048	Oak St/Mt Pleasant	11	Interceptor	(4)

049	Piney Branch	468	Tunnel	(3)
050	M St - 27th St	21	interceptor	(4)
051	Olive-29th St	4	Interceptor	(4)
052	O St - 31st St	56	Interceptor	(4)
053	O St	to be separated	n/a	n/a
054	West Rock Cr Diversion Sewer	(5)	Interceptor	(4)
055	Abandoned	n/a	n/a	n/a
056	Normanstone Dr	(5)	Interceptor	(4)
057	Cleveland - 28th St & Conn Ave	33	Interceptor	(3)
058	Conn Ave	to be separated	n/a	n/a
059	16th and Rittenhouse Sts, NW	Separated	n/a	(4)

(1) These outfalls have been consolidated. Diversion capacity listed is that required for CSO control.

(2) Diversion capacity validated by construction performance test, no additional monitoring required.

(3) Continuous flow measurement of diversion and outfall. Provision for temporary sampling on diversion and outfalls.

(4) Diversion capacities from the referenced outfalls have been estimated based on computer modeling.

(5) These CSOs are emergency reliefs for the West Rock Creek Diversion sewer. There is no tributary drainage area, and flow diversion does not occur at these CSOs. The performance of these CSOs will be validated by computer modeling, no additional monitoring required.

10. With each DMR, report operations of the monitored CSO control facilities by systems as follows:

    a. Volume into and out of storage tunnels;
    b. Diversion rates into storage tunnels;
    c. Discharge rates from outfalls;
    d. Start and end time of wet weather event;
    e. Time when storage tunnel became filled to minimum required capacity;

f. All discharges from outfalls occurring prior to storage tunnel being filled to minimum required capacity and at less than minimum required diversion rates;
g. Volume of overflows from outfalls;
h. Results of any overflow or diversion sampling.

SECTION D. POST CONSTRUCTION MONITORING

The permittee shall implement a phased post-construction monitoring program to obtain information on rainfall, the volume and character of overflows and receiving waters characteristics. The monitoring phases shall be as follows:

Phase	Post-Construction Condition
1	Following the placement in operation of the inflatable dams and pumping stations rehabilitation.
2	Following the placement in operation of the Anacostia, Rock Creek and Potomac storage tunnels, respectively, As each tunnel is placed in operation.
3	Following the placement in operation of the complete CSO tunnels storage system

1. Phase I monitoring shall be in accordance with the following:

CSO Systems

Monitoring Type	Anacostia River	Potomac River	Frequency (3)
Rainfall Monitoring (1)	1 gauge in Northeast Boundary 1 gauge in Tiber Creek	1 gauge in Slash Run	Continuous
CSO Overflow (flow and volume) (1)	Northeast Boundary CSO 019 B ST/NJ Ave pumped overflow CSO 010	Potomac Pumping Station CSO 021 College Pond CSO 024	Continuous
CSO Overflow Sampling (2)	1 sampling station at Northeast Boundary	n/a	4 storms minimum approximately 1 hr sample interval for each storm.
Receiving Water Monitoring - Dissolved Oxygen (4)	Continuous DO Monitors	Continuous DO Monitors	approximately 30 minute intervals

Receiving Water Monitoring - Bacteria, Field Parameters(2)(4)	Bacteria Samples	Bacteria Samples	4 storms minimum

(1) Temporary gauges, meters and samplers to be installed.
(2) Samples shall be analyzed for fecal coliform, E.coli, CBOD5 and TSS.
(3) Monitoring shall be conducted for a continuous period of 12 months.
(4) The permittee is responsible for submitting all data, however, it is acceptable to use data developed by other sources.

2. Phase 2 monitoring shall be in accordance with the following:

CSO Systems

Monitoring Type	**Anacostia**	**Potomac**	**Rock Creek**	**Frequency**
Rainfall Monitoring (1)	1 gauge in Northeast Boundary 1 gauge in Tiber Creek	1 gauge in Slash Run 1 gauge in College Pond	1 gauge in Piney Branch	Continuous
CSO Overflow Monitoring and Diversion to Storage Monitoring (2)	Northeast Boundary CSO 019 Fort Stanton CSO 007 B ST/NJ Ave Pumped Overflow CSO 010	Potomac Pumping Station CSO 021 College Pond CSO 029	Piney Branch CSO 049	Continuous
Tunnel Storage Level Monitoring (2)	1 sensor in Tunnel	1 sensor in tunnel	1 sensor in tunnel	Continuous
CSO Overflow Sampling (2) (3)	Sampling stations at Northeast Boundary CSO 019 and CSO 10	Sampling stations at CSO 020 and CSO 021	1 sampling station at CSO 049	4 storms minimum approx. 1 hour sample interval for each storm
Receiving Water Monitoring - Dissolved Oxygen (5)	Continuous DO monitors (5)	Continuous DO monitors (5)	n/a	approx. 30 minute intervals (5)

Receiving Water Monitoring - Bacteria, Field Parameters (3)	Use data from existing monitors and establish at least 6 other locations	Use data from existing monitors and establish at least 3 other locations	Use data from existing monitors and establish at least 7 other locations	once per week for bacteria and once per quarter for all other substances

(1) Temporary gauges to be installed.
(2) Shall use facilities and equipment installed as part of CSO control systems.
(3) Sampling shall be analyzed for fecal coliform, E.coli, mercury, arsenic, cadmium, total chromium, copper, lead, nickel, selenium, silver, zinc, chromium VI, hardness, cyanide, pesticides, PCBs, volatiles and semivolatiles, DO, ammonia as N, TKN, total phosphorus, and ortho-phosphorus. Metals shall be analyzed as dissolved and total recoverable.
(4) Monitoring shall be conducted for a continuous period of 12 months, in each CSO system after appropriate facilities are placed in operation.
(5) Permittee is responsible for submitting all data, however, it is acceptable to submit data provided by other sources.

3. Phase 3 monitoring shall be in accordance with the following:

CSO Systems

Monitoring Type	**Anacostia River**	**Potomac River**	**Rock Creek**	**Frequency (4)**
Rainfall Monitoring (1)	1 gauge in Northwest Boundary 1 gauge in Tiber Creek	1 gauge in Slash Run 1 gauge in College Pond	1 gauge in Piney Branch	Continuous
CSO Monitoring and Diversion to Storage Monitoring (2)	Northeast Boundary CSO 019 Fort Stanton CSO 007 B St/NJ Ave Pumped Overflow CSO 010	Potomac Pumping Station CSO 021 College Pond CSO 029	Piney Branch CSO 049	Continuous
Tunnel Storage Level Monitoring (2)	L sensor in Tunnel	1 sensor in Tunnel	1 sensor in tunnel	Continuous
CSO Overflow Sampling (2) (3)	Sampling stations at CSO 019 and CSO 010	Sampling stations at CSO 021 and 020	1 sampling station at CSO 049	4 storms maximum approx. 1 hour sample interval for each storm
Receiving water Monitoring - Dissolved Oxygen (5)	continuous DO monitors	continuous DO monitors	n/a	approx 30 minute intervals

Receiving water monitoring-bacteria, field parameters (3) (5)	establish at least 6 locations	Establish at least 6 locations	7 other locations	once per week for bacteria and once per quarter for all other parameters

(1) Temporary gauges will be installed.
(2) Shall use facilities and equipment installed as part of CSO control systems.
(3) Sampling shall be analyzed for fecal coliform, E.coli, CBOD5, TSS, the 126 priority pollutants, mercury, arsenic, cadmium, total chromium, copper, lead, nickel, selenium, silver, zinc, chromium VI, hardness, cyanide, pesticides, PCBs, volatiles, semi-volatiles, DO, ammonia as N, TKN, total phosphorus and ortho-phosphorus. Metals shall be analyzed as dissolved and total recoverable.
(4) Monitoring shall be conducted for a continuous period of 12 months.
(5) The permittee is responsible for submitting all monitoring data.

4. Results from the monitoring phases shall be used to assess the performance of CSO controls against predictions established as part of LTCP development and its supplements. Performance assessments shall be prepared by the permittee and submitted to EPA within 180 days of completion of a monitoring phase. In general, the assessments shall include:

a. Comparison of monitored overflow magnitude and duration with the LTCP predictions;
b. Comparison of monitored water quality in receiving waters with LTCP predictions;
c. Comparison of monitored CSO reductions with LTCP reductions;
d. Comparison of performance to TMDLs and allocations established for CSOs and approved bypasses in the receiving waters; and
e. Overall evaluation as to whether or not CSO controls are providing degree of control predicted for LTCP conditions and whether or not modifications or additions to the LTCP are required.

SECTION E. CSO STATUS REPORTS AND SCHEDULES

1. Progress reports are to be provided to EPA for all activities scheduled or completed in accordance with the terms of this permit. Such reports shall be submitted in quarterly and annual reports which summarize actions and activities undertaken to comply with Part III, Section B.1. and Part III, Section C of this permit (Nine Minimum Controls Program and the LTCP). Reports shall be submitted to EPA and DDOE as follows:

a. Submit quarterly reports on the 28th day of April, the 28th day of July, the 28th day of October and the 28th day of January. Reports shall summarize information through the last day of the month prior to the month in which the report is due. The first quarterly report shall be submitted for the first full quarter following the effective date of the permit.

b. Submit annual reports by March 31 of each year summarizing information for the previous calendar year. The first annual report shall be submitted for the first full year following the effective date of the permit.

2. Information submitted in reports shall, in general, be prepared in a tabular format giving dates, times and locations as applicable. The information to be reported of the Nine Minimum Controls Program shall include the following:

a. CSS Control Structures - Number of inspections conducted, conditions observed (e.g., function normal, blockages, malfunctions, repairs needed) and maintenance and repairs performed. For blockages observed provide: the location of blockage, date and time that the blockage was discovered, date and time blockage was corrected, and whether or not a discharge from the outfall to the receiving water was observed. If a discharge was observed, provide an estimate of discharge volume.

b. Pumping Stations - Number of inspections conducted, numbers of screens and pumps installed and numbers available for service; and preventative maintenance performed. For pumps found not to be available for service, permittee shall report the cause of unavailability, schedule for and status of repairs. For the Main and O Street pumping stations, report the results of visual wet weather surveys and record of overflow screenings.

c. Northeast Boundary Swirl Facility - Number of inspections conducted, number of screens and swirls installed and numbers available for service; and preventative maintenance performed. Report record of flow treated and screenings removed.

d. Inflatable Dams and SCADA System - Number of inspections conducted. Number of dams installed and number of dams operational. Occurrence of an overflow and approximate duration of overflow based on dams inflation status.

e. Major Combined Sewers - Upon development of inspection program. Inspections planned, inspections conducted, results of inspections and description and schedule for maintenance and repairs planned and performed.

f. Wet Weather Overflows - Report the modeled results of the number, volume and average duration of overflows for each active CSO outfall due to wet weather events.

g. Dry Weather Overflows - Are prohibited, however, in the event that they do occur, report their location, cause, date and time discovered, action taken, date and time discharge confirmed ceased and actions taken to prevent reoccurrence of the condition causing the overflow. Include an estimate of the overflow volume.

h. Catch Basin Cleaning - Number and location of catch basins required to be cleaned plus the number and location of catch basins actually cleaned.

i. Anacostia River Floatable Debris Removal Program - Number of boats available for service, number of cleaning trips, record of amount and nature of material removed.

j. BMP Demonstration for Solid and Floatable Control - Number of inspections conducted and conditions observed, and records of material removed at CSO outfalls 018, 040 and 041.

k. Other - Summarize actions and activities under programs for Pollution Prevention, Public Notification and Pretreatment.

l. Wet Weather Flows to Blue Plains WWTP - Upon development of a reporting system, report operations for each wet weather event.

m. CSS Litter Control - Number of meetings or conferences with DPW and NPS. Summary of topics discussed and actions adopted.

3. Report on the following quarterly:

a. Northeast Boundary Swirl Facility
b. Inflatable Dams and SCADA System
c. Dry Weather Overflows
d. CSS Control Structures
e. Pumping Stations
f. Wet Weather Flows to Blue Plains
g. Wet Weather Overflows
h. CSS Litter Control

4. Report on the following annually:

a. CSS Inventory
b. Major Combined Sewers
c. Catch Basin Cleaning
d. BMP Demonstration for Solid and Floatable Control
e. Anacostia River Floatable Debris Removal Program
f. Other

PART IV. SPECIAL CONDITIONS

SECTION A. PRETREATMENT

Pretreatment Conditions for Program Implementation

1. General Requirements - The permittee shall operate and implement an industrial pretreatment program in accordance with the federal Clean Water Act and the federal General Pretreatment Regulations at 40 C.F.R. Part 403. The program shall also be

implemented in accordance with the permittee's pretreatment program and any modifications thereto submitted by the permittee and approved by the EPA.

2. Annual Report - In accordance with 40 C.F.R. § 403.12(i), the permittee shall submit an Annual Report by March 31 of each year to EPA that describes the permittee's pretreatment activities for the previous calendar year. The Annual Report shall include a description of pretreatment activities in all municipalities from which wastewater is received at the permittee's POTW. At a minimum, the Annual Report shall include the following:

a. Industrial Listing - The Annual Report shall contain an updated industrial listing showing the name and address of all current Significant Industrial Users (SIUs) and Non-Significant Categorical Industrial Users (NSCIUs) as defined by 40 C.F.R. § 403.3 and the categorical standard, if any, applicable to each. The listing must: (1) identify any users that are subject to reduced reporting requirements under 40 C.F.R. § 403.12(e)(3); (2) identify which users are NSCIUs; (3) identify any users that have been granted a monitoring waiver in accordance with 40 C.F.R. § 403.12(e)(2) as well as the pollutants for which the waiver was granted and the date of the last POTW sampling event for each of those pollutants; and (4) identify any categorical industrial users that have been given mass-based limits in place of concentration-based categorical limits in accordance with 40 C.F.R. § 403.6(c)(5) or concentration-based limits in place of mass-based categorical limits in accordance with 40 C.F.R. § 403.6(c)(6). In addition, the report shall contain a summary of any trucked or hauled wastewater accepted into the POTW including the source of the wastewater (domestic, commercial, or industrial) and the discharge point(s) designated by the POTW for acceptance of such wastewater. For each industrial source, the report shall indicate the name and address of the industrial source, the average amount of wastewater received per discharge day, a brief description of the type of process operations conducted at the industrial facility, whether the source facility is a categorical industrial user (including NSCIUs), significant industrial user, or non-significant industrial user, and any controls imposed on the user;

b. Control Mechanism Issuance - The Annual Report shall contain a summary of SIU control mechanism issuance, including a list of issuance and expiration dates for each SIU. For each general control mechanism issued, provide the names of all SIUs covered by the general control mechanism and an explanation of how the users meet the criteria under 40 C.F.R. § 403.8(f)(1)(iii)(A) for issuance of a general control mechanism.

c. Sampling and Inspection - The Annual Report shall contain a summary of the number and type of inspections and samplings of SIUs by the permittee, including a list of all SIUs either not sampled or not inspected, and the reason that the sampling and/or inspection was not conducted. For any user subject to reduced reporting under 40 C.F.R. § 403.12(e)(3), the list shall include the date of the last POTW sampling and the date of the last POTW inspection of the user. In addition, the report shall include a summary of the number of self-monitoring events conducted by each SIU and the number required to be conducted, including a list of all SIUs that did not submit the required number of reports and the reason why the reports were not submitted. For NSCIUs, the report shall provide the date of the compliance certification required under 40 C.F.R. § 403.12(q);

d. Industrial User (IU) Compliance and POTW Enforcement - The Annual Report shall contain a summary of the number and type of violations of pretreatment standards and requirements, including local limits, and the actions taken by the permittee to obtain compliance, including compliance schedules, penalty assessments, and actions for injunctive relief. The report shall state whether each SIU was in significant noncompliance, as that term is defined in 40 C.F.R. § 403.8(f)(2)(viii), including the parameter(s) in violation, the period of violation, the actions taken by the POTW in response to the violations, and the compliance status at the end of the reporting period. A copy of the publication of users meeting the significant noncompliance criteria shall be included. In addition, the report shall provide a list of users previously designated as NSCIUs that have violated (to any extent) any pretreatment standard or requirement during the year and the date and description of the violation(s);

e. Summary of POTW Operations - The Annual Report shall contain a summary of any interference, pass-through, or permit violations by the POTW and indicate the following: (1) which (if any) NPDES violations may be attributed to industrial users; (2) which IU(s) are responsible for such violations; and (3) actions taken to address these events. The report shall also include all sampling and analysis of POTW treatment plant influent, effluent, and sludge for local limits and priority pollutants identified pursuant to section 303(d)of the Clean Water Act, 33 U.S.C. § 1313(d), and conducted during the year;

f. Pretreatment Program Changes - The Annual Report shall contain a summary of any changes made or proposed to the approved program during the period covered by the report and the date of submission to EPA;

g. Signatory Requirements - The Annual Report shall be signed by a principal executive officer, ranking elected official or other duly authorized employee in accordance with 40 C.F.R. § 403.12(m). Any such authorization must be made in writing and identify an individual or position having responsibility for the overall operation of the POTW or pretreatment program.

3. Pretreatment Monitoring - The permittee shall conduct monitoring at its treatment plant that, at a minimum, includes quarterly influent, effluent, and sludge analysis for all pollutants for which local limits have been established, and an annual priority pollutant scan for influent and sludge.

4. Notification of Pass-Through or Interference - The permittee shall notify EPA, in writing, of any instance of pass-through or interference, as defined at 40 C.F.R. § 403.3(p) and (k), respectively, known or suspected to be related to an industrial discharge from an IU into the POTW. The notification shall be attached to the Discharge Monitoring Report submitted to EPA and shall describe the incident, including the date, time, length, cause (including the responsible user if known), and the steps taken by the permittee and the IU (if identified) to address the incident. A copy of the notification shall also be sent to the EPA Pretreatment Coordinator at the address provided below.

5. Headworks Analysis - The permittee shall submit to EPA a reevaluation of its local limits based on a headworks analysis of its treatment plant within 1 (one) year of permit issuance. In order to ensure that the permittee's discharge complies with water quality

standards, the reevaluation of the local limits shall be conducted using, among other things, any water quality standards applicable to the pollutants included in the reevaluation unless the permit includes a limit for that pollutant. The list of pollutants to be evaluated, as well as a sampling plan for collection of necessary data, shall be submitted to EPA within 3 (three) months of permit issuance. Within 4 (four) months of acceptance of the headworks analysis by the Approval Authority, the permittee shall adopt the revised local limits and notify all contributing municipalities of the need to adopt the revised local limits.

6. Changes to Pretreatment Program - EPA or the permittee may initiate program modification at any time to reflect changing conditions at the POTW, which may include (but are not limited to) the following reasons:

   a. The program is not implemented in accordance with 40 C.F.R. Part 403;

   b. Problems such as interference, pass-through, or sludge contamination develop or continue;

   c. Federal, State, or local requirements change;

   d. Changes are needed to assure protection of waters of the United States. Program modification is necessary whenever there is a significant change in the operation of the Pretreatment Program that differs from the information in the permittee's submission, as approved under 40 C.F.R. § 403.11.

7. Procedure for Pretreatment Program Changes - Upon submittal by the permittee, and written notice of approval by EPA to the permittee of any changes to the permittee's approved pretreatment program, such changes are effective and binding upon the permittee unless the permittee objects within 30 days of receipt of the written notice of approval. Any such objection must be submitted in writing to EPA at the address shown below.

8. Correspondence - Pretreatment correspondence shall be submitted to EPA at the following address:

   Pretreatment Coordinator (3WP41)
   U.S. Environmental Protection Agency
   1650 Arch Street
   Philadelphia, PA 19103-2029

SECTION B. STANDARD SLUDGE CONDITIONS

1. The permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices, including 40 C.F.R. 503 and 40 C.F.R. 258 which are hereby incorporated as part of the permit by reference, and the Clean Water Act (CWA) Part 405(d) technical standards.

   If an applicable management or practice or numerical limitation for pollutants in sewage sludge more stringent than existing federal and state regulations is

promulgated under Part 405(d) of the CWA, this permit shall be modified to conform to the promulgated regulations.

2. The permittee shall give notice to the Director of any change(s) planned or in the permittee's sludge use or disposal practice.

3. A change in the permittee's sludge use or disposal practice is a cause for modification of the permit. It is a cause for revocation and reissuance of the permit if the permittee requests or agrees.

4. The permittee shall submit an annual sludge report containing the information required in 40 C.F.R. 503 by February 19 each year. The report shall cover the previous calendar year. The sludge report shall be submitted to"

U.S. EPA, Region III
Water Protection Division
Office of NPDES Permitting and Enforcement
(3WP42)
1650 Arch Street
Philadelphia, PA 19103 - 2029

SECTION C. CHLORINATION/DECHLORINATION

1. The permittee shall report chlorine dosage (on a pound basis) per discharge event on Outfall 001. Dosage figures shall be submitted with the DMR for the month of the discharge event.

2. The concentration of Total Residual Chlorine (TRC) in the final effluent after dechlorination shall not exceed not-detectable. The permittee is required to achieve non-detectable for TRC as measured by 0.10 mg/l.

   When the TRC concentration in the final effluent results in a detectable measurement (above 0.10 m/l) the permittee shall take immediate steps to achieve a non-detectable concentration.

   The permittee shall resample TRC within one hour after the original grab sample measurement. If this grab sample shows a non-detectable amount as measured by 0.10 mg/l or less, then the original sample shall be considered in compliance. If this grab sample shows a detectable amount, above 0.10 mg/l, then the permittee shall retest in the second hour after the original non-compliance. If this grab sample in the second hour after the original non-compliance shows a not detectable amount as measured by 0.10 mg/l or less, then the sample shall be considered in compliance, but if the grab sample is above 0.10 mg/l then it will be considered a violation and recorded on the DMR. Each subsequent hourly sample above 0.10 mg/l shall be enumerated on the DMR until the effluent returns to compliance.

Whenever there is an initial detectable TRC concentration, all subsequent sampling results shall be tabulated and reported with the DMRs and the time required to achieve the TRC of 0.10 mg/l. The analytical method used and the detection limit for each sample should be included on the data tabulation.

For purposes of reporting on the DMR form, a non-detectable result shall be reported as zero. For a violation(s) of the limit, the maximum chlorine residual for the month and the total number of excursions in that month should be recorded in the appropriate column on the DMR form. The permittee shall operate the dechlorination facilities in a manner which will ensure continuous compliance with the TRC non-detectable limit.

All analytical testing for TRC shall be in accordance with 40 C.F.R. Part 136, Amperometric Titration or DPD Ferrous Titrimetric Method.

SECTION D. TOTAL NITROGEN COMPLIANCE SCHEDULE

1. The total nitrogen (TN) effluent limit from the Blue Plains plant, for Outfall 002 shall be 4,377,580 pounds per year. Improvements to the existing nitrogen removal facilities to achieve this limit shall occur no later than the dates in the following schedule:

   a. Award contract for Construction – December 31, 2011;
   b. Place in operation – July 14, 2014
   c. Begin compliance with TN effluent limit – January 1, 2015.

2. Progress Reports: Beginning six months from the effective date of this permit and every six months until January 1, 2015, the permittee shall submit reports detailing progress towards completion of each of the above requirements. In addition, no later than 14 days following each of the dates set forth above, the permittee shall notify EPA in writing of its compliance or non-compliance with these requirements.

SECTION E. STORM WATER MANAGEMENT

1. Storm Water Pollution Prevention Plan

   a. General

   A Storm Water Pollution Prevention Plan (SWPP) was developed for this facility in accordance with the factors outlined in 40 C.F.R.125.3 (d)(2)or (3), as appropriate. The plan identifies potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharge associated with sludge handling operations or other portions of the waste water treatment plant as appropriate.

b. Plan Review

The plan shall be retained on site at the facility. The permittee shall make plans available upon request to the EPA. The EPA may notify the permittee at the time that the plan does not meet one or more of the requirements of this Part. Such notification shall identify those provisions of the permit that are not being met by the plan, and identify which provisions of the plan require modification in order to meet the minimum requirements of this Part. Within 30 days of such notification, the permittee shall make the required changes to the plan and shall submit to EPA a written certification that the requested changes have been made.

c. Plan Modification

The permittee shall amend the plan whenever;

i. There is a change in design, construction, operation or maintenance which has a significant effect on the potential for the discharge of pollutants to the waters of the United States; or

ii. EPA notifies the permittee of its finding that the SWPPP is inadequate in eliminating or minimizing pollutants from identified sources, or that the SWPPP is inadequate to prevent the facility from causing, or having a reasonable potential to cause or contribute to a violation of the D.C. Water Quality Standards.

SECTION F. PCB MONITORING AND REDUCTION

1. The permittee shall monitor quarterly for PCBs at Outfalls 001 and 002 during the term of this permit using composite or grab samples as specified for these outfalls at Part I of this permit. The samples for Outfall 002 shall represent 2 dry weather and 2 wet weather samples quarterly during the term of this permit. Samples from Outfall 001 shall represent 2 wet weather samples quarterly during the term of this permit. During the first year of the permit, the permittee shall also monitor plant influent during one of the corresponding wet weather and one of the corresponding dry weather sampling events.

For the purpose of obtaining samples, dry weather means no measurable rain at Ronald Reagan National Airport in the prior 72 hours and wet weather means a condition when the average daily plant influent flow is greater than 511 mgd.

Samples shall be analyzed using Method 1668B. After the permittee has collected four quarterly samples from Outfall 002 and 001, the permittee may request a waiver from EPA for the remaining samples. Documentation shall be submitted with the waiver request to demonstrate why other sampling is not necessary. If the results of the monitoring indicate actual or potential exceedance of the Waste Load Allocation, and upon notification by EPA, the permittee shall within 120 days submit to EPA for comment a work plan and schedule for

preparation and implementation of a Pollution Minimization Plan (PMP) and other submittals or analyses of PCB data. Such submittals may include an assessment of PCBs in the initial source intake water to determine the net contributions of PCBs introduced to the treatment works and an analysis of the net reductions provided by treatment.

2. The PMP developed from the work plan shall include, but not necessarily be limited to:

   a. The name and contact information for an individual who will serve as the permittee's contact for information concerning the PMP.

   b. A narrative discussion together with necessary supporting data, charts, maps, diagrams and similar material of the permittee's CSO service area (CSO Area) including the location of all outfalls.

   c. A time schedule with milestone dates.

   d. Description of all known materials, equipment, processes, soil areas or facilities within the CSO area from which PCBs are known or suspected to be released, directly or indirectly into a CSO, including a description of the entry pathway if that is known. Pollutant concentrations, if known shall be reported.

   e. Description of all known materials, processes, soil area or facilities within the CSO Area that are known to contain PCBs, but are not known to be releasing PCBs within the District's CSO Area.

   f. During the term of this permit, the permittee shall collect and analyze at least twelve (12) in-stream samples for PCBs. Samples shall be taken simultaneously upstream and downstream of CSO outfalls and the PMP shall include planned locations for the monitoring.

   g. The permittee shall develop a report of all known PCB sources within the CSO system that the permittee believes or has reason to believe may require some control measure to reduce its discharge of PCBs. The permittee shall work with the Interstate Commission on the Potomac River Basin (ICPRB), and other appropriate agencies, to develop a plan of action to control the discharge of PCBs from these sources.

   h. The permittee shall develop and implement a program to identify whether industrial users have the potential to contribute to PCBs. Because PCBs may be contributed from many industrial processes, principally through oils which are contaminated by PCBs and may be rinsed and discharged into the sewer system, the permittee shall include PCBs as a sampling requirement for facilities with known or suspected sources of

PCBs. In addition, the permittee shall conduct period reviews of its industrial database, including analytical scans of suspected sources to determine whether PCBs are being discharged in detectable concentrations.

i. The permittee shall demonstrate its compliance with the PMP by reporting the number of known sites, the number of sites referred for action and the results of the in-stream sampling activity and any other actions taken to further the goals of the PMP. The permittee shall report on PMP implementation annually by February 15 and the report shall cover the preceding calendar year.

SECTION G. WHOLE EFFLUENT TOXICITY (WET) TESTING

1. In accordance with 40 C.F.R.§ 122.21(j)(5), the permittee must conduct and provide the results of WET tests for chronic toxicity for Outfall 002 and acute toxicity for Outfall 001.

2. Testing Frequency

a. For the duration of this permit, these results must include quarterly testing on 24-hour composite effluent samples for Outfall 002, and grab samples for Outfall 001 beginning within three months of the effective date of the permit. The permittee shall conduct the toxicity tests, using a minimum of two species, using the fish fathead minnow - *Pimephales promelas* and the invertebrate species *Ceriodaphnia dubia.* Upon the completion of the last of four quarterly tests, the permittee may petition EPA for a reduction in the frequency of this testing.

b. In addition, pursuant to 40 C.F.R. 122.21(5)(iv)(A), the permittee shall submit the results of four quarterly tests for Outfalls 001 and 002 for a year immediately preceding the next permit application with its application for permit reissuance.

3. Monitoring

a. *Outfall 001.* Species and toxicity test methods for estimating the acute toxicity of NPDES effluents are found in the fifth edition of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012, 2002; Table 1A, 40 C.F.R. Part 136). The permittee shall conduct definitive 96-hour static renewal toxicity tests using a vertebrate species, the fathead minnow - *Pimephales promelas, and definitive 96-hour static renewal toxicity tests using* the invertebrate species, *Ceriodaphnia dubia* for Outfall 001. Each test will include a control and the permitted IWC of 45% concentrations in order to quantify any measurable acute toxicity. These renewal tests will need to have sufficient volume collected by grab during the storm event to use for the start of the test, the additional test renewals and TIE, if necessary.

During the first year of the WET studies the permittee shall use the multiple species required above. For the following years the permittee may perform the study using the most sensitive species only.

b. For *Outfall 002*. Species and toxicity test methods for estimating the chronic toxicity of NPDES effluents are found in the fourth edition of *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA/821/R-02/013, 2002; Table 1A, 40 C.F.R. Part 136)(Chronic Test Methods Manual). The permittee shall conduct static renewal toxicity tests with a vertebrate species, the fathead minnow - *Pimephales promelas*, and an invertebrate species - *Ceriodaphnia dubia* for Outfall 002.

4. WET Requirements

a. *For Outfall 001,* the acute WET requirement for this discharge is "Pass" for any one test result. For this permit, the determination of Pass or Fail from a single-effluent-concentration (paired) acute toxicity test is determined using a one-tailed hypothesis test called a "t-test". As discussed in paragraph 7. below, a mixing zone is authorized at Outfall 001. The resulting in-stream waste concentration (IWC) for Outfall 001 is 45%. The objective of a Pass or Fail test is to determine if survival in the single treatment (45% effluent) is significantly different from survival in the control (0% effluent). Following Section 11.3 in the Acute Test Methods Manual (EPA/821/R-02, 2002), the t statistic for the single-effluent-concentration acute toxicity test shall be calculated and compared with the critical t set at the 5% level of significance. If the calculated t does not exceed the critical t, then the mean responses for the single treatment and control are declared "not statistically different" and the permittee shall report "pass" on the DMR form. If the calculated t does exceed the critical t, then the mean responses for a single treatment and control are declared "statistically different" and the permittee shall report "fail" on the DMR form. This permit requires a TIE to be conducted on the original sample if the acute WET test is reported as "fail".

b. There are no chronic toxicity effluent limits for Outfall 002. Quarterly monitoring of chronic toxicity shall be conducted. If four consecutive chronic tests demonstrate an IC25 greater than the IWC of 52%, calculated for outfall 002, the permittee may request that EPA re-evaluate the effects of Outfall 002's effluent upon the aquatic community and reduce or remove the WET testing frequency for the remainder of the permit cycle. If any of the quarterly chronic tests result in an IC25 less than the IWC of 52%, the permittee shall follow the requirements in paragraph G.8.b. below.

To properly conduct chronic WET tests, the laboratory must prepare a series of effluent dilutions which are specific to the permittee's discharge. The permittee must inform the laboratory of the proper dilution series. The dilution series must include at least one dilution below the IWC. Based upon the calculated IWC, the recommended series for the chronic tests is 100, 72, 52, 38 and 27 percent effluent.

5. Reporting Results

All information reported must be based on data collected through analysis conducted using 40 C.F.R. Section 136 Table 1A methods. In addition, all data must comply with QA/QC requirements of 40 C.F.R. Part 136 and other appropriate QA/QC requirements for standard methods not addressed by 40 C.F.R. Part 136.

The permittee shall notify the permitting authority and DC DOE in writing within 14 days of an exceedance of a chronic or acute WET permit trigger. This notification shall describe actions the permittee has taken or will take to investigate, identify, and correct the causes of toxicity; the status of actions required by this permit; and schedule for actions not yet completed; or reason(s)that no action has been taken.

Results for toxicity testing shall be submitted with the DMRs for the month in which the toxicity was conducted.

Additional Reporting Requirements

The permittee shall provide the results of all WET tests conducted during the four and one-half years prior to application for a new permit.

7. Mixing Zones

Pursuant to the District of Columbia Water Quality Standards (WQS) (21 DCMR 1105.7), a mixing zone may be allowed for point source discharges of pollutants on a case-by-case basis where it is demonstrated that allowing a small area impact will not adversely affect the waterbody as a whole. Specific conditions apply. In accordance with the DC WQS, EPA is allowing the use of mixing zones for chronic WET testing, as long as the conditions of 21 DCMR 1105.7 are met. WASA may make a request in writing for a mixing zone for one or both outfalls. The request should demonstrate how the discharge meets the conditions of 21 DCMR 1105.5.

8. Accelerated Toxicity Testing and Toxicity Reduction Evaluation (TRE) Toxicity Identification Evaluation (TIE)Process

a. *For Outfall 001*. The acute permit trigger is defined as the IWC. If an acute permit trigger is exceeded, then the permittee shall begin TIE testing using the excess of the original sample collected. This test shall begin immediately upon receipt of test results exceeding the acute WET trigger. If an acute trigger is exceeded, the permittee shall conduct two additional toxicity tests using the same species and test method as soon as additional Outfall 001 CSO releases occur. If the additional toxicity tests do not exceed the specified acute WET permit trigger, then the permittee may return to their regular testing frequency.

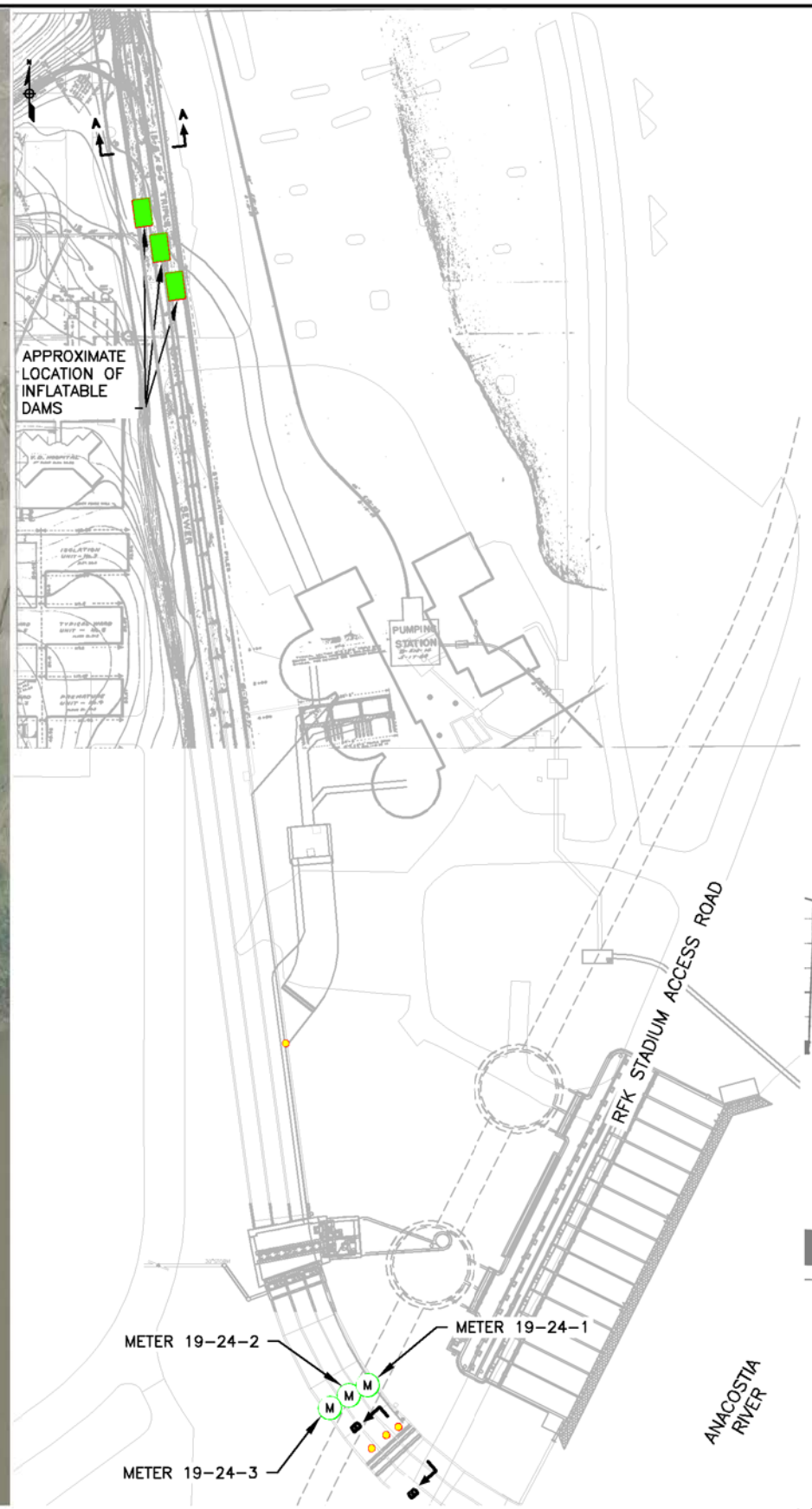
If a toxicant(s) is identified in the TIE process, the permittee shall develop a detailed TRE Workplan which shall include, at a minimum, the additional actions the permittee shall take to investigate, identify and correct the problem.

b. *For Outfall 002.* The chronic permit trigger is defined as the IWC for outfall 002. If the chronic permit trigger is exceeded, then the permittee shall conduct two additional toxicity tests using the same species and test method. The tests shall begin within 14 days of receipt of test results exceeding the chronic WET trigger. If one of the additional toxicity tests exceeds a chronic WET permit trigger, then, within 30 days of the receipt of this confirmation test result, the permittee shall initiate a TRE using the U.S.*EPA Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants* (EPA/833/B-99/002) *(1999)*. The TRE Workplan shall include, at a minimum, additional actions to be taken by the permittee to investigate, identify, and correct the causes of toxicity; actions the permittee will take to mitigate the impact of the discharge and prevent the recurrence of the toxicity; and a schedule to implement required remedial actions.

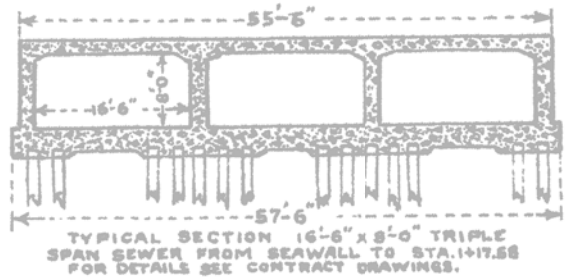
c. During the pendency of the TRE/TIE process, the permittee shall continue quarterly acute and/or chronic WET testing.

d. In the event that a toxicant is identified and a remedy can be quickly implemented (e.g., lowering concentrations of chlorine or ammonia), such remedy should be implemented as quickly as possible and prior to the development and submission of a TRE Workplan.

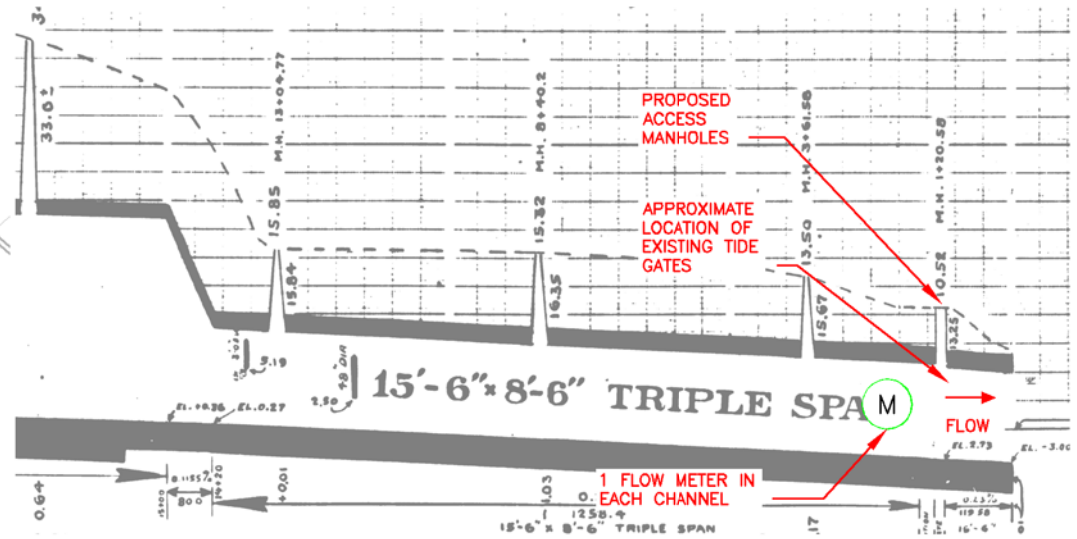
Appendix B Flow Meter Location Maps



FLOW METER LOCATION PLAN
SCALE: NTS



TYPICAL CROSS SECTION A–A
SCALE NTS



TYPICAL CROSS SECTION B–B
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

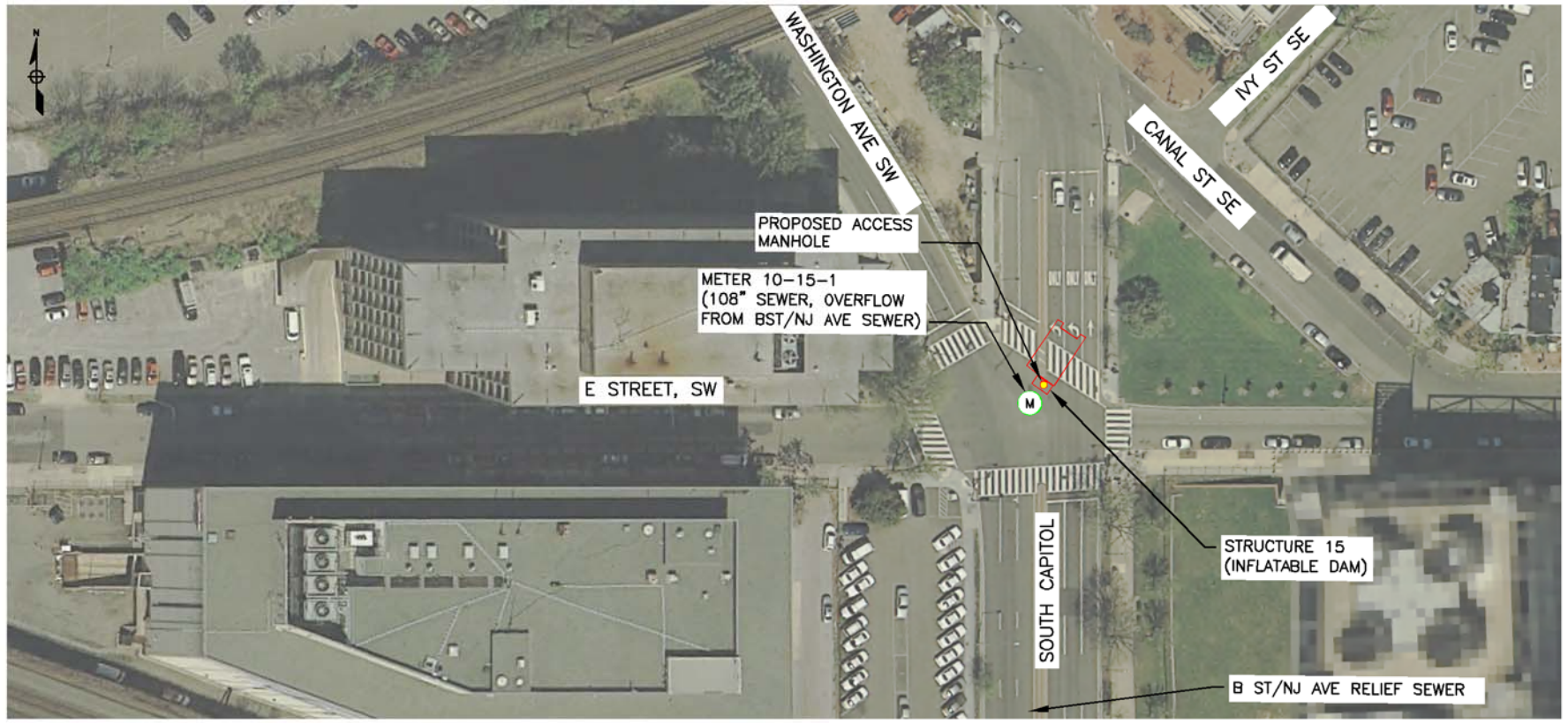
dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

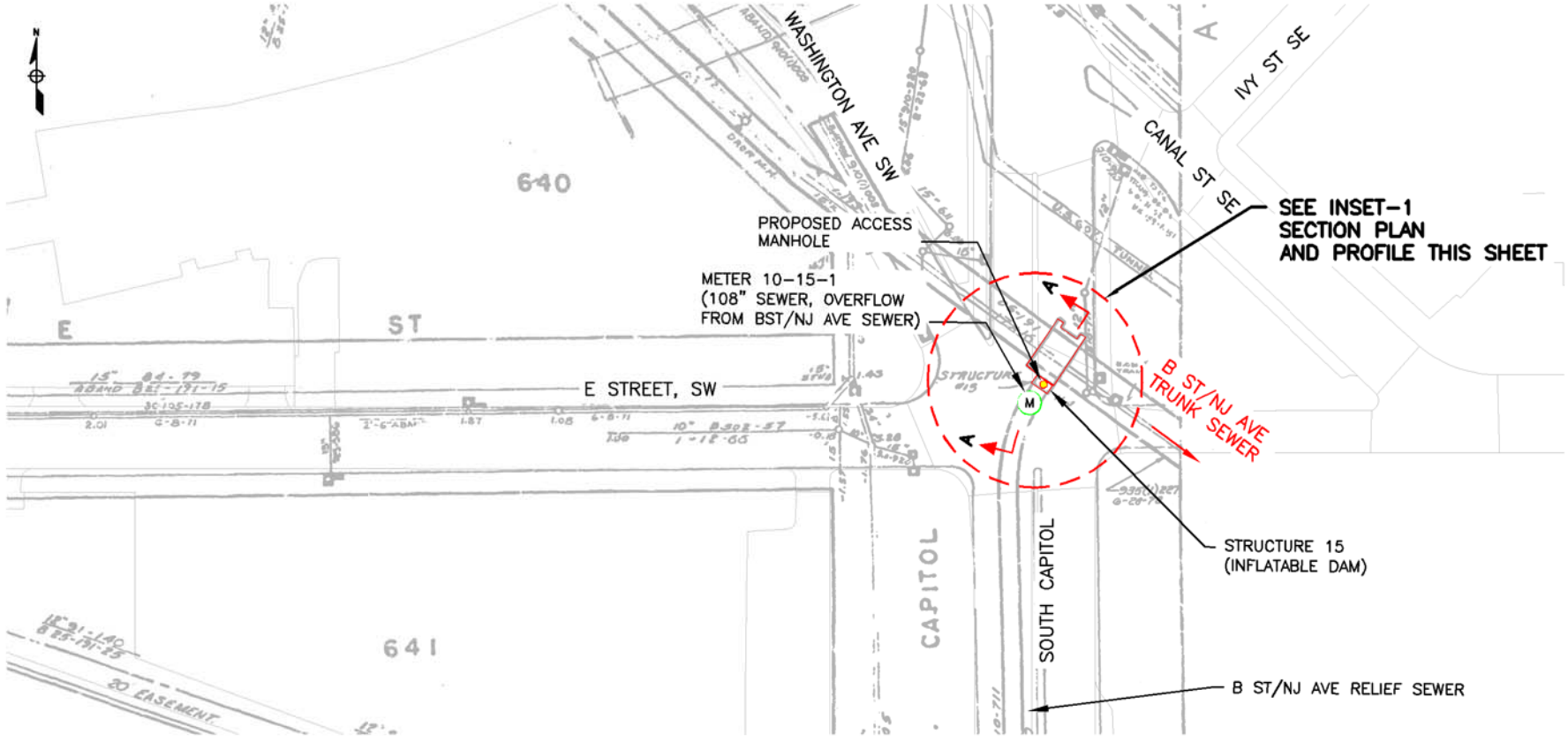
DC CLEAN RIVERS PROJECT
POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

19-24-1_2_3 METER LOCATION AND TYPICAL CROSS SECTION

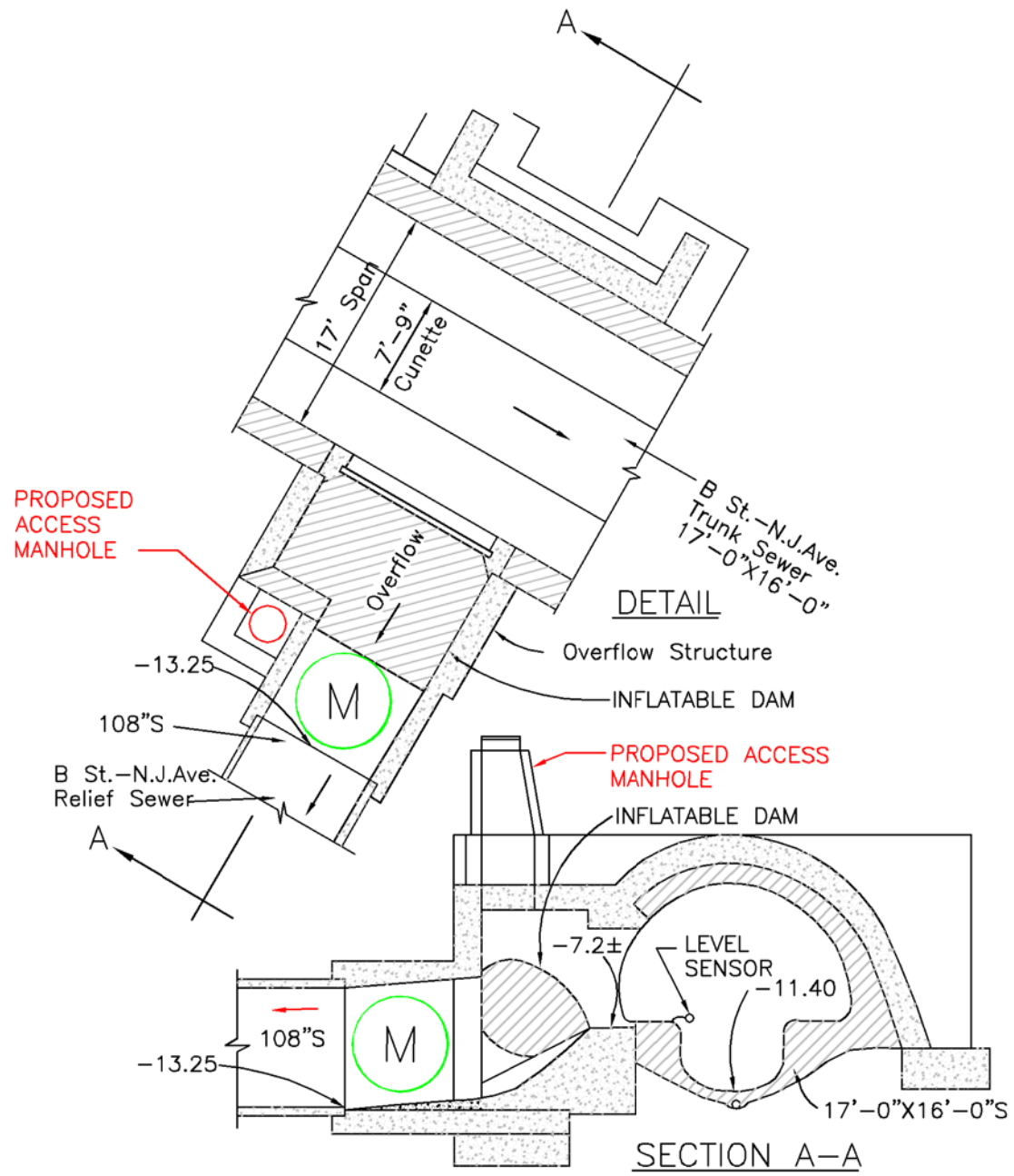
DATE: APRIL 2014 | SITE 1

LAST SAVED BY: CONSTANT A. NORTEY DATE: 1/13/2014 4:28:22 PM
DRAWING ID: L:\LTCP\PCM\FLOW METER - EXHIBITS\EXHIBITS-FIGURES\1_19-24-1_2_3.DWG





FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN AND PROFILE
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

dc clean RIVERS PROJECT

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
FAX: 202-787-4478

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10-15-1 METER LOCATION AND TYPICAL CROSS SECTION

DATE: APRIL 2014 | SITE 2

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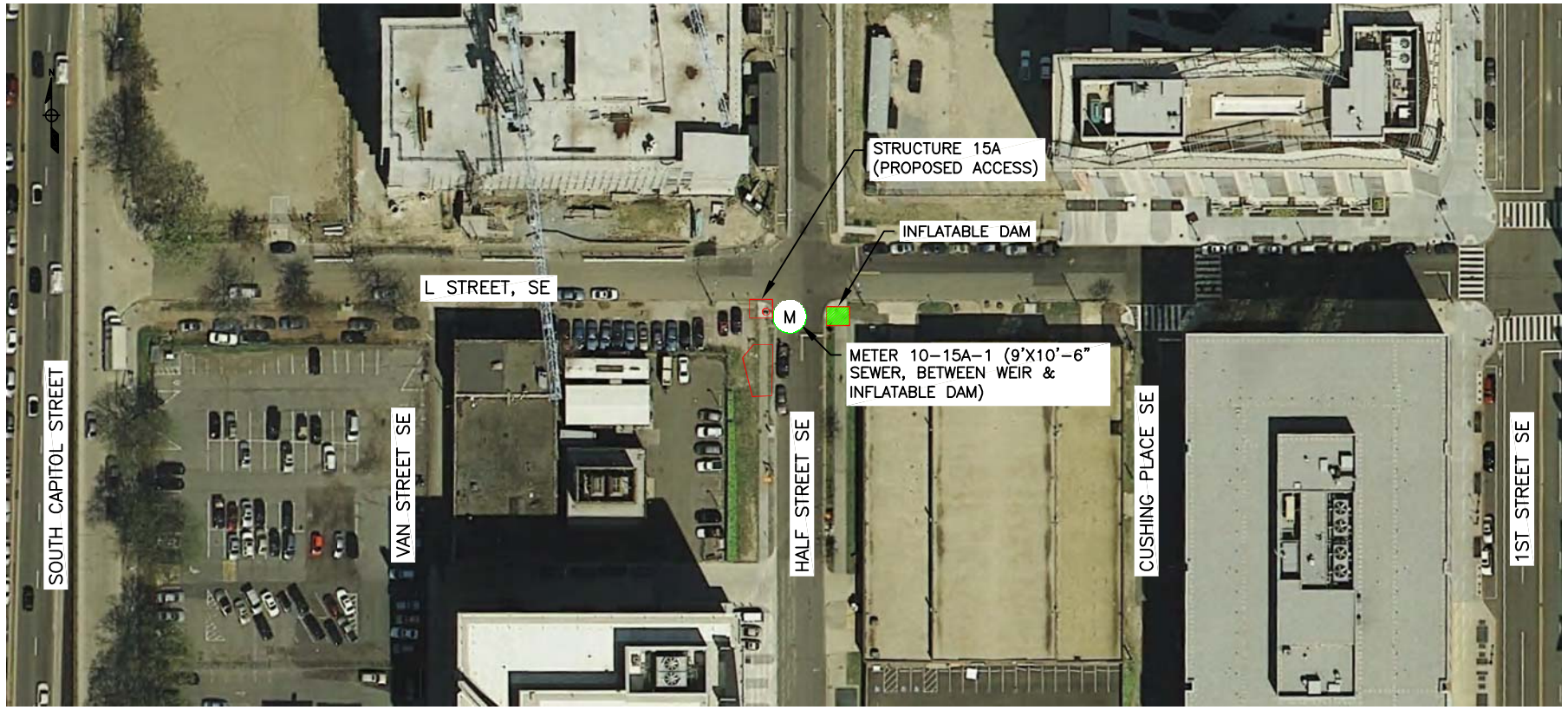
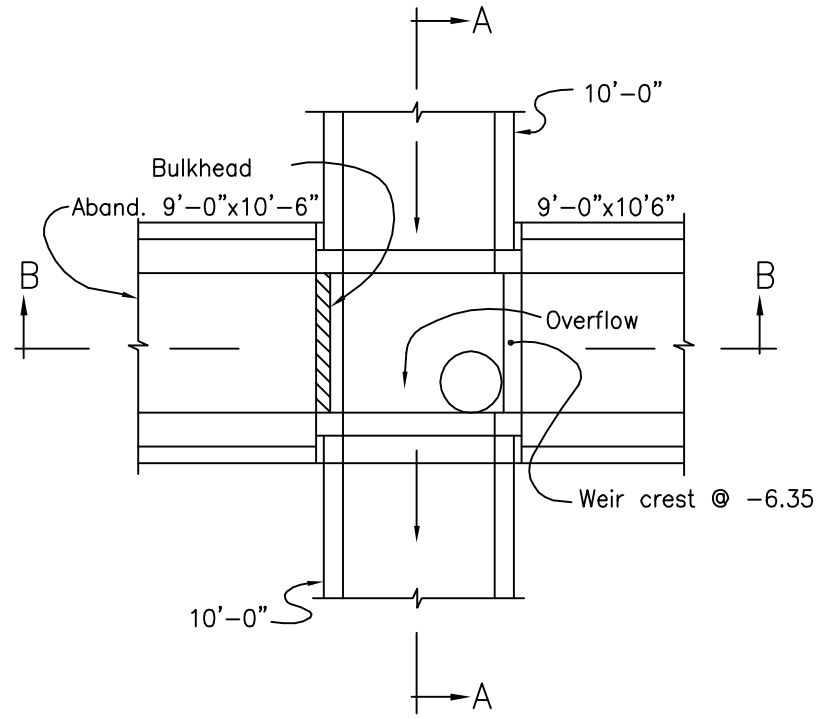
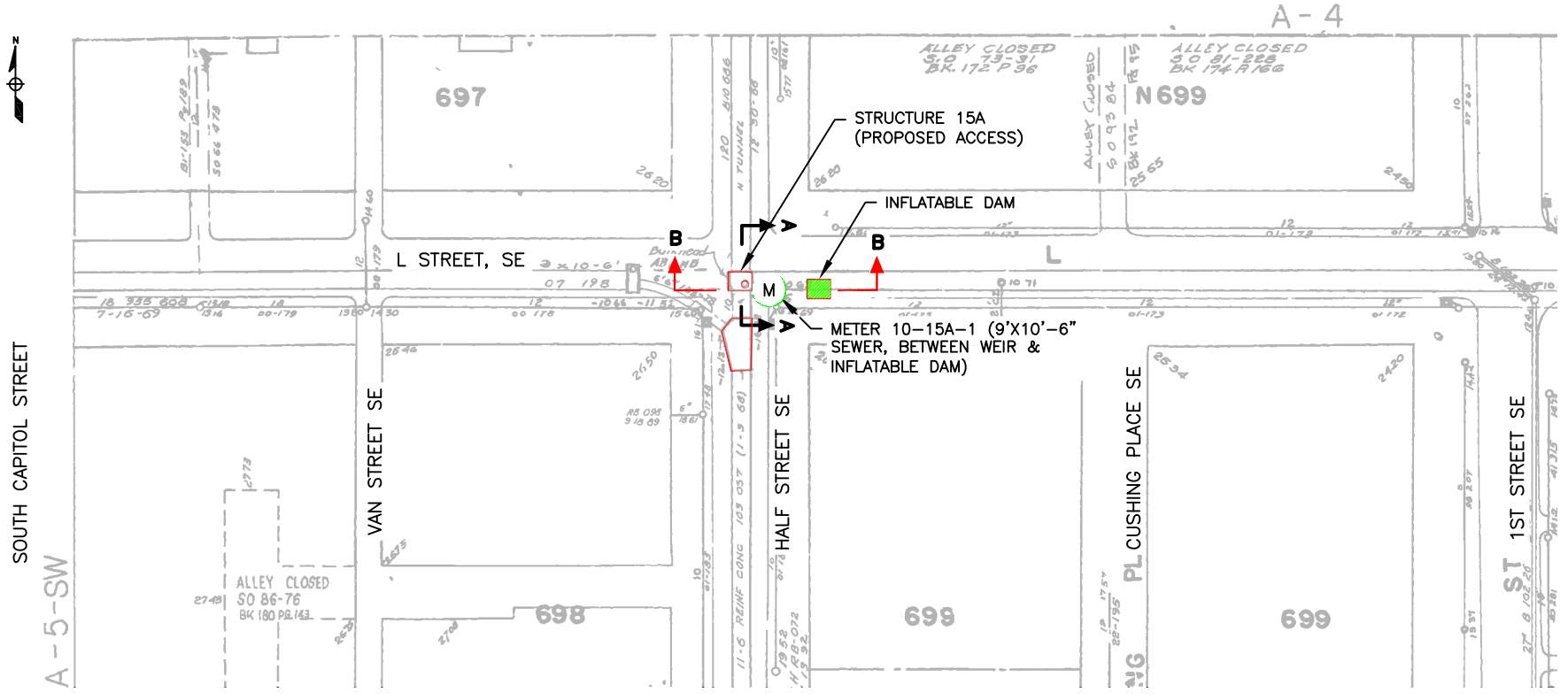
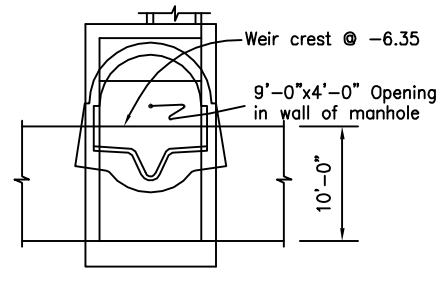




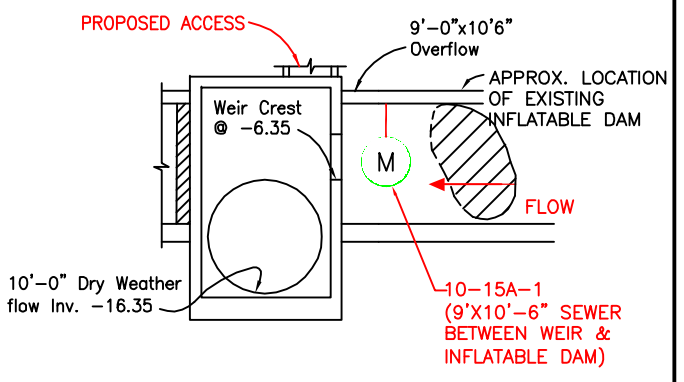
PLAN
SCALE: NTS



FLOW METER LOCATION PLAN
SCALE: NTS



TYPICAL CROSS SECTION A-A
SCALE: NTS



TYPICAL CROSS SECTION B-B
SCALE: NTS

LEGEND

M FLOW METER LOCATION

dc clean RIVERS PROJECT
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
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POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

10-15A-1 METER LOCATION AND TYPICAL CROSS SECTION

DATE: APRIL 2014 | SITE 3

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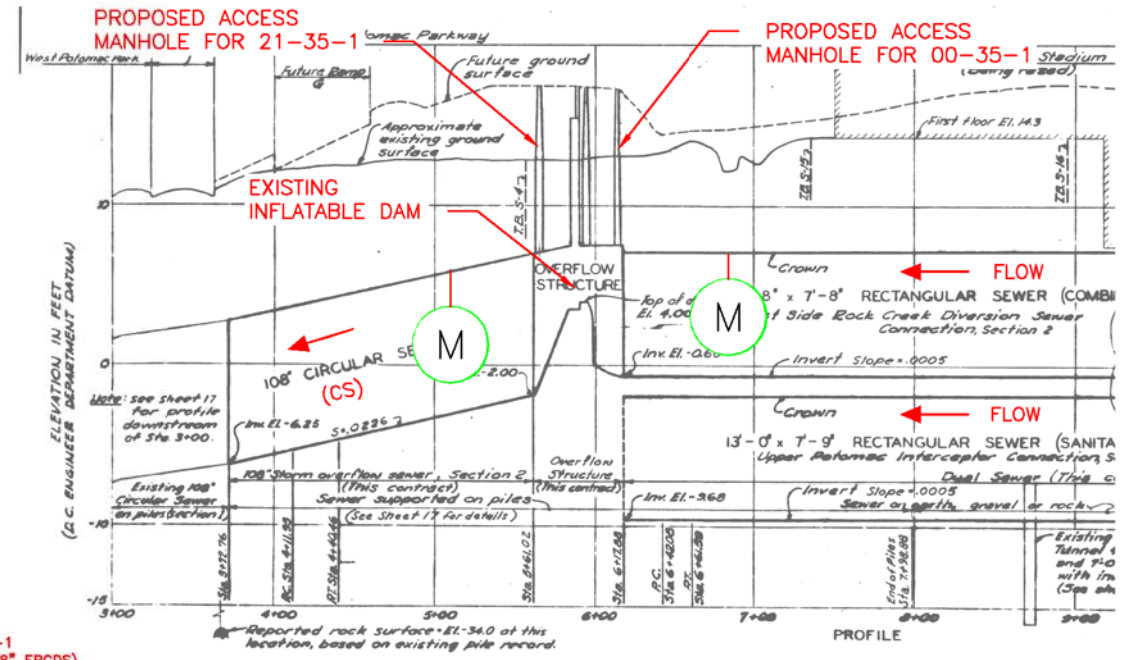
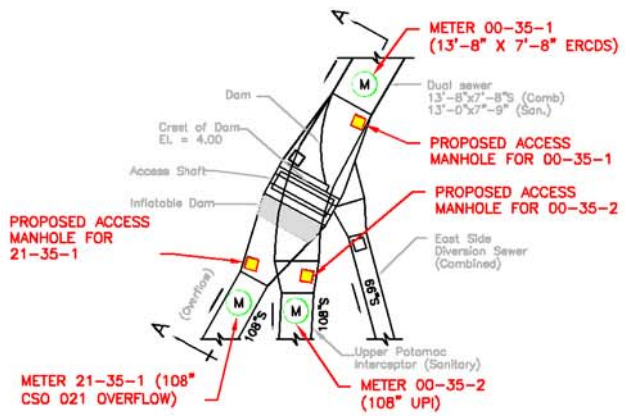


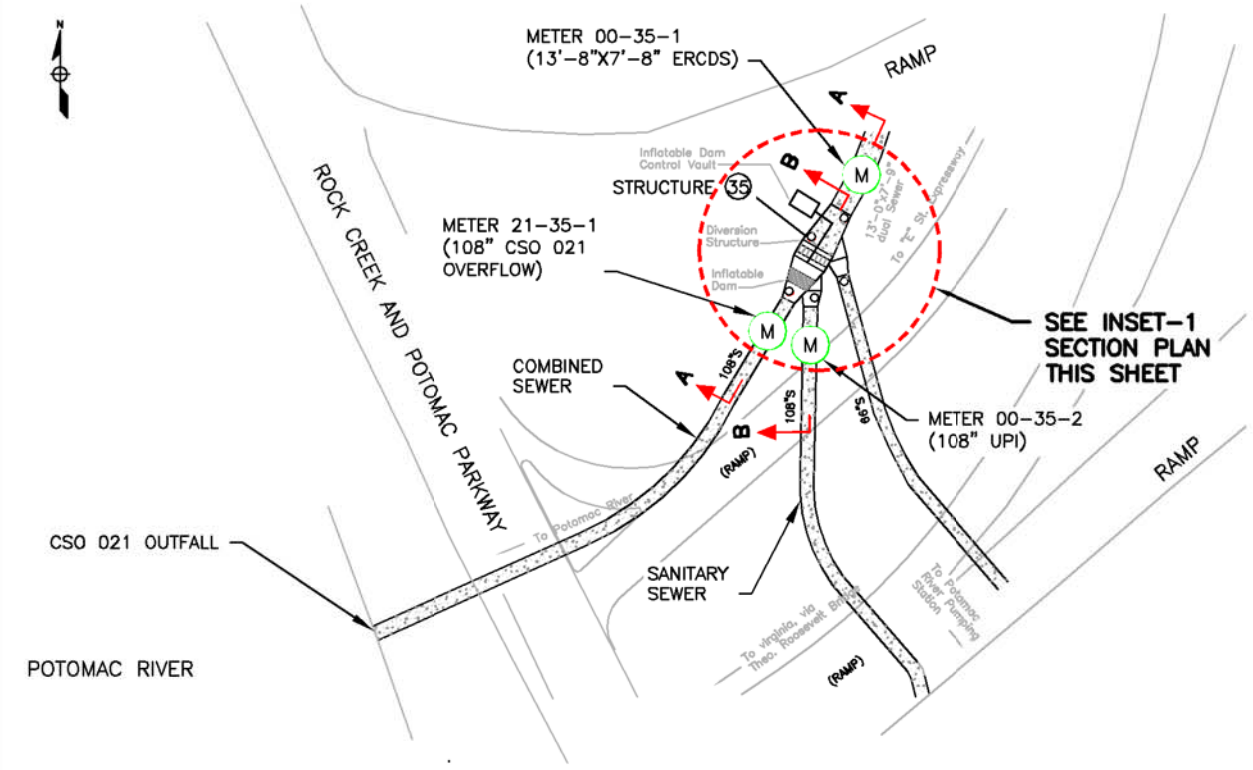
TYPICAL CROSS SECTION A-A (PROFILE VIEW)

SCALE: NTS



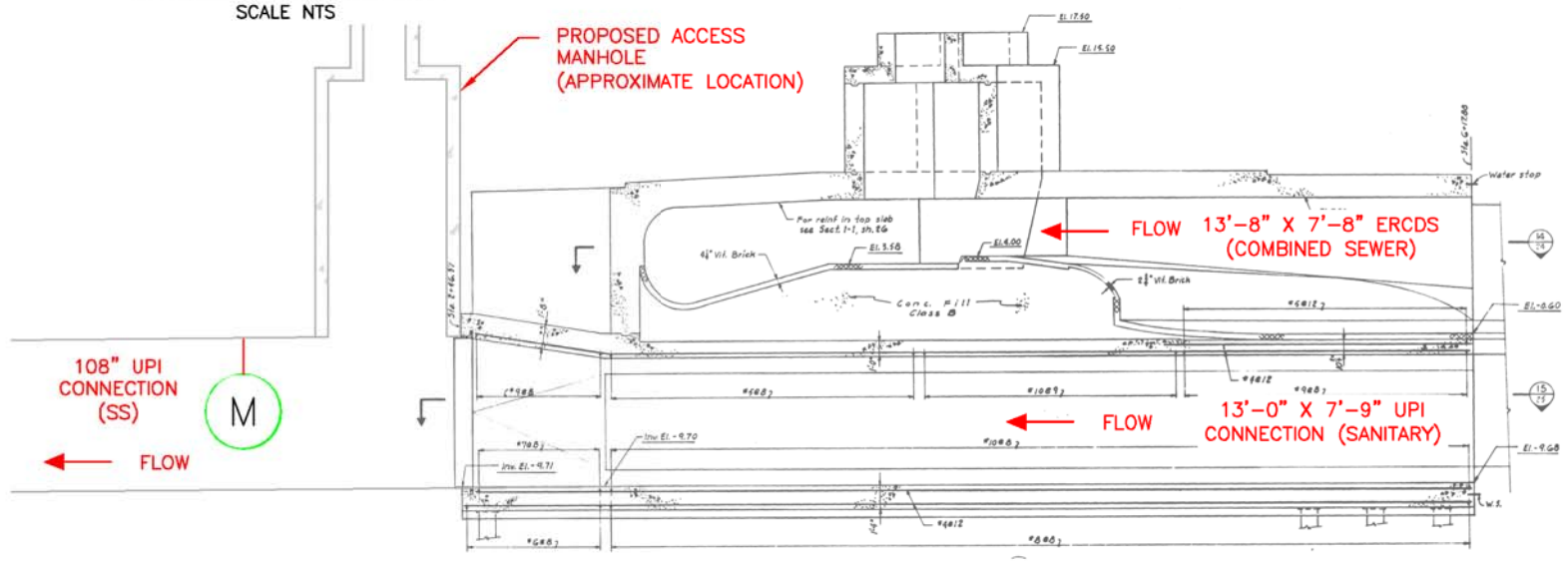
INSET-1 SECTION PLAN

SCALE NTS



FLOW METER LOCATION PLAN

SCALE: NTS



TYPICAL CROSS SECTION B-B (PROFILE VIEW)

SCALE: NTS

LEGEND

M FLOW METER LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
PHONE: 202-787-4460
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POST CONSTRUCTION MONITORING
FLOW MONITORING MAPS

21-35-1, 00-35-1, & 00-35-2 METER LOCATIONS AND TYPICAL CROSS SECTIONS

DATE: APRIL 2014 | SITE 4

LAST SAVED BY: CONSTANT A. NORTEY DATE: 12/11/2013 1:47:05 PM
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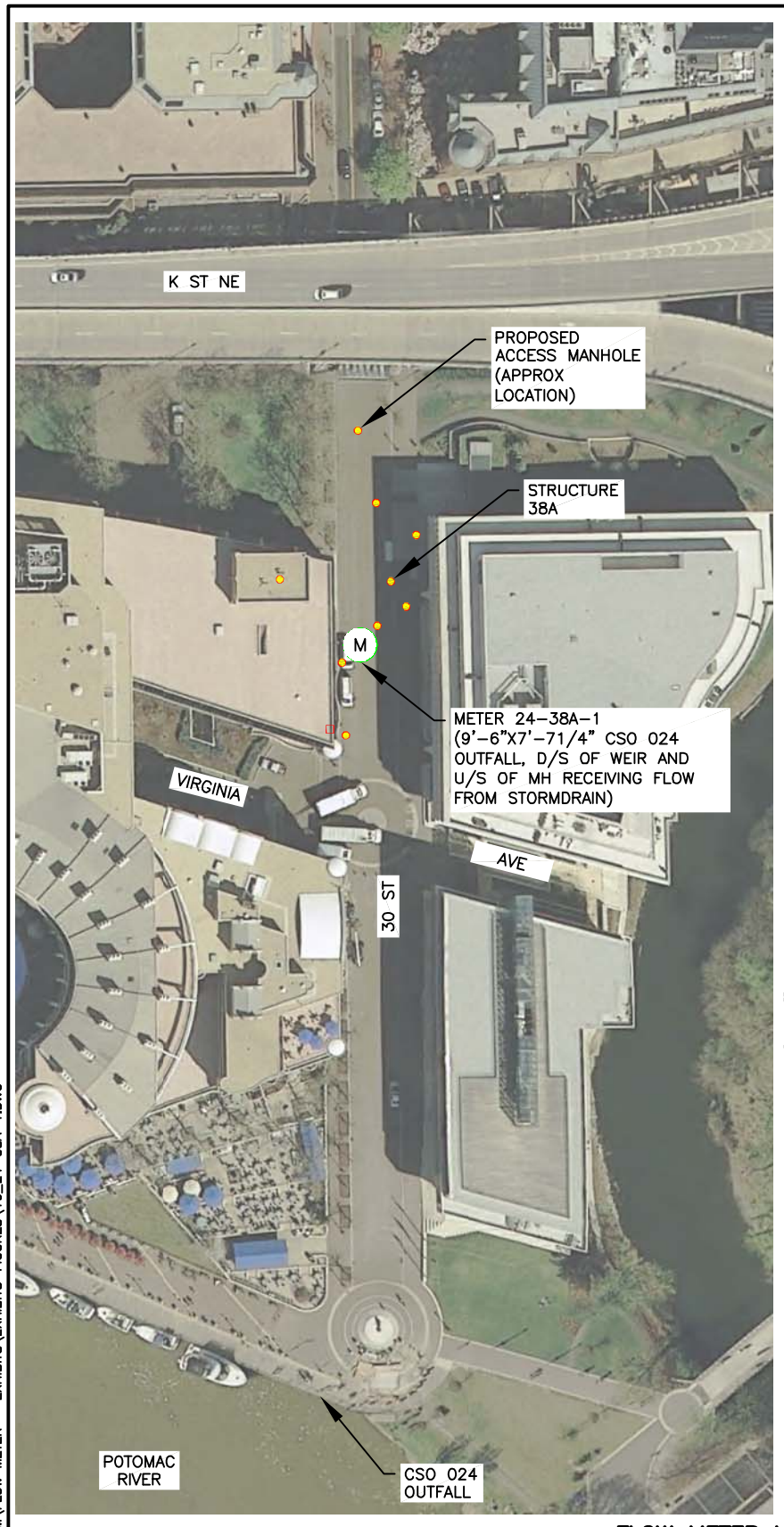
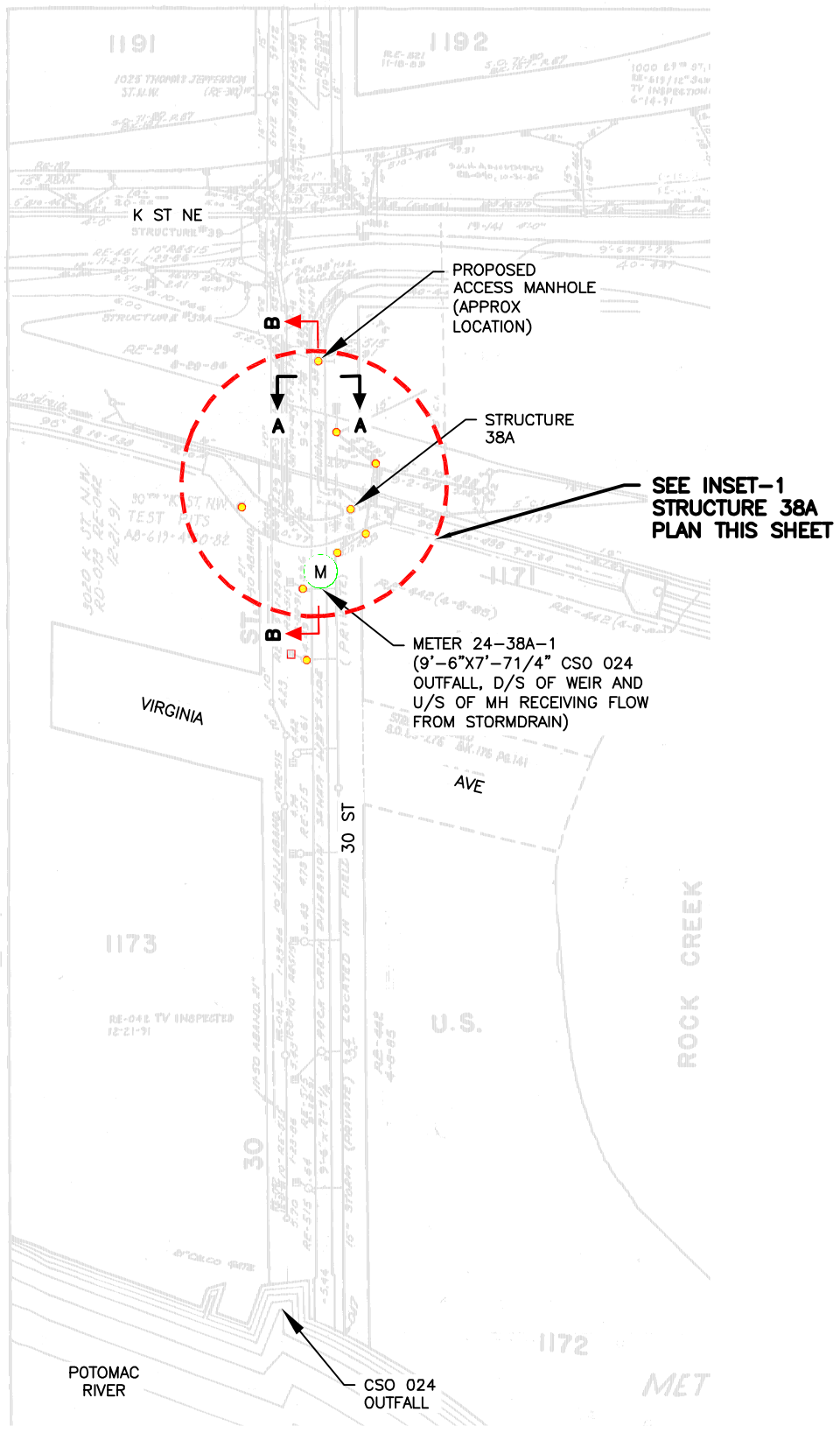
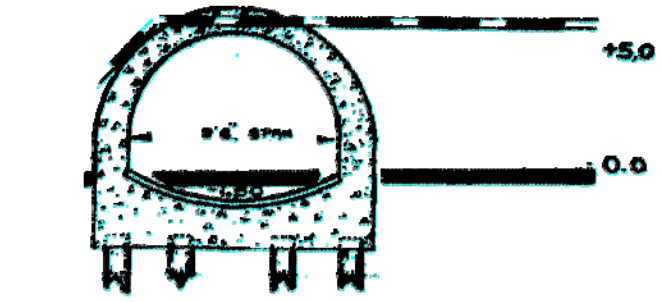


FLOW METER LOCATION PLAN

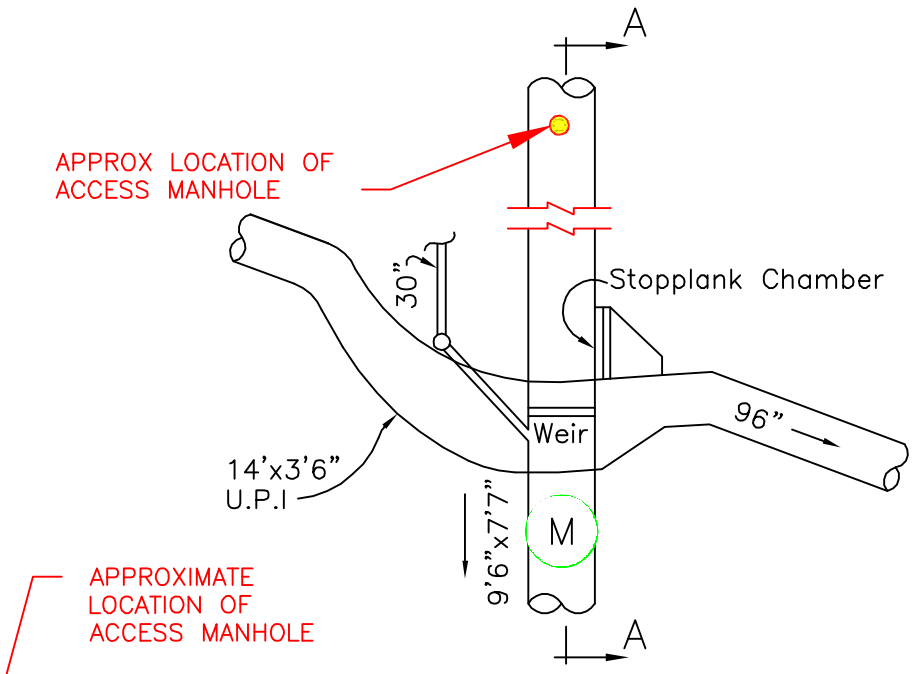
SCALE: NTS





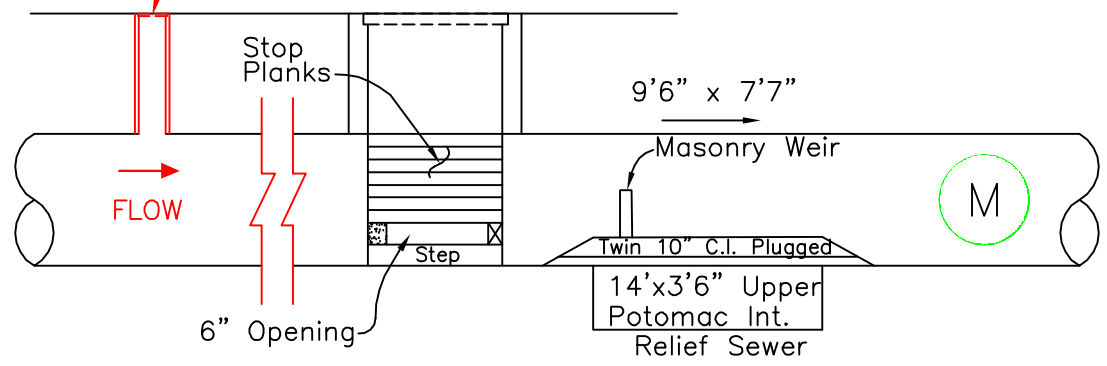
TYPICAL CROSS SECTION A-A

SCALE NTS



INSET-1 STRUCTURE 38A PLAN

SCALE NTS



CROSS SECTION B-B (SEWER PROFILE)

SCALE NTS

LEGEND

(M) FLOW METER LOCATION

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
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24-38A-1 METER LOCATION AND TYPICAL CROSS SECTION

DATE: APRIL 2014 | SITE 5

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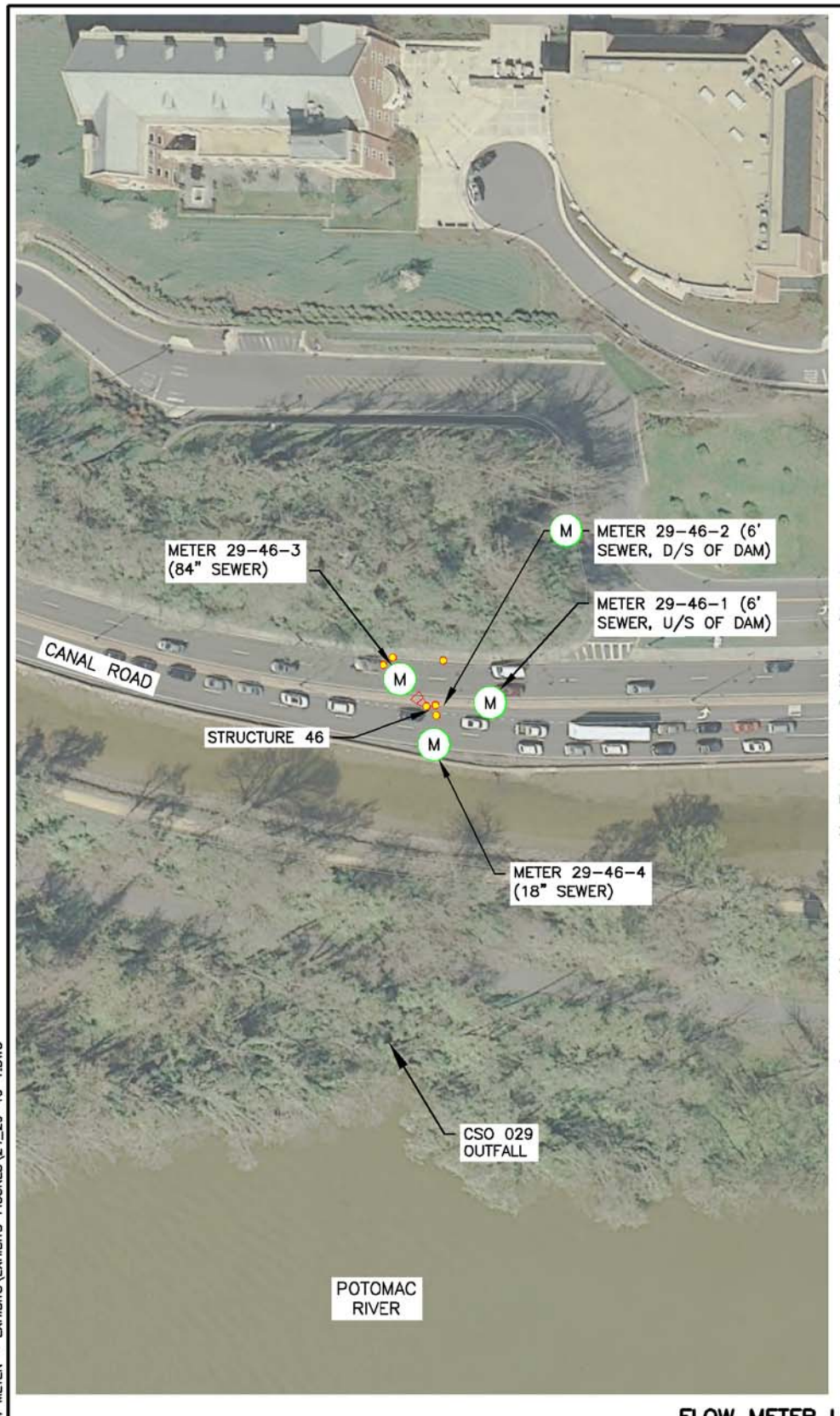
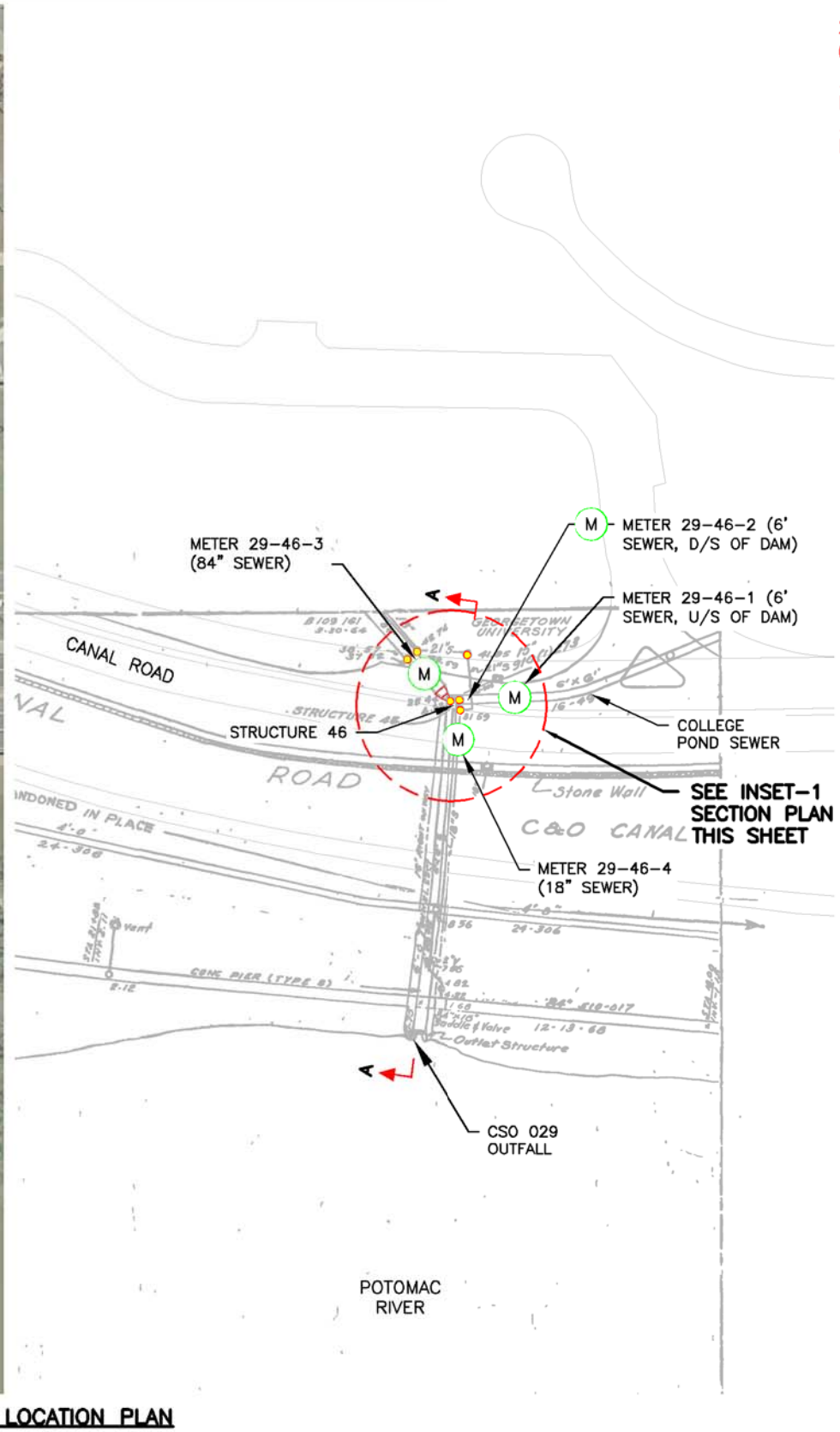
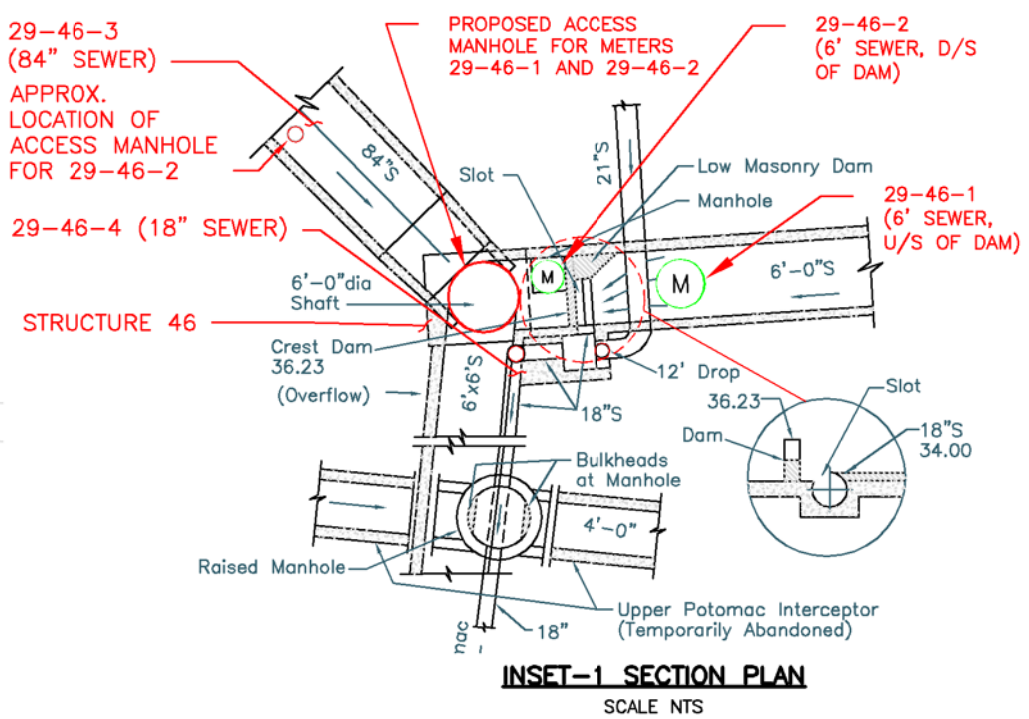
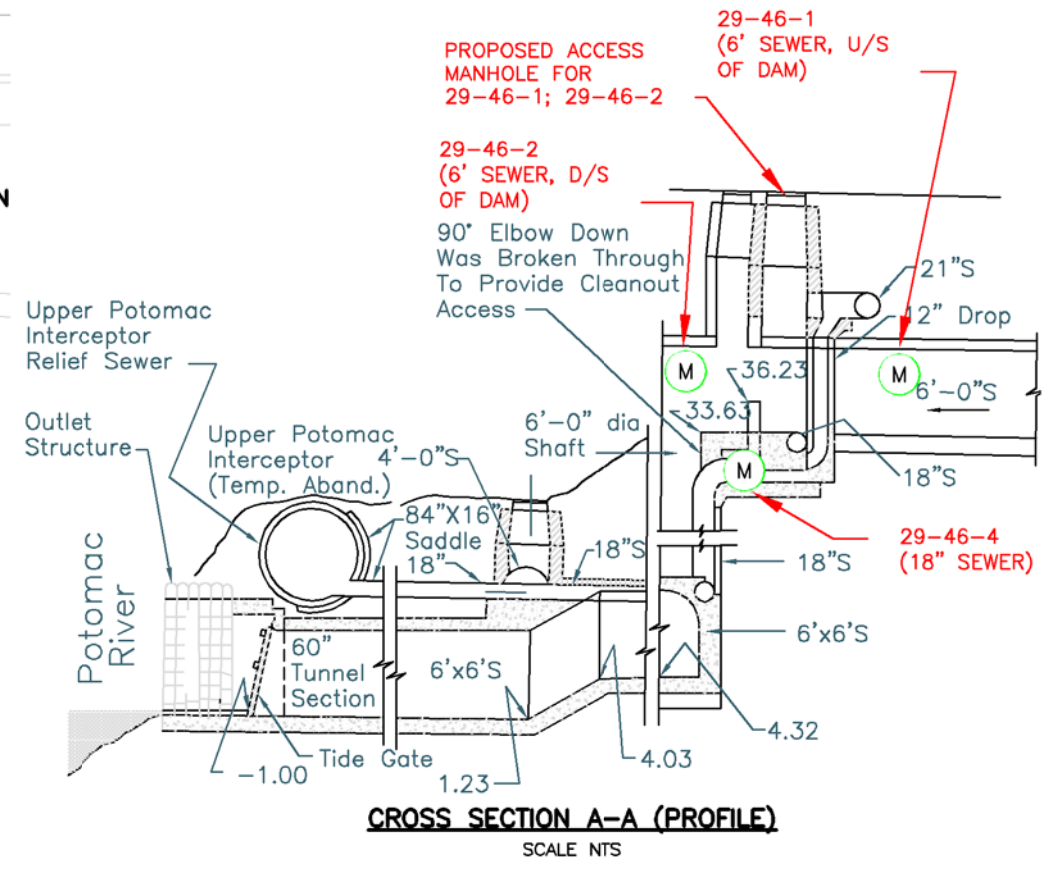




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 SECTION PLAN
SCALE NTS



CROSS SECTION A-A (PROFILE)
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

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WATER AND SEWER AUTHORITY
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FLOW MONITORING MAPS

29-46-1_2_3_4 METER LOCATION AND TYPICAL CROSS SECTION

DATE: APRIL 2014 | SITE 6

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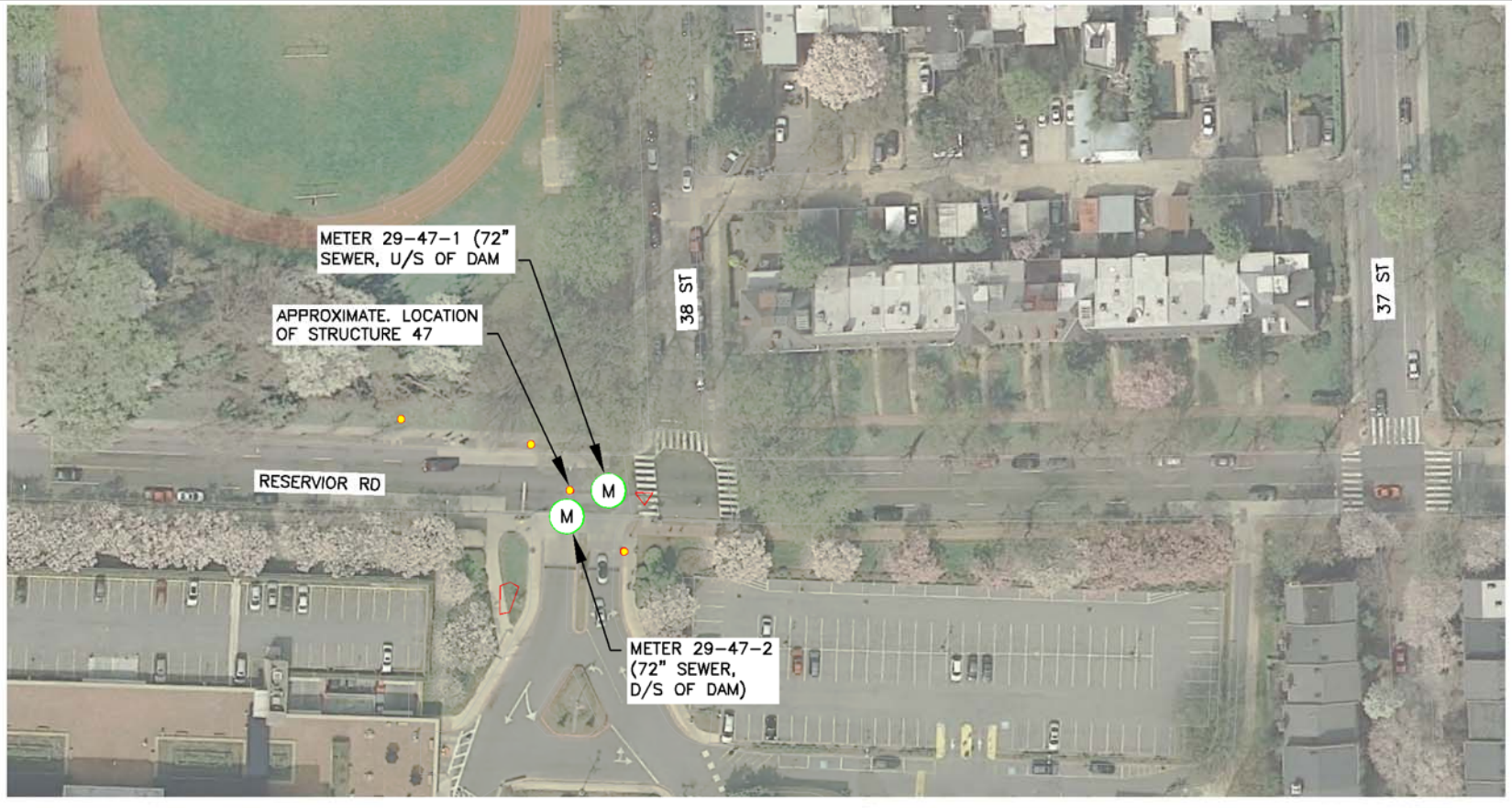
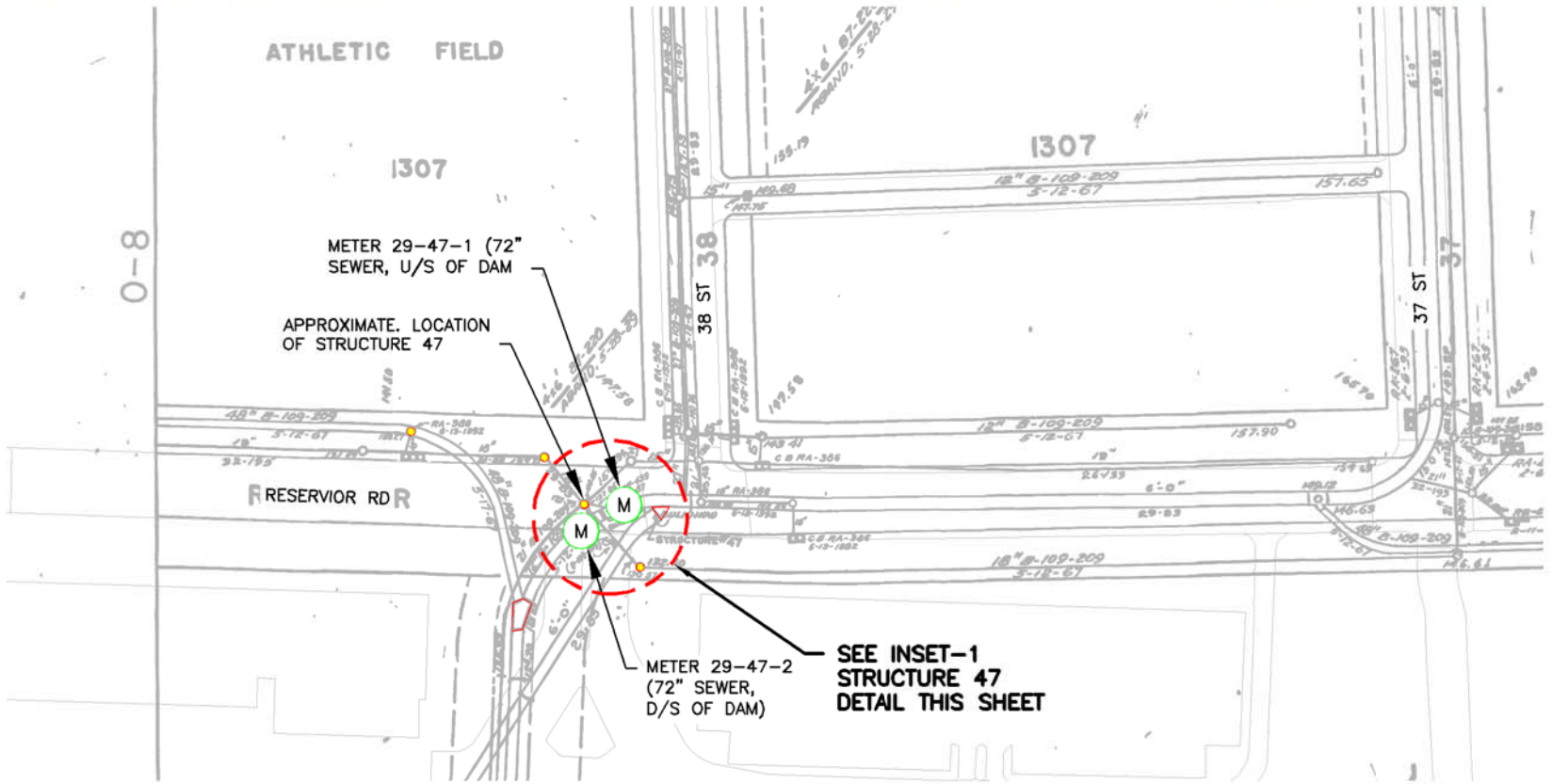
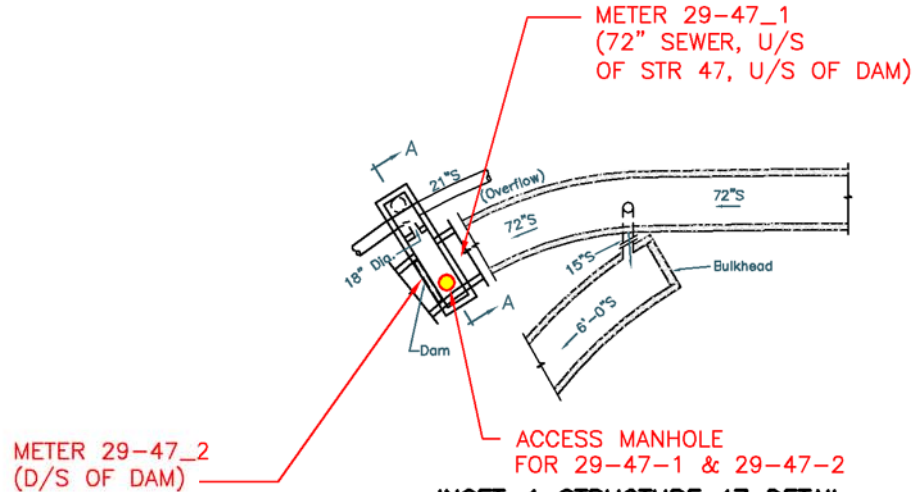
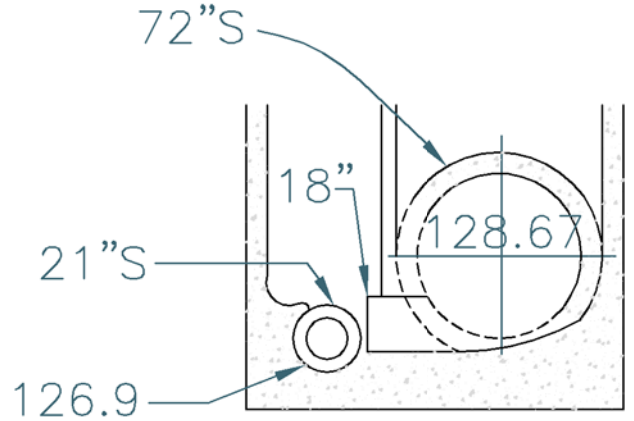




FLOW METER LOCATION PLAN
SCALE: NTS



INSET-1 STRUCTURE 47 DETAIL
SCALE NTS



SECTION A-A
SCALE NTS

LEGEND

(M) FLOW METER LOCATION

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WATER AND SEWER AUTHORITY
5000 OVERLOOK AVENUE, SW
WASHINGTON, DC 20032
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29-47-1_2 METER LOCATION AND TYPICAL CROSS SECTION

DATE: APRIL 2014 | SITE 7

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