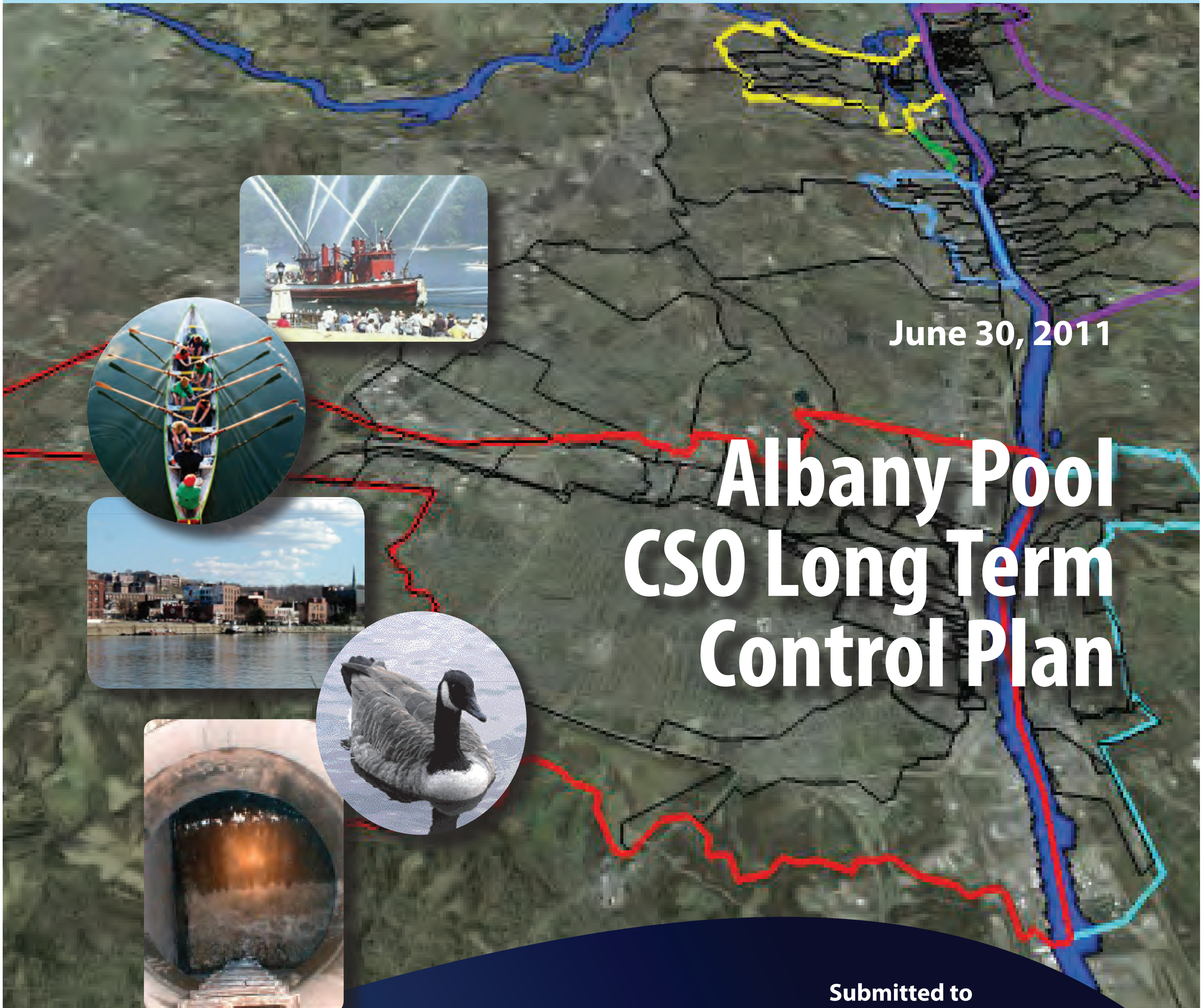
City of Albany City of Cohoes City of Rensselaer City of Troy City of Watervliet Village of Green Island



June 30, 2011

# Albany Pool CSO Long Term Control Plan

Submitted to

CDRPC

and

NYSDEC

Joint Venture Team
albany pool
CDM MALCOLM PIRNIE CHA

## Executive Summary

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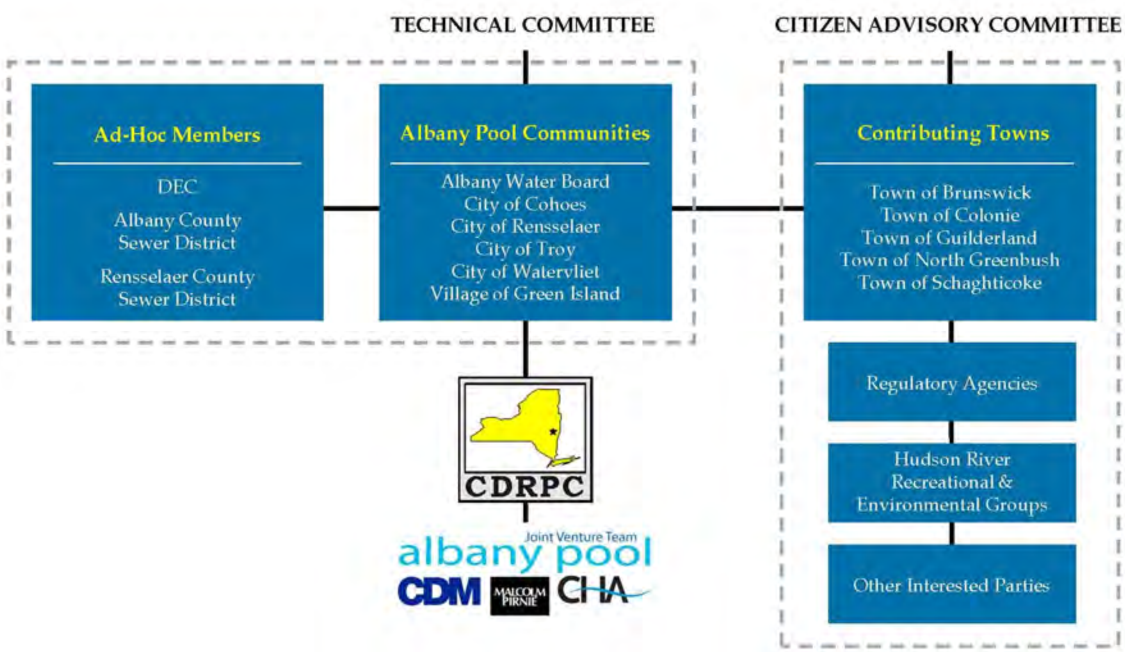
The electronic version of the appendices is included on the enclosed disc.

# 1. Introduction

In 2007, the City of Albany, the City of Cohoes, the City of Rensselaer, the City of Troy, the City of Watervliet and the Village of Green Island (the Albany Pool Communities, or APCs) joined in a comprehensive inter-municipal venture, led by the Capital District Regional Planning Commission (CDRPC) to develop a Phase I Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP). To complete the development of this plan, the CDRPC selected a consulting team consisting of a joint venture between Malcolm Pirnie, CDM and CHA; collectively referred to as the Albany Pool Joint Venture Team (APJVT).

CSOs occur when a combined sewer system (CSS) is overwhelmed with rain (or other runoff like snowmelt) and sewage resulting in discharge to the receiving waters, rather than to a WWTP. CSOs are subject to National Pollutant Discharge Elimination System (NPDES) permit requirements including both technology based and water quality based requirements of the Clean Water Act. The APCs collectively own and operate 92 CSOs that discharge to the Hudson and Mohawk Rivers, and their tributaries. Each of the APCs contributes flow to a WWTP owned and operated by either the Albany County Sewer District or the Rensselaer County Sewer District. While not directly responsible for addressing the CSO discharges, sewer district facilities can impact the conveyance and treatment of peak wet weather flows. As a result, the sewer districts are connected to the CSO program through their SPDES permits and have actively cooperated with the communities in the development of a LTCP for abatement of CSOs.

Figure 1: Project Organizational Framework




A robust public participation program was established to facilitate public participation and involvement throughout the development of the CSO LTCP. As part of these efforts, two committees were formed in order to direct the development of the LTCP, collect feedback on project status and findings, and provide input on issues deemed important to the public. The two committees were formed to represent the APCs, regulatory agencies, involved and interested parties, as well as the greater public interests. Figure 1 illustrates the organizational framework created to assist with the development of the LTCP.

## 2. CSO LTCP Development Process

The primary goal of the CSO LTCP is to develop a cost-effective, regional solution to achieve water quality standards; maximizing the environmental benefits while considering the financial impacts to the member communities. The CSO LTCP was developed using a two phase process. The APJVT first characterized the performance and response of the existing CSS and the water quality of the receiving waters. Then, once the baseline conditions were established, the APJVT identified and evaluated CSO control alternatives. Throughout the process, the public participation program provided a means by which to keep the public informed, and also offered a forum to solicit their input. An overview of the LTCP development process is illustrated in the Figure below.

Figure 2: CSO LTCP Process Chart


### 2.1 CSS Characterization

A critical element in the planning and development of the Albany Pool CSO LTCP was the characterization of the CSS. It is essential to understand the existing systems' response during dry weather and wet weather events, the frequency and volume of combined sewer overflows, and existing quality of the receiving waters prior to the development of strategies to minimize any potential impacts to the environment from CSOs.

#### 2.1.1 Receiving Waters Conditions Assessment

A water quality sampling program was implemented to develop an understanding of the water quality in the Hudson River, Mohawk River and their tributaries throughout the area where the Albany Pool Communities discharge CSOs. The program was based on an approved plan and was limited to parameters where CSOs may cause or contribute to exceedances of water quality standards. Water quality data was collected for the receiving water bodies during dry weather and during storm events in order to examine the potential effects of CSOs.

In 2008 sampling was successfully completed for 15 dry weather events and 4 wet weather events. Dry weather samples were collected to develop an understanding of specific background water quality parameters. Wet weather samples were collected to ascertain the water quality impact of the wet weather events and CSOs on the receiving waters. Samples were collected for both fecal coliform and E. Coli analyses in order to assess the data relative to the existing NYSDEC Class A and Class C fecal coliform standard defined in Part 703.4 and the USEPA proposed standard for E. Coli. Field measurements of general water quality physical chemical variables were also made for temperature, specific conductance, pH and dissolved oxygen in order to assess the data relative to the existing NYS standards also defined in Part 703.

During wet weather conditions, the APJVT also collected and analyzed samples at four CSO locations for fecal coliform, E. Coli, total suspended solids (TSS), biological oxygen demand (BOD), Ammonia Nitrogen (NH3), total Kjeldahl nitrogen (TKN) and total phosphorus (TP). Wet weather sampling was initiated at the activation of any one of the observed sites. These samples were collected to determine the typical range of values for these parameters, within the Albany Pool, and verify that these values were consistent with expected values for combined sewage based upon published national averages.

A subsequent sampling program was completed the following summer to collect additional information on the tributaries, from June to September of 2009. The combined work performed represents the most significant study on bacteria performed to date, within the receiving waters for the Capital District.

### 2.1.1.1 Dry Weather Sampling Results

The 2008 dry weather bacteria sampling indicated consistent widespread compliance with recreational use water quality criteria in the rivers, but the data indicated that there was an accumulation of bacteria through the Albany Pool region (with the maximum measured values typically observed between the Dunn Memorial Bridge and the Port of Albany). Downstream of its confluence with the Mohawk Rivers, the Hudson River is consistently well mixed across the River.

During the three 30-day periods sampled, the upstream boundaries of the sampling program showed little indication of dry weather sources of bacteria that could result in exceeding the water quality standards in either the tributaries or the receiving waters. Two potential beach sites downstream of the APCs did not indicate any dry weather periods of non-compliance. The sampling of WWTP discharges illustrated dry weather bacteria concentrations consistent with the absence of disinfection at these plants.

The samples taken at the tributary inlets generally met or exceeded the fecal coliform compliance limit for dry (and wet) weather sampling. This indicated that there are bacteria sources discharging to the tributaries, contributing to bacteria standard exceedences in the Rivers. This finding prompted a second round of sampling for some of the major tributaries in the summer of 2009.

### 2.1.1.2 Wet Weather Sampling Results

In 2008, sampling was completed for four wet weather events of varying magnitude, in accordance with the approved plan. The analytical results for fecal coliform and E. Coli for the wet weather events showed close correlations between the two indicator organism groups. During wet weather, the observation of little or no lateral differences in the river was consistent with what was observed in dry weather.

For each of the events sampled, the Hudson and Mohawk Rivers were generally in compliance with the NYS fecal coliform standard at the upstream limits of the study area. Similar to the dry weather results, the wet weather data indicated that there was an accumulation of bacteria through the Albany Pool region, with the maximum measured values typically observed, again, between the Dunn Memorial Bridge and the Port of Albany. Comparisons made between wet weather bacteria concentrations and applicable criteria showed consistent exceedances of those criteria in both the Rivers and major tributaries.

Field measurements obtained during wet weather events for temperature, specific conductance, pH, and DO showed general consistency through the events. Concentrations of bacteria in CSO and WWTP effluent samples were consistent with what is typical in those discharges during wet weather. BOD, TSS and nutrient variables were measured in CSO discharges and the observed concentrations were consistent with what is typically observed in other CSO communities.

### 2.1.1.3 Implications for CSO Control

Despite the high concentrations of indicator bacteria observed in WWTP and CSO discharge samples, statistical analyses of in-stream samples data showed a high proportion of locations where applicable water quality standards were met. In particular, potential full contact recreation beach areas, located downstream of the Albany Pool communities, showed only a moderate risk of exceeding recreational standards. It is believed that disinfection at the WWTPs, with a limited level of CSO control would reduce the frequency of exceedences of the water quality standard for bacteria.

The results of the water quality investigations provided important information in regards to the evaluation and selection of appropriate levels of control for Albany Pool overflows, including the following:

- The Hudson River appears to be generally well mixed in the CSO receiving waters. The combination of tidal forces and river flow results in distribution of bacteria evenly across the River.
- Despite both dry and wet weather loading of bacteria to the River, the areas where the River fails to meet standards appear to be spatially and temporally small.
- Wet weather loadings of bacteria, BOD and other pollutants from CSO sources appear to be comparable to other similary sized communities.
- The most significant dry weather sources of bacteria measured in 2008 were the local WWTPs and the Patroon Creek, which appeared to be impacted by a consistent dry weather source(s). 2009 sampling data indicated a significant reduction in bacteria levels for the Patroon Creek, which resulted from investigations and mitigation efforts performed by the ACSD and Albany Water Board.

- Other tributaries contribute wet weather loading of bacteria that might be reduced with application of non-point source best management practices.
- A review of the collected dissolved oxygen data, in conjunction with other sources of historical River data, indicates that CSOs are not a cause of violations of the dissolved oxygen standard. As a result, a dissolved oxygen model was not required.
- Control of dry weather sources of bacteria provides an opportunity to improve water quality and increase the rate of compliance with the water quality standards for bacteria prior to implementation of CSO controls.
- Control of dry weather bacteria sources provides an opportunity to demonstrate that a lesser degree of wet weather control will prevent CSOs from causing or contributing to violations of water quality standards.
- Based on the CSS characterization and the types of floatables observed during the sampling program, it would appear that source control programs, in conjunction with end-of-pipe technologies, will provide the most cost-effective system-wide floatables control strategy.

### 2.1.2 Mapping, Database and Digitizing

A standard pre-requisite to the characterization of any system is the collection and organization of the available system data, information and mapping. A comprehensive search was conducted and, as anticipated, communities had different levels of records and mapping completed for the sewer systems; varying from hard-copies of historical drawings to GIS and/or AutoCAD files for the sewer systems.

In general, sewersheds, interceptors, pump stations, WWTPs, control structures, regulators, outfalls and major trunk sewers were digitized into a regionally based geographic information system (GIS). In addition, field data and information was compiled in a database and linked to the GIS. It is envisioned that the database and GIS layers will provide standards, protocols and templates that can be utilized to further build critical system information into a system-wide GIS. The development and compilation of the existing infrastructure database and GIS information was used to populate the CSS models and will provide the communities additional long-term benefits (beyond the LTCP project) in regards to system operations and maintenance, planning and design support, and asset management.

### 2.1.3 CSS Monitoring

A monitoring program was conducted in the summer of 2008 to verify and supplement available CSS monitoring data. The monitoring program included the installation of 4 rain gauges and 45 flow meters at key locations throughout the CSS. Data was collected over a 3 month period, beginning in June 2008 and ending in September 2008. In addition, the flow monitoring program utilized information from the ACSD which owns and maintains 27 flow meters. Permanently installed meters located at the in-system pump stations and influent sewers to the Rensselaer County Sewer District (RCSD) Wastewater Treatment Plant (WWTP) were also used.

Site installation reports and details, average conditions, data quality summaries, monthly scatter graphs, and monthly flow velocity and depth plots were compiled for each of the 45 metering locations. Daily rainfall summaries and hyetographs were also compiled for each of the four rainfall monitoring locations. The data was compiled into independent volumes prepared for areas tributary to the ACSD North WWTP, ACSD South WWTP, RCSD WWTP for flows from the City of Troy, and the RCSD WWTP for flows from the City of Rensselaer. The collection of this data provided valuable insights into the CSS response (during dry and wet periods), and greatly aided in the overall system characterization and CSS model calibrations.

### 2.1.4 CSS Model Development

CSS models were developed to characterize the systems, quantify CSO discharges and evaluate CSO control alternatives. This work was done in accordance with the protocol defined in the approved work plan submitted to, and approved by, the NYSDEC. The CSS models simulate conveyance of combined and sanitary flows through interceptor sewers, selected trunk sewers, CSO regulators and overflow conduits using USEPA Stormwater Management Model Version 5 (SWMM) modeling software. Four separate models were developed and calibrated to represent the systems contributing flows to each of the three WWTPs, as follows:

- Albany North - The sewersheds tributary to the ACSD North WWTP, which serves the primarily combined sewer systems from Cohoes, Watervliet and Green Island. The WWTP also receives separate sanitary wastewater from Albany, Colonie and Guilderland conveyed directly to the plant via the Patroon Creek Interceptor;
- Albany South - The sewersheds tributary to the ACSD South WWTP, which primarily serves the mostly combined sewer systems from Albany;
- Troy - The City of Troy combined sewersheds tributary to the RCSD WWTP which also includes additional separate sanitary wastewater conveyed through Troy from North Greenbush, Brunswick, and Schaghticoke.
- Rensselaer - The City of Rensselaer combined sewersheds tributary to the RCSD WWTP.

The CSS models were developed for planning purposes, and extend along a 12-mile stretch of the Hudson River. The models were compiled to represent the interceptor sewers, regulator structures and overflow points for the ACSD and RCSD combined sewer networks. Record drawings, GIS data, flow monitoring inspection reports and field surveys were used to develop the geometry of the piping network.

Each model was calibrated for dry weather flow, wet weather flow, and a multi-month continuous simulation using the flow metering and rainfall data collected in 2008. To evaluate the existing system performance, a long-term simulation was performed and checked against long term WWTP data. A five-year representative design period was selected to obtain more robust statistics than would be possible from a single representative year simulation. Precipitation data from the Albany Airport from 1948 through 2006 was analyzed to identify a 5-year period with precipitation close to long-term averages. The years 1985 through 1989 were selected as having representative precipitation.

Baseline CSO statistics and percentage capture were computed from the five-year simulation results. Table 1 lists average annual CSO volume, duration of discharge, number of overflow events, and percent capture for each CSS Model. Percent capture is the ratio of flow treated at each WWTP during wet weather to the total flow entering the collection system during wet weather.

TABLE 1: Baseline Annual CSO by Community

| Community | Volume of Overflow (MG) | Duration of Overflow (Hrs) | Number of Overflow Events | Percent Capture |
|---|---|---|---|---|
| ACSD North | 30 | 380 | 61 | 94 |
| ACSD South | 739 | 637 | 58 | 66 |
| Troy | 447 | 723 | 52 | 67 |
| Rensselaer | 20 | 192 | 52 | 88 |
| Albany Pool total | 1,236 | | | 70 |

### 2.1.5 Receiving Water Quality Model (RWQM) Development

A Hudson River water quality model was developed to characterize the impacts of pollutants from the Albany Pool communities' CSO and WWTP discharges. The modeling was designed to address the following questions:

- How far downstream are in-stream concentrations of fecal coliform bacteria likely to exceed water quality standards from the current CSO discharges (Existing Conditions)?
- What is the frequency of water quality standard exceedance for fecal coliform bacteria during the recreation season (Existing Conditions)?
- What are the improvements associated with in-stream levels of fecal coliform bacteria, and the reduction in the magnitude and extent (length) of Hudson River impacts, associated with potential CSO control alternatives (Proposed Conditions)?

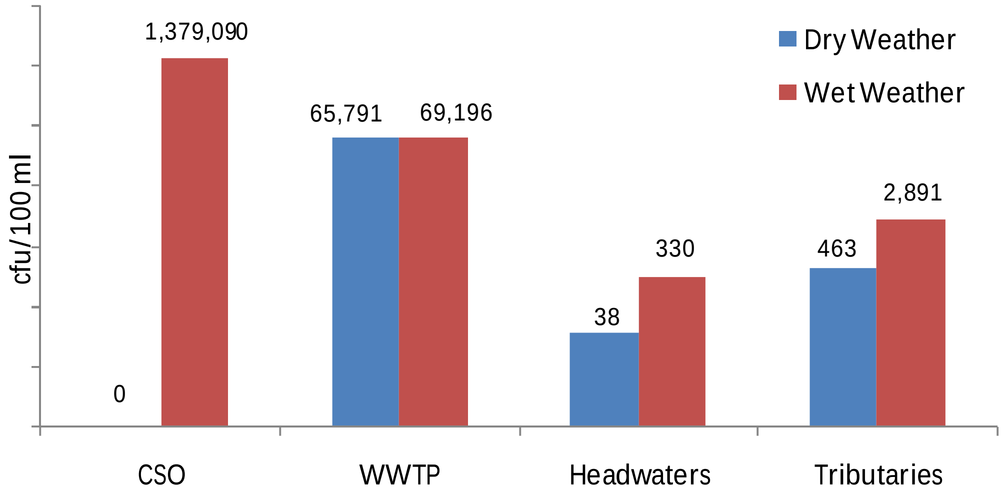
Ultimate oxygen demand may result in depleting dissolved oxygen (DO) concentrations and can also be considered a pollutant of concern with regards to CSO discharges. However review of historical sampling data within the Hudson River (as obtained from ACSD for 1987-1996 and the Hudson River Environmental Conditions Observing System near Schodack Island for 2008-2009) showed that DO has consistently been above water quality standards (5.0 mg/l daily average and 4.0 mg/l daily minimum). NYSDEC concluded that available data support the conclusion that there are no violations of the water quality standard for dissolved oxygen in the Hudson River as a result of CSOs. Thus, the modeling effort focused upon the evaluation of fecal coliform bacteria.

The USEPA Stormwater Management Model Version 5 (SWMM) was selected for the river hydrodynamics and bacteria analysis. As discussed previously, SWMM was also used to develop the CSS models to simulate the rainfall-runoff process and the routing of flows through the sewer systems. For the receiving water modeling, the routing portion of SWMM was used to simulate flow and hydraulics (depth and velocity) for the Hudson River, accounting for tidal impacts by imposing measured stages from a gauge at Poughkeepsie, New York. In addition, the model uses as input the WWTP and CSO discharges from the four combined sewer system (CSS) models.

#### 2.1.5.1 RWQM Existing Conditions Results

The bacteria model was validated for dry weather, wet weather, and a multi-month continuous simulation. The validation period extended from June through mid-September 2008. The validated bacteria model was used to perform continuous long-term simulations to evaluate standards compliance for baseline and alternatives scenario conditions. The 1985 through 1989 representative period (used for the CSS models) was also used for the river model. Average fecal coliform bacteria concentrations used as input to the receiving water model under baseline conditions are shown in Figure 3. The tributary concentrations shown on the figures are weighted averages based on the watershed areas.

Figure 3: Average Fecal Coliform Bacteria Concentration for Baseline Conditions



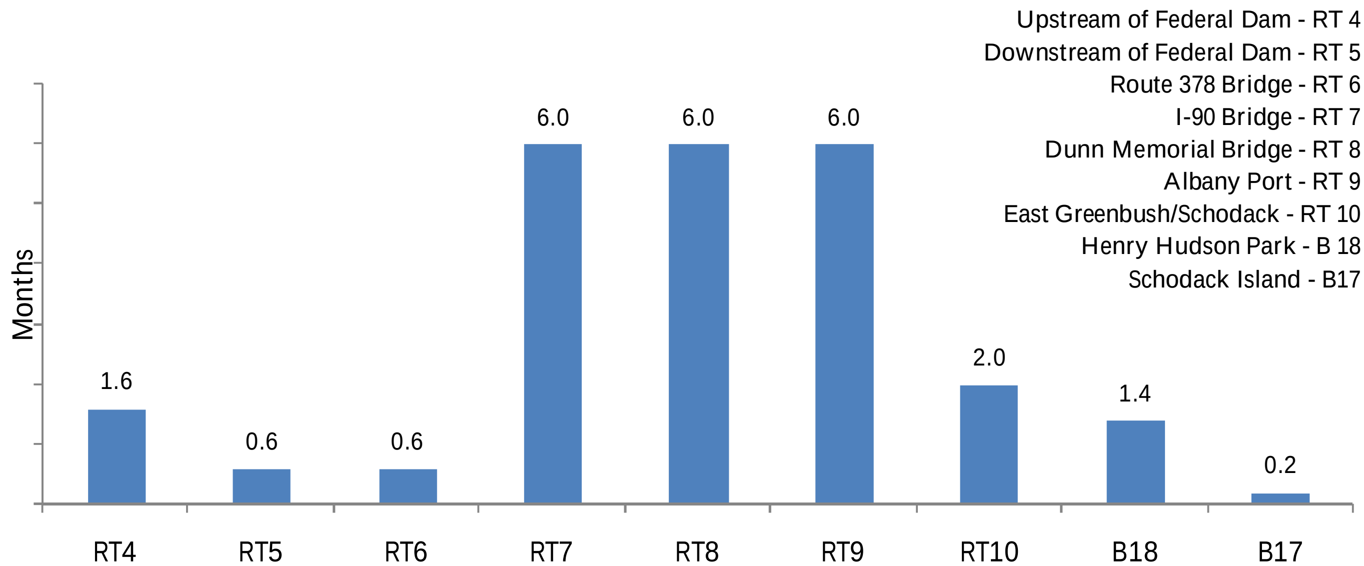

The model output of bacteria concentrations was analyzed to establish water quality standard exceedance frequency. This standard is a geometric mean value of 200 colony-forming units (cfu) per 100 ml, based on a minimum of five samples over a 30-day period. Exceedance frequency at a particular location was initially calculated based on a “monthly” approach, in which monthly geometric means of modeled bacteria concentrations were evaluated, assuming that a single daily sample at each modeled transect is “taken” at noon of each day. The monthly geometric mean was thus established based on one sample per day, and a total of 30 monthly geometric mean values were calculated (6 months of recreational season per year times 5 years of simulation). The total number of months with a geometric mean exceeding 200 cfu/100 ml was determined, and was then divided by five to determine the frequency of water quality standard exceedances during a single recreation season (i.e., how many months per season would exceedance be expected). The exceedance frequency percentage was calculated based on how many of the 30 geometric means exceeded the standard. For example, if 10 of the 30 monthly values exceeded the standard, the frequency percentage would be 33 percent (10 divided by 30).

At the request of NYSDEC, the frequency of water quality exceedance was also evaluated using the daily arithmetic average of modeled bacteria concentrations and compared to the method based on selecting the noon value as the representative value for the day. Additionally the exceedance frequency was evaluated using a “rolling average” approach where a 30-day geometric mean was calculated for every 30-day period falling within the recreational season (May 1 – October 30). For example, the 30-day geometric mean for May 1 was calculated based on model output from May 1 through May 30. This analysis considered both the noon value and daily average value approaches discussed earlier. The exceedance frequency percentage was calculated based on the number of 30-day periods with an exceedance, divided by the total number of 30-day periods evaluated in the 5-year simulation (770). Comparisons of the two methods showed that the noon value and monthly geometric mean approach provide similar results and without bias.

A summary of the exceedance frequencies at each river transect site and shoreline location under baseline conditions is provided in Figure 4. As indicated in the figure, the frequency of exceeding the monthly geometric mean bacteria standard upstream of the Federal Dam (RT4) is an average of 1.6 months per six-month recreation season, or eight months during the recreation season over a five year period.

Under the baseline conditions, the frequency of exceeding the bacteria standard is greatest in the vicinity of the I-90 Bridge, Dunn Memorial Bridge, and the Port of Albany (RT7, RT8, and RT9). In this area, the long-term average monthly geometric mean standard exceedance is 6 months per 6-month recreation season. The RCSD WWTP and ACSD North WWTP are both located just upstream of RT7, while the ACSD South WWTP and East Greenbush WWTP are located between RT8 and RT9. Big C, the largest volume CSO in Albany, which accounts for 45 percent of all CSO in the Pool communities, corresponds with RT8 in the model.

Figure 4: Monthly Exceedances of Bacteria Standard per Recreation Season for Baseline Conditions




### 2.1.5.2 RWQM Simulations

After establishing baseline conditions, four alternative scenarios were evaluated for developing a better understanding of the bacterial influences on the Hudson River; and for identifying cost-effective CSO control strategies for achieving compliance with the water quality standards. Each scenario is described below:

- Scenario 1 evaluated conditions with all WWTPs providing seasonal disinfection to 200 cfu/100 ml from May 1 through October 30.
- Scenario 2 incorporated the improvements included in Scenario 1, and assumes that inflows at the headwater boundaries and from the tributaries were improved to meet water quality standards. Scenario 2 was intended to isolate the contribution of CSOs to exceedance of the fecal coliform bacteria water quality standard.
- Scenario 2A was also developed to simulate Hudson River water quality impacts if compliance with the standards for fecal coliform along tributaries was not attainable in the near future. This scenario assumed that the tributaries were unchanged from the Baseline conditions with the exception of Patroon Creek which showed significant reductions in bacteria counts in 2009 in response to correction of illicit sewer connections performed by ACSD and the Albany Water Board.
- Scenario 3 incorporated the improvements included in Scenario 1, and evaluates upgrading the combined sewer system to achieve 85 percent CSO capture (in accordance with the Presumption Approach). This scenario does not include improvement in headwater or tributary bacteria concentrations.
- Scenario 4 evaluates the benefits of only upgrading the combined sewer system to achieve 85 percent CSO capture, with no WWTP disinfection and no improvement in headwater or tributary bacteria concentrations.

For all scenarios, model results were compared to the baseline condition to assess the benefits of each scenario in reducing exceedance of the fecal coliform bacteria standard. A summary of the bacteria modeling results follows in Table 2.

Table 2: Bacteria Modeling Results

| Scenario | WWTP Disinfection(1) | Headwaters | Tributaries | CSO | Exceedances(3) (months/30 months) |
|---|---|---|---|---|---|
| Baseline | No | Baseline | Baseline | Baseline | 30 |
| 1 | Yes | Baseline | Baseline | Baseline | 2 |
| 2 | Yes | Improved(2) | Improved(2) | Baseline | 0 |
| 2A | Yes | Improved | Baseline; Patroon Creek improved to 2009 levels | Baseline | 0 |
| 3 | Yes | Baseline | Baseline | 85% Capture | 2 |
| 4 | No | Baseline | Baseline | 85% Capture | 30 |

Notes:

(1) Disinfection was applied at the WWTPs only during the recreation season.

(2) Improved headwaters and tributaries meet water quality standards for fecal coliform.

(3) Exceedances are based upon the five-year simulation and refer to the number of months during the recreation season that the monthly geometric mean exceeds 200 cfu/ 100 ml at any transect within the Albany Pool.

The key conclusions of the RWQM efforts are as follows:

- A review of historical river dissolved oxygen data indicates that Albany Pool CSOs do not cause violations of the dissolved oxygen standard.
- Improvements to continuous sources of bacteria contributions to the Hudson River, such as WWTPs, tributaries and headwaters, provide more effective bacteria-based water quality improvements than improvements to intermittent wet weather discharges.
- The water quality conditions of the headwaters of the Hudson River, as assumed under Scenario 2A, are believed to be achievable, since the WWTPs upstream of the Albany Pool have recently completed projects to disinfect their effluent discharges to the Hudson River. The documented improvements to water quality conditions of Patroon Creek are believed to be sustainable due to continuing efforts by the City of Albany and the ACSD to identify and eliminate possible illicit sewer connections. This finding was substantiated by sampling performed in 2009.
- The results of Scenario 2A (no exceedances during the recreation season over the five-year model simulation) indicate CSOs do not preclude the attainment of water quality standards upon implementation of seasonal disinfection of WWTPs, and improvements to the headwaters and Patroon Creek associated with completed and ongoing projects.

### 2.1.6 WWTP Wet Weather Capacity Study

The CSO LTCP recommends improvements to both the combined sewer system and the three WWTPs that comprise the project service area, including the ACSD North WWTP, the ACSD South WWTP, and the RCSD WWTP. The process and hydraulic capacities of each plant's unit processes were evaluated independently. The hydraulic capacity is defined as the maximum flow that can be passed through a unit process without exceeding a specific freeboard or weir submergence criteria. The process capacity is defined as the maximum flow that can be treated in a unit process without exceeding any process criteria (i.e., treatment performance). In some areas of the plants the hydraulic capacity exceeds the process capacity and in other areas the process capacity exceeds the hydraulic capacity. The treatment capacity was determined as the flow that could successfully meet both the process and hydraulic criteria.

The hydraulic capacities were determined based on both the 1-year flood elevation and the 25-year flood elevation in the Hudson River. Hydraulic capacities considered only peak wet weather flows; while process capacities considered both average annual daily flows and sustained short term peak wet weather flows. The overall WWTP treatment capacity is defined as the maximum flow that can pass through all the operating treatment process units without exceeding any hydraulic or process capacity criteria. No disinfection practices are presently being employed at the WWTP's. The summaries of the WWTP capacities for each plant are provided in the following sections.

#### 2.1.6.1 ACSD North WWTP

The evaluation concluded that ACSD North WWTP is limited by its process capacity. The plant has an existing average primary treatment capacity of 35 mgd and an existing average secondary treatment capacity of 29 mgd. The plant has an existing peak wet weather primary treatment capacity of 88 mgd and an existing peak secondary treatment capacity of 55 mgd. During wet weather peak flow events, the primary effluent in excess of 55 mgd is sent through the secondary bypass and blended with the secondary effluent before discharge. The existing plant reliable and emergency hydraulic capacities exceed the process capacities for both the 1-year and 25-year flood elevations.

### 2.1.6.2 ACSD South WWTP

This evaluation concluded that the ACSD South WWTP is limited by both its hydraulic and process capacities depending on the flow condition and Hudson River elevation. Because of the hydraulic limitation, the capacity can be influenced by Hudson River elevation.

For the 1-year flood elevation, the ACSD South WWTP has an existing average primary and secondary treatment capacity of 29 mgd. Similarly, the plant has an existing peak wet weather primary treatment capacity of 29 mgd and an existing peak secondary treatment capacity of 32 mgd. The peak wet weather capacities for both primary and secondary treatment limits are controlled by the plant hydraulic capacity. Because the peak process capacities exceed hydraulic capacities, the plant is operated outside normal hydraulic limitations in order to maximize wet weather flow and reach the process capacity limits. Under these circumstances, the ACSD has demonstrated the ability to achieve SPDES Permit Compliance by allowing the plant secondary and primary clarifier weirs to submerge, resulting in a peak wet weather primary treatment capacity of 45 mgd and an existing peak secondary treatment capacity of 40 mgd with the 1-year flood elevation. During peak wet weather flow events, the primary effluent in excess of 40 mgd is sent through the secondary bypass and blended with the secondary effluent before discharge.

The operations of the ACSD South WWTP are significantly affected by the 25-year flood elevation as this elevation approaches the secondary clarifier weir elevation. Similar to the peak flow plant operations under normal river levels, the plant is operated outside normal hydraulic limitations in order to maximize treatment and approach its process capacity. Under these circumstances, the ACSD has demonstrated the ability to achieve SPDES Permit Compliance by allowing the plant secondary and primary clarifier weirs to submerge resulting in an increase in the existing average secondary treatment capacity to 29 mgd. These average treatment capacities are similar to the 1-year flood values but with the loss of hydraulic control (i.e., secondary weirs submerged).

For peak wet weather events under the 25-year Hudson River flood elevations, the primary clarifiers can accept additional flow up to their process capacity limitation of 45 mgd. The secondary system treatment capacity can be increased to 32 mgd. During peak wet weather flow events, the excess primary effluent is sent through the secondary bypass and blended with the secondary effluent before discharge.

### 2.1.6.3 RCSD WWTP

The WWTP was originally designed for an average daily primary, secondary (with four final clarifiers) and disinfection flow rate of 24 mgd; a peak secondary flow rate of 51 mgd (with 50% return activated sludge flow); and a peak wet weather primary, partial secondary bypass, and disinfection flow of 63.5 mgd. An additional final clarifier was installed in 2001 as part of a consent decree with the United States Northern District Court. The additional final clarifier was designed for a maximum daily flow of 11.3 mgd.

The primary treatment capacity is limited by the surface overflow rate, but operates successfully at its design and peak loading rates. With the dilute influent strength, only two of the four aeration tanks are needed to meet permit limits. The secondary system currently operates with the original four (peripheral feed) final settling tanks plus one deeper, center feed clarifier. Even with this additional clarifier, the existing four final settling tanks exhibit severe short circuiting which limits process capacity.

The major hydraulic restriction for the plant is the flood conditions at the Hudson River. The 25-year flood level is well above the effluent weirs at the chlorine contact tank (CCT). The 25-year flood condition also reduces the available head between the CCT and the final clarifiers.

The existing operations and plant performance support the treatment of peak wet weather flows up to 35 mgd at the 1-year flood elevation, which is less than the original maximum design and current permitted flow of 51 mgd through secondary treatment. Accepting more flow to increase the peak wet weather influent above current levels is not recommended in order to avoid performance degradation. However, the evaluation shows that the plant should be able to pass and treat a higher flow for a short duration assuming all tanks are in service and a 6-inch freeboard is provided. The hydraulic capacity is highly dependent on the river elevation and whether the conditions under the reliable or emergency capacity definition are followed. A summary of the respective plant peak wet weather capacities is presented in Table 3.

Table 3: WWTP Peak Wet Weather Capacities

| Unit Process | ACSD North (1) | ACSD South (1 year flood) | ACSD South (25 year flood) | RCSD(2) |
|---|---|---|---|---|
| Headworks | 90 | 60.5 | 60.5 | 63 |
| Primary Treatment | 88 | 45 | 45 | 70 |
| Secondary Treatment | 55 | 40 | 32 | 35 |
| Disinfection | 0 | 0 | 0 | 0 |

(1) Values represent capacities at both the 1-year and 25-year Hudson River Flood Elevations
(2) Values represent capacities at the 1-year Hudson River Flood Elevations

## 2.2 LTCP Development

The primary objectives of the Albany Pool CSO LTCP are to maintain the current Class C river uses, support riverfront economic development and to better accommodate swimming and bathing activities at the potential beach sites on the Hudson River. The CSO LTCP is also required to meet current permit requirements, including the 15 best management practices (BMPs) included in each communities' SPDES permit. The assessment performed considered technologies presented in the EPA guidance manuals and selected appropriate technologies to achieve the program goals and objectives in the development of the recommended plan.

In consideration of the CSS and receiving water quality models' findings and conclusions, the regulatory compliance strategy for the Albany Pool Communities utilizes the Demonstrative Approach for development of a recommended plan for CSO compliance. This approach requires the communities to demonstrate that the remaining CSOs do not preclude the attainment of water quality standards, or the designated uses of the receiving waters, through a post construction compliance monitoring program. The results of the characterization and modeling efforts determined that bacteria and floatables are the primary pollutants that the LTCP should focus upon for achievement of water quality standards.

To achieve compliance, CSO control technologies focus on seasonal disinfection of WWTP effluent, WWTP process improvements, best management practices, system optimization, sewer separation, floatables control and tributaries enhancement. Specifically, the CSO control strategy strives to:

- Achieve regulatory compliance as measured by the water quality standard for bacteria;
- Optimize performance of existing infrastructure;
- Incorporate WWTP and system rehabilitation projects to address current needs and reduce risk of emergency repairs;
- Preserve capital for future operation and maintenance.

It is important to recognize the efforts of each of the communities and sewer districts prior to engaging in this CSO control planning effort. Each of the APCs and sewer districts have performed a number of projects designated to improve collection and treatment systems performance. The performance of these projects highlights the commitment of the APCs and sewer districts to improving the water quality of the Mohawk and Hudson Rivers, and their tributaries. In recent years, CSO related efforts implemented by the APCs total almost $34 million.

### 2.2.1 Development and Evaluation of CSO Control Alternatives

The APCs plan to take a build and measure approach to allow them to cost–effectively address CSO related water quality compliance issues. The CSO LTCP focuses on the main contributors of the primary pollutant of concern (bacteria), and then addresses other measures for improving system performance, reducing CSO discharges and controlling floatables in the overflows.

As indicated by the receiving water modeling, reduction of continuous sources of fecal coliform provide the greatest bacteria-based water quality benefits to the Hudson River. Additional CSO control measures include WWTP capacity improvements, BMPs, system optimization, and sewer separation. Floatables control facilities provide the means for minimizing the discharge of floatables associated with those CSOs remaining after the implementation of the LTCP. Additional tools for improving CSO control and educating the public have also been considered.

In accordance with the foregoing discussion, CSO controls have been evaluated and categorized into the recommended projects as follows:

- Disinfection Projects – These consist of seasonal disinfection at the ACSD and RCSD WWTP's.
- Tributary Enhancements – The water quality improvements observed along Patroon Creek during the water quality sampling program highlight the benefits of investigating sources of bacteria contributions to tributaries of the Hudson River. Initial projects will consist of field investigations to identify potential illicit sewer connections, failed septic systems, exfiltration from sewers running parallel or crossing stream, or other sources of bacteria.

- BMPs/System Optimization – These projects focus on SPDES Permit BMPs and maximizing the performance of the existing infrastructure through regulator and weir modifications, reduction of system inflow, capacity upgrades, and improved operations.
- Sewer Separation/Storm Water Storage – These projects consist of separating sewers in select sewersheds (including diverting streams from existing combined sewers and storm water from existing outfalls), installation of storm water storage structures, and diversion of stormwater to groundwater recharge basins.
- Floatables Control Facilities – These facilities provide screening of CSO discharges to remove floatable material. Projects were identified based upon the volume of overflow contributed by a particular outfall and/or its location in relation to recreational areas. Projects also include consolidation of outfalls where appropriate.
- Additional Pool-Wide Projects – These projects were developed for the purpose of improving management and operations of the existing wastewater infrastructure, modifying land use ordinances for the purposes of controlling stormwater runoff and developing programs for educating the public on the water quality impacts of CSOs on the Hudson River.

Table 4 provides a summary of the Recommended CSO LTCP elements with the estimated project costs.

Table 4: Recommended CSO LTCP Elements

| Project Type | Estimated Cost ($ Millions) |
|---|---|
| Disinfection Projects | $16.0 |
| WWTP Process Improvements | $15.8 |
| BMPs/System Optimization | $15.7 |
| Sewer Separation/Storm Water Storage | $32.1 |
| Floatables Control Facilities (FCFs) | $25.8 |
| Tributary Enhancements | $2.8 |
| Additional Pool-Wide Projects | $1.5 |
| Total Recommended Plan | $109.7 |

Combined sewer system and receiving water quality model runs were performed to determine the benefits associated with implementation of the recommended plan. The RWQM was run for the defined 5-year simulation period to cover a wide range of seasonal variations in groundwater and precipitation. Results of the post construction model run were compared with the baseline conditions to quantify the improvements to collection system and treatment system performance. In addition, the frequency of bacteria violations (based on the receiving water quality standards) were evaluated to reaffirm the benefits associated with the recommended Albany Pool CSO Control Strategies.

Table 5 provides a summary of the cumulative receiving water improvements associated with implementation of the Recommended CSO LTCP.

Table 5: CSO Control and Receiving Water Improvements

| Statistic | Baseline Conditions | Post Construction of Recommended Projects |
|---|---|---|
| CSO Volume (MGal) | 1236 | 925 |
| Number of Pool-Wide Events(1) | 65 | 65 |
| Wet Weather Flow Treated at WWTPs (MGal) | 2827 | 3031 |
| Pool-Wide Percent Capture | 69.5% | 77.2% |
| CSO Flow Receiving Floatables Control (MGal) | 27 | 454 |
| Pool-Wide Treatment & Floatables Capture | 70.1% | 88.8% |
| Disinfection at WWTPs | No | Seasonal |
| Fecal Coliform WQ Standard Exceedences (during the recreation season for 5 yr model run) | 30 | 0 |

(1) A CSO from any one of the 92 APC CSO's constitutes an event

Under post construction conditions, the model predicts that the volume of CSO discharged annually will be reduced by 311 million gallons, or 25 percent. Pool-wide percent capture improves from 69.5 percent to 77.2 percent with an additional 204 million gallons of wet weather flow being conveyed to, and treated by, the WWTPs. Upon implementation of the seasonal disinfection facilities at each of the WWTP's along with the other defined program elements, it is anticipated that exceedences of the Fecal Coliform Water Standard during the recreation season (May to October) will be eliminated.

The results of the receiving water quality modeling for the post construction conditions support the achievement of water quality standards for fecal coliform. In accordance with the Demonstrative Approach of the USEPA CSO Policy, the Recommended Long Term Control Plan for the APCs will achieve compliance with the receiving water quality standards as follows:

- The control program meets water quality standards and preserves designated uses.
- The remaining CSO discharges will not preclude the attainment of the water quality standards for bacteria or the designated uses of the receiving waters.
- The proposed controls provide the maximum bacterial reduction benefits reasonably attainable, and
- The Recommended CSO LTCP provides for cost effective expansion, retrofit or upgrade (if required) in the future to meet the receiving water quality standards or preserve designated uses.

### 2.2.2 Green Infrastructure Strategies

As part of the development of CSO control strategies, green infrastructure tools and measures have been considered and incorporated into the proposed CSO control projects, to the greatest extent practicable. Incorporated green infrastructure elements include the reduction of inflow to the combined sewer systems and WWTP's; which results in a reduction of the energy usage and treatment costs, and maximizes the CSO percent capture for the system. In addition to the defined projects in the CSO LTCP Program that incorporate "green benefits", the APCs have defined program goals which include the specification and installation of energy efficient equipment; the promotion of Green Infrastructure Practices within Municipal Capital Improvement Programs; as well as the promotion and enforcement of the new 2010 NYSDEC Stormwater Design Manual for both public and private development projects.

Furthermore, the APCs propose enhancing coordination efforts between Albany Pool CSO communities and additional MS4 communities, within both Albany and Rensselaer Counties, where opportunities to share services/work products exist. Examples of sharing work products may include efforts undertaken by the Stormwater Coalition of Albany County which is currently performing municipal code reviews with respect to the new NYSDEC stormwater Design Manual and the development of green infrastructure technical design guidance documents for public and private projects as part of this LTCP.

Several green pilot or demonstration projects have been completed or are presently under development, including the following:

- Member communities of the Stormwater Coalition of Albany County participate in a rain barrel program to educate the public and promote the reuse and conservation of stormwater.
- Rain garden and tree planter demonstration projects have been completed to educate the public and promote infiltration practices.
- Porous pavement demonstration project was completed in the City of Cohoes, and
- "Green Street" demonstration projects are proposed within the City of Albany and the City of Rensselaer.

### 2.2.3 Financial Capability Assessment

The EPA's guidance documents suggest that the LTCP include a financial capability assessment in order to assess the financial burden on both ratepayers and the municipalities, and to aid in the development of an implementation schedule for the LTCP by balancing the pace of the construction with the financial and economic capability of the municipalities. The goal of the process is to permit flexibility in the scheduling and completion of CSO compliance measures, based on the financial capabilities of the communities served.

#### 2.2.3.1 Residential Indicator

The Residential Indicator was compared to EPA financial impact ranges provided in the EPA guidance document to assess the financial impact that wastewater treatment and LTCP costs may have on the communities' residential customers. The calculated Residential Indicator corresponds to financial impact in the "Mid-Range" category. However, due to the variability of income levels across the communities' service areas, some neighborhoods within the communities will experience more severe financial impacts and economic hardship as a result of implementation of the LTCP. These neighborhoods will face residential sewer rates, as a percentage of household income, that are much greater than the median for the combined service areas. These areas tend to be the core urban areas, such as within the cities of Albany and Troy, which are the areas with the highest unemployment rates, lowest household incomes, and greatest number of households with incomes below the poverty level.

#### 2.2.3.2 Community Financial Capability Indicators

The second phase of the financial capability assessment involved calculating financial capability indicators. These indicators characterize the permittee's debt burden, socioeconomic conditions, financial operations, and the ability to secure the funding necessary to implement the LTCP. The weighted average Financial Capability Indicator score for the APCs corresponds to a "Mid-Range" financial capability indicator rating.

#### 2.2.3.3 Financial Capability Assessment Summary

The results of the financial capability assessment, which combine a "mid-range" Residential Indicator with a "mid-range" Financial Capability Indicator, indicate an overall financial capability for the combined APCs in the "medium burden" category. While the EPA guidance suggests a 10-year schedule for LTCP implementation based on a "medium burden" financial capability result, there are several additional financial, socioeconomic, and political factors that are not reflected in the EPA Financial Capability Assessment score, including: the higher than average property taxes, the unemployment rate, significant rate adjustments, and the large portion of low income areas within the Pool Communities.

#### 2.2.3.4 Rate Impact Analysis

A rate impact analysis was completed for each community to assess the potential year-by-year sewer rate impacts associated with implementation of the LTCP. The sewer rate increases and bill impacts provided are based upon a cost allocation method derived for Phase I of the LTCP. As the specific allocation of costs among the APCs has not yet been determined, the predicted rate impacts were computed for illustrative purposes only. Actual individual community costs and rate impacts will be subject to Phase II inter-municipal contract negotiation and actual implementation costs.

The implementation of the LTCP over a 15-year schedule will require significant annual sewer rate increases for each of the communities. In some years, several of the communities will require more than a 10 percent rate increase. A 15-year LTCP implementation schedule helps mitigate the higher annual rate increases that would be needed if the implementation schedule were shorter.

The fiscal constraints and economic realities that exist within the APCs require the proposed 15-year implementation schedule, and will allow the communities to achieve the water quality benefits while minimizing the financial impacts and the economic hardship within the communities.

### 2.2.4 CSO LTCP Program Schedule

In developing the implementation schedule for the Recommended CSO LTCP, a regional, watershed-based approach was used in addition to typical construction sequencing practices. This method allows the APCs to identify a schedule that provides the greatest water quality benefits to the region, while maintaining affordability and a logical construction sequence to complete the recommended LTCP projects. Furthermore, other considerations included the time required to complete each individual project, water quality goals, regulatory drivers, sequencing logic, and the findings of the affordability analysis.

In order to achieve the maximum benefit, as early as possible, the following water quality based goals for development of the implementation schedule were established:

- Implement disinfection projects early for the greatest benefit;
- Perform tributary improvements to reduce continuous non-CSO bacteria sources;
- Implement optimization projects to reduce the frequency and volume of overflow and maximize flow to the WWTP;
- Perform WWTP and pump station upgrades to improve peak wet weather conveyance and treatment capacity;
- Construct the Big C Floatables Control Project early for greatest impact;
- Implement WWTP satellite floatables control projects.

### 2.2.5 CSO LTCP Program Implementation

The regulatory compliance strategy for the Albany Pool Communities utilizes the Demonstrative Approach in developing the recommended LTCP for CSO compliance. This approach requires the communities to demonstrate that the remaining CSOs do not preclude the attainment of water quality standards or the designated uses of the receiving waters, through a Post Construction Compliance Monitoring Program (PCCMP). The goals of the PCCMP are designed to focus on monitoring the areas where previous modeling and sampling efforts indicated consistent non-attainment of recreational use (bacteria) criteria, and to ensure that the actions of the APCs result in increased compliance appropriate to the goals of the CSO policy and guidance.

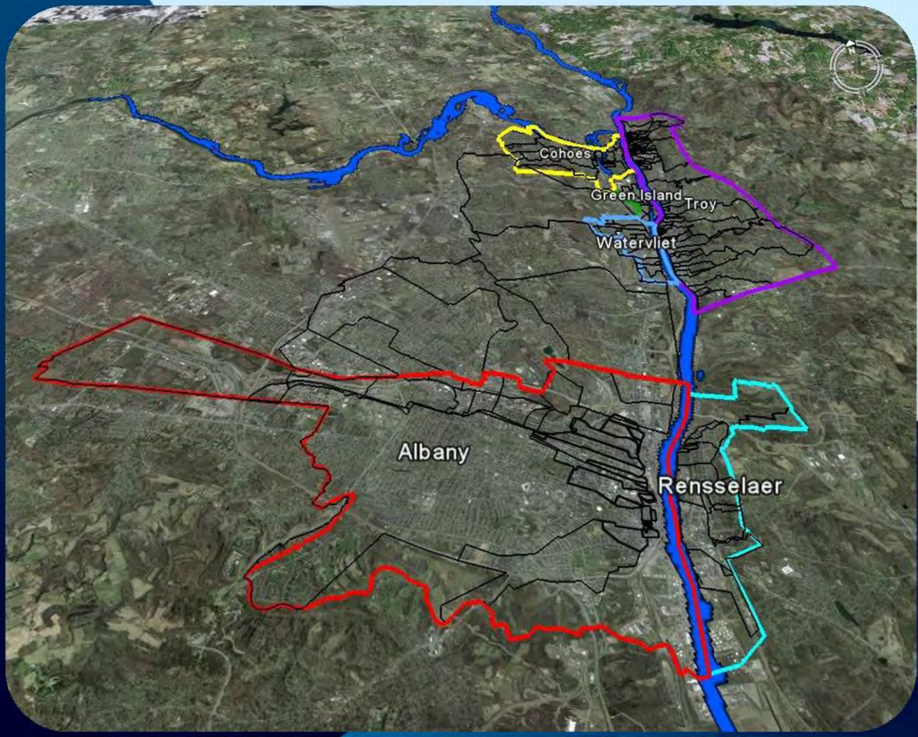
The Receiving Water Quality Assessment noted (and the Baseline results of the River Water Quality Model confirmed) that there was an accumulation of bacteria through the Albany Pool region, with the maximum measured values typically observed at the Dunn Memorial Bridge and Port of Albany transects. Comparisons made between wet weather and dry weather bacteria concentrations showed consistent non-attainment of the bacteria standard in these areas. The goal of this program will be to demonstrate increased attainment of recreational use water quality criteria, during the May 1 through October 30 recreation season. This will be accomplished through the weekly sampling of critical river transects and tributaries and comparison of these results with applicable water quality standards for bacteria.

#### 2.2.5.1 Governance

Based upon discussions with municipal leadership, it is the intent amongst the APCs to establish a Phase II inter-municipal arrangement for future governance of the Albany Pool CSO program. The APCs anticipate submitting an application to the Department of State for a Shared Services Municipal Planning Grant to identify and evaluate legal options available for the implementation of the LTCP. Reaching consensus to proceed with the inter-municipal arrangement will be subject to negotiations and agreement, amongst the parties involved, in regards to the final terms and conditions of the CSO LTCP; as well as the respective financial commitments borne by each of the individual communities.

Chapter 1
# Introduction






Joint Venture Team
albany pool

# 1.0 Introduction

## 1.1 Project Background

Combined Sewer Overflows (CSOs) are point sources subject to National Pollutant Discharge Elimination System (NPDES) permit requirements including both technology-based and water quality based requirements of the Clean Water Act. The Albany Pool Communities (APCs) include the City of Troy, City of Albany, City of Cohoes, City of Rensselaer, City of Watervliet and the Village of Green Island. They collectively own and operate 92 CSOs that discharge to the Hudson and Mohawk Rivers, and their tributaries. According to the New York State Department of Environmental Conservation (NYSDEC), CSOs from each of the APCs include:

- City of Albany with eleven (11) CSOs under SPDES Permit No. NY-002 5747;
- City of Rensselaer with eight (8) CSOs under SPDES Permit No. NY-002 6026;
- City of Watervliet with five (5) CSOs under SPDES Permit No. NY-002 0899;
- Village of Green Island with three (3) CSOs under SPDES Permit No. NY-003 3031;
- City of Cohoes with seventeen (17) CSOs under SPDES Permit No. NY-003 1046;
- City of Troy with forty-eight (48) CSOs under SPDES Permit No. NY-009 9309.

In 2007 the APCs joined in a comprehensive inter-municipal venture, led by the Capital District Regional Planning Commission (CDRPC) to develop a Phase I Long Term Control Plan (LTCP). The CDRPC selected a consulting team to complete the development of this plan. The consulting team consists of a joint venture between Malcolm Pirnie, CDM and CHA; collectively referred to as the Albany Pool Joint Venture Team (APJVT).

The APCs combined sewer system (CSS) flows are tributary to three wastewater treatment plants (WWTP) including the Rensselaer County Sewer District (RCSD) WWTP, and two Albany County Sewer District (ACSD) WWTPs. Troy and Rensselaer are served by the RCSD WWTP. RCSD owns and operates the interceptor sewer system, the regulator structures and pump stations which convey wastewater to the WWTP. The ACSD North Plant serves Cohoes, Green Island, Watervliet and northern portions of Albany. The ACSD South Plant serves the southern portion of Albany. ACSD owns and operates the interceptor sewer system and regulators which convey wastewater the North and South Plants. Each of the sewer districts are connected to the CSO program through their SPDES permits and while not directly responsible for addressing the CSO discharges, they are required to cooperate with the communities in development of a LTCP for abatement of CSOs.

The following CSO LTCP has been developed in accordance with the USEPA CSO Policy and utilizes a regional watershed approach to addresses each of the 92 CSOs, permitted under each community's respective State Pollution Discharge Elimination System (SPDES) permits. The LTCP recommends improvements to both the combined sewer system and the three wastewater treatment plants (WWTPs) that comprise the project service area.

## 1.2 Organization of this Report

This report addresses all aspects of the development of the LTCP. The report is organized so that each chapter coincides with a task in the Albany Pool Combined Sewer Overflow Long Term Control Plan Development Scope of Work.

### 1.2.1 Introduction

Chapter 1 provides some project background, and details the organization of the report, topics covered, and provides a brief summary of each of the subsequent chapters.

### 1.2.2 Receiving Water Conditions and Assessment

Chapter 2 describes the 2008 Receiving Water Quality Sampling Program, and the subsequent 2009 Tributary Sampling Program. These programs were designed to characterize the receiving water quality of the Hudson and Mohawk Rivers and select tributaries. Sampling was performed for both dry and wet weather to evaluate the influence of CSO discharges on the water quality conditions. Detailed reports were developed to describe the plan and the findings of each of the sampling and monitoring programs.

### 1.2.3 Combined Sewer System Mapping, Database & Digitizing

Chapter 3 briefly describes the mapping, field verification and digitizing that was required as part of the LTCP development. The APJVT developed GIS databases that were used in the modeling and characterization efforts, but may also be used by the APCs in future applications.

### 1.2.4 Combined Sewer System Monitoring

Chapter 4 illustrates the monitoring program that was developed and conducted to verify and supplement available CSS monitoring and water quality data. The APJVT completed field sampling and laboratory analysis for wet weather and dry weather sampling throughout the project area. Detailed reports were developed to describe the monitoring plan and the findings of each program.

### 1.2.5 Combined Sewer System Modeling

Chapter 5 describes the modeling efforts completed in support of the LTCP Development. The APJVT developed four hydraulic and hydrologic models for each of the CSSs that are tributary to the ACSD South, ACSD North and RCSD WWTPs. These are planning-level models that include interceptor sewers, major trunk sewers, regulator structures with integrated real time controls, and outfall pipes. The CSS models were calibrated to a variety of dry and wet weather conditions, and verified using long term data.

The APJVT also developed and calibrated a model of the Hudson River, the major receiving water for the APC CSOs. CSO volume and frequency results from the CSS models were input into the River Model to predict bacteria concentrations in the Hudson River.

### 1.2.6 WWTP Wet Weather Capacity Study

Chapter 6 details the findings of the APJVT process and hydraulic analyses completed at each of the three WWTPs to which the APC's combined sewer systems transport wastewater for treatment. A comprehensive field data collection program was developed and implemented for each plant. The data was then used to develop computerized models for each plant to support this capacity study. The APJVT evaluated the limiting factors at each WWTP and developed recommendations for increasing peak wet weather capacity.

### 1.2.7 Development and Evaluation of CSO Control Alternatives

Chapter 7 describes CSO abatement technologies, assesses their ability to fulfill the CSO control objectives, and recommends projects to be included in the LTCP. Each project is categorized and the benefits of the different types of projects are summarized. The chapter also discusses the projects the APCs have completed in their efforts to reduce combined sewer overflows.

### 1.2.8 Financial Capability Assessment

Chapter 8 discusses the financial capability assessment completed in accordance with United States Environmental Protection Agency (EPA) guidance. The assessment consisted of studying the residential and community impacts of the proposed plan. It includes a year-by-year rate impact analysis, a discussion of socioeconomic trends, and a discussion of financial challenges that the region faces, which are relevant to the recommended LTCP schedule.

### 1.2.9 Implementation Schedule

In addition to the implementation schedules, the CSO Policy requires a Post Construction Monitoring Plan to be developed for monitoring performance of the completed CSO control facilities and to ultimately confirm achievement of water quality standards. Chapter 9 discusses the development of the implementation schedule for the Recommended CSO LTCP and the proposed Post Construction Monitoring Program for verifying compliance with the water quality standards.

### 1.2.10 Public Participation Program Support

Chapter 10 addresses the vigorous Public Participation Program (PPP) that was established in order to facilitate public involvement throughout the development process for the CSO LTCP. The PPP provided a framework for the CDRPC, APJVT, APCs, and project stakeholders such as DEC, ACSD, RCSD, regulatory agencies, environmental groups, and other interested parties to work together and provide feedback at critical stages of the LTCP development. The PPP also provided the opportunity to address concerns and comments provided by the stakeholders and the general public.

## 1.3 Acknowledgements

The APJVT would like to give a special acknowledgement to the CDRPC for graciously accepting the challenge of functioning in a non-traditional role for the project; overseeing coordination efforts and developing the inter-municipal arrangement between the APCs. Furthermore, we sincerely appreciate

the assistance that CDRPC provided in regards to the facilitation of funding opportunities; as well as the countless hours provided performing program management and oversight for the project.

In addition, we would like to acknowledge those agencies that have assisted with the development of the Albany Pool CSO LTCP through the dedication of their time and resources, specifically; we would like to recognize the following:

- The U.S. Environmental Protection Agency for provided funding under the Water Quality Cooperative Agreements program
- New York State Department of State who provided two Shared Municipal Services Incentive grants
- New York State Department of Environmental Conservation who provided assistance under the Water Quality Improvement Projects, Round 9 grant
- New York State Department of Environmental Conservation, Hudson River Estuary Program for providing an Environmental Protection Fund grant

Lastly, we would like to give a special thanks to all of the members of the Technical Committee and Citizen Advisory Committee who have served so diligently over the past several years; as well as all of the involved agencies and interested parties who have selflessly donated their time to provide input and assistance in the development of this document. It was only through the time, efforts and resources of all of the involved parties that we were able to develop this cost-effective, regional approach for addressing the CSO issues within the Capital District.

Chapter 2

# Receiving Waters Conditions Assessment



Joint Venture Team albany pool

# 2.0 Receiving Waters Conditions Assessment

## 2.1 Introduction

The Albany Pool Communities have 92 CSOs that discharge to the Hudson and Mohawk Rivers and their tributaries. CSOs are point sources subject to National Pollutant Discharge Elimination System (NPDES) permit requirements including both technology-based and water quality based requirements of the Clean Water Act. The APCs combined sewer system (CSS) flows are tributary to three wastewater treatment plants (WWTP) including the RCSD WWTP, the ACSD South WWTP and the ACSD North WWTP. There are 95 discharge locations (92 CSO locations and three WWTPs) within the CSS that are permitted under each of the Pool community's SPDES permits. These discharge to the Hudson and Mohawk Rivers and their tributaries.

One of the first steps in planning and developing a LTCP for CSOs is to characterize the receiving water system. As part of the LTCP for the APCs, a monitoring and sampling program was performed to verify and supplement the available receiving water quality data. The plan consists of dry and wet weather discrete sampling and laboratory analyses of receiving water samples.

This chapter describes the results of the summer of 2008 implementation of the *Receiving Water Quality Sampling Plan* (included in Appendix A) and the subsequent sampling which was performed in 2009. These programs were designed to characterize the receiving water quality of the Hudson and Mohawk Rivers and their tributaries where the Albany Pool Communities CSOs discharge. The analyses were based on an approved plan and limited to parameters where CSOs could cause or contribute to exceedences of water quality standards.

The *Receiving Water Quality Assessment Report* (included in Appendix B) was produced describing the results of the implementation of the 2008 sampling performed in accordance with the approved Plan. The Albany Pool *Tributary Water Quality Assessment Report* (included in Appendix C) was produced in August 2010 describing the results of the 2009 Tributary Sampling.

## 2.2 Water Quality Standards

The State of New York has promulgated standards for water quality in Part 703 based on the designated class of the receiving water. The 2008 Section 303(d) List of Impaired Water Requiring a TMDL/Other Strategy identifies those waters that do not support appropriate uses and, as the title states, which require development of a Total Maximum Daily Load (TMDL) or other restoration strategy. A review of this list identifies the Hudson River Estuary in Albany County in Part 2b – "Multiple Segment/Categorical Impaired Waterbody Segments (fish consumption) for PCBs". The list also identifies Patroon Creek in Part 3a – "Waterbodies for which TMDL Development May be Deferred (Requiring Verification of Impairment) for Dissolved Oxygen and Oxygen Demand". No investigation of PCBs was considered as part of this study. PCBs are not considered to be associated with CSO discharges.

The Rivers and tributaries in this study area are generally designated as Class C receiving streams, however, both the Hudson River and the Mohawk River have Class A designations in the northern and western portions of the sampling region. The Mohawk changes from Class A to Class C at the School Street Dam approximately two miles southeast of the Route 9 Bridge (River Transect 1 [RT1]), see Chapter 2.4.1) and the Hudson changes from Class A to Class C at the confluence with the Mohawk just south of Waterford. The Hudson remains Class C for approximately 25 miles after which it becomes Class A again just south of Schodack Island. All the tributaries are Class C with the exception of the Wynants Kill and Poesten Kill which are Class C(t).

Applicable NYS standards which were considered for this study include:

- The fecal coliform standard for both Class A and C designations states that the geometric mean of no less than 5 examinations (samples) shall be less than 200 colony-forming unit (cfu)/100 milliliter (ml). For A-special waters, the rule states that the five samples must be taken over not more than a 30-day period. The standard does not differentiate between wet and dry weather sampling. There is no specific single sample maximum criterion applicable to these receiving waters. This study compared geometric means to these criteria as is appropriate, but also indicated the relative difference between individual samples and these geometric mean criteria as a point of reference for several sets of data.
- The applicable dissolved oxygen standard as stated by New York is “For nontrout waters, the minimum daily average shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L.” [Note: mg/L = milligrams per liter, and DO = dissolved oxygen]
- The pH standard for both Class A and C designations states that the pH “shall not be less than 6.5 nor more than 8.5.”
- In nontrout waters the water temperature at the surface of a stream shall not be raised to more than 90 degrees Fahrenheit at any point.
- Specific conductivity was also measured in the field; however New York State has not produced a standard for this parameter.

Testing was also performed in this study for E. Coli. E. Coli is an indicator bacterium somewhat more specific than fecal coliform for relationship to potential pathogens. New York State has not promulgated a standard for E. coli. The United States Environmental Protection Agency (USEPA) has proposed a standard of a geometric mean of no less than 5 samples shall be less than 126 cfu/100ml for E. coli. Other states have adopted that standard or a value similar to that standard.

## 2.3 Acknowledgements

The APJVT would like to acknowledge both the economic contributions and staffing requirements that were committed by the Albany Pool member communities and the ACSD toward these sampling programs. The 2008 sampling required in excess of 12 staff members to complete each of the 15 dry weather sampling events and in excess of 36 staff members were actively required to support each of the four wet weather events. Significantly greater numbers of employees were impacted with training activities and overtime commitments in an effort to staff these sampling events during the peak vacation season, weekends, and holidays. The sampling program could not have been implemented successfully without their dedication, perseverance, and commitment to its successful completion.

The APJVT would also like to thank Watershed Assessments Associates who successfully implemented the 2008 sampling protocols, St. Peter's Bender Laboratory and the Environmental Laboratory Services for their analytical services for both the 2008 and 2009 sampling, and meteorologist Michael Landon for his assistance in event prediction and sampling event initiation. Together with the APJVT and the community representatives, these subcontractors assisted in the collection and analyses of over 3,400 samples for this project.

## 2.4 Summary of 2008 Sampling Program

Sampling was conducted to characterize the receiving water quality of the Hudson and Mohawk Rivers where the Albany Pool Communities CSOs discharge. Sampling was successfully completed for 15 dryweather events and four wet weather events. Sampling was conducted at 10 River Transects, five wastewater treatment plant discharges, six tributaries, and two potential beach sites. Dry weather samples were collected to develop an understanding of the specific ambient, or background, water quality parameters measured. Wet weather samples were collected to ascertain the water quality impact of the wet weather events and CSOs both on the Mohawk and Hudson rivers at their upstream limits of the sampling area and throughout the Albany Pool area.

### 2.4.1 Water Quality Sampling Locations in 2008

Discrete samples of receiving water were collected for laboratory analyses at 10 transects along the Mohawk and Hudson Rivers, five wastewater treatment plant discharges, six tributaries of these Rivers, and two potential beach sites. The locations for each of the transects are identified in Table 2-1. East and west bank locations were revised per the suggestion of an NYSDEC representative who accompanied the sampling team on an early sampling event. The wastewater treatment plants that were included in the sampling plan are the RCSD WWTP, ACSD North WWTP, ACSD South WWTP, the East Greenbush WWTP, and the Waterford WWTP. The dry and wet weather water quality sampling locations are listed in Table 2-2 and shown on Figure 2-1.

TABLE 2-1: Original and Revised Transect Locations

| Transects | West Bank | | River Center | East Bank | |
|---|---|---|---|---|---|
| | Up to 5/27/2008 | Beginning 5/28/2008 | All Samples | Up to 5/27/2008 | Beginning 5/28/2008 |
| RT1 | 42.820371 | 42.820371 | 42.821313 | 42.822255 | 42.822255 |
| | -73.731039 | -73.731039 | -73.731467 | -73.731926 | -73.731926 |
| RT3 | 42.800415 | 42.800612 | 42.800152 | 42.799801 | 42.799714 |
| | -73.667569 | -73.667595 | -73.667366 | -73.667314 | -73.667226 |
| RT2 | 42.7681 | 42.7681 | 42.767971 | 42.767929 | 42.767929 |
| | -73.696177 | -73.696177 | -73.695763 | -73.695376 | -73.695376 |
| RT4 | 42.755522 | 42.75563 | 42.755389 | 42.755247 | 42.755206 |
| | -73.686247 | -73.686572 | -73.685361 | -73.684137 | -73.683512 |

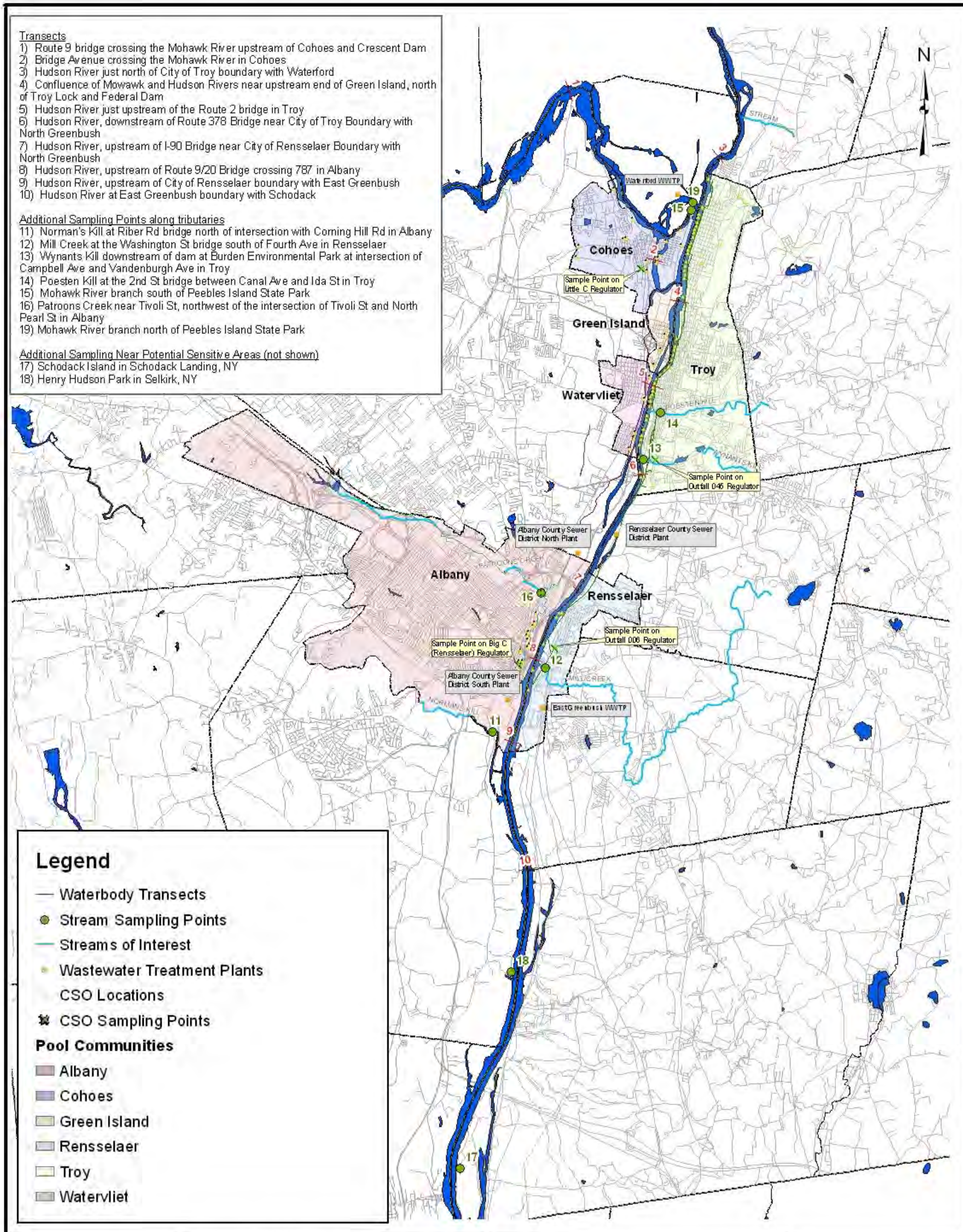
| Transects | West Bank | | River Center | East Bank | |
|---|---|---|---|---|---|
| | Up to 5/27/2008 | Beginning 5/28/2008 | All Samples | Up to 5/27/2008 | Beginning 5/28/2008 |
| RT5 | 42.728518 | 42.72867 | 42.728367 | 42.728217 | 42.728088 |
| | -73.697919 | -73.698273 | -73.697267 | -73.696615 | -73.696111 |
| RT6 | 42.70051 | 42.700243 | 42.700625 | 42.70074 | 42.700609 |
| | -73.703886 | -73.704516 | -73.702782 | -73.701797 | -73.701651 |
| RT7 | 42.664936 | 42.665109 | 42.66461 | 42.664262 | 42.664041 |
| | -73.729848 | -73.73038 | -73.72923 | -73.728582 | -73.728795 |
| RT8 | 42.643233 | 42.643164 | 42.642974 | 42.642694 | 42.642407 |
| | -73.748756 | -73.749322 | -73.74775 | -73.746744 | -73.746928 |
| RT9 | 42.616913 | 42.616779 | 42.616765 | 42.616616 | 42.616111 |
| | -73.759624 | -73.760192 | -73.758557 | -73.757519 | -73.757529 |
| RT10 | 42.577741 | 42.57752 | 42.577725 | 42.577751 | 42.577555 |
| | -73.753708 | -73.75395 | -73.75255 | -73.751539 | -73.751305 |

## TABLE 2-2: Receiving Water Body Sample Locations

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| River Transect Locations | | | |
| A-RT1-WB<br>A-RT1-RC<br>A-RT1-EB | Route 9 bridge crossing of Mohawk River upstream of Cohoes and Crescent Dam | bridge | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| A-RT2-WB<br>A-RT2-RC<br>A-RT2-EB | Bridge Avenue crossing the Mohawk River in Cohoes | bridge | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| A-RT3-WB<br>A-RT3-RC<br>A-RT3-EB | Hudson River just north of the City of Troy boundary and downstream of Lock #1 | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| A-RT4-WB<br>A-RT4-RC<br>A-RT4-EB | Confluence of Mohawk and Hudson Rivers near upstream end of Green Island, north of Troy Lock and Federal Dam | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| B-RT5-WB<br>B-RT5-RC<br>B-RT5-EB | Hudson River just upstream of the Route 2 bridge | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| B-RT6-WB<br>B-RT6-RC<br>B-RT6-EB | Hudson River, downstream of Route 378 bridge near City of Troy boundary with North Greenbush | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| B-RT7-WB<br>B-RT7-RC<br>B-RT7-EB | Hudson River, upstream of I--90 Bridge near City of Rensselaer boundary with North Greenbush | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| B-RT8-WB<br>B-RT8-RC<br>B-RT8-EB | Hudson River, upstream of Route 9/20 bridge crossing I-787 in Albany | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| B-RT9-WB<br>B-RT9-RC<br>B-RT9-EB | Hudson River, upstream of city of Rensselaer boundary with East Greenbush | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| B-RT10-WB<br>B-RT10-RC<br>B-RT10-EB | Hudson River at East Greenbush boundary with Schodack | boat | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| Tributary Locations | | | |
| C-T11-SH | Norman's Kill near confluence with Hudson River at River Road Bridge north of intersection with Corning Hill Road in Albany | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| C-T12-SH | Mill Creek near confluence with Hudson River at the Washington Ave. bridge south of Fourth Avenue in Rensselaer | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| D-T13-SH | Wynants Kill near confluence with Hudson River | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| D-T14-SH | Poesten Kill near confluence with Hudson River at the 2nd Street bridge between Canal Ave. and Ida Street in Troy | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| D-T15-SH | Mohawk River branch south of Peebles Island State Park | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| C-T16-SH | Patroon Creek near confluence with Hudson River near Tivoli Street northwest of the intersection of Tivoli Street and North Pearl Street in Albany | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| C-T19-SH | Mohawk River branch north of Peebles Island State Park. | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| Potential Beach Locations | | | |
| E-B17-SH | Schodack Island in Schodack Landing, NY | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, Secchi depth |
| E-B18-SH | Henry Hudson Park in Selkirk, NY | shore | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, Secchi depth |
| WWTPs | | | |
| F-N-WWTP | ACSD - North WWTP | Effluent | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| G-S-WWTP | ACSD - South WWTP | Effluent | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| J-R-WWTP | RCSD WWTP | Effluent | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| D-EG-WWTP | East Greenbush WWTP | Effluent (Downstream Manhole) | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| A-W-WWTP | Waterford WWTP | Effluent | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH |
| CSS Sites | | | |
| L-A-CSO | Big C in Albany at the intersection of Rensselaer Street and Green Avenue | Overflow | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, TSS, BOD5, Total Phosphorous, Ammonia, TKN |
| M-C-CSO | Little C (008) in Cohoes at intersection of Saratoga Street with Main Street | Overflow | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, TSS, BOD5, Total Phosphorous, Ammonia, TKN |
| N-R-CSO | Rensselaer CSO 006 at Amtrak Way north of Washington Street and 7th Street | Overflow | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, TSS, BOD5, Total Phosphorous, Ammonia, TKN |
| O-T-CSO | Troy (CSO 045) at the Cross Street near the intersection with Kelly Street | Overflow | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, TSS, BOD5, Total Phosphorous, Ammonia, TKN |
| P-W-CSO | Front Street( located on 1st) Waterford | Overflow | Fecal Coliform, E. Coli, Temperature, Specific Conductance, DO, pH, TSS, BOD5, Total Phosphorous, Ammonia, TKN |
| N-WWTP-IN | Albany County Sewer District North Plant | Influent | pH, COD, NH3, TON, TKN, SS, TS, PO4 |
| S-WWTP-IN | Albany County Sewer District South Plant | Influent | pH, COD, NH3, TON, TKN, SS, TS, PO4 |
| R-WWTP-IN | Rensselaer County Sewer District Plant | Influent | TSS, CBOD, pH, temperature, settleable solids |




| | | | |
|---|---|---|---|
| albany pool CDM CHA / CDRPC | ALBANY CSO POOL LONG TERM CONTROL PLAN | SAMPLING LOCATIONS 2008 | JUNE 2011 FIGURE 2-1 |

### 2.4.2 Water Quality Sampling Events in 2008

The initial sampling period began in May 2008 and was completed in July 2008. Fifteen dry weather events were sampled at all receiving water body locations during the sampling effort. Four wet weather events were sampled at all designated receiving water body locations as well as five combined sewer overflow locations. These locations were selected to place one sampling point in the largest contributing combined sewershed within the contributory sewersheds of each CSS model. Table 2-3 lists the dates and times of the actual sampling events as conducted.

TABLE 2-3: Start Times of Dry and Wet Weather Events

| Date | Dry/Wet | Event No. | Start Time |
|---|---|---|---|
| 5/13/2008 | Dry | 1 | 8:00 AM |
| 5/14/2008 | Dry | 2 | 8:00 AM |
| 5/15/2008 | Dry | 3 | 8:00 AM |
| 5/16/2008 | Dry | 4 | 8:00 AM |
| 5/27/2008 | Dry | 5 | 10:00 AM |
| 5/28/2008 | Dry | 6 | 10:00 AM |
| 5/29/2008 | Dry | 7 | 8:00 AM |
| 5/31/2008 | Dry | 8 | 12:00 AM |
| 5/31/2008 | Wet | 1 | 3:00 PM |
| 6/4/2008 | Dry | 9 | 12:00 PM |
| 6/26/2008 | Dry | 10 | 3:00 PM |
| 6/27/2008 | Dry | 11 | 12:00 PM |
| 6/28/2008 | Dry | 12 | 12:00 PM |
| 6/28/2008 | Wet | 2 | 4:00 PM |
| 7/7/2008 | Dry | 13 | 11:00 AM |
| 7/8/2008 | Wet | 3 | 11:00 AM |
| 7/13/2008 | Wet | 4 | 12:00 PM |
| 7/17/2008 | Dry | 14 | 8:00 AM |
| 7/18/2008 | Dry | 15 | 8:00 AM |

Receiving water samples were collected for both fecal coliform and E. Coli analyses in order to assess the data relative to the existing NYSDEC Class A and Class C fecal coliform standard defined in Part 703.4 and the USEPA proposed standard for E. Coli. Field measurements of general water quality physical chemical variables were also made for temperature, specific conductance, pH and dissolved oxygen in order to assess the data relative to the existing NYS standards also defined in Part 703. Five CSO locations were also monitored and sampled. Wet weather sampling was initiated at the activation of any one of the observed sites. CSO samples were analyzed for: fecal coliform, E. Coli, total suspended solids (TSS), biological oxygen demand (BOD), Ammonia Nitrogen ($NH_3$), total Kjeldahl nitrogen (TKN) and total phosphorus (TP). These samples were collected to identify that the typical range of values measured for these parameters were consistent with what was expected for combined sewage, and to determine appropriate event mean concentration values for estimation of CSO loadings.

### 2.4.3 Albany Pool Hydrodynamics

In addition to characterizing the water quality parameters, the receiving water hydrodynamic characteristics are an important consideration in quantifying the potential impacts of CSO discharges. The water quality impact of the CSO discharges on the receiving water could be influenced by river flows and tides which may be subject to upstream control devices or influenced by local and regional weather events. The Albany Pool area includes the confluence of the Mohawk and Upper Hudson Rivers and the Federal Lock and Dam in Troy. The watersheds for these two major water courses upstream of the Albany Pool, shown on Figure 2-2, is approximately 8,500 square miles roughly equivalent to 17 percent of the State of New York. Numerous hydraulic control structures, locks and hydroelectric dams exist upstream of the Albany Pool region and the Federal Lock and Dam. The Albany Pool region of the Hudson River downstream of the Federal Dam is tidally influenced.

FIGURE 2-2: Albany Pool Community Watersheds


A review of the United States Geological Service (USGS) stream gauging stations on the Hudson River, Mohawk River and the tributaries considered in this study was performed to develop an understanding of the Rivers' hydrodynamics relative to the dry and wet weather sampling activities performed. In general this review concluded that the flows in the Hudson River south of the Federal Dam in Troy shows little correlation with the local precipitation measured within the sewersheds of the Albany Pool communities and subsequently little correlation with CSO events. This review indicated that the Hudson River flows are strongly regulated by upstream hydroelectric facilities with the E.J. West Facility at the Conklingville Dam having the greatest impact on the Hudson River flow. The Conklingville Dam is located approximately 50 river miles upstream of the Albany Pool and impounds the Sacandaga River which is tributary to the Hudson River. Throughout the duration of the 2008 sampling period, this facility typically released approximately 4000 cfs for a period of 15 hours with the balance of the day at approximately 50 cfs. This temporal pattern is maintained through the Albany Pool reach of the Hudson River though slightly less prevalent after the confluence with the Mohawk River. On a few occasions, most notably between May 14 and May 16, 2008 (concurrent with dry weather sampling events numbers 2, 3, and 4), the 4000 cfs release continued for up to 22 hours. The releases and subsequent Hudson River flows showed little correlation with local precipitation. The Mohawk River flows showed a greater correlation with larger, likely more regional, precipitation events.

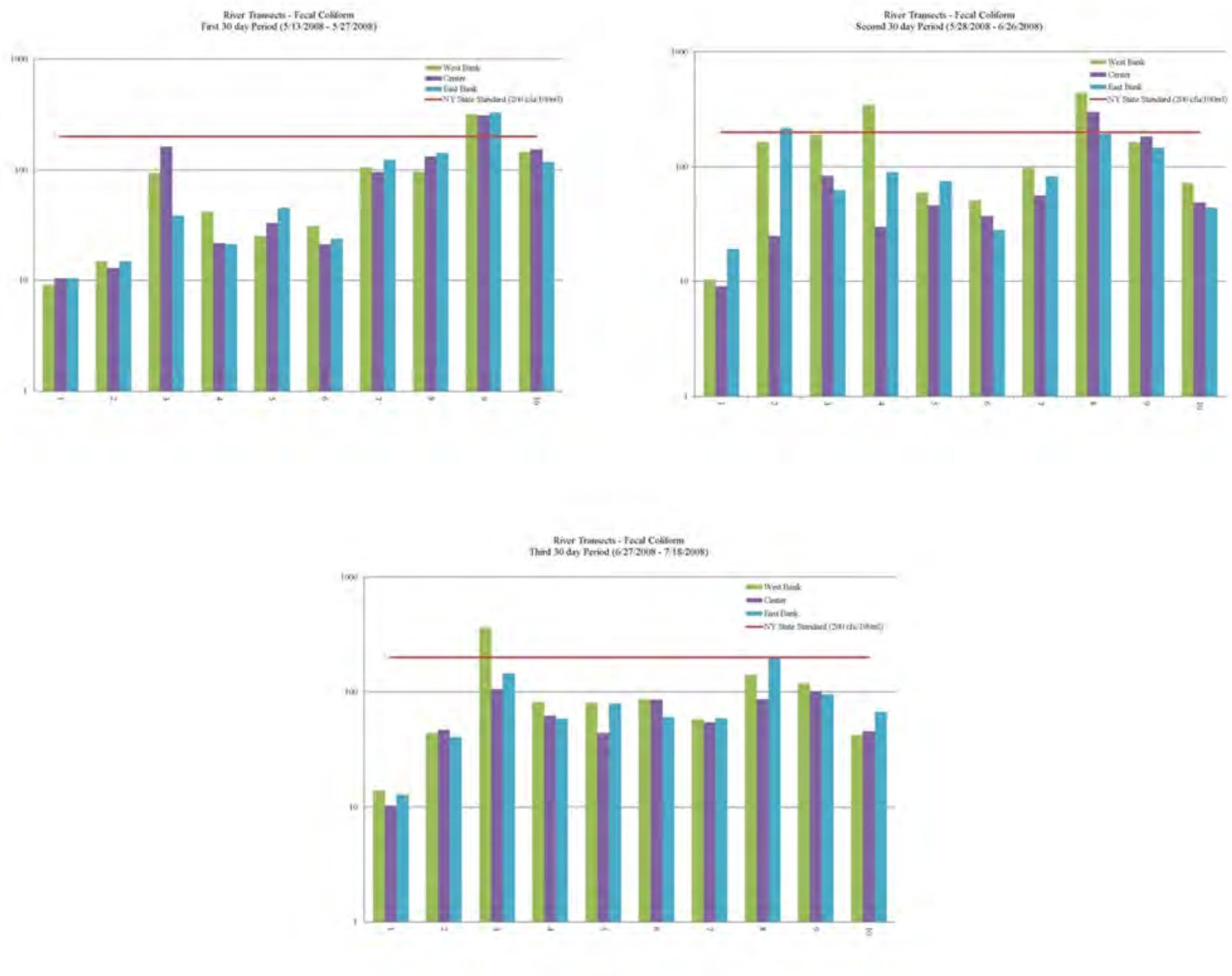
### 2.4.4 Dry Weather Conditions Observed in 2008

Comprehensive dry weather sampling results can be found in Appendix B. Samples were collected for both E. Coli and fecal coliform analysis. Results of all the samples showed a close correlation between the two indicator groups for virtually all samples.

There were slight differences observed across the River Transects and comparisons between the banks and river center samples did not show any trends. Downstream of its confluence with the Mohawk River the Hudson River is consistently well mixed across each transect.

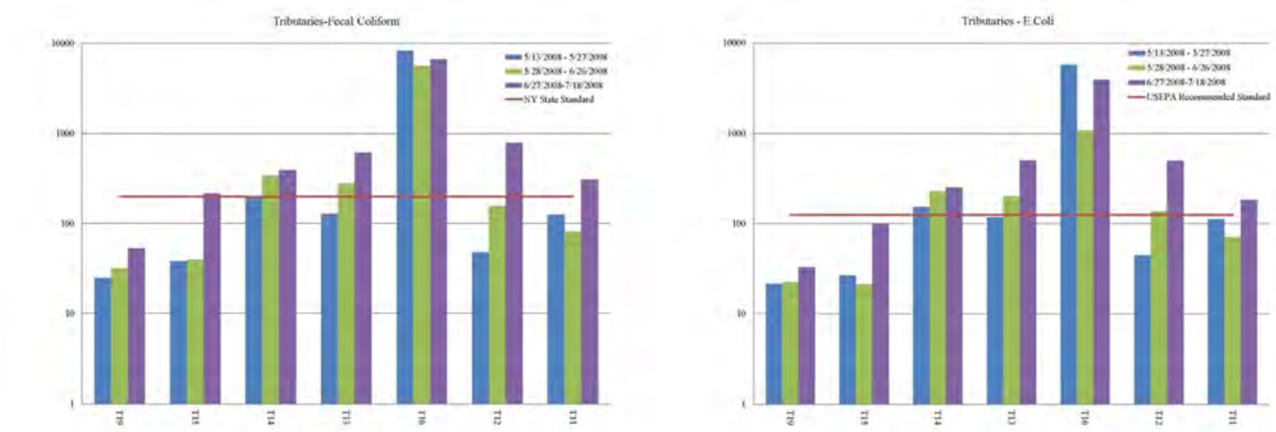
During the three 30-day periods sampled, the Hudson and Mohawk Rivers were generally in compliance with the NYS fecal coliform standard at the upstream limits of the study, as indicated by the results for transects RT1 (Mohawk River) and RT3 (Hudson River). The dry weather bacteria sampling did not indicate any consistent wide spread compliance issues with meeting recreational use criteria. In general the data indicated that there was an accumulation of bacteria through the Albany Pool region with the maximum measured values typically observed at the RT8 (Dunn Memorial Bridge) and RT9 (Port of Albany) transects. This is illustrated in Figure 2-3 which shows the geometric mean values for Fecal Coliform for the three 30-day sampling periods. As can be seen, most transects were generally in compliance with the fecal coliform standard with the exception of periodic exceedences which were observed at RT3 (the Hudson River's upstream boundaries of the sampling area), at the RT2 (Bridge Street) transect and for one period each at the RT8 (Dunn Memorial Bridge) and RT9 transects.

FIGURE 2-3: Geometric Means of Dry Weather Fecal Coliform Samples of River Transects




The tributaries sampled in 2008 were generally at, or exceeded, the fecal coliform compliance limit. Of particular concern were the significant bacteria counts recorded during all the sampling events for the Patroon Creek (T16). Geometric mean values for fecal coliform for each of the three 30-day periods sampled exceeded 8000 cfu/100ml. Of lesser significance were the fecal coliform counts at the Wynants Kill (T13), and Poesten Kill (T14) each of which exceeded the compliance limit for two of the three 30-day periods sampled, though at a value an order of magnitude less than the Patroon Creek. The Normans Kill (T11) and the Mill Creek (T12) each exceeded the compliance limit for the last of the three, 30-day periods sampled. Figure 2-4 illustrates the tributary geometric mean values for Fecal Coliform and E. Coli for the tributaries for the three 30-day sampling periods.

FIGURE 2-4: Geometric Means of Dry Weather Fecal Coliform Samples on Tributary Sites




The upstream sites for the Mohawk River at the confluence with the Hudson River (T19 north of Peebles Island and T15 south of Peebles Island) show little indication of dry weather sources of bacteria that could pose a threat to recreational use of either the tributary or the receiving water. This is somewhat surprising for site T19 given its relatively close proximity to the Waterford WWTP outfall which is approximately one-quarter mile upstream.

The two designated potential future beach sites did not indicate any dry weather periods of non-compliance. Only a single sample for fecal coliform exceeded 200cfu/100ml (324 cfu/100ml recorded on June 4), and only 3 samples exceeded 126 cfu/100ml for E. Coli.

The sampling of WWTP discharges illustrated dry weather bacteria concentrations consistent with the absence of chemical disinfection at these plants.

Values for temperature, specific conductance, pH, and DO were within acceptable ranges with the exception of low early season DO readings throughout the Hudson River transects and marginally high pH readings in the Mohawk River transects and at its confluence with the Hudson River (T19 north of Peebles Island and T15 south of Peebles Island). The pH sampled in the Mohawk River exceeded the applicable standard of 8.5 standard units during dry weather. It is not clear what source of high pH could be responsible for these measurements on the Mohawk River, but the observations are consistent in demonstrating that the source of high pH water is upstream of the study area. Possible causes could include natural soil characteristics, agricultural applications of lime or other bases, or other unknown upstream conditions.

During the first four dry weather events, low dissolved oxygen concentrations were observed at most Hudson River transects. It was subsequently concluded following additional sampling performed in 2009 and a review of real time DO data recorded by the in-stream Hudson River Environmental Conditions Observing System (HRECOS) gage that DO in the Albany Pool region is consistently maintained above standards.

The field measurements for the 2008 tributary samples were similar to those measurements of the River Transects. During the dry weather events the variations of DO, Temperature, pH and Conductivity were within normal seasonal ranges. Measurements of pH for several tributary sites were near the upper limit of New York State water quality criteria of 8.5 standard units. Some measurements from the upstream shoreline sites (sampled as tributaries) on the confluence of the Mohawk River with the Hudson River exceed that standard at times. The tributaries all showed low DO readings that corresponded to the low DO in the first four dry events observed in the River Transect samples during the same events. Later in the season all of the tributary samples show DO readings that meet water quality standards, with the exception of one sample on July 17$^{th}$ in Patroon Creek where DO was measured at 0.0mg/L.

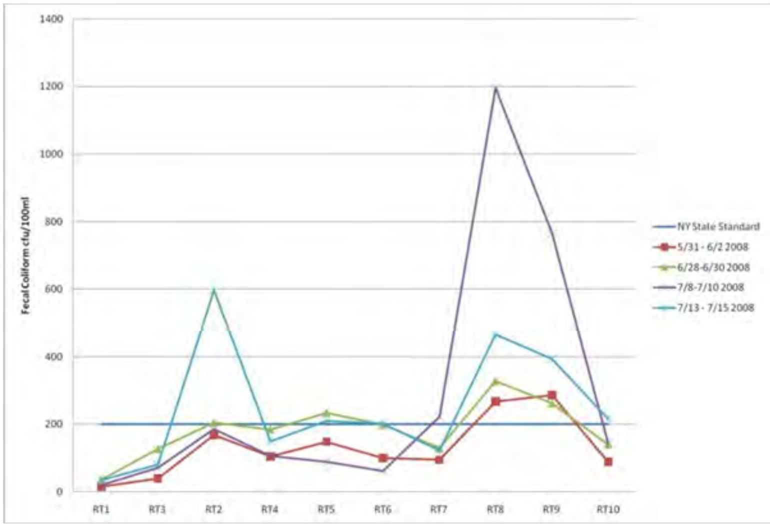
The field measurements at the potential future beach sites for dry weather are comparable to the River transects for the same dates. The Temperature, pH and Conductivity are within normal ranges and show no indications of water quality problems. The dissolved oxygen shows the same pattern of early season low DO readings as was seen in the River Transects and the tributary sites. DO for the first four dry weather events was low (but not below 4.0) at the Henry Hudson Park Site between May 13-16 2008 and below 4.0 mg/L at the downstream Schodack Island site during those same four events. DO at all other dry weather beach site samples was within normal ranges.

### 2.4.5 Wet Weather Conditions Observed in 2008

Sampling was successfully completed for four wet weather events of varying magnitude at all of the stations as identified. Comprehensive wet weather sampling results can be found in the *Receiving Water Quality Assessment Report* (included in Appendix B). Samples were collected for both E. Coli and fecal coliform analysis. The analytical results for fecal coliform and E. Coli for the wet weather events also showed close correlation between the two indicator organism groups. During wet weather, the observation of little or no lateral differences in the river was consistent with what was observed in dry weather.

For each of the 2008 events sampled, the Hudson and Mohawk Rivers were generally in compliance with the NYS fecal coliform standard at the upstream limits of the study as indicated by the geometric means computed for transects RT1 (Mohawk River) and RT3 (Hudson River). Fecal Coliform geometric means for the four wet weather events are shown on Figure 2-5. Similar to the dry weather results, the wet weather data indicated that there was an accumulation of bacteria through the Albany Pool region with the maximum measured values typically observed at the RT8 (Dunn Memorial Bridge) and RT9 (Port of Albany) transects. Comparisons made between wet weather bacteria concentrations and applicable criteria showed consistent exceedences of those criteria at these two River Transects. The maximum concentration and persistence of high concentrations of bacteria are at least partly related to the size of storm events.

FIGURE 2-5: Fecal Coliform Geometric Means of Wet Weather Events




With the exception of the Mohawk River, samples taken at the confluence with the Hudson River (T19 north of Peebles Island and T15 south of Peebles Island), which met the fecal coliform standard for all four events. The tributaries sampled within the Albany Pool all showed high concentrations of bacteria during wet weather, contributing to the accumulation of bacteria through the Albany Pool region of the Hudson River.  In a few cases there was a slight decline in bacteria concentration observed as an event progressed.

During wet weather events, the potential future downstream beach sites did not show a measureable exceedence of existing fecal coliform standards.  Although high concentrations of bacteria were observed in samples 24-48 hours after the start of a rain event at the beach sites, high concentrations did not result in any event geometric means exceeding the applicable criteria for any of the events. E. Coli results were also reviewed in consideration of the proposed USEPA standard of a geometric mean of no less than 5 samples of 126 cfu/100ml with a potential single sample maximum of 235 cfu/100ml for a designated beach area.  The data suggests that both beach sites were in compliance with the geometric mean standard for all four events, but that single sample maximum values exceeded the proposed maximum.

Field measurements obtained during wet weather events for temperature, specific conductance, pH, and DO showed general consistency through the events. The low DO observed during earlier dry weather events on the Hudson upstream was not observed during the wet weather events. For wet weather events 1 and 4, the pH at the two Mohawk River sites showed average values that exceed the New York State criteria for pH. Those values are consistent with what was observed in several dry weather events as well. As with the dry weather observations of high pH, these observations consistently show that the high pH water is coming in from the Mohawk above the study area.

During the 2008 wet weather events, the tributary field measurements for Temperature, pH and conductivity showed no readings that are outside of normal ranges.  Dissolved Oxygen measurements in the tributaries show different responses in each of the four events, with each of the tributaries recording less than 4.0 mg/L on occasion. Given that field measurements for DO at the River Transects taken during the same event did not show low dissolved oxygen it is likely that the readings observed in these tributaries are representative of upstream conditions or loadings only.

Concentrations of bacteria in CSO and WWTP effluent samples were consistent with what is typical in those discharges during wet weather. BOD, TSS and nutrient variables were measured in CSO discharges and the observed concentrations were consistent with what is typically observed in other communities. The relative magnitude of those materials varied with the magnitude of the storm event and illustrated a tendency to decline for longer discharge duration events. No significant differences were observed between the five CSOs sampled.

## 2.5 Summary of 2009 Sampling Program

In 2009, additional locations were sampled on each tributary to better identify potential pollution sources and determine the influences from outside communities. This work was done as a follow up to the 2008 sampling which identified that the tributaries were generally at or exceeding the fecal coliform compliance limit during both dry and wet weather conditions.

### 2.5.1 Water Quality Sampling Locations in 2009

Discrete samples of receiving water were collected for laboratory analyses at two river transects, one each along the Mohawk and Hudson Rivers, and sixteen locations along five tributaries to the Hudson River. Each river transect included a sample collected from the west bank, river center, and east bank. The dry and wet weather water quality sampling locations are listed in Table 2-4 and shown on Figure 2-6.

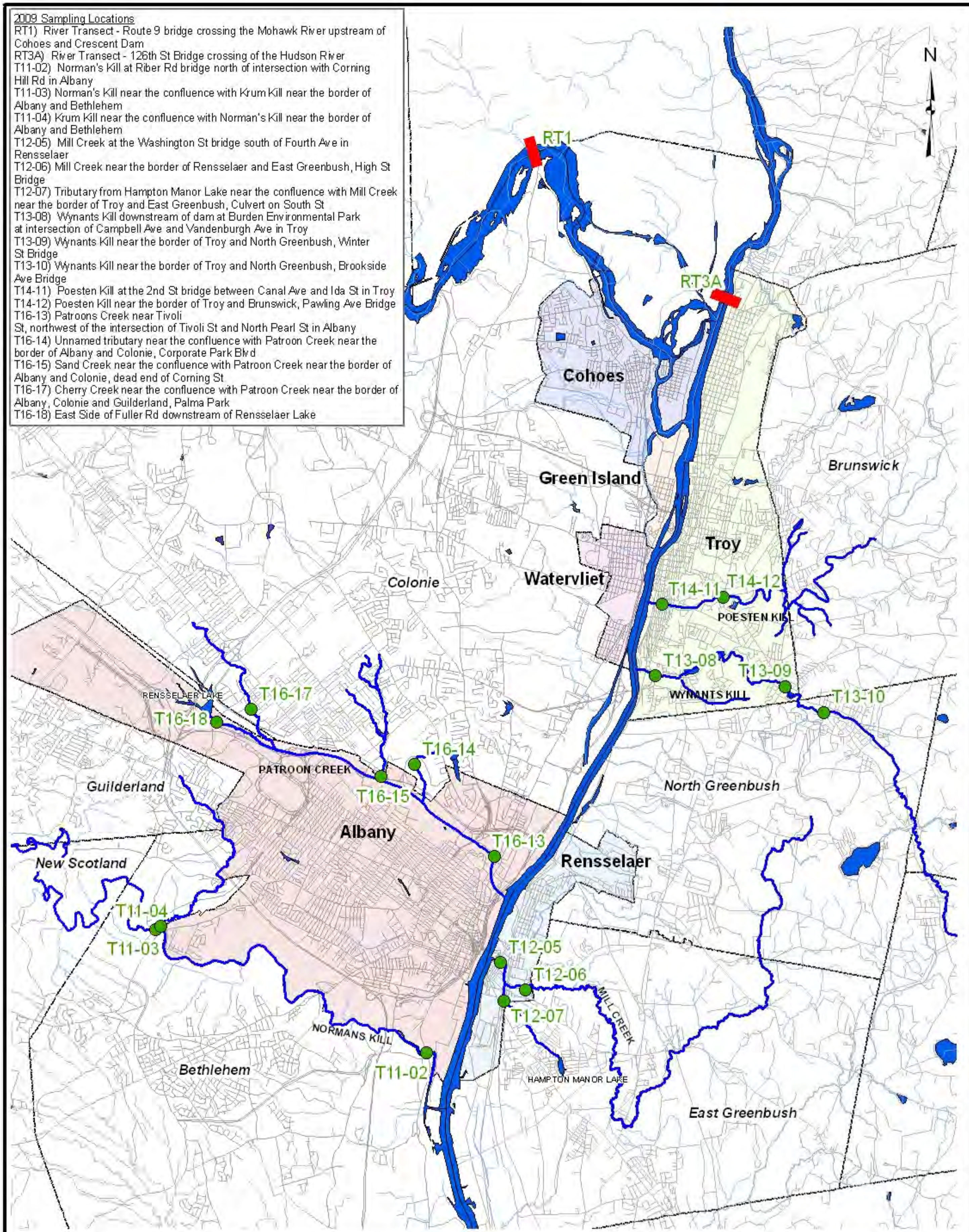
TABLE 2-4: Receiving Water Body Sample Locations in 2009

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| River Transect Locations | | | |
| RT1-WB<br>RT1-RC<br>RT1-EB | Route 9 bridge crossing of Mohawk River upstream of Cohoes and Crescent Dam (2008) | bridge | Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |
| RT3A-WB<br>RT3A-RC<br>RT3A-EB | 126th Street Bridge crossing of Hudson River | bridge | Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |
| Tributary Locations | | | |
| T11-02 | Normans Kill near confluence with Hudson River at River Road Bridge north of intersection with Corning Hill Road in Albany (2008) | bridge | Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| T11-03 | Normans Kill near the confluence with Krum Kill at the foot bridge off NY State Route 85 north of Blessing Road | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T11-04 | Krum Kill near the confluence with Normans Kill at the NY State Route 85 Bridge south of Blessing Road | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T12-05 | Mill Creek near confluence with Hudson River at the Washington Avenue bridge south of Fourth Avenue in Rensselaer (2008) | bridge | Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |
| T12-06 | Mill Creek near the border of Rensselaer and East Greenbush, High Street Bridge | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T12-07 | Tributary from Hampton Manor Lake near the confluence with Mill Creek near the border of Rensselaer and East Greenbush, Culvert on South Street | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T13-08 | Wynants Kill near confluence with Hudson River, Burden Avenue (2008) | bridge | Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |
| T13-09 | Wynants Kill near the border of Troy and North Greenbush, Winter Street Bridge | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T13-10 | Wynants Kill near the border of Troy and North Greenbush, Brookside Avenue Bridge | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T14-11 | Poesten Kill near confluence with Hudson River at the 2nd Street bridge between Canal Avenue and Ida Street in Troy (2008) | bridge | Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |
| T14-12 | Poesten Kill near the border of Troy and Brunswick, Pawling Avenue Bridge | bridge | Fecal Coliform, Temperature, DO, Specific Conductance |
| T16-13 | Patroon Creek near confluence with Hudson River near Tivoli Street northwest of the intersection of Tivoli Street and North Pearl Street in Albany (2008) | bridge | Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus |

| Sampling Location ID Number | Location | Sample Collection Location | Parameters |
|---|---|---|---|
| T16-14 | Unnamed tributary near the confluence with Patroon Creek near the border of Albany and Colonie (Corporate Woods Boulevard) | shore | Fecal Coliform, Temperature, DO, Specific Conductance |
| T16-15 | Sand Creek near the confluence with Patroon Creek near the border of Albany and Colonie, Dead end of Corning Street. | shore | Fecal Coliform, Temperature, DO, Specific Conductance |
| T16-17 | Cherry Creek near the confluence with Patroon Creek near the border of Albany, Colonie, and Guilderland (Palma Park) | shore | Fecal Coliform, Temperature, DO, Specific Conductance |
| T16-18 | Patroon Creek culvert outlet on the east side of Fuller Road. | shore | Fecal Coliform, Temperature, DO, Specific Conductance |

In the table above, sample locations that carried over from the 2008 sampling have a bold identification number and "(2008)" at the end of the location description. These locations include: T11-02, T12-05, T13-08, T14-11, and T16-13. The first half of the identification number corresponds to the 2008 sample location. The additional 2009 sample locations with the same first half of the identification number correspond to locations contributing to the same tributary.




albany pool CDM CHA CDRPC

ALBANY CSO POOL
LONG TERM CONTROL PLAN

SAMPLING LOCATIONS 2009

JUNE 2011
FIGURE 2-6

### 2.5.2 Water Quality Sampling Events in 2009

The 2009 sampling period began in July 2009 and was completed in September 2009. Five dry weather events and three wet weather events were sampled at all locations during this sampling effort. Table 2-5 lists the dates and times of the actual sampling events as conducted.

TABLE 2-5: Start Times of Dry and Wet Weather Events

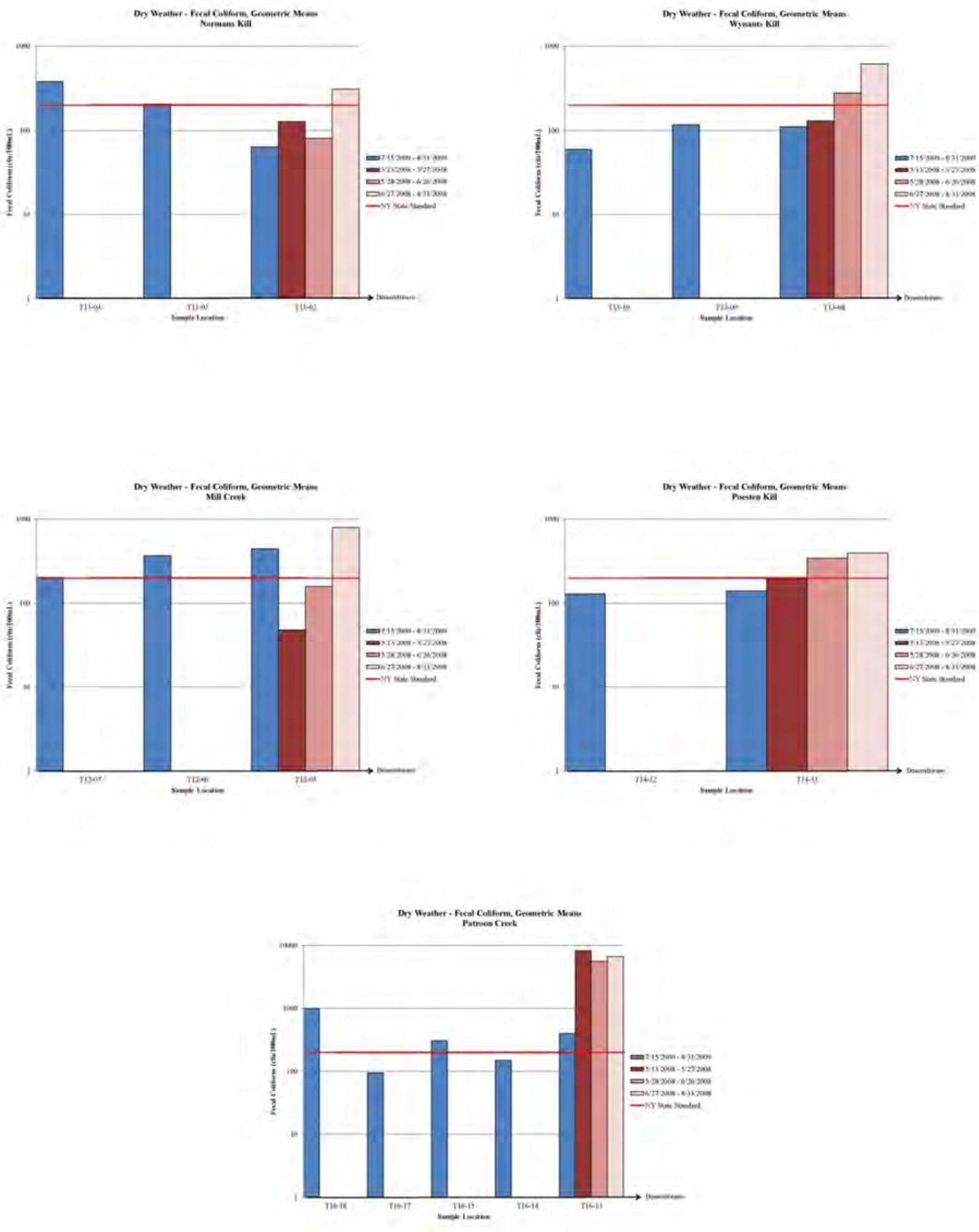
| Date | Dry/Wet | Event No. | Start Time |
|---|---|---|---|
| 7/15/2009 | Dry | 1 | 8:00 AM |
| 7/16/2009 | Dry | 2 | 8:00 AM |
| 7/16/2009 | Wet | 1 | 6:00 PM |
| 7/21/2009 | Dry | 3 | 8:00 AM |
| 7/21/2009 | Wet | 2 | 12:00 PM |
| 8/5/2009 | Dry | 4 | 8:00 PM |
| 8/6/2009 | Dry | 5 | 8:00 AM |
| 8/28/2009 | Wet | 3 | 8:00 PM |

Samples were collected at 18 locations during five dry weather events and three wet weather events. The samples were analyzed for fecal coliform and in-situ field measurements were also collected including dissolved oxygen (DO). The tributaries sampled included: the Patroon Creek, Normans Kill, Wynants Kill, Poesten Kill, and Mill Creek.

### 2.5.3 Dry Weather Conditions Observed in 2009

Comprehensive dry weather sampling results for 2009 can be found in the *Albany Pool Tributary Water Quality Assessment Report* (included in Appendix C). Geometric mean values for fecal coliform for the five dry weather events were used to determine the compliance of each sample location. As shown in Figure 2-7, the results were generally consistent with the 2008 sampling for the locations that were sampled in both years, with the exception of the Patroon Creek which showed significant reductions in fecal coliform counts. The following sections summarize the 2009 dry weather sampling results for each tributary sampled.

## FIGURE 2-7: Dry Weather Fecal Coliform Geometric Mean Summary 2008 & 2009 Data Comparison



### 2.5.3.1 Patroon Creek

The Patroon Creek was sampled at Tivoli Street near its confluence with the Hudson River in 2008 and 2009. During both years, the resulting fecal coliform counts exceeded the compliance limit during dry weather. However, the geometric mean fecal coliform counts decreased significantly from the values of more than 8,000 colony-forming units (cfu)/100 milliliter (mL) recorded during the sampling of 2008 to 400 cfu/100 mL recorded in 2009. The City of Albany and the ACSD identified and mitigated two illicit sanitary sewer connections contributing to the Patroon Creek. The significant reductions in fecal coliform, witnessed in 2009, are likely the result of these activities. Despite this significant reduction in coliform, the water quality standard of 200 cfu/100 mL is still exceeded at its confluence with the Hudson River.

Of particular concern were the significant bacteria counts recorded during all sampling events where the Patroon Creek crosses Fuller Road. The geometric mean value for the 30-day period was almost 1,000 cfu/100 mL. The consistent exceedence of the water quality standard prompted additional sampling in the vicinity. The results of the additional sampling suggest that Rensselaer Lake is not a source of fecal coliform but that there is a significant source between Rensselaer Lake and the Fuller Road sampling location. Additional investigations at this location are ongoing with remedial actions proposed as part of this LTCP.

Samples were also collected in three tributaries to the Patroon Creek entering Albany from the Town of Colonie. Two of the sampling locations, Palma Park and Corporate Woods Boulevard, were in compliance during the 2009 dry weather sampling. The third sampling location, Sand Creek, exceeded the compliance limit indicating that the Patroon Creek is being negatively impacted by Sand Creek.

### 2.5.3.2 Normans Kill

The Normans Kill was sampled at River Road near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform for all dry weather sampling events and some improvement over the 2008 dry weather sampling results.

The Normans Kill and the Krum Kill were also sampled upstream of their confluence near Route 85. Both of these locations exceeded the water quality standard for fecal coliform based on the geometric mean of five samples. The upstream Normans Kill sample results showed slightly elevated fecal coliform counts coming from the Town of Bethlehem. The Krum Kill location showed larger exceedences but, because it runs along the border of Albany and Bethlehem and has its source in the Town of Guilderland, source conclusions are difficult without detailed investigations.

### 2.5.3.3 Wynants Kill

The Wynants Kill was sampled at Burden Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform, based on the geometric mean of the five dry weather sampling events, and some improvement over the 2008 sampling results.

The Wynants Kill was also sampled at Brookside Avenue and Winter Street. Both these locations met the water quality standard for all dry weather events indicating that no significant dry weather sources are entering Troy from North Greenbush at these locations.

#### 2.5.3.4 Poesten Kill

The Poesten Kill was sampled at 2nd Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform, based on the geometric mean of the five dry weather sampling events, and some improvement over the 2008 sampling results.

The Poesten Kill was also sampled at Pawling Avenue. This location met the water quality standard for all dry weather events indicating that no significant dry weather sources are entering Troy from Brunswick at this location.

#### 2.5.3.5 Mill Creek

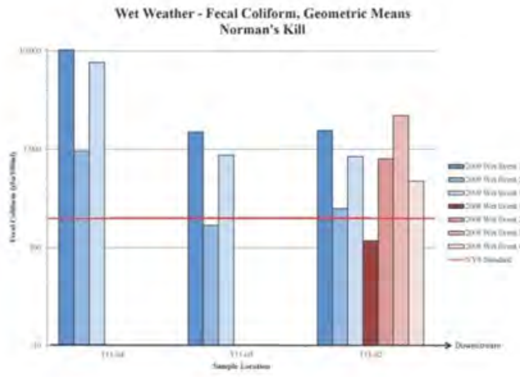
The Mill Creek was sampled at Washington Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for fecal coliform for all samples. A similar exceedence at this location was observed in 2008.

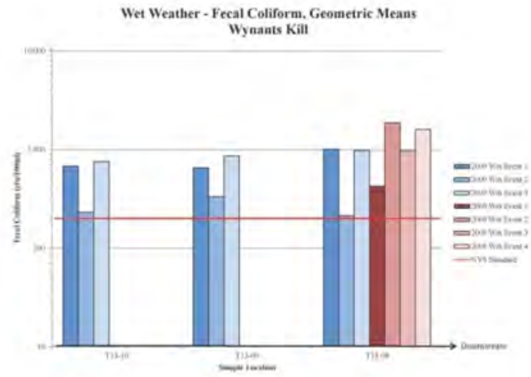
The Mill Creek was also sampled at High Street and at a tributary from Hampton Lake Manor at South Street. Both these locations exceeded the water quality standard for fecal coliform indicating that dry weather sources are entering Rensselaer from East Greenbush.

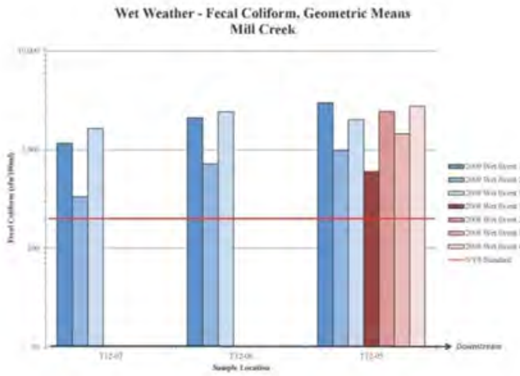
### 2.5.4 Wet Weather Conditions Observed in 2009

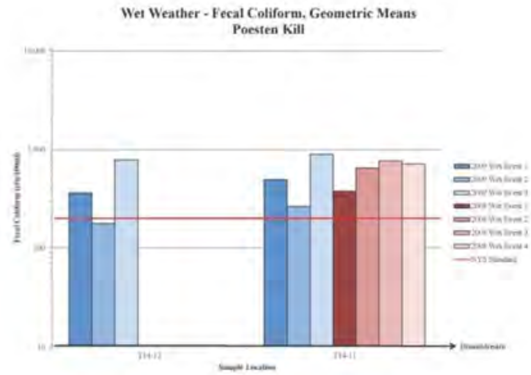
Comprehensive wet weather sampling results for 2009 can be found in the *Albany Pool Tributary Water Quality Assessment Report* (included in Appendix C). As with the dry weather events, geometric mean values for fecal coliform were used to determine the compliance of each sample location. The geometric means include 10 samples collected during each 48 hour sampling event period. Three wet weather events were sampled; Event 1 and Event 3 had a similar amount of cumulative precipitation, 1.12 and 1.19 inches, respectively. The cumulative rainfall measured during Event 2 was 0.34 inches. As shown in Figure 2-8, the results were generally consistent with 2008 for the locations that were sampled in both 2008 and 2009, with the exception of the Patroon Creek which showed significant reductions in fecal coliform counts. The following sections summarize the 2009 wet weather sampling results for each tributary sampled.

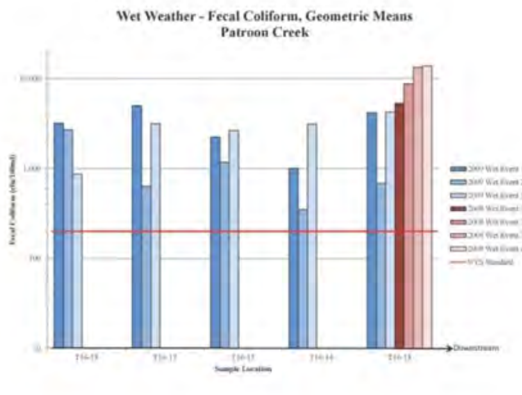
## FIGURE 2-8: Wet Weather Fecal Coliform Geometric Mean Summary 2008 & 2009 Data Comparison



### 2.5.4.1 Patroon Creek

The Patroon Creek was sampled at Tivoli Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for fecal coliform for all samples. However, the geometric mean fecal coliform counts decreased significantly from the values of more than 10,000 cfu/100 mL recorded during the sampling of 2008 to 4000 cfu/100 mL recorded in 2009. As stated earlier, the City of Albany and the ACSD identified and mitigated two illicit sanitary sewer connections contributing to the Patroon Creek; the significant reductions in fecal coliform are likely the result of these activities. Despite this significant reduction in coliform, the water quality standard of 200 cfu/100 mL was still exceeded at its confluence with the Hudson River for all three events.

The Patroon Creek was also sampled at Fuller Road and at three tributaries to Patroon Creek from the Town of Colonie. All four locations exceeded the water quality standard for all of the wet weather events, indicating elevated counts entering Albany from the Town of Colonie.

### 2.5.4.2 Normans Kill

The Normans Kill was sampled at River Road near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for fecal coliform for all of the wet weather events. A similar exceedence at this location was observed in 2008.

The Normans Kill and the Krum Kill were also sampled upstream of their confluence near Route 85. The Normans Kill exceeded the water quality standard for two of the three wet weather events while the Krum Kill exceeded the water quality standard for all of the wet weather events. The Krum Kill location showed larger exceedences but, because it runs along the border of Albany and Bethlehem and has its source in the Town of Guilderland, source conclusions are difficult. Although no direct evidence was collected, this is potentially due to the City of Albany's permitted overflow at the Woodville Pump Station which is approximately 7.6 miles upstream of our sampling location.

### 2.5.4.3 Wynants Kill

The Wynants Kill was sampled at Burden Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for all of the wet weather events. However, the sampling also indicated some improvement over the 2008 sampling results.

The Wynants Kill was also sampled at Brookside Avenue and Winter Street. Both these locations exceeded the water quality standard for all of the wet weather events, indicating that wet weather sources are entering Troy from North Greenbush at these locations.

### 2.5.4.4 Poesten Kill

The Poesten Kill was sampled at 2nd Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated exceedence of the water quality standard for all of the wet weather events at this location. A similar exceedence at this location was observed in 2008.

The Poesten Kill was also sampled at Pawling Avenue. This location exceeded the water quality standard for two of the three wet weather events, indicating that wet weather sources are entering Troy from Brunswick.

#### 2.5.4.5 Mill Creek

The Mill Creek was sampled at Washington Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for all of the wet weather events. A similar exceedence at this location was observed in 2008.

The Mill Creek was also sampled at High Street and at a tributary from Hampton Lake Manor at South Street. Both these locations exceeded the water quality standard for fecal coliform, indicating that wet weather sources are entering Rensselaer from East Greenbush.

### 2.5.5 Dissolved Oxygen in 2009

Along with fecal coliform samples, field measurements, including DO, were collected at each tributary location. All dry weather DO values measured in the tributaries in 2009 were in compliance. During wet weather events the DO measurements along Mill Creek, Wynants Kill and Poesten Kill were in compliance during Event 1 but were out of compliance during the subsequent events, with minimum and average values at approximately 4 mg/l. DO measurements along the Normans Kill and Patroon Creek were in compliance for all three wet weather events.

DO measurements were also collected along a transect of the Mohawk and Hudson Rivers at their upstream boundary of the Albany Pool. All dry weather DO values measured at both the Mohawk River and Hudson River transects in 2009 were in compliance (on the order of 8 mg/l). The Mohawk River (RT1) DO measurements were also in compliance for all the wet weather events (on the order of 9 mg/l). The Hudson River (RT3A) DO measurements were lower than the water quality standard (approximately 4 mg/l) during all three wet weather events. Because of the location of the 2009 Hudson River transect (RT3A), the reduced DO is not likely associated with a CSO discharge within the Albany Pool. Rather, the lowered DO values are likely due to an upstream source sufficiently far away to influence to Hudson River’s DO at the measurement location. In addition, the real time DO data recorded by the in-stream Hudson River Environmental Conditions Observing System (HRECOS) gage at Schodack Island show acceptable DO levels throughout the 2009 sampling period, including the periods during and following the sampled wet weather events. This data implies that the DO is recovering through the Albany Pool region as similar lower DO values are not present at Schodack Island. These conclusions support the belief of the NYSDEC that there are no violations of the water quality standard for dissolved oxygen in the Hudson River as a result of CSOs (Correspondence dated April 13, 2010 included in Appendix D).

### 2.5.6 Quality Assurance and Quality Control

The Quality Assurance and Quality Control (QA/QC) protocols for the 2008 and 2009 sampling programs were defined in the field sampling plan document and in the Quality Assurance Project Plan (QAPP) documents from the selected laboratories as required in the sampling plan. Field QA included requirements for calibration of field instruments, record keeping, chain of custody and site photography. In addition, training was conducted with the field crews prior to the sampling season and a safety and QA/QC discussion was held with all field teams prior to the start of each dry or wet weather sampling event.

Lab QA/QC performance was stipulated to meet the certification standards as acceptable to NYSDEC and were detailed in the lab proposals. In addition to the internal lab QA/QC each field team collected co-located duplicate samples at one of their sampling sites for each event. Co-located samples were used since true duplicates or split samples were not practical.

### 2.5.6.1 Field Sampling QA/QC

Quality Assurance and Quality Control Activities for field activities were performed by Watershed Assessments Associates of Schenectady, New York. The field crews provided standardized notations on field sheets for each station for all events that correspond to the chain of custody attached to samples submitted to the laboratory for bacterial or chemical analysis. Complete chain of custody is available for all lab samples and each field measurement was recorded on original field sheets and submitted to the project team. The field probes were provided through a rental company with documented certification and were calibrated at the start and end of each sampling event. Dissolved Oxygen, pH, conductivity, and Temperature calibration of the field probes was within 5 percent of starting value for each probe at the conclusion of each event. Calibration data was recorded electronically and printed onto standard calibration sheets provided with the field data.

Quality control review of the field data consisted of examination of the values recorded and the documentation provided on the field sheets. The following minor quality control issues were identified:

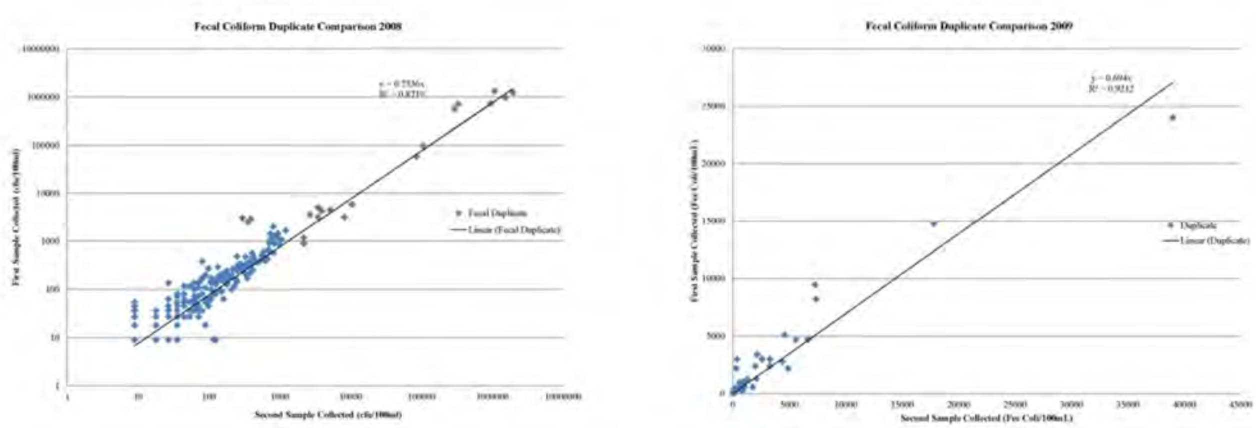
1. In a small number of instances, pH values were recorded that did not seem to be within the range of normal values for open water. Values between 13 and 13.5 were recorded for 4 samples. A single pH value of 18.75 was recorded. Examining the records of the field sheets showed that in 4 of the 5 instances where these high values were noted, they were the first measurement recorded by that field team on that day. In the fifth case, it was the second measurement taken. From this information it seems likely that either bleach used for cleaning field equipment, or some other high pH substance, was introduced into the sampling containers, or onto the equipment, and artificially raised the measured pH for those samples. These measurements were removed from the analysis since they appeared to be outside of the range of possible measurements.
2. In one instance a temperature value of 6.25 degrees Celsius was recorded. That value seems to have been recorded incorrectly, or was a measurement from another probe recorded on the wrong line. This measurement was removed from the analysis.
3. There were several instances where the field teams did not initial and comment on erasures and changes made in the field so it is not clear what the reason was that values were changed. Generally it appears that those changes were where the field team initially wrote values in the wrong box and did not note that the initial value was erased and a change made.

## 2.5.6.2 Laboratory QA/QC

St. Peter's Bender Laboratory of Albany, New York performed all the bacterial analyses (both fecal coliform and E. Coli) for this study and Environmental Laboratory Services of North Syracuse, New York performed the analytical services associated with CSO overflow locations. Both laboratories provided internal chain of custody documentation for all samples and other documentation that they met their internal QA/QC checks for all of the data provided. For the bacteria samples the range of dilutions was selected to provide quantification down to 10cfu/100ml and up to approximately 2 million cfu/100ml. Numerous samples were reported (as expected) at <10 cfu/100ml for both fecal coliform and E. coli. Four samples were reported as >2,000,000 cfu/100ml (or too numerous to count at the highest dilution) for fecal coliform concentration. For those 4 samples the lab was able to quantify E. coli concentrations.

Analysis of the co-located samples shows strong correlation for both fecal coliform and E. coli concentrations. The relationship of the bacteria samples to their duplicates is shown on Figure 2-9. Some deviation between originals and duplicate samples is anticipated due to the variability of bacteria in water samples and the limitations inherent in dilution based analysis. Despite these known challenges, the differences between measured values and their duplicates were within a range that is acceptable for this type of test.

FIGURE 2-9: Fecal Coliform Duplicate Comparison 2008 and 2009




Quality control of bacteria lab data involved review of the reported values and in particular an evaluation of apparent high values, such as those observed in the June 4th dry weather event. Those high values could not be attributed to any single sampling team or field protocol error and were also consistent in showing an upstream downstream relationship consistent with a possible slug of bacteria from an unknown source in that area.

Quality control review of the laboratory chemistry of the CSO samples did not show any questionable values or deviations from protocol. The laboratory did not report any violations of their internal QA/QC procedures in analyzing those samples.

## 2.6 Implications for CSO Control

Only a few areas were identified within, and downstream of, the Albany Pool where exceedances of the applicable water quality standards consistently occur. A review of the sampling data indicates that the accumulation of multiple sources of bacteria results in dry weather exceedances of the bacteria standards in the Albany Pool portion of the Hudson River, generally between the Patroon Island Bridge and the Albany Port. The most significant dry weather sources of bacteria are the local WWTPs and the Patroon Creek, which appears to be impacted by a consistent dry weather source(s). Other tributaries contribute wet weather loading of bacteria that might be reduced with application of non-point source best management practices.

Despite the high concentrations of indicator bacteria observed in all source samples, River samples show a high proportion of events where applicable water quality standards are met. In particular, potential full contact recreation beach areas, located downstream of the APCs, showed only a moderate risk of exceeding recreational standards. It is believed that disinfection at the WWTPs and some level of CSO control would reduce the frequency of exceedances of the water quality standard for bacteria.

Although wet weather discharges can contribute significant loads of bacteria from the headwaters, tributaries, CSOs and other urban sources including the WWTPs, the river samples show a high proportion of events where existing applicable water quality standards are met including at the potential beach sites downstream.

The results of the water quality investigations provide important information that will contribute a substantive role in the evaluation and selection of appropriate levels of control for Albany Pool overflows. These include:

1. The Hudson River appears to be generally well mixed in the CSO receiving waters. River Transect samples downstream of the Federal Dam did not show much variation between east, west and center channel samples. The combination of tidal forces and river flow results in distribution of bacteria evenly across the River. The implication of this is that modeling and estimation of water quality effects of CSO and other loads can be performed using a one dimensional transport model.

Despite both wet and dry weather loading of bacteria to the River, the areas where the River fails to meet standards appear to be spatially and temporally small. Even during wet weather the Hudson River provides sufficient dilution for geometric mean bacteria concentrations to not exceed standards at most sites. The two potential future downstream beach sites were in compliance of geometric mean standards during both dry and wet weather sampling periods. The implication for CSO control is that some level of control of dry and wet weather loading will result in compliance with bacteria criteria for most of the River most of the time.

Wet weather loadings of bacteria, BOD and other pollutants from CSO sources appear to be comparable to other similar sized communities. The samples collected from the representative CSO outfalls exhibited concentrations of bacteria, BOD, TSS, NH3, TKN and TP consistent with what is typically observed in CSO communities. The sampling also demonstrated that some decrease in concentration was measureable for long duration events as more diluted waste water left the system. These measurements were utilized to provide event mean concentrations that can be used with the collection system model to estimate event specific loads from the system to the receiving waters. Those loads will provide input for different control alternatives to the one dimensional river model sufficient to estimate the relative importance of different levels of control for different sources.

A review of the dissolved oxygen data collected during the monitoring period, in conjunction with other sources of historical river data, indicate that CSOs are not a cause of violations of the dissolved oxygen standard. As a result, a dissolved oxygen river model is not required.

Dry weather sources of bacteria provide an opportunity to increase compliance prior to implementation of CSO controls. In addition to disinfection opportunities at the WWTP discharges during dry weather, there appears to be at least one tributary that poses a potential source of bacteria sufficient to add to background concentrations. An early action program to look for illegal cross connections or broken sewers adjacent to Patroon Creek might provide opportunity to reduce dry weather violations. 2009 sampling of the Patroon Creek confirmed that active illicit discharge investigation can provide significant benefits.

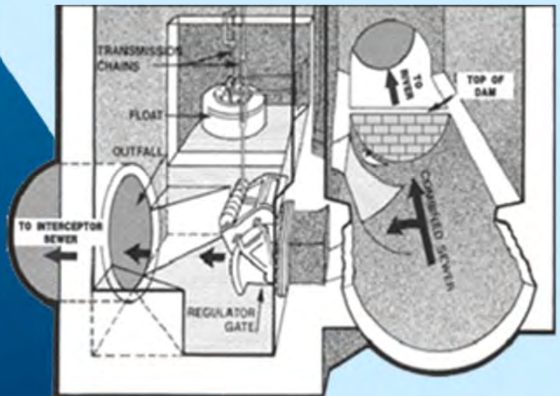
Control of dry weather sources may provide an opportunity to demonstrate that a lesser degree of wet weather control will prevent CSOs from causing or contributing to violations of water quality standards. Comparison of the magnitude of overall loading from those sources to the loading from wet weather discharges will demonstrate how much additional control for CSO is required to meet standards.

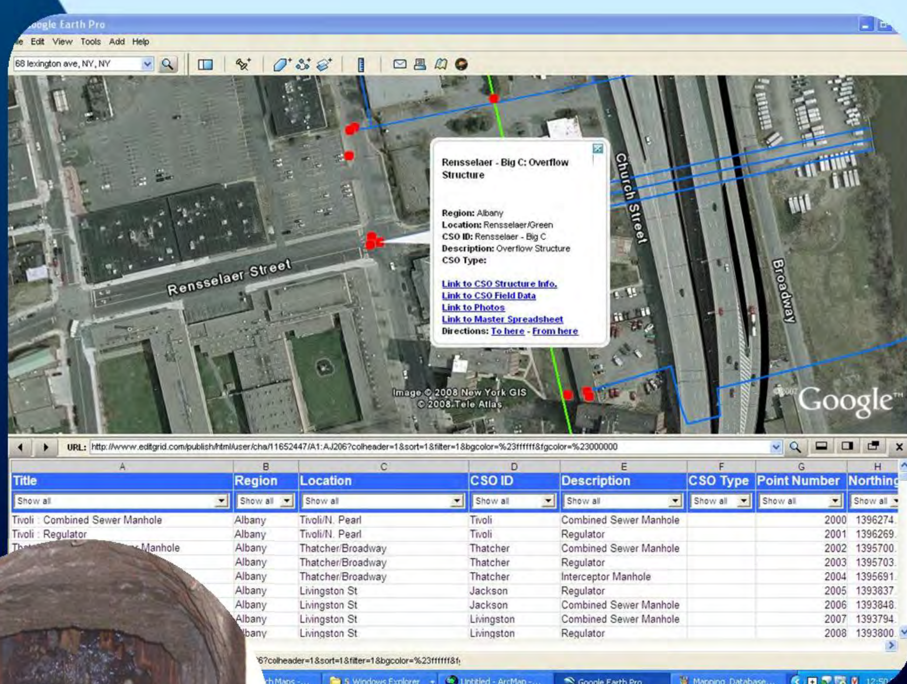
Based on the types of floatables observed during the sampling program, it would appear that source control programs may be the most cost-effective system-wide floatables control alternative. Evaluation and recommendations for floatables controls will be performed as part of the CSO alternatives evaluation task.

The study provides data sufficient to characterize loads of bacteria from both dry and wet weather sources. A one-dimensional model is recommended and supported by the data which suggests that the Hudson River is relatively homogeneous and well mixed. Development of a one dimensional river model, incorporating estimates of dry and wet weather loads, can provide an estimate of the amount of reduction which will be obtained from control of those sources. For evaluation of control of bacteria our recommended approach is to use a simple loading model to calculate total loads from the various sources. The data for bacteria and other characteristics of wet weather sources provides a verifiable average concentration that could readily be used to estimate CSO loadings. Further analysis of flow data and loading for BOD from CSO sources can be combined with the bacteria data to calibrate simple loading calculations that could produce a verifiable tool to support decision making for prioritizing wet weather controls. Receiving Water Quality modeling is discussed comprehensively in Section 5.

Chapter 3

# Combined Sewer System Mapping, Database and Digitizing






Joint Venture Team
albany pool

## 3.0 Introduction

## 3.1 Introduction

Each of the APCs is required, under their respective SPDES Permits, to characterize their existing combined sewer systems. A standard prerequisite for the modeling efforts is the development of digital mapping and an associated attribute database. It was envisioned that the geographic information system (GIS) layers, created as part of the development of the LTCP, will provide standards, protocols and templates that can be utilized to further build critical system information into a system-wide GIS. The development of this existing infrastructure database and GIS information will provide the communities additional long-term benefits (beyond the LTCP project) in regards to system operations and maintenance, planning and design support, and asset management.

## 3.2 Sewer System Data

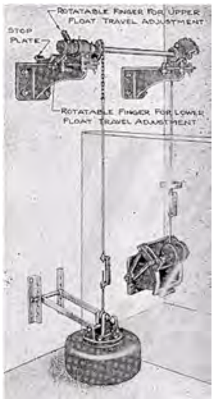
The APJVT, along with the APCs, completed a comprehensive search for system data and operations records. As anticipated, communities had different levels of records and mapping completed for the sewer systems; varying from hard copies of historical drawings to GIS and/or AutoCAD files for the sewer systems. Based on the general characteristics of the sewer systems, subareas were defined and placed into one of the following categories, which were then incorporated into the GIS:

- Typical combined sewer system that is regulated prior to entering the interceptor, with excessive wet weather flows diverted to a CSO outfall.
- Separate sanitary sewer connected directly to the interceptor.
- Unregulated combined sewer connections to the interceptor.
- Separate sanitary sewer connections to combined trunk or collector sewers.
- Separate storm sewers or streams connected to a combined trunk sewer.
- Separate storm sewers or streams connected to a CSO outfall pipe, downstream of the regulator.
- Separate storm sewers that discharge directly to a receiving water body.

In general, interceptors, pump stations, WWTPs, control structures, regulators, outfalls and major trunk sewers were digitized into the GIS. In order to better understand the systems' performance during dry and wet weather operations, the APJVT met with each community's or sewer district's personnel to identify critical data needs, existence of potential cross connections, drainage and/or flooding issues, and potential bottlenecks in the systems that could affect how data was being interpreted or how modeling of the systems was being developed.

One of the key elements of compiling the vast array of system mapping, spanning the six APCs and two sewer districts, was the verification and/or adjustment of the information to a common, or shared, datum system. As such, level runs were performed to tie each of the communities' information to the USGS NAV88 datum. The survey work generally included critical manholes along the interceptors, regulator/control structures, tide gate chambers and outfall manholes. Information was collected on each of the RCSD combined sewage pump stations located along the interceptor. In addition, field crews performed work at each of the Albany and Rensselaer County WWTPs to collect and verify critical as-built information which impact hydraulic performance or plant operations. Lastly, benchmarks were set at the four (4) combined sewage pump stations along the Rensselaer County interceptor and at the headworks for each of the WWTPs. All collected survey data was compiled and entered into the GIS database for use in the development of the respective combined sewer system models.

## 3.3 Regulator/Diversion/Special Structure Data




The APJVT, with support from the APCs and sewer districts, inspected critical system components to document current settings and conditions (e.g., regulators, special structures, pumping stations, siphons, etc.). Specifically, field crews entered into each of the control structures and regulators to verify elevations, dimensions, and configurations of weirs, orifices, regulator settings and chamber configurations. All of the field information collected was compiled into a database and linked to the GIS, thereby, providing detailed descriptions, field sketches, measurements and pictures for the critical CSS components.

## 3.4 Sewershed Data

The APJVT identified streams, separate storm sewers and other significant contributors of stormwater to each community's CSS. Limits of the combined sewersheds were delineated based upon the best available CSS mapping and field data collected in the subtasks previously described. Albany County and Rensselaer County both maintain electronic databases containing information on tax parcels, land use, soils and census tract data. The integration of the CSO sewershed boundaries with the other available electronic information was utilized to assist in the characterization of sewershed properties, and predicted dry and wet weather system responses. Specifically, the characteristics of each sewershed such as size, impervious area, land use, slope and percent separation were compiled into a database for use in the development of the hydrologic and hydraulic modeling of the CSSs. In addition, the mapping was utilized to assess contributions from significant industrial users within the CSO sewersheds.

For the purposes of system characterization and model development, the APJVT delineated the separate sewersheds tributary to the interceptor sewers and combined trunk sewers within the Albany Pool communities. Once again, boundaries of each separate sewershed within the six communities, along with their individual properties, were entered into the GIS for use in the CSS modeling efforts. Separate sewersheds associated with separate sewers from neighboring communities, tributary to the ACSD and RCSD WWTPs, were delineated by approximate means and later calibrated based upon metering data collected for the project.

## 3.5 Graphical Database

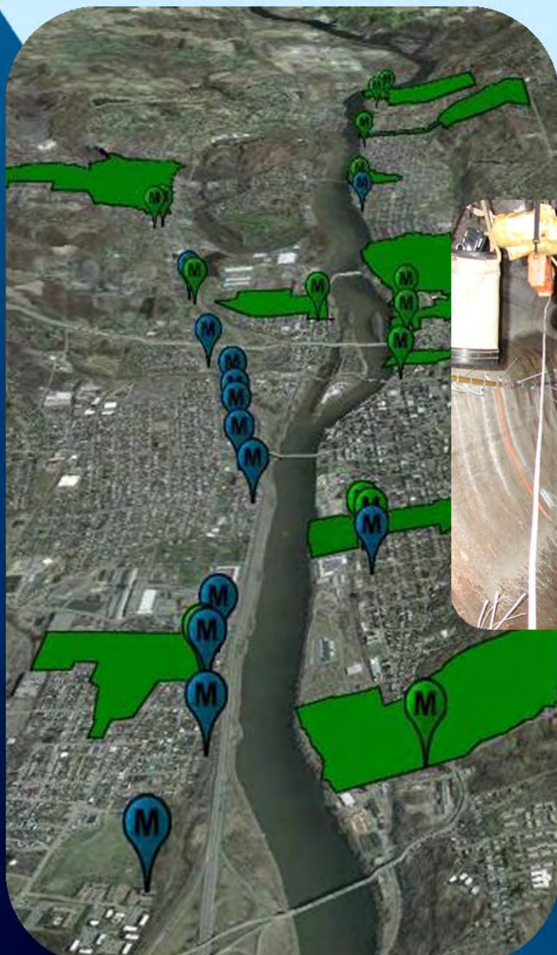
In order to assist with the management of the large amount of project data, the APJVT created a web-based database and graphical interface. Specifically, the graphical database was developed to enable data to be stored and viewed amongst the APCs and consultant team. The web-based database includes the following types of information:

- Interceptor and major collection sewer pipes
- Regulator, specialty and control structures
- Sewershed delineations
- Land use, soils, impervious properties
- Census tract data
- Existing sewer district and project metering locations
- Sampling transects and collection points
- Proposed CSO LTCP program elements

The graphical interface was also utilized during the presentation of information to the committees and general public throughout the execution of the public participation plan. In addition, this tool could serve to deliver information to the public during the implementation of the Albany Pool CSO LTCP program.

Chapter 4

# Combined Sewer System Monitoring



# 4.0 Combined Sewer System Monitoring

## 4.1 Introduction

The Albany Pool Communities CSS flows are tributary to three wastewater treatment plants (WWTP) including the Rensselaer County Sewer District plant, and two Albany County Sewer District plants (both North and South plants). There are 95 discharge locations (92 CSO locations and three WWTPs) within the CSS that are permitted under each community's SPDES permits. These discharge to the Hudson and Mohawk Rivers and their tributaries.

Combined sewer system models were developed (see Chapter 5) to characterize the behavior of the CSS, quantify CSO discharges, and evaluate CSO control alternatives. The models will help the communities assess the hydraulics of the systems and, using event mean concentration, predict existing pollutant loads discharged from the CSS during CSO events. These were used to evaluate impacts on the CSS that may result from future development, improvements to the sewer system, and changes in maintenance and operational procedures. This effort will directly contribute to the reduction of CSO discharges that may impair water quality and affect contact recreation and habitat in the Class C waters of the Hudson and Mohawk Rivers, and their tributaries within the Albany pool region.

A major task in planning and developing a LTCP for CSOs is the characterization of the CSS. As part of the LTCP for the Albany Pool Communities, a monitoring program was developed and conducted to verify and supplement available CSS monitoring data (in addition to the flow data already being collected by the ACSD and the RCSD) and water quality data. The implemented plan included additional sampling and laboratory analyses of dry and wet weather flows and the installation of additional flow meters at key locations throughout the systems to record depth and velocity of CSS flows continually for a 3 month period. Collection of water quality data was required for the CSS during storm events in order to determine water quality characteristics of the CSO discharges and collection of flow monitoring data within the CSS was required to analyze the CSS flow patterns. These data combined with the analyses of the receiving water bodies, performed under a separate task, enabled the Albany Pool Communities to assess the impacts of CSOs, and help prioritize areas of principal concern with regard to water quality impacts. In addition, the sampling results help with selecting the most effective CSO control alternatives and establishing their benefits.

The basis of CSS monitoring and sampling of CSO discharges was defined in the approved *Combined Sewer System Monitoring Plan* (Plan) (included in Appendix E). The discussion in the Plan defines:

- The flow monitoring equipment used
- The locations of the flow monitoring equipment installed
- The duration of the flow monitoring
- Which storm events were be sampled
- The locations of CSS sampling points
- The water quality parameters analyzed
- Data storage protocols followed

The initial plan identified 4 rainfall gage locations, 4 CSO sampling locations and 25 continuous flow monitoring locations. The communities proactively elected to implement a more comprehensive program which included 45 flow monitoring locations. The flow monitoring was performed by ADS Environmental Services, a specialty flow monitoring subcontractor, and the CSO sampling was performed by the APJVT with assistance from the Albany Pool Communities and the ACSD.

As discussed in Chapter 2, *the Receiving Water Quality Assessment Report* (included in Appendix B) was produced describing the results of the implementation of the 2008 sampling performed in accordance with the approved *Receiving Water Quality Sampling Plan* (included in Appendix A). That Report also described the results of the combined sewer overflow water quality sampling. Four volumes of flow monitoring data were produced by ADS documenting the approved flow monitoring performed for Albany, Albany North (including Cohoes, Watervliet, and Green Island), Rensselaer, and Troy, respectively. These complete documents are attached in the appendices of the *Receiving Water Quality Assessment Report* (included in Appendix B).

## 4.2 Acknowledgements

The APJVT would like to acknowledge both the efforts of the Albany Pool member communities and the Albany County Sewer District toward the implementation of the CSS Monitoring program. The 2008 flow monitoring required careful coordination between the communities, Sewer Districts and the flow monitoring subcontractor for installation, maintenance, and removal of 45 flow monitoring stations. The flow monitoring sampling program could not have been implemented successfully without their dedication, perseverance, and commitment to its successful completion.

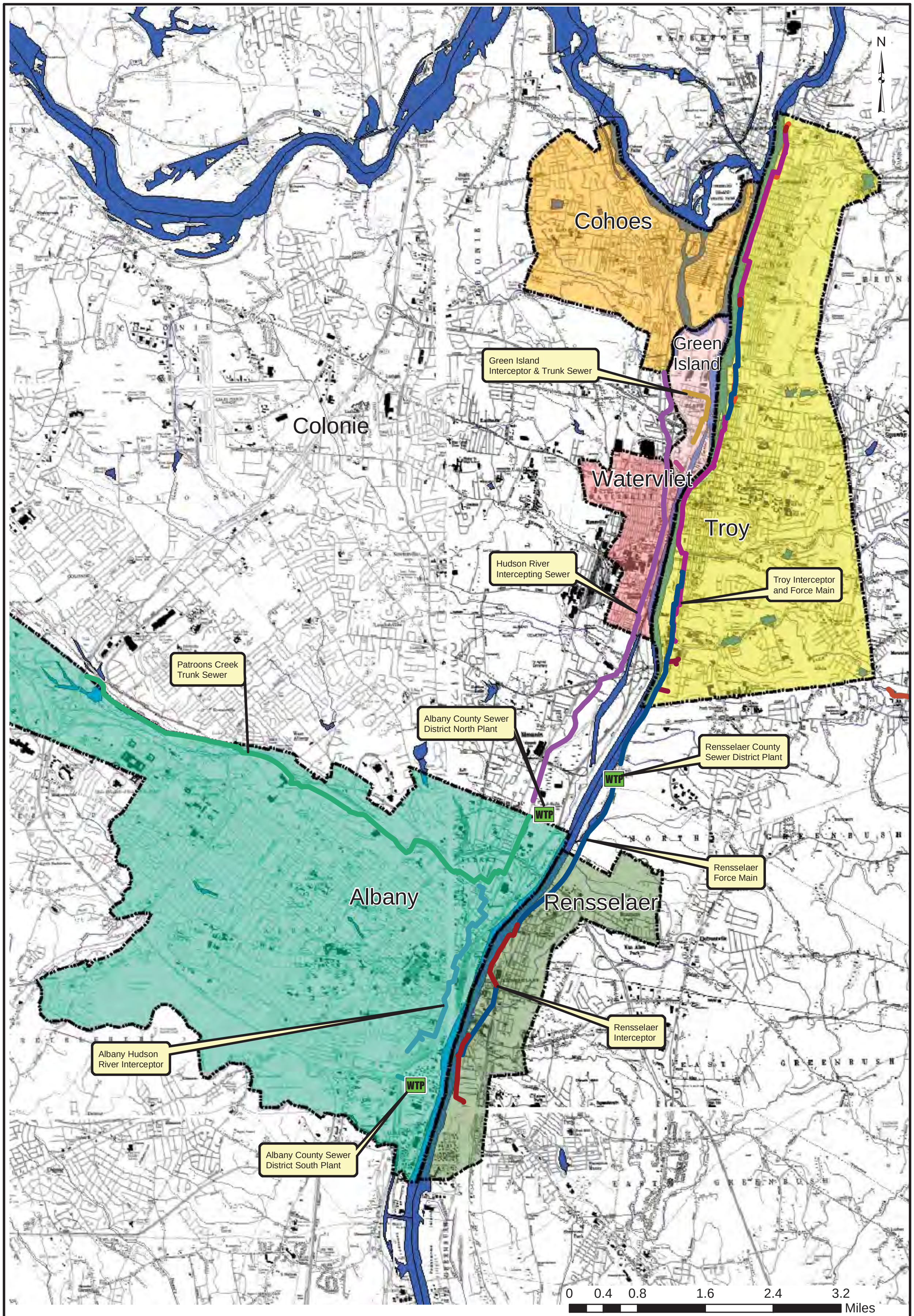
The APJVT would also like to thank ADS Environmental Services who successfully implemented the 2008 flow monitoring protocols.

## 4.3 Summary of 2008 Flow and Rainfall Monitoring Program

Both Flow and Rainfall monitoring and CSO sampling were performed to characterize the behavior of the CSS and quantify CSO discharges. The primary intent of the metering was to collect data that could be used to accurately characterize the collection system and assess the hydraulics of the interceptor sewers. This information was used to calibrate the model under the Combined Sewer System Modeling task. Flow and CSS wastewater quality data were collected to support the CSS characterization of those systems tributary to the ACSD North Plant, the ACSD South Plant, the RCSD Plant for flows from the City of Troy contributory area, and the RCSD Plant for flows from the City of Rensselaer contributory area.

Figure 4-1 shows an overview of the Albany Pool CSO contributory areas.

Continuous flow and rainfall monitoring were performed for a 12 week period beginning in June 2008 and ending in September 2008. Monitoring was successfully completed for 45 flow metering locations and 4 rainfall monitoring locations. Sampling was performed at five CSO locations for four rainfall events during the monitoring period.

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albany pool CDM CHA CDRPC

ALBANY CSO POOL LONG TERM CONTROL PLAN

OVERALL ALBANY POOL PLAN

JUNE 2011
FIGURE 4-1

## 4.4 Flow Monitoring

Flow meters were installed at 45 locations within the CSS of the Albany Pool communities. In addition, the flow monitoring program utilized information from the ACSD which owns and maintains 27 additional flow meters. Permanently installed meters located at the in-system pump stations and influent sewers to the RCSD WWTP were also used. Block and chalk testing was also performed at selected locations as an in-kind service by the ACSD, RCSD, and by the communities. Flow and rainfall monitoring locations were chosen based on a combination of many factors including:

- Historical knowledge of the system.
- The size of the upstream trunk sewer.
- The activity of the overflow locations during the initial block and chalk testing period.
- The location of existing meters.
- The inclusion of at least one flow meter within each community.
- The interceptor hydraulic data requirements.
- Characteristics of the tributary areas and receiving water bodies.
- Modeling requirements.
- Data requirements for tributary communities to establish boundary conditions (upstream flow contributors).
- Site access and safety.

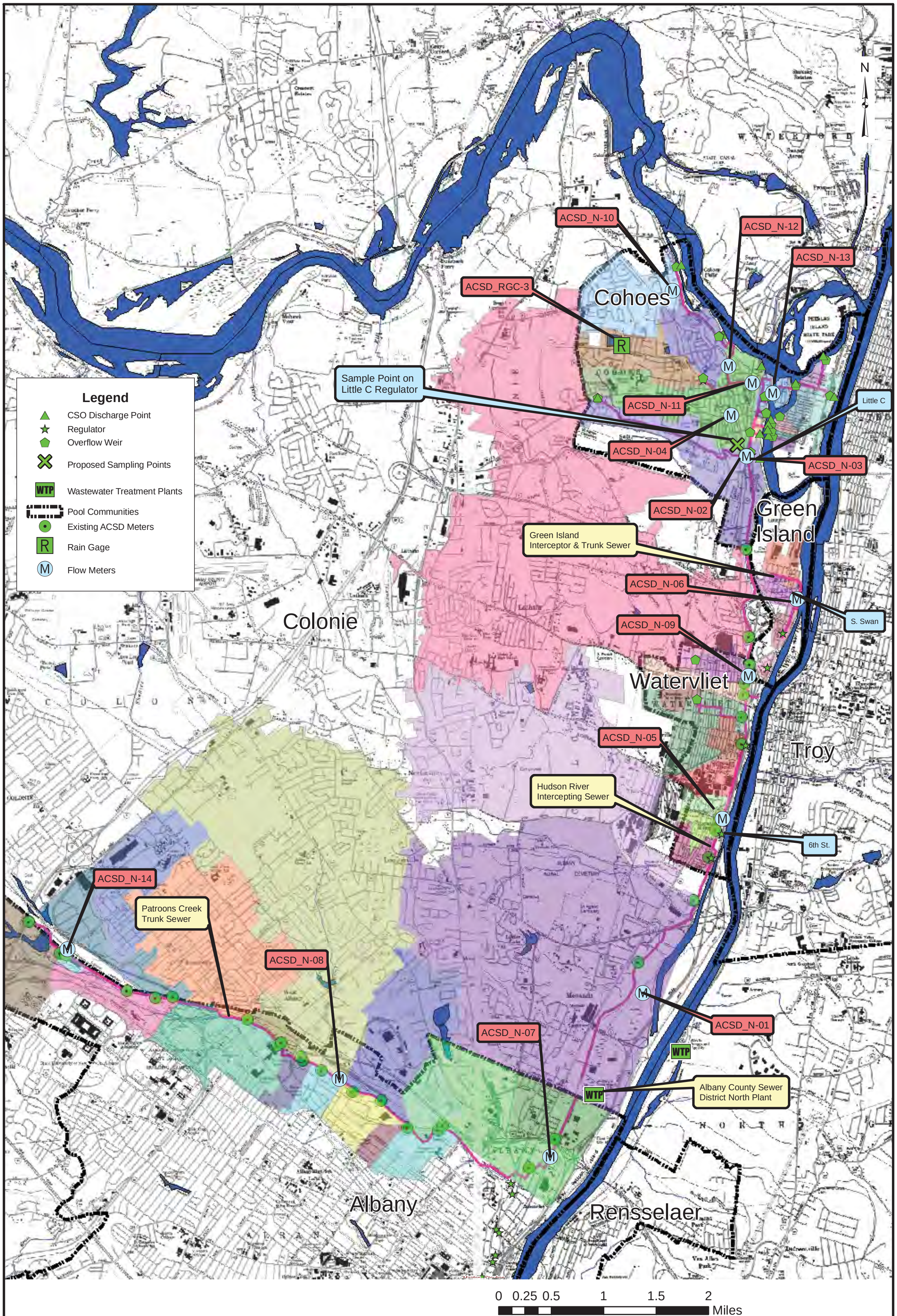
The following sections detail the placement of flow monitoring equipment installed to support the CSS models developed for this project. The meters were placed to capture the greatest extent of the contributory area possible, verify reactions of the interceptor under various weather conditions, and to characterize contributions from select trunk sewers entering from outside communities.  The flow metering locations were identified and distributed in a way to maximize the sewershed area covered while establishing controls along the interceptor sewer and the trunk sewers from the outside communities.

### 4.4.1 Flow Monitoring for the ACSD North Plant CSS Model

The 14 flow meters placed within the CSS system contributory to the ACSD North Plant were installed to augment the information already available from the 27 permanent ACSD flow meters. Figure 4-2 shows updated ACSD North Plant contributory sewershed areas, the regulator locations, the CSO locations, and the metering locations. The areas contributory to the metering locations represent approximately 37 percent of the total combined sewer contributory area to ACSD North Plant. Table 4-1 further identifies the characteristics of the contributory areas and provides additional information supporting the selection of the metering locations.

TABLE 4-1: ACSD North CSS Flow Metering Locations

| Flow Metering ID Number | Coordinates | | Flow Metering Location | City |
|---|---|---|---|---|
| | y | x | | |
| ACSDN-01 | 42.690083 | -73.719722 | Off Market Rd. down dirt access drive, right past power lines | Menands |
| ACSDN-02 | 42.764111 | -73.699389 | 349 Saratoga St at fence | Cohoes |
| ACSDN-03 | 42.764000 | -73.699333 | 349 Saratoga St- in field | Cohoes |
| ACSDN-04 | 42.769722 | -73.702139 | Columbia St at Congress St | Cohoes |
| ACSDN-05 | 42.714028 | -73.704472 | Broadway at 7th St | Watervliet |
| ACSDN-06 | 42.744250 | -73.690194 | Swan St end | Green Island |
| ACSDN-07 | 42.667583 | -73.737333 | 400' N of 39 Erie Blvd | Menands |
| ACSDN-08 | 42.678583 | -73.776667 | 36 Industrial Park Road | Albany |
| ACSDN-09 | 42.733694 | -73.699417 | 2332 Broadway | Watervliet |
| ACSDN-10 | 42.786972 | -73.712917 | Manor Ave at N Reservoir St | Cohoes |
| ACSDN-11 | 42.774111 | -73.698167 | 244 Ontario St | Cohoes |
| ACSDN-12 | 42.776472 | -73.702583 | Cayuga at Olmstead, 300' north into woods | Cohoes |
| ACSDN-13 | 42.772667 | -73.694333 | Pershing Ave end, 175' into woods | Cohoes |
| ACSDN-14 | 42.696778 | -73.827333 | 136 Fuller Road | Albany |

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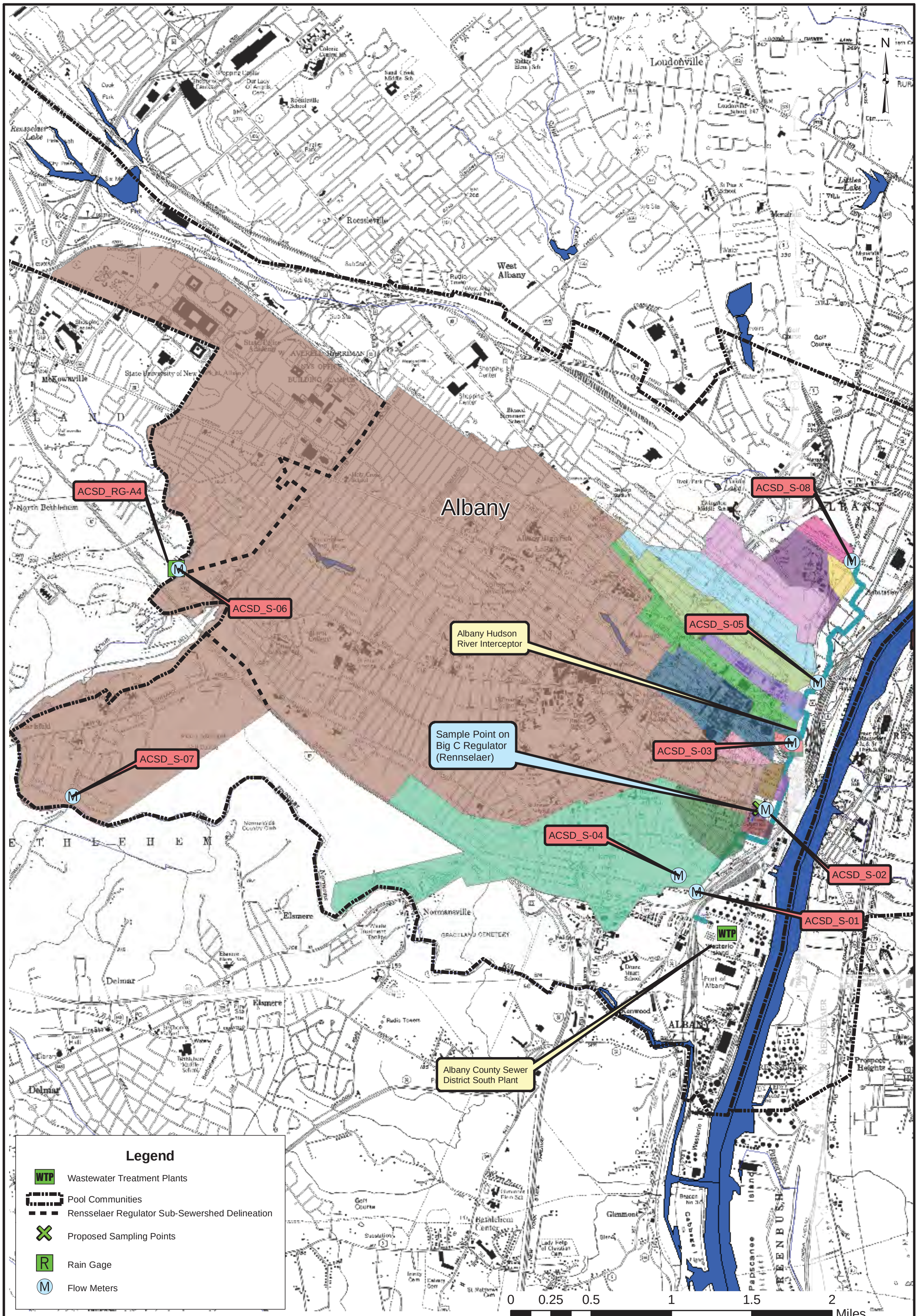
| albany pool / CDM / CHA | CDRPC | ALBANY CSO POOL LONG TERM CONTROL PLAN | ACSD NORTH CONTRIBUTORY SEWERSHEDS, REGULATORS, CSO LOCATIONS, AND METERS | JUNE 2011 FIGURE 4-2 |
| --- | --- | --- | --- | --- |

### 4.4.2 Flow Monitoring for the ACSD South Plant CSS Model

Eight flow meters were placed within the CSS system contributory to the ACSD South Plant. The meters were placed to capture the greatest extent of the contributory area possible and to characterize the hydraulics of the interceptor, including the Beaver Creek Sewer District flows tributary to the “Big C” regulator. This conveys flow from approximately 75 percent of the area contributory to the ACSD South Plant. Figure 4-3 shows the ACSD South Plant contributory sewershed areas, the regulator locations, the CSO locations, and the metering locations. Table 4-2 further identifies the characteristics of the areas and provides additional information supporting the selection of the metering locations.

TABLE 4-2: ACSD South CSS Flow Metering Locations

| Flow Metering ID Number | Coordinates y | x | Flow Metering Location | City |
|---|---|---|---|---|
| ACSDS-01 | 42.633972 | -73.763361 | 431 S Pearl St | Albany |
| ACSDS-02 | 42.641333 | -73.754806 | Rensselaer St at Green St | Albany |
| ACSDS-03 | 42.647333 | -73.751528 | Dallius St. btwn Division and Hudson Sts | Albany |
| ACSDS-04 | 42.635444 | -73.765528 | 1st Ave, 25' S of Elmendorf | Albany |
| ACSDS-05 | 42.652744 | -73.748333 | Orange Street btwn Broadway and Water St | Albany |
| ACSDS-06 | 42.663444 | -73.826250 | End of Woodville Ave | Albany |
| ACSDS-07 | 42.643028 | -73.839389 | McCormack Rd at Meadow Ln | Albany |
| ACSDS-08 | 42.663667 | -73.744028 | N Pearl St. 50' SW of Tivoli St | Albany |

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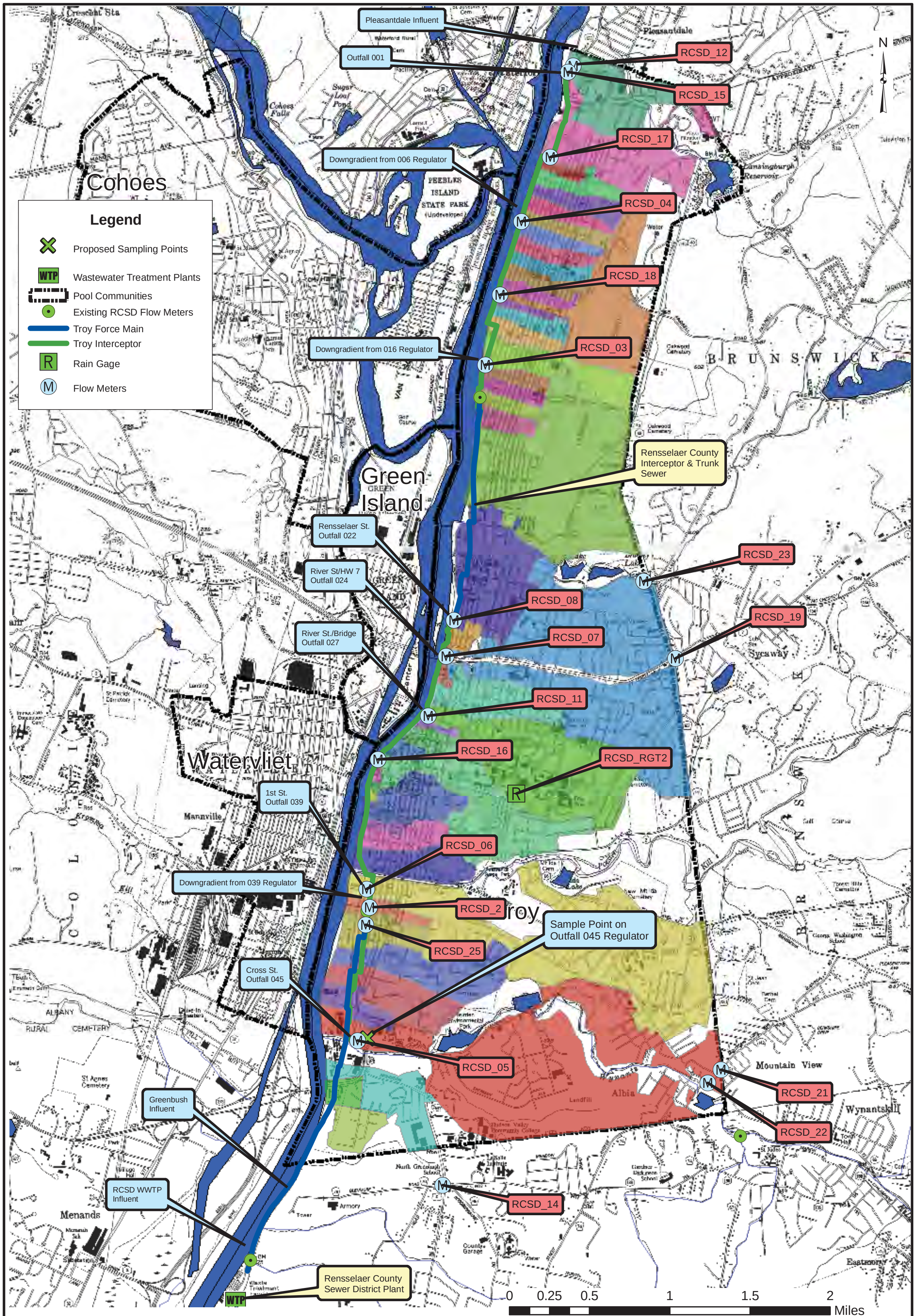
| albany pool / CDM / CHA / CDRPC | ALBANY CSO POOL LONG TERM CONTROL PLAN | ACSD SOUTH CONTRIBUTORY SEWERSHEDS, REGULATORS, CSO LOCATIONS, AND METERS | JUNE 2011 FIGURE 4-3 |
|---|---|---|---|

### 4.4.3 Flow Monitoring for the RCSD CSS Model (City of Troy Contributory Area)

There were 19 flow meters placed within the Troy CSS system contributory to the RCSD Plant. Existing flow meters located at the 106th Street Pump Station, the Monroe Street Pump Station, and on the influent sewer to the RCSD Plant were also used in characterizing the CSS that services Troy and the upstream communities. Figure 4-4 shows updated City of Troy, RCSD contributory sewershed areas, the regulator locations, the CSO locations, and the metering locations. The areas contributory to the metering locations represent approximately 57 percent of the total combined sewer contributory area to RCSD Plant. Table 4-3 further identifies the characteristics of the contributory areas and provides additional information supporting the selection of the metering locations.

TABLE 4-3: Troy Contributory Area CSS Flow Metering Locations

| Flow Metering ID Number | Coordinates | | Flow Metering Location | City |
|---|---|---|---|---|
| | y | x | | |
| RCSD_02 | 42.717306 | -73.695806 | 1st St at Monroe St | Troy |
| RCSD_03 | 42.766250 | -73.680944 | 343 2nd Ave. | Troy |
| RCSD_04 | 42.779186 | -73.676375 | 679 1st Ave. | Troy |
| RCSD_05 | 42.705278 | -73.697389 | Cross St at Burden Ave | Troy |
| RCSD_06 | 42.718950 | -73.696116 | 7 Madison St | Troy |
| RCSD_07 | 42.739944 | -73.686111 | River St at Hoosik St | Troy |
| RCSD_08 | 42.743183 | -73.685100 | Rensselaer St at River St | Troy |
| RCSD_11 | 42.734556 | -73.688389 | Federal St - Parking lot of Fresno's | Troy |
| RCSD_12 | 42.793200 | -73.669833 | River Rd at Roosevelt Ave | Troy |
| RCSD_14 | 42.692133 | -73.687150 | N Greenbush Rd at Glenmore Rd | Troy |
| RCSD_15 | 42.792633 | -73.670433 | 148 River Rd | Troy |
| RCSD_16 | 42.730650 | -73.694583 | Front St at State St | Troy |
| RCSD_17 | 42.784983 | -73.672733 | 842 2nd Ave - parking lot | Troy |
| RCSD_18 | 42.772550 | -73.679083 | 1st Ave at 113th St | Troy |
| RCSD_19 | 42.739528 | -73.658000 | Mt Pleasant Ave at Hoosik St | Troy |
| RCSD_21 | 42.702316 | -73.652933 | 22 Mountain View Rd | Troy |
| RCSD_22 | 42.701139 | -73.654528 | Pawling Ave 50' N of Mountain View Rd | Troy |
| RCSD_23 | 42.746544 | -73.661786 | Frear Park Rd near golf course | Troy |
| RCSD_25 | 42.715716 | -73.696283 | 392 1st St | Troy |

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albany pool CDM CHA CDRPC

ALBANY CSO POOL LONG TERM CONTROL PLAN

TROY CONTRIBUTORY SEWERSHEDS, REGULATORS, CSO LOCATIONS, AND METERS

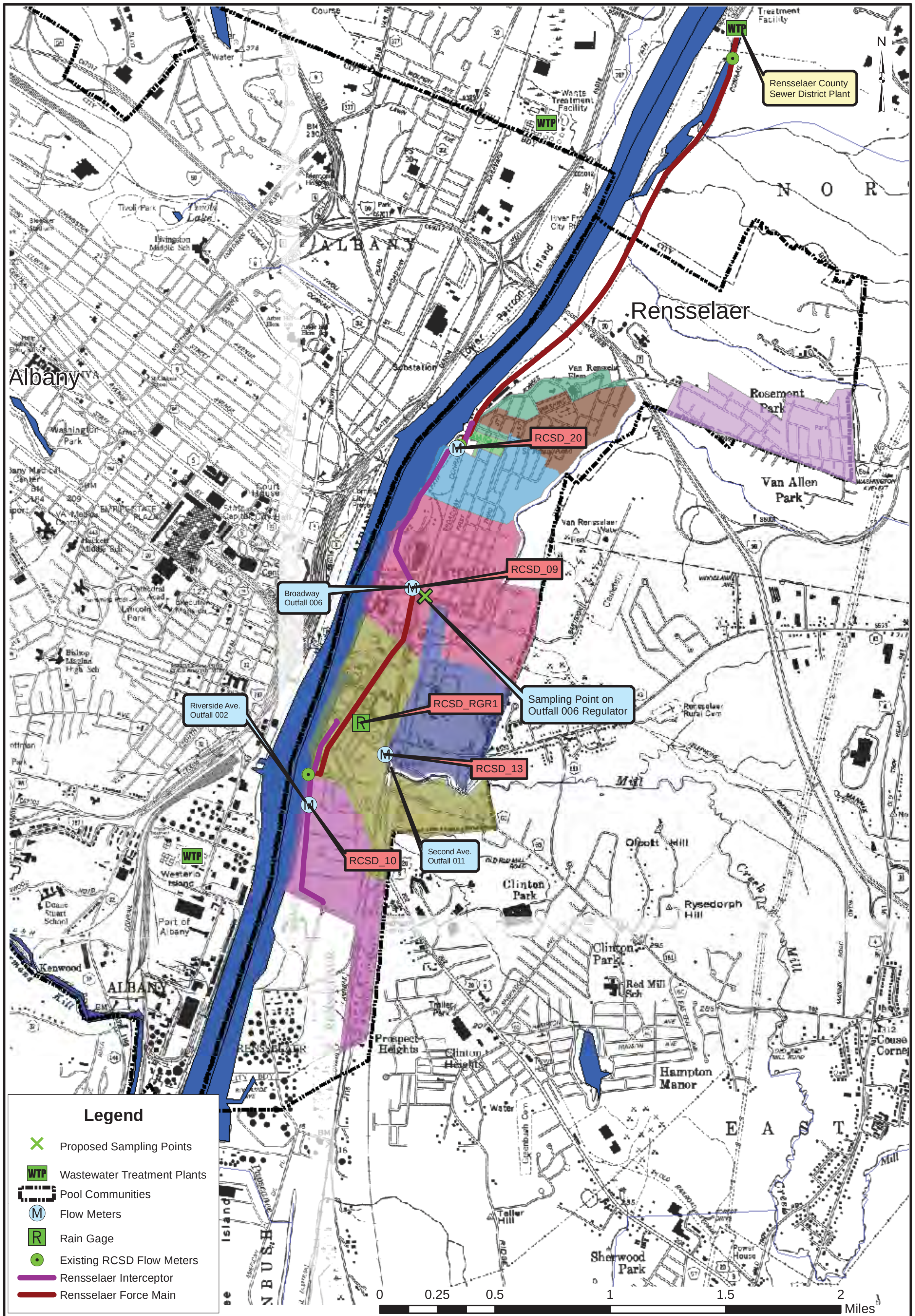
JUNE 2011
FIGURE 4-4

### 4.4.4 Flow Monitoring for the RCSD CSS Model (City of Rensselaer Contributory Area)

Five flow meters were placed within the Rensselaer CSS system contributory to the RCSD Plant. Existing flow meters located at the Columbia Street Pump Station, the Forbes Avenue Pump Station, and on the influent sewer to the RCSD Plant were also be used in characterizing the CSS that services Rensselaer and the upstream communities. Figure 4-5 shows updated City of Rensselaer, RCSD contributory sewershed areas, the regulator locations, the CSO locations, and the metering locations. The areas contributory to the metering location represent approximately 46 percent of the total combined sewer contributory area to the RCSD Plant. Table 4-4 further identifies the characteristics of the contributory areas and provides additional information supporting the selection of the metering locations.

TABLE 4-4: Rensselaer Contributory Area CSS Flow Metering Locations

| Flow Metering ID Number | Coordinates y | Coordinates x | Flow Metering Location | City |
|---|---|---|---|---|
| RCSD_09 | 42.646950 | -73.740733 | Amtrak Maintenance Rd | Rensselaer |
| RCSD_10 | 42.633364 | -73.749692 | 23 Riverside Ave at Belmore Pl | Rensselaer |
| RCSD_13 | 42.636483 | -73.743183 | 2nd Ave | Rensselaer |
| RCSD_20 | 42.655694 | -73.736833 | Forbes Ave Pump Station | Rensselaer |

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ALBANY CSO POOL LONG TERM CONTROL PLAN

RENSSELAER CONTRIBUTORY SEWERSHEDS, REGULATORS, CSO LOCATIONS, AND METERS

JUNE 2011
FIGURE 4-5

## 4.5 Flow Metering Specifications

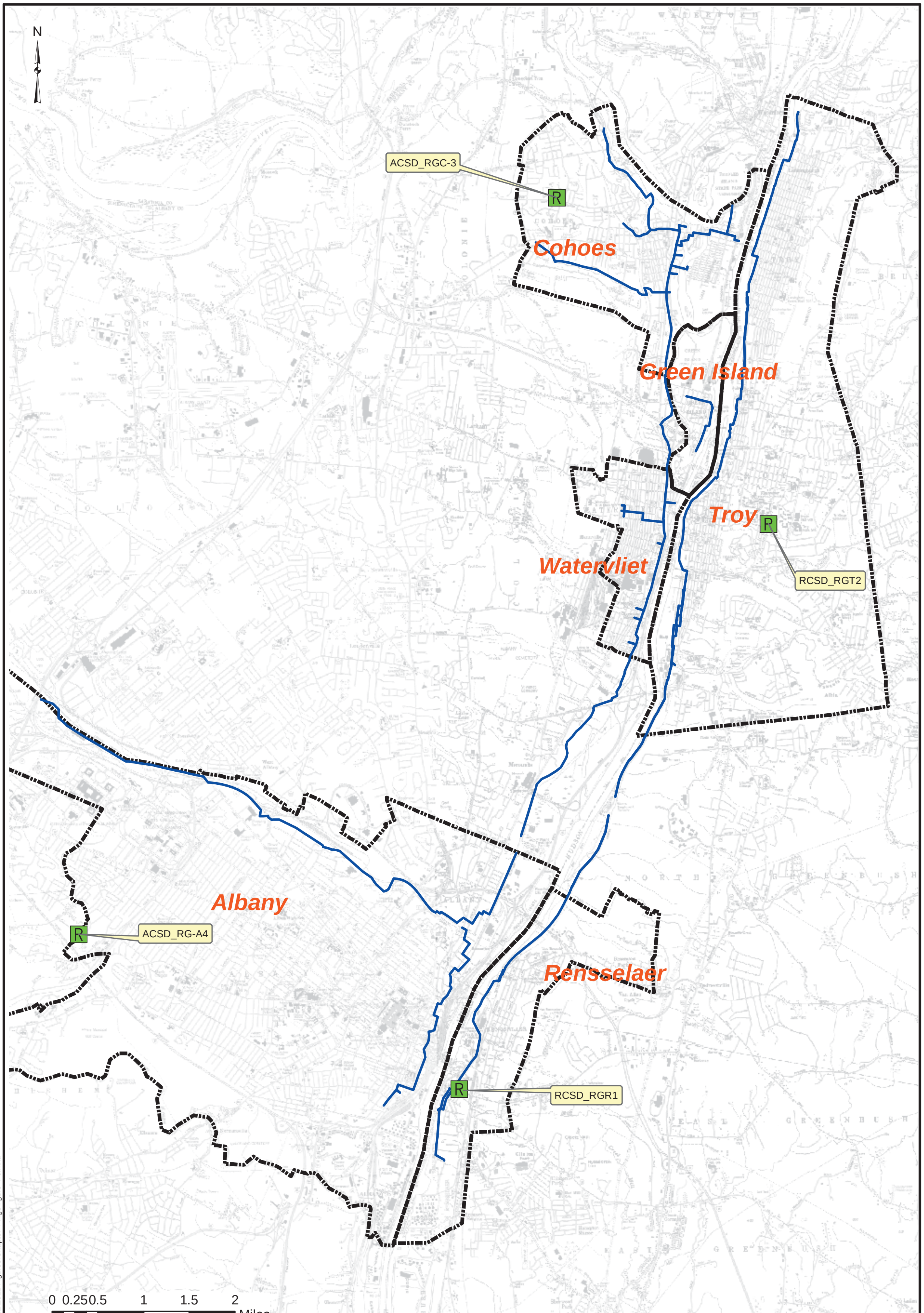
The flow monitoring was accomplished using continuous monitoring devices incorporating a velocity sensor combined with a pressure depth sensor in order to quantify surcharge depths. The flow meters collected flow velocity and depth at 5 minute intervals and computed the flow rate based on the collected data and channel geometry. All data was collected and verified weekly by the specialty subcontractor. The flow monitors were checked every week to update flow data, obtain required calibration data, perform required maintenance, and assure proper operation. Flow monitoring data reduction and review was performed on all data obtained from each flow monitoring location.

## 4.6 Rainfall Monitoring

Rainfall data was required for the flow monitoring and water quality sampling period to assist with the characterization of the CSS. The rainfall data was used to interpret the flow monitoring and water quality sampling data as well as to calibrate the hydraulic model. Rainfall intensity and volume were monitored for the duration of the flow and water quality monitoring effort. Four rain gauges were installed for project purposes, one in each of the four main community areas. The resolution of the rain gauges was set at 0.01 inch of rain and rainfall volume was collected at 5 minute intervals. Data from all rain gauges was downloaded by ADS Environmental Services weekly for the duration of the flow monitoring effort. ADS was also responsible for validation and verification of the data. The rain gauges were inspected, maintained and cleaned weekly throughout the monitoring period. Figure 4-6 shows the rainfall monitoring locations. Table 4-5 further provides information supporting the selection of the rainfall monitoring locations.

TABLE 4-5: Rainfall Monitoring Locations

| Rain Gauge ID Number | Coordinates y | Coordinates x | Flow Metering Location | City |
|---|---|---|---|---|
| ACSD_RG-A4 | 42.663500 | -73.826556 | Woodville PS | Albany |
| ACSD_RGC-3 | 42.779444 | -73.722528 | 319 Vliet Blvd | Cohoes |
| RCSD_RGR1 | 42.638494 | -73.745203 | 62 Washington St (Rensselaer City Hall) | Rensselaer |
| RCSD_RGT2 | 42.727444 | -73.677667 | 15th St at Bouton Rd - Fire Station | Troy |

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CDRPC

ALBANY CSO POOL
LONG TERM
CONTROL PLAN

RAINFALL MONITORING LOCATIONS

JUNE 2011
FIGURE 4-6

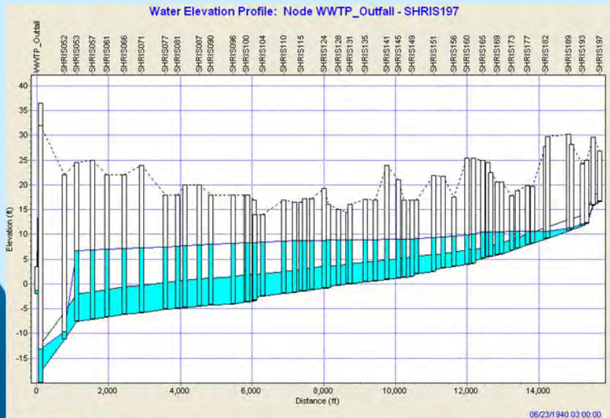
## 4.7 Monitoring Results

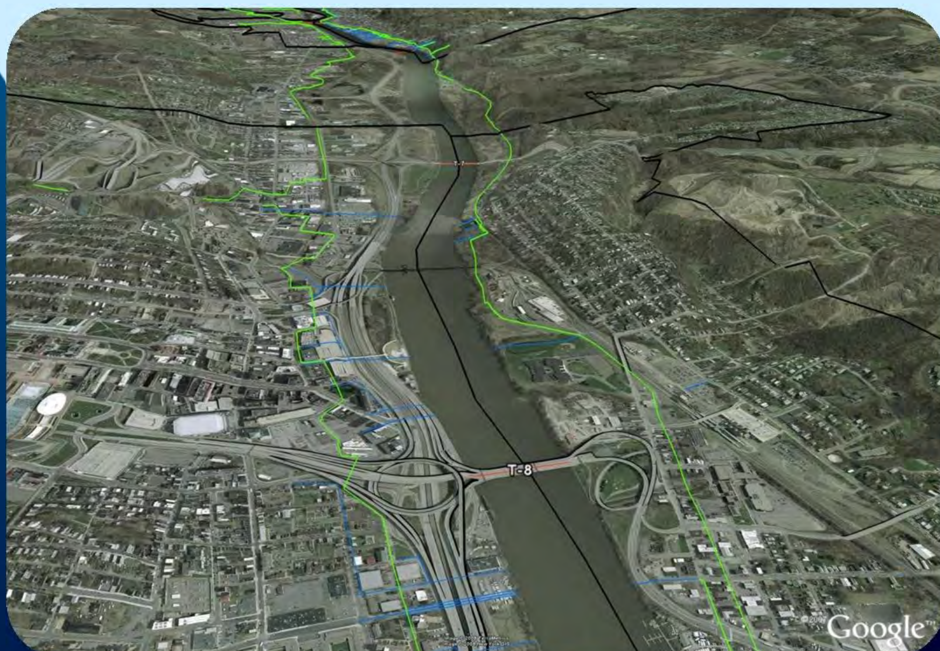
Flow and Rainfall monitoring and CSO sampling were performed to characterize the behavior of the CSS, quantify CSO discharges, and evaluate CSO control alternatives. Flow monitoring data, rainfall data, and and CSS wastewater quality data were collected to support the CSS characterization of the four systems tributary to the ACSD North Plant, ACSD South Plant, the RCSD Plant for flows from the City of Troy, and the RCSD Plant for flows from the City of Rensselaer. Continuous flow and rainfall monitoring were performed for a 12 week period beginning in June 2008 and ending in September 2008. Monitoring was successfully completed for 45 flow metering locations and four rainfall monitoring locations. Sampling was performed at five CSO locations for four rainfall events during the monitoring period.

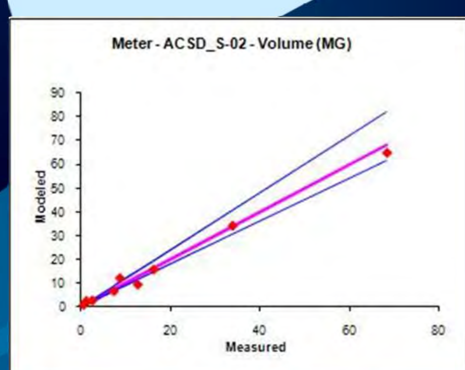
Four volumes of flow monitoring data were prepared by ADS that detailed the data collected over the monitoring period. Site installation reports and details, average conditions, data quality summaries, monthly scatter graphs, and monthly flow velocity and depth plots were provided for each of the 45 metering locations. Daily rainfall summaries and hyetographs were also provided for each of the four rainfall monitoring locations. Independent volumes were prepared for areas tributary to the ACSD North Plant, ACSD South Plant, the RCSD Plant for flows from the City of Troy, and the RCSD Plant for flows from the City of Rensselaer, respectively. These documents are provided in the appendices of the Receiving Water Quality Assessment Report (included in Appendix B). Sufficient data was collected for use in calibration of the CSS models as discussed in Chapter 5.

Chapter 5

# CSO Model Development






Joint Venture Team
albany pool

# 5.0 CSO Model Development

## 5.1 Introduction

The APJVT developed CSS models to characterize the combined sewer systems, quantify CSO discharges and evaluate CSO control alternatives. The modeling was performed in accordance with the September 2007 *Combined Sewer System Modeling Work Plan* approved by NYSDEC (included in Appendix F).

The CSS models simulate conveyance of combined and sanitary flows through interceptor sewers, selected trunk sewers, CSO regulators and overflow conduits using USEPA SWMM5 modeling software. Three modeling teams developed and calibrated four computer models. Each model encompasses the complete collection system upgradient of an entrance to one of the three WWTPs serving the Pool communities:

- Malcolm Pirnie modeled the area tributary to the ACSD North WWTP, which serves the primarily combined sewer systems from Cohoes, Watervliet and Green Island. The WWTP also receives separate sanitary wastewater from Albany, Colonie and Guilderland conveyed directly to the plant via the Patroon Creek Interceptor;
- CHA modeled the area tributary to the ACSD South WWTP, which primarily serves the mostly combined sewer systems from Albany;
- CDM developed individual models for Troy and Rensselaer; these communities discharge independently to the RCSD WWTP. Additional sanitary wastewater is conveyed through these sewer systems from North Greenbush, Brunswick, and Schaghticoke.

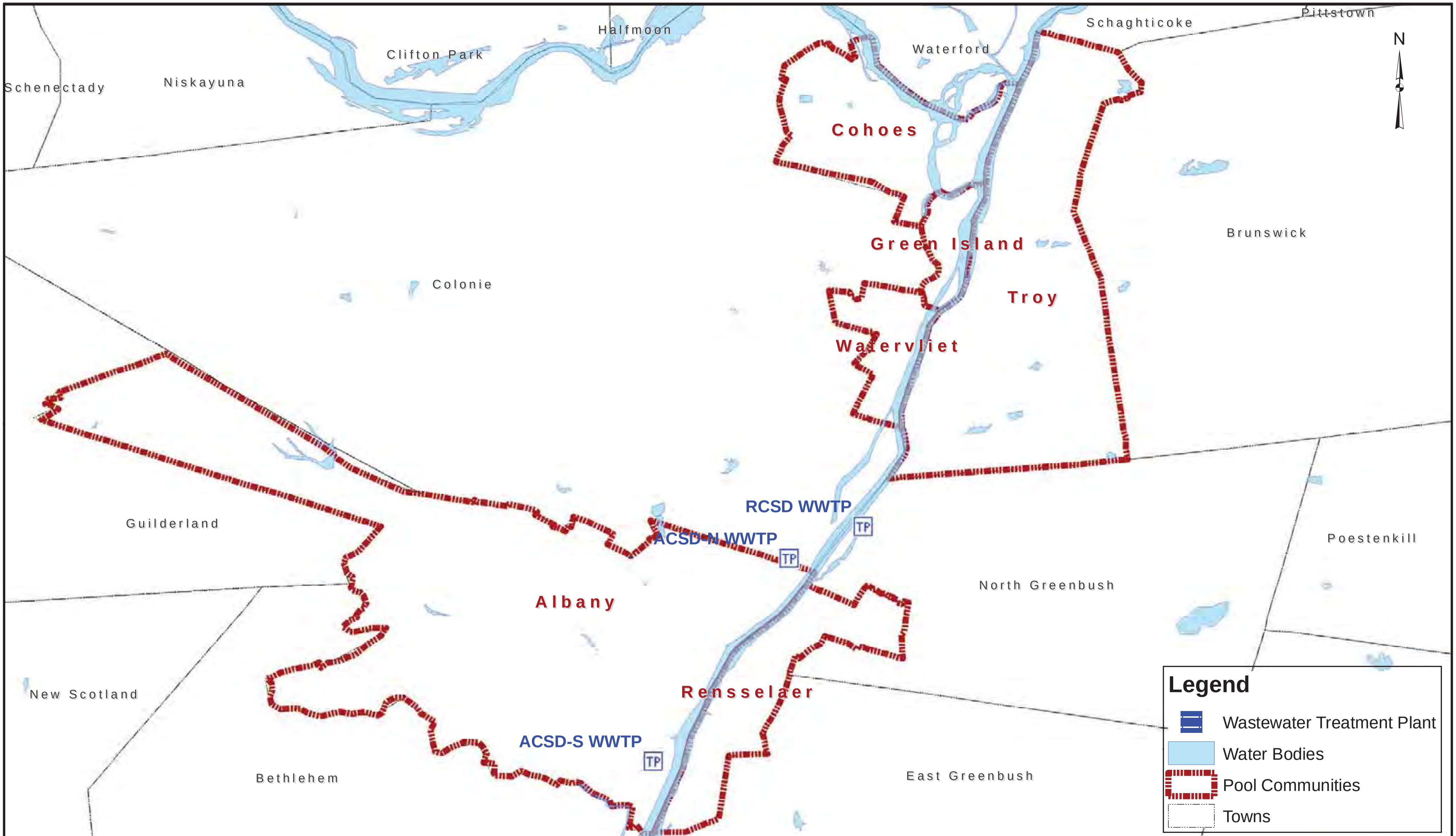
Figure 5-1 shows the modeled combined sewer communities.

The development, calibration and results of the baseline modeling effort are detailed in the *CSO Model Development and Baseline Conditions Report* (included in Appendix G) and summarized in the following sections.

## 5.2 Model Development

The planning-level sewer system models extend along a 12-mile stretch of the Hudson River, and include the interceptor sewers, all regulator structures and overflow points for the ACSD and RCSD. The hydraulic network of each model begins a minimum of one pipe segment above each regulator structure, although long runs of principal upgradient sewers were included with limited detail where needed. Record drawings, GIS data, flow monitoring inspection reports and field surveys were used to develop the geometry of the piping network. The networks incorporate real-time control rules, where needed, to simulate gate operations. These rules were developed based on standard operating protocols of the sewer districts and modified, as necessary, during the calibration process to replicate the metering period conditions.

The models are bounded at the WWTPs and CSOs with a flow constraint or other appropriate boundary condition. Where river stage potentially influences sewer system hydraulics upgradient of regulators, the models include the overflow pipe and a time-series boundary representing river level.




| | | | |
|---|---|---|---|
| albany pool Joint Venture Team CDM Malcolm Pirnie CHA | ALBANY POOL CSO LTCP | OVERVIEW OF THE ALBANY POOL CSO CONTRIBUTORY AREAS | FIGURE 5-1 |

Pipe hydraulics were simulated using SWMM's dynamic wave solution which accounts for channel storage, backwater, form losses, flow reversal, and pressurized flow. The models simulate diurnally varied sanitary flow, monthly varied baseflows, and rainfall-runoff. The baseflow component represents dry weather infiltration into the collection system; in the case of the City of Troy model, baseflow is also used to represent inflow from streams connected to the combined system. The sanitary flow and baseflow were specified with average values estimated from sewershed area, piping size, and population served, and then calibrated to fit the flow metering data.

Runoff is simulated using SWMM's non-linear reservoir formulation for all combined, separate sanitary and stormwater-only areas contributing to the sewer systems. Within each model the contributing area was broken into subcatchments according to elevation and sewer network layout. Each subcatchment was assigned hydrologic parameters including contributing area, imperviousness, pervious routing fraction, catchment width, slope, roughness, depression storage, and soil infiltration characteristics. In separated and partially separated sewersheds in Troy, Rensselaer, and Albany South, contributing areas were adjusted to represent the area contributing rainfall-dependent inflow and infiltration (RDII) to the sewer system. The degree of separation for each catchment was estimated from sewer maps, interviews with community staff, and flow metering data. This same methodology was applied to sanitary sewersheds in outside communities that contribute to Pool sewer systems. The Albany North system had a more significant portion of separate sanitary contributing area (primarily along Patroon Creek) compared to the other areas. Because of this, RDII into these areas was simulated by applying pervious runoff from SWMM's runoff model, with the Green-Ampt infiltration model used to drive the pervious runoff calculations. For all models, average imperviousness percentages were computed from National Land Cover Data (NLCD) imperviousness data for each subcatchment. SWMM's catchment width parameter was set proportional to the square root of the area and then calibrated to observed flows. Catchment slope was computed from GIS zonal statistics or specified with model-wide values based on overall drainage characteristics. Infiltration parameters were selected based on predominant soil types in the study area. The remaining parameters were set in line with SWMM guidance documents.

## 5.3 Individual Models

General characteristics of the models are presented in Table 5-1 and discussed below.

TABLE 5-1: Model Characteristics

| System | CSOs | Manholes | Pipes (miles) | Combined Sewershed (acres) [1] | Sanitary Sewershed (acres) | Catchments |
|---|---|---|---|---|---|---|
| Albany North | 24 | 550 | 30 | 2,800 | 23,700 | 68 |
| Albany South | 11 | 250 | 13 | 4,800 | 1,700 | 30 |
| Rensselaer | 9 | 90 | 8 | 740 | 700 | 17 |
| Troy | 48 | 460 | 33 | 5,5001 | 11,300 | 97 |

(1) includes stormwater-only areas

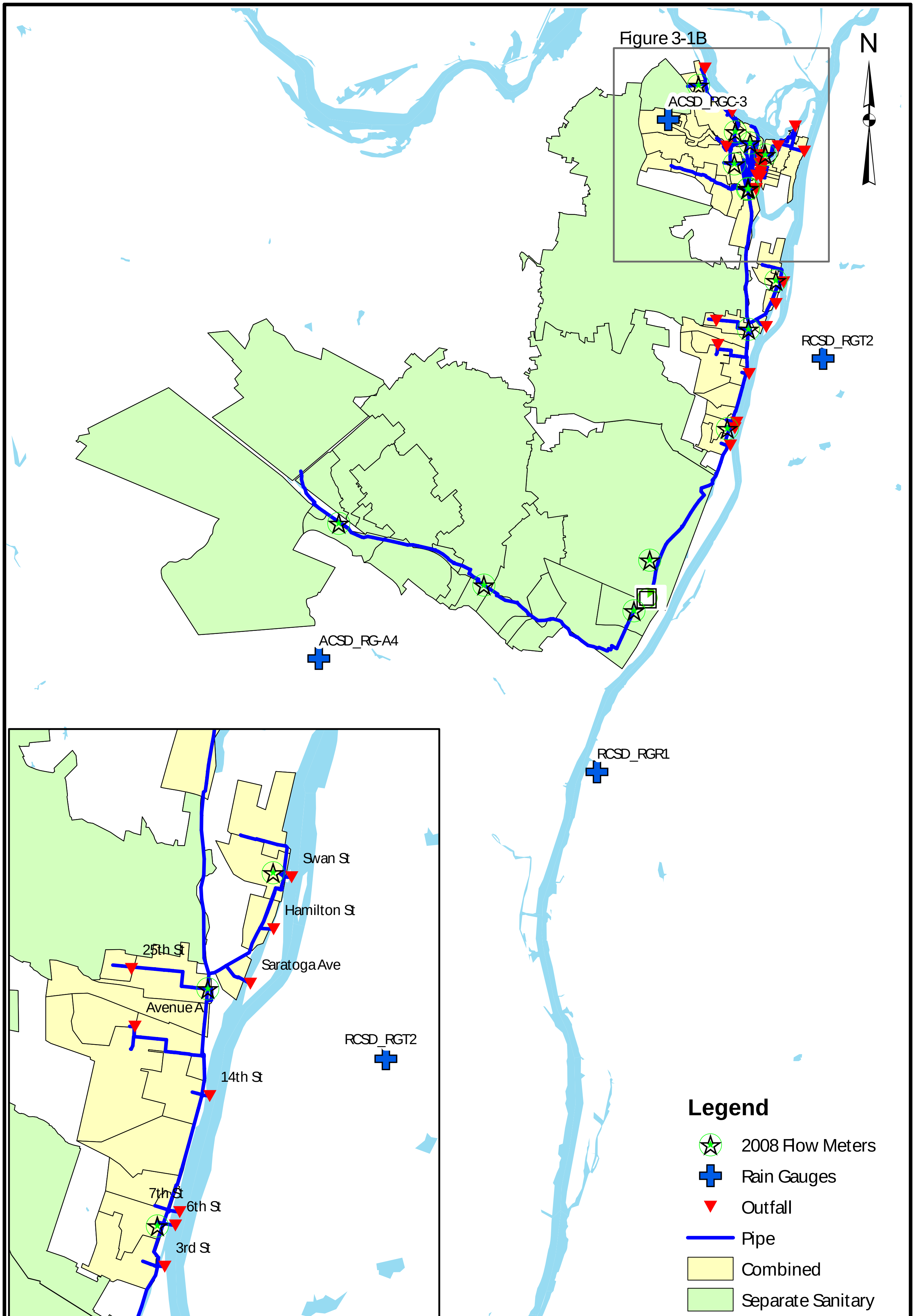
### 5.3.1 Albany North

Figure 5-2 shows the Albany North model pipe network, catchments, and CSO locations. The City of Cohoes' main trunk sewer drains south along the Hudson River. Tributary sewers enter the trunk sewer from the west via gravity, while four force main connections bring pumped flow from the east. Multiple CSO regulators along the trunk sewer discharge to the Mohawk and Hudson Rivers during wet weather. The principal regulator structure in the City of Cohoes combined sewer system, "Little C", is located where the City's main trunk connects to an interceptor sewer.

The City of Cohoes's interceptor sewer continues three-quarters of one mile downstream of Little C. South of Cohoes, the interceptor is ACSD's responsibility and is known as the Hudson River Interceptor (HRI). The HRI receives flow from Watervliet's and Menands' gravity sewers from the west and Green Island's force main connection from the east. Multiple CSO regulators on Watervliet and Green Island tributary sewers divert excess wet weather flow to the Hudson River. The combined flow continues south in the HRI for two and one-half miles, collecting sanitary flows from unincorporated Colonie before treatment at the ACSD North WWTP. All flow entering the HRI is metered by ACSD for billing purposes.

ACSD's Patroon Creek Interceptor collects sanitary flow from the Town of Colonie and northern portions of the City of Albany and conveys wastewater east for seven miles to the ACSD North WWTP. This sewer enters the plant's influent manhole seven feet above the HRI which results in it behaving hydraulically independent for most HRI backwater conditions. All flows entering the Patroon Creek Interceptor are metered by ACSD.

A peak capacity of 90 million gallons per day (mgd) was assumed at the ACSD North WWTP for establishing baseline conditions. This is based upon the estimated peak hydraulic firm capacity of the WWTP headworks pumps.



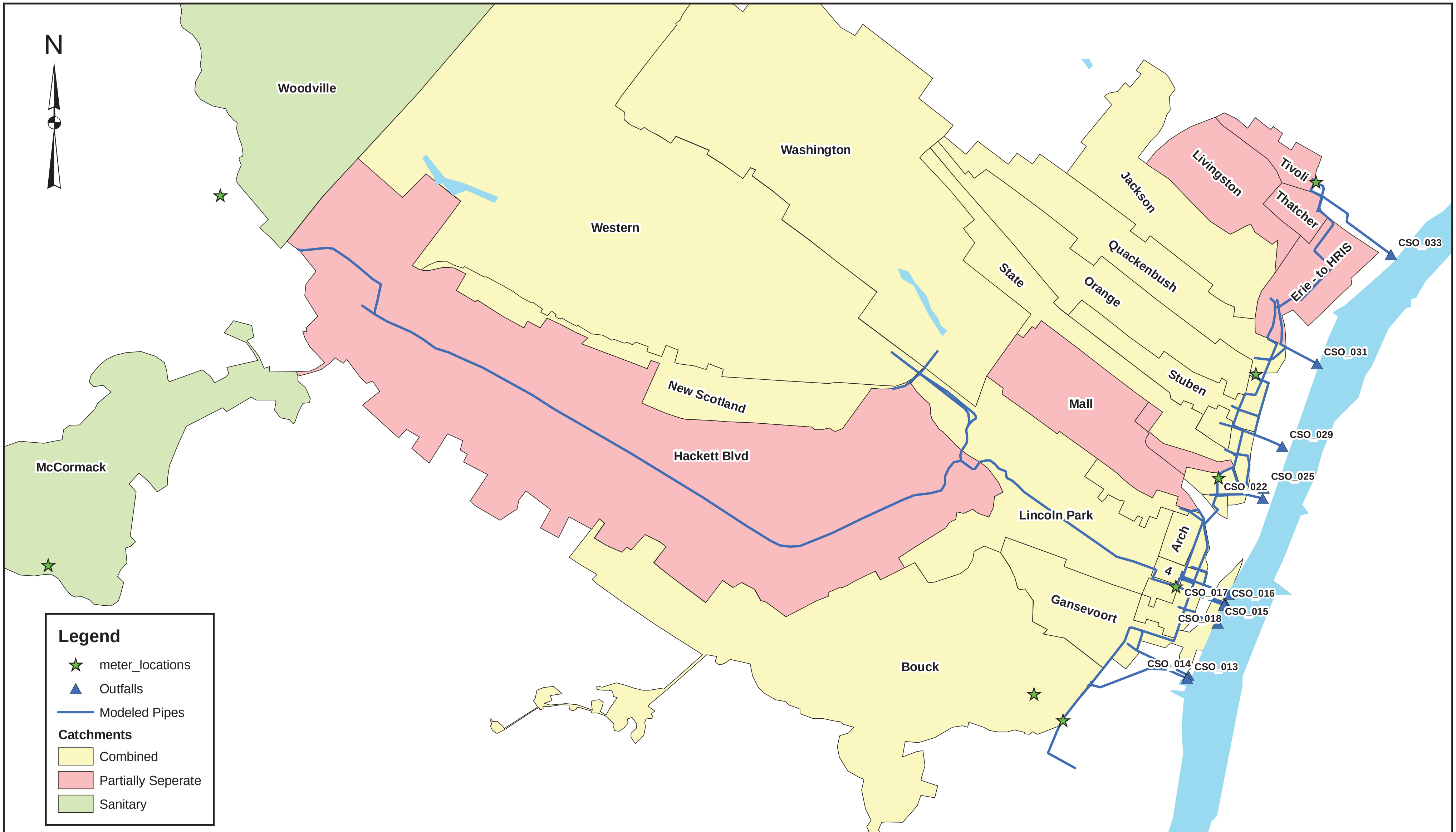

| | | | |
|---|---|---|---|
| albany pool CDM CHA | ALBANY POOL CSO LTCP | ALBANY NORTH | FIGURE 5-2 |

### 5.3.2 Albany South

Figure 5-3 shows the Albany South model pipe network and catchments. The Albany South sewer collection system features the main Hudson River Interceptor Sewer (HRIS) ranging in size from 36-inch diameter to a 54-inch diameter and paralleling the Hudson River through downtown Albany that conveys sewage to the ACSD South WWTP. The Beaver Creek Trunk Sewer is an 8-foot by14.5-foot box culvert and conveys combined sewage from three-fourths of the ACSD South WWTP sewershed to the “Big C” regulator, where flow continues to the HRIS or is diverted to the Hudson River.

The ACSD South WWTP sewershed was delineated into subcatchments for use in the model. The Beaver Creek sewershed upgradient of the Big C regulator was subdivided into six subcatchments. Its Woodville and McCormack subcatchments are fully separated and pumped into the Beaver Creek trunk sewer, while the others are partially separated. Other subcatchments throughout the city, tributary directly to the HRIS, are also partially separated.

Sluice gates at the ACSD South WWTP are used to limit peak wet weather flow, as reported to the modeling team by ACSD personnel. WWTP records indicate the plant rarely receives sustained flows above 35 mgd. The APJVT thus imposed a 35 mgd inflow limit at ACSD South WWTP for baseline simulations.

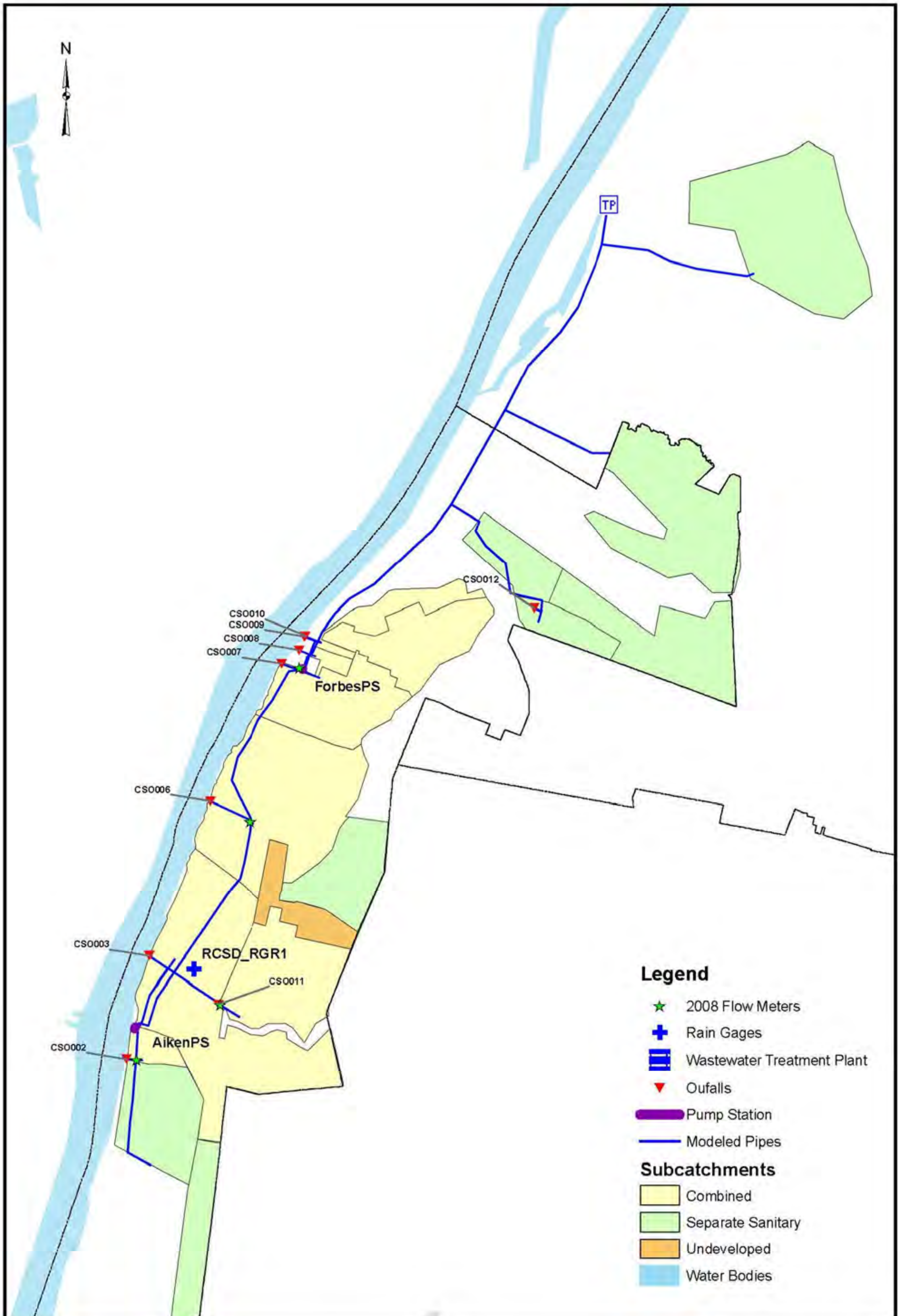



| | | | |
|---|---|---|---|
| albany pool Joint Venture Team CDM MALCOLM PIRNIE CHA | ALBANY POOL CSO LTCP | ALBANY SOUTH | FIGURE 5-3 |

### 5.3.3 Rensselaer

Figure 5-4 shows the Rensselaer model pipe network and catchments. The Rensselaer sewer system parallels the Hudson River draining north to the RCSD WWTP. Its interceptors, regulators, and pump stations are owned and operated by RCSD. The southern portion of the City, between the Port of Albany-Rensselaer and Herrick Street, is serviced by two gravity interceptor sewers that convey wastewater to the 11.6 mgd Aiken Avenue Pump Station (PS). It lifts flow from 0 feet NGVD to 14 feet and discharges into a one-mile long force main. Two miles north of Aiken Avenue, flow enters the 14.2 mgd Forbes Avenue PS. The Forbes Avenue sub-system serves the north of the City, between Herrick and Washington Streets. At Forbes PS, wastewater is pumped from 0 feet NGVD to 17 feet and discharged via a three-mile force main to the RCSD WWTP in North Greenbush. The Washington Avenue and Sterling Ridge Drive sewersheds on the north end of the City discharge directly to the RCSD force main via gravity sewers. Other tributary sewers also enter the force main from the east via gravity, including sanitary wastewater from North Greenbush.

There is considerable sewer separation throughout the City of Rensselaer. Storm drains and open channel drainage that discharge directly to the Hudson River are not included in the sewer model.



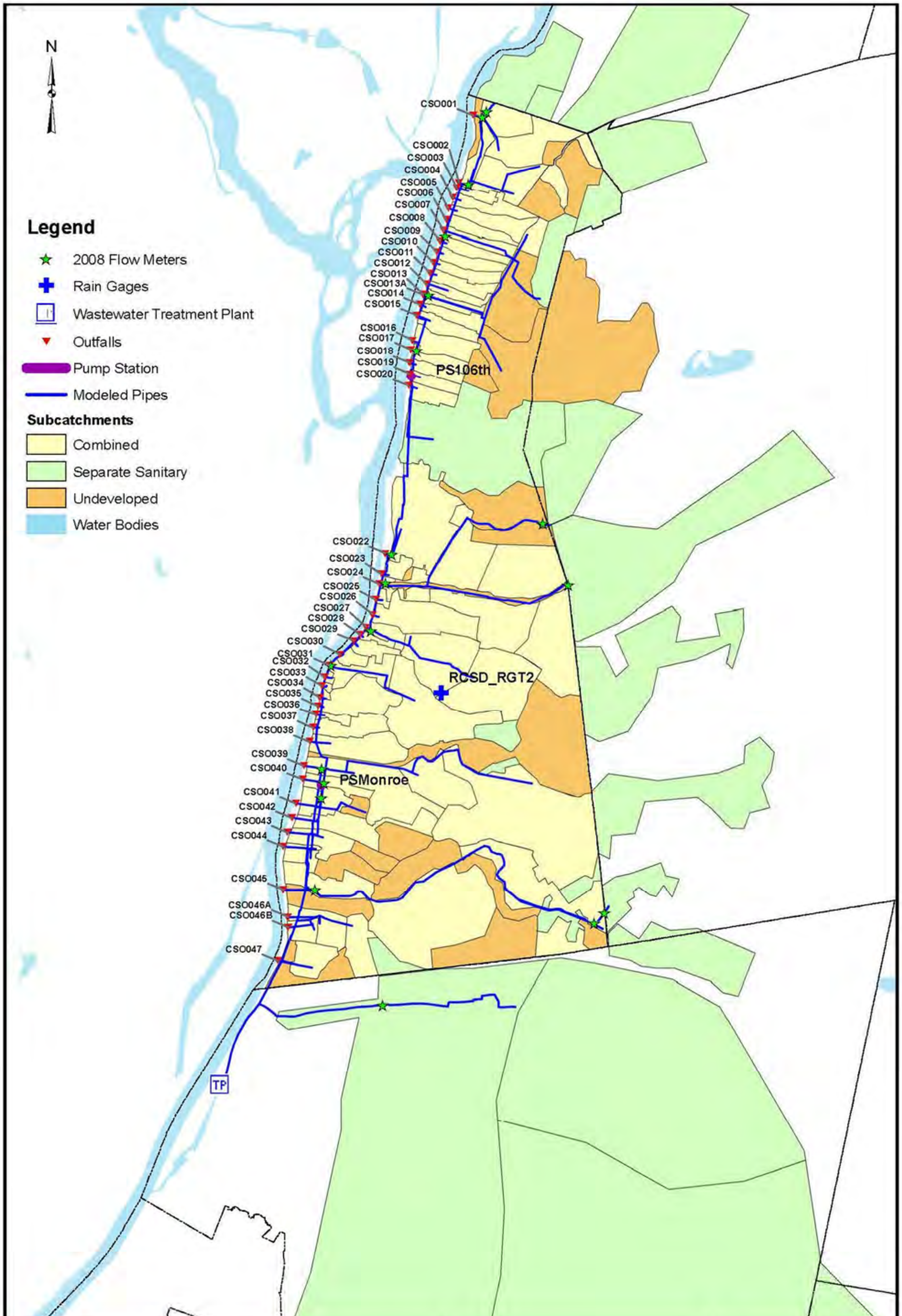

| | | | |
|---|---|---|---|
| albany pool Joint Venture Team CDM Malcolm Pirnie CHA | ALBANY POOL CSO LTCP | RENSSELAER | FIGURE 5-4 |

### 5.3.4 Troy

The Troy model is shown in Figure 5-5. Troy's interceptor sewer system drains south from the City's northern border towards the RCSD WWTP in North Greenbush. The interceptor, regulators and pump stations are owned and operated by RCSD. A gravity interceptor sewer ranging from 16 to 36 inches diameter services the portion of the City between River Road and 102nd Street. The interceptor collects wastewater from trunk sewers tributary to CSOs 001 through 020 and conveys wastewater to the 8.1 mgd 106th Street PS. Flow is then conveyed via a 24-inch force main to a gravity interceptor sewer, which runs from Rensselaer Street to the 31.2 mgd Monroe Street PS. The gravity sewer collects wastewater from trunk sewers tributary to CSOs 022 through 040. Another gravity interceptor sewer collects wastewater from areas tributary to CSOs 041 through 046 and conveys flow to Monroe Street PS. Wastewater is conveyed from Monroe Street via a 42-inch force main to the RCSD WWTP. Combined sewage from areas tributary to CSOs 046A, 046B and 047 enter the pressurized force main along with flow from the North Greenbush Trunk Sewer and Rensselaer Technology Park between Monroe Street PS and the WWTP.

RCSD personnel reported that sluice gates at the 106th Street and Monroe Street pump stations are used to limit peak wet weather flow into the pump stations, thereby reducing blinding of the manual bar racks, and preventing flooding. The gates are manually raised and lowered by RCSD before, during, and after rain events. In the model these gates were simulated as orifices with real-time controls. These controls were calibrated using RCSDs records of gate movements in conjunction with the flow metering data.

The City of Troy identified three specific locations where streams currently discharge to the combined sewer system. The contributing drainage areas were delineated using USGS topography, and base stream flow patterns were estimated from available flow gauge data on nearby streams. RCSD and the City also indicated that tide gates at most of the regulators north of the Federal Dam (where the outfalls are typically submerged) are susceptible to leakage under high stage conditions, allowing river water into the RCSD regulator and interceptor. This condition was observed during the 2008 field survey at the regulators for CSOs 003, 006, 007, 012, 014, 015, and 017. This inflow was modeled by allowing leakage through tide gates at CSOs 006 and 012.




albany pool | ALBANY POOL CSO LTCP | TROY | FIGURE 5-5

## 5.4 Model Calibration

Each model was calibrated for dry weather flow, wet weather flow, and a multi-month continuous simulation using the flow metering and rainfall data collected in 2008 and detailed in Chapter 4 of this report. The models were adjusted within reasonable limits to minimize differences between observed and modeled timing of peaks and troughs, peak flow rates, peak velocity, and total volume at each metered location. Calibration was assessed by evaluating differences between observed and modeled values for each type of simulation. Calibration was primarily based on visual match of metered and simulated hydrographs to match peak flow, volume and timing in accordance with USEPA's Combined Sewer Overflows: Guidance for Monitoring and Modeling (1999) guidelines. Quantitative comparisons between model results and monitored data followed guidelines in the UK Wastewater Planning Users Group Code of Practice for the Hydraulic Modeling of Sewer Systems (2002).

## 5.5 Calibration Parameters

### 5.5.1 Dry Weather Flow

Dry weather calibration was performed for a four-day period in late August at most meter locations. The models were adjusted to provide reasonable correspondence between measured and observed flows, depths, and velocities throughout the calibration period. Principal calibration parameters were the sanitary and baseflow values and patterns, and pipe roughness. Roughness for pipes with very low flow depths in dry weather was only calibrated to wet weather data, as roughness near the pipe invert may not represent overall pipe condition. Efforts to replicate the diurnal pattern observed at each site were similarly limited, as minor fluctuations in dry weather flow have minimal bearing on total flow during storms. Dry weather flow calibration plots of depth, velocity, and discharge for each meter location are available in the appendices of the *CSO Model Development and Baseline Conditions Report* (included in Appendix G).

### 5.5.2 Wet Weather Flow

The models were adjusted to match observed hydrographs for three principal storms at each flow meter. Catchment width, routing fraction, and pipe roughness were principal calibration parameters. For partially separated catchments, contributing area was also adjusted.

The July 13 and July 23 events were chosen as principal storms for calibrating all four models. Due to variations in rainfall and flow meter data availability, other storms were used in different locations as a third principal calibration event. The third event was September 6 for Albany North and Rensselaer, August 2 for Albany South, and June 6 for Troy. Event details are discussed in Chapter 4 and the *Receiving Water Quality Assessment Report* (included in Appendix B). Calibration plots of observed and modeled depth, flow rate, and velocity were produced for each meter location for each of the applicable principal storms as documented in the *CSO Model Development and Baseline Conditions Report* (included in Appendix G).

Each model was run continuously for the three month metering period to assess its long-term performance across a spectrum of observed storms. For the selected calibration storms at each flow meter, metered and simulated flow volumes, peak discharge, and peak depth were compared to observed values. Scatterplots were prepared to compare metered and simulated flows, volumes, depths, and velocities during all chosen events. A diagonal on each scatterplot marks ideal correspondence between observations and modeled results; points plotted above the 45-degree line indicate where the modeled result is larger than the observed value, while points below the line indicate where the model results are lower than the observed values. Points plotted within a specified range of values were considered reflective of a well calibrated model. The ideal range of modeled peak flows within +25% to -15% of measurements, volumes within +20 to -10%, and depths within +0.5 to -0.3 ft, and velocities within ±10%, are shown on each scatterplot which are available as appendices in the *CSO Model Development and Baseline Conditions Report* (included in Appendix G).

## 5.6 System-Specific Issues

### 5.6.1 Albany North

The HRI receives combined sewage from Cohoes, Green Island, and Watervliet. Storm flows from some Cohoes subcatchments exhibited typical combined system high inflow peaking factors along with extended recession limbs, indicating significant infiltration. To simulate this phenomenon, slow response subcatchments representing groundwater infiltration were added to portions of the Albany North Model. This allowed the model to better match observed data during the end of large events or during back-to-back storms.

### 5.6.2 Albany South

Metering showed infiltration or inflow of 2.7 mgd entering the interceptor between Big C and the ACSD South WWTP which represents more than 10% of the WWTP average daily flow. This section of the interceptor was built in the early 1900s; it is likely subject to higher than average rates of infiltration. In addition, based on discussions with the Albany Water Board and ACSD personnel, the APJVT believes there may be leaking or missing tide gates along this reach. Additional baseflow was assigned to the interceptor sewer at each manholes between the ACSD South WWTP and Big C to account for this suspected infiltration and/or inflow.

### 5.6.3 Rensselaer

Much of the Rensselaer sewer system is partially separated; separate storm drains throughout the City convey stormwater to drainage outfalls along the Hudson River and various tributaries. Calibration of the model required adjustment of the effective contributing area for many catchments. The contributing area for the CSO 003 sewershed was reduced to 60 percent of its total service area, while the contributing area for the CSO 011 sewershed was reduced to 40percent of its service area. These figures do not reflect the precise amount of separation within the sewersheds, but are indicative of extensive separation and diversion of stormwater out of the sewer system. RCSD flow meter 9, located on the influent to the CSO 006 regulator, operated very erratically; it produced valid depth data throughout the metering program, but its velocity sensor failed in the July 13 calibration event, as well as in the middle of the July 23 storm. It operated well at the end of the metering program, and produced valid data throughout the September 6 storm.

### 5.6.4 Troy

The Troy sewer system accepts natural drainage from areas within the City of Troy and from the Town of Brunswick. The calibration process helped identify the principal sources of drainage. Pond outlet structures and pumps, associated with drainage from outlying areas, were added to the model. To represent the variations in drainage baseflow entering the sewer system, observed flows from the 2008 metering program were correlated with stream flow data at USGS gaging stations in the Albany area. Monthly baseflow patterns were established based on long-term mean stream flow.

## 5.7 Model Definition of Existing System Performance

To evaluate the existing system performance, a long-term simulation was performed. A five-year period was selected to obtain more robust statistics than would be possible from a single representative year simulation. Precipitation data from the Albany Airport from 1948 through 2006 was analyzed to identify a 5-year period with precipitation close to long-term averages. The years 1985 through 1989 were selected as having representative precipitation. Prior to use in the models, the hourly data were synthetically disaggregated to five-minute frequency using NetSTORM software to account for short-duration, high-intensity rainfall and to ensure compatibility with the calibrated conditions.

## 5.8 Calibrated Model Adjustments

Model adjustments from the calibrated conditions, were necessary to eliminate model-predicted dry weather overflows in Troy. Initial long-term simulations indicated the likelihood of substantial dry weather overflow from CSO regulators downgradient of several areas receiving natural drainage, particularly during periods of high groundwater in the spring. These locations were reviewed with the City of Troy and subsequent field investigation in 2009 led to confirmation of sporadic dry weather overflow at two locations, CSO 013 and CSO 024. As no dry weather overflows were observed at the remaining locations, minor modifications to the modeled regulator geometry were made to eliminate these predicted overflows. At the confirmed locations, the City and RCSD are implementing improvements to the regulators to improve sewer hydraulics to remediate the overflows, and these improvements were incorporated into the baseline model.

Adjustments were also made to the Albany South model. Following the submission of the *CSO Model Development and Baseline Conditions Report* (included in Appendix G), the following omissions/errors were discovered in the model.

- A permitted CSO (CSO 012) discharge location on the Krum Kill was not included
- Three of the regulator structures (CSO 016, 017 and 018) that were included and reported as individual CSO locations actually discharge, and are permitted, via a single outfall (CSO 016)
- The permitted CSO outfall numbers were updated

The APJVT updated the model and ran simulations for the calibration period to predict the volume and frequency of CSO discharging to the Krum Kill. The addition of CSO 012 did not significantly affect the calibration plots of metered vs. simulated data at other calibration points, so no further parameters were adjusted. The addition of CSO 012 did, however, affect the long-term simulation results and, as such, the results for Albany South reported in this LTCP do not exactly match the statistics reported in the CSO

Model Development and Baseline Conditions Report. The permitted CSO outfall numbers was also updated following the submission of the CSO Model Development and Baseline Conditions Report (included in Appendix G), and therefore do not match.

CDRPC predicts a 2 percent population decline in Pool communities from 2007 to 2040 (statistics accessed at www.cdrpc.org/Proj-Pop.html). Growth of 0.3 percent and 4 percent is predicted for Albany and Green Island respectively, while population declines from 3percent to 6 percent are predicted for the other communities. Because these population changes are small and their correlation with water use is difficult to forecast, the calibrated existing condition sanitary flows in the models were not changed for baseline simulations.

## 5.9 CSO Statistics

Baseline CSO statistics and percentage capture were computed from the five-year simulation results. Table 5-2 lists average annual CSO volume, duration of discharge, number of overflow events, and percent capture for each APCs. Percent capture is the ratio of flow treated at each WWTP during wet weather to the total flow entering the collection system during wet weather.

TABLE 5-2: Baseline Annual CSO by Community

| Community | Volume of Overflow (MG) | Duration of Overflow (Hours) | Number of Overflow Events | Percent Capture |
|---|---|---|---|---|
| Cohoes | 21 | 380 | 61 | |
| Green Island | 4.6 | 220 | 41 | |
| Watervliet | 4.8 | 330 | 44 | |
| ACSD North | 30 | | | 91 |
| Albany / ACSD South | 739 | 637 | 58 | 66 |
| Rensselaer | 20 | 192 | 52 | 88 |
| Troy | 447 | 723 | 65 | 67 |
| RCSD | 467 | | | |
| Albany Pool total | 1,236 | | | 70 |

While percent capture for the ACSD North and Rensselaer systems exceed the “presumptive approach” criterion (85 percent capture), overflow frequency in these systems is much greater than the limit of four to six events annually specified in the presumptive approach. These estimates are consistent with other smaller communities that are partially separated or have lower density development. These systems overflow frequently, but with shorter durations, smaller discharge volume, and higher capture rates than in larger cities.

In Albany and Troy, CSOs discharge to the River during most storms. Capture rates are well below 85 percent and overflow frequency far exceeds four per year. These results are consistent with the larger combined sewer service areas, which typically have larger trunk sewers and outfalls and limited available interceptor system capacity. Overflows from these sewersheds tend to be frequent and longer, producing much higher overflow volumes than the smaller communities.

An overall Albany Pool percent capture was estimated using the total system inflow and WWTP inflow during wet weather from each of the four models. Because of the significant influence of the larger systems (ACSD South and Troy), the Albany Pool community's total percent capture was estimated to be 70 percent, well below the 85 percent "presumptive approach" criterion.

Table 5-3 lists the top ten CSOs by annual discharge volume. The Big C overflow in Albany accounts for 43percent of all CSO discharged in the APCs. Together, the six largest CSOs by volume, all in Albany and Troy, account for 819 million gallons (MG), two-thirds of the total Albany Pool CSO volume. CSO statistics for each individual community are presented with a discussion of each respective sewer system in Section 5.10.

TABLE 5-3: Most Active CSOs by Volume

| Community | Outfall | Location/Regulator Identifier | Volume of Overflow (MG) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|---|---|
| Albany | 016 | Big C | 532.0 | 452 | 45 |
| Albany | 013 | Bouck | 94.1 | 637 | 58 |
| Troy | 035 | Liberty St | 55.2 | 518 | 53 |
| Troy | 031 | State St | 53.7 | 415 | 52 |
| Albany | 026 | Maiden, Orange, Steuben | 48.1 | 496 | 56 |
| Albany | 030 | Livingston, Jackson, Quackenbush | 35.8 | 260 | 55 |
| Troy | 024 | Hoosick St | 24.7 | 100 | 33 |
| Troy | 037 | Adams St | 24.6 | 346 | 50 |
| Troy | 026 | Jacob St | 23.0 | 429 | 62 |
| Troy | 027 | Federal St | 19.3 | 216 | 50 |

## 5.10 System-Specific Discussion

### 5.10.1 ACSD North

Table 5-4 summarizes Albany North baseline annual CSO statistics by community. CSO outfalls: Mohawk St 007 (4.2 MG) and Little C 008 (8.6 MG) in Cohoes, Swan Street (4.0 MG) in Green Island, and Seventh Street (4.5 MG) in Watervliet are the four largest overflows by volume, accounting for 71percent of annual Albany North overflow volume (21.3 MG out of 30 MG). A bottleneck along Cohoes' main interceptor between Little C and the Hudson River Interceptor (HRI) is mainly responsible for the overflow at Little C 008. At the Mohawk and Seventh Street overflows, low weirs within the CSO regulators and limited downstream conveyance yield the second and third largest overflow volumes.

TABLE 5-4: ACSD North Baseline Annual CSO Statistics by Community

| Outfall | Volume of Overflow (MG) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|
| **Cohoes** | | | |
| Hudson Ave 001 | 0.2 | 188 | 61 |
| Bridge Ave 002 | 0.7 | 304 | 45 |
| Van Schaick Ave 003 | 0.3 | 195 | 35 |
| Myrtle Ave 004 | 0.6 | 151 | 40 |
| Continental Ave 005 | 2.9 | 23 | 11 |
| Ontario St 006 | 0.7 | 61 | 22 |
| Mohawk St 007 | 4.2 | 380 | 21 |
| Little C 008 | 8.6 | 30 | 11 |
| Conboy Ave 009 | 1.0 | 147 | 32 |
| Peach St 010 | 0.5 | 23 | 5 |
| Cedar St 011 | <0.1 | <1 | 1 |
| Duncan 012 | <0.1 | 13 | 1.4 |
| Eagles Nest 015 | <0.1 | <1 | <1 |
| River St 016 | 0.3 | 4 | 3 |
| Linden St 017 | 0.4 | 36 | 12 |
| *Cohoes Subtotal* | *21* | *380* | *61* |
| **Green Island** | | | |
| Swan St | 4.0 | 209 | 41 |
| Hamilton St | 0.4 | 220 | 34 |
| Saratoga Ave | 0.2 | 41 | 12 |
| *Green Island Subtotal* | *4.6* | *220* | *41* |
| **Watervliet** | | | |
| 7th St | 4.5 | 330 | 44 |
| 6th St | 0.2 | 100 | 24 |
| 14th St | 0.1 | 51 | 16 |
| 3rd St | <0.1 | 14 | 5 |
| Avenue A | <0.1 | 6 | 1.2 |
| 25th St | <0.1 | <1 | <1 |
| *Watervliet Subtotal* | *4.8* | *330* | *44* |
| *ACSD North Total* | *30* | | |

The most highly active overflows in Albany North occur at pump stations with small drainage areas in upstream areas and produce minimal CSO volume. CSO outfalls: Hudson Avenue 001, Bridge Avenue 002 in Cohoes, Swan Street in Green Island, and Seventh Street in Watervliet are the four most active overflows, each with over 40 events annually. Pump station capacity limitations are primarily responsible for the Hudson Avenue, Bridge Avenue, and Swan Street overflows.

Annual CSO volumes range from trace volumes at 25th Street to 8.6 MG at Little C. The CSO volume from all 24 overflows is 30 MG; less than three percent of the total CSO discharged annually by Albany Pool communities to the Hudson River.

A peak capacity of 90 mgd was assumed at the ACSD North WWTP for establishing baseline conditions. This is based upon the estimated peak hydraulic firm capacity of the WWTP headworks pumps. During the five-year simulations, peak flow to the WWTP exceeded this capacity, causing moderate backwater along the Hudson River Interceptor. WWTP capacity is discussed in Chapter 6 of this LTCP.

### 5.10.2 ACSD South

Table 5-5 lists CSO baseline conditions for the City of Albany. CSO 012 discharges to the Krum Kill; all other CSOs discharge to the Hudson River. Discharge volumes range from 0.5 MG to 532 MG.

Each outfall discharges between two and 58 times annually. The most active is the most downstream regulator, CSO 013. CSO 016 (Big C), with a very large contributing area, discharges the greatest volume of combined sewage.

Since the interceptor has sufficient capacity to deliver the simulated flows to the WWTP this is not the limiting factor in the collection system. The existing regulator arrangements, with orifice plates and regulator gates controlling flow to the interceptor, and the wet weather capacity at the WWTP are the principal system constraints.

TABLE 5-5: Albany Baseline Annual CSO

| Outfall | Volume of Overflow (Million Gallons) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|
| 012 | 0.48 | 6.35 | 2 |
| 013 | 94.1 | 637 | 58 |
| 014 | 6.4 | 258 | 19 |
| 015 | 0.9 | 87 | 10 |
| 016 | 532.73 | 452 | 45 |
| 019 | 3.4 | 85 | 27 |
| 022 | 1.0 | 85 | 13 |
| 024 | 18.5 | 213 | 39 |
| 026 | 48.1 | 496 | 53 |
| 030 | 35.8 | 260 | 51 |
| 032 | 1.0 | 61 | 37 |

### 5.10.3 Rensselaer

Table 5-6 summarizes the City of Rensselaer baseline CSO statistics. Outfalls 003 and 006, which relieve the two largest sewersheds in the City, discharge the most CSO by volume. While these areas are partially separated, 60 percent of their sewersheds have combined sewers. Interceptor capacity limitations during wet weather are the main cause of overflow at both these outfalls. Overflows at CSO 003 are also affected by capacity limitations at Aiken Avenue PS. The limitations at CSO 006 are due to flows contributed to the interceptor by the force main connection from Aiken Avenue PS. The peak wet weather flow conveyed by the pump station limits the interceptor's capacity to receive flow from the CSO 006 sewershed.

CSO 010 is the most active overflow with 52 events annually. Its 24-inch trunk sewer connects to the upstream end of the 16-inch interceptor conveying wastewater to the Forbes Avenue Pump Station from the northern end of the City. During wet weather, peak flows from sewersheds tributary to CSOs 008 and 009 consume the conveyance capacity of the 16-inch interceptor to the Forbes Avenue PS, leaving limited capacity for flows to enter the interceptor from the sewershed tributary to CSO 010.

During intense storms, the interceptors surcharge, causing CSO 52 times per year on average. Annual CSO discharge volumes range from 4,000 gallons to 8.5 MG. Total annual CSO for Rensselaer is 20 MG; less than two percent of the total CSO discharged by the Albany Pool communities to the Hudson River.

TABLE 5-6: Rensselaer Baseline Annual CSO

| Outfall | Volume of Overflow (Million Gallons) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|
| 002 | 0.5 | 39 | 27 |
| 003 | 8.5 | 109 | 41 |
| 006 | 5.6 | 192 | 40 |
| 007 | 1.8 | 108 | 42 |
| 008 | 0.004 | 0.2 | 0.6 |
| 009 | 0.4 | 27 | 23 |
| 010 | 3.2 | 158 | 52 |
| 011 | 0.01 | 0.8 | 1.2 |
| 012 | 0.01 | 0.5 | 1.2 |

### 5.10.4 Troy

Table 5-7 summarizes baseline modeling results for the City of Troy. Overflow frequency for its 48 CSOs ranges from 6 to 65 events per year; discharge volumes range from 0.1 to 55.2 million gallons per year. Troy's total annual CSO is 447 MG, constituting 36percent of CSO discharged by APCs to the Hudson River.

TABLE 5-7: Troy Baseline Annual CSO

| Outfall | Volume of Overflow (Million Gallons) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|
| 001 | 0.3 | 18 | 16 |
| 002 | 1.1 | 26 | 17 |
| 003 | 6.9 | 442 | 53 |
| 004 | 2.0 | 123 | 46 |
| 005 | 11.8 | 543 | 55 |
| 006 | 14.6 | 197 | 51 |
| 007 | 14.3 | 662 | 56 |
| 008 | 2.0 | 174 | 52 |
| 009 | 7.6 | 214 | 50 |
| 010 | 3.3 | 227 | 57 |
| 011 | 7.5 | 93 | 44 |
| 012 | 7.8 | 181 | 48 |
| 013 | 17.4 | 396 | 23 |
| 013A | 10.1 | 381 | 65 |
| 014 | 7.6 | 168 | 47 |
| 015 | 9.8 | 148 | 44 |
| 016 | 4.6 | 119 | 40 |
| 017 | 3.9 | 101 | 40 |
| 018 | 1.8 | 214 | 57 |
| 019 | 4.4 | 39 | 31 |
| 020 | 1.4 | 151 | 51 |
| 022 | 10.6 | 51 | 21 |
| 023 | 1.6 | 34 | 22 |
| 024 | 24.7 | 100 | 33 |
| 025 | 0.5 | 20 | 18 |
| 026 | 23.0 | 429 | 62 |
| 027 | 19.3 | 216 | 50 |
| 028 | 0.4 | 9 | 10 |
| 029 | 3.4 | 61 | 28 |
| 030 | 1.7 | 34 | 21 |
| 031 | 53.7 | 415 | 52 |

| Outfall | Volume of Overflow (Million Gallons) | Duration of Overflow (Hours) | Number of Overflow Events |
|---|---|---|---|
| 032 | 3.2 | 183 | 37 |
| 033 | 4.2 | 265 | 45 |
| 034 | 0.1 | 6 | 6 |
| 035 | 55.2 | 518 | 53 |
| 036 | 18.2 | 723 | 56 |
| 037 | 24.6 | 346 | 50 |
| 038 | 12.6 | 143 | 34 |
| 039 | 11.8 | 186 | 37 |
| 040 | 2.3 | 33 | 21 |
| 041 | 12.5 | 201 | 45 |
| 042 | 3.4 | 62 | 30 |
| 043 | 6.1 | 88 | 29 |
| 044 | 5.2 | 88 | 24 |
| 045 | 1.4 | 29 | 12 |
| 046A | 4.8 | 185 | 51 |
| 046B | 0.7 | 76 | 40 |
| 047 | 1.9 | 102 | 41 |

CSOs in Troy are driven by a combination of collection system constraints and sources contributing flows. Key issues affecting Troy's CSO statistics are sanitary sewer inputs from neighboring communities, pump station limitations, stream flow entering the sewer system, and leakage through tide gates.

In addition to sharing the Rensselaer County WWTP with the City of Rensselaer, Troy also accepts flow into its sewer system from North Greenbush and Wynantskill to the south and portions of Brunswick and Schaghticoke to the east and north respectively. Total dry weather flow from these communities is estimated at 0.5 to 0.7 mgd. Infiltration and inflow from these neighboring towns influences the frequency and volume of CSOs from Troy's collection system, as peak wet weather contributions from the upstream communities range up to 5 mgd for a one-year storm.

The 106$^{th}$ PS and Monroe Street PS limit interceptor flows, thereby contributing to CSO at upgradient regulators. Pumping capacity at the stations is 8.1 mgd at 106$^{th}$ and 31.2 mgd at Monroe. CSOs 018, 019, and 020 are less than 500 ft upgradient of the 106$^{th}$ Street station. CSOs 039, 040, and 041 are within 1,000 feet of the Monroe Street PS. During wet weather, the manually cleaned pump station screens can become blinded with debris. This causes surcharging of the interceptors at the pump station entrances, contributing to overflow at the nearby CSOs, and at other CSOs with low-lying weir crests. The most susceptible locations to pump station backup are CSOs 031, 033, 035, 036, and 037. The crown of the interceptor entering Monroe Street PS from the north is 1.5 ft NAVD, while weir crests on the regulators to those CSOs range from 4.6 to 5.9 ft NAVD. CSOs 031 and 035 account for one-fourth of Troy's CSO; these are two of the four structures with 500 hours of annual CSO activity.

Along Troy's eastern edge, storm drainage and streamflow enter the collection system at numerous points from within Troy and from Brunswick. Areas tributary to CSOs 002, 013, 017, 024, 041, 043, and 044 receive stream flow. CSO 013 is the third most active outfall by volume in the City. The other CSOs receiving streamflow are not among the most active, but these areas elevate baseflows in the sewer system year-round, and further burden the collection system during wet weather. As discussed in Section 4, dry-weather overflow was observed at CSOs 013 and 024 in the summer of 2009. Table 5-8 shows that the CSO 013 drainage area accounts for 70 percent of the stormwater-only drainage contributing to Troy's sewer system. The CSO 017 service area includes pumped drainage from Lansingburgh High School and Knickerbacker Middle School near Knickerbacker Park. A 1.4 mgd pump station dewaters the low-lying field complex to the combined sewer system during large storms.

TABLE 5-8: Troy Stormwater-Only Contributing Areas

| Sewershed SPDES | Acres | Imperviousness (%) |
|---|---|---|
| 002 | 60 | 18 |
| 013 | 750 | 20 |
| 017 | 34 | 10 |
| 024 | 62 | 21 |
| 041 | 71 | 30 |
| 043 | 27 | 12 |
| 044 | 51 | 22 |
| Total | 1,055 | 20 |

Tide gates at several CSO outfalls have been observed stuck in the partially open position, allowing river water to enter the sewer system. This condition was documented during the 2008 field survey at CSOs 003, 006, 007, 012, 014, 015, and 017. Tidal inflow to the sewer system, based on calibration to 2008 conditions, was included in the CSO baseline conditions through simulation of leaky tide gates. This condition was removed for simulation of CSO mitigation alternatives.

Ultimately, Troy's collection system is constrained by the capacity of the force main downgradient of the Monroe pump station. While the 42-inch force main could convey 37 mgd of flow at 6 ft/s velocity, the resultant 42 feet of head loss is beyond the current capacity of the Monroe Street PS. The existing pump station currently has a peak wet weather pumping capacity of 31.2 mgd.

A peak capacity of 63.5 mgd was assumed at the RCSD WWTP for establishing baseline conditions. This is consistent with BMP#5 of RCSD's SPDES Permit which requires the WWTP to be capable of receiving and treating a minimum peak hydraulic loading rate of 63.5 mgd through the headworks facilities. The total peak flow recorded to the WWTP during the 2008 metering period was approximately 45 mgd. As the combined peak pumping capacity of the Forbes Avenue PS in Rensselaer, the Monroe Street PS in Troy and the Wynantskill PS in North Greenbush is approximately 50 mgd the conveyance capacity of the collection system must be upgraded to achieve compliance with BMP#5. WWTP wet weather capacity is discussed in Chapter 6.

## 5.11 Receiving Water Quality Modeling

The APJVT developed a Hudson River water quality model as part of this LTCP to characterize the impacts of pollutants from the APCs' CSO and WWTP discharges. This work was done in accordance with the protocol provided as an Appendix to the *Receiving Water Quality Assessment Report* (included in Appendix B). The model was established to evaluate the fate and transport of fecal coliform bacteria in the river. The modeling was designed to address the following questions:

- How far downstream are in-stream concentrations of fecal coliform bacteria likely to exceed water quality standards from the current CSO discharges (Existing Conditions)?
- What is the frequency of water quality standard exceedance for fecal coliform bacteria during the recreation season (Existing Conditions)?
- What are the improvements associated with in-stream levels of fecal coliform bacteria, and the reduction in the magnitude and extent (length) of Hudson River impacts, associated with potential CSO control alternatives (Proposed Conditions)?

Ultimate oxygen demand and resulting dissolved oxygen concentrations can also be considered pollutants of concern with regards to CSO discharges. However review of historical sampling data within the Hudson River (as obtained from ACSD for 1987-1996 and the Hudson River Environmental Conditions Observing System near Schodack Island for 2008-2009) showed that DO has consistently been above water quality standards (5.0 mg/l daily average and 4.0 mg/l daily minimum). NYSDEC concluded that available data support the conclusion that there are no violations of the water quality standard for dissolved oxygen in the Hudson River as a result of CSOs. Thus, the modeling effort focused upon the evaluation of fecal coliform bacteria.

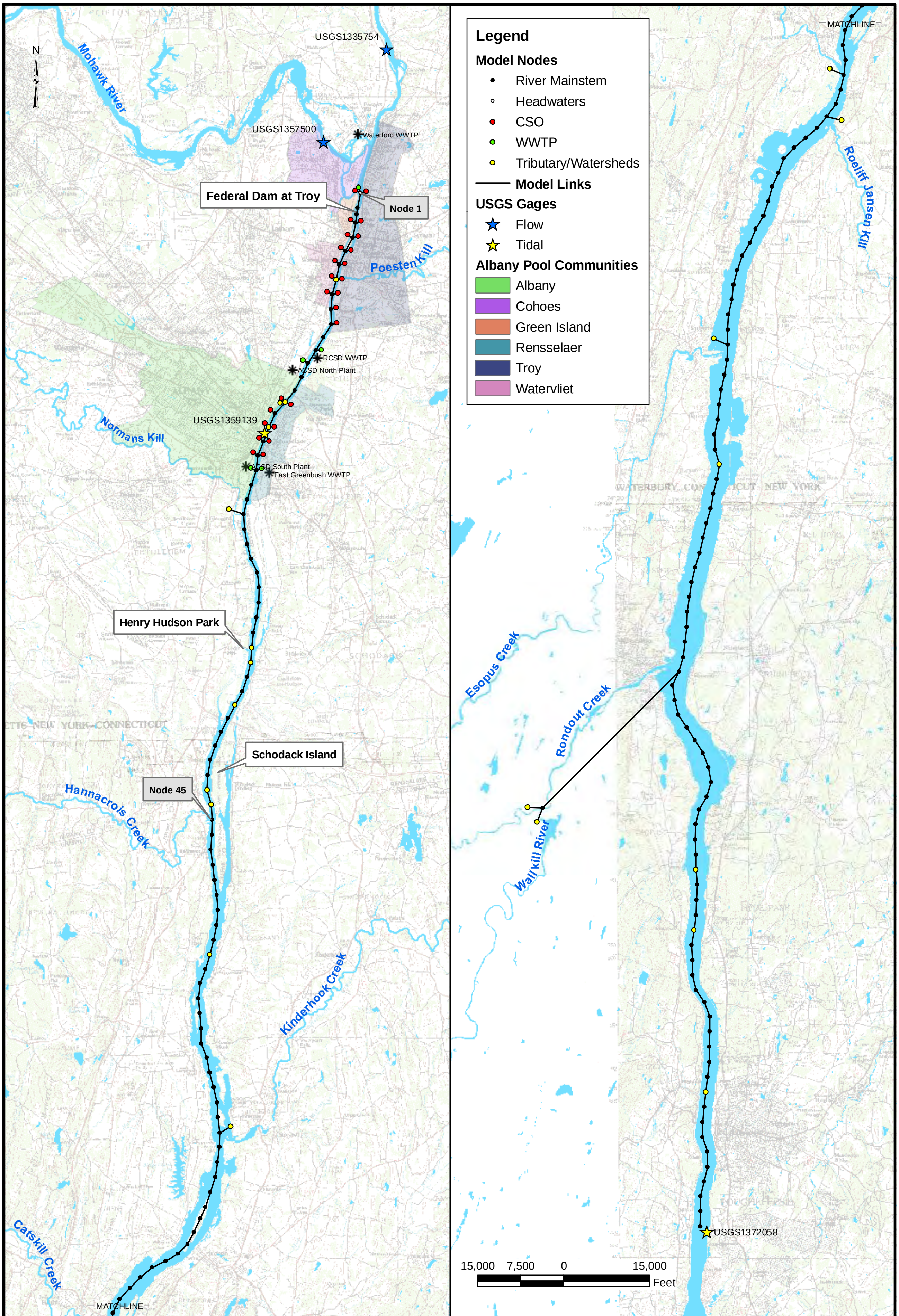
The Receiving Water Quality Model (RWQM) uses as input the WWTP and CSO discharges from the four combined sewer system (CSS) models. The development, calibration, and results of the baseline modeling effort are detailed in the *Receiving Water Quality Model Development Report* (included in Appendix H) and summarized in sections 5.12 to 5.16.

## 5.12 RWQM Development

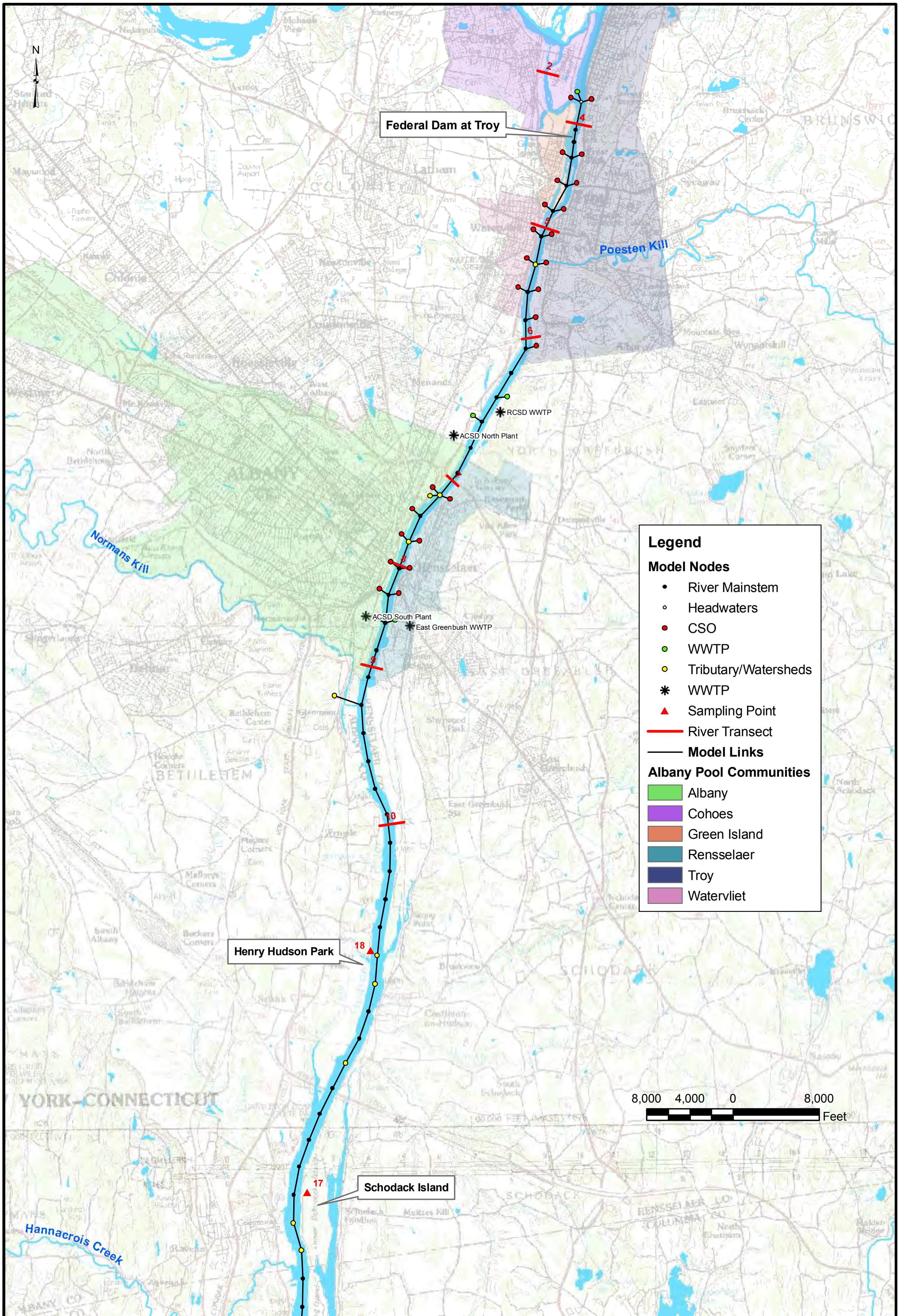
The USEPA Stormwater Management Model (SWMM5) was selected for the river hydrodynamics and bacteria analysis. As discussed previously, SWMM was used to develop the CSS models to simulate the rainfall-runoff process and the routing of flows through the sewer systems. For the receiving water modeling, the routing portion of SWMM was used to simulate flow and hydraulics (depth and velocity) for the Hudson River, accounting for tidal impacts by imposing measured stages from a gauge at Poughkeepsie, New York. SWMM was also selected for bacteria simulation because the model is capable of simulating first-order decay, which was used to account for bacteria die-off in the river. Consistent with the findings of the *Receiving Water Quality Assessment* Report (included in Appendix B), the RWQM assumes CSO discharges are fully mixed across the river and are one-dimensionally transported down the river.

Model setup began with establishment of the physical characteristics of the river system. This included discretization of the river system into distinct receiving water segments, and characterization of each segment with respect to channel dimensions such as width, depth and cross-sectional geometry. River cross-sections were established based on available Federal Emergency Management Agency Flood Insurance Study data, as well as National Oceanic and Atmospheric Administration navigational charts. One cross-section per half mile was used to delineate receiving water model segments. The upstream boundary of the receiving water model is just above the Federal Dam in Troy on the Hudson River and includes the combined flows of the Mohawk and Upper Hudson Rivers. The model extends 80 miles past Henry Hudson Park and Schodack Island in Selkirk south to Poughkeepsie. Poughkeepsie was selected for the downstream limit of the model to allow adequate travel time for die-off of bacteria discharged by the CSOs, and because an existing USGS tide station at Poughkeepsie was used as the downstream stage boundary condition.

Figure 5-6 illustrates the extent and segmentation of the model network. Model nodes used as loading points for CSO, WWTP, headwater, tributary, and watershed flows are indicated on the figure. A total watershed area of 11,800 square miles is represented in the model, of which 8,000 square miles drain to the Hudson and Mohawk Rivers (headwaters) and 3,800 square miles are tributary to the Hudson River within the study area. The river transects (RT) that were used in calibrating and evaluating the model are shown on Figure 5-7.




| | | | |
|---|---|---|---|
| | ALBANY POOL CSO LTCP | RECEIVING WATER QUALITY MODEL | FIGURE 5-6 |




| | ALBANY POOL CSO LTCP | Receiving Water Quality Model | FIGURE 5-7 |
|---|---|---|---|

River hydrodynamics were developed using available tidal and daily flow data from various USGS stations within the modeled area. The tide station at Poughkeepsie (USGS station ID 01372058) was used at the downstream boundary of the river model. This allows the model to adequately reflect the tides' influence on the river hydrodynamics up to the Federal Dam. Daily flow data for the Hudson River at the upstream boundary (north of the Federal Dam) were developed by summing the flow records of the upstream USGS flow stations on the Hudson and Mohawk Rivers (USGS station ID 01335754 and USGS station ID 01357500). Flow records for tributaries and other directly contributing watershed areas were developed from gage transformation of available USGS flow records at:

- USGS 01364500 Esopus Creek at Mount Marion, NY
- USGS 01367500 Rondout Creek at Rosendale, NY
- USGS 01371500 Wallkill River at Gardiner, NY

These gages were selected based on their available period of flow records and representative flow characteristics. Gage transformation was performed by scaling the measured flows by the ratio of the tributary watershed area and the watershed area of the gage.

The RWQM receives input from the four CSS models. These include discharges that flow directly into the main stem of the Hudson River, either via outfalls on the banks of the river, or via channels that deliver discharge from multiple outfalls to the Hudson River. The concentration of bacteria in CSO discharges was based on discharge monitoring data collected in 2008. Fecal coliform bacteria counts from the ACSD and RCSD WWTP discharges were also based on the 2008 monitoring program data collected at the WWTPs under dry weather and wet weather conditions. Similarly, tributary bacteria concentrations were set for dry weather and wet weather periods based on averaging data from the 2008 water quality assessment. The wet weather and dry weather periods were based on local rainfall data. Other sources of bacteria to the river were also represented, including tributaries, direct non-point sources, and WWTP discharges. Direct non-point sources refer to the watershed areas with runoff draining directly to the River. Fecal coliform concentrations used as input to the receiving water model under existing conditions are provided in Table 5-9.

TABLE 5-9: Summary of SWMM Input Data for Fecal Coliform Bacteria Concentrations (cfu/100 ml) to Hudson River for Existing Conditions

| | Dry | Wet |
|---|---|---|
| Combined Sewer Overflows (CSO) | | |
| Albany North | - | 1,139,683 |
| Albany South | - | 1,587,572 |
| Troy | - | 1,692,660 |
| Rensselaer | - | 1,096,445 |
| Wastewater Treatment Plants | | |
| Albany North WWTP | 41,067 | 73,586 |
| Albany South WWTP | 18,833 | 32,156 |

| | Dry | Wet |
|---|---|---|
| Rensselaer County WWTP | 19,779 | 58,871 |
| East Greenbush WWTP | 113,146 | 133,395 |
| Waterford WWTP | 136,132 | 47,972 |
| Headwaters | | |
| Hudson and Mohawk Rivers | 38 | 330 |
| Tributaries/Watershed Runoff | | |
| Normans Kill | 296 | 2,009 |
| Patroon Creek | 7,789 | 14,367 |

Notes:
Tributaries/Watershed Runoff:
1) Baseline concentrations based on results of 2008 sampling.
Dry weather concentration based on average of all dry event results.
Wet weather concentration based on overall average of all wet event average concentrations.
2) Normans Kill concentations based on sampling results at transect 11 (E-T11-SH).
3) Patroon Creek concentrations based on sampling results at transect 16 (E-T16-SH).
4) Poesten Kill and Wynants Kill concentrations based on weighted average of sampling results at transects D-T14-SH (Poesten Kill) and D-T13-SH (Wynants Kill) according to watershed area ratio.
5) Mill Creek concentrations based on sampling results at transect 12 (D-T12-SH).
6) Other tributaries include Kinderhook Creek, Catskill Creek, Roeliff Jansen Kill, Esopus Creek, Rondout Creek, Wallkill River, Hannacrois Creek, and additional watershed areas. Concentrations based on average of Normans Kill, Poesten Kill, Wynants Kill, and Mill Creek concentrations.

Bacteria fate in the RWQM was simulated as a first-order loss rate. The general form of the mathematical representation of bacteria loss for plug flow is:

$$c_x = c_0 e^{-\left(\frac{kx}{U}\right)}$$

where $c_x$ = concentration at $x$ feet downstream, $c_0$ = initial concentration, $k$ = decay coefficient (1/day), $x$ = distance downstream of outfall in feet, and $U$ = flow velocity in feet/day. The decay coefficient ($k$) was initially set to 1.15/day based on typical literature values. Model validation suggested that this value was appropriate for the study area.

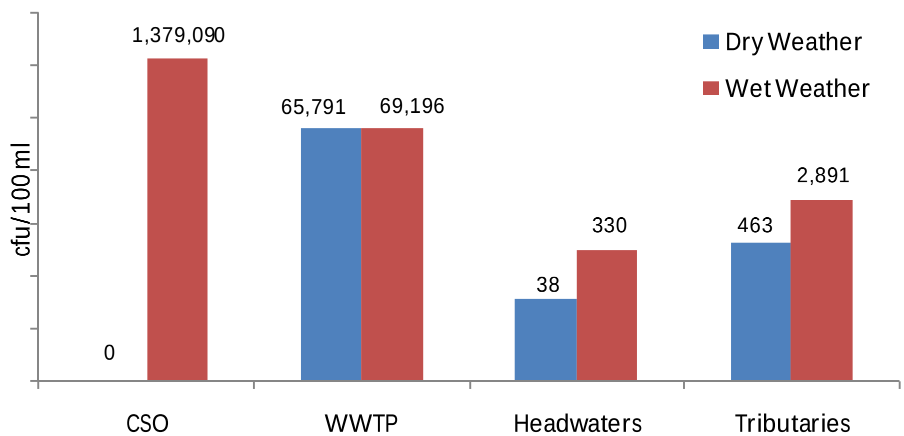
## 5.13 RWQM Validation

The bacteria model was validated for dry weather, wet weather, and a multi-month continuous simulation. The validation period extended from June through mid-September 2008. These limits were defined by the start of both the wet weather sampling program (first event on May 31, 2008) and installation of the combined sewer system flow meters and rain gages (completed June 5, 2008). Measured data at the Port of Albany tidal station (USGS station ID 01359139) were compared to modeled stages to validate the model hydrodynamics. The Manning's n value for the river was adjusted to 0.02 to obtain a reasonable match between measured and modeled stages. Fecal coliform bacteria concentrations obtained from the water quality assessment during summer 2008 were compared to modeled concentrations to validate simulated bacteria fate and transport in the River. Each River Transect site within the model limits had data for three sampling locations monitored across the width of the river (west, center, east). Bacteria concentrations measured at the three sampling locations were arithmetically averaged to obtain a single value at each sampling time for comparison to modeled concentrations. The comparison of measured and modeled flow rates and bacteria concentrations at each gage station and modeled river transect site is provided in the *Receiving Water Quality Model Development Report* (included in Appendix H). The model provided a reasonable match with measured bacteria levels during both dry weather and wet weather peaks.

## 5.14 RWQM Existing Conditions Model Results

The validated bacteria model was used to perform continuous long term simulations to evaluate standards compliance for baseline and scenario conditions. The 1985 through 1989 representative period used for the combined sewer system models was also used for the river model. Average fecal coliform bacteria concentrations used as input to the receiving water model under baseline conditions are shown on Figure 5-8. The tributary concentrations shown on the figures are weighted averages based on the watershed areas.

FIGURE 5-8: Average Fecal Coliform Bacteria Concentration for Baseline Conditions

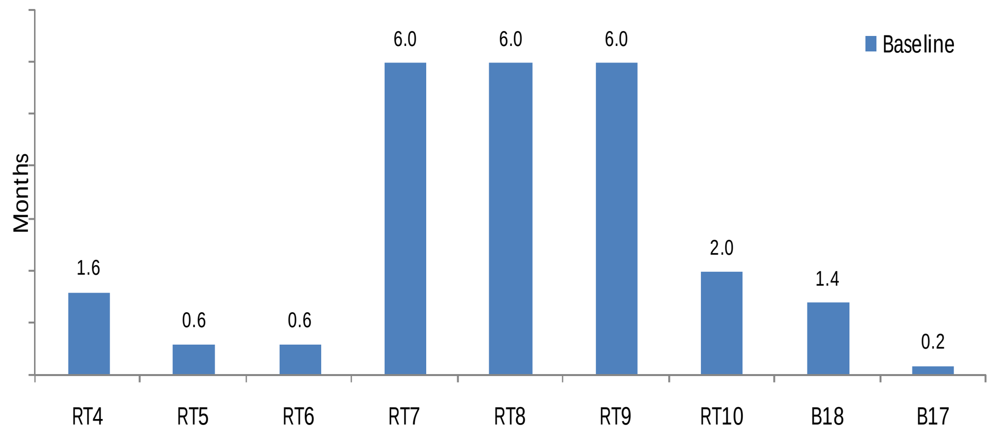



The model output of bacteria concentrations was analyzed to establish water quality standard exceedance frequency. This standard is a geometric mean value of 200 colony-forming units (cfu) per 100 ml, based on a minimum of five samples over a 30-day period.

Exceedance frequency at a particular location was initially calculated based on a “monthly” approach, in which monthly geometric means of modeled bacteria concentrations were evaluated, assuming that a single daily sample at each modeled transect is “taken” at noon of each day. The monthly geometric mean was thus established based on one sample per day, and a total of 30 monthly geometric mean values were calculated (6 months of recreational season per year times 5 years of simulation). The total number of months with a geometric mean exceeding 200 cfu/100 ml was determined, and was then divided by five to determine the frequency of water quality standard exceedances during a single recreation season (i.e., how many months per season would exceedance be expected). The exceedance frequency percentage was calculated based on how many of the 30 geometric means exceeded the standard. For example, if 10 of the 30 monthly values exceeded the standard, the frequency percentage would be 33 percent (10 divided by 30).

A summary of the exceedance frequencies at each river transect site and shoreline location under baseline and scenario conditions is provided in Table 5-10A and Table 5-10B, and as shown in Figure 5-9. As indicated in the tables, for example, the frequency of exceeding the monthly geometric mean bacteria standard upstream of the Federal Dam (RT4) is 27 percent, which is equivalent to an average of 1.6 months per six-month recreation season, which also equates to eight months every five years during recreation season.

FIGURE 5-9: Monthly Exceedances of Bacteria Standard per Recreation Season for Baseline Conditions




Under the baseline conditions, the frequency of exceeding the bacteria standard is greatest in the vicinity of the I-90 bridge, Dunn Memorial Bridge, and the Port of Albany (RT7, RT8, and RT9). In this area, the long-term average monthly geometric mean standard exceedance is 6 months per 6-month recreation season. The RCSD WWTP and ACSD North WWTP are both located just upstream of RT7, while the ACSD South WWTP and East Greenbush WWTP are located between RT8 and RT9. The Big C overflow in Albany, which accounts for 45 percent of all CSO in the Pool communities, corresponds with RT8 in the model.

TABLE 5-10A: Frequency of Exceeding Fecal Coliform Standard and Expected Monthly Exceedance during Recreation Season (Monthly Geomean Using Noon Values)

| Site | Site Description | Baseline (2008) | | | Scenario 1 | | | Scenario 2 | | | Scenario 2A | | | Scenario 3 | | | Scenario 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / # Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons |
| RT4 | Upstream of Federal Dam | 27% | 1.6 | 8/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 20% | 1.2 | 6/5 |
| RT5 | Downstream of Federal Dam | 10% | 0.6 | 3/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 3% | 0.2 | 1/5 |
| RT6 | Route 378 Bridge | 10% | 0.6 | 3/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 3% | 0.2 | 1/5 |
| RT7 | I-90 Bridge | 100% | 6.0 | 6/1 | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 100% | 6.0 | 6/1 |
| RT8 | Dunn Memorial Bridge | 100% | 6.0 | 6/1 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 7% | 0.4 | 2/5 | 97% | 5.8 | 29/5 |
| RT9 | Albany Port | 100% | 6.0 | 6/1 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 97% | 5.8 | 29/5 |
| RT10 | East Greenbush/Schodack | 33% | 2.0 | 2/1 | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 27% | 1.6 | 8/5 |
| B18 | Henry Hudson Park in Selkirk, NY (shore) | 23% | 1.4 | 7/5 | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 10% | 0.6 | 3/5 |
| B17 | Schodack Island in Schodack Landing, NY (shore) | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 |

Notes:
1) Expected monthly exceedance refers to number of months per 6-month recreational season that would expect to exceed the bacteria standard.
2) Exceedance of 0.2 months per 6-month recreational season is equivalent to exceedance frequency of 1 month per 5 recreational seasons.
3) Scenario 1 included WWTPs providing disinfection (at a concentration of 200/100 ml) during the recreation season.
4) Scenario 2 included WWTP disinfection improvements of Scenario 1 and assumed headwater and tributary inflows were improved to meet water quality standards.
5) Scenario 2A included WWTP disinfection improvements of Scenario 1, headwater inflows improved to meet water quality standards, and Patroon Creek improved to 2009 levels.
6) Scenario 3 included overall 85% capture and WWTPs providing disinfection (at a concentration of 200/100 ml) during the recreation season.
7) Scenario 4 included overall 85% capture with baseline concentations (no WWTP disinfection and no improvements to headwaters or tributary inflows).
8) Geomeans based on daily bacteria concentrations at noon.

TABLE 5-10B: Frequency of Exceeding Fecal Coliform Standard and Expected Monthly Exceedance during Recreation Season (Monthly Geomean Using Daily Average Values)

| Site | Site Description | Baseline (2008) | | | Scenario 1 | | | Scenario 2 | | | Scenario 2A | | | Scenario 3 | | | Scenario 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons | Exceedance Frequency | Months per Recreation Season | # Months / #Recreation Seasons |
| RT4 | Upstream of Federal Dam | 30% | 1.8 | 9/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 23% | 1.4 | 7/5 |
| RT5 | Downstream of Federal Dam | 20% | 1.2 | 6/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 3% | 0.2 | 1/5 |
| RT6 | Route 378 Bridge | 10% | 0.6 | 3/5 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 3% | 0.2 | 1/5 | 7% | 0.4 | 2/5 |
| RT7 | I-90 Bridge | 100% | 6.0 | 6/1 | 7% | 0.4 | 2/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 100% | 6.0 | 6/1 |
| RT8 | Dunn Memorial Bridge | 100% | 6.0 | 6/1 | 20% | 1.2 | 6/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 7% | 0.4 | 2/5 | 100% | 6.0 | 6/1 |
| RT9 | Albany Port | 100% | 6.0 | 6/1 | 13% | 0.8 | 4/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 97% | 5.8 | 29/5 |
| RT10 | East Greenbush/Schodack | 50% | 3.0 | 3/1 | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 30% | 1.8 | 9/5 |
| B18 | Henry Hudson Park in Selkirk, NY (shore) | 27% | 1.6 | 8/5 | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 17% | 1.0 | 1/1 |
| B17 | Schodack Island in Schodack Landing, NY (shore) | 3% | 0.2 | 1/5 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 | 0% | 0.0 | 0 |

Notes:
1) Expected monthly exceedance refers to number of months per 6-month recreational season that would expect to exceed the bacteria standard.
2) Exceedance of 0.2 months per 6-month recreational season is equivalent to exceedance frequency of 1 month per 5 recreational seasons.
3) Scenario 1 included WWTPs providing disinfection (at a concentration of 200/100 ml) during the recreation season.
4) Scenario 2 included WWTP disinfection improvements of Scenario 1 and assumed headwater and tributary inflows were improved to meet water quality standards.
5) Scenario 2A included WWTP disinfection improvements of Scenario 1, headwater inflows improved to meet water quality standards, and Patroon Creek improved to 2009 levels.
6) Scenario 3 included overall 85% capture and WWTPs providing disinfection (at a concentration of 200/100 ml) during the recreation season.
7) Scenario 4 included overall 85% capture with baseline concentations (no WWTP disinfection and no improvements to headwaters or tributary inflows).
8) Geomeans based on daily average of hourly bacteria concentrations.

At the request of NYSDEC, the frequency of water quality exceedance was also evaluated using the daily arithmetic average of modeled bacteria concentrations (which were saved on an hourly basis in the model output) and compared to the previously-described method. Additionally, exceedance frequency was re-evaluated using a “rolling average” approach. For this analysis, a 30-day geometric mean was calculated for every 30-day period falling within the recreational season (May 1 – October 30). For example, the 30-day geometric mean for May 1 was calculated based on model output from May 1 through May 30. This analysis considered both the noon value and daily average value approaches discussed earlier. The exceedance frequency percentage was calculated based on the number of 30-day periods with an exceedance, divided by the total number of 30-day periods evaluated in the 5-year simulation (154 dates/year x 5 years = 770). Summaries of the exceedance frequencies at each river transect site using these alternative calculation methods are provided in the *Receiving Water Quality Model Development Report* (included in Appendix H).

The APJVT concludes that the noon value and monthly geometric mean approach used initially provides a reasonable indication of expected exceedance frequency, based on review of the various results. In almost every case, the exceedance frequency calculated using that approach was within the range of exceedance values calculated by the other potential approaches, and does not show a bias (i.e., calculated values are not always higher or lower than those calculated by other approaches). The selected method is also believed to be more consistent with the approach that could realistically be applied for post-construction compliance sampling.

## 5.15 RWQM Simulations

After establishing baseline conditions, four alternative scenarios were evaluated for developing a better understanding of the bacterial influences on the Hudson River and identifying a cost-effective CSO control strategy for achieving compliance with the water quality standards for fecal coliform. Each scenario is described below:

- Scenario 1 evaluated conditions with all WWTPs providing disinfection to200 cfu/100 ml from May 1 through October 30.
- Scenario 2 incorporated the improvements included in Scenario 1, and assumes that inflows at the headwater boundary and from the tributaries were improved to meet water quality standards. Scenario 2 isolates the contribution of CSOs to exceedance of the fecal coliform bacteria water quality standard.
- Scenario 3 incorporated the improvements included in Scenario 1, and evaluates upgrading the combined sewer system to achieve 85 percent CSO capture. This scenario does not include improvement in headwater or tributary bacteria concentrations.
- Scenario 4 evaluates the benefits of only upgrading the combined sewer system to achieve 85 percent CSO capture, with no WWTP disinfection and no improvement in headwater or tributary bacteria concentrations.

For all scenarios, model results were compared to the baseline condition to assess the benefits of each scenario in reducing exceedance of the fecal coliform bacteria standard.

The bacteria concentrations used as input to the receiving water model for each condition are provided in Table 5-11; average values are shown on Figures 5-10 to 5-12. The tributary concentrations shown on the figures are weighted averages based on the watershed areas.

FIGURE 5-10: Average Fecal Coliform Bacteria Concentration for Scenario 1 and Scenario 3

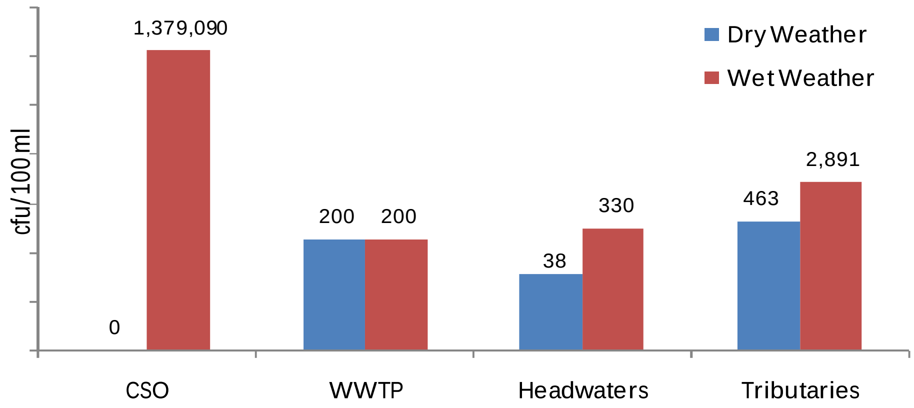



FIGURE 5-11: Average Fecal Coliform Bacteria Concentration for Scenario 2

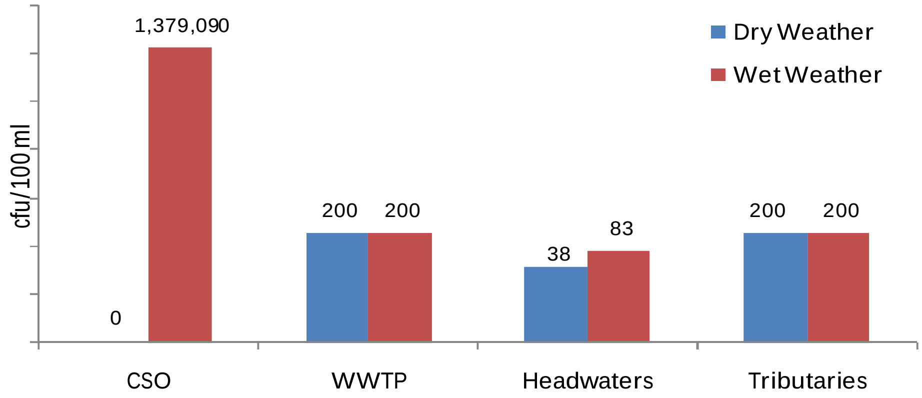



FIGURE 5-12: Average Fecal Coliform Bacteria Concentration for Scenario 4

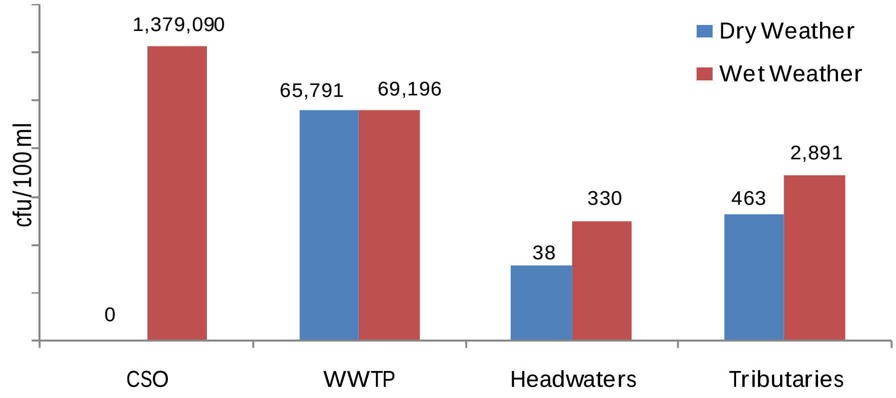


Table 5-11: Summary of SWMM Input Data for Fecal Coliform Bacteria Concentrations (cfu/100 ml) to Hudson River

| Community | Baseline (2008) and Scenario 4 | | Scenario 1 and Scenario 3 | | Scenario 1 | | Scenario 2a | |
|---|---|---|---|---|---|---|---|---|
| | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Combined Sewer Overflows (CSO) | | | | | | | | |
| Albany North | - | 1,139,683 | - | 1,139,683 | - | 1,139,683 | - | 1,139,683 |
| Albany South | - | 1,587,572 | - | 1,587,572 | - | 1,587,572 | - | 1,587,572 |
| Troy | - | 1,692,660 | - | 1,692,660 | - | 1,692,660 | - | 1,692,660 |
| Rensselear | - | 1,096,445 | - | 1,096,445 | - | 1,096,445 | - | 1,096,445 |
| Wastewater Treatment Plants | | | | | | | | |
| Albany North WWTP | 41,067 | 73,586 | 200 | 200 | 200 | 200 | 200 | 200 |
| Albany South WWTP | 18,833 | 32,156 | 200 | 200 | 200 | 200 | 200 | 200 |
| Rensselaer County WWTP | 19,779 | 58,871 | 200 | 200 | 200 | 200 | 200 | 200 |
| East Greenbush WWTP | 113,146 | 133,395 | 200 | 200 | 200 | 200 | 200 | 200 |
| Waterford WWTP | 136,132 | 47,972 | 200 | 200 | 200 | 200 | 200 | 200 |
| Headwaters | | | | | | | | |
| Hudson and Mohawk Rivers | 38 | 330 | 38 | 330 | 38 | 83 | 38 | 83 |
| Tributaries/Watershed Runoff | | | | | | | | |
| Normans Kill | 296 | 2,009 | 296 | 2,009 | 200 | 200 | 296 | 2,009 |
| Patroon Creek | 7,789 | 14,367 | 7,789 | 14,367 | 200 | 200 | 472 | 5,016 |
| Poesten Kill/Wynants Kill | 382 | 1,600 | 382 | 1,600 | 200 | 200 | 382 | 1,600 |
| Mill Creek | 657 | 5,214 | 657 | 5,214 | 200 | 200 | 657 | 5,214 |
| Others | 446 | 2,929 | 446 | 2,929 | 200 | 200 | 446 | 2,929 |

Notes:

*Combined Sewer Overflows:*

1) Concentrations based on results of 2008 sampling. Wet weather concentration based on average of all wet event average concentrations.

*Wastewater Treatment Plants:*

2) Baseline concentrations based on results of 2008 sampling. Dry weather concentration based on average of all dry event results. Wet weather concentration based on overall average of all wet event average concentrations.

3) WWTP concentrations for Scenarios 1, 2, 2A, and 3 were set to 200 cfu/100 ml during May 1 - Oct 30 and set to baseline concentrations at all other times of the year.

*Headwaters:*

4) Baseline concentrations based on results of 2008 sampling. A baseflow separation analysis was performed. Baseflow concentration (38 cfu/100 ml) computed as average of dry event results at river transects 1 and 3 (RT1, RT3). Runoff concentration estimated based on river model validation results and 2008 wet weather sampling.

*Tributaries/Watershed Runoff:*

5) Baseline concentrations based on results of 2008 sampling. Dry weather concentration based on average of all dry event results. Wet weather concentration based on overall average of all wet event average concentrations.

6) Normans Kill concentations based on sampling results at transect 11 (E-T11-SH).

7) Patroon Creek baseline concentrations based on sampling results from 2008 at transect 16 (E-T16-SH). Scenario 2A concentrations based on sampling results from 2009 (T-16-13).

8) Poesten Kill concentrations based on weighted average of sampling results at transects D-T14-SH (Poesten Kill) and D-T13-SH (Wynants Kill) according to watershed area ratio.

9) Mill Creek concentrations based on sampling results at transect 12 (D-T12-SH).

10) Other tributaries include Kinderhook Creek, Catskill Creek, Roeliff Jansen Kill, Esopus Creek, Rondout Creek, Wallkill River, Hannacrois Creek, and additional watershed areas. Concentrations based on average of Normans Kill, Poesten Kill, Wynants Kill, and Mill Creek concentrations.

For each five-year simulation, the model output was analyzed to establish an average frequency for water quality standard exceedance. This standard is a geometric mean value of 200 cfu/100 ml, based on a minimum of five daily samples over 30 days.

A comparison of the exceedance frequencies under baseline and scenario conditions is provided on Figures 5-13 through 5-16. The figures indicate the projected average number of months per recreation season that the water quality standard would not be met.

FIGURE 5-13: Monthly Exceedances of Bacteria Standard per Recreation Season for Scenario 1

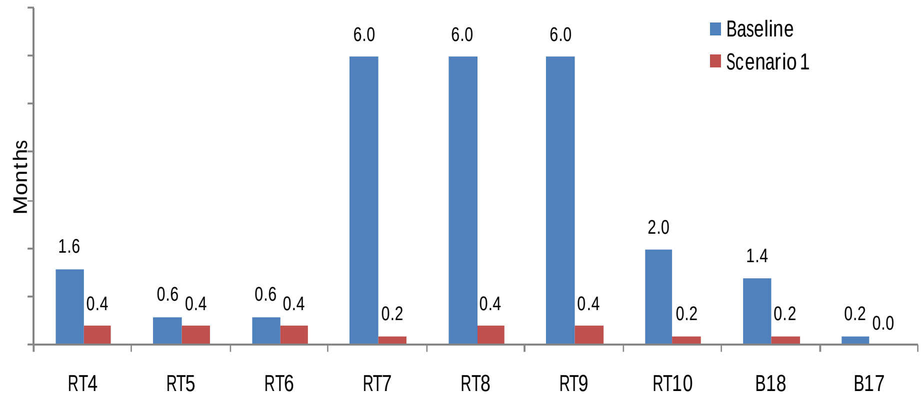



FIGURE 5-14: Monthly Exceedances of Bacteria Standard per Recreation Season for Scenario 2

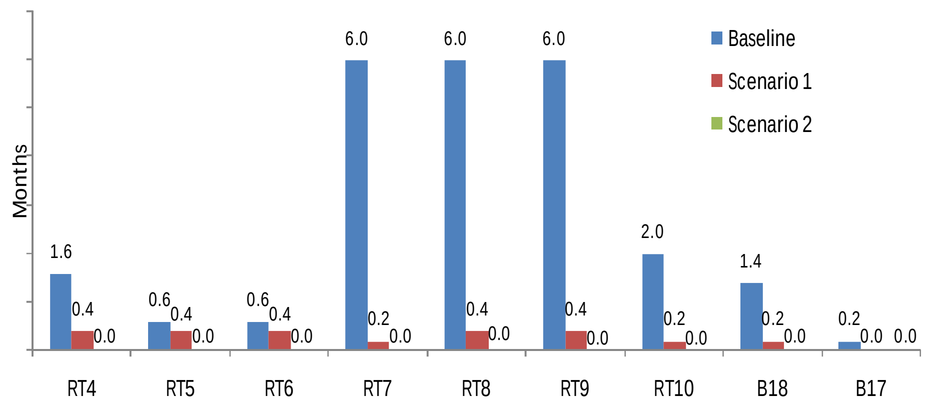


FIGURE 5-15: Monthly Exceedances of Bacteria Standard per Recreation Season for Scenario 3

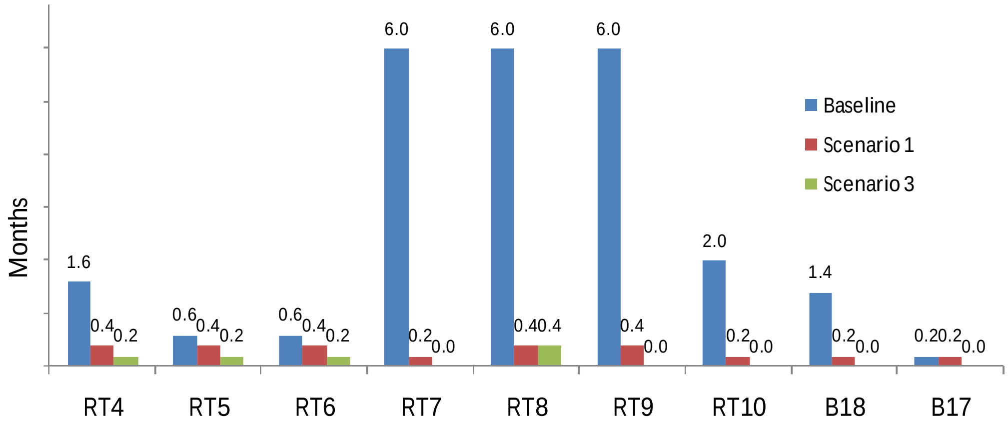
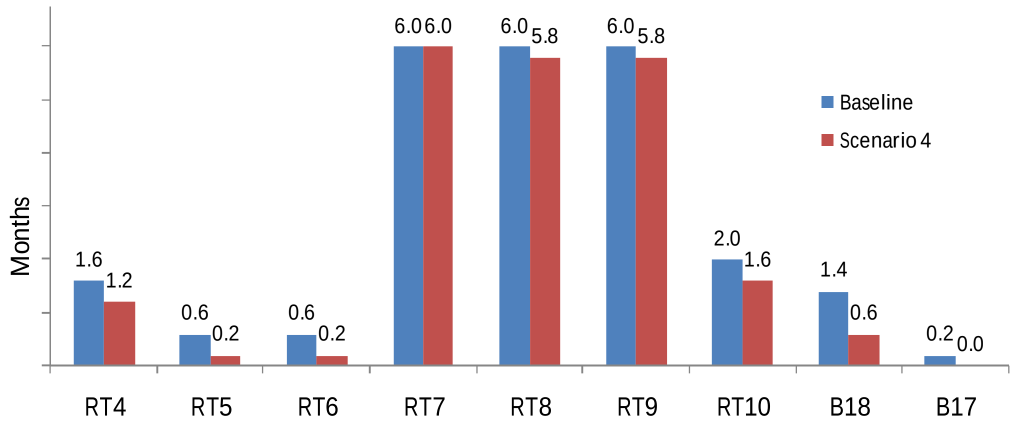



FIGURE 5-16: Monthly Exceedances of Bacteria Standard per Recreation Season for Scenario 4




With implementation of disinfection at the WWTPs under Scenario 1, exceedance frequencies are greatly reduced at transects RT7, RT8, and RT9, suggesting that the WWTPs have a significant impact on bacteria levels in the river. Figure 5-10 shows that exceedances at RT7, RT8 and RT9 are expected every month during the recreation season (total of 30 months) for the baseline condition. With disinfection, this is reduced to less than one month per recreation season at those locations. At all locations except Schodack Island (B17), disinfection at the WWTPs limits the exceedance of the monthly geometric mean standard to one or two months of the 30 recreational season months simulated. There are no months with exceedance at Schodack Island.

The exceedance frequencies are reduced to zero at all locations when the water quality of the headwaters and tributaries is also improved in Scenario 2. This suggests that Albany Pool CSOs alone have minimal or no effect on exceedance of the monthly geometric mean standard during the recreational season.

Comparison of Scenario 1 (disinfection) and Scenario 3 (disinfection and 85 percent capture) shows that combined sewer system enhancements would provide limited additional benefit beyond WWTP disinfection alone in reducing exceedance frequency at most transect locations. Scenario 3 reduces the total number of months with standard exceedance compared with Scenario 1 by one out of the 30 recreational season months simulated in most locations. This incremental benefit is much smaller than the benefit in going from the baseline condition to Scenario 1.

Similarly, comparison of baseline and Scenario 4 (85 percent capture) results show that only implementing combined sewer system enhancements would provide limited benefit in reducing exceedance frequency at most locations. The total number of months with exceedance of the standard in most locations for Scenario 4 was one or two months less than in the baseline condition. This incremental benefit is much smaller than the benefit in going from the baseline condition to Scenario 1. Frequent exceedances occur at RT7, RT8 and RT9 under Scenario 4. These results show that the impact of continuous undisinfected WWTP effluent discharges on bacteria standard exceedances is much larger than the influence of intermittent CSO discharges.

### 5.15.1 Additional Scenario

Upon review of the model results for the baseline conditions and the initial four scenarios, NYSDEC expressed concerns relating to the feasibility of achieving water quality compliance for the bacteria standard for all tributaries within the Albany Pool. In response to those concerns, Scenario 2A was developed to simulate Hudson River water quality impacts if compliance with the standards for fecal coliform along tributaries was not attainable in the near future. The only exception was Patroon Creek which showed reductions in bacteria counts for the additional tributary monitoring performed in 2009 in comparison to the baseline sampling performed in 2008. These water quality improvements are attributed to investigations by the City of Albany and ACSD which identified and eliminated two sanitary connections to a storm drain. Investigations are ongoing and are expected to yield additional water quality benefits.

Because of these findings, Scenario 2A reflects the 2009 bacteria levels for Patroon Creek, while maintaining baseline conditions for the other tributaries, and Scenario 2 conditions for the treatment plants, headwaters and CSOs. Despite the higher background bacterial concentrations in the tributaries, no exceedances of the fecal coliform standard were observed over the five year simulation period. These findings further demonstrate that Albany Pool CSOs alone have minimal effect on exceedance of the monthly geometric mean standard during the recreational season.

## 5.16 RWQM Conclusions

As discussed above, a one-dimensional receiving water quality model of the Hudson River was developed and used to evaluate compliance with bacteria standards for baseline (existing) conditions and five future conditions scenarios. A summary of the bacteria modeling results follows in Table 5-12.

TABLE 5-12: Bacteria Modeling Results

| Scenario | WWTP Disinfection | Headwaters | Tributaries | CSO | Exceedances (months/30 months) |
|---|---|---|---|---|---|
| Baseline | No | Baseline | Baseline | Baseline | 30 |
| 1 | Yes | Baseline | Baseline | Baseline | 2 |
| 2 | Yes | Improved | Improved | Baseline | 0 |
| 2A | Yes | Improved | Baseline; Patroon Creek improved to 2009 levels | Baseline | 0 |
| 3 | Yes | Baseline | Baseline | 85% Capture | 2 |
| 4 | No | Baseline | Baseline | 85% Capture | 30 |

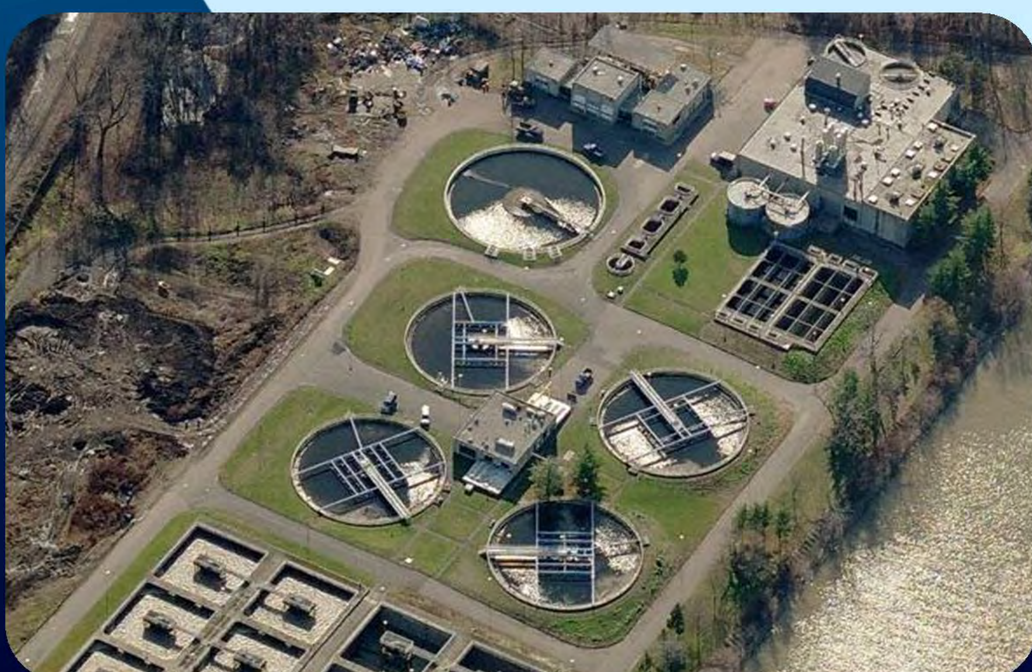
Notes:
Disinfection was applied at the WWTPs only during the recreation season.
Improved headwaters and tributaries meet water quality standards for fecal coliform.
Exceedances are based upon the five-year simulation and refer to the number of months during the recreation season that the monthly geometric mean exceeds 200 cfu/ 100 ml at any transect within the Albany Pool. Monthly geometric means were calculated based on noon values.

The key conclusions of the *Receiving Water Quality Model Development Report* (included in Appendix H) are as follows:

- A review of historical river dissolved oxygen data indicates that Albany Pool CSOs do not cause violations of the dissolved oxygen standard. As a result, a dissolved oxygen river model is not warranted.
- Improvements to continuous sources of bacteria contributions to the Hudson River, such as WWTPs, tributaries and headwaters, provide more effective bacteria-based water quality improvements than improvements to intermittent wet weather discharges.
- The water quality conditions of the headwaters of the Hudson River, as assumed under Scenario 2A, are believed to be achievable, since the WWTPs upstream of the Albany Pool have either recently completed or are currently performing projects to disinfect their effluent discharges to the Hudson River. The documented improvements to water quality conditions of Patroon Creek are believed to be sustainable due to continuing efforts by the City of Albany and the Albany County Sewer District to identify and eliminate possible illicit sewer connections. This finding is substantiated by sampling performed in 2009.
- The results of Scenario 2A (no exceedances during the recreation season over the five-year model simulation) indicate CSOs do not preclude the attainment of water quality standards upon implementation of seasonal disinfection of WWTPs, and improvements to the headwaters and Patroon Creek associated with completed and ongoing projects.

Chapter 6

# Wastewater Treatment Plant Wet Weather Capacity



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# 6.0 Wastewater Treatment Plant Wet Weather Capacity

## 6.1 Introduction

This LTCP will recommend improvements to both the combined sewer system and the three WWTPs that comprise the project service area, including the ACSD North WWTP, the ACSD South WWTP, and the RCSD WWTP.

The process and hydraulic capacities of each plant's unit processes were evaluated independently. The hydraulic capacity is defined as the maximum flow that can be passed through a unit process without exceeding a specific freeboard or weir submergence criteria. The process capacity is defined as the maximum flow that can be treated in a unit process without exceeding any process criteria (i.e., treatment performance). In some areas of the plants the hydraulic capacity exceeds the process capacity and in other areas the process capacity exceeds the hydraulic capacity. The treatment capacity was determined as the flow that could successfully meet both the process and hydraulic criteria.

The hydraulic capacities were determined for both the 1-year flood elevation and the 25-year flood elevation in the Hudson River at the outfall discharge location. Hydraulic capacities considered only peak wet weather flows while process capacities considered both average annual daily flows and sustained short term peak wet weather flows. The overall WWTP treatment capacity is defined as the maximum flow that can pass through all the operating treatment process units without exceeding any hydraulic or process capacity criteria.

Computerized models for each plant were developed to support this evaluation. The *BioWin*™ model by EnviroSim Associates, Ltd. was utilized for treatment process simulations. Plant-wide hydraulic models of the ACSD WWTPs were developed using Malcolm Pirnie's in-house hydraulic profile software, *Visual Profile*. A plant-wide hydraulic model of the RCSD WWTP was developed using Visual Hydraulics by Innovative Hydraulics and WaterGems by Bentley Systems. Together, these models were utilized to determine operating capacities and flow distributions among wet stream processes and to examine how variations in flow and organic loading would affect the treatment processes and effluent quality.

Comprehensive field data collection programs were developed and implemented for each WWTP. Field data was collected and utilized to calibrate each of the computerized models. The calibrated models were utilized to assess WWTP performance under various scenarios of current and future flows and loadings.

The summaries of the WWTP Capacities for each plant are provided in the following sections. The comprehensive evaluations are provided in the *Albany County Sewer District Wastewater Treatment Plant Process and Hydraulic Capacity Report* and the *RCSD WWTP Process and Hydraulic Capacity Report* (included in Appendix I).

## 6.2 ACSD North WWTP

The ACSD North WWTP is a conventional activated sludge treatment facility and receives wastewater from the combined sewer systems of the cities of Albany, Cohoes, and Watervliet and the Village of

Green Island. The Albany County Interceptors also receive flow from the sanitary sewers in Villages of Menands and Colonie and the Towns of Colonie and Guilderland. The WWTP was originally designed in 1970 for an average primary, secondary, and disinfection flow rate of 35 mgd; a peak secondary flow rate of 70 mgd; and a peak wet weather primary, partial secondary bypass and disinfection flow rate of 88 mgd. The actual average daily flow was 23.7 mgd based on the analyses of three years of data from January 1, 2005 through December 31, 2007.

This evaluation concluded that ACSD North WWTP is limited by its process capacity. The plant has an existing average primary treatment capacity of 35 mgd and an existing average secondary treatment capacity of 29 mgd. Plant effluent passes through the existing disinfection contact tanks but no disinfection capability currently exists. The plant has an existing peak wet weather primary treatment capacity of 88 mgd and an existing peak secondary treatment capacity of 55 mgd. During wet weather peak wet weather flow events, the primary effluent in excess of 55 mgd is sent through the secondary bypass and blended with the secondary effluent before discharge. Table 6-1 summarizes the ACSD North WWTP unit process capacities and limitations.

TABLE 6-1: ACSD North WWTP Capacity Summary Table

| Unit Process | Limiting Capacity (MGD) | Limitation | Comment |
|---|---|---|---|
| Average Daily Flow Plant Capacity(1) | | | |
| Headworks | 90 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 35 | Process | Limited by surface overflow rate |
| Secondary Treatment | 29 | Process | Limited by solids loading rate |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |
| Peak Wet Weather Capacity(1) | | | |
| Headworks | 90 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 88 | Process | Limited by surface overflow rate |
| Secondary Treatment | 55 | Process | Limited by solids loading rate |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |

(1) Values represent capacities at both the 1-year and 25-year Hudson River Flood Elevations

Both the primary and secondary treatment capacities are limited by the surface overflow rates and solids loading rates for the process trains. The primary treatment system continues to operate successfully at its original design loading rates. The secondary system currently operates with only three of the original six aeration tanks. Overall, the three aeration tanks and six secondary settling tanks in service are effectively treating the wastewater as shown by the good final effluent quality. The aeration tanks demonstrated effective treatment at an average per-tank flow that is approximately 40 percent higher than the original average design basis (8 mgd per tank vs. 5.8 mgd design), based on only three of six aeration tanks currently being operated at the 23.7 mgd average daily flow. Though ample secondary treatment capacity exists for current and future flow projections, the average and peak secondary treatment capacities are reduced from the original design capacities due to the reduction in actual flows and loads. Full aeration tank volume is realized by operating the existing mechanical mixers in three of the six tanks which is not typical and therefore not considered as part of this evaluation. Plant effluent passes through the existing disinfection contact tanks but no disinfection capability exists.

The existing plant reliable and emergency hydraulic capacities exceed the process capacities for both the 1-year and 25-year flood elevations.

The capacity evaluation for the ACSD North WWTP concluded that the plant operations support the best management practice of maximizing flow to the WWTP. Peak wet weather capacities determined by this evaluation are consistent with current operations. The existing operations and plant performance support the treatment of peak wet weather flows up to the original design flow of 88 mgd for primary treatment and 55 mgd for secondary treatment at current influent characteristics. Accepting more flow to increase the wet weather peak influent above current levels is not recommended in order to avoid performance degradation; particularly since the loss of one unit will significantly increase the load on the units remaining units in service.

## 6.3 ACSD South WWTP

The ACSD South WWTP is a conventional activated sludge treatment facility that receives wastewater from the combined sewer system of the City of Albany. The plant was originally designed in 1970 for an average daily primary, secondary and disinfection flow rate of 19 mgd; a peak secondary flow rate of 38 mgd; and a peak wet weather primary, partial secondary bypass, and disinfection flow of 45 mgd. The plant is currently permitted for a 29 mgd, 12-month rolling average flow. Actual plant influent flow averaged approximately 23.4 mgd based on the analyses of three years of data from January 1, 2005 through December 31, 2007.

This evaluation concluded that the ACSD South WWTP is limited by both its hydraulic and process capacities depending on the flow condition and Hudson River elevation. Because of the hydraulic limitation, the capacity can be influenced by Hudson River elevation. Capacities were determined for both the 1-year flood elevation and the 25-year flood elevation.

For the 1-year flood elevation, the ACSD South WWTP has an existing average primary and secondary treatment capacity of 29 mgd. Plant effluent passes through the existing disinfection contact tanks but no disinfection capability exists. Similarly, the plant has an existing peak wet weather primary treatment capacity of 29 mgd and an existing peak secondary treatment capacity of 32 mgd. The peak wet weather capacities for both primary and secondary treatment limits are controlled by the plant hydraulic capacity. Because the peak process capacities exceed hydraulic capacities, the plant is operated outside normal hydraulic limitations in order to maximize wet weather flow and reach the process capacity limits. Under these circumstances, the ACSD has demonstrated the ability to achieve SPDES Permit Compliance by allowing the plant secondary and primary clarifier weirs to submerge, resulting in a peak wet weather primary treatment capacity of 45 mgd and an existing peak secondary treatment capacity of 40 mgd with the 1-year flood elevation. During peak wet weather flow events, the primary effluent in excess of 40 mgd is sent through the secondary bypass and blended with the secondary effluent before discharge. Table 6-2 summarizes the ACSD South WWTP unit process capacities and limitations for the 1-year flood elevation.

TABLE 6-2: ACSD South WWTP Capacity Summary Table (1-Year Flood Elevations)

| Unit Process | Limiting Capacity (MGD) | Limitation | Comment |
|---|---|---|---|
| Average Daily Flow Plant Capacity | | | |
| Headworks | 60.5 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 29 | Hydraulic/ Process | Limited by surface overflow rate and by 3" free drop at weirs |
| Secondary Treatment | 29 | Process | Limited by solids loading rate |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |
| Peak Wet Weather Capacity | | | |
| Headworks | 60.5 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 29/45 | Hydraulic/ Process | Limited by 3" free drop at weirs at 29 mgd. Primary weirs are allowed to submerge to reach limiting surface overflow rate |
| Secondary Treatment | 32/40 | Hydraulic/ Process | Limited by 3" free drop at weirs at 32 mgd. Secondary weirs are allowed to submerge to reach limiting surface overflow rate |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |

The operations of the ACSD South WWTP are significantly affected by the 25-year flood elevation. Theoretically, there would be no reliable secondary treatment capacity because the 25-year flood elevation at the plant outfall approaches the secondary clarifier weir elevation. However, similar to the peak flow plant operations under normal river levels, the plant is operated outside normal hydraulic limitations in order to maximize treatment and approach the process capacity limits. Under these circumstances, the ACSD has demonstrated the ability to achieve SPDES Permit Compliance by allowing the plant secondary and primary clarifier weirs to submerge resulting in an increase in the existing average secondary treatment capacity to 29 mgd. These average treatment capacities are similar to the 1-year flood values but with the loss of hydraulic control (i.e., secondary weirs submerged).

For peak wet weather events under the 25-year Hudson River flood elevations, the primary clarifiers can accept additional flow up to their process capacity limitation of 45 mgd. The secondary system treatment capacity can be increased to 32 mgd. During peak wet weather flow events, the excess primary effluent is sent through the secondary bypass and blended with the secondary effluent before discharge. Table 6-3 summarizes the ACSD South WWTP unit process capacities and limitations for the 25-year flood elevation.

TABLE 6-3: ACSD South WWTP Capacity Summary Table (25-Year Flood Elevations)

| Unit Process | Limiting Capacity (mgd) | Limitation | Comment |
|---|---|---|---|
| Average Daily Flow Plant Capacity | | | |
| Headworks | 60.5 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 29 | Hydraulic/ Process | Limited by surface overflow rate and by 3” free drop at primary clarifier weirs |
| Secondary Treatment | 0/29 | Hydraulic/ Process | Flood elevation approaches the secondary clarifier weir elevation. Weirs are allowed to submerge to reach limiting surface overflow rate |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |
| Peak Wet Weather Capacity | | | |
| Headworks | 60.5 | Hydraulic | Influent pumping firm capacity |
| Primary Treatment | 29/45 | Hydraulic/ Process | Limited by 3” free drop at primary clarifier weirs at 29 mgd. Weirs are allowed to submerge to reach limiting surface overflow rate |
| Secondary Treatment | 0/32 | Hydraulic/ Hydraulic | Flood elevation approaches the secondary clarifier weir elevation. Weirs are allowed to submerge to maximize treatment. Capacity limited by allowable freeboard. |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required 30 months following approval of this LTCP. |

The capacity evaluation for the ACSD South WWTP concluded that the plant operations support the best management practice of maximizing flow to the WWTP. Peak wet weather flows capacities determined by this evaluation are consistent with current operations. The existing operations and plant performance support the treatment of peak wet weather flows up to the original design flow of 45 mgd for primary treatment and 40 mgd for secondary treatment (above the original design flow) at current influent characteristics. However, the primary settling tanks and final settling tanks operate at or above industry recommended surface overflow rates with all available tanks in service. Accepting more flow to increase the peak wet weather influent above current levels is not recommended in order to avoid performance degradation; particularly since the loss of one unit will significantly increase the load on the units remaining units in service. Operating at the higher surface overflow rates, especially without adequate redundancy for planned or unplanned tanks out of service, increases the potential for reduced treatment performance and risk of not meeting permit requirements.

## 6.4 RCSD WWTP

The RCSD owns and operates the WWTP located in Troy, New York. The plant is a conventional secondary treatment facility and receives wastewater from the combined sewer systems of the cities of Rensselaer and Troy. The influent to the RCSD WWTP originates in the Cities of Troy and Rensselaer, and the Towns of North Greenbush, Schaghticoke, Brunswick and Sand Lake. The WWTP was built and placed into operation in 1973 and serves a combined sewer system. In addition, the plant receives approximately 4.0 MG annually (or 11,000 gpd) of hauled septage.

Liquid-stream units at the WWTP include mechanical bar screens, primary clarifiers, aeration tanks, final clarifiers and chlorine contact tanks (CCTs). The plant effluent discharges directly into the Hudson River.

The WWTP was originally designed for an average daily primary, secondary and disinfection flow rate of 24 mgd; a peak secondary flow rate of 51 mgd (with 50% return activated sludge flow); and a peak wet weather primary, partial secondary bypass, and disinfection flow of 63.5 mgd. Actual plant influent flow averaged approximately 17.0 mgd based on the analyses of three years of data from January 1, 2005 through October 31, 2007. The peak hourly flow rate during this time period was 49 mgd.

The four original final clarifiers were designed for a maximum daily flow (MDF) of 24 mgd. An additional final clarifier was installed in 2001 as part of a consent decree with the United States Northern District Court. The consent decree was the result of a Citizen's suit filed against RCSD due to SPDES permit violations (suspended solids) during high flow periods and occasional storm flow settleable solids violations. The additional final clarifier was designed for a maximum daily flow of 11.3 mgd.

Table 6-4 details the limiting peak capacity of each process unit and its specific limitation.

TABLE 6-4: RCSD WWTP Capacity Summary Table

| Unit Process | Limiting Capacity (mgd) | Limitation | Comment |
|---|---|---|---|
| Peak Flow Plant Capacity at 25-Year Flood Elevation | | | |
| Headworks | 63 | Process | Assumes all 3 screens are operational. |
| Primary Treatment | 70 | Process | Limited by surface overflow rate |
| Secondary Treatment | 30 | Hydraulic | CCT weir elevations |
| Disinfection | 0 | Process/ Hydraulic | No disinfection is currently required/Submerged weirs at all flow rates. Disinfection is required by 9/1/12 |
| Peak Wet Weather Capacity at 1-Year Flood Elevation | | | |
| Headworks | 63 | Process | Assumes all 3 screens are operational. |
| Primary Treatment | 70 | Process | Limited by surface overflow rate |
| Secondary Treatment | 35 | Process | Limited by short circuiting in final settling tanks |
| Disinfection | 0 | Process | No disinfection is currently required. Disinfection is required by 9/1/12. |

Two of the three mechanical bar screens are undergoing replacement in 2011. For this evaluation, it was assumed that three screens will be operational. The primary treatment capacity is limited by the surface overflow rate, but operates successfully at below its design and peak loading rates. With the dilute influent strength, only two of the four aeration tanks are needed to meet permit limits. The secondary system currently operates with the original four (peripheral feed) final settling tanks plus one deeper, center feed clarifier. Even with this additional clarifier, the existing four final settling tanks exhibit severe short circuiting which limits process capacity.

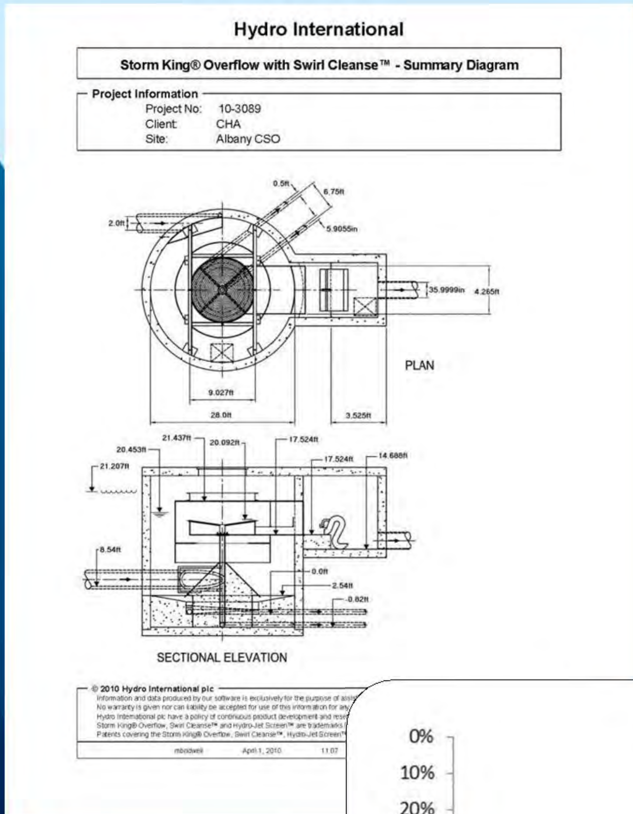
Plant effluent passes through the existing disinfection contact tanks but no disinfection capability exists. The major hydraulic restriction is the flood conditions at the Hudson River. The 25-year flood level is well above the effluent weirs at the CCT that are at an elevation of 15.54-ft. The 25-year flood condition also reduces the available head between the CCT and the final clarifiers.

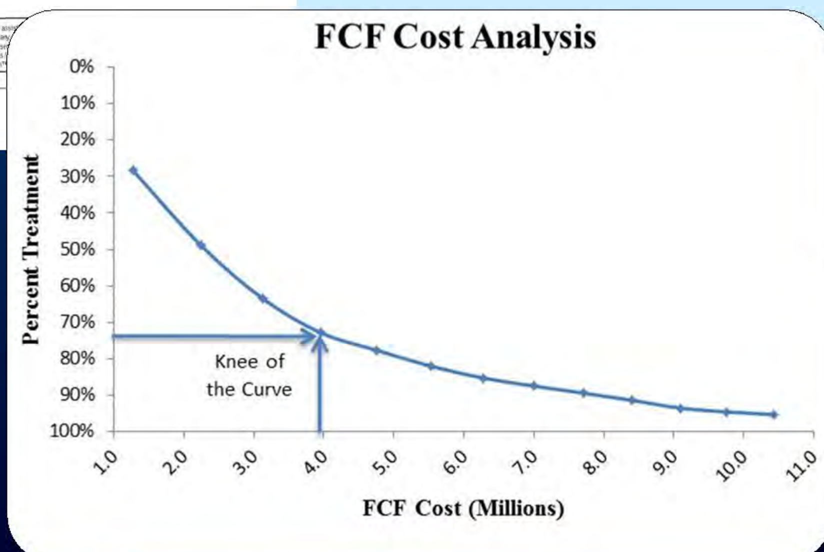
The existing operations and plant performance support the treatment of peak wet weather flows up to 35 mgd at the 1-year flood elevation, which is less than the original maximum design and current permitted flow of 51 mgd through secondary treatment. Accepting more flow to increase the peak wet weather influent above current levels is not recommended in order to avoid performance degradation. However, the evaluation shows that the plant should be able to pass and treat a higher flow for a short duration assuming all tanks are in service and a 6-inch freeboard is provided. As is shown in the various scenarios, the hydraulic capacity is highly dependent on the river elevation and whether the conditions under the reliable or emergency capacity definition are followed.

Chapter 7

# Development and Evaluation of CSO Control Alternatives



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# 7.0 Development and Evaluation of CSO Control Alternatives

## 7.1 Introduction

This chapter describes available CSO abatement technologies and assesses their ability to fulfill the CSO control objectives. Many alternative strategies are available to control pollutants discharged from CSOs ranging from no action to complete separation of the combined sewer system into separate sanitary and stormwater systems. This assessment considers technologies presented in the EPA guidance manuals, selects appropriate technologies for further evaluation and identifies a recommended plan.

The following summarizes the text of the Development and Evaluation of CSO Control Alternatives Report (included in Appendix J).

## 7.2 CSO Control Objectives

NYSDEC regulations classify water bodies and their designated uses. They also identify impairments that may preclude the attainment of water quality standards. The NYSDEC Regulations Chapter X, Parts 858 Lower Hudson, Part 876 Mohawk River and Part 941 Upper Hudson indicate that the standards of quality and purity for these water bodies are the same as their current classifications. The headwaters of the Mohawk and Hudson Rivers are identified as Class A waters as the rivers enter the Albany Pool Communities. The Class A headwaters provides a source of drinking water, as well as fishing, bathing and primary contact recreation. The Class C waters of the Mohawk and Hudson Rivers begin at the upstream border of the APCS and continue downstream of the CSOs. Class C Waters are typically used for fishing. They may also be suitable for primary or secondary contact recreation, but there may be conditions that limit those uses. These classifications coincide with the current uses.

As discussed in the previous chapters of this report, the primary objectives of the CSO LTCP are to maintain the current Class C river uses, support riverfront economic development and accommodate swimming and bathing at the potential future beach sites. The CSO LTCP is also required to meet current permit requirements, including the 15 best management practices (BMPs) included in each communities' SPDES permit.

## 7.3 Regulatory Compliance Strategy

The results of the receiving water quality characterization and receiving water quality modeling efforts, as discussed in earlier chapters of this report, determined that bacteria and floatables should be the primary pollutants to be focused upon for achievement of water quality standards. As a result, the review of CSO abatement technologies will concentrate on technologies suitable for addressing bacteria and floatables.

As discussed in Chapter 5, a one-dimensional receiving water quality model of the Hudson River was developed and used to evaluate compliance with bacteria standards for baseline (existing) conditions and five scenarios of future conditions. A summary of the bacteria modeling results follows in Table 7-1.

TABLE 7-1: Bacteria Modeling Results

| Scenario | WWTP Disinfection | Headwaters | Tributaries | CSO | Exceedances (months/30 months) |
|---|---|---|---|---|---|
| Baseline | No | Baseline | Baseline | Baseline | 30 |
| 1 | Yes | Baseline | Baseline | Baseline | 2 |
| 2 | Yes | Improved | Improved | Baseline | 0 |
| 2A | Yes | Improved | Baseline; Patroon Creek improved to 2009 levels | Baseline | 0 |
| 3 | Yes | Baseline | Baseline | 85% Capture | 2 |
| 4 | No | Baseline | Baseline | 85% Capture | 30 |

Notes:
Disinfection was applied at the WWTPs only during the recreation season.
Improved headwaters and tributaries meet water quality standards for fecal coliform.
Exceedances are based upon the 5-yr simulation and refer to the number of months during the recreation season that the monthly geomean exceeds 200 cfu/ml at any transect within the Albany Pool. Monthly geometric means were calculated based on noon values.

The key conclusions of the Receiving Water Quality Model Development Report (included in appendix H) which shape the regulatory compliance strategy are as follows:

A review of the historical river dissolved oxygen data indicates that CSOs are not a cause of violations of the dissolved oxygen standard. As a result, a dissolved oxygen river model is not required.

Improvements to continuous sources of bacteria contributions to the Hudson River, such as WWTPs, tributaries and the headwaters, provide more effective bacteria based water quality improvements in comparison to improvements to intermittent wet weather based discharges.

The water quality conditions of the headwaters of the Hudson River, as assumed under Scenario 2A are believed to be achievable since the WWTPs upstream of the Albany Pool have either completed or are in the midst of performing projects to disinfect their effluent discharges to the Hudson River. The documented improvements to water quality conditions of Patroon Creek are believed to be sustainable due to continuing efforts by the City of Albany and the Albany Count Sewer District to identify and eliminate possible illicit sewer connections and are substantiated by sampling performed in 2009.

The results of Scenario 2A (no exceedances during the recreation season over the 5-yr model simulation) indicate CSOs do not preclude the attainment of water quality standards upon implementation of seasonal disinfection of WWTPs, improvements to the headwaters and Patroon Creek associated with completed and ongoing projects.

Use of the Demonstrative Approach should be considered for evaluating CSO controls. The focus of the CSO control alternatives analysis will be on best management practices, WWTP hydraulic and disinfection upgrades, floatables control and improvements to select watersheds where CSO controls provide cost effective bacteria based water quality improvements in areas where primary contact recreation is envisioned.

In consideration of the receiving water quality model observations and conclusions, the regulatory compliance strategy for the Albany Pool Communities will utilize the Demonstrative Approach for development of a recommended plan for CSO compliance. The CSO control strategy will:

- Achieve regulatory compliance as measured by the water quality standard for bacteria;
- Optimize performance of existing infrastructure;
- Incorporate WWTP and system rehabilitation projects to address current needs and reduce risk of emergency repairs;
- Preserve capital for future operation and maintenance.

The primary goal of the recommended plan is to minimize continuous contributions of bacteria to the Hudson River, optimize existing conveyance and WWTP capacity, reduce inflow sources and peak wet weather flows, and control floatables. To achieve compliance, CSO control technologies will focus on seasonal disinfection of WWTP effluent, WWTP process improvements, best management practices, system optimization, sewer separation, floatables control and tributaries enhancement.

## 7.4 Identification and Screening of CSO Abatement Technologies

Specific factors that deem whether a technology is appropriate include: the water quality uses and goals, the current condition of the sewer system, the characteristics of the wet weather flow (peak flow rate, volume, frequency and duration), hydraulic and pollutant loading, climate, implementation requirements (land, neighborhood, noise, disruption), and maintenance requirements.

Each of the technologies evaluated in this chapter of the report were divided into two general categories, Best Management Practices (BMPs) and CSO Control Technologies. BMPs include Quantity Source Control Measures and Quality Source Control Measures. These measures are generally low cost facilities or practices intended for reducing the volume of stormwater or the introduction of pollutants to the sewer system at the source. Many of the quantity and quality source control measures are already performed by the Albany Pool Communities and/or the upstream communities. An overview of these controls is presented herein as part of LTCP evaluation process. Some of the BMPs are watershed/drainage basin type controls that are complemented by general public housekeeping efforts (i.e., litter control, household hazardous waste collection, illegal dumping ordinances, etc.).

CSO Control Technologies consist of Collection System Controls, Storage Technologies; and Treatment Technologies which generally address pollutants after they have been introduced to the sewer system. Collection System Controls are utilized for the purposes of reducing inflow to the sewer system, maximizing capture of wastewater, and improving overall sewer system conveyance capacity. Storage Technologies are used to reduce peak wet weather flows and improve CSO capture by the collection system. Treatment technologies provide either in-system or WWTP enhancements focused on the pollutants which are causing non-compliance with the water quality standards.

Table 7-2 lists each of the CSO abatement technologies considered in this report and identifies the results of the technology evaluation/screening. The technologies have been identified by the following categories:

- Technology Not Feasible or Appropriate - These technologies are not considered appropriate for CSO control because they will not work effectively or will not reduce water quality impacts to the extent required. They may also include technologies that exceed the requirements for meeting water quality standards, but have been eliminated from consideration in favor of other technologies which are less costly to build or operate, require a smaller footprint, or have other features that make them better suited for the application.
- Continue Current Practice - These technologies are typically best management practices that will help to optimize system operations and minimize CSO discharges and impacts to receiving water bodies.
- LTCP Technology - These technologies are feasible structural controls that will reduce and/or eliminate CSO discharges and impacts, and are being carried forward for further evaluation as a LTCP technology.

TABLE 7-2: Screening of CSO Abatement Technologies

| CSO Abatement Technologies | Recommendation |
|---|---|
| Quantity Source Control Measures | |
| Porous Pavement | Not Feasible or Appropriate |
| Flow Detention or Retention of Stormwater | Not Feasible or Appropriate |
| Disconnection of Stormwater Inflow Sources | Continue Current Practice |
| Utilization of Pervious Areas for Infiltration | Not Feasible or Appropriate |
| Catch Basin Modifications to Reduce Peak Discharges | Not Feasible or Appropriate |
| Construction of Urban Parks and Green Spaces | Not Feasible or Appropriate |
| Installation of Green Roofs | Not Feasible or Appropriate |
| Bioretention for Capture of Stormwater | Not Feasible or Appropriate |
| Water Conservation to Reduce Wastewater Discharges | Not Feasible or Appropriate |
| Infiltration Sumps for Stormwater Capture | Not Feasible or Appropriate |
| Quality Source Control Measures | |
| Air Pollution Reduction | Not Feasible or Appropriate |
| Solid Waste Management | Continue Current Practice |
| Fat, Oil, and Grease Control Programs | Continue Current Practice |
| Street Sweeping | Continue Current Practice |
| Cleaning of Catch Basin Sumps | Continue Current Practice |
| Catch Basin Modifications for Floatables Capture | Continue Current Practice |

| CSO Abatement Technologies | Recommendation |
|---|---|
| Fertilizer/Pesticide Control | Continue Current Practice |
| Snow Removal and Deicing Practices | Continue Current Practice |
| Soil Erosion Control | Continue Current Practice |
| Commercial/Industrial Runoff Control | Continue Current Practice |
| Animal Waste Removal | Continue Current Practice |
| Floating Curtains and Booms | Not Feasible or Appropriate |
| Collection System Controls | |
| Existing Collection System Management | Long Term Control Plan Technology |
| Regulator Modifications | Long Term Control Plan Technology |
| Sewer Cleaning/Flushing | Continue Current Practice |
| Sewer Separation | Long Term Control Plan Technology |
| Infiltration/Inflow Control | Long Term Control Plan Technology |
| Maximize Efficiency of Backwater Gates | Long Term Control Plan Technology |
| Remote Monitoring and Control/Flow Diversion | Not Feasible or Appropriate |
| Relocation of CSO Outfalls | Long Term Control Plan Technology |
| CSO Storage Technologies | |
| In-Line CSO Storage and Real Time Control | Not Feasible or Appropriate |
| Off-Line CSO Storage | Long Term Control Plan Technology |
| Surface Storage of CSO | Not Feasible or Appropriate |
| CSO Treatment Technologies | |
| Wastewater Treatment Plant Improvements | Long Term Control Plan Technology |
| CSO Screening | Long Term Control Plan Technology |
| Sedimentation | Not Feasible or Appropriate |
| Enhanced High-Rate Clarification | Not Feasible or Appropriate |
| Chemical Flocculation | Not Feasible or Appropriate |
| Dissolved Air Flotation | Not Feasible or Appropriate |
| Vortex Treatment Technologies | Long Term Control Plan Technology |
| Biological Treatment | Not Feasible or Appropriate |
| Filtration | Not Feasible or Appropriate |
| Disinfection | Long Term Control Plan Technology |

## 7.5 Green Infrastructure Strategies

As part of the development of CSO control strategies, green infrastructure tools and measures have been considered and incorporated into the proposed CSO control projects, to the greatest extent practicable. Incorporated green infrastructure elements include the reduction of inflow to the combined sewer systems and WWTP's; which results in a reduction of the energy usage and treatment costs, and maximizes the CSO percent capture for the system. In addition to the defined projects in the CSO LTCP Program that incorporate "green benefits", the APCs have defined program goals which include the specification and installation of energy efficient equipment; the promotion of Green Infrastructure Practices within Municipal Capital Improvement Programs; and the promotion and enforcement of the new 2011 NYSDEC Stormwater Regulations for both public and private development projects.

Furthermore, the APCs propose to enhance coordination efforts between Albany Pool CSO communities and additional MS4 communities, within both Albany and Rensselaer Counties, where opportunities to share services/work products exist. Examples of sharing work products may include efforts undertaken by the Stormwater Coalition of Albany County which are performing municipal code review in regards to the new NYSDEC stormwater regulations; and/or the proposed efforts by the Albany Pool CSO communities which are proposing to develop green infrastructure technical design guidance documents for public and private projects.

Several pilot or demonstration projects have been completed or are presently under development, including the following:

- Member Communities of the Stormwater Coalition of Albany County participate in a Rain Barrel Program to educate the public and promote the reuse and conservation of stormwater.
- Rain Garden and Tree Planter Demonstration Projects have been completed to educate the public and promote infiltration practices.
- Porous Pavement Demonstration Project was completed in the City of Cohoes, and
- Green Street Demonstration Projects are proposed within the City of Albany and the City of Rensselaer.

## 7.6 LTCP Technologies

The screening of available CSO abatement technologies has eliminated many technologies from further consideration for the Albany Pool CSO LTCP. Those technologies which remain have been identified as the best options for directly addressing the primary pollutants of concern (bacteria and floatables) as identified in the receiving water quality characterization and modeling efforts. Other technologies on this list have been identified for addressing BMPs. These technologies will incorporate good maintenance practices to ensure that system operation is maximized to the extent possible before more expensive structural controls are implemented. The remaining CSO control technologies will be further evaluated later in this chapter of the report. Table 7-3 provides a summary of these technologies.

TABLE 7-3: Long Term Control Plan Technologies

| CSO Abatement Technology | Application |
|---|---|
| Disinfection at the Treatment Plants | Sewer Districts |
| WWTP Improvements | Sewer Districts |
| Existing Collection System Management | Communities & Sewer Districts |
| Regulator Modifications to Enhance CSO Capture | Sewer Districts |
| Maximize Efficiency of Backwater Gates | Communities |
| Infiltration/Inflow Control | Communities & Sewer Districts (also upstream communities with separate systems) |
| Relocation of CSO Outfalls | Communities |
| Sewer Separation | Communities |
| Off-line CSO Storage Tanks | Communities |
| Screening (Including Vortex Treatment) | Communities & Sewer Districts |

## 7.7 Evaluation of CSO Control Facility Requirements

The SPDES Permits for each of the communities and sewer districts identify the basic requirements for combined sewer systems. Each permit includes 15 best management practices (BMPs) for CSOs which focus on improving collection system performance and reducing water quality impacts of CSO discharges. The SPDES permits for each of the sewer districts also include requirements for seasonal disinfection of WWTP effluent, as well as a residual chlorine limit.

While the SPDES Permit requirements provide the minimum basic requirements for CSO control, the USEPA CSO Control Policy provides the regulatory framework for evaluating CSO control alternatives. The Policy allows for two approaches to CSO control evaluations, the Presumption Approach and the Demonstrative Approach.

In accordance with the regulatory compliance strategy for the APCs discussed in 7.3, the Demonstrative Approach will be used for development of the CSO LTCP. CSO controls will primarily focus on achieving regulatory compliance as measured by the water quality standard for fecal coliform. Consistent with the demonstrative approach, the APCs plan to take a build and measure approach to allow them to cost–efficiently address CSO related water quality compliance issues. The CSO LTCP will initially focus on the main contributors of the primary pollutant of concern (bacteria), and then address other measures for improving system performance, reducing CSO discharges and controlling floatables in the remaining overflows.

As indicated by the receiving water modeling, reduction of continuous sources of fecal coliform provide the greatest bacteria-based water quality benefits to the Hudson River. Seasonal disinfection of WWTP all effluent and enhancement of tributaries provide opportunities for significantly reducing continuous bacteria contributions to the river. Additional CSO control measures include WWTP capacity improvements, BMPs, system optimization, and sewer separation. These control measures provide improvements in wet weather capture and reduction of CSO discharges. Floatables control facilities provide the means for minimizing the discharge of floatables associated with those CSOs remaining after the implementation of the LTCP. Additional tools for improving CSO control and educating the public have also been considered.

In accordance with the foregoing discussion, CSO controls have been evaluated and categorized into the recommended projects as follows:

- Disinfection Projects – These consist of seasonal disinfection of the effluent at each WWTP.
- Tributary Enhancements – The water quality improvements observed along Patroon Creek during the water quality sampling program highlight the benefits of investigating sources of bacteria contributions to tributaries of the Hudson River. Initial projects will consist of field investigations to identify potential illicit sewer connections, failed septic systems, exfiltration from sewers running parallel or crossing stream, or other sources of bacteria.
- BMPs/System Optimization – These projects focus on SPDES Permit BMPs and maximizing the performance of the existing infrastructure through system characterization and mapping, regulator modifications, reduction of system inflow, capacity upgrades, and improved operations.
- Sewer Separation/Stormwater Storage – These projects consist of separating sewers in select sewersheds (including diverting streams from existing combined sewers and storm water from existing outfalls), installation of storm water storage structures, diversion of stormwater to groundwater recharge basins.
- Floatables Control Facilities – These facilities provide screening of CSO discharges to remove floatable material. Projects were identified based upon the volume of overflow contributed by a particular outfall and/or its location in relation to recreational areas. Projects also include consolidation of outfalls where appropriate.
- Additional Pool-Wide Projects – These projects were developed for the purpose of improving management and operations of the existing wastewater infrastructure, modifying land use ordinances for the purposes of controlling stormwater runoff and developing programs for educating the public on the water quality impacts of CSOs on the Hudson River.

## 7.8 CSO Control Alternatives Cost Estimating Guidelines

Project cost estimates were developed for each of the recommended projects in accordance with CSO Control Alternatives Cost Estimating Guidelines developed for the Albany Pool CSO LTCP. The Cost Estimating Guidelines are included in the appendices of the *Development and Evaluation of CSO Control Alternatives Report* (Included in Appendix J).

The guidelines provide a set methodology for developing planning level construction costs for various control alternatives, as well as a process for including contingencies, non-direct costs, overhead and profit and soft costs for legal, administrative and engineering services.

## 7.9 Summary of Recommended CSO LTCP

In accordance with the CSO control strategy, the Recommended CSO LTCP focuses on the main contributors of the primary pollutant of concern (bacteria), and then addresses measures for improving system performance, reducing CSO discharges and controlling floatables in the remaining overflows. Table 7-4 provides a summary of the Recommended CSO LTCP and the estimated project costs.

TABLE 7-4: Recommended CSO LTCP

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| | Disinfection Projects | |
| ACSD | North Plant Disinfection Project | $5.70 |
| ACSD | South Plant Disinfection Project | $3.10 |
| RCSD | Disinfection Facilities at WWTP | $7.22 |
| | Subtotal | $16.02 |
| | WWTP Process Improvements | |
| RCSD | Replacement of Mechanical Bar Screens | $1.18 |
| RCSD | Primary Sludge Degritting | $3.12 |
| RCSD | Enhanced Final Settling | $11.47 |
| | Subtotal | $15.77 |
| | BMPs/System Optimization | |
| Albany | Bouck Tide Gate Installation | $0.12 |
| Albany | Pumping Station Upgrades | $0.37 |
| Albany | Sewer Rehabilitation Projects Throughout the City of Albany | $0.63 |
| Albany | Eliminate Schyler (CSO 015) Overflow | $0.27 |
| Albany | Eliminate Liberty (CSO 022) Overflow | $1.10 |
| Albany | Modify Bouck Regulator | $0.25 |
| Albany | Eliminate Hudson Street Overflow | $0.01 |
| Cohoes | Upgrade Pump Stations (new pumps and controls) | $0.06 |
| Cohoes | Pump Station Bypass Evaluation | $0.03 |
| Cohoes | Pump Station Bypass Design and Construction | $0.11 |
| Cohoes | Improvements at Ten Regulators | $0.10 |
| Green Island | Swan St and Hamilton St. Improvements | $0.02 |
| Rensselaer | Partition Street Trunk Sewer Inspection and Cleaning (CSO 006) | $0.05 |
| RCSD | Upgrade Pump Stations | $10.00 |

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| RCSD | Regulator Improvements to Address DWOs | $0.38 |
| RCSD/Troy | Outside Community Metering | $2.07 |
| Troy | Regulator Monitoring for DWOs | $0.04 |
| Troy | Catch Basin Survey and Mapping | $0.02 |
| Watervliet | Improvements at Five Regulators | $0.05 |
| Watervliet | 18th Street and Avenue A Weir Improvements | $0.04 |
| | Subtotal | $15.72 |
| | Sewer Separation/Stormwater Storage | |
| Albany | Elberon Place Area Storm Water Storage | $0.30 |
| Albany | Lawnridge/Grove/Glendale/ Forrest Avenue Partial Separation (CSO 016) | $0.37 |
| Albany | Marietta Place Area Storage Structures | $0.22 |
| Albany | Marrion/Myrtle Area Storm Water Storage Structures | $0.34 |
| Albany | Mereline Combined Sewage Storage | $0.50 |
| Albany | Upper Washington Avenue Groundwater Recharge | $0.50 |
| Albany | Melrose/Winthrop Groundwater Recharge Basins | $0.65 |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase I (CSO 007) | $1.43 |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase II (CSO 007) | $1.43 |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase III (CSO 007) | $1.43 |
| Cohoes | Columbia St. Phase II Separation (CSO 008/015) | $1.00 |
| Cohoes | George St. Sewer Separation (CSO 008/015) | $0.42 |
| Cohoes | Middle Vliet St. Sewer Separation (CSO 007) | $0.50 |
| Cohoes | 2011 Storm Sewer Improvements | $1.50 |
| Rensselaer | Broadway Sewer and Drain Improvements (CSO 006) | $2.80 |
| Rensselaer | Broadway Dry Weather Overflow Elimination Project | $1.79 |
| Rensselaer | Washington Avenue Sewer Improvements and Elimination of Farley Drive CSO (CSO 012) | $3.00 |
| Troy | 123rd Street Stream Separation (CSO 002) | $4.54 |
| Troy | Van Buren Street Stream Separation (CSO 041) | $4.74 |
| Troy | Polk Street Stream Separation (CSO 044) | $2.17 |
| Troy | 113th Street Stream Separation (CSO 013 and 013A) | $1.43 |

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| Troy | Hoosick St. Storm Sewer Extension (CSO 024) | $1.05 |
| | Subtotal | $32.11 |
| | Floatables Control Facilities (FCFs) | |
| Albany | FCF for CSO 016 and CSO 019 Outfalls (Regulators Big C, 4 and 4a, Arch, Ferry and Madison) | $14.52 |
| Albany | FCF for CSO 026 Outfall (Regulators Maiden, Stuben and Orange) | $4.00 |
| Albany | FCF for CSO 030 Outfall (Regulators Quackenbush, Jackson and Livingston) | $4.00 |
| Cohoes | Little C FCF (CSO 008/015) | $2.87 |
| Green Island | Hamilton St FCF (CSO 003) | $0.36 |
| | Subtotal | $25.75 |
| | Tributary Enhancements | |
| ACSD | Patroon Creek Trunk Sewer Repairs | $0.68 |
| Rensselaer/East Greenbush | Investigate Non-CSO Bacteria Sources Along Mill Creek | $0.03 |
| Troy | Cross Street Trunk Sewer Repair Along Wynants Kill (CSO 045) | $1.92 |
| Troy | Cross Street Trunk Sewer Evaluation (along Wynants Kill) (CSO 045) | $0.05 |
| Troy/Brunswick | Investigate Non-CSO Bacteria Sources Along Poesten Kill | $0.04 |
| Troy/North Greenbush | Investigate Non-CSO Bacteria Sources Along Wynants Kill | $0.03 |
| | Subtotal | $2.75 |
| | Additional Pool-Wide Projects | |
| All Communities | Hudson River Water Quality Public Advisory Webpage | $0.50 |
| All Communities | Green Infrastructure Technical Design Guidance | $0.10 |
| All Communities | Sewer System Operations, Maintenance and Inspection Plans | $0.30 |
| All Communities | Asset Management Plans | $0.60 |
| | Subtotal | $1.50 |
| | Total Recommended Plan | $109.62 |

## 7.10 Summary of Completed CSO Projects

Upon reviewing the Recommended CSO LTCP, it is important to recognize the efforts of each of the communities and sewer districts prior to engaging in this CSO control planning effort. Each of the APCs and sewer districts have performed a number of projects intended for improving collection and treatment systems performance. The performance of these projects highlights the commitment of the APCs to improving the water quality of the Mohawk and Hudson Rivers.

A summary of each of the completed projects and the associated project costs is provided as Table 7-5.

TABLE 7-5: Completed CSO Projects

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| | Disinfection Projects | |
| | No Projects Completed | |
| | WWTP Process Improvements | |
| ACSD | North Plant Screen Replacement Project Phase 2 | $0.55 |
| ACSD | South Plant Screen Replacement Project Phase 2 | $0.55 |
| ASCD | North Plant Primary Clarifier Upgrades | $0.25 |
| ASCD | North Plant Screen Replacement Project Phase 1 | $0.75 |
| ASCD | South Plant Screen Replacement Project Phase 1 | $0.75 |
| ACSD | South Plant Emergency Generator | $0.50 |
| ACSD | Influent Pumps North and South Plants | $1.60 |
| ASCD | Aeration System Upgrades North and South | $2.80 |
| RCSD | Secondary Clarifier | $2.25 |
| RCSD | Replace Mechanicals on One Primary Settling Tank | $0.28 |
| | Subtotal | $10.28 |
| | BMPs/System Optimization | |
| Albany | Backflow Prevention Valve Program | $0.34 |
| Cohoes | PS Telemetry Project | $0.06 |
| Cohoes | Comprehensive Pump Station Evaluation | $0.02 |
| Cohoes | Bridge Ave. PS Upgrade (PS #4) | $0.28 |
| Cohoes | Ontario St. PS Upgrade (PS #5) | $0.28 |
| Cohoes | Continental Ave. PS Upgrade (PS #6) | $0.28 |
| Cohoes | Linden St. PS Upgrade (PS #10) | $0.28 |
| Cohoes | McDonald Drive PS Upgrade (PS #1) | $0.03 |

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| Cohoes | DPW Garage PS Upgrade (PS #9) | $0.02 |
| Cohoes | Linen Place PS Upgrade (PS #2) | $0.02 |
| Cohoes | North Mohawk St. PS Upgrade (PS #7) | $0.03 |
| Cohoes | Niver Street PS Upgrade (PS #13) | $0.02 |
| | Subtotal | $1.64 |
| | Sewer Separation/Storm Water Storage | |
| Albany | Berkshire Blvd Sewer Separation | $1.77 |
| Albany | Beaver Creek Sewer Separation, Phase 1-5 | $3.95 |
| Albany | Hansen Avenue Combined Sewer Storage Facility | $0.31 |
| Albany | North and South Pearl Street | $2.56 |
| Albany | Whitehall Road Improvements | $0.50 |
| Albany | Academy Road Sewer Separation | $0.13 |
| Albany | Erie Blvd Service Area Extension | $0.15 |
| Albany | Rose Court Detention System | $0.36 |
| Albany | Melrose Avenue Recharge System | $0.39 |
| Albany | Hansen Alley Detention System | $0.22 |
| Albany | Ridgefield Alley Detention System | $0.15 |
| Albany | Academy Road Retention System | $0.21 |
| Albany | North Pine Sewer Separation | $0.15 |
| Albany | Central Avenue Storm Improvements | $1.63 |
| Albany | Delaware Avenue Sewer Separation | $2.11 |
| Cohoes | McDonald Dr. Sewer Separation | $0.10 |
| Cohoes | Lancaster St. Sewer Separation | $0.30 |
| Cohoes | Vliet St. Sewer Separation | $0.30 |
| Cohoes | Bridge Ave. Sewer Separation | $0.12 |
| Cohoes | White and Main St. Parking Improvements and Drainage | $0.20 |
| Troy | 101st and 102nd Street Separation and CSO Elimination Project | $3.00 |
| Watervliet | 10th Ave sewer separation | $0.02 |
| Watervliet | Wiswall Ave. Sewer Separation | $0.38 |
| Watervliet | 12th Ave CSO Elimination | $0.23 |
| | Subtotal | $19.24 |

| Community | Project | Estimated Project Cost ($M) |
|---|---|---|
| | Floatables Control Facilities | |
| Cohoes | Vliet Street FCF (CSO 007) | $1.00 |
| Watervliet | 19th Street Reconstruction | $0.72 |
| | Subtotal | $1.72 |
| | Tributary Enhancements | |
| | No Projects Completed | |
| | Total Spent To Date By Albany Pool Communities | $33.88 |

## 7.11 Assessment of CSO Control Effectiveness

Each of the projects recommended for implementation under the Albany Pool CSO LTCP were assessed based on their ability to address six basic components as follows:

- SPDES Permit Compliance – consists of projects that primarily focus on addressing Best Management Practices for CSOs;
- Pending Consent Order Requirements – include those projects which address concerns relating to dry weather overflows or sanitary sewer overflows;
- CSO Capture – comprises projects that reduce CSO discharge frequency and volume, as well as maximize flow to the WWTP;
- Receiving Water Quality Improvements – include those projects which will reduce pollutants entering the Hudson River and its tributaries through direct discharges or other sources;
- Green Infrastructure – applies to those projects which reduce energy consumption by using premium efficiency equipment in pumping and treatment and/or reduce the volume of stormwater conveyed to the WWTP;
- Floatables Control – includes those projects primarily focused on the capture of floatables in CSO discharges.

Table 7-6 provides a summary of the benefits of the Recommended CSO LTCP.

TABLE 7-6: Benefits of Recommended LTCP Projects

| Community | Project | SPDES Permit | Pending Consent Order | CSO Volume | Water Quality | Green Infrastructure | Floatables Control |
|---|---|---|---|---|---|---|---|
| **Disinfection Projects** | | | | | | | |
| ACSD | North Plant Disinfection Project | X | | | X | | |
| ACSD | South Plant Disinfection Project | X | | | X | | |
| RCSD | Disinfection Facilities at WWTP | X | | | X | | |
| **WWTP Process Improvements** | | | | | | | |
| RCSD | Replacement of Mechanical Bar Screens | X | | X | X | X | X |
| RCSD | Primary Sludge Degritting | X | | X | X | X | |
| RCSD | Enhanced Final Settling | X | | X | X | X | |
| **BMPs/System Optimization** | | | | | | | |
| Albany | Bouck Tide Gate Installation | | | X | | X | |
| Albany | Pumping Station Upgrades | | | X | X | X | X |
| Albany | Sewer Rehabilitation throughout the City of Albany | | | X | X | X | X |
| Albany | Remove Schyler (CSO 015) Overflow | | | X | X | | X |
| Albany | Remove Liberty (CSO 022) Overflow | | | X | X | | X |
| Albany | Modify Bouck Regulator | | | X | X | X | X |
| Albany | Remove Hudson Street Overflow | | | X | | | X |
| Cohoes | Upgrade Pump Stations (new pumps and controls) | | | X | X | X | |
| Cohoes | Pump Station Bypass Evaluation | | X | X | X | | |
| Cohoes | Pump Station Bypass Design and Construction | X | X | X | X | | X |
| Cohoes | Improvements at Ten Regulators | | | X | X | | X |
| Green Island | Swan St and Hamilton St. Improvements | | | X | X | | X |
| Rensselaer | Partition Street Trunk Sewer Inspection and Cleaning (CSO 006) | X | X | | X | | |
| RCSD | Upgrade Pump Stations | X | X | X | X | X | X |
| RCSD | Regulator Improvements to Address DWOs | X | X | X | X | | X |
| RCSD/Troy | Outside Community Metering | X | X | | | | |
| Troy | Regulator Monitoring for DWOs | X | X | X | X | | |

| Community | Project | SPDES Permit | Pending Consent Order | CSO Volume | Water Quality | Green Infrastructure | Floatables Control |
|---|---|---|---|---|---|---|---|
| Troy | Catch Basin Survey and Mapping | X | X | X | X | | X |
| Watervliet | Improvements at Five Regulators | | | X | X | | X |
| Watervliet | 18th Street and Avenue A Weir Improvements | | | X | X | | |
| | Sewer Separation/Storm Water Storage | | | | | | |
| Albany | Elberon Place Area Storm Water Storage | | | X | X | X | |
| Albany | Lawnridge/Grove/Glendale/ Forrest Avenue Separation | | | X | X | X | X |
| Albany | Marietta Place Area Storage Structures | | | X | X | X | X |
| Albany | Marrion/Myrtle Area Storm Water Storage Structures | | | X | X | X | |
| Albany | Mereline Combined Sewage Storage | | | X | X | X | X |
| Albany | Upper Washington Avenue Groundwater Recharge | | | X | X | X | |
| Albany | Melrose/Winthrop Groundwater Recharge Basins | | | X | X | X | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase I (CSO 007) | | | X | X | X | X |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase II (CSO 007) | | | X | X | X | X |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase III (CSO 007) | | | X | X | X | X |
| Cohoes | Columbia St. Phase II Separation (CSO 008/015) | | | X | X | X | X |
| Cohoes | George St. Sewer Separation (CSO 008/015) | | | X | X | X | X |
| Cohoes | Middle Vliet St. Sewer Separation (CSO 007) | | | X | X | X | X |
| Cohoes | 2011 Storm Sewer Improvements | | | X | X | X | X |
| Rensselaer | Broadway Sewer and Drain Improvements (CSO 006) | X | X | X | X | X | X |
| Rensselaer | Broadway Dry Weather Overflow Elimination Project | X | X | X | X | X | X |
| Rensselaer | Washington Avenue Sewer Improvements and Elimination of Farley Drive CSO (CSO 012) | X | | X | X | X | X |
| Troy | 123rd Street Stream Separation (CSO 002) | | | X | X | X | X |
| Troy | Van Buren Street Stream Separation (CSO 041) | | | X | X | X | X |
| Troy | Polk Street Stream Separation (CSO 044) | | | X | X | X | X |
| Troy | 113th Street Stream Separation (CSO 013 and 013A) | X | X | X | X | X | X |
| Troy | Hoosick St. Storm Sewer Extension (CSO 024) | X | X | X | X | X | X |

| Community | Project | SPDES Permit | Pending Consent Order | CSO Volume | Water Quality | Green Infrastructure | Floatables Control |
|---|---|---|---|---|---|---|---|
| Floatables Control Facilities (FCFs) | | | | | | | |
| Albany | FCF for CSO 016 and CSO 019 Outfalls (Regulators Big C, 4 and 4a, Arch, Ferry and Madison) | | | | X | | X |
| City of Albany | FCF for CSO 026 Outfall (Regulators Maiden, Stuben and Orange) | | | | X | | X |
| City of Albany | FCF for CSO 030 Outfall (Regulators Quackenbush, Jackson and Livingston) | | | | X | | X |
| Cohoes | Little C FCF (CSO 008/015) | | | | X | | X |
| Green Island | Hamilton St FCF (CSO 003) | | | | X | | X |
| Tributary Enhancements | | | | | | | |
| ACSD | Patroon Creek Trunk Sewer Repairs | | | X | X | | |
| Rensselaer/East Greenbush | Investigate Non-CSO Bacteria Sources Along Mill Creek | | | | X | | |
| Troy | Cross Street Trunk Sewer Repair Along Wynants Kill (CSO 045) | | | X | X | | X |
| Troy | Cross Street Trunk Sewer Evaluation (along Wynants Kill) (CSO 045) | | | X | X | | |
| Troy/ Brunswick | Investigate Non-CSO Bacteria Sources Along Poesten Kill | | | | X | | |
| Troy/North Greenbush | Investigate Non-CSO Bacteria Sources Along Wynants Kill | | | | X | | |
| Additional Pool-Wide Projects | | | | | | | |
| All Communities | Hudson River Water Quality Public Advisory Webpage | | | | X | | |
| All Communities | Green Infrastructure Technical Design Guidance | | | | | X | |
| All Communities | Sewer System Operations, Maintenance and Inspection Plans | X | X | | X | | |
| All Communities | Asset Management Plans | | X | | X | | |

Combined sewer system and receiving water quality model runs were performed to determine the benefits associated with implementation of the recommended plan. The RWQM was run for a five year simulation to cover a wide range of seasonal variations in groundwater and precipitation. Results of the post construction model run were compared with the baseline conditions to quantify the improvements to collection system and treatment system performance. In addition, the frequency of bacteria violations based on the receiving water quality standards were evaluated to reaffirm the receiving water modeling results performed during development of the Albany Pool CSO Control Strategy.

Table 7-7 provides a summary of the cumulative CSO control and receiving water improvements associated with implementation of the Recommended CSO LTCP.

TABLE 7-7: CSO Control and Receiving Water Improvements

| Scenario | Baseline Conditions | Post Construction of Recommended Projects |
|---|---|---|
| CSO Volume (MG) | 1236 | 925 |
| Number of Pool-Wide Events | 65 | 65 |
| Wet Weather Flow Treated at WWTPs (MG) | 2827 | 3031 |
| Pool-Wide Percent Capture | 69.5% | 77.2% |
| CSO Flow Receiving Floatables Control (MG) | 27 | 454 |
| Pool-Wide Treatment & Floatables Capture | 70.1% | 88.8% |
| Disinfection at WWTPs | No | Seasonal |
| Fecal Coliform WQ Standard Violations (during the recreation season for 5 yr model run) | 30 | 0 |

Under post construction conditions, the model predicts that the volume of CSO discharged annually will be reduced by 311 million gallons or 25 percent. Pool wide percent capture improves from 69.5 percent to 77.2 percent with an additional 204 million gallons of wet weather flow being conveyed to and treated by the WWTPs. Upon implementation of the seasonal disinfection facilities at each of the WWTPS, violations of the Fecal Coliform Water Standard during the recreation season (May to October) will be eliminated.

The results of the receiving water quality modeling for the post construction conditions support the achievement of water quality standards for fecal coliform. In accordance with the Demonstrative Approach of the USEPA CSO Policy, the Recommended Long Term Control Plan for the Albany Pool Communities will achieve compliance with the receiving water quality standards as follows:

- The control program meets water quality standards and preserves designated uses.
- The remaining CSO discharges will not preclude the attainment of the water quality standards for bacteria or the designated uses of the receiving waters.
- The proposed controls provide the maximum bacterial reduction benefits reasonably attainable, and
- The Recommended LTCP provides for cost effective expansion, retrofit or upgrade if required in the future to meet the receiving water quality standards or preserve designated uses.

A post construction monitoring program will be developed to demonstrate compliance. Details of the plan will be provided Chapter 9 of this report.

Chapter 8

# Financial Capability Assessment



albany pool
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# 8.0 Financial Capability Assessment

## 8.1 Introduction

A Financial Capability Assessment was completed in accordance with the February 1997 EPA document "CSO Guidance for Financial Capability Assessment and Schedule Development" (EPA, 1997). The EPA guidance suggests that the LTCP include a financial capability assessment in order to assess the financial burden on both ratepayers and the permittee, and to aid in the development of an implementation schedule for the LTCP by balancing the pace of LTCP implementation with the financial and economic capability of the permittees. The goal of the process is to permit flexibility in the scheduling and completion of CSO compliance measures, based on the financial capability of the area served.

The assessment consisted of a two-phase process for assessing the financial capability to fund the LTCP. Phase I of the analysis assesses residential customer financial capability as measured by the Residential Indicator. The Residential Indicator is calculated by dividing the projected total residential cost by the median household income (MHI). If the costs are at or above one percent of the MHI, a Phase II analysis is completed. The Phase II analysis assesses community financial capacity (i.e., financial strength and financing capacity) to afford the program.

In addition, the EPA encourages inclusion of any additional information related to the unique financial conditions of the permittees. Therefore, this assessment includes a year-by-year rate impact analysis, a discussion of socioeconomic trends, and a discussion of financial challenges that the region faces, which are relevant to the recommended LTCP schedule.

The complete Financial Capability Assessment including the Phase I, Phase II, and additional affordability arguments are detailed in the *Financial Capability Assessment Report* (included in Appendix K).

## 8.2 Residential Indicator

The Residential Indicator was calculated for the combined Albany Pool service area by first determining the total annual cost of wastewater treatment (including the LTCP costs). A portion of the total cost was then allocated to residential customers based on their flow proportion. Finally, the total residential cost was allocated amongst the total number of households associated with the Albany Pool communities to determine the wastewater collection and treatment (including LTCP) cost per household. Once the cost per household was determined, the Residential Indicator was calculated by dividing the cost per household by the MHI of the communities, and was compared to the EPA criteria for classifying the financial impact as "low," "mid-range," or "high."

The total annual cost of wastewater treatment (including the LTCP) was estimated to be approximately $40.9 million, of which, approximately $31.3 million or 76.5 percent of these costs was attributed to residential customers. This amount includes annualized cost of the recommended LTCP ($109.6 million, of which $97.3 million is the Albany Pool communities' estimated share[1]), anticipated annualized cost of other non-LTCP capital projects, current and projected incremental operation and maintenance expense, and current debt service obligations.

The total residential cost was divided by 79,618 occupied housing units associated within the Albany Pool communities, resulting in a cost per household of approximately $393 per year, as shown in Table 8-1.

TABLE 8-1: Annual Residential Cost per Household

| Description | Total Annual Cost | Residential Cost | Occupied Households | Residential Cost per Household |
|---|---|---|---|---|
| Total for Albany Pool Communities | $40,893,196 | $31,259,519 | 79,618 | $393 |

The Residential Indicator was then calculated by dividing the cost per household by the MHI. The combined median household income of the Albany Pool communities for 2010 was estimated to be $38,290, based on the 2000 U.S. Census and the 2005-2009 American Community Survey income statistics obtained from the U.S. Census Bureau. No income data was collected in the 2010 Decennial Census. The resulting Residential Indicator was calculated to be 1.03 percent, as shown in Table 8-2.

TABLE 8-2: Residential Cost as a Percentage of MHI (the Residential Indicator)

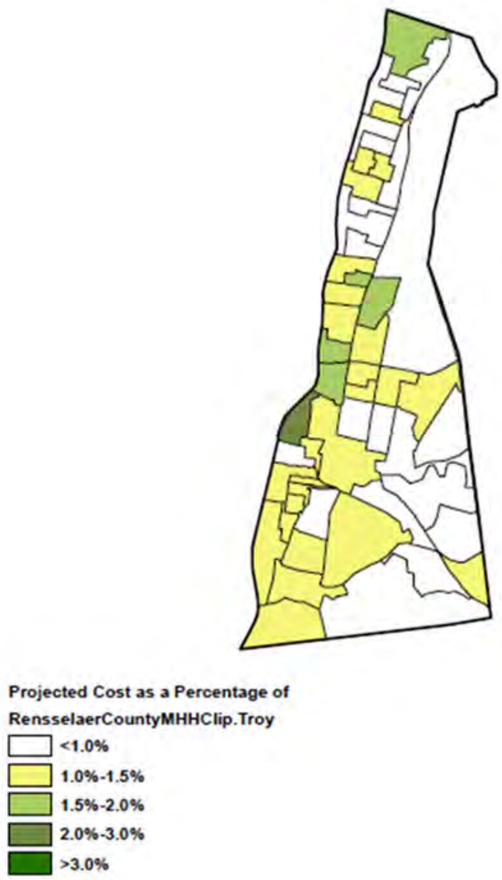
| Description | Residential Cost | Estimated 2010 MHI | Cost as % of MHI | EPA impact Range |
|---|---|---|---|---|
| Total for All Communities | $393 | $38,290 | 1.03% | Mid-Range |

The Residential Indicator was compared to EPA financial impact ranges provided in the EPA guidance document to assess the financial impact that wastewater treatment and LTCP costs may have on the communities' residential customers. The calculated Residential Indicator corresponds to financial impact in the "Mid-Range" category.

However, due to the variability of income levels across the communities' service areas, some neighborhoods within the communities will experience more severe financial impacts and economic hardship as a result of implementation of the LTCP, and will exhibit residential costs as a percentage of household income that are much greater than the median for the combined service areas. These areas tend to be the core urban areas, such as within the cities of Albany and Troy, which are the areas with the highest unemployment rates, lowest household incomes, and greatest number of households with incomes below the poverty level. A map depicting the variability of cost as a percentage of income across the City of Troy service area is provided in Figure 8-1. Similar service area maps depicting the spread of household income across the service areas of other APCs are provided in the Financial Capability Assessment Report.

[1] It was assumed that ACSD and RCSD WWTP capital projects will be shared by other non-Albany Pool communities, thereby reducing the Albany Pool communities' LTCP cost responsibility.

FIGURE 8-1: Residential Cost as a Percentage of Household Income – City of Troy FY2030




## 8.3 Community Financial Capability Indicators

The second phase of the financial capability assessment involved calculating financial capability indicators. These indicators characterize the permittee's debt burden, socioeconomic conditions, financial operations, and the ability to secure the funding necessary to implement the LTCP. Under this phase of the assessment, a financial capability index was developed based on six individual indicators. These six indicators are discussed below:

### *Bond Rating*

The cities of Albany, Cohoes, Watervliet and Rensselaer carry a credit rating on General Obligation debt, which is backed by the full faith, credit, and taxing power of the municipality, of between A and AA placing them in the "Strong" category on this measure. The City of Troy has a Baa rating placing them in the "Mid-Range" category, and the debt of the Village of Green Island has not been rated.

### *Net Debt and a Percentage of Full Market Property Value*

This indicator provides a measure of the debt burden on residents within the service area, measures the ability of the municipalities within the service area to issue additional debt, and includes the debt issued directly by the municipalities within the service area as well as debt of overlapping entities, such as school districts.

The overall net debt as a percentage of full market property value for the communities that comprise the Albany Pool was calculated to be in the range of 1.8 percent to 5.7 percent, which places the cities of Albany, Watervliet, and Rensselaer in the "Weak" category, the cities of Cohoes and Troy in the "Mid-Range" category, and the Village of Green Island in the "Strong" category, based on the EPA indicator ranges.

### Unemployment Rate

Socioeconomic indicators, such as the unemployment rate, are indicators of the economic well being of residential customers in each of the communities that comprise the Albany Pool. The unemployment rate statistics show that the Region's unemployment is very high from a historical perspective, but is consistently below the national average. In 2011, the average regional unemployment rates for the Albany Pool communities were lower than the national average by between 0.2 percent and 2.2 percent. The comparison with the national average places each of the communities, with the exception of the City of Troy, in the "Strong Range" on this measure, based on the EPA indicator ranges. The City of Troy scored in the "Mid-Range" category.

While, the unemployment rate for the Capital District remains below the national average, the cities of Albany and Troy, in particular, have historically exhibited significantly higher unemployment rates than those of their corresponding counties. For example, the March 2011 unemployment rate for Albany County was 6.8 percent, while the rate for the City of Albany was 8.2 percent. Similarly, the unemployment rate for Rensselaer County was 7.7 percent in 2011, while the rate for the City of Troy was 9.3 percent. These statistics further demonstrate that the LTCP will be paid for by communities that are some of the most economically distressed in the Capital District, which in part necessitates an extended schedule for LTCP implementation.

In addition, the Capital District economy has been hit hard by fallout from the recent national economic downturn that started in December 2007; the longest and deepest recession since the 1930s. During the recent recession, manufacturing and Federal and State government sectors have all continued to deteriorate. For example, from January 2009 to January 2010, the number of private sector jobs in the Albany-Schenectady-Troy Metropolitan area fell by 7,600 or by 2.3 percent, to 322,800 – its lowest level for the month since 2003.[2] Although job loss has impacted a variety of industries, the majority of the jobs that have been eliminated in the Capital District have been in the manufacturing sector, with job losses in the Federal and State government sectors not far behind. It is anticipated that government job loss in the Region will continue in the future as state and local governments deal with budget shortfalls. These job losses have, and will continue to be, exceptionally detrimental to the Capital District's economy because they demonstrate the decline of the highest paid sectors in the Region. The loss of these high paying jobs in the Capital District and the decline in wages have had, and will continue to have, a negative impact on personal income and the ability to pay for LTCP improvements.

[2] March 2010 Employment in New York State: State's Recession Worsened in 2009. http://www.labor.ny.gov/stats/PDFs/enys0310.pdf.

Furthermore, increased cost burdens on nonresidential users will further discourage new businesses to locate within these existing urban centers and encourage them to locate in more cost competitive locations thereby resulting in fewer job opportunities for urban residents already suffering from high unemployment rates. Also, existing businesses may consider relocation options if the cost of doing businesses becomes too high further exacerbating the already high unemployment rates.

### *Median Household Income*

MHI serves as an overall indicator of the community's earning capacity. Each community's adjusted MHI is below the adjusted national MHI, placing each of the communities in the "Mid-Range" on this measure.

Furthermore, there are a significant number of households within the APCs that are below the poverty level. Household poverty statistics provide a more complete picture of the socioeconomic conditions of the Albany Pool communities in comparison to the Capital District and the national average. The comparison indicates that the APCs with the largest number of households, particularly the cities of Albany and Troy, have the greatest portion of households below the poverty level. Approximately 22 percent of the households in the City of Albany and 21 percent of the households in the City of Troy have incomes that are below the poverty level. These percentages are much higher than the 12.8 percent of households below the poverty level for the U.S. This comparison demonstrates the relatively poor and fragile socioeconomic condition of the core urban areas within the APCs.

### *Property Tax as a Percentage of Full Market Property Value*

This indicator is referred to as the "property tax burden" since it indicates the funding capacity available to support debt based on the wealth of the service area. It is also intended to indicate the effectiveness of managing community services.

The property tax revenue collected for each of the communities is below 2.0 percent of full market property value, placing each community in the "Strong" range on this measure, based on the EPA indicator ranges. However, this measure is misleading since the EPA Financial Capability Assessment makes no provision for the elevated home prices in this region as compared to other regions and states in the U.S. An alternative comparison, which considers the property taxes paid per home as a percentage of MHI is shown in Table 8-3. As shown in this comparison, the property taxes paid in Albany and Rensselaer County are more than 1.5 times the national average as a percentage of MHI. New York's high tax burden is almost entirely driven by high local taxes, which are among the highest in the country. According to a study completed by the Office of the New York State Comptroller, per capita property tax burdens in New York are 49 percent higher than the national average and property taxes measured as a share of personal income are 28 percent higher.[3] This high tax burden impacts the financial capability of the Albany Pool communities to pay for the LTCP, but is not reflected in the property tax revenue as a percentage of full market property value measure.

[3] Property Taxes in New York State, Local Government Issues in Focus, Volume 2, No. 2, Office of the New York State Comptroller's Office.

TABLE 8-3: Property Tax of Owner-Occupied Housing Compared to Income

| County | Median Property Taxes Paid on Homes | Median Household Income | Taxes as percent of Income |
|---|---|---|---|
| Rensselaer County | $3,350 | $71,085 | 4.71% |
| Albany County | $3,344 | $78,117 | 4.28% |
| United States | $1,838 | $50,221 | 2.85% |

2007-2009 (three-year average)
Source: U.S. Census Bureau; Tax Foundation calculations.

### *Property Tax Revenue Collection Rate*

The property tax revenue collection rate is an indicator of the efficiency of the tax collection system and the acceptability of tax levels to residents. The property tax collection rates for the cities of Albany, Cohoes, and Watervliet are in the “Strong Range.” However, for these communities, the cities are made whole by Albany County, so therefore the collection rate is not indicative of the acceptability of the tax levels to residents. The collection rate for the City of Rensselaer and the Village of Green Island are in the “Mid-Range”, and the collection rates for the City of Troy is in the “Weak Range”, based on the EPA indicator ranges.

### *Community Financial Capability Indicator Summary*

The weighted average Financial Capability Indicator score for the Albany Pool communities corresponds to a “Mid-Range” financial capability indicator rating. Individually, each of the APCs, except the City of Cohoes and Village of Green Island, have an overall Financial Capability Indicator score that corresponded to a “Mid-Range” rating. Only the City of Cohoes and Village of Green Island had a Financial Capability Indicator score that corresponded to a “Strong” financial capability indicator rating.

## 8.4 Rate Impact Analysis

A rate impact analysis was completed for each community to assess the potential year-by-year sewer rate impacts associated with implementation of the LTCP. The sewer rate increases and bill impacts provided are based upon a cost allocation method derived for Phase I of the LTCP. This cost allocation and resulting rate impacts are for illustrative purposes only. Individual community costs will be subject to Phase II inter-municipal contract negotiation.

The implementation of the LTCP over a 15-year schedule will require significant annual sewer rate increases for each of the communities, as shown in Table 8-4. In some years, several of the communities will require more than a 10 percent rate increase. However, a 15-year LTCP implementation schedule mitigates much higher annual rate increases that would be needed if the implementation schedule were shorter. Even with the proposed implementation schedule, the sewer rates are projected to increase approximately 65 percent to 141 percent over the 15 year period from 2013 through 2027, as shown in Table 8-5.

## TABLE 8-4: Projected Annual Sewer Rate Increases

| Year | Albany | Cohoes | Green Island | Watervliet | Rensselaer | Troy |
|---|---|---|---|---|---|---|
| 2010 | 0.0% | 2.3% | 3.0% | 5.2% | 3.0% | 2.5% |
| 2011 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 2012 | 2.0% | 8.6% | 5.0% | 0.0% | 9.0% | 6.0% |
| 2013 | 6.0% | 10.1% | 6.0% | 0.0% | 13.6% | 11.0% |
| 2014 | 4.9% | 14.4% | 6.5% | 9.4% | 10.6% | 8.2% |
| 2015 | 4.0% | 4.9% | 0.0% | 4.1% | 7.2% | 4.4% |
| 2016 | 4.1% | 4.9% | 4.9% | 4.2% | 5.3% | 4.1% |
| 2017 | 2.3% | 5.4% | 4.8% | 4.3% | 5.8% | 4.4% |
| 2018 | 4.3% | 9.5% | 6.2% | 5.9% | 9.5% | 7.2% |
| 2019 | 8.7% | 12.2% | 7.2% | 7.1% | 12.0% | 9.0% |
| 2020 | 4.3% | 8.7% | 5.9% | 5.7% | 9.0% | 6.7% |
| 2021 | 5.2% | 6.3% | 4.7% | 4.7% | 6.4% | 5.1% |
| 2022 | 13.9% | 5.6% | 4.8% | 4.5% | 5.4% | 4.5% |
| 2023 | 0.0% | 5.5% | 3.9% | 4.2% | 5.3% | 4.5% |
| 2024 | 0.0% | 5.5% | 4.8% | 4.5% | 5.1% | 4.4% |
| 2025 | 0.0% | 3.4% | 3.8% | 3.4% | 3.2% | 3.0% |
| 2026 | 0.0% | 2.7% | 3.5% | 3.1% | 2.8% | 2.6% |
| 2027 | 0.0% | 2.4% | 1.8% | 2.6% | 2.7% | 2.6% |

## TABLE 8-5: Projected Annual Residential Sewer Bill

| Year | Albany | Cohoes | Green Island | Watervliet | Rensselaer | Troy |
|---|---|---|---|---|---|---|
| 2010 | $90.73 | $170.10 | $195.68 | $309.22 | $310.50 | $375.00 |
| 2011 | 90.73 | 170.10 | 195.68 | 309.22 | 310.50 | 375.00 |
| 2012 | 92.55 | 184.67 | 205.46 | 309.22 | 338.45 | 397.50 |
| 2013 | 98.10 | 203.36 | 217.79 | 309.22 | 384.35 | 441.26 |
| 2014 | 102.94 | 232.61 | 231.92 | 338.18 | 425.02 | 477.56 |
| 2015 | 107.02 | 244.00 | 232.02 | 351.98 | 455.49 | 498.40 |
| 2016 | 111.38 | 256.07 | 243.45 | 366.72 | 479.85 | 518.80 |
| 2017 | 113.90 | 269.83 | 255.22 | 382.48 | 507.88 | 541.79 |

| Year | Albany | Cohoes | Green Island | Watervliet | Rensselaer | Troy |
|---|---|---|---|---|---|---|
| 2018 | 118.80 | 295.59 | 271.08 | 405.12 | 555.90 | 580.92 |
| 2019 | 129.16 | 331.63 | 290.46 | 433.70 | 622.67 | 633.28 |
| 2020 | 134.76 | 360.42 | 307.61 | 458.62 | 678.43 | 675.81 |
| 2021 | 141.74 | 383.30 | 321.97 | 480.16 | 721.95 | 710.29 |
| 2022 | 161.39 | 404.82 | 337.34 | 501.67 | 761.10 | 742.35 |
| 2023 | 161.39 | 427.09 | 350.60 | 522.97 | 801.67 | 776.04 |
| 2024 | 161.39 | 450.74 | 367.36 | 546.36 | 842.50 | 809.92 |
| 2025 | 161.39 | 465.91 | 381.21 | 565.15 | 869.65 | 834.06 |
| 2026 | 161.39 | 478.71 | 394.54 | 582.92 | 893.72 | 856.14 |
| 2027 | 161.39 | 490.31 | 401.46 | 598.06 | 917.90 | 878.45 |
| 15-yr Increase (2013-2027) | 65% | 141% | 84% | 93% | 139% | 99% |

(1) Based on water usage of 7,500 gallons per month.

## 8.5 Sewer Bill Comparison

A sewer bill comparison was completed to compare the annual residential sewer bill for the APCs with other similarly sized communities in New York State. The results indicate that on average, the current annual sewer bill for residential customers within the Albany Pool is comparable to the annual bill for residential customers in other communities in New York State, as shown in Table 8-6. However, as shown in Table 8-5 the annual bill for the APCs is anticipated to increase dramatically over the next 15 years in order to pay for the LTCP improvements, and may outpace the increases in the other communities surveyed.

### TABLE 8-6: Residential Bill Comparison

| Community | Rate Structure | | Annual Bill [1] |
|---|---|---|---|
| Albany Pool Communities [2] | | | |
| Village of Green Island | $7.54 | per 1,000 cf | $90.73 |
| City of Rensselaer | $1.80 | per 1,000 gallons (RCSD) + City sewer maintenance fee at 5% | $170.10 |
| City of Troy | $3.31 | $1.51 per 1,000 gallons (City) + $1.80/1,000 gallons (RCSD) | $297.83 |
| City of Albany | $2.57 | per ccf | $309.22 |
| City of Watervliet | $3.45 | per 1,000 gallons | $310.50 |
| City of Cohoes | $3.50 | per 1,000 gallons + $15/qtr | $375.00 |

| Community | Rate Structure | | Annual Bill[1] |
|---|---|---|---|
| Other Utilities in New York | | | |
| Buffalo Sewer Authority (Buffalo) | $66.30 | per 4,000 cf/qtr | $265.20 |
| City of Binghamton | $2.39 | per ccf | $287.33 |
| Monroe County DES (Rochester) | $2.47 | per 1,000 gallons + $1.34 per $1,000 of Assessed Value | $301.76 |
| Onondaga County (Syracuse) | $302.66 | per unit (150 gal/person/day x 2.55 people/household x 365days/year) | $302.66 |
| Erie County | $200.00 | per EDU + $1/$1,000 in assessed value + $1/ft in frontage | $417.00 |

(1) Based on water usage of 7,500 gallons per month.
(2) Includes ACSD and RCSD cost.

## 8.6 Financial Capability Assessment Summary

The results of the Residential Indicator and the Financial Capability indicators assessment scores are combined into a Financial Capability Matrix to evaluate the level of financial burden that wastewater treatment and the LTCP costs may impose on the APCs. The results of the financial capability assessment, which combine a "mid-range" Residential Indicator with a "mid-range" Financial Capability Indicator, point to an overall financial capability for the collective APCs in the "medium burden" category.

While the guidance suggests a 10-year schedule for LTCP implementation based on a "medium burden" financial capability result, there are several additional financial, socioeconomic, and political factors that are not reflected in the EPA Financial Capability Assessment score that justify a slightly longer 15-year implementation schedule. These include:

- Residents in the APCs pay property taxes that are more than 1.5 times the national average as a percentage of MHI. New York's high tax burden is almost entirely driven by high local taxes, which are among the highest in the country. This high tax burden impacts negatively upon the financial capability of the Albany Pool communities to pay for the LTCP.
- The recent recession has elevated the Region's unemployment rate, which is very high from a historical perspective. Even higher unemployment rates are exhibited in the core urban areas within the cities of Albany and Troy, in particular, which have historically exhibited significantly higher unemployment rates than those of their corresponding counties. The cost of implementing the LTCP will be paid for by communities that have high unemployment and are among some of the most economically distressed areas in the Capital District.
- Increased cost burdens on nonresidential users will further discourage new businesses to locate within these existing urban centers and encourage them to locate in more cost competitive locations thereby resulting in fewer job opportunities for urban residents already suffering from high unemployment rates. Also, existing businesses may consider relocation options if the cost of doing businesses becomes too high further exacerbating the already high unemployment rates.

- Each community as a whole will need to accept multiple years of very significant wastewater rate increases, resulting in nearly doubling rates over a 15-year period. These rate increases would be even higher if the implementation schedule were condensed into a shorter timeframe. A 15-year schedule mitigates these annual rate increases and reduces the potential for “rate shock”, and will allow sufficient time for elected officials to raise rates and generate additional revenues to pay for the LTCP.
- Low income areas within the urban cores, including the Cities of Albany and Troy will experience the greatest amount of economic hardship. These areas have the highest concentration of household incomes that are below the poverty level, as well as the most elevated unemployment rates. Implementation of the LTCP over a 15-year schedule allows sewer rates to be implemented more gradually, thereby lessening the immediate impact on these households. Moreover, a 15-year schedule provides time for the implementation of programs to address economic hardship for highly burdened neighborhoods and households within the service area.

The fiscal constraints and economic realities that exist within the APCs justify the proposed 15-year implementation schedule, and will allow the communities to achieve the water quality benefits while minimizing the financial impacts and the economic hardship within the communities.

Chapter 9

# Implementation Schedule


Chapter 9

Joint Venture Team
albany pool

# 9.0 Implementation Schedule

## 9.1 Introduction

This chapter discusses the development of the implementation schedule for the Recommended CSO LTCP and the proposed Post Construction Monitoring Program (PCMP) for verifying compliance with the water quality standards. In developing the implementation schedule, a watershed approach was used in addition to typical construction sequencing practices. This allowed the APCs to identify a schedule that provides the greatest water quality benefits to the region while maintaining affordability and a logical construction sequence to complete the recommended LTCP projects.

In addition to the implementation schedule, the CSO Policy requires a plan to be developed for monitoring performance of the completed CSO control facilities and to ultimately confirm achievement of water quality standards. The PCMP is particularly important to the APCs since the CSO control strategy is based upon the Demonstrative Approach. This approach requires the communities to demonstrate, upon implementation of the LTCP, that the remaining CSOs do not preclude the attainment of water quality standards or the designated uses of the receiving waters.

## 9.2 Develop Sequence and Phasing of CSO Facilities

In developing the sequence and phasing of the CSO Recommended LTCP, the APJVT considered the time required to complete each individual project, the water quality goals, the regulatory drivers, sequencing logic and then adjusted the schedule based upon the findings of the affordability analysis. In determining the duration for each individual project we considered a number of factors including, but not limited to: the time required to complete the design, bidding and construction phases, acquisition of property and/or easements, regulatory/permit requirements, coordination among stakeholders and other projects, traffic and neighborhood impacts, and maintenance of sewer service throughout construction.

In developing our sequence and phasing plan, the APJVT first considered the regional water quality goals. The receiving water quality model simulations, discussed in Chapter 5, clearly showed that addressing continuous non-CSO bacteria sources provides the greatest water quality based benefits to the Hudson River. In order to achieve the maximum benefit as early as possible, the following water quality based goals for development of the implementation schedule were established:

- Implement disinfection projects early for the greatest benefit;
- Perform tributary improvements to reduce continuous non-CSO bacteria sources;
- Implement optimization projects to reduce the frequency and volume of overflow and maximize flow to the WWTP;
- Perform WWTP and pump station upgrades to improve peak wet weather conveyance and treatment capacity;
- Construct the Big C Floatables Control Project early for greatest impact;
- Implement WWTP satellite floatables control projects.

Regulatory compliance also played a part in the phasing and sequencing of the recommended plan. Each of the APCs and sewer districts operate in accordance of the terms of their individual SPDES Permits. The ACSD and RCSD permits include requirements for implementation of seasonal disinfection. ACSD is required to install and commence operation of disinfection facilities at their WWTPs within 30 months of approval of the LTCP, while RCSD is required to complete disinfection facilities by September 2012. In addition, some communities are addressing permit compliance issues relating to their collection system facilities through current or pending consent orders. Cohoes is performing upgrades to their pump stations to minimize overflows in accordance with a current consent order with NYSDEC. Troy and Rensselaer and the RCSD are currently negotiating the terms of a consent order relating to collection system upgrades intended for the purposes of addressing alleged dry weather overflows. Projects associated with permit compliance, particularly consent order driven projects, were given highest priority.

After considering the water quality and regulatory influences on the schedule, the APJVT reviewed the potential impacts of each project upon the other projects. For example, WWTP capacity upgrades need to be performed before pump station or collection system upgrades are implemented so that the plants are capable of receiving the increased wastewater flow. In turn, system optimization measures, such as regulator modifications, tide gate repairs, and sewer rehabilitation projects should be performed in advance of the collection system upgrades and floatables control projects so that the designs of these facilities take into consideration the changed flow conditions associated with the optimization projects.

The additional community-wide projects were also prioritized. The System Operations, Maintenance and Inspection Plans were identified as a high priority as improved best management practices and operation of the system will lead to reductions in CSO frequency and volume, while improvements in inspection practices will help to better identify system rehabilitation and replacement needs. The development of asset management plans for each of the communities was identified as a high priority. Early identification of capital improvements projects for rehabilitation of the collection system allows identified projects to be incorporated into LTCP projects, where appropriate, to reduce long term costs and minimize neighborhood and traffic impacts. Green infrastructure technical design guidance should be developed early in the implementation schedule to allow these components to be incorporated into the LTCP designs, particularly for sewer separation and stormwater reduction projects. The manual will provide for consistent design, operation and maintenance practices and provide communities with a guidance document for use in planning stormwater management practices for urban renewal and future development projects. The proposed Hudson River Water Quality Public Advisory Webpage will provide a tool for predicting bacteria based water quality conditions from national weather service forecasts. The rainfall duration and intensities from weather forecasts can be used to predict the bacteria levels in the river, which would then be used to inform the public through a webpage posting. While it would take some time to accumulate the required data, these efforts can be supplemented through the post construction monitoring program. Initial data collection efforts would be used to develop and calibrate the predictive tool, while subsequent data would be used to verify results and provide periodic updates as projects are implemented and water quality conditions improve.

Figure 9-1 provides the sequence and phasing plan based upon a 15-year schedule. This plan provides the basis of the implementation schedule which will be driven by the affordability analysis and available funding.

## Figure 9-1: Sequence and Phasing Plan

| Community | Project | Years After Approval of LTCP | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Albany | Bouck Tide Gate Installation | ■ | | | | | | | | | | | | | | |
| Albany | Marrion/Myrtle Area Storm Water Storage Structures | ■ | | | | | | | | | | | | | | |
| Albany | Pumping Station Upgrades | ■ | ■ | | | | | | | | | | | | | |
| Albany | Sewer Rehabilitation Projects Throughout the City of Albany | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | |
| ACSD | Patroon Creek Trunk Sewer Repairs | ■ | | | | | | | | | | | | | | |
| All Communities | Sewer System Operations, Maintenance and Inspection Plans | ■ | ■ | | | | | | | | | | | | | |
| All Communities | Asset Management Plans | ■ | ■ | ■ | | | | | | | | | | | | |
| Cohoes | 2011 Storm Sewer Improvements | ■ | | | | | | | | | | | | | | |
| Cohoes | Upgrade Pump Stations (new pumps and controls) | ■ | | | | | | | | | | | | | | |
| Cohoes | Pump Station Bypass Evaluation | ■ | | | | | | | | | | | | | | |
| Cohoes | Pump Station Bypass Design and Construction | ■ | | | | | | | | | | | | | | |
| Green Island | Swan St. Improvements | ■ | | | | | | | | | | | | | | |
| Rensselaer | Broadway Dry Weather Overflow Elimination Project | ■ | | | | | | | | | | | | | | |
| Rensselaer | Broadway Sewer and Drain Improvements (CSO 006) | ■ | ■ | | | | | | | | | | | | | |
| Rensselaer | Partition Street Trunk Sewer Inspection and Cleaning (CSO 006) | ■ | ■ | | | | | | | | | | | | | |
| RCSD | Replacement of Mechanical Bar Screens | ■ | | | | | | | | | | | | | | |
| RCSD | Disinfection Facilities at WWTP | ■ | ■ | | | | | | | | | | | | | |
| RCSD | Regulator Improvements to Address DWOs | ■ | ■ | | | | | | | | | | | | | |
| Troy | Regulator Monitoring for DWOs | ■ | ■ | | | | | | | | | | | | | |
| Troy | Catch Basin Survey and Mapping | ■ | ■ | | | | | | | | | | | | | |
| Watervliet | Improvements at Five Regulators | ■ | | | | | | | | | | | | | | |
| Albany | Elberon Place Area Storm Water Storage | | ■ | | | | | | | | | | | | | |
| Albany | Lawnridge/Grove/Glendale/Forrest Ave. Separation (CSO 016) | | ■ | | | | | | | | | | | | | |
| Albany | Marietta Place Area Storage Structures | | ■ | | | | | | | | | | | | | |
| ACSD | North Plant Disinfection Project | | ■ | | | | | | | | | | | | | |
| ACSD | South Plant Disinfection Project | | ■ | | | | | | | | | | | | | |
| All Communities | Green Infrastructure Technical Design Guidance | | ■ | ■ | | | | | | | | | | | | |
| Cohoes | Improvements at Ten Regulators | | ■ | ■ | | | | | | | | | | | | |
| RCSD/Troy | Outside Community Metering | | ■ | ■ | | | | | | | | | | | | |
| Albany | Upper Washington Avenue Groundwater Recharge | | | ■ | ■ | | | | | | | | | | | |
| Albany | Melrose/Winthrop Groundwater Recharge Basins | | | ■ | ■ | | | | | | | | | | | |
| Rensselaer/East Greenbush | Investigate Non-CSO Bacteria Sources Along Mill Creek | | | ■ | | | | | | | | | | | | |
| Troy | Hoosick St. Storm Sewer Extension (CSO 024) | | | ■ | ■ | | | | | | | | | | | |
| Cohoes | George St. Sewer Separation (CSO 008/015) | | | | ■ | | | | | | | | | | | |
| Troy | Cross St. Trunk Sewer Evaluation (Wynants Kill) (CSO 045) | | | | ■ | | | | | | | | | | | |
| Troy | 113th Street Stream Separation (CSO 013 and 013A) | | | | ■ | ■ | | | | | | | | | | |
| Troy/Brunswick | Investigate Non-CSO Bacteria Sources Along Poesten Kill | | | | ■ | | | | | | | | | | | |
| Troy/North Greenbush | Investigate Non-CSO Bacteria Sources Along Wynants Kill | | | | ■ | | | | | | | | | | | |
| Albany | Modify Bouck Regulator | | | | | ■ | | | | | | | | | | |
| Albany | Mereline Combined Sewage Storage | | | | | ■ | | | | | | | | | | |
| All Communities | Hudson River Water Quality Public Advisory Webpage | | | | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| Cohoes | Middle Vliet St. Sewer Separation (CSO 007) | | | | | ■ | | ■ | | | | | | | | |
| Rensselaer | Washington Avenue Sewer Improvements and Elimination of Farley Drive CSO (CSO 012) | | | | | ■ | ■ | | | | | | | | | |
| Albany | Remove Schyler (CSO 015) Overflow | | | | | | ■ | | | | | | | | | |
| Cohoes | Little C Floatables Control Facility (CSO 008/015) | | | | | | ■ | ■ | | | | | | | | |
| Green Island | Hamiton St. Improvements | | | | | | ■ | | | | | | | | | |
| Green Island | Hamilton St Floatables Control Facility (CSO 003) | | | | | | ■ | | | | | | | | | |
| RCSD | Primary Sludge Degritting | | | | | | ■ | ■ | | | | | | | | |
| RCSD | Enhanced Final Settling | | | | | | ■ | ■ | | | | | | | | |
| Albany | Remove Liberty (CSO 022) Overflow | | | | | | | ■ | | | | | | | | |
| RCSD | Upgrade Pump Stations | | | | | | | ■ | ■ | | | | | | | |
| Troy | Cross Street Trunk Sewer Repair Along Wynants Kill (CSO 045) | | | | | | | ■ | | | | | | | | |
| Albany | Remove Hudson Street Overflow | | | | | | | | ■ | | | | | | | |
| Albany | Floatables Control Facility for CSO 026 Outfall (Regulators Maiden, Stuben and Orange) | | | | | | | | ■ | | | | | | | |
| Cohoes | Columbia St. Phase II Separation (CSO 008/015) | | | | | | | | ■ | ■ | | | | | | |
| Troy | Van Buren Street Stream Separation (CSO 041) | | | | | | | | ■ | ■ | | | | | | |
| Albany | Floatables Control Facility for CSO 030 Outfall (Regulators Quackenbush, Jackson and Livingston) | | | | | | | | | ■ | | | | | | |
| Troy | Polk Street Stream Separation (CSO 044) | | | | | | | | | ■ | ■ | | | | | |
| Albany | Floatables Control Facility for CSO 016 and CSO 019 Outfalls (Regulators Big C, 4 and 4a, Arch, Ferry and Madison) | | | | | | | | | | ■ | ■ | ■ | | | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase I (CSO 007) | | | | | | | | | | ■ | ■ | | | | |
| Troy | 123rd Street Stream Separation (CSO 002) | | | | | | | | | | | ■ | ■ | ■ | | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase II (CSO 007) | | | | | | | | | | | | ■ | ■ | | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase III (CSO 007) | | | | | | | | | | | | | | ■ | ■ |

Figure 9-1: Sequence and Phasing Plan

## 9.3 Define Facility Planning and Design Requirements

The LCTP consists of a number of projects dispersed across the communities. The proposed projects include new facilities, and modifications and/or upgrades to existing infrastructure ranging from manholes, regulators, pumping stations and WWTPs. The majority of the proposed work: disinfection projects, optimization efforts, best management practices, and separation projects, will be completed within the limits or vicinity of existing infrastructure.

The disinfection and pumping station upgrades will be confined to the existing WWTP and pump station sites. All regulator modifications and optimization efforts will be completed below grade within or adjacent to existing chambers. There will be no lasting impact on the surrounding area caused by these upgrades and modifications. However, where work is expected to be impacted by existing soils conditions, land use, or other construction issues, then the communities will be required to complete planning investigations to identify appropriate sites and routes for piping as part of the preliminary design.

There are a number of different end of pipe floatables control technologies available on the market today. The recommendations for appropriate floatables control technology will be completed during preliminary design on a site specific basis. It is anticipated that at least four of the five proposed floatable control facilities will be vortex treatment units similar to the continuous deflective separation (CDS) unit that was installed in Cohoes in 2008. These units are typically constructed below-grade, with access provided for a vacuum truck to remove floatables and grit from the sump. Due to the fact that the peak flows associated with the proposed floatables control facility at Big C are substantial, thereby increasing the anticipated volume of floatables and grit, a more automated mechanical system with some above grade facilities may be required. However, the APJVT anticipates any facilities for this FCF will be located in the industrial area between I787 and the Hudson River. As part of the preliminary design it is anticipated that a SEQR environmental impact assessment will be completed along with soil borings and detailed land use and cultural resource investigations with the intent to limit the impact of the proposed facility on the community.

## 9.4 Post Construction Monitoring Requirements

The Receiving Water Quality Assessment discussed in Chapter 2 defined the water quality conditions of concern in the Albany Pool area. The 2008 and 2009 sampling programs were focused on variables and resultant water quality standards that are sometimes impaired by wet weather discharges.

Applicable NYS standards which were considered during the water quality assessment included:

- The fecal coliform standard for both Class A and C designations states that the monthly geometric mean of no less than 5 examinations (samples) shall be less than 200 colony-forming unit (cfu)/100 milliliter (ml). For A-special waters, the rule states that the five samples must be taken over not more than a 30-day period. The standard does not differentiate between wet and dry weather sampling. There is no specific single sample maximum criterion applicable to these receiving waters.

- The applicable dissolved oxygen standard as stated by New York is "For non-trout waters, the minimum daily average shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L." [Note: mg/L = milligrams per liter, and DO = dissolved oxygen]
- The pH standard for both Class A and C designations states that the pH "shall not be less than 6.5 nor more than 8.5."
- In non-trout waters, the water temperature at the surface of a stream shall not be raised to more than 90 degrees Fahrenheit at any point.

The results of the Water Quality Assessment indicated that most water quality standards were met in areas where CSO discharge could cause or contribute to non-attainment. Some non-attainment of dissolved oxygen criteria was observed, but monitoring and modeling supported the conclusion that CSO was not the cause of that non-attainment.

Conclusions presented in Chapter 2 helped to shape the Water Quality Modeling activities described in Chapter 5 and the PCMP. Of particular relevance for the PCMP were conclusions (2) and (6) repeated below for the reader's convenience:

2. Despite both wet and dry weather loading of bacteria to the river, the areas where the river fails to meet standards appear to be spatially and temporally small. Even during wet weather the Hudson River provides sufficient dilution for geometric mean bacteria concentrations to not exceed standards at most sites. The two downstream beach sites were in compliance with geometric mean standards during both dry and wet weather sampling periods. The implication for CSO control is that some level of control of dry and wet weather loading will result in compliance with bacteria criteria for most of the river most of the time.

6. Control of dry weather sources may provide an opportunity to demonstrate that a lesser degree of wet weather control will prevent CSOs from causing or contributing to violations of water quality standards. Comparison of the magnitude of overall loading from those sources to the loading from wet weather discharges will demonstrate how much additional control for CSO is required to meet standards.

The conclusions of that Receiving Water Quality Assessment indicated that attainment of the bacteria standards, during both dry and wet weather events, was consistently not achieved at Hudson River transect sampled at RT8 (Dunn Memorial Bridge) and RT9 (Port of Albany) downstream of the WWTP discharges and the largest tributaries. Therefore, the efforts to achieve attainment of water quality standards have been focused on reducing the largest loadings of bacteria. Calculation and modeling of bacteria loading from both dry and wet weather sources indicated that reducing bacteria loads from municipal WWTPs with incomplete disinfection would increase the probability of attainment.

The PCMP will be focused on the demonstration of recreational use attainment as disinfection of WWTP effluent is accomplished.

### 9.4.1 Monitoring Goals

The goals of the PCMP are designed to focus on monitoring the areas where modeling and sampling indicated consistent non-attainment of recreational use (bacteria) criteria to ensure that the actions of the APCs result in increased compliance appropriate to the goals of the CSO policy and guidance.

The Receiving Water Quality Assessment noted that there was an accumulation of bacteria through the Albany Pool region with the maximum measured values typically observed at the RT8 (Dunn Memorial Bridge) and RT9 (Port of Albany) transects. Comparisons made between wet weather and dry weather bacteria concentrations and other applicable criteria showed consistent non-attainment of the bacteria standard at these River Transects. Those non-attainments were observed during both dry and wet weather events with only a slight relationship to larger wet weather events. The goal of this program will be to demonstrate increased attainment of recreational use criteria at those transects during the recreational season.

The monitoring program will focus on demonstrating attainment at the River Transects where consistent non-attainment was observed during the 2008 Receiving Water Quality Assessment and subsequent water quality modeling. Samples will also be collected at the upstream stations on the Mohawk and Hudson Rivers to assure that those upstream waters continue to show attainment of recreational use criteria prior to entering the Albany Pool reach. Sampling will also be conducted on the major Hudson River tributaries within the Albany Pool that have been shown to continuously contribute elevated bacteria loads to the river. A sample will be collected at each of the tributaries' confluence with the Hudson River during each sampling event. The data collected from the headwaters and tributaries can be used as revised input into the water quality model for future verification and validation runs, if needed.

### 9.4.2 Sampling Methods

Detailed sampling protocols will follow those developed and documented in the *Receiving Water Quality Sampling Plan* (Plan) (included in Appendix A).

In the original Plan, analysis was performed for both fecal coliform and E. coli to determine if the indicator organism used to measure recreational attainment was appropriate. Results from the 2008 Receiving Water Quality Study showed that both E. coli and fecal coliform provided similar measures of recreational use impairment. For the purposes of post construction monitoring, testing will be limited to fecal coliform because fecal coliform concentrations can be directly compared to the current NYS standard for recreational use. In the event that the NYS standard is modified in the future, the sampling parameter may need to provide a comparison to whatever indicator organism might be adopted in a future standard.

### 9.4.3 Sampling Locations

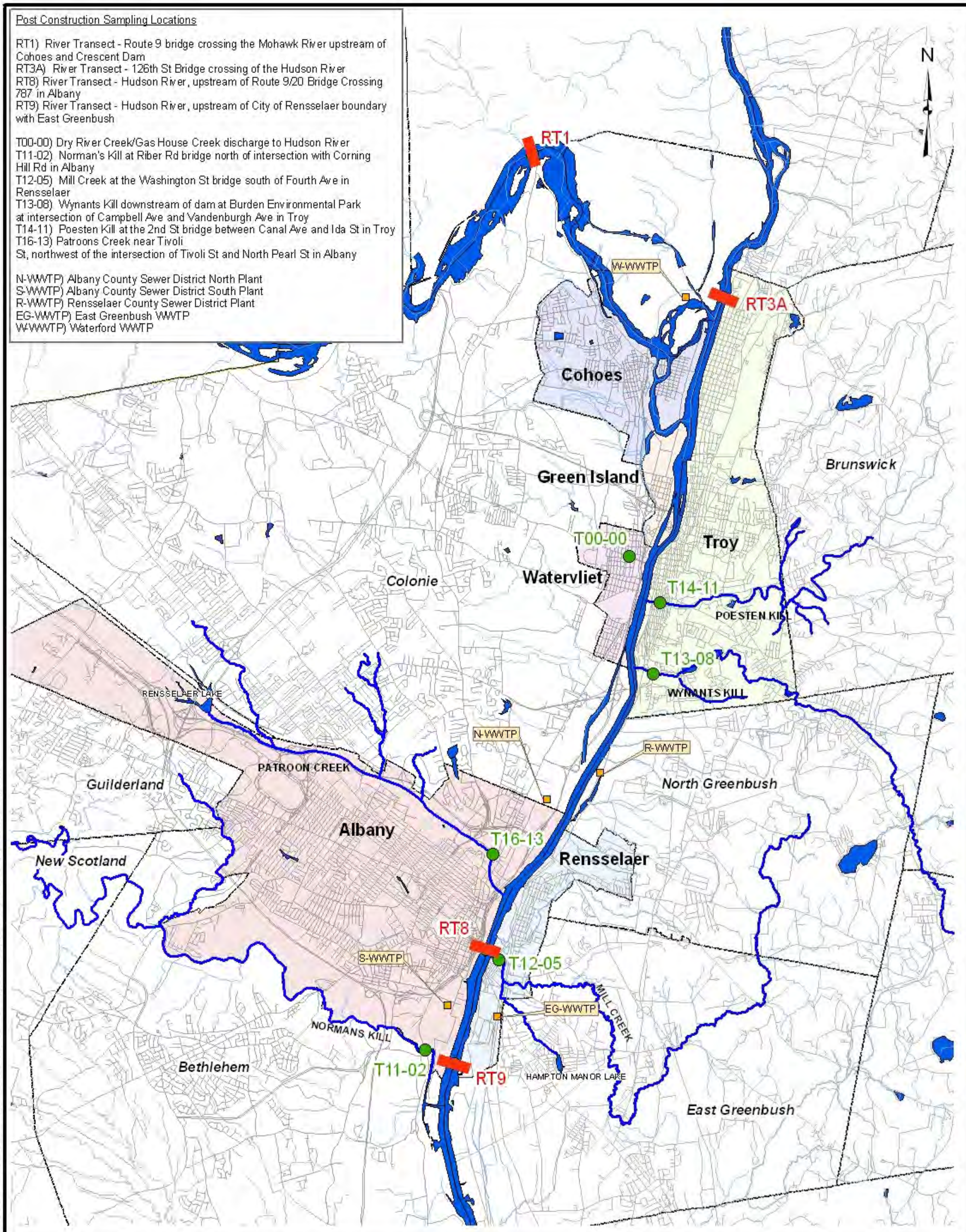
For the PCMP, discrete samples will be collected for laboratory analysis of fecal coliform from four River Transects, six tributaries, five WWTPs, and two randomly selected duplicate samples. Table 9-1 details the sampling locations, purpose, and analytical parameters that will be analyzed. Figure 9-2 illustrates the sampling locations.

TABLE 9-1: Locations and Designations of Sampling Sites for Fecal Coliform

| Sampling Location Identification Number | Location | Sample Collection Location | Purpose | Parameters |
|---|---|---|---|---|
| River Transect Locations | | | | |
| RT1-RC | Route 9 bridge crossing of Mohawk River upstream of Cohoes and Crescent Dam | bridge | Documentation of Mohawk River Background | Fecal Coliform |
| RT3A-RC | 126th Street Bridge crossing of Hudson River just south of the City of Troy boundary | bridge | Documentation of Hudson River Background | Fecal Coliform |
| RT8-WB<br>RT8-RC<br>RT8-EB | Hudson River, upstream of Route 9/20 bridge crossing I-787 in Albany | boat | Documentation of Attainment | Fecal Coliform |
| RT9-WB<br>RT9-RC<br>RT9-EB | Hudson River, upstream of city of Rensselaer boundary with East Greenbush | boat | Documentation of Attainment | Fecal Coliform |
| RT1-RC | Route 9 bridge crossing of Mohawk River upstream of Cohoes and Crescent Dam | bridge | Documentation of Mohawk River Background | Fecal Coliform |
| Tributary Locations | | | | |
| T00-00 | Dry River Creek/Gas House Creek discharge to Hudson | Shore/manhole | Documentation of Tributary Contribution | Fecal Coliform |
| T11-02 | Norman's Kill near confluence with Hudson River at River Road Bridge north of intersection with Corning Hill Road in Albany | Shore | Documentation of Tributary Contribution | Fecal Coliform |
| T12-05 | Mill Creek near confluence with Hudson River at the Washington Avenue bridge south of Fourth Avenue in Rensselaer | Shore | Documentation of Tributary Contribution | Fecal Coliform |
| T13-08 | Wynants Kill near confluence with Hudson River | Shore | Documentation of Tributary Contribution | Fecal Coliform |

| Sampling Location Identification Number | Location | Sample Collection Location | Purpose | Parameters |
|---|---|---|---|---|
| T14-11 | Poesten Kill near confluence with Hudson River at the 2nd Street bridge between Canal Ave. and Ida Street in Troy | Shore | Documentation of Tributary Contribution | Fecal Coliform |
| T16-13 | Patroon Creek near confluence with Hudson River near Tivoli Street northwest of the intersection of Tivoli Street and North Pearl Street in Albany | Shore | Documentation of Tributary Contribution | Fecal Coliform |
| T00-00 | Dry River Creek/Gas House Creek discharge to Hudson | Shore/manhole | Documentation of Tributary Contribution | Fecal Coliform |
| WWTP Locations | | | | |
| N-WWTP | Albany County Sewer District North Plant | Effluent | Documentation of WWTP Contribution | Fecal Coliform(1) |
| S-WWTP | Albany County Sewer District South Plant | Effluent | Documentation of WWTP Contribution | Fecal Coliform(1) |
| R-WWTP | Rensselaer County Sewer District Plant | Effluent | Documentation of WWTP Contribution | Fecal Coliform(1) |
| EG-WWTP | East Greenbush WWTP | Effluent (Downstream Manhole) | Documentation of WWTP Contribution | Fecal Coliform(1) |
| W-WWTP | Waterford WWTP | Effluent | Documentation of WWTP Contribution | Fecal Coliform(1) |

(1) Pending access agreements are obtained from SPDES permit holder.




albany pool CDM CHA CDRPC

ALBANY CSO POOL
LONG TERM
CONTROL PLAN

POST CONSTRUCTION
MONITORING
SAMPLING LOCATIONS

JUNE 2011
FIGURE 9-2

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River Transects RT8 and RT9 will be used to monitor attainment and will be sampled at the east bank, west bank and river center. River Transects RT1 and RT3A will be used to monitor the background contributions of the headwaters and will only be sampled at the river center.

Samples will also be collected at each of the six (6) major tributaries, including a new location which captures the combined discharges of the Gas House Creek and Dry River Creek which originate in the Town of Colonie and are piped through the City of Watervliet. The tributary sampling will provide documentation of the tributaries' contributions toward attainment at the sampling time and will be coordinated with any monitoring efforts associated with illicit discharge detection and removal in the major tributaries. The fecal coliform data collected at the WWTPs will also be utilized to identify their contributions toward attainment at river transects RT8 and RT9.

Table 9-2 lists the specific River Transect locations by latitude and longitude. These locations were previously documented during the 2008 and 2009 sampling program.

TABLE 9-2: Specific of River Transect Sampling Sites

| Sampling Location Identifier | West Bank | River Center | East Bank |
|---|---|---|---|
| RT1 | 42.820371 | 42.821313 | 42.822255 |
| | -73.731039 | -73.731467 | -73.731926 |
| RT3A | 42.788997 | 42.788682 | 42.788389 |
| | -73.674790 | -73.673883 | -73.672917 |
| RT8 | 42.643164 | 42.642974 | 42.642407 |
| | -73.749322 | -73.74775 | -73.746928 |
| RT9 | 42.616779 | 42.616765 | 42.616111 |
| | -73.760192 | -73.758557 | -73.757529 |

### 9.4.4 Sampling Frequency

The sampling will be performed weekly throughout the recreation season at a consistent and repeated day and time. This schedule insures that each location will have 5 samples collected within 30 days, that sampling will be performed regularly without bias toward day, time, weather, rainfall, or tide. The only constraints on sampling days will be that they would not occur under conditions unsafe for boating. Sampling will be initiated during the week of May 1 and terminated during the week of October 31 (or later until the fifth consecutive sample in a series is collected).

Samples will be collected at river transects RT8 and RT9 on alternating 5 week periods whereby one of the two transects will be selected and sampled weekly for five consecutive weeks. Concurrent with the collection of the river transect samples, a single sample will be collected at each of the upstream center channel transect stations, RT1 and RT3A, and at each of the tributaries and WWTPs (pending access agreements are obtained from the WWTP SPDES permit holders). WWTP sampling will be performed independent of the permit holders' compliance schedule.

In summary, each weekly sampling event will include 18 samples comprised of three transect samples (either from RT8 or RT9), two upstream river center samples from RT1 and RT3A (Mohawk and Hudson River upstream boundaries), six tributary samples, five WWTP samples and two randomly selected duplicate samples. Weekly sampling will be performed for 25 weeks per year for a total of 450 samples per recreational season.

Local rainfall and tidal data will be collected concurrently with the monitoring program to determine if relationships with wet weather or tide conditions exist.

#### 9.4.4.1 Frequency Modifications for Attainment of Water Quality Standards

Water quality attainment will be measured at RT8 and RT9 based on a geometric mean of five consecutive samples less than 200 cfu/100ml. If conditions for the first four sampling periods (i.e., consecutive 5 weekly samples at RT8, RT9, RT8, and RT9) show consistent attainment of the water quality standard monitoring in that season will stop and not continue into the September and October periods. Otherwise sampling should continue for the entire recreational season.

#### 9.4.4.2 Frequency Modifications for Non-Attainment of Water Quality Standards

Modifications to the sampling program for non-attainment will be implemented following the commission of the WWTP disinfection projects at the ACSD North and South Plants and the RCSD Plant.

Water quality attainment will be measured at RT8 and RT9 based on a geometric mean of five consecutive samples less than 200 cfu/100ml. In the case that a 5 week period indicates an exceedence of water quality standards, the following 5 week period should include sampling of both river transects RT8 and RT9. If non-attainment persists for the second 5 week period, additional replication samples (3 per location) will be collected at the upstream River Transects, tributary sites, and WWTPs. This data will be used to verify the other contributions toward non-attainment and to parameterize the existing water quality model.

Water quality modeling will be performed in an attempt to replicate the observed non-attainment conditions and retest the loading assumptions developed during the development of this LTCP. If Water Quality Modeling results indicate that wet weather conditions are causing or contributing to non-attainment an additional monitoring and modeling study will be proposed to prioritize which wet weather sources should be addressed to eliminate any remaining violations. That study will continue to coordinate with the results of the illicit discharge investigations on the tributaries where non-attainment was observed during the Water Quality Assessment.

### 9.4.5 Sampling Schedule

Sampling should begin as soon as practical in the first recreational season following approval of this LTCP. Sampling will be conducted through three consecutive recreational seasons following completion of the proposed disinfection projects (approximately approval of the LTCP plus 66 months). If the three seasons show attainment of recreational use criteria then sampling should be repeated once every five years to provide a long term history of recreational use attainment. If one or more of the seasons shows non-attainment (as described above) an additional year of monitoring will be added for each non-attaining year.

## 9.5 Finalize Implementation Schedule

Based upon discussions with municipal leadership, it is the intent amongst the APCs to establish a Phase II inter-municipal arrangement in regards to the future governance of the Albany Pool CSO program. The APCs anticipate submitting an application to the Department of State for a Shared Services Municipal Planning Grant to identify and evaluate legal options available for the implementation of the LTCP. Reaching consensus to proceed with the inter-municipal arrangement will be subject to negotiations and agreement, amongst the parties involved, in regards to the final terms and conditions of the CSO LTCP; as well as the respective financial commitments borne by each of the individual communities.

The findings of the financial affordability analysis, discussed in Chapter 8, were used in transforming the sequencing and phasing plan into the final implementation schedule for the recommended CSO LTCP. Annual rate impacts were evaluated and sequencing of projects was adjusted to minimize the year-to-year rate fluctuations, as much as possible. Initial rate increases are projected to fall in the 5 to 14 percent range for the first five years. These increases will be necessary to ramp up funding to cover the costs of initial projects, as well as those driven by SPDES Permit or consent order compliance deadlines.

Figure 9-3 provides the implementation schedule with a projection of annual costs for advancing the recommended plan over a 15 year schedule. Upon approval of the CSO LTCP and development of a cost-sharing equation, a plan should be developed for each community to better plan the appropriate rate adjustments and minimize the impacts to sewer users. The Post Construction Monitoring Program has been incorporated into the schedule. Budget estimates for the monitoring program should be developed and incorporated into the financial planning upon approval of the plan by NYSDEC.

## Figure 9-3: Proposed Implementation Schedule

| Community | Project | Estimated Project Cost (millions) | Years After Approval of LTCP 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albany | Bouck Tide Gate Installation | $0.12 | ■ | | | | | | | | | | | | | | |
| Albany | Marrion/Myrtle Area Storm Water Storage Structures | $0.34 | ■ | | | | | | | | | | | | | | |
| Albany | Pumping Station Upgrades | $0.37 | ■ | ■ | | | | | | | | | | | | | |
| Albany | Sewer Rehabilitation Projects Throughout the City of Albany | $0.63 | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | |
| ACSD | Patroon Creek Trunk Sewer Repairs | $0.68 | ■ | | | | | | | | | | | | | | |
| All Communities | Sewer System Operations, Maintenance and Inspection Plans | $0.30 | ■ | ■ | | | | | | | | | | | | | |
| All Communities | Asset Management Plans | $0.60 | ■ | ■ | ■ | | | | | | | | | | | | |
| Cohoes | 2011 Storm Sewer Improvements | $1.50 | ■ | | | | | | | | | | | | | | |
| Cohoes | Upgrade Pump Stations (new pumps and controls) | $0.06 | ■ | | | | | | | | | | | | | | |
| Cohoes | Pump Station Bypass Evaluation | $0.03 | ■ | | | | | | | | | | | | | | |
| Cohoes | Pump Station Bypass Design and Construction | $0.11 | ■ | | | | | | | | | | | | | | |
| Green Island | Swan St. Improvements | $0.01 | ■ | | | | | | | | | | | | | | |
| Rensselaer | Broadway Dry Weather Overflow Elimination Project | $1.79 | ■ | | | | | | | | | | | | | | |
| Rensselaer | Broadway Sewer and Drain Improvements (CSO 006) | $2.80 | ■ | ■ | | | | | | | | | | | | | |
| Rensselaer | Partition Street Trunk Sewer Inspection and Cleaning (CSO 006) | $0.05 | ■ | ■ | | | | | | | | | | | | | |
| RCSD | Replacement of Mechanical Bar Screens | $1.18 | ■ | | | | | | | | | | | | | | |
| RCSD | Disinfection Facilities at WWTP | $7.22 | ■ | ■ | | | | | | | | | | | | | |
| RCSD | Regulator Improvements to Address DWOs | $0.38 | ■ | ■ | | | | | | | | | | | | | |
| Troy | Regulator Monitoring for DWOs | $0.04 | ■ | ■ | | | | | | | | | | | | | |
| Troy | Catch Basin Survey and Mapping | $0.02 | ■ | ■ | | | | | | | | | | | | | |
| Watervliet | Improvements at Five Regulators | $0.05 | ■ | | | | | | | | | | | | | | |
| Watervliet | 18th Street and Avenue A Weir Improvements | $0.04 | ■ | | | | | | | | | | | | | | |
| All Communities | Green Infrastructure Technical Design Guidance | $0.10 | ■ | | | | | | | | | | | | | | |
| Cohoes | Improvements at Ten Regulators | $0.10 | ■ | ■ | | | | | | | | | | | | | |
| Green Island | Hamiton St. Improvements | $0.01 | ■ | | | | | | | | | | | | | | |
| Albany | Remove Hudson Street Overflow | $0.01 | ■ | | | | | | | | | | | | | | |
| ACSD | North Plant Disinfection Project | $5.70 | ■ | ■ | | | | | | | | | | | | | |
| ACSD | South Plant Disinfection Project | $3.10 | ■ | ■ | | | | | | | | | | | | | |
| All Communities | Post Construction Monitoring Plan | TBD | ■ | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | | ■ |
| Rensselaer | Washington Avenue Sewer Improvements and Elimination of Farley Drive CSO (CSO 012) | $3.00 | | ■ | ■ | | | | | | | | | | | | |
| Albany | Elberon Place Area Storm Water Storage | $0.30 | | | ■ | | | | | | | | | | | | |
| Albany | Lawnridge/Grove/Glendale/Forrest Ave. Separation (CSO 016) | $0.37 | | | ■ | | | | | | | | | | | | |
| Albany | Marietta Place Area Storage Structures | $0.22 | | | ■ | | | | | | | | | | | | |
| RCSD/Troy | Outside Community Metering | $2.07 | | | ■ | ■ | | | | | | | | | | | |
| Albany | Upper Washington Avenue Groundwater Recharge | $0.50 | | | ■ | ■ | | | | | | | | | | | |
| Albany | Melrose/Winthrop Groundwater Recharge Basins | $0.65 | | | ■ | ■ | | | | | | | | | | | |
| Rensselaer/East Greenbush | Investigate Non-CSO Bacteria Sources Along Mill Creek | $0.03 | | | ■ | | | | | | | | | | | | |
| Troy | Hoosick St. Storm Sewer Extension (CSO 024) | $1.05 | | | ■ | ■ | | | | | | | | | | | |
| Albany | Floatables Control Facility for CSO 016 and CSO 019 Outfalls (Regulators Big C, 4 and 4a, Arch, Ferry and Madison) | $14.52 | | | | ■ | ■ | ■ | | | | | | | | | |
| Cohoes | George St. Sewer Separation (CSO 008/015) | $0.42 | | | | ■ | | | | | | | | | | | |
| Troy | Cross St. Trunk Sewer Evaluation (Wynants Kill) (CSO 045) | $0.05 | | | | ■ | | | | | | | | | | | |
| Troy | 113th Street Stream Separation (CSO 013 and 013A) | $1.43 | | | | ■ | ■ | | | | | | | | | | |
| Troy/Brunswick | Investigate Non-CSO Bacteria Sources Along Poesten Kill | $0.04 | | | | ■ | | | | | | | | | | | |
| Troy/North Greenbush | Investigate Non-CSO Bacteria Sources Along Wynants Kill | $0.03 | | | | ■ | | | | | | | | | | | |
| Albany | Modify Bouck Regulator | $0.25 | | | | | ■ | | | | | | | | | | |
| Albany | Mereline Combined Sewage Storage | $0.50 | | | | | ■ | | | | | | | | | | |
| Albany | Remove Schyler (CSO 015) Overflow | $0.27 | | | | | ■ | | | | | | | | | | |
| All Communities | Hudson River Water Quality Public Advisory Webpage | $0.50 | | | | | ■ | ■ | ■ | ■ | ■ | | | | | | |
| Cohoes | Middle Vliet St. Sewer Separation (CSO 007) | $0.50 | | | | | ■ | ■ | | | | | | | | | |
| RCSD | Primary Sludge Degritting | $3.12 | | | | | | ■ | ■ | ■ | | | | | | | |
| RCSD | Enhanced Final Settling | $11.47 | | | | | | ■ | ■ | ■ | | | | | | | |
| RCSD | Upgrade Pump Stations | $10.00 | | | | | | | ■ | ■ | ■ | | | | | | |
| Cohoes | Columbia St. Phase II Separation (CSO 008/015) | $1.00 | | | | | | | | | ■ | ■ | | | | | |
| Troy | Polk Street Stream Separation (CSO 044) | $2.17 | | | | | | | | | ■ | ■ | | | | | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase I (CSO 007) | $1.43 | | | | | | | | | ■ | ■ | | | | | |
| Troy | Cross Street Trunk Sewer Repair Along Wynants Kill (CSO 045) | $1.92 | | | | | | | | | | ■ | | | | | |
| Cohoes | Little C Floatables Control Facility (CSO 008/015) | $2.87 | | | | | | | | | | ■ | ■ | | | | |
| Green Island | Hamilton St Floatables Control Facility (CSO 003) | $0.36 | | | | | | | | | | | ■ | | | | |
| Albany | Remove Liberty (CSO 022) Overflow | $1.10 | | | | | | | | | | | ■ | | | | |
| Troy | Van Buren Street Stream Separation (CSO 041) | $4.74 | | | | | | | | | | | ■ | ■ | | | |
| Albany | Floatables Control Facility for CSO 026 Outfall (Regulators Maiden, Stuben and Orange) | $4.00 | | | | | | | | | | | | ■ | ■ | | |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase II (CSO 007) | $1.43 | | | | | | | | | | | | ■ | ■ | | |
| Troy | 123rd Street Stream Separation (CSO 002) | $4.54 | | | | | | | | | | | | | ■ | ■ | ■ |
| Albany | Floatables Control Facility for CSO 030 Outfall (Regulators Quackenbush, Jackson and Livingston) | $4.00 | | | | | | | | | | | | | | ■ | ■ |
| Cohoes | Vliet St and Manor Ave. Sewer Rehab, Replacement and Separation. Phase III (CSO 007) | $1.43 | | | | | | | | | | | | | | ■ | ■ |
| **Total Recommended Plan (millions)** | | **$109.62** | $16.40 | $11.87 | $4.88 | $8.36 | $7.05 | $10.05 | $8.30 | $8.30 | $5.73 | $5.66 | $5.27 | $5.09 | $4.23 | $4.23 | $4.23 |

Figure 9-3: Proposed Implementation Schedule

Chapter 10

# Public Participation

# 10.0 Public Participation

## 10.1 Introduction

A robust public participation program was established in order to facilitate public participation and involvement throughout the development process for the CSO LTCP. In accordance with the requirements for the development of the Albany Pool CSO LTCP, a Public Participation Plan (PPP) was developed to outline the goals and objectives of the program, recommend a committee structure to assist in the process, and outline strategies for the distribution of project information and solicitation of comments from the general public. This plan was submitted to the NYS DEC in February of 2006, and was subsequently approved. In general, the goals and objectives of the plan were as follows:

- Provide the Albany Pool municipal officials with a better sense of public perspective on issues that affect their communities
- Establish early communication with the affected public; including a wide array of key stakeholders and interested organizations as well as regulatory agencies
- Encourage dialogue between NYSDEC and the general public
- Solicit the opinions and address issues and concerns from the affected public, stakeholders, and interested parties during the development of the LTCP
- Make the technical aspects of the project clear and understandable to the public
- Build awareness of the issues associated with CSOs; while gaining broad support for the LTCP by involving the public throughout the development process

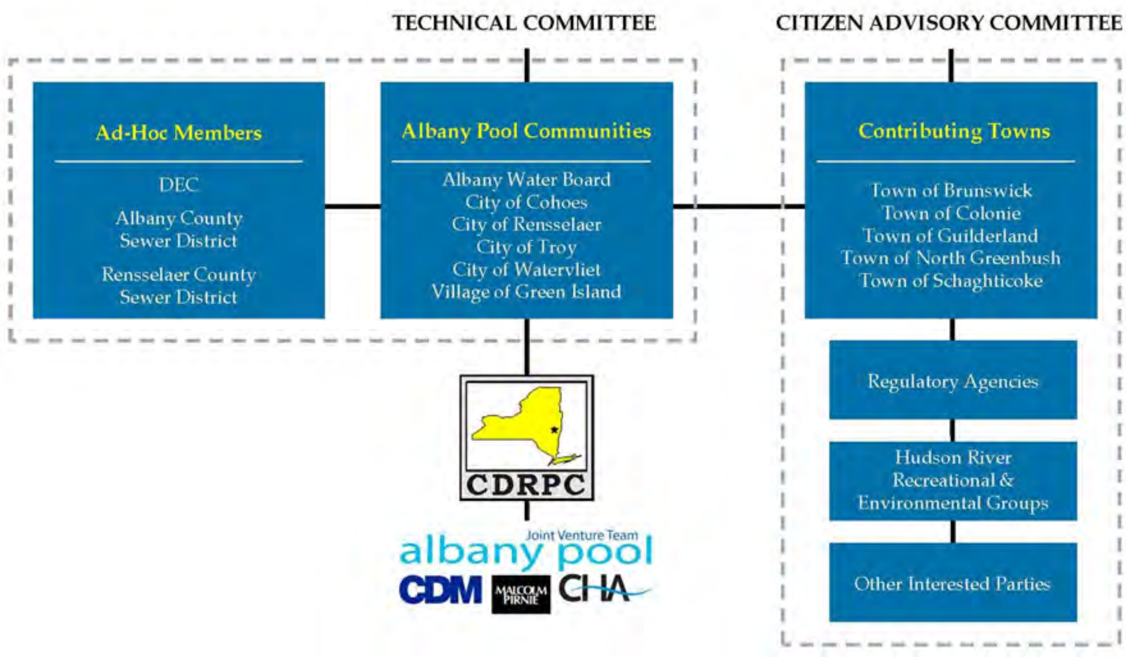
In our efforts to involve the public at large, a number of specific groups were targeted for their participation in the program, including the following:

- Albany Pool Communities' ratepayers/taxpayers and residents
- Elected and appointed leadership of the pool communities
- Environmental groups and recreational users of the Mohawk and Hudson Rivers
- The residents of adjoining communities contributing flows to the Albany Pool CSS, member communities of the Albany and Rensselaer County Sewer Districts
- Riverfront business operators

## 10.2 Project Organization

Two committee groups were formed in order to direct the development of the LTCP, collect feedback on project status and findings, and provide input on issues deemed important to the public. These two committees were formed to represent the member APCs as well as the greater public interests. Figure 10-1 summarizes the organizational framework for the committees created to assist with the development of the LTCP.

FIGURE 10-1: Project Organization Framework




The Technical Committee (TC) was responsible for steering the direction of the development of the LTCP and making recommendations to their respective legislative and chief officials for adoption. The TC generally met monthly, or as needed to make timely decisions and ensure steady progress towards the completion of the LTCP. The members of the TC were defined as follows:

- Six (6) voting members, one (1) appointed by each municipality/water board within the APCs.
- Ad-Hoc members include one (1) advisory member appointed by each sewer district along with representative(s) of the DEC.

The purpose of the Citizen Advisory Committee (CAC) was to work together with the TC to identify issues important to the public, provide input on potential solutions for mitigating the impacts of CSOs and to assist with the facilitation of the public outreach process. The CAC generally met with the TC prior to any meetings with the general public, and at major project milestones. Entities represented on the CAC were as follows:

- Neighborhood organization representatives (rate payers)
- Hudson River and environmental organizations representatives
- Adjoining municipality representatives within the Albany and Rensselaer County Sewer Districts

## 10.3 Public Participation Plan Meetings

### 10.3.1 Technical Committee Meetings

There have been 47 technical committee meetings held, to date, through the development of the LTCP. Meetings were generally attended by representatives from the APCs, ACSD, RCSD, CDRPC, and the

APJVT. Table 10-1 provides a summary of the TC meetings, along with a listing of the general items of business.

TABLE 10-1: Technical Committee Meeting Summary

| Date | Attendants | Items Discussed |
|---|---|---|
| 3-Oct -05 | APCs | Kickoff Meeting - discussed data collection requirements and plans for the development of the scope of work, the public participation plan, and the cost allocation plan. |
| 23-Mar-06 | APCs | Provided update on the status of the Public Participation Plan, Data Inventory/Data Gap Analyses. |
| 12- Dec-06 | APCs | Discussed DEC comments and responses to LTCP Scope of Work submitted on October 18, 2006 |
| 14-Jun-07 | DEC, APCs | Discussed detailed submissions on CSS Modeling and Receiving Water Conditions Assessment. DEC's planned sampling on the Hudson River was also discussed. |
| 23-Jul-07 | DEC, APCs | Follow-up from 14-Jun-07 meeting. Reviewed technical issues and submittal requirements for the CSS Modeling Workplan and the Receiving Water Conditions Assessment Workplan. |
| 13-Aug-07 | APCs | Reviewed project management structure, the goals and objectives of the project, and the roles and responsibilities of all parties involved. |
| 30-Aug-07 | APCs | Discussed CAC meeting and CSS modeling submission. |
| 26-Sept-07 | APCs | Reviewed RWQ Sampling Plan, Block Testing, Part A Financial Summary |
| 30-Oct-07 | DEC, APCs | Coordination/Progress Status Meeting was held to review the Receiving Water Conditions Assessment Workplan. |
| 13-Dec-07 | APCs | Provided a year-end status report in regards to major task items under development. |
| 22-Jan-08 | APCs | Reviewed Draft *Combined Sewer System Monitoring Plan* prior to submission to the NYSDEC (February 1st submittal deadline). |
| 4-Mar-08 | APCs | Discussed the potential need to expand the proposed *Combined Sewer System Monitoring Plan*. As a result of these discussions, the APCs elected to incorporate an additional 20 monitoring sites into the program to better define system performance. |
| 13-Mar-08 | APCs | Discussed the draft CSO LTCP brochure. |
| 20-Mar-08 | APCs | Reviewed NYSDEC comments pertaining to the Draft *Combined Sewer System Monitoring Plan*. The NYSDEC subsequently approved the plan via correspondence dated May 1, 2008. This submission represented the last of the three required report submissions, and as such, the *Scope of Work* associated with the development of the *Albany Pool CSO Long-Term Control Plan* was granted final approval by the NYSDEC. |
| 4-Apr-08 | APCs | Discussed municipal involvement and staffing levels in regards to the upcoming field activities in support of the monitoring and sampling program. |
| 20-Jun-08 | DEC, APCs | Provided project status report. |
| 5-Aug-08 | DEC, APCs | Provided a status report for the monitoring program. |
| 13-Nov-08 | APCs | Reviewed preliminary water quality data for the Mohawk and Hudson Rivers. |
| 24-Nov-08 | DEC, APCs | Reviewed preliminary water quality data for the Mohawk and Hudson Rivers, and provided a status report for the project. |

| Date | Attendants | Items Discussed |
|---|---|---|
| 26-Jan-09 | APCs | Discussed potential American Recovery and Reinvestment Act (ARRA) funding opportunities in regards to the LTCP CSO program initiatives. |
| 3-Mar-09 | APCs | Discussed potential American Recovery and Reinvestment Act (ARRA) funding opportunities in regards to the LTCP CSO program initiatives. |
| 19-Mar-09 | APCs | Discussed potential American Recovery and Reinvestment Act (ARRA) funding opportunities in regards to the LTCP CSO program initiatives. |
| 24-Mar-09 | DEC, APCs | Reviewed the water quality assessment report for the receiving waters. |
| 9-Apr-09 | APCs | Discussed potential American Recovery and Reinvestment Act (ARRA) funding opportunities in regards to the LTCP CSO program initiatives. Discussed the proposed 2009 Tributary Sampling program. |
| 27-Apr-09 | APCs | Provided an introduction to CSO control technologies and alternatives. |
| 4-Jun-09 | APCs | Reviewed the findings of the CSS modeling efforts. |
| 19-Jun-09 | APCs | DEC and APCs Discussed Receiving Water Quality Assessment |
| 26-Aug-09 | DEC, APCs | Reviewed the findings of the CSS modeling efforts. |
| 9-Sep-09 | APCs | Discussed the recommended modeling approach for the DO river assessment. |
| 24-Sep-09 | DEC, APCs | Discussed the recommended modeling approach for the DO assessment and proposed project schedule extension. |
| 9-Dec-09 | APCs | Reviewed the findings of the river modeling efforts. |
| 15-Dec-09 | APCs | Reviewed the findings of the river modeling efforts. |
| 15-Jan-10 | DEC, APCs | Discussed the DEC's request that the APCs complete a BMP Initiative in support of the proposed schedule extension for submittal of the Draft LTCP. In addition, the APJVT provided an overview of the Financial Impact & Affordability Evaluation work, and discussed/outlined the specific data requested from the communities. |
| 21-Jan-10 | DEC, APCs | Provided a more detailed technical discussion of the river modeling efforts and findings. |
| 8-Mar-10 | APCs | Reviewed the draft comments from DEC in regards to the receiving waters modeling efforts. |
| 15-Mar-10 | DEC, APCs | Reviewed the APJVT responses to the draft comments for the receiving waters model. It was agreed upon by all involved parties that the Albany Pool CSO's are not creating a dissolved oxygen issue in the receiving waters. |
| 12-May-10 | APCs | Discussed the DEC's comments (dated April 13, 2010) regarding the receiving waters model. |
| 7-Jun-10 | APCs | Reviewed the comments from DEC in regards to the receiving waters modeling efforts; reviewed the project schedule; provided the communities with an update on the financial impact and affordability evaluation and findings for the 2009 additional sampling program. |
| 12-Jul-10 | DEC, APCs | Reviewed the project status and discuss mitigation measures under consideration. |
| 20-Jul-10 | APCs | Reviewed the model issues and discuss the Presumptive versus Demonstrative approaches to CSO mitigation. |

| Date | Attendants | Items Discussed |
|---|---|---|
| 29-Jul-10 | DEC, APCs | Reviewed the model issues and discuss the Presumptive versus Demonstrative approaches to CSO mitigation. |
| 8-Oct-10 | APCs | Provided an overview of the water quality findings and regulatory compliance issues; an overview of CSO control strategies and discussed the next steps in the LTCP process. In addition, CDRPC provided a brief overview of the GIGP. |
| 9-Nov-10 | DEC, APCs | Reviewed the project status and discuss green infrastructure projects under consideration |
| 3-Mar-11 | APCs | Reviewed the proposed CSO control strategies for the LTCP including: disinfection at the WWTP, system optimization, BMP's and floatable controls. |
| 31-Mar-11 | DEC, APCs | Reviewed the proposed CSO control strategies for the LTCP. |
| 18-April-11 | APCs | Reviewed the Financial Impact and Affordability Assessment. |
| 27-April-11 | DEC, APCs | Reviewed the recommended LTCP, implementation schedule and community impacts. |

### 10.3.2 Citizen Advisory Committee Meetings

There have been six CAC meetings held, to date, through the development of the LTCP. Meetings were generally attended by representatives from the APCs, ACSD, RCSD, CDRPC, APJVT, and representatives from the DEC and other regulatory agencies. Representatives from the following organizations and municipalities were also invited to each CAC meeting:

- Institute of Ecosystem Studies
- Hudson River Sloop Clearwater
- The Nature Conservancy
- Riverkeeper, Inc.
- Scenic Hudson, Inc.
- Albany Rowing Center
- NY B.A.S.S. Chapter Federation
- Trout Unlimited
- Albany County Water Quality Coordinating Committee
- Rensselaer County Water Quality Coordinating Committee
- Town of Bethlehem
- Town of Brunswick
- Village of Castleton-on-Hudson
- Town of Coeymans
- Town of Colonie
- Village of Colonie
- Town of East Greenbush
- Town of Guilderland
- Village of Menands
- Town of North Greenbush
- Town of Poestenkill

- Village of Ravena
- Town of Sand Lake
- Town of Schaghticoke
- Town of Schodack
- Village of Waterford
- Town of Waterford

Table 10-2 provides a summary of the CAC meetings, along with a listing of the general items of business. Appendix L includes a copy of the PowerPoint presentation for each one of the CAC meetings.

TABLE 10-2: Citizen Advisory Committee Meeting Summary

| Date | Items Discussed |
|---|---|
| 9-Aug-07 | The APJVT provided a general overview of the CAC roles and responsibilities. There was an introduction to the Organization Structure for the Albany Pool CSO LTCP project; introduction to the Albany Pool CSO LTCP development program; Overview of the Public Participation Plan |
| 13-Mar-08 | The APJVT gave an update on the major tasks of the LTCP being progressed, including the: CSS Mapping, Database, and Digitizing, Receiving Waters Condition Assessment, CSS Monitoring & Sampling Plan and a CSS Modeling Plan. The APJVT also provided a schedule update. |
| 30-Mar-09 | The APJVT presented the findings of the receiving waters sampling program. The meeting covered the receiving waters condition assessment, the water quality sampling results, the hydrodynamics of the river systems, dry/wet weather data review and provided a summary of major findings. |
| 7-Oct-09 | The APJVT presented the development and calibration of the hydraulic modeling, or SWMM models. The typical 5-year CSO statistics (including percent capture, volume and frequency) at each overflow were presented. The team characterized the significance of the statistics, and then presented the river modeling approach along with an update on the project schedule. |
| 22-Nov-10 | The APJVT presented the findings for River Quality Modeling along with the 2009 Tributary Water Quality Sampling program. As part of the discussions, an overview was provided in regards to the obtainment of water quality standards, and the impacts different variable have on the existing water quality in the Hudson River. The impacts on water quality from the tributaries, headwaters, CSOs and wastewater treatment plants were discussed. |
| 10-May-11 | The APJVT presented the CSO Long Term Control Plan Project Elements. The proposed plan included a range of projects from BMPS, system optimization, floatables control, and disinfection of the treatment plant effluent. Key projects were discussed, along with the financial assessment and affordability of the proposed program. |

## 10.3.3 Public Meetings

Public meetings were held throughout the duration of the project in an attempt to keep the public informed on the progress, provide a forum to ask questions, and provide a platform for interested citizens to be heard on this project. There were four public meetings held, at major project milestones, at the Bulmer Telecommunications Center, Hudson Valley Community College. Table 10-3 provides a summary of the Public Meetings, along with a listing of the general items of business. Appendix M includes a copy of the PowerPoint presentation for each one of the Public meetings.

TABLE 10-3: Public Meeting Summary

| Date | Items Discussed |
|---|---|
| 31-Mar-08 | The objective of this meeting was to inform attendees about the study objectives, scope of work and the public participation process. The meeting was designed to give the general public an overall understanding for the project components, why this work is being required, and the anticipated schedule for the project. A public flyer (or informational piece) which provided a general understanding of the goals and objectives of the program was developed for public distribution. The flyer was distributed to attendees at the first public meeting, and remained available for distribution at CDRPC and through the APCs. |
| 10-Nov-09 | The objective of this second public meeting was to provide the public an update on the status of the project. Specifically, a summary of data collected for the receiving waters sampling program and the metering and monitoring program was presented. In addition, the development of the four hydraulic models representing the combined sewer systems and overflows were discussed in detail. The presentation was intended to provide the general public with an overall characterization of the existing system performance. Lastly, steps moving forward were outline along with the revised project schedule. |
| 13-Jan-11 | The purpose of third public meeting was to provide a status report on the progress being made on the development of the LTCP. In 2008, the findings of the receiving waters sampling program suggested that further investigations were warranted to provide a better understanding regarding the pollutants loadings associated with the tributaries within the Albany Pool communities. As part of the third public meeting, the results of additional tributary sampling performed in 2009 was presented, along with the findings of the Water Quality River Modeling efforts. The presentation discussed alternatives evaluated to improve the water quality of the receiving waters and their respective benefits, along with CSO control strategies under consideration. |
| 1-Jun-11 | The purpose of the fourth public meeting was to provide the details of the CSO Control elements to be included in the LTCP, and the financial impacts and affordability review. The APJVT provided a visual presentation of the all the projects, included in the $110M plan, and discussed in detail key strategies and projects. |

## 10.3.4 Municipal Leadership Meetings

As part of the outreach to municipal officials and leadership, two rounds of meetings were held with the APCs, and the County Sewer Districts. The purpose of the meetings was to provide an overview of the project status to key municipal leadership and decision makers within the affected municipalities and county legislatures. The meetings were scheduled individually with all parties to promote open dialog in regards to the proposed CSO control alternatives and inter-municipal relationships under consideration for the implementation phase of the Albany Pool CSO Program. Table 10-4 provides a summary of the Municipal Leadership Meetings, along with a listing of the general items of business.

TABLE 10-4: Municipal Leadership Meeting Summary

| Date | Items Discussed |
|---|---|
| Fourth Quarter, 2010 | The objective of this first meeting was to provide leadership with a better understanding of the existing CSS characterization and water quality findings. The items presented included alternatives being evaluated to improve the water quality of the receiving waters and their respective benefits, along with overall CSO control strategies under consideration. Lastly, input was solicited in regards to the potential inter-municipal agreement options under consideration for the implementation of the Albany Pool CSO Control Program. |
| Second Quarter, 2011 | The objective of this second leadership meeting was to review the CSS and receiving waters model findings, recommended CSO LTCP elements, implementation schedule, and the financial implications or impacts on a community by community basis. Lastly, input was again solicited in regards to the potential inter-municipal agreement options under consideration for the implementation of the Albany Pool CSO Control Program. |

## 10.4 Distribution of Program Information to the Public

As part of the overall public participation plan, a website was developed and maintained throughout the project to serve as a tool for the distribution of program related materials and the solicitation of public opinions. The site was managed by CDRPC and linked through the home page of the CDRPC webpage. The committee members and general public were advised of the site at meetings, and through correspondence, throughout the public participation program. Specific uses of the website included the following:

- Provide general public educational materials regarding CSOs, stormwater, and the LTCP process.
- Assist in the definition and clarification of technical aspects associated with the development of the LTCP.
- Provide an opportunity for public feedback and opinions on the project.
- Contain the official documents delivered to DEC, as outlined in the approved scope of work.
- Post CAC and public presentation meeting minutes and materials.