Long Term Control Plan

Post Construction Monitoring Plan

December 2015

1. Introduction

The Buffalo Sewer Authority (BSA) is a New York State public benefit corporation, established in 1935 for the purpose of constructing sewers, treatment and other facilities to relieve the Niagara River, Buffalo River and Lake Erie from pollution. The BSA system consists of a wastewater treatment plant located on Bird Island and a collection system of approximately 850 miles of sewer lines (790 miles of combined sewer and 60 miles of storm sewer). Figure 1 graphically represents the BSA system. BSA also receives and treats wastewater and sludge from tributary communities in Erie County through inter-jurisdictional agreements. The service area of the BSA, within the City of Buffalo, is served primarily by a combined sewer system (CSS). The CSS was constructed with permitted combined sewer overflow (CSOs) outfalls to relieve the CSS during wet weather events in order to protect downstream treatment facilities and prevent basement flooding. Over the years, the BSA has completed numerous CSS improvement projects resulting in the elimination of several CSO outfalls. Currently, the system includes 52 permitted CSO outfalls.

1.1 LTCP Development

The USEPA issued a national CSO Control Policy in 1994, requiring communities with CSSs to develop Long Term Control Plans (LTCPs) that will provide for compliance with the requirements of the Clean Water Act, including attainment of water quality standards (WQS). For over a decade, the BSA has worked to develop their LTCP for CSO abatement within the City of Buffalo in compliance with the CSO Control Policy. At the center of this process was the development of a calibrated and validated system-wide hydraulic model, hereafter "model," and the identification of the "typical" year (TY) rainfall pattern that would be used in the model to predict CSO events[1].

The BSA originally submitted its CSO LTCP to the NYSDEC in July 2004 (2004 LTCP). The BSA received comments from the NYSDEC in 2006, and subsequently, the NYSDEC and the USEPA requested additional evaluations to address questions and comments derived from their regulatory review. The BSA began additional work in 2008 and completed the update of the 2004 LTCP in April 2012.

Following submission of the April 2012 LTCP, the Agencies provided comments in a letter dated December 6, 2012. The BSA and the Agencies subsequently discussed these comments through a series of meetings and correspondence. The final LTCP was submitted on January 10, 2014. This LTCP was ultimately approved in March 2014 and resulted in the issuance of an Amended Administrative Order (AO) requiring the implementation of the LTCP within a 20-year time frame. The AO also requires the completion and submission of this Post Construction Monitoring (PCM) Plan within one-year of approval of the LTCP.

[1] After considering more than 50 years of rainfall data, NYS DEC and US EPA approved the use of a modified 1993 rainfall year for LTCP purposes.

1.2 Recommended Plan

A careful analysis of detailed receiving stream water quality modeling results revealed that a uniform level of CSO control for all BSA receiving water bodies was neither cost effective nor necessary to meet the established WQS in each water body. Therefore, the BSA's recommended alternative was assembled with a primary focus on providing a cost-effective attainment of the current NYS bacteria WQS in each water body. Specifically, the LTCP establishes a maximum frequency of CSO activation to ensure CSO discharges do not preclude the attainment of WQS within each receiving water body.

A summary of the basis for the selected target LOCs is presented in Table 1 (a reprint of LTCP Table 12-1).

Table 1: Summary of Recommended Plan LOC Selection

Receiving Water Body	Basis for Selection of Level of Control
Black Rock Canal	WQS attainment KOC for Alternative UA2
Buffalo River	LOC and Remaining Volume KOC for Alternative UA2
Cazenovia Cr.-B	LOC and Remaining Volume KOC for Alternative UA2
Cazenovia Cr.-C	LOC and Remaining Volume KOC for Alternative UA2
Erie Basin	Remaining Volume KOC for Alternative UA2; Designation as a Sensitive Area
Niagara River (incl. CSO 055)	LOC and Remaining Volume KOC for Alternative UA2
Scajaquada Creek	WQS attainment KOC for Alternative UA2

Table 2, a reprint of LTCP Table 12-6, presents a more detailed listing of the projects that comprise the Recommended Plan. As shown, the list presents the projects proposed for each general type of project for each water body. Figure 2 presents a graphical representation of the components of the Recommended Plan.

Table 2 (from LTCP Table 12-6): Summary of Recommended Plan Projects

Project Grouping	Specific Projects (Concept Level Approximate Sizing)

Revised Foundation Projects: Focus is on combination of low-cost system optimizations, pilot GI projects and cost-effective RTC projects	• Phase 1 Projects: Includes all Phase 1 projects described in Section 11.2 of LTCP.
	• Non-Phase 1 Projects: These projects are primarily sewer separation projects carried over from the original Foundation Plan and completed prior to the Phase 1 projects. These are also described in Section 11.2 of LTCP.
	• Real Time Control: 16 real-time control (RTC) projects that were selected after the evaluation described in Section 11.3 of LTCP
	• Green Infrastructure Pilot Projects
	  ○ CSO 060 – Combination of pervious pavements, rain gardens and downspout disconnections/rain barrel installations
	  ○ Downspout disconnect/rain barrel pilot projects in the Old First Ward and Hamlin Park neighborhoods
	• Additional SPP Optimizations: 20 additional optimization projects were identified as part of the alternatives evaluations conducted for this LTCP update. These modifications include optimizing weir elevations and orifice plate openings, increasing underflow pipe capacity, and flow redirection at a limited number of locations. Details on these SPP optimization projects are presented in Section 11.4 of LTCP
	• Additional Storage Projects: Three projects designed to increase capture of CSO flows have been identified and are currently in various stages of design by BSA.
	  ○ Hamburg Drain Storage - 5 MG offline storage facility
	  ○ Smith Street Storage - 0.5 MG offline storage facility
	  ○ CSO-016 Storage - 60,000 gallon inline storage

Gray Infrastructure Projects	• Black Rock Canal and Niagara River
	  ○ Underflow pipe upsizing (to maximize flow to the existing interceptors)
	  ○ New Northern Relief Sewer that runs parallel to the Black Rock Canal between CSO 004 and CSO 011/012 with an additional parallel relief sewer from CSO 004 to the existing siphon crossing at the WWTP influent. Northern Relief consists of the following components:
	  ▪ 5,310 feet of 96-inch pipe
	  ▪ 571 feet of 120-inch pipe
	  ○ CSO 055 – 7.5 MG offline storage facility
	  ○ CSO 013 – 0.3 MG offline storage facility
	• Scajaquada Creek
	  ○ SPP 337: 0.7 MG offline storage facility
	  ○ Jefferson Avenue & Florida Street: 2.6 MG offline storage facility
	  ○ SPP 336 a & b: 4.2 MG offline storage facility
	• Buffalo River and Cazenovia Creek:
	  ○ CSOs 028, 044 and 047: 2.3 MG offline storage facility
	  ○ CSO 052: 0.6 MG offline storage facility
	  ○ CSO 064: 0.1 MG offline storage facility
	• Erie Basin
	  ○ CSO 014 and 015 – 0.8 MG offline storage facility

Green Infrastructure Projects	Green Infrastructure projects will include a mixture of the following technologies based upon the results of pilot studies undertaken during the first five years of the LTCP implementation and will be focused primarily on publically owned properties. • Vacant property demolitions • Use existing vacant lots to store and infiltrate street runoff • Pervious pavements (public streets and parking lots) • Rain gardens • Downspout disconnections/rain barrels Green Infrastructure technology implementation will be based upon the control of up to 20% of the impervious surfaces (generally assumed to be publically owned) within selected sewer sheds as follows based on the SPP-level refinement outlined in the GI Master Plan:

Project Grouping	Specific Projects (Concept Level Approximate Sizing)
	• Black Rock Canal – 198 acres • Buffalo River – 319 acres • Cazenovia Creek (Class B section) – 3 acres • Cazenovia Creek (Class C section) – 58 acres • Erie Basin – 53 acres • Niagara River – 378 acres • Scajaquada Creek – 305 acres Total controlled acreage – 1,315 acres

1.3 Summary of LTCP Performance Criteria

Table 3 presents a summary of the baseline conditions and performance criteria for each modeled CSO outfall as presented in the final LTCP and approved by the regulatory agencies. Table is a slightly revised version of LTCP Table 12-9.

Table 3 (from LTCP Table 12-9): Summary of Performance Criteria

Receiving Water Body	Typical Year Performance Criteria (LOC)	CSO	Baseline Activations	Predicted Activations (per CSO)
Black Rock Canal	**0-4**	004	5	3
		005	4	4
		006	65	4
		008	39	0
		010	44	1
		012	42	2
		013	7	4
		061	10	2
		063	13	4
Buffalo River	**0-6**	017	49	4
		022	49	5
		025	11	6
		026	63	3
		027	36	6
		028	69	6
		029	0	0
		032	0	0
		033	9	5
		034	Closed	0

Receiving Water Body	Typical Year Performance Criteria (LOC)	CSO	Baseline Activations	Predicted Activations (per CSO)
		049	0	0
		050	14	5
		051	4	4
		052	10	3
		064	56	3
		066	10	4
Cazenovia Cr.-B	**0**	035	0	0
Cazenovia Cr.-C	**0-6**	037	13	6
		039	0	0
		044	7	2
		046	1	0
		047	44	3
		048	0	0
Erie Basin	**0-2**	014	4	2
		015	12	1
		016	0	0
Niagara River	**0-9**	055	41	9
		003	6	5
		011	41	4
		054	0	0
Scajaquada Creek	**0-4**	053	65	4
		056	5	3
		057	0	0
		058	0	0
		059	0	0
		060	5	0

The Recommended Plan was also evaluated for each receiving water body in terms of water quality compliance, with bacteria being the main pollutant of concern. As agreed with the Regulatory Agencies at

technical meetings conducted in 2011, for purposes of evaluating water quality compliance, improved upstream water quality was assumed for the Buffalo River, Scajaquada Creek, and Black Rock Canal under the baseline scenario and Recommended Plan conditions. These modified upstream boundary conditions were identical for both the baseline scenario used in the LTCP and for the Recommended Plan and assume upstream water quality for bacteria will be at 75 percent of the current WQS. Stormwater fecal coliform bacteria concentrations for these upstream (non-BSA) contributions were set to 150 counts/100 mL, and BOD concentrations set to 75 percent of baseline in-stream conditions.

Attainment of the bacteria WQS for each water body under the Recommended Plan was calculated from model output and compared to the bacteria WQS attainment for the baseline condition. Table 4, (LTCP Table 12-10) presents a summary of annual percent attainment of bacteria WQS for all modeled water bodies under these two scenarios. Attainment was first calculated for each model segment and then spatially averaged across each water body.

Table 4 (LTCP Table 12-10): Water Quality Standards Attainment for Bacteria (Background Loadings set at 75% of WQS)

Scenario	Bacteria: Annual Percent Attainment (%) of WQS					
	Upper Scajaquada Creek	Lower Scajaquada Creek	Buffalo River	Black Rock Canal	Erie Basin	Niagara River (incl. CSO 055)
Baseline	99	77	93	86	100	100
Recommended Plan	100	100	100	100	100	100

1.4 Implementation Schedule

The LTCP Recommended Plan will be implemented over a 20-year period. Figure 3 presents the implementation schedule of the BSA's Recommended Plan over the course of 20 years, resulting in a substantial reduction in annual CSO activation frequencies and volumes. Remaining Phase I and Revised Foundation Plan projects are scheduled to be implemented first, with the next priority given to Erie Basin Marina (sensitive area) and Black Rock Canal (water quality most affected by wet weather discharges). Storage and conveyance projects in the Scajaquada Creek, Buffalo River (with the exception of Smith Street project), and Niagara River sewersheds would primarily be implemented starting about halfway through the overall 20-year implementation period.

1.5 PCM Plan Requirements

As briefly discussed above, the AO under which the BSA is implementing the LTCP requires that the BSA develop a PCM Plan to verify that the approved CSO LTCP measures, when completed, meet the performance criteria specified in the approved CSO LTCP.

The following sections of this PCM Plan describe the process by which the BSA will document the success of the LTCP annually throughout the 20-year implementation period.

2. PCM Plan Objectives

The PCM Plan presents the processes and procedures to be followed to document the effectiveness of the improvements constructed across the BSA system for abatement of CSOs. The objectives of the PCM include:

- Verification of achievement of the specified performance criteria for the frequency of activation of all modeled CSOs in the system after completion of the construction of approved CSO control measures.
- Documentation of water quality conditions upon the LTCP implementation.
- Description of reporting procedures to provide to the Agencies the results of the PCM program both on an annual basis and upon full implementation of the LTCP (final PCM report).

2.1 CSO Level of Control Criteria

The success of the LTCP program will be based upon the constructed improvements achieving the performance criteria which consist of water body specific CSO frequency of activation as documented in the LTCP. Table 3 provides the approved level of control (LOC) for each receiving water body in the BSA system. The approved Combined Sewer System (CSS) model, described in Section 3, will be the primary tool for determining compliance. The model will be run using the TY rainfall to determine the impact of the project(s) on the CSO activations, and in particular, if the project meets or makes progress towards the established LOC.

Section 3.2 discusses how the model will be utilized to assess compliance with the frequency of activation performance criteria presented in Table 3.

The CSS model will also be used in conjunction with the water quality model described below to evaluate bacteria levels in the CSO receiving streams.

The BSA will complete a water quality monitoring and modeling effort upon completion of the entire LTCP implementation period. The program will be developed to document water quality conditions for bacteria, using the background source conditions approach specified in the LTCP. The ultimate goal of the water quality monitoring and modeling program will be to confirm that remaining BSA overflows do not preclude attainment of water quality standards in receiving water bodies consistent with upstream pollutant loading assumptions. Because the LTCP documented impacts to water quality from CSOs in all receiving streams except the Niagara River, water quality monitoring will be completed in the Buffalo River, Cazenovia Creek, Scajaquada Creek, Black Rock Canal and the Erie Basin. However, because the Niagara River impacts the water quality in the Black Rock Canal, a Niagara River model will be updated only as an input to the Black Rock Canal model. Finally, given that the CSO volumes are inputs into the water quality model it is anticipated that the water quality monitoring program will be completed at the same time as the final CSS model calibration.

2.2 PCM Reporting

The AO requires that an annual PCM report be submitted with the LTCP Semi-Annual Status Report. These Annual PCM reports will be supplemented with a Final PCM report to be submitted within 120 days following the completion and implementation of all CSO abatement projects and associated PCM efforts.

The annual PCM reports will, at a minimum, document the results of selected CSO activation PCM efforts, document any model updates and/or calibration efforts completed over the previous year and describe proposed projects and monitoring to be completed over the subsequent year. Annual reports prepared prior to the completion of the year 3-4 calibration effort will utilize the 2010 approved model (calibrated using 2009 data.)

During years 3 through 4 and 19 through 21 of the LTCP implementation, the annual reports will include updates on the system-wide flow metering and CSS model calibration efforts.

The Final PCM report will summarize the data collection and modeling efforts during the final PCM period and confirm that the BSA is meeting the typical year performance criteria specified in Table 3. In the event that the improvements constructed during the LTCP implementation period fall short of the LTCP performance criteria, the final PCM report will also include a discussion of the remedial measures to be taken by the BSA to reach full compliance along with a proposed compliance schedule.

3. PCM Program Description

The BSA's PCM Program will use a combination of techniques to demonstrate compliance with the LTCP typical year performance criteria presented in Table 3 including CSS model updates, model calibration, and water quality monitoring and modeling. Descriptions of these various techniques and approaches are included in this section.

3.1 CSS Model Updates

The approved system-wide CSS model will be the primary tool for tracking progress toward achieving LTCP LOCs for each receiving water body as well as for determining overall compliance with performance criteria at the end of the implementation schedule. In order to increase confidence in these model predictions, the BSA will make periodic updates to the CSS model to ensure the system-wide model represents the current system configuration.

The CSS model will be updated, as necessary, based on information such as, but not limited to:

- Field data collected during the design and optimization phases of specific projects, such as weir elevations, manhole rim and invert elevations, and other physical attribute data collected on the existing system; and/or
- Selected flow and rainfall data; and/or
- As-built conditions for completed projects.

Updates to the CSS model will be documented and included in the LTCP Semi-Annual Status Reports.

3.2 Annual CSO Activation Report

In support of BSA's SPDES CSO BMP Annual Report, the most recent version of the CSS model will be run to predict the system's CSO activations and compare them to the LTCP LOCs listed in Table 3. This effort will confirm that BSA is progressing toward meeting the required typical year performance criteria. The results of the annual model simulation also will allow the BSA to identify the impacts of completed projects on the CSO system.

3.3 Model Calibration

In order to track progress toward overall compliance with the LTCP performance criteria and support ongoing LTCP design projects, the BSA will complete two system-wide CSS model calibrations at years 3-4 and years 19-21. These system-wide calibrations will not only account for ongoing changes within the BSA system, but also incorporate any changes in flows from the tributary municipality systems. The first calibration (years 3-4) will at a minimum take into account all of the completed Phase 1 projects. BSA will

submit a work plan for the year 3-4 calibration of its CSS model to the USEPA and NYSDEC by December 31, 2015. The work plan will be based upon a two year schedule, with provisions to extend to ensure targeted seasonal flow and rainfall monitoring field work completion. The year 3-4 calibration will provide an updated tool for supporting the design of the large infrastructure projects to be completed in the subsequent phases. The second calibration (years 19-21) will support final LTCP compliance verifications.

Each calibration will include flow and rainfall monitoring to evaluate changes in dry and wet weather flows as well as seasonally varying flows. Flow and rainfall monitoring work plans will be developed prior to each system-wide monitoring event to identify the approximate number and location of monitors to be used. Upon completion of the calibration monitoring programs and subsequent calibration, the full model will be run with the TY rainfall data to verify the resulting level of control. The CSS model calibration will be performed consistent with previous calibrations and to the same level of confidence as the models used to support the LTCP alternatives evaluation.

3.4 CSO Basin Activation Monitoring and CSS Model Simulation

Table 5 summarizes the LTCP projects, including target GI acreage, based on receiving waterbody, as well as presents the anticipated completion dates in accordance with the approved implementation schedule. When all planned work (gray and green) is completed in a given CSO basin, the BSA may elect to complete activation verification using the CSS model in that basin at that time, rather than waiting until the end of the LTCP implementation period.

Activation and rainfall monitoring work plans will be developed for each CSO basin monitoring effort to examine frequency of CSO events (or, if necessary, SPP or group of SPPs upstream of the CSO) as appropriate to determine overall CSO activation frequency for that monitoring period. The CSS model will then be run using the actual rainfall data to correlate the model predicted activations with actual activations.

The CSS model will then be run using the TY rainfall to determine the effect of the project(s) on the level of control and in particular if the project meets or makes progress towards meeting the established LOC for the given CSOs. The CSS model results and comparison to the TY will determine the success or shortcoming of a project (including GI acreage control) to meet the performance criteria and if necessary form the basis for corrections to the recommended plan.

3.5 Water Quality Monitoring and Modeling

At the completion of the LTCP implementation period, the success of the program will be measured on the compliance with the typical year performance criteria presented on Table 3. The BSA will also complete a water quality monitoring and modeling effort as part of the PCM program. The overall purpose of the post construction water quality monitoring and modeling program will be to:

- Document water quality conditions for bacteria after the LTCP completion.

- Confirm that remaining CSO events do not preclude attainment of WQ standards in receiving water bodies (using same approach for source conditions as in approved LTCP).

Design of the monitoring and modeling program will be informed by the LTCP monitoring and modeling efforts discussed in LTCP Sections 3 and 4, except no water quality monitoring will be completed for the Niagara River, which already meets the WQ standards at 100%.

4. PCM Reporting

The AO requires that the results of the post-construction monitoring program be reported both annually with the LTCP Semi-annual Report and again in a Final PCM Report submitted within 120 days after completion of all PCM efforts. The following sections provide a general description of the contents of each type of PCM report.

4.1 Annual Reports

According to Paragraph 4.c of the AO, the BSA must prepare and submit with Semi-annual report an Annual PCM Report. This report is intended to document any ongoing or completed PCM efforts for the prior year. Generally speaking the Annual PCM Reports will include the following:

- Detailed discussion of all PCM tasks begun or completed both for individual projects and for CSO/SPP sewersheds or receiving water bodies;
- Results of PCM efforts;
- Model updates completed during that period;
- Results of CSS model calibration efforts (included only in the years immediately following the calibrations).

4.2 Final PCM Report

Within 120 days of completing all PCM efforts, the BSA must submit a Final PCM Report which documents the results of all PCM efforts. The Final PCM Report will:

- Demonstrate that the BSA completed all of the requirements of this PCM Plan.
- Confirm that each modeled CSO meets the typical year performance criteria established in Table 3.
- Document water quality conditions for bacteria upon completion of the LTCP implementation.

If CSS modeling or monitoring results of the CSOs show that the completed LTCP efforts did not meet level of control criteria established for each receiving water body, the Final PCM Report will identify and describe in detail the observed deficiencies or performance limiting factors in system design, process, operations, and maintenance that may have limited the ability of the control measures to achieve their intended performance. The Report will also identify and describe in detail all necessary corrective measures including alternative operating strategies, project modifications, construction of additional facilities, and/or inclusion of additional green infrastructure acreage necessary to meet the level of control. The Report will also include a schedule for completion of modifications including additional PCM efforts.