

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT

March 2019



Front cover: Map of NYC Water Supply identifying location of Delaware Aqueduct ByPass Tunnel Project

Photographs of Tunnel Boring Machine (TBM) and Delaware Aqueduct ByPass Tunnel

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<https://www.flickr.com/photos/nycwater/>

March 1, 2019

Ms. Olga Chernat
Executive Director
New York City Municipal Water Finance Authority
255 Greenwich Street
New York, NY 10007

Re: New York City Municipal Water
Finance Authority
Fiscal Year 2019 Consulting Engineer's Report

Dear Ms. Chernat:

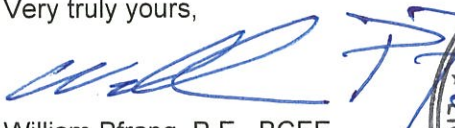
We herewith submit the Fiscal Year (FY) 2019 Consulting Engineer's Report on the operation of the Water and Sewer System of the City of New York (hereinafter referred to as "The System"). This Report addresses the condition and operation of The System as it presently stands, as well as the adequacy of capital and operating programs for Fiscal Years 2019 and 2020.

It is our opinion that The System condition is adequate and that it continues to be managed by the New York City Department of Environmental Protection (NYCDEP) in a professional and prudent manner. The current capital budget allocations for FY 2019 and FY 2020 are adequate for the immediate needs of The System.

The information presented in this report is based on the Preliminary Budget released on February 7, 2019. It is important to note that budgetary planning will continue past the date of this report and revisions may be made. It is our opinion, however, that meaningful observations and conclusions can be drawn at this time, although the final budget allocations may change during the budget finalization process.

We are not required to update this report for events and circumstances occurring after the date of this Report.

Very truly yours,


William Pfrang, P.E., BCEE
Consulting Engineer for
Municipal Water Finance Authority



**THE NEW YORK CITY MUNICIPAL WATER
FINANCE AUTHORITY**

**FISCAL YEAR 2019 CONSULTING ENGINEER'S
REPORT**

PREPARED BY

AECOM

March 1, 2019

TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
1.0 EXECUTIVE SUMMARY	1
2.0 PURPOSE AND SCOPE OF THE REPORT	2
3.0 METHODOLOGY FOR ANALYSIS.....	2
4.0 MANAGEMENT AND OPERATION OF THE NYCDEP SYSTEM	3
5.0 OVERVIEW OF THE SYSTEM.....	7
5.1 Water Supply System.....	7
5.2 Wastewater System	11
6.0 CAPITAL IMPROVEMENT PROGRAM (CIP)	13
6.1 Overview	13
6.2 System-wide Programs	16
6.3 Program Accomplishments	20
6.4 Capital Improvement Program Highlights for the Water System (Supply, Treatment, and Conveyance Programs)	20
6.5 Capital Improvement Program Highlights for the Wastewater and Stormwater System	25
6.6 Superfund Designations	30
6.7 Potential Future Long-Term Water and Wastewater Projects Beyond Current Budget Planning	32
7.0 EXPENSE BUDGET	32
8.0 PERFORMANCE OVERVIEW.....	33
9.0 OTHER NOTEWORTHY ISSUES AND COMMENTS	41
10.0 SUMMARY AND CONCLUSIONS	42
11.0 LIST OF ACRONYMS	45

LIST OF FIGURES

Figure 1: NYCDEP Executive Level Organizational Chart	4
Figure 2: New York City Water Supply System	8
Figure 3: New York City Water Conveyance Infrastructure	10
Figure 4: New York City Wastewater Treatment Plants (WWTPs).....	12
Figure 5: Capital Improvement Program (\$ in thousands) FY 2019 through FY 2029 by NYCDEP Operating Bureau	14
Figure 6: NYCDEP Comparison of Preliminary Ten Year Capital Strategies	15
Figure 7: Filtration Avoidance Determination (FAD) for the Delaware and Catskill Watersheds	21
Figure 8: Delaware Aqueduct by-pass tunneling underway	21
Figure 9: Delaware Aqueduct Bypass Program.....	22
Figure 10: Hillview Reservoir located in Yonkers.....	23
Figure 11: CSO LTCP Waterbodies.....	25
Figure 12: Green Infrastructure Rain Garden	27
Figure 13: Green Infrastructure Annual Report	27
Figure 14: Bluebelt Program in Staten Island	30
Figure 15: New York City Average Daily Water Demand in Million Gallons per Day (MGD)	33
Figure 16: NYCDEP – Staffing and Vacancy Levels FY 1997-2019	34
Figure 17: Total NYCDEP Water Main Breaks per Fiscal Year.....	35
Figure 18: Sewer Backup (SBU) Complaints.....	36
Figure 19: Dissolved Oxygen for Harbor Survey Key Stations (1968-2018)	39
Figure 20: Fecal Coliform Counts and Enterococci for Harbor Survey Key Stations (1974-2018).....	39

LIST OF TABLES

Table 1: Status of CSO Long Term Control Plans	26
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1.0 EXECUTIVE SUMMARY

This Report addresses the condition of The System as it stands and the adequacy of the capital program and operating budgets for Fiscal Years 2019 and 2020 as presented in the New York City Department of Environmental Protection (NYCDEP) Preliminary Budget received on February 7, 2019.

The NYCDEP is charged with the responsibility of the overall operation and maintenance of the vast water and wastewater infrastructure serving New York City (NYC). NYCDEP's vision is "*to be a world class water and wastewater utility, while building a sustainable future for all New Yorkers*". The critical mission of NYCDEP is to enrich the environment and protect public health for all New Yorkers by providing high quality drinking water, managing wastewater and stormwater, and reducing air, noise and hazardous materials pollution in NYC¹. The scope of this report will focus on the water and wastewater system. NYCDEP remains vigilant in providing operation and maintenance of water and wastewater infrastructure comprising significant capital assets and providing long-term planning of future needs. In recent years NYCDEP has implemented new programs and infrastructure to meet more stringent regulatory requirements (Biological Nitrogen Removal (BNR) for wastewater treatment plants, Combined Sewer Overflow (CSO) treatment facilities, and water treatment facilities). While providing these infrastructure improvements, DEP is also tasked to maintain its vast water and wastewater infrastructure to comply with strict regulations and avoid critical failure of processes and assets. NYCDEP must constantly manage risks and prioritize competing needs of The System to achieve its objectives. Considering the magnitude of the overall infrastructure and the level of operational service required, it is our opinion that:

- The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users within the available funding.
- The physical condition of The System receives an "adequate rating", our highest rating. Due to the size and complexity of The System, NYCDEP requires future capital investments for the continuous replacement and/or repair of aging infrastructure in a systematic and cost-effective manner.
- NYCDEP capital and expense budget projections for FY 2019 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 31% of the capital budget for FY 2019.
- NYCDEP capital budget projections for FY 2020 satisfy the immediate needs for the System including legally mandated projects, which comprise approximately 27% of the capital budget for FY 2020. Expense budget projections for FY 2020 are currently being evaluated based upon the projected new needs of The System and may require adjustment when the evaluation is complete.
- NYCDEP capital planning is an ongoing iterative process addressing priorities and needs of The System. The Capital Improvement Program (CIP) for Fiscal Years 2019-2029 is responsive to the long-term requirements of the service area.
- Staffing levels are approximately 92% of current allocations. NYCDEP has identified additional needs and skill sets to meet more complex facility operation requirements. NYCDEP is also evaluating its future needs focusing on succession planning, transfer of knowledge, filling vacancies and staff retention in anticipation of departure of experienced NYCDEP employees that are eligible for retirement in the near future.

¹ NYCDEP 2018 Strategic Plan, *Enriching Our Legacy*.

2.0 PURPOSE AND SCOPE OF THE REPORT

The purpose of this report is to provide engineering information pertinent to the condition of the Water and Sewer System (The System) serving NYC and the adequacy of the proposed CIP funds. Since 1983, AECOM (formerly Metcalf & Eddy) has provided engineering services related to the NYC Water and Wastewater Operations Evaluation Study (Study) and has provided services to the NYC Municipal Water Finance Authority (Authority) since 1985. Certain studies and analyses were performed in anticipation of the creation of the Authority and were used in developing the information included in the Municipal Water Finance Authority Official Statements under the captions: "CAPITAL IMPROVEMENT AND FINANCING PROGRAM — Ten Year Capital Strategy, Current Capital Plan and the Capital Improvement Program", "THE SYSTEM — The Water System", and "THE SYSTEM — The Sewer System". AECOM has performed ongoing evaluations of the condition of The System, which has included independently reviewing the capital and operating programs pertaining to water and wastewater, reviewing select pertinent studies associated with the long-term development of The System, and conducting Due Diligence interviews with key individuals responsible for managing the activities of the NYCDEP.

The report addresses the issues listed below:

- present physical condition of The System,
- Fiscal Year (FY) 2019² capital budget and FY 2020 projected capital budget for The System,
- FY 2019 expense budget and FY 2020 projected expense budget relative to operation and maintenance of The System,
- overview of the Preliminary Ten Year Capital Strategy for FYs 2020 to 2029 and,
- management of The System.

3.0 METHODOLOGY FOR ANALYSIS

The analyses conducted by AECOM were accomplished utilizing the following methods:

- Due Diligence interviews with representatives of the NYCDEP and discussions with representatives of the Authority,
- review of documentation relative to the ongoing budgetary process,
- review of the status of ongoing major programs and review of select reports/presentations provided by NYCDEP,
- information gathered from visiting operating facilities and major on-going construction programs, and
- consideration of national and local trends in the water and wastewater industry (federal, state and local regulations, resource recovery, aging infrastructure, resiliency, climate change impacts, other issues).

² The NYCDEP Fiscal Year begins on July 1 and ends on June 30. FY 2019 began on July 1, 2018 and ends on June 30, 2019.

The budgetary process is ongoing and was not concluded by the time of this report's publication. It is anticipated that the Executive Plan will be released in April 2019. Observations and conclusions presented herein are therefore based on budget data as it stood at the date of this report. It is our opinion that these observations and conclusions are meaningful with respect to The System. It should be noted, however, that these observations and conclusions are subject to change based on the outcome of the budgetary process.

4.0 MANAGEMENT AND OPERATION OF THE NYCDEP SYSTEM

NYCDEP Strategic Plan

NYCDEP released their Strategic Plan in June 2018, the *2018 Strategic Plan Enriching Our Legacy*. NYCDEP updated the mission and vision of the organization to reflect the shifting priorities and meet new objectives. The Plan identifies eight core values that pertain to how NYCDEP conducts business; these core values are safety, integrity, service, diversity, support, transparency, sustainability, and innovation. The Strategic Plan outlines the following seven goals and forty-three specific initiatives that will guide NYCDEP to focus on their priorities:

- Provide world-class and sustainable water and wastewater services now and for future generations (along with thirteen specific initiatives)
- Control local sources of pollution to improve quality of life (along with six specific initiatives)
- Reduce our carbon impact and mitigate the effects of climate change (along with four specific initiatives)
- Increase public awareness of our operations and improve service to our customers and the business community (along with six specific initiatives)
- Cultivate a diverse and highly qualified workforce to meet future challenges (along with four specific initiatives)
- Maximize operational efficiencies across the agency (along with five specific initiatives)
- Leverage innovative approaches to improve performance (along with five specific initiatives)

NYCDEP considered a wide range of factors in the development of the Plan, including current and anticipated mandates, institutional knowledge of The System, financial planning, technology and industry trends, workforce demographics, customer service, and the economic impact of water rates to customers. NYCDEP plans to publish annual updates of the Strategic Plan to monitor performance and provide accountability of their progress in implementing these goals. The Strategic Plan will evolve over the years to reflect emerging and changing trends in the industry while adhering to the NYCDEP visionary goals.

Organizational Structure

NYCDEP maintains an ongoing close collaboration among all the bureaus since many complex programs impact multiple disciplines and operating bureaus. This past year, NYCDEP implemented organizational changes with the creation of the Office of the Agency Chief Engineer (OACE). The capital planning functions and long-term planning activities has shifted to OACE, as described below. The Office of Energy and Resource Recovery Programs has been reorganized and now reports directly to the Commissioner. The NYCDEP is currently organized into the following Bureaus:

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Fiscal Year 2019 Consulting Engineer's Report

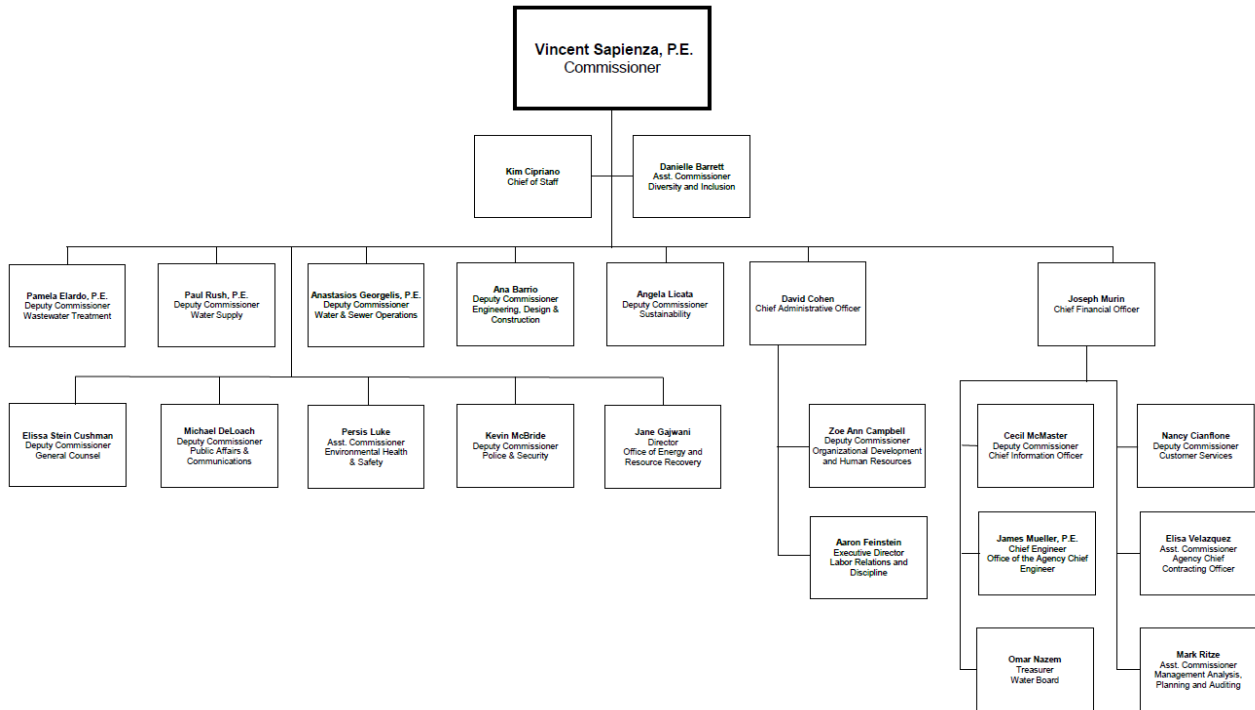


Figure 1: NYCDEP Executive Level Organizational Chart

- The following offices and bureaus report directly to the Commissioner: Chief of Staff, Bureau of Public Affairs and Communications, Assistant Commissioner of Diversity and Inclusion, General Counsel, Environmental Health & Safety (EH&S), the Chief Financial Officer, Police and Security, Chief Administrative Officer, Bureau of Wastewater Treatment (BWT), Bureau of Water Supply (BWS), Bureau of Water and Sewer Operations (BWSO), Office of Energy and Resource Recovery Programs, Sustainability and Bureau of Engineering, Design, and Construction (BEDC).
- The Chief Financial Officer oversees the Budget Office, Bureau of Customer Service, the Office of the Agency Chief Engineer (OACE), the Office of Agency Chief Contracting Officer (ACCO), Information Technology, Management Analysis, Planning and Auditing, and the Water Board.
 - The main function of the OACE is planning, capital funding and program prioritization and optimization within NYCDEP. The OACE is organized within the following groups: Infrastructure and Resiliency; Water Quality; Asset Management; Budget; Business Analysis and Economics; Engineering Standards. The OACE will coordinate with the Capital Planning section of the Operating Bureaus (BWS, BWT and BWSO). The OACE will provide the function of integrating projects and setting priorities within DEP, and coordinating with BEDC, BWS, BWT, BWSO, and Sustainability. The OACE will also be the lead on key goals and strategies outlines in the 2018 DEP Strategic Plan. OACE intends to develop integrated facility plans for the 14 drainage areas through collaboration with Sustainability, BWSO and BWT and other city agencies to address current and future long-term planning for infrastructure.
- The three Operations Bureaus consist of the Bureau of Wastewater Treatment (BWT), Bureau of Water Supply (BWS) and the Bureau of Water and Sewer Operations (BWSO).

The Deputy Commissioner of each operating Bureau reports directly to the Commissioner. The key responsibilities of each operating bureau are:

- BWS is responsible for delivering high quality drinking water to the City of New York. It is organized into seven directorates (Planning, Watershed Protection, Source Water Operations, Water Treatment Operations, Water Quality, Management Services/Budget and Environmental Health/Safety) that report directly to the Deputy Commissioner of BWS. A Research Application section was developed within BWS to apply national and international research developments to BWS best practices and to help prepare for future challenges. The Water Treatment Operations Directorate focuses on the treatment of water leaving the reservoirs, and before it moves toward the distribution system. Once the water leaves the Hillview Reservoir and Croton Water Filtration Plant (WFP), it enters the distribution system that is operated and maintained by BWSO. BWS' responsibilities include the management, operation and maintenance of the Croton Water Filtration Plant (WFP), Catskill/Delaware Ultraviolet (Cat/Del UV) Disinfection Facility, Hillview Reservoir, Jerome Park Reservoir, and Chlorination and Fluoridation at Delaware Aqueduct Shaft 18, Pleasantville Alum Plant and all associated dams, aqueducts, shafts, waterworks and support systems. The Source Water Operations Directorate is responsible for the storage and transmission of drinking water, maintenance of reservoirs, dams and other infrastructure, downstream releases and treatment at upstate wastewater treatment plants. BWS conducts extensive monitoring of water quality, both within the city's distribution system and throughout the upstate watersheds. BWS is also responsible for the overall management and implementation of the provisions for the city's Watershed Protection Program and for complying with the city's Filtration Avoidance Determination (FAD) program.
- BWSO is responsible for the operation and maintenance of the city's drinking water distribution system, wastewater collection system, Bluebelts and Green Infrastructure. BWSO field operations are responsible for the following: (1) that residences and businesses have an adequate supply of potable water, (2) that there is sufficient water for fire protection, and (3) that the wastewater collection system is properly functioning. BWSO coordinates closely with the New York City Department of Design and Construction (NYCDDC), since NYCDDC does the design of the water mains and sewers that BWSO operates and maintains. BWSO is heavily focused on stormwater management issues and has an intensive program to alleviate the Southeast Queens flooding problem. The Green Jobs/ Green Infrastructure Maintenance are part of BWSO. BWSO is in the process of implementing online permitting for water, sewer and stormwater permits.
- BWT is responsible for the operation and maintenance of the fourteen in-city wastewater treatment plants (WWTPs)³, the City's 96 wastewater pump stations (PSSs), interceptors, CSO regulators, sludge dewatering facilities, fleet of marine vessels, laboratories, and the control of discharges from combined sewer overflows. Two Assistant Commissioners (Capital Planning/Delivery and Wastewater Treatment/Resource Recovery Operations) report directly to the Deputy Commissioner of BWT. BWT plans to further drive decision-making through data driven analytics. BWT continues the transition from wastewater treatment plants to water resource recovery facility operations. Because of the energy-intensive nature of their facilities, BWT coordinates closely with the Office of Energy and Resource Recovery Programs. BWT has created a Research and Development Plan which will focus on innovation, one of NYCDEP's core values. BWT continues to focus on organizational development planning to identify and evaluate the current and future

³ Wastewater Treatment Plants (WWTPs) are also referred to as Wastewater Resource Recovery Facilities (WRRF), as described later in the report.

staffing and skill set needs of BWT operations. Seven Area Facility Managers (two WWTPs per Facility Manager) provide senior leadership in the operation of the fourteen wastewater treatment plants. The Area Facility Managers report to the Director of Plant Operations. Working with the Chief Operators of the individual plants, the Area Facility Managers provide overall operational consistency. Each Area Facility Manager has an assigned Maintenance Facilitator who coordinates maintenance operations.

- Capital Improvement Program Delivery is executed by the Bureau of Engineering, Design, and Construction (BEDC). BEDC is responsible for project delivery consisting of the design and construction of capital improvement projects, including major water transmission facilities, water treatment facilities, wastewater treatment facilities, wastewater pumping stations, and stormwater/CSO facilities. BEDC implements many of these projects with contract services for planning, design, construction and construction management (CM), along with an In-House Design group. BEDC continues to find ways to improve business practices that will have a positive impact on project implementation, such as streamlining procurement processes for improved efficiency and the development of front end business cases. These improvements will benefit overall project execution with better controls on project schedules and project costs/change orders.
- The Office of Energy and Resource Recovery Programs is responsible for the coordination of energy management for all operating bureaus and overall NYCDEP energy initiatives, and works closely with NYC Department of Citywide Administrative Services (DCAS). This Office guides and oversees NYCDEP's energy, biosolids and residuals, organics/ food waste, resource recovery, and GHG policy, planning, projects, budgeting, research and studies. This Office advises on energy and GHG related expense and capital funding, in addition to seeking outside funding sources for projects, such as those available through DCAS.
- The Bureau of Sustainability at NYCDEP is responsible for the development and implementation of environmental policy and strategy, including water and air quality, the noise code, and other quality of life issues. The Group includes the Bureau of Environmental Planning and Analysis (BEPA), Hazardous Materials and Superfund Planning & Analysis, and the Bureau of Environmental Compliance (BEC). Coordinating and tracking the many elements of the Green Infrastructure Plan occurs within BEPA. BEPA is also responsible for conducting environmental reviews for NYCDEP, providing technical assistance for the preservation of natural resources, conducting long range planning (population/ employment, consumption and demand/flow), conducting strategic planning to help ensure appropriate forecasting, trend analysis, regulatory review, scientific modeling, and research. BEPA continues the work on the climate change task force, and helps NYCDEP plan for the new growth stimulated by rezoning throughout the city. The Sustainability Group is also responsible for implementing and tracking the OneNYC sustainability initiatives for NYCDEP. BEC is made up of the Division of Air & Noise Policy, Permitting and Enforcement and the Asbestos Control Program. BEC is responsible for responding to air and noise code complaints, maintaining the database of facilities containing hazardous and toxic material, overseeing remediation of hazardous waste municipal landfills, managing investigation of contaminated sites and responding to hazardous material emergency incidents.

5.0 OVERVIEW OF THE SYSTEM

NYCDEP is charged with the operation, maintenance and management of a vast complex system of water, wastewater and stormwater infrastructure.

5.1 Water Supply System

The NYC water is supplied from three upstate watersheds (Delaware, Catskill and Croton), which extend as far as 125 miles north of NYC, consisting of 19 collecting reservoirs (in the Delaware, Catskill, and Croton Systems), three controlled lakes (in the Croton System), and two additional balancing and distribution reservoirs (Hillview and Jerome Reservoirs) as shown in Figure 2. The NYC water supply system has a total available storage capacity of 570 billion gallons, and extends 125 miles north and west of NYC. NYCDEP maintains operational flexibility to vary the water supply from all three water systems, as they deem necessary; the Catskill, Delaware and Croton systems.

The Croton water supply system is the NYC's oldest water supply, put into service in 1842 with the construction of the Old Croton Aqueduct delivering water to the City. The Croton system continued to expand; the Croton watershed is made up of several reservoirs (New Croton, Croton Falls Main, Cross River, West Branch, Titicus, Amawalk, East Branch, Muscoot, Bog Brook, Middle Branch, Boyds Corner, Croton Falls Diverting), all of which now feed into The New Croton Aqueduct.

The Catskill system was put into service in 1915 and provided water to all five boroughs by 1917. The Catskill system is made up of the Schoharie Reservoir and the Ashokan Reservoir, which feed water to the City via the Catskill Aqueduct.

Construction of the Delaware system began in 1937. The Delaware watershed was put into service in phases and is comprised of four reservoirs - Cannonsville Reservoir completed in 1964, Pepacton Reservoir completed in 1955, Neversink Reservoir completed in 1954 and Rondout Reservoir completed in 1950, which receives water from the other reservoirs in the Delaware System. Delaware water is conveyed to the City by the Delaware Aqueduct.

NYCDEP also maintains wells in Queens; however, the groundwater supply system has not been providing water to the NYC distribution network since 2007. NYCDEP submitted the groundwater permits renewal in December 2017 so that the groundwater will be available as a back-up water supply, if necessary. However, the upstate surface water supply is the primary source water for NYC. The average daily NYC water delivered for calendar year (CY) 2018 was 1,007 million gallons per day (MGD)⁴, which provides for more than 8.6 million residents of New York City, and transients consisting primarily of tourists and daily commuters. It should be noted that current average daily water delivery in NYC is about 35% less than the delivery levels experienced in the early 1990s. If the conservation measures currently in place remain effective there will be no immediate need for the city to develop additional long-term water sources to meet normal demand. The Water System also provides potable water (approximately 105 MGD) to upstate consumers in parts of Westchester, Putnam, Ulster, and Orange Counties (population approximately one million people).

The New York City water supply is conveyed by gravity from the upstate reservoirs through an extensive system of tunnels and aqueducts. The 92-mile Catskill Aqueduct conveys water from the Ashokan Reservoir to the Kensico Reservoir and the 85-mile Delaware Aqueduct conveys water from the Rondout Reservoir to the West Branch Reservoir and then to the Kensico Reservoir. Because of the high quality water in the upstate reservoirs and well protected water supply, the US Environmental Protection Agency (USEPA) granted NYC a waiver from the federal requirement to filter drinking water originating from surface water supplies. As a result, the Delaware and Catskill watersheds do not require filtration and the watersheds are protected by a mandated Filtration Avoidance

⁴ Water delivery data provided by NYCDEP BWS

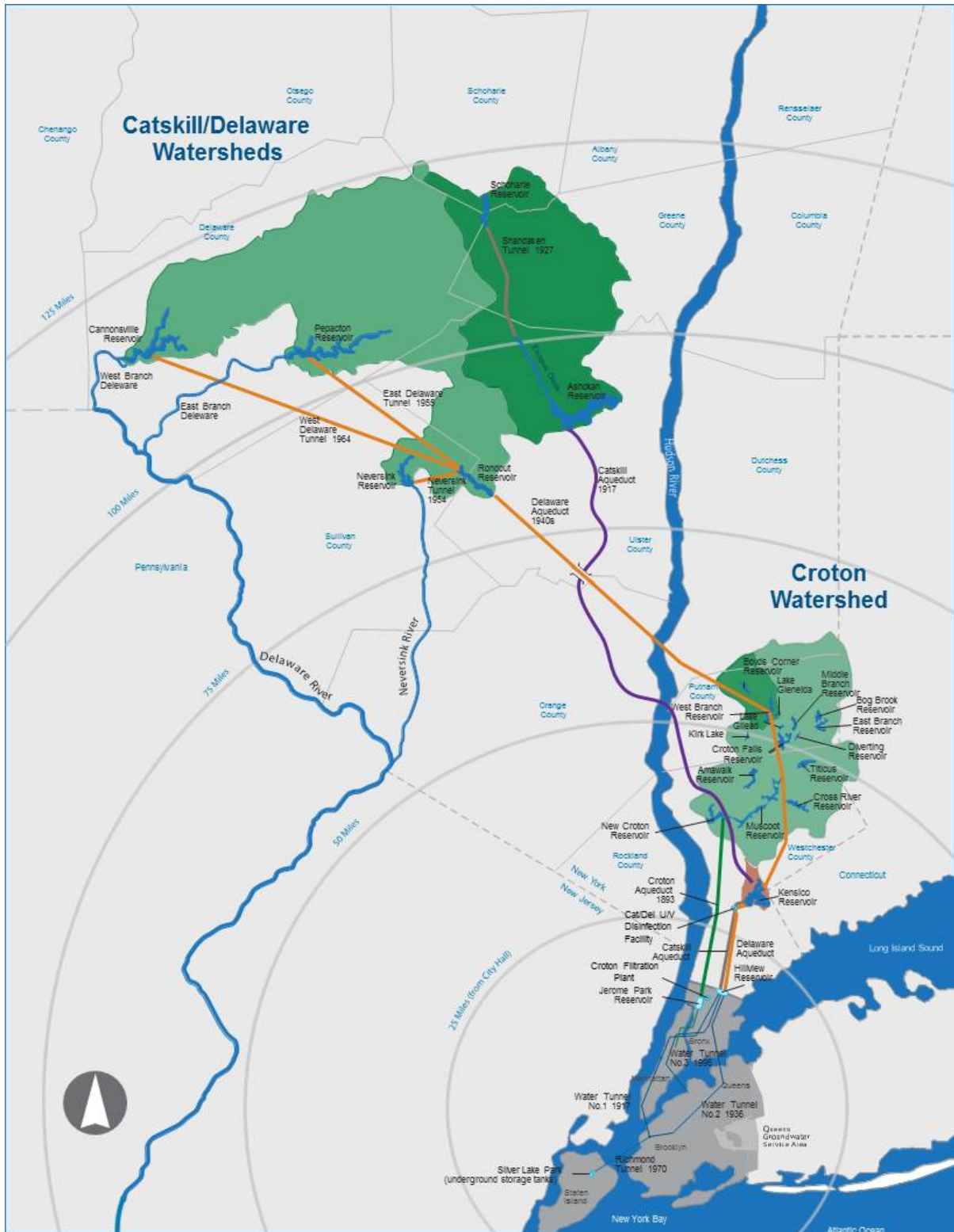


Figure 2: New York City Water Supply System

Determination (FAD), which specifies disinfection requirements and identifies watershed source protection requirements to maintain its high level of water quality. Water entering the distribution system is treated with chlorine, fluoride, food-grade phosphoric acid and sodium hydroxide. BWS disinfects Catskill and Delaware water systems at Kensico Reservoir Shaft 18 and additional chlorine disinfection occurs prior to entering the distribution system at Hillview Reservoir. The Catskill/Delaware Ultraviolet Disinfection (Cat/Del UV) Facility, which treats water from Kensico Reservoir feeds water to NYC through the Hillview Reservoir. The Cat/Del UV Facility, located in Eastview on a 153 acre facility between the Kensico and Hillview reservoirs has a capacity of 2.4 BGD and is the largest UV facility in the United States.

The Croton System delivers water from the New Croton Reservoir through the New Croton Aqueduct to the Jerome Park Reservoir in the Bronx. The water is then sent to the Croton WFP, which came online in May 2015. The Croton WFP has a maximum capacity of 290 MGD and is divided into Plant A and Plant B. The water treatment processes consist of chemical addition, dissolved air flotation (DAF), and filtration followed by UV disinfection. The Croton WFP is located beneath Van Cortlandt Park in the Bronx. It is the largest underground water filtration plant in the United States. The Croton WFP is also the largest stacked DAF filter plant in the United States. After treatment, the water is conveyed through concrete lined pressure water tunnels to the distribution service areas. Use of the Croton WFP varies based upon NYCDEP's operational needs. The Croton WFP provides NYCDEP with a valuable and flexible resource.

Both the Kensico Reservoir (30.6 billion gallons storage capacity) and the Hillview Reservoir (900 million gallons storage capacity) serve as balancing reservoirs for the water system, handling the daily and hourly fluctuations of water demand, respectively. Figure 3 shows the NYCDEP conveyance facilities downstream of these reservoirs. Water from Hillview Reservoir is conveyed to the city through three tunnels, City Tunnel No. 1, City Tunnel No. 2, and City Tunnel No. 3, which is partially in operation and partially under construction. Most of the water from the Croton WFP is pumped into the city tunnels, with some water conveyed by gravity to the lower supply areas. The water distribution system from the three city tunnels consists of a network of approximately 7,000 miles of water mains, as well as valves, fire hydrants, distribution facilities, gatehouses, pump stations, water quality monitoring stations, laboratories and maintenance and repair yards.



Figure 3: New York City Water Conveyance Infrastructure

5.2 Wastewater System

The NYCDEP wastewater treatment system is comprised of fourteen (14) in-city WWTPs that discharge into receiving bodies surrounding NYC, as indicated in Figure 4 and is operated by the BWT. There are seven upstate WWTPs and one community septic system that are operated by BWS which are necessary to protect the NYC upstate watersheds. The NYC WWTPs have an average design capacity of 1.8 BGD and are currently treating approximately 1.23 BGD of municipal wastewater consisting of municipal sewage and some stormwater from combined sewers.

The NYC sewer system is divided into 14 drainage areas, which correspond to each WWTP. The NYCDEP in-city WWTPs provide secondary treatment in accordance with their State Pollutant Discharge Elimination System (SPDES) permits. As indicated in Figure 4, eight of the WWTPs are required to provide Biological Nitrogen Removal (BNR) to meet Total Maximum Discharge Limit (TMDL) regulatory requirements that have been set to protect the Upper East River and Jamaica Bay receiving waters. Four of the Upper East River WWTPs and two of the Jamaica Bay WWTPs are currently operating in BNR mode. The Rockaway WWTP and Coney Island WWTP are currently under construction for BNR upgrades. While the main purpose of the WWTPs is to protect the receiving waters surrounding New York City, the industry is rapidly evolving and WWTPs are now being considered as Wastewater Resource Recovery Facilities (WRRFs) where treated wastewater effluent can be recycled and beneficially used to meet non-potable water demand, wastewater treatment sludge can be reclaimed as biosolids suitable for beneficial reuse, and methane gas created during the anaerobic stabilization of sludge can be used as a green energy source. Utilities across the country are shifting the name from Wastewater Treatment Plants to Water Resource Recovery Facilities. Additional capital investment and operational modifications will be needed as NYCDEP WWTPs transition to WRRFs.

The sewer system is comprised of approximately 7,500 miles of sewer pipes of varying size and material, which are classified as sanitary, storm or combined sewers. Much like many other older cities, the NYC collection system consists primarily of combined sewers (approximately 60% of NYC land area is served by combined sewers). During dry weather, the combined sewers carry municipal wastewater to the WWTPs. During a wet weather event, municipal wastewater, and rainwater from surface water runoff is also collected in the combined sewers. Most of the flow is sent to the WWTPs while excess combined sewer flow discharges to the receiving water as combined sewer overflow (CSO). There are approximately 426 permitted CSO outfalls and four CSO retention facilities (Paerdegat, Alley Creek, Spring Creek, Flushing Bay) that provide screening, settling and storage of the CSO before discharging. The stormwater remaining in the CSO facilities after the wet weather event is then directed to the WWTPs for treatment.

Additional NYCDEP infrastructure that supports the wastewater system includes 96 wastewater pump stations, 497 regulators, 148,000 catch basins, laboratories, six active sludge dewatering facilities and five inner-harbor sludge vessels which transport sludge between facilities.

THE NEW YORK CITY MUNICIPAL WATER FINANCE AUTHORITY
Fiscal Year 2019 Consulting Engineer's Report

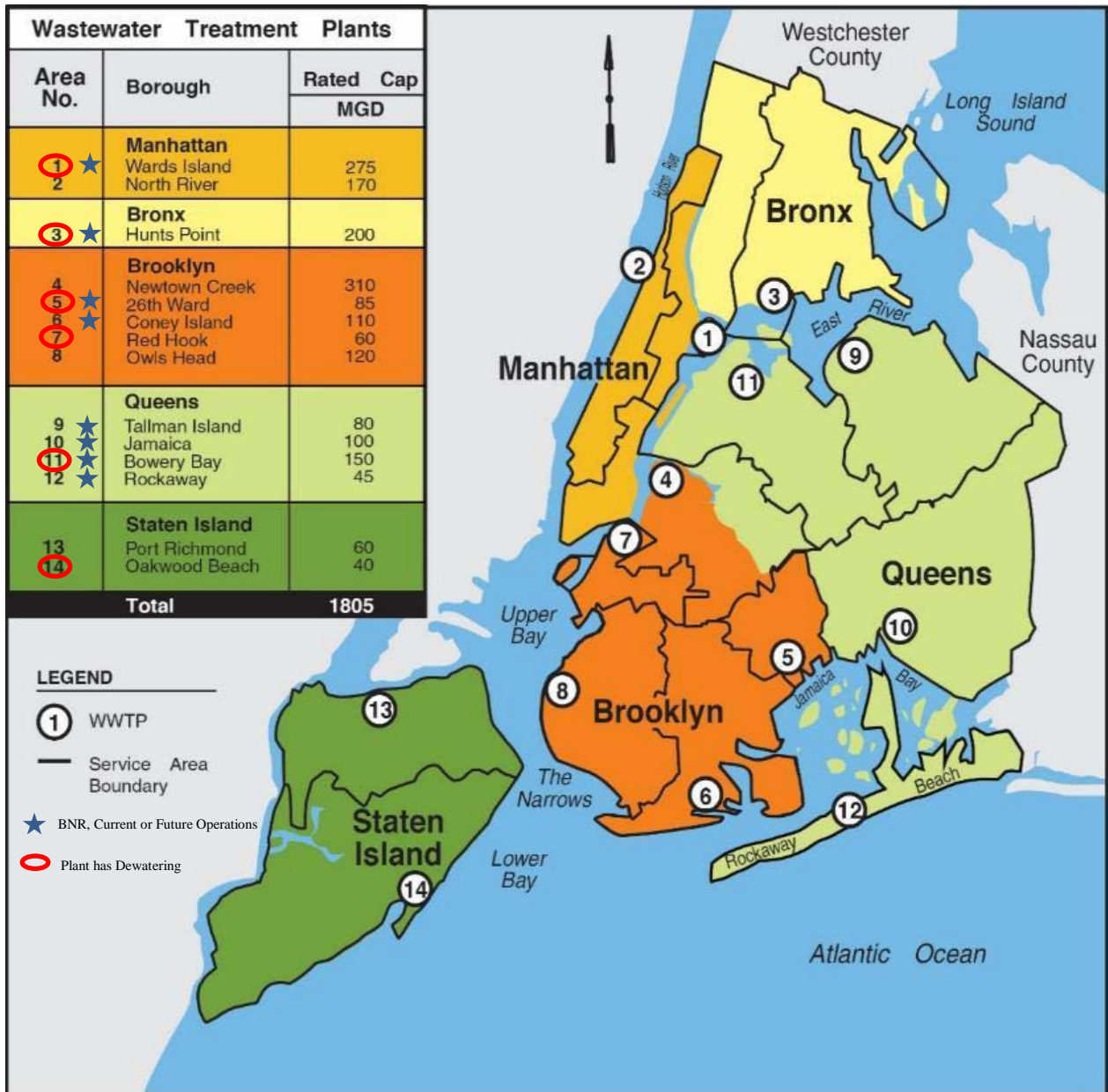


Figure 4: New York City Wastewater Treatment Plants (WWTPs)

6.0 CAPITAL IMPROVEMENT PROGRAM (CIP)

6.1 Overview

Budgeting is a lengthy and comprehensive process, especially for an agency operating such a large and complex system as is the responsibility of the NYCDEP. NYCDEP budgeting is an ongoing iterative process that takes into account significant and substantial needs including regulatory requirements, legal mandates, mayoral initiatives, state of good repair (SOGR) projects to maintain existing aging infrastructure, energy projects, capacity enhancements, dependability, environmental, health, and safety (EH&S) compliance requirements, localized community drivers, and climate change adaptation/resiliency improvements. These many needs must be met within the funding limitations; NYCDEP seeks opportunities for synergies with project implementation such as addressing SOGR needs along with energy and resource recovery projects and flood resiliency projects. Project schedules, cost estimate updates, technical issues, regulatory updates, emergency events, reoccurring events and legal issues may impact project prioritization and the overall budgeting process. NYCDEP is continuously evaluating projects to determine the most important funding requirements across all NYCDEP programs to prioritize NYCDEP's most critical needs first. This challenging budget exercise constantly forces NYCDEP (and other City agencies) to prioritize and in the process of doing so, some projects could be deferred. Such deferred projects are reevaluated on a regular basis and funded in future budget cycles.

The NYCDEP CIP consists of the Preliminary Ten Year Capital Strategy for FY 2020 through FY 2029 and the Current Capital Plan for FY 2019 through FY 2023, which were published on February 7, 2019. The Ten Year Capital Strategy is updated every two years. The Current Capital Plan is updated quarterly. It supersedes the Ten Year Capital Strategy in the overlapping fiscal years. This report reviews the CIP, including the capital budget for FY 2019, which ends on June 30, 2019, and the preliminary capital budget for FY 2020, which ends on June 30, 2020. AECOM has reviewed the Preliminary Ten Year Capital Strategy and the Current Capital Plan and met with key individuals responsible for budgetary planning to provide an assessment of its adequacy. It is anticipated that the Mayor will issue the Ten Year Capital Strategy and Executive Budget for FY 2020 in April 2019. Our findings are summarized in the following paragraphs.

FY 2019 Capital Budget

The FY 2019 budget is set at \$2.395 billion. Approximately 31% of FY 2019 funding supports regulatory mandated projects, consisting primarily of CSO (green and grey infrastructure) projects, the FAD programs, Croton Filtration Plan above-ground structures, and the Kensico Eastview connection tunnel. Significant funding is also included in FY 2019 for NYCDEP priority projects such as sewer build-out for the Southeast Queens program, City Tunnel #3, emergency contracts for water and sewer work, water distribution system and wastewater collection sewer work, wastewater treatment plant SOGR projects, and water supply infrastructure SOGR projects.

FY 2020 Preliminary Capital Budget

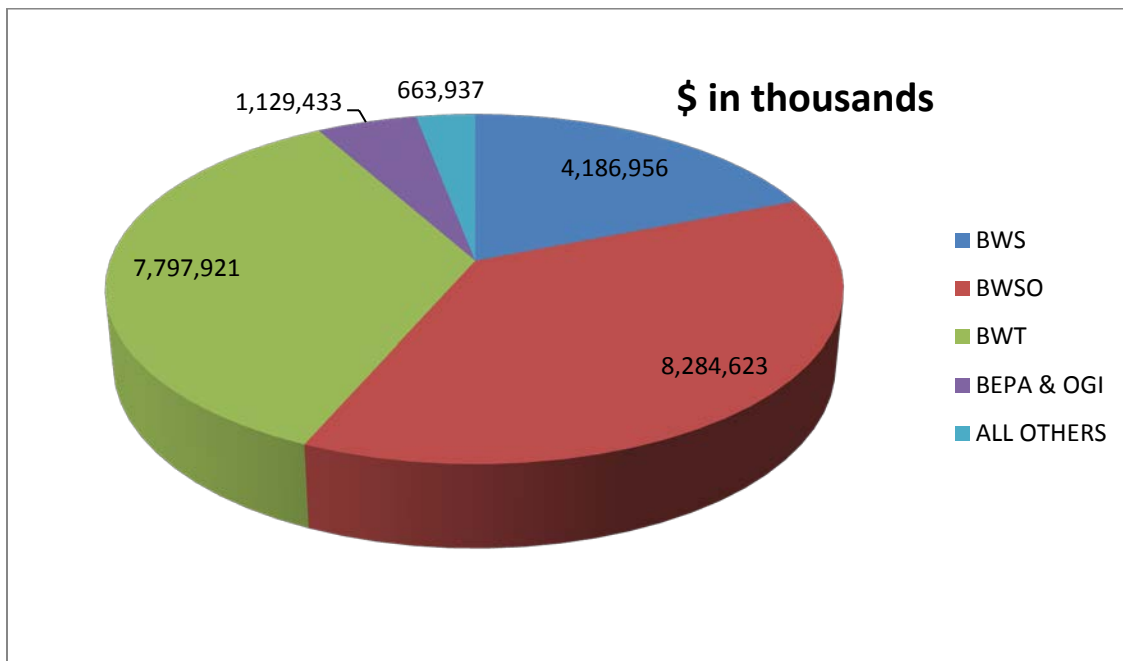
The FY 2020 preliminary capital budget is set at \$2.926 billion. Approximately 27% of FY 2020 funding supports regulatory mandated projects, such as CSO projects (grey and green infrastructure), the FAD program, and storm sewer build-out requirements. Significant funding is also included in FY 2020 for NYCDEP priority projects such as the Southeast Queens storm sewer program, City Tunnel #3, wastewater treatment SOGR projects, specific sewer and water main work, and water supply infrastructure SOGR projects.

Regarding the Capital Improvement Plan for FY 2019 to FY 2029

The Capital Improvement Plan for FY 2019 through FY 2029 consists of \$22.06 billion in funding. Figure 5 shows how the funding is allocated by each operating bureau over the next ten years.

BWSO's funding of \$8.28 billion, represents 37.6% of the total CIP and covers water and sewer main replacement, Southeast Queens Stormwater Program, City Tunnel #3 completion, bluebelts, emergency water and sewer contracts, and other BWSO projects. BWT's funding of \$7.8 billion, represents 35.3% of the total CIP and covers SOGR needs for wastewater infrastructure, CSO Program, Gowanus Superfund program, resiliency projects, the TRC Program, and other BWT projects. BWS's funding of \$4.19 billion, represents 19% of the total CIP and covers KEC tunnel, SOGR needs for water supply infrastructure, FAD requirements, and other BWS projects. The OGI and BEPA's funding of \$1.13 billion, represents 5.1% of the total CIP and covers the green infrastructure program. The funding of \$664 million for all others, represents 3% of the total CIP, and includes projects within BEDC, BCS, Police and Security, Facilities Management, Fleet, Office of Information Technology, Department of Parks and Recreation and other bureaus.

This is the largest NYCDEP Ten Year Capital Strategy released in the past decade, as shown in Figure 6. Approximately 25% of the total funding for FY 2019 through FY 2029 is dedicated to regulatory mandated projects, also shown in Figure 6. The majority of the mandated projects in FY 2019 through FY 2029 consist of the green and grey CSO-related infrastructure, the Kensico Eastview connection tunnel, the FAD program, and the TRC program. As will be described later in the report, the KEC tunnel is now considered mandated as it is included in the Hillview Cover Consent Decree as a mandated pre-cursor project. The majority of the remaining capital improvement program for FY 2019 through FY 2029 must be planned and budgeted based solely on its importance to the overall System and NYCDEP prioritization as determined by NYCDEP, such as the state of good repair needs of the older assets in The System, the Southeast Queens storm sewer buildout program, City Tunnel #3 completion and activation, and significantly more BWSO water main replacement and sewer work. However, as discussed later in this report, the mandated CSO



**Figure 5: Capital Improvement Program (\$ in thousands)
FY 2019 through FY 2029 by NYCDEP Operating Bureau**

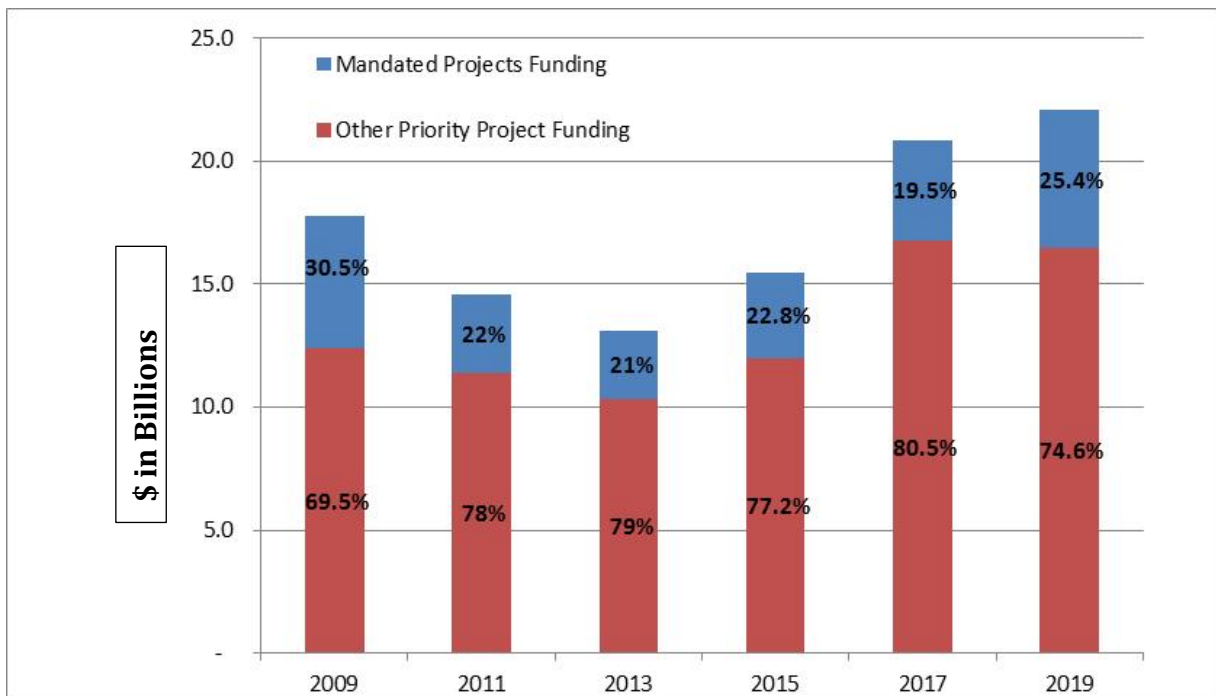


Figure 6: NYCDEP Comparison of Preliminary Ten Year Capital Strategies

Program and the Hillview Cover will require additional funding in the future and will extend beyond the next ten year planning horizon. It is anticipated that there will be a continuous need to fund regulatory mandated projects. There will also be an increased and continuous need for SOGR funding due to the age of the NYCDEP infrastructure and the ability to more readily identify needs using the Asset Management tools now in place. Based upon the age of the infrastructure, there will be a need to replace wastewater and water system assets in accordance with a proactive, systematic data-driven plan that minimizes reactive replacements brought about by asset failures.

As is the case in most US cities and municipalities, the NYCDEP water and wastewater infrastructure is aging. Therefore, it is necessary to refurbish or replace infrastructure in a planned manner to cost effectively minimize risk of failure. The NYCDEP has refined and implemented its Asset Management program significantly in order to set priorities for the continued refurbishment of its physical assets. The Asset Management program provides a uniform methodology for a comprehensive evaluation of capital assets throughout The System and allows a systematic approach to maintain and upgrade physical assets so that capital improvements can progress in an orderly manner. To further improve upon this effort, a pilot program at the Port Richmond WWTP is underway to take a more detailed assessment of its asset management program. The pilot program will help BWT further identify needs by assessing life cycle costs of equipment and will provide a bottom up approach to identify needs for equipment repair/replacement.

In addition to the asset condition assessment NYCDEP is considering a number of other studies/assessment tools that will support the long-term requirements of the NYCDEP assets. NYCDEP will be performing Integrated Master Planning for all 14 drainage areas. In addition, energy feasibility studies are being performed to identify opportunities to reduce energy consumption and costs. Resiliency improvements are also ongoing to protect facilities from projected sea level rise and increasing storm intensities due to changing weather patterns. These studies will identify needed improvements that will then have to be organized and prioritized. With the completion of these studies/assessments, Facility Plans should be prepared to effectively group and prioritize the needed upgrades for each WWTP as part of a systematic approach to guide capital investment planning.

6.2 System-wide Programs

NYCDEP Sustainability Initiatives

NYCDEP continues to further implement sustainability in planning, design, construction of new facilities and everyday operations of current facilities. Sustainability is a core value identified in the *2018 Strategic Plan*, which supports the NYCDEP vision to “*be a world-class water and wastewater utility, while building a sustainable future for all New Yorkers*”. One of the seven goals of the *2018 Strategic Plan* is to reduce the carbon impact and mitigate the effects of climate change. NYCDEP has identified four strategies to achieve this sustainability goal:

- Reduce greenhouse gas emissions and expand renewable energy sources.
- Restore natural habitats throughout New York harbor.
- Expand the green infrastructure program.
- Expand integrated water management through water conservation, water reuse, and resource recovery.

There are many sustainability Local Laws in NYC that impact water supply and wastewater resource recovery facility operations therefore NYCDEP continues to evaluate current and future facility operations.

On April 22, 2015, Mayor deBlasio released *One New York, The Plan for a Strong and Just City Report* (OneNYC). This comprehensive plan focuses on four principles - growth, sustainability, resiliency and equity. OneNYC is an expansion of the previous citywide sustainability plan, PlaNYC. Greenhouse gas reduction and energy planning are being incorporated into NYCDEP's planning and design projects. Annual Progress Reports are issued providing progress on the OneNYC initiatives. The most recent Progress Report was released on April 20, 2018, and the next update is planned for April 2019.

Greenhouse Gas Reduction and Energy Planning. Mayor deBlasio released *One City: Built to Last* in September 2014 with further aggressive reductions of greenhouse gas emissions and carbon management. New York City Office of Sustainability committed to an 80% citywide reduction in green-house gas emissions from FY 2006 base year levels by 2050 (also known as 80 by 50). Also, an interim goal of 35% reduction of green-house gas emissions from 2006 base year levels in municipal government operations is required by 2025. In accordance with Local Law 66 of 2014, the NYC Mayor's Office of Sustainability released a report in September 2016 titled, *Roadmap to 80 x 50 Report*. Although the GHG and energy reduction targets are citywide, NYCDEP will have a significant role since NYCDEP energy-intensive operations makes them the second largest municipal emitter of GHG and the third largest municipal energy consumer.

NYCDEP's maintains a four-point approach to GHG reductions, which consists of: demand-side reductions, supply-side improvements, traditional renewable energy solutions and energy/ carbon offsets. NYCDEP has reduced its GHG emissions by approximately 22% since FY 2006, despite the addition of energy-intensive facilities and processes coming on-line since the base year. NYCDEP is performing an Energy and Carbon Neutrality Plan to determine how NYCDEP will contribute to the city's overall 80 by 50 GHG reductions. The Plan will evaluate carbon management and net energy neutrality of the NYCDEP operations. In order for the NYCDEP to become net energy neutral, a cost effective analysis is required to evaluate energy efficiencies, energy generation and renewable energy initiatives. The results of this Plan will form NYCDEP's strategic plan to achieve energy neutral operations. NYCDEP has secured some funding through the Department of Citywide Administrative Services (DCAS) programs - Accelerated Conservation and Efficiency (ACE) and the

Expenses for Conservation and Efficiency Leadership (ExCEL) for energy and GHG reduction projects.

In September 2017, NYC released the report titled *1.5°C: Aligning New York City with the Paris Climate Agreement*. This plan further committed NYC to a goal of reducing citywide greenhouse gas emissions 80% by 2050 and an interim energy reduction goal of 20% by 2025 for City-owned buildings.

With new systems and facilities coming on-line, NYCDEP Office of Energy and Resource Recovery Programs will assist in the planning of reliable sources of power, both from conventional and renewable sources. NYCDEP will commence a comprehensive energy plan this year that will evaluate energy project opportunities throughout all NYCDEP operations. NYCDEP continues to implement energy conservation measures (ECMs) at each of the WWTPs. NYCDEP is evaluating the incorporation of energy efficiency with SOGR projects through the SOGR-ECM Integration Study for all 14 WWTPs. This study evaluates existing ECMs and identifies new ECMs, then prioritizes energy projects around the SOGR needs of the facilities to optimize operating costs and bring significant potential GHG reductions. NYCDEP looks for synergies to coordinate SOGR upgrades with GHG reduction opportunities. For example, the energy intensive centrifuges at Newtown Creek WWTP will be replaced with gravity belt thickeners (GBT).

NYCDEP is participating in an innovative resource recovery program at the Newtown Creek WWTP, their largest wastewater treatment plant. As part of the Newtown Creek/National Grid public private partnership, NYCDEP will send anaerobic digester gas (ADG) to a digester gas conditioning system to be operated by National Grid. The product gas, referred to as renewable natural gas, will be pipeline quality gas and will be added to National Grid's natural gas supply network. This project will improve local air quality, reduce citywide greenhouse gas emissions, utilize a renewable energy resource, and supplement the citywide natural gas supply. Another public private partnership ongoing at Newtown Creek WWTP is with Waste Management (WM), Inc. Newtown Creek WWTP is accepting food wastes from NYC public schools, NYC residents, the green markets, and commercial establishments. The food waste, delivered by WM, Inc. is added to the digesters to increase the production of ADG. NYCDEP has successfully completed a one-year monitoring and testing pilot study under a grant from New York State Energy Research and Development Authority (NYSERDA) to evaluate the food waste/ADG co-digestion in Newtown Creek digesters. Due to the success of that study, NYCDEP has implemented a more comprehensive three-year demonstration project in collaboration with NYSERDA, Bucknell University and Manhattan College. Phase 1 of the demonstration operated with the addition of 85 tons per day (tpd) of food waste. Phase 2 of the demonstration is currently operating with the addition of 130 tpd. In Phase 3, NYCDEP plans to co-digest as many as 250 tpd of food waste at Newtown Creek by the end of the calendar year. The Office of Energy and Resource Recovery Programs continues to evaluate system-wide implications of this demonstration. Approximately 500 tpd of food waste is the estimated capacity for co-digestion of food waste at Newtown Creek. The food waste co-digestion and the ADG sent to National Grid projects at Newtown Creek serve as a model for integrating renewable energy in a dense urban environment. Food waste co-digestion will be evaluated at other NYCDEP WWTPs, where applicable.

Other energy projects that NYCDEP is implementing are cogeneration facilities and solar panels at NYCDEP facilities. A cogeneration facility is currently under construction at North River WWTP. Cogeneration at other WWTPs is being evaluated. Solar panels (1.2 megawatt (MW) system) have been installed at the Port Richmond WWTP in Staten Island since 2015. NYCDEP completed a feasibility study for solar photovoltaic (PV) and battery storage installations at the Wards Island WWTP. A feasibility study for solar installations at five locations in the upstate watershed was completed this year. A Feasibility Study was also completed for hydroelectric potential at Shaft 4, the Catskill Aqueduct and Delaware Aqueduct Interconnection.

NYCDEP completed a Feasibility Study to determine the viability of a hydroelectric facility at Cannonsville Dam. Based upon the study, a 6-megawatt hydroelectric facility is being developed.

This is a significantly smaller facility compared to the original 14-megawatt facility with a 9,000 square foot powerhouse. This smaller revised plan may qualify for a license exemption from FERC. The hydroelectric facility will use water that is continuously released downstream of the Cannonsville Reservoir. The proposed hydroelectric plant consists of two 3-megawatt generators inside a 4,400 square-foot powerhouse, adjacent to the West Delaware Release Chamber. There is \$8 million in funding for a hydroelectric facility at the Cannonsville Reservoir in the CIP. DCAS is providing \$17 million in funding for the Cannonsville Hydroelectric Facility. The current estimate of this hydroelectric facility is \$34 million. NYCDEP's main priorities continue to be dam safety, maintaining operational control over the dams and the ability to meet flow management agreements.

Climate Change Adaptation and Resiliency

NYCDEP has been planning and evaluating climate change adaptation requirements for the past several years, well before Superstorm Sandy impacted the NYC area. Adaptation refers to those actions that must be taken to allow NYCDEP facilities to meet its intended functions when considering projected sea level rise and more intense storm events. In May 2008, NYCDEP released its Climate Change Program Assessment and Action Plan. Following its release, the NYCDEP began studying the effects of climate change on the city's stormwater/wastewater collection system in more detail to determine what level of infrastructure and policy modifications are necessary to alleviate potential damage from larger, more frequent storm events and projected rising sea levels. In May 2010, the NYC Panel on Climate Change released a report titled *Climate Change Adaptation in New York City: Building a Risk Management Response*, which among other important information, includes climate trends and projections for NYC, which NYCDEP has used for analysis and planning. In addition, BEPA completed a two-year pilot study to develop an adaptation and optimization strategy to minimize global climate change risks for NYCDEP infrastructure using one WWTP (Hunts Point) and one drainage area (Flushing Bay).

When Superstorm Sandy significantly impacted the New York City area in October 2012, NYCDEP made a clear decision to continue to strengthen its work on climate change adaptation and resiliency. In December 2012, the Mayor's Office formed the Special Initiative for Rebuilding and Resiliency (SIRR). In June 2013, NYC released a comprehensive document entitled *A Stronger, More Resilient New York*, which covered citywide infrastructure impacts and community rebuilding and resiliency plans. Subsequently, NYCDEP released the *NYC Wastewater Resiliency Plan, Climate Risk Assessment and Adaptation Study* in October 2013. This Plan provided a comprehensive assessment of wastewater facilities at risk from future storms with proposed measures to protect equipment to reduce the risk of damage and loss of service. The study evaluated infrastructure at the NYCDEP WWTPs and wastewater pump stations to identify and prioritize facilities most at risk for flood damage. The framework used for this study consisted of climate analysis, risk analysis and adaptation analysis. The possible adaptation strategies ranged in varying degrees of resiliency, effectiveness and cost.

The NYCDEP Resiliency Program is on-going and being managed in BEDC. There are established contracting mechanisms to implement resiliency projects across 14 WWTPs and 96 PSs. There are three design contracts in place to address resiliency upgrades at the WWTPs and PSs. The resiliency construction contracts will start to go out for bid this year. NYCDEP plans to secure funding and financing through the NYSDEC Storm Mitigation Loan Program (SMLP) and through the Flood Emergency Management Agency (FEMA) for these resiliency upgrades. Prioritizing the resiliency capital projects is an important step in the planning process. The criteria being used for prioritization of projects and needs includes operational, environmental, social and financial metrics. As facilities are being upgraded the results of the October 2013 Wastewater Resiliency Plan will be reassessed with detailed site analyses during the design. NYCDEP has adopted new design standards to account for the critical flood elevation with FEMA maps. NYCDEP has developed *Resiliency Design Guidelines*. As part of the October 2013 study, Storm Surge Guidance was also developed for all 14 NYCDEP WWTPs to assist NYCDEP staff in preparing for another storm.

Along with many other NYC agencies, NYCDEP will play a role in the Eastside Coastal Resiliency (ESCR) project. This project will provide improved coastal protection by reducing flood risk due to coastal storms and sea level rise on Manhattan's East Side. The CIP includes \$170 million for NYCDEP's participation in the ESCR project.

Climate change adaptation evaluations are also taking place for other parts of The System. BWS is focused on climate change impacts on the water supply side through the use of their Operation Support Tool (OST) models, the watershed protection program and improving flexibility in operations with increased water supply interconnections.

NYCDEP's Green Infrastructure Program provides a comprehensive adaptive approach to stormwater management. The plan is based on implementing citywide green infrastructure improvements to reduce the volume of stormwater that reaches the engineered (grey infrastructure) stormwater collection system. NYCDEP continues to focus on climate change as it evaluates its stormwater management needs.

NYCDEP maintains strong involvement with the climate change science community on the city, state, national and international level. On the national level, NYCDEP maintains utility membership and actively engages with the Water Utility Climate Alliance (WUCA) and the National Association of Clean Water Agencies (NACWA). NYCDEP continues a working partnership with Copenhagen, Denmark. The knowledge sharing between the NYCDEP and Copenhagen will involve best practices in response to intense rain events and stormwater management. NYCDEP completed a Cloudburst Resiliency Planning study applied to Southeast Queens. Two pilot projects derived from this study are being developed in coordination with NYC Housing Authority (NYCHA) and New York City Department of Transportation (NYCDOT).

The New York City Panel on Climate Change (NPCC) is an independent body that advises the city on climate risks and resiliency. In February 2015, Mayor de Blasio announced the release of the NPCC 2015 report titled *Building the Knowledge Base for Climate Resiliency*. This report provides climate projections for temperature, precipitation and sea level rise through year 2100. The NPCC recommends setting up a climate change monitoring system, so that resiliency measures can be adapted as changes continue to evolve in the future. In April 2018, the Mayor's Office of Recovery and Resiliency released *Climate Resiliency Design Guidelines* version 2.0. The Guidelines were developed based on the New York City Panel on Climate Change's regional climate projections that inform New York City resiliency policy. The NPCC is expected to release an updated report in 2019.

Climate change adaptation is a challenge facing all water and wastewater utilities, and should be considered in short-term and long-term utility planning. There is uncertainty inherent in climate science due to the magnitude, variability, timing and frequency of localized events and their impacts on The System. However, despite the uncertainty of climate change prediction, rational capital investments must be considered to protect NYCDEP facilities. NYCDEP's Resiliency Program Management will provide a framework for the implementation of climate change adaptation and resiliency in a systematic prioritized approach at NYCDEP WWTPs and PSs.

Asset Management

NYCDEP is continuing with a 5-year Asset Management contract (December 2015 – November 2020), to provide a third party independent review of all assets. NYCDEP Asset Management program includes the majority of the water and wastewater infrastructure. The results of the Asset Management program will be used in the development of the funding needs for the state of good repair for future capital budgets. This effort is based upon a collaborative approach between the operating bureaus so that all stakeholders have input throughout the process. Business case project prioritization is based upon a scoring of the following criteria: physical condition, performance/process condition, regulatory/environmental, service level/reliability, efficiency/energy, O&M and hazard, community, public image and financial. All potential projects receive a numerical

rating. NYCDEP will perform continuous real time updating of the status of the many NYCDEP physical assets to reflect completion of improvement projects and condition survey updates for operating assets. The capital program for the state of good repair projects is determined based upon the highest numerically rated projects within the available funding. The principles of Asset Management have been effectively applied to many water and wastewater utilities worldwide and the NYCDEP's progress in Asset Management is a positive development. The continued integration of the NYCDEP Asset Management program with the Capital Improvement Program for the prioritization of the replacement and rehabilitation of NYCDEP assets is anticipated.

NYCDEP has completed several Asset Management Guidance Documents that establish criteria project prioritization. The 2016 Omnibus Consent Order requires NYCDEP to submit annual updates of the NYCDEP Asset Management Program to NYSDEC.

6.3 Program Accomplishments

There are a number of capital program accomplishments during the past year that are noteworthy. These items play an essential role in the development and advancement of the CIP, and providing for prudent and professional management of the System.

- NYCDEP is boring the by-pass tunnel around the leaking section of the Delaware Aqueduct under the Hudson River, as part of the Water for the Future Program. The boring operation has completed approximately 62% of tunneling for the by-pass tunnel.
- In preparation for the Delaware Aqueduct shutdown planned for October 2022, the first of the three planned Catskill Aqueduct shutdowns began in October 2018, to perform cleaning inside the aqueduct, repair of structural and mechanical equipment and, replacement of valves.
- Construction continues on the low-level outlet of the Schoharie Reservoir project. The low level outlet will provide NYCDEP the ability to release water downstream of the reservoir into Schoharie Creek to help with dam maintenance, respond to potential emergencies, mitigate flood risk for downstream communities and enhance downstream fish and wildlife habitat. The land leg of the new release tunnel is complete and excavation of the water leg of the tunnel is ongoing.
- The NYSDEC has approved nine of the ten submitted LTCPs for the CSO Program. One LTCP is still under NYSDEC review (as it was submitted June 2018) and the final Citywide/Open Waters LTCP is under development by NYCDEP.

6.4 Capital Improvement Program Highlights for the Water System (Supply, Treatment, and Conveyance Programs)

A number of NYCDEP projects and programs for the water system are in various stages of implementation (planning, design, and construction). Many of these significant programs are described below.

Catskill/Delaware Water Supply System Filtration Avoidance

On December 28, 2017, the New York State Department of Health (NYSDOH) issued another 10-year Filtration Avoidance Determination (FAD), known as the 2017 FAD to the NYCDEP for the Catskill and Delaware watersheds. The 2017 FAD consists of a watershed protection program for 2017-2027. The new FAD requires NYCDEP to continue its core watershed protection programs that are already established and in place, such as land acquisition, whole farm planning, stream management and various upgrades to wastewater infrastructure in the upstate watersheds. In addition, the FAD contains new requirements, which includes expanding the small business septic

program in the Catskills, development of a community wastewater treatment facility for the hamlet of Shokan near Ashokan Reservoir, and protecting additional streamside lands through the Conservation Reserve Enhancement Program and the Streamside Acquisition Program. The FAD has several milestones and implementation schedules for the required programs.

National Academies of Sciences, Engineering, and Medicine (NASEM) released a report on their independent review of the NYCDEP Operation Support Tool (OST). The report summarizes their recommendations to improve and maintain the OST for continued use for NYCDEP decision-making in the future. A NASEM expert panel has begun reviewing the current FAD programs. Although the FAD spans ten years there is a halfway point review planned at the five year mark. This review will be based upon the findings of the expert panel and could impact the future capital investment program. The NASEM report on the FAD review is expected in mid-2020.

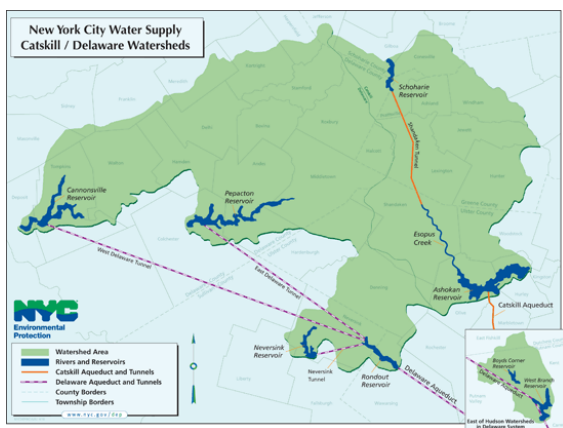


Figure 7: Filtration Avoidance Determination (FAD) for the Delaware and Catskill Watersheds

NYCDEP estimated approximately \$1 billion will be spent in programs over the 10-year FAD to comply with the current program. Funding for FAD programs comes from both the NYCDEP capital budget and the annual expense budgets. The continuation of the existing FAD program is currently funded in the CIP at a level of approximately \$370.56 million. Additional capital funding will be required in the next Ten Year Capital Strategy for the second half of the ten year FAD to continue to support FAD programs. It is anticipated that funding for the FAD will be included in the NYCDEP expense budget for the duration of the FAD.

NYCDEP is planning a comprehensive review of filtration methods and technologies, which will result in the development of a new conceptual design for a filtration facility, and updated cost estimates. The NYCDEP capital and expense financial investment in FAD programs are a far more cost-effective means to protect the Catskill/ Delaware water supply than building a costly filtration plan with high operation and maintenance costs.

Water for the Future (WFF)

The Water for the Future program is a comprehensive program that requires continued thorough coordination throughout the entire NYCDEP. It consists of two main components; (1) fixing the Delaware Aqueduct in two areas where significant leaking has been noted and (2) supplementing NYC water supply during the period when these water transmission elements are out-of-service. A strong organizational structure is in place within BEDC and across all operating bureaus (with designated liaisons) and executive management, to continue with the construction, implementation and risk management of the program due to its magnitude and complexity. There is approximately \$152 million in the CIP



Figure 8: Delaware Aqueduct by-pass tunneling underway

for the Water for the Future program, which consists of \$23.6 million for the continued construction of by-pass tunnel and repairs and \$128.5 million in water supply augmentation and conservation-related projects (when the Delaware Aqueduct is not in service for by-pass connection). Engineering studies conducted during the project development have identified program improvements that will result in shorter shutdown periods and less required water supply augmentation reducing the overall program cost.

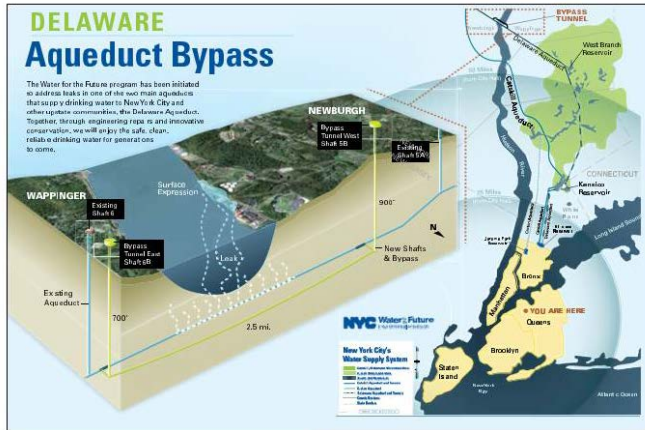


Figure 9: Delaware Aqueduct Bypass Program

the two shafts. The TBM was assembled 845 feet below ground in Newburgh at the bottom of the shaft in a bell-out chamber. It is approximately 470 feet in length and weighs 2.7 million pounds. The TBM began tunnel construction in January 2018, and the tunneling is currently about 62% complete. The by-pass tunnel will be steel lined when completed. Construction to connect the bypass tunnel with the existing Delaware Aqueduct is planned for October 2022. These connections will require taking the Delaware Aqueduct out-of-service and dewatering the aqueduct for several months during the low water demand season.

After evaluating several repair alternatives, NYCDEP developed a comprehensive plan to build a two and a half mile bypass tunnel around the leaking section under the river in the area of Roseton, NY and to perform repairs of the concrete liner in upstream areas near Wawarsing, NY. In 2013, NYCDEP began construction of two new shafts, Shaft 5B (in the Town of Newburgh) and Shaft 6B (in the Town of Wappinger). Construction of the two vertical shafts has been completed (contract BT#1). The tunnel construction contract (contract BT#2) was initiated in the summer of 2015. A tunnel boring machine (TBM) is being utilized for the construction of the new tunnel between

The NYCDEP has been evaluating and planning strategies for water supply augmentation to meet the demands of The System when water supply system components are out-of-service, either planned (when the Delaware Aqueduct is shut down to connect the bypass tunnel to the existing tunnel and to make the other upstream repairs) or unplanned. NYCDEP is currently implementing demand management measures and optimization of the Upper Catskill Aqueduct to increase its capacity.

NYCDEP released *One Water NYC: 2018 Water Demand Management Plan* in June 2018. NYCDEP's current Water Demand Management Plan has achieved 10 mgd in water savings. The plan focuses on the following key strategies for managing water demand, which consists of: the Municipal Water Efficiency Program, the Residential Water Efficiency Program, the Non-Residential Water Efficiency Program, Water Distribution System Optimization, Water Supply Shortage Management, and Wholesale Customers Demand Management. NYCDEP anticipates an additional 10 mgd reduction in water consumption citywide due to the continuation of planned water demand management program.

NYCDEP has planned 10-week shutdowns of the Catskill Aqueduct over a three-year period to repair and rehabilitate the Upper Catskill Aqueduct (from Ashokan Reservoir to Kensico Reservoir). NYCDEP completed a several week Catskill Aqueduct shutdown in October 2018. This project includes full inspection, implementation of mechanical and structural upgrades, and removal of the biofilm with chemical addition to increase the capacity to its historical flows. It is anticipated that 40 MGD of additional capacity in the Catskill Aqueduct will be available when this project is completed. Catskill Aqueduct shutdown also requires close coordination with the upstate users to ensure sufficient water quantity during the shutdown.

Catskill Aqueduct Roundout Pressure Tunnel

NYCDEP began monitoring the Catskill Aqueduct pressure tunnel due to leaks beneath the Roundout Creek using a remote operated vehicle. United States Geological Survey (USGS) is monitoring the area. Funding of \$217 million is included in the CIP; however, additional funding will need to be added to future budgets to devise a plan to repair the leaks. Once the Delaware repairs are completed, it is anticipated that NYCDEP will further address these leaks in the Catskill Aqueduct tunnel section. During the Catskill Shutdowns (Fall 2018 and planned Fall 2019 and Fall 2020) a temporary fix for a leaking valve, which is causing one area of leaks, will be implemented. A long-term solution will need to be devised to address the other suspected leaks in the pressurized tunnel portion of the Catskill Aqueduct.

Hillview Reservoir

The Hillview cover is required by federal regulations administered by USEPA, Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and an Administrative Consent Order with NYSDOH and USEPA. NYCDEP and USEPA executed a revised Administrative Order in May 2010, which provided an extension of time for construction of the Hillview cover. There are several water related projects that must be completed before the construction of the Hillview cover. In October 2010, DEP requested an additional six years to complete these projects prior to the Hillview cover construction.



Figure 10: Hillview Reservoir located in Yonkers

In February 2011, NYCDEP received a letter from the United States Department of Justice (USDOJ) indicating that this issue had been referred to the USDOJ. In August 2011, USEPA announced that it was reviewing the requirements of LT2 for controlling microbial risks, including covering reservoirs, such as Hillview Reservoir. At that time, USDOJ and the city had agreed to defer negotiations over revised dates until USEPA completes its review. USEPA notified NYCDEP in December 2016 that the USEPA will not be amending the LT2 Rule or providing a waiver for the Hillview Cover. In January 2017, EPA published in the Federal Register its decision not to revise the reservoir cover requirement under the LT2.

In 2017, after the USEPA declined to reconsider the requirement to cover finished water reservoirs such as Hillview, NYCDEP requested that NYSDOH and USEPA further extend the deadline to complete construction of the cover to enable NYCDEP to complete two higher priority water supply infrastructure capital improvements: construction of the Kensico Eastview Connection (KEC) tunnel and Hillview Reservoir Improvements. NYSDOH and USEPA agreed to extend the schedule for construction of the cover to 2049. A federal Consent Decree, known as the Hillview Consent Decree is now subject to approval of the federal court prior to becoming enforceable. DEP anticipates this approval to occur in the near future. The Hillview Consent Decree includes new deadlines for covering the reservoir, along with design and construction milestones for the KEC tunnel, the Hillview Reservoir Improvements and stipulated penalties to enforce such milestones. The Consent Decree also includes \$1 million civil penalty payable to the United States and a \$250,000 penalty to the State (\$50,000 in cash and \$200,000 as an environmental benefit project).

NYCDEP is planning to undertake a facility planning study, which will allow NYCDEP to analyze alternative ways to achieve LT2 compliance. NYCDEP plans to further evaluate cover alternatives before committing capital investment funding. There is no capital funding in the CIP since the cover requirements are well beyond the 10 year budget planning period. However, there is funding for the pre-cursor priority projects that are now mandated in the Hillview Consent Decree. There are several interim milestones included in the Hillview Consent Decree with the final milestone being full operation of the covered Hillview Reservoir in 2049.

The Hillview Reservoir Improvements include significant SOGR for the modification of chambers and chemical addition facilities, flow control improvements, and other upgrades. Funding is included in the CIP for \$339.5 million for this work at Hillview.

Kensico Eastview Connection (KEC) Tunnel

NYCDEP has determined that the KEC tunnel is essential to improve redundancy and increase operational flexibility by having a secondary means to convey water from the Kensico Reservoir to the CAT/DEL UV Facility. The Catskill Aqueduct has not been able to convey water between Kensico and the Cat/Del UV Facility due to hydraulic limitations. As a result, the Delaware Aqueduct has been the only means to convey water from Kensico to the UV plant. The KEC tunnel project will add another connection between these two vital components of the water supply, providing critical redundancy. This is an important high priority project for NYCDEP. Funding of \$1.3 billion is included in the CIP. The project is currently in the design phase.

The KEC tunnel will be approximately two miles in length, starting at an intake chamber on the western side of the Kensico Reservoir to a connection point at the UV Facility. DEP expects the finished tunnel to be approximately 27 feet in diameter and run 400 to 500 feet below ground. The tunnel will be large enough to carry a maximum of 2.6 billion gallons of water each day. Its design accounts for future growth in the City and Westchester County, the potential addition of treatment facilities, and the need to periodically take other aqueducts out-of-service for maintenance or inspection.

The project also includes new facilities and site work at Kensico Reservoir and the UV Facility. The intake chamber that draws water from Kensico will be upgraded and increased due to the new tunnel. The Kensico Reservoir's shoreline around that intake will also be improved to prevent sediment from entering the tunnel. The chemical feed systems at Kensico Reservoir will be upgraded to meet the needs of the Delaware Aqueduct and the new tunnel.

Dam Safety

Upstate reservoir dams are critical infrastructure for NYCDEP operations and the safety of the surrounding communities. NYCDEP has committed to go beyond the level of protection currently mandated by New York State, which requires existing dams to be capable of safely passing half of the probable maximum flood (PMF). When capital improvements are made at a dam, NYCDEP commits to providing that the dams safely pass the full PMF.

Due to significant SOGR needs to provide continued dam safety; there is \$545 million in funding for the Olive Bridge Dam at the Ashokan Reservoir and the upper/lower outlet structures. The full long-term rehabilitation upgrades for the Gilboa Dam that brought the dam into compliance with the NYSDEC dam safety guidelines have been completed. The remaining upgrades at Gilboa Dam are funded at approximately \$22 million in the CIP. The New Croton Dam requires reconstruction and is funded in the budget with \$148 million. NYCDEP expects to add funding for Delaware system dam upgrades in future planning periods.

NYCDEP has installed additional monitoring equipment at several upstate dams to enhance the monitoring capacity during and after storms. In addition to capital programs, NYCDEP maintains an

inspection and maintenance program to support dam safety. NYCDEP continues their dam inspection program using engineering contracts and in-house NYCDEP inspectors. NYCDEP operates and maintains a safe dam system for upstate and in-city dams, based upon capital upgrades, inspection and maintenance program, and emergency action plans.

Ashokan Century Program

As part of their commitment to SOGR upgrades in the watershed, in 2017 NYCDEP announced the Ashokan Century Program which will upgrade all infrastructure associated with the Ashokan Reservoir in the Catskill watershed. In addition to the upgrade to the Olive Bridge Dam discussed above, this program will include upgrades to the Ashokan Reservoir spillway, dividing weir bridge, and the Ashokan Reservoir headworks. This program was originally estimated at \$750 million. The replacement of the dividing weir bridge over Ashokan Reservoir is funded at \$ 265 million in the CIP. Additional funding will be required for the Ashokan SOGR projects in future budgets.

City Tunnel No. 3, Stage 2

Most of the tunneling work for City Tunnel No. 3, Stage 2 has been completed. There is funding of \$626 million in the CIP for the completion, activation and shaft work (Shafts 17B and 18B) for City Tunnel No. 3, Stage 2 Brooklyn/Queens leg. As of December 2017, City Tunnel No. 3 Brooklyn/Queens leg achieved activation-readiness, which means it is available in case of an emergency. Design of Shafts 17B and 18B is ongoing. There is significant ongoing coordination required with NYCDOT and other city agencies. Full operation of City Tunnel No. 3 Brooklyn/Queens leg is expected once the funded construction contracts are completed. Design is also underway for the connection of the Brooklyn/Queens leg of City Tunnel No. 3 to the Richmond Downtake Chamber, which will connect City Tunnel No. 3 to Staten Island. NYCDEP plans to conduct inspections of CT#1 and then eventually CT#2 once CT#3 is fully in service. Funding of \$22.7 million is included in the CIP for NYCDDC trunk water main connection projects for City Tunnel No. 3.

Water Main and Sewer Replacement

There is significant funding of \$3.8 billion in the CIP for water main and sewer replacement throughout the City over the next ten years. BWSO coordinates closely with NYCDDC and other city agencies for water and sewer projects. Among the several parameters NYCDEP utilizes for the selection of water main and sewer replacement, the age of pipes in the ground and coordination with other utility underground infrastructure construction projects are critical.

6.5 Capital Improvement Program Highlights for the Wastewater and Stormwater System

A number of NYCDEP projects and programs for the wastewater and stormwater system are in various stages of planning, design, and construction. Many of these significant programs are described below.

Combined Sewer Overflow (CSO) Program

The 2012 CSO Consent Order Modification incorporates a hybrid approach of green and grey infrastructure control strategies. The modified Consent Order is based upon an adaptive management approach to solving the CSO water quality issues which incorporates the Green Infrastructure (GI) Plan. The CSO Order contains milestones and schedules governing the planning, design and construction of a significant number of projects for NYCDEP's Citywide

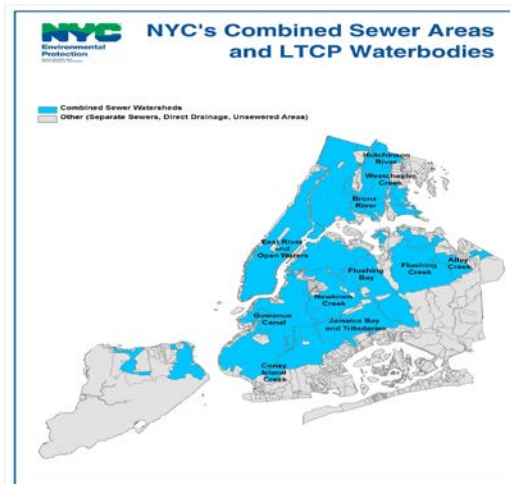


Figure 11: CSO LTCP Waterbodies

CSO Program. As required by the Order, NYCDEP has developed several waterbody-specific Long Term Control Plans (LTCPs) for NYC tributaries to reduce CSOs and improve water quality in NYC's waterbodies and waterways. The goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and the water quality goals of the federal Clean Water Act (CWA).

NYCDEP has submitted ten of the eleven LTCPs to NYSDEC. Each approved LTCP identifies recommended plans at each CSO LTCP waterbody. The following table presents the status of the LTCPs:

Table 1: Status of CSO Long Term Control Plans

Waterbody/LTCP	Status of LTCP
Alley Creek	Approved March 2017
Westchester Creek	Approved August 2017
Hutchinson River	Approved March 2017
Flushing Creek	Approved March 2017
Bronx River	Approved March 2017
Gowanus Canal	Approved March 2017
Flushing Bay	Approved March 2017
Coney Island Creek	Approved April 2018
Newtown Creek	Approved June 2018
Jamaica Bay and Tributaries	Submitted June 2018, Pending approval
Citywide/Open Waters	Revised submittal date March 2020

NYCDEP held the annual citywide public meeting for the CSO Long Term Control Plan in December 2018. This annual meeting provided an update on the entire CSO Program, provided status updates on LTCP progress and the NYC Green Infrastructure Program, discussed affordability and public participation within the CSO Program.

The recommended projects in the approved LTCPs are now enforceable requirements under the CSO Consent Order. Based upon the recommended plans and projects derived from the ten submitted CSO LTCPs, NYCDEP has estimated an additional \$5 billion in CSO projects to mitigate the impacts of CSOs. Several of these CSO projects are planned outside this ten year planning period, and therefore are not included in the CIP. Since the Citywide/ Open Waters LTCP is under development, costs are not yet known for that LTCP. The CIP includes approximately \$2.14 billion in funding for grey infrastructure capital projects for implementation of the CSO Program, which includes \$735 million for the CSO retention tank at the Gowanus Superfund site, required due to the federal EPA Superfund Program. Funding for disinfection facilities, required as part of the LTCPs at Alley Creek, Hutchinson River and Flushing Creek are included in the CIP. Additional funding will be required beyond the current budget planning period to implement infrastructure required as part of the approved LTCPs.

The LTCPs are based upon the current water quality standards for fecal coliform bacteria. Environmental groups have sued USEPA over the NY State's 2015 water quality standards. The claim is that water quality standards should be for enterococcus bacteria rather than fecal coliform. Pending the court's finding, NYCDEP may be required to revise the LTCPs based upon enterococcus bacteria rather than fecal coliform standard. If this occurs, there can be significant additional costs required to comply with the CSO 2012 Consent Order.

Green Infrastructure (GI)

Green infrastructure is an approach to wet weather management that is cost-effective, sustainable and environmentally friendly. Several cities across the country have implemented green infrastructure for wet weather management and water quality control issues. The ambitious goal of NYC's Green Infrastructure Plan, which NYCDEP released in September 2010, is to capture the first inch of rainfall on 10% of the impervious areas in combined sewer watersheds through detention or infiltration over a 20-year period. The Green Infrastructure Plan is an adaptive approach to incorporating green infrastructure into NYCDEP's overall CSO program. DEP's adaptive management strategy includes regular monitoring of green infrastructure performance, continuous evaluation of lessons learned in the field, furthering the understanding of green infrastructure co-benefits, and development of additional cost-effective tools to implement GI. NYCDEP's ongoing Research and Development Program assists in this effort.



Figure 12: Green Infrastructure Rain Garden

The implementation of the GI Program in NYC focuses on three main areas which are (1) right of way bioswales or rain gardens, (2) installation of GI on public property (3) installation of GI assets on private property through the grants program. There are approximately 4,320 total green infrastructure assets currently installed in NYC, primarily in right-of-ways (public sidewalks and streets). NYCDEP coordinates with many city agencies and partnering agencies to implement green infrastructure on city property. These partnerships include NYC Parks and Recreation, NYCDOT, NYCDDC, Economic Development Corporation (EDC), NYC Housing Authority (NYCHA), Department of Education (DOE), School Construction Authority (SCA), Trust for Public Land (TPL), other city agencies, and non-profit organizations.

NYC GREEN INFRASTRUCTURE 2017 Annual Report



**Figure 13: Green Infrastructure
Annual Report**

The NYCDEP submits an annual report updating NYSDEC on the progress of the GI Plan. The 2017 Annual Report was submitted April 30, 2018. It provides a comprehensive summary of the green infrastructure program in NYC. The concept of a "greened acre" was recently introduced to the GI Program. A "greened acre" represents a volume of runoff managed by a green infrastructure project. It is the same as an "equivalent impervious acre", which is the term referenced and used in the CSO Consent Order. The "greened acre" was derived from the Performance Metrics Report, since the "greened acre" represents the metrics and targets of green infrastructure projects in a volumetric unit. There have been 467 greened acres in NYC from 2010-2017. As of 2017, the GI Program has reduced approximately 200 million gallons of CSO volume per year. The 2017 Annual Report began presenting the green infrastructure implementation and planning updates at a watershed level to share with stakeholders. The next annual update, the Annual Report for 2018 will be submitted on April 30, 2019.

NYCDEP has developed and implemented a database, known as NYC GreenHUB for green infrastructure tracking (geographic location, cubic feet of stormwater managed, soil classification, permeability data, year constructed, and other data).

The CIP includes approximately \$1.08 billion in funding for green infrastructure projects. Components of the GI program are also funded through the expense budget, such as the Research and Development program and maintenance of the GI assets. NYCDEP continues aggressive efforts for optimizing the GI Program.

Southeast Queens Stormwater Infrastructure

NYCDEP is continuing a comprehensive program to improve drainage to address flooding issues in Southeast Queens. NYC has made a commitment of \$1.9 billion to construct infrastructure projects in Southeast Queens to buildout the drainage system and reduce flooding. In the CIP, \$1.52 billion is funded for the Southeast Queens storm sewer program. There have been 10 completed projects and another 10 that are currently under construction. An additional 25 projects are currently in the planning and design phase and will break ground in the coming years. The majority of the funding will go towards the construction of priority large trunk sewer spines that will add capacity to the sewer system and include crossings of the LIRR, Air Train, Belt Parkway, Van Wyck Expressway, and Nassau Expressway. Several smaller storm sewer projects are in the planning, design, or construction phases. These smaller local storm sewer projects will connect neighborhoods to these trunk storm sewer spines. NYCDEP is aggressively working on this storm sewer build-out program in Southeast Queens. NYCDEP provides continuous public outreach and program updates to the Southeast Queens community. The buildout of the drainage system in Southeast Queens is collaboration between NYCDEP, NYCDDC and NYCDOT. NYCDEP maintains close coordination with other city agencies. NYCDEP plans to implement projects in a phased approach on a priority basis. Green infrastructure and bluebelts are also being constructed in Southeast Queens to help manage stormwater.

A Groundwater Feasibility Study is ongoing to study the groundwater drainage project with the goal of addressing basement flooding. The study will evaluate how high the groundwater table has risen, how far it must be lowered in order to reduce the basement flooding, and the feasibility of a groundwater collection plan.

Cogeneration Facility at North River WWTP

A project for a Cogeneration Facility at North River WWTP was developed as a sustainability project to provide significant GHG emission reductions and achieve a SOGR to replace the engine-driven, main sewage pumps and engine blowers that are near the end of their useful life. The North River WWTP Cogeneration Facility is currently under construction, and completion is anticipated in 2022. Additional funding of \$25.9 million is included in the CIP. The project consists of replacing the engines driving the main sewage pumps with electric motors, and the existing engine-driven aeration blowers with new aeration blowers with electric motors. The new cogeneration facilities will provide new gas driven engines and generators which will provide electricity to drive the main sewage pumps and the nine high speed turbo aeration blowers, and heat for digester and building heating. The new engines would operate on both digester gas and natural gas. Fuel oil will no longer be used at the facility.

Hunts Point WWTP Digesters and Sludge Thickening

NYCDEP is planning a major sludge processing upgrade at the Hunts Point WWTP that will improve digestion performance, enhance biosolids quality to enable more beneficial reuse, and increase biogas production. Replacement and upgrade of the digesters at Hunts Point WWTP is funded in the CIP at a level of \$339 million in FY 2021. The upgrade to the sludge thickening equipment is an integral part of the overall sludge processing facilities and improved thickening will make the digesters

operate more efficiently. Funding for the sludge thickeners at Hunts Point is in the CIP at a level of \$29.5 million. Additional funding will be required in the next budget cycle for construction of the sludge thickener upgrades.

The sludge thickeners reduce the volume of water that passes through the digesters, which reduces the energy required for heating and provide sufficient solids retention time to result in a sludge stabilization product meeting the criteria for Class "B" Biosolids so that the full program goals are attained. It is important that the schedules of these two projects (digesters and sludge thickening) are coordinated so that both process upgrades will be operational at the same time to provide the most efficient processes.

As discussed earlier in the report, NYCDEP is evaluating potential energy projects in collaboration with SOGR needs. It is anticipated that digesters and sludge thickening at other WWTPs will be evaluated.

Citywide Nitrogen Removal Program

The Upper East River (UER) WWTPs (Hunts Point, Bowery Bay, Tallman Island, and Wards Island WWTPs) and two of the Jamaica Bay WWTPs (26th Ward and Jamaica WWTPs) have been operating in Step Feed BNR mode as required by the Nitrogen Consent Judgment for the Phase I Facility Plan and a Stipulation and Order Modifying the Nitrogen Consent Judgment.

NYCDEP, NYSDEC and Natural Resources Defense Council (NRDC) entered into a Jamaica Bay Agreement, which includes nitrogen removal upgrades at Rockaway WWTP and Coney Island WWTP, construction milestones for the Jamaica Bay WWTPs interim nitrogen effluent discharge limits for Jamaica Bay and the funding of an environmental benefits project for the saltwater marsh restoration in Jamaica Bay. Rockaway WWTP and Coney Island WWTP are currently under construction for BNR upgrades. NYCDEP is evaluating alternatives for future use and operations at the Rockaway WWTP facility. The interim nitrogen load limits for the Jamaica Bay WWTPs are currently being met. Final Jamaica Bay nitrogen limits are based upon performance based standards.

Glycerol has been selected as the supplemental carbon source for additional nitrogen removal. The supplemental carbon addition for Phase II BNR at the UER WWTPs (Hunts Point, Bowery Bay, Tallman Island and Wards Island WWTPs) and the Jamaica Bay WWTPs (Jamaica and 26th Ward WWTPs) is operational. The Consent Judgement requires reducing the combined nitrogen discharges in the WWTP effluent for the UER WWTPs by 58.5 percent by January 2017. The UER WWTPs achieved the required level of nitrogen removals in advance of the milestone. By September 2016, nitrogen discharges from the UER WWTPs had been reduced by approximately 61 percent. However, NYCDEP received a NOV from NYSDEC due to exceedance of the UER TN aggregate limits for the time period of May through August 2018. NYCDEP and NYSDEC are in discussions regarding a settlement of the NOV and NYCDEP is providing monthly compliance reports on nitrogen removal performance to NYSDEC.

There is funding of \$40 million in the budget for the conversion of the Sharon® demonstration facility at Wards Island to another nitrogen removal process, known as Anammox.

Total Residual Chlorine (TRC)

Prior to discharge to a receiving body, wastewater effluent is disinfected with chlorine at the WWTPs. Excessive residual chlorine can be toxic to aquatic life in the receiving water body. A TRC modified Consent Order between NYSDEC and NYCDEP became effective March 2018, which includes interim TRC limits, proposed final TRC limits and a compliance schedule for the TRC upgrade projects required at the WWTPs. There is \$278.5 million in the Ten Year Capital Plan for the TRC program.

Rockaway WWTP

Due to several factors including low wastewater flows and the Hurricane Sandy impacts, NYCDEP has been evaluating alternatives for future operation of the Rockaway WWTP. NYCDEP completed a Facility Plan for Rockaway WWTP in 2014, which analyzed alternatives for future Rockaway WWTP operations. The evaluation considers maintaining wastewater treatment operations at the Rockaway WWTP or diverting wastewater to 26th Ward WWTP for treatment. Significant upgrades for SOGR, BNR, and flood resiliency are required at Rockaway WWTP to maintain continuous operation. Two consolidation plans were evaluated to transfer the wastewater flows to 26th Ward WWTP across the Jamaica Bay: horizontal directional drilling (HDD) with open cut conveyance and tunneling under Jamaica Bay with tunnel boring machine (TBM). A pumping station would be required for the consolidation options. The Facility Plan underwent a Value Engineering workshop in December 2014. This project has also undergone an Envision™ triple bottom line evaluation. NYCDEP is updating the alternative analysis to determine the best solution for future Rockaway wastewater flow. Additional studies are underway that may impact this decision, such as the Rockaway infiltration/inflow (I/I) studies. There is currently approximately \$81.9 million in SOGR funding for Rockaway WWTP in the Preliminary Ten Year Capital Plan. However, after a decision has been determined for future operations, significant additional funding may be required for serving the Rockaway drainage basin.

Bluebelts

NYCDEP has been successful in developing effective Bluebelt sites in the South Shore of Staten Island since the 1990s. Bluebelts are an innovative stormwater drainage system made up of wetlands, streams and ponds. NYCDEP is evaluating expansion of the program to sites on the North Shore of Staten Island, Queens and the Bronx, where they would be effective. Approximately \$375 million is included in the CIP for land acquisition and construction to expand the Bluebelts for stormwater management. Recently, NYCDEP completed its largest expansion of the Bluebelt program in Staten Island, in the South Shore neighborhood of Woodrow. This project included new storm sewers,



Figure 14: Bluebelt Program in Staten Island

catch basins, manholes, new sanitary sewers and replacement of existing water mains. The catch basins will allow precipitation to drain from the roadways into the new storm sewers which will then direct it to the Bluebelt wetland where it will be filtered naturally to protect the environment.

6.6 Superfund Designations

NYC has been identified as a potential responsible party (PRP) for the following three Superfund sites – Gowanus Canal, Newtown Creek, and Wolff-Alport Chemical Company. This may have future potential financial impacts to NYC; however, the extent to which NYC will be responsible has not yet been fully determined for the Newtown Creek and the Wolff-Alport Chemical Company sites.

In March 2010, the Gowanus Canal was declared a Superfund site and USEPA notified NYC that they are considered a PRP for hazardous waste under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). On September 30, 2013, USEPA issued its Record of Decision (ROD) for the Gowanus Canal, establishing the dredging, capping and source control requirements. The ROD requires NYC to build two CSO retention tanks as part of the source control component due to the CSO contribution at Gowanus Canal. In May 2014, USEPA issued a Unilateral Administrative Order requiring the City to design major components of the remedy for the Gowanus Canal, including the CSO retention tanks. In June 2016, USEPA issued a memorandum stating that the size of the two CSO storage tanks should be 8-million gallons at RH-034 outfall and 4-million gallons at OH-007 outfall. Also, in June 2016, USEPA issued an Administrative Settlement Agreement directing NYCDEP to construct the Head End Facility at the recommended location and requiring that NYCDEP issue an environmental impact statement (EIS) for the Head End Facility. NYCDEP is proceeding with the siting and design of the CSO Facility at Owl's Head Outfall OH-007 in accordance with the Unilateral Order.

In parallel with the design of the two CSO tanks, this past year NYCDEP has evaluated construction of a 0.5 mile large diameter CSO storage tunnel in Gowanus. NYCDEP has identified advantages to providing storage tunnels and has begun conversations with the USEPA regarding the proposed tunnel solution, rather than building the two tanks. NYCDEP has also presented the new tunnel proposal to the Gowanus Canal Community Advisory Group (CAG). The advantages of the large diameter tunnel compared to the two tanks include – larger capacity, adaptable to expand for future additional resiliency needs, similar cost, similar schedule, and reduced construction impacts. The tunnel would have a 16 MG capacity and the tanks would have 12 MG capacity combined. USEPA is currently evaluating the new tunnel proposal. NYCDEP continues on a parallel track with both designs, meeting all milestones required in the USEPA Order for the two CSO tanks. However NYCDEP would like to minimize duplicative efforts and plans to terminate parallel design efforts as soon as USEPA provides feedback to NYCDEP. Both projects are currently estimated close to \$1.2 billion, and have similar construction schedules. Funding of \$735 million is included in the CIP for the Gowanus Canal CSO retention facility. It is anticipated that additional funding will be required in the later years of the Ten Year Capital Strategy.

In September 2010, Newtown Creek was declared a Superfund site. In July 2011, NYCDEP has entered into an Administrative Settlement Agreement and Order on Consent with EPA, along with five other PRPs that own or operate facilities adjacent to Newtown Creek in the investigation of conditions in Newtown Creek and the evaluation of feasible remedies. The Remedial Investigation/Feasibility Study (RI/FS) is ongoing. The city is responsible for a portion of the cost of the study; however, the settlement does not cover any remediation that might eventually be required by USEPA to address the contamination identified as a result of the investigation and evaluation. The ROD for the Newtown Creek Superfund has been delayed. NYCDEP is coordinating with the NYSDEC and the USEPA regarding the recommended plans for the Newtown Creek CSO LTCP along with the Newtown Creek Superfund program.

In May 2014, the USEPA listed Wolff-Alport Chemical Company in Queens as a Superfund site, based upon radioactive contamination at the site. USEPA has indicated that the Superfund process would include an investigation of impacts to the NYCDEP sewer system from operations at the chemical company site. Radioactive material was disposed on-site and also into the sewer system. In December 2017, USEPA notified NYC of its status of a PRP for the work on City property pertaining to this Superfund site. NYC plans to negotiate an agreement with the USEPA regarding sewer replacement, jet washing, and excavation of contaminated portions of City right-of-ways that are impacted by the Wolff-Alport Superfund site.

NYC operated a wastewater treatment plant in the Town of Mt. Kisco which was decommissioned in the 1960s. Elevated radiation levels have been detected throughout the site. These levels are most likely due to the operations of Canadian Radium & Uranium Corporation (CRUC) which processed radioactive materials in Mt. Kisco and most likely sent wastewater to the Mt. Kisco WWTP. Based

upon DEP's former operation of the Mt. Kisco WWTP, DEP signed an Order of Consent with NYSDEC, which commits NYCDEP to fund an environmental study of the site. After completion of the study, NYCDEP may be required to fund remedial design and remedial action at the site, along with waste disposal, which could amount to significant costs.

6.7 Potential Future Long-Term Water and Wastewater Projects Beyond Current Budget Planning

City Tunnel No. 3, Stage 4

The long-term planning for the next phase of City Tunnel No. 3 is the Stage 4 extension. Stage 4 would deliver additional water to the eastern parts of the Bronx and Queens. It would extend southeast from the northern end of Stage 1 in the Bronx to Queens and then southwest to interconnect with the Queens portion of Stage 2. City Tunnel No. 3 Stage 4 will enable The System to maintain full service even if Tunnel 1 or 2 were shut down. NYCDEP must decide on its next long-term priorities and needs, and therefore a schedule or budget for this anticipated next phase will have to be developed.

Potential Further Nitrogen Removal in NYC WWTPs

The USEPA Long Island Sound Study is evaluating further nitrogen reductions for the Long Island Sound. The results of this analysis have the potential to impact NYCDEP UER WWTPs by requiring further nitrogen removals. NYCDEP will continue to remain involved and will provide meaningful input throughout this Nitrogen Reduction Strategy.

7.0 EXPENSE BUDGET

The FY 2019 expense budget released in the Preliminary Plan is \$1.329 billion. The proposed FY 2020 expense budget in the Preliminary Plan is \$1.317 billion. Expense budget projections for FY 2020 are currently being evaluated based upon the new needs of The System and will require adjustment when the evaluation is complete. The FY 2020 expense budget is expected to increase and be updated in the Executive Budget, to be released in April 2019. The expense budget is made up of both Personal Services (PS) costs and Other than Personal Services (OTPS) costs. The personnel services budget is made up of staff salary, fringe benefits and pension costs. The OTPS makes up the remaining expense budget, including taxes, chemicals, supplies, fuel oil, gasoline, biosolids, equipment, contract services, leases, FAD, training, and others requirements/needs. There are many competing needs within the Expense budget each year; therefore, NYCDEP must continue to evaluate all requirements of the water and wastewater system when completing the expense budget. In accordance with applicable regulations and directives, NYC decides the projects (or elements of a project) that are eligible for capital funding. The remaining needs are covered in the expense budget. In addition to the day-to-day requirements to operate and maintain the NYCDEP system, the expense budget must also cover planning studies that are necessary to prioritize capital investments but the studies, themselves, are not capital eligible. Planning studies/Facility Plans are important aspects of long-term management of The System and should be carried out before any significant capital funds are committed to a specific facility.

8.0 PERFORMANCE OVERVIEW

Water Conservation

Figure 15 presents the annual water demand for the City over the last 25 years. Water conservation measures taken by NYCDEP in the 1990s have resulted in a steady reduction in the overall water demand. Water demand has decreased by approximately 35% since the 1990s. More recent declines in water consumption have been noted most likely attributed to continued conservation measures, water usage metering, availability of easily accessible data for tracking, and weather patterns. New York's per capita water demand has declined from its peak of 213 gallons a day per person in 1979 to 115 gallons a day per person in 2017. This change reflects a 46% reduction in per capita water demand.⁵

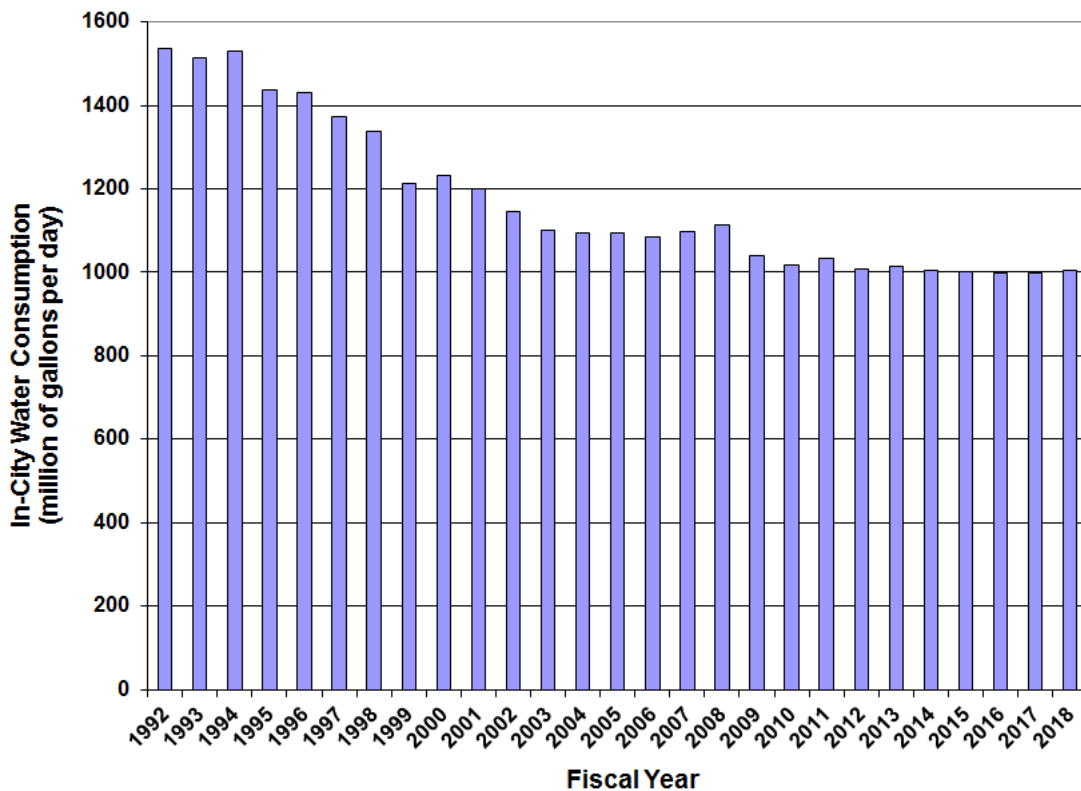


Figure 15: New York City Average Daily Water Demand in Million Gallons per Day (MGD)

System Staffing Levels

Staffing levels are approximately 92% of current allocations, a slight increase from 91% last year. Approved positions for the entire NYCDEP system are currently at 6,359 for FY 2019 and vacancies currently stand at 508. This reflects a decrease of 33 heads in budgeted approved headcount and also a decrease in vacancies compared to FY 2018, as shown in Figure 16. NYCDEP aggressively works to fill vacancies and has seen improvements in attracting highly skilled and qualified staff. NYCDEP Organizational Development is also developing and implementing succession planning and staff retention programs. A large number of NYCDEP staff is eligible to retire in the near future (1/2 the current workforce is eligible to retire in the next 10 years). Recruitment, training and succession

⁵ One Water NYC: 2018 Water Demand Management Plan, NYCDEP.

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Fiscal Year 2019 Consulting Engineer's Report

planning are essential to maintain a skilled DEP workforce. NYCDEP maintains a strong diverse workforce. A goal of the *2018 Strategic Plan* is to continue to cultivate a diverse and highly qualified workforce to meet future challenges. NYCDEP has identified strategies to help implement this goal.

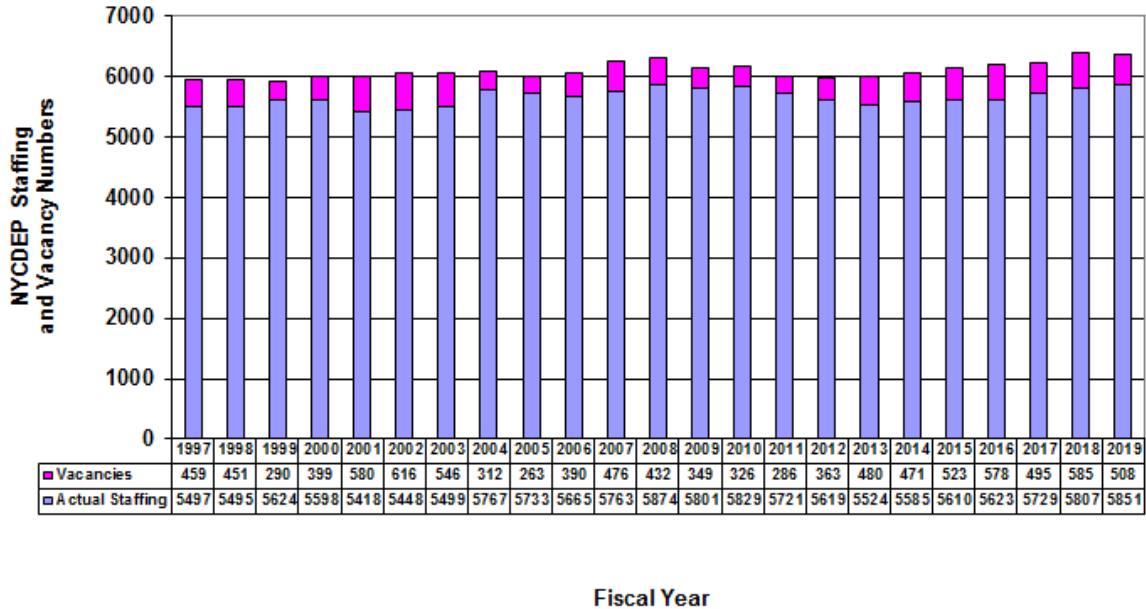


Figure 16: NYCDEP – Staffing and Vacancy Levels FY 1997-2019

NYCDEP continues evaluating current and future staffing needs and skill sets to meet both operational needs and implementation of the capital program. Additional staff will be required as the growing demands of NYCDEP operations continue. The operating bureaus are evaluating means to operate more efficiently. BWT has added an Organizational Development Director to evaluate their staffing needs. BWT is constantly trying to fill Sewage Treatment Worker (STW) positions, as it is important for knowledge transfer, mentoring programs that encourage the interaction between experienced staff and new hires. BWT is trying to implement a process which will improve flexibility to get STWs on board. BWT is aggressively trying to fill staffing vacancies. In addition, BWT will identify new staffing needs as new facilities come on-line (CSO facilities, BNR facilities). For BWS, retention of skilled staff and succession planning is challenging particularly for licensed operators of new water treatment facilities; BWS will remain focused on succession planning and retention of licensed operators. For BWSO, there will be an increase in the Green Jobs that perform maintenance of green infrastructure assets throughout the City, over the next few years as the GI Program expands and more assets require maintenance. BWSO positions have increased recently to support the expansion of the catch basin inspection program.

Another goal of the 2018 Strategic Plan is to maximize operational efficiencies across the agency. This goal will be implemented with various strategic initiatives, which includes in-sourcing (expanding in-house capabilities, where appropriate) to improve capital program delivery and operations, streamline procurement practices, and use predictive analytics to drive operational efficiencies. NYCDEP is evaluating the cost-effectiveness of in-sourcing some tasks/needs that are currently provided by contract services. If NYCDEP determines that insourcing is a viable means of achieving the same result, it is anticipated that additional staff will be identified and needed. NYCDEP will look to provide a balance of in-sourcing and contract service where appropriate.

Operational Performance Indicators

There are many operational parameters that can be reviewed to assess the effectiveness of operating programs. Several performance indicators for water and sewer operations are summarized below. However there are other parameters that impact these indicators, such as localized weather patterns.

There were 520 water main breaks reported in FY 2018, which translates to 7.3 breaks per 100 miles of main over a 12-month period. The number of water mains breaks in FY 2018 increased compared with FY 2017 (see Figure 17). However, the range of water main breaks that NYC has recently experienced remains below water main break experienced by other municipalities in the United States. NYCDEP BWSO operations continue a preventative maintenance program to target pressure reducing valves by exercising valves and inspecting regulators to help prevent the occurrence of water main breaks, costly repairs, leaks and disruption of service. The majority of water main breaks occur in the winter since the water mains are impacted by the freeze/thaw cycles in the colder temperatures. NYCDEP continued to restore water to residents within an average of 4.5 hours after confirming the water main break.

NYCDEP achieved 92.6 miles of new water main replacement this past year which is great than a 1.3% annual replacement rate.

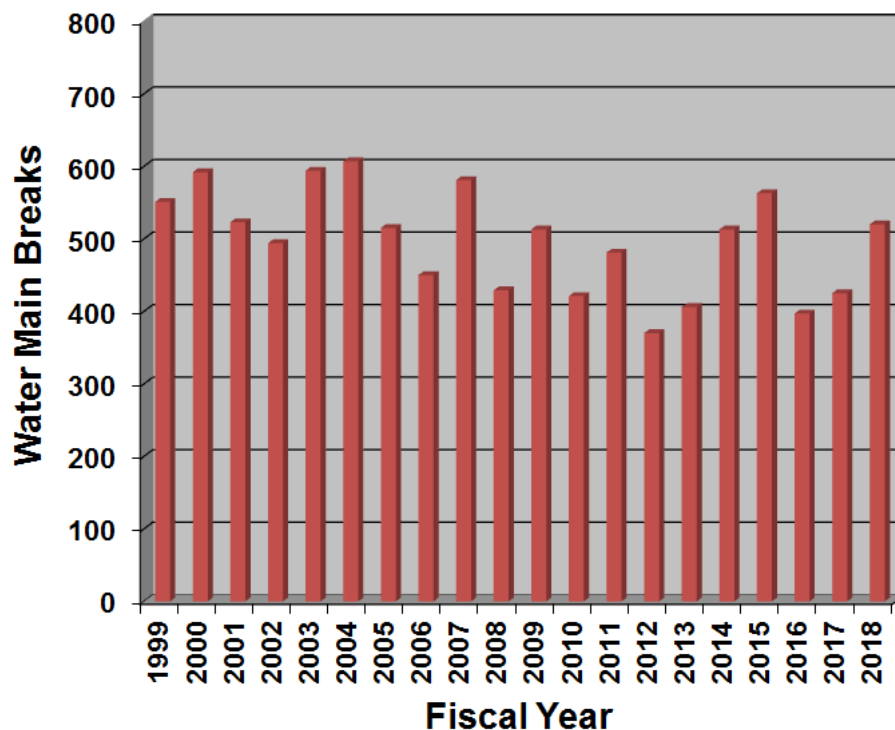


Figure 17: Total NYCDEP Water Main Breaks per Fiscal Year

Approximately 0.41% of total fire hydrants were broken and inoperative in FY 2018. The average time to repair or replace high priority broken or inoperative hydrants (as determined by the Fire Department) by NYCDEP was 2.9 days in FY 2018, which is less than the target time for repair or replacement of seven days. The number of catch basins that were surveyed and inspected in FY 2018 was 99.4% of the total (148,000 catch basins). In accordance with Local Law (LL) 48, effective FY 2017, the inspection cycle for catch basin inspection changed. This new LL requires annual catch

basin inspections for the next three years. The LL includes reporting requirements to the City Council. BWSO field crews are using tablets in the field to track catch basin cleaning data. The total number of catch basins that were cleaned by NYCDEP in FY 2018 is 38,500.

As shown in Figure 18, NYCDEP received 11,303 sewer backup (SBU) complaints in FY 2018, which is made up of 2,389 confirmed SBUs (on NYCDEP infrastructure) and 8,904 unconfirmed SBUs (not on NYCDEP infrastructure or not found). Response time for SBUs was 3.7 hours on average, which is similar to the past several years and well below the target of seven hours. NYCDEP has found that the significant majority of confirmed sewer backups can be attributed to fats, oils and grease (FOG) buildup in the sewers. NYCDEP has continued to implement and expand aggressive operational and public outreach initiatives to address the FOG problem in the sewers. NYCDEP recently initiated a new public outreach campaign to educate the public what should not be flushed down the toilet (wipes, cooking oil, and many other personal hygiene products) as they impact the operation of sewers and treatment plants. This new campaign is known as **Trash It. Don't Flush It. FatbergFree.nyc.**

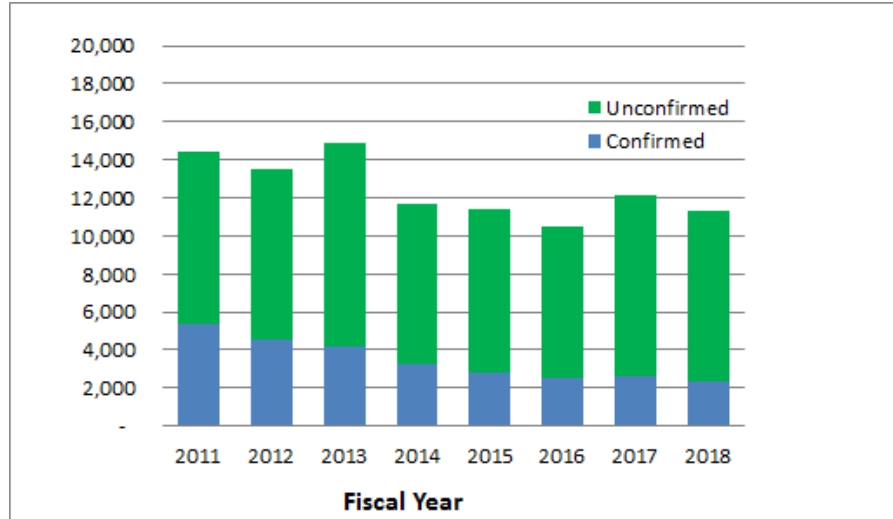


Figure 18: Sewer Backup (SBU) Complaints

NYCDEP uses a data-driven risk management approach to operate and maintain the sewer system, targeting specific locations with reoccurring problems. A group within BWSO addresses the Capacity, Management, Operations, and Maintenance (CMOM) program and related issues with specific Standard Operating Procedures (SOPs) in place. The Sewer Operations and Analysis Program (SOAP) at NYCDEP allows for a more proactive rather than reactive approach. This group analyzes areas with reoccurring problems to determine the cause of the problem and then determines a remediation plan (degreasing, cleaning, repair, replacement). BWSO's top priority remains its core work, which consists of televising of sewers, sewer cleaning, catch basin reconstruction and cleaning, hydrant repair, installation of new water mains.

NYCDEP submitted a Sewer Backup Prevention and Response Plan to the NYSDEC in May 2017. In July 2017, NYCDEP commenced a three year pilot program (July 2017 – June 2020), known as a Targeted Sewer Inspection Pilot (TSIP). The goal of the pilot is to further reduce the frequency of confirmed SBUs throughout NYC. During the pilot NYCDEP will perform two cycles of visual inspections of the sanitary sewers over the 3-year period across specific geographic areas in Brooklyn and Queens that historically have had the highest number of SBUs. BWSO plans to complete 55,000 sewer segment inspections by June 2020. Based upon the results of the SBU pilot,

additional SBU performance metrics may be identified. The increased inspections for these targeted areas reflect a proactive position rather than reactive for NYCDEP operations. BWSO issued a State of the Sewers 2018 Report, which documents several metrics on the sewer operations annually.

Operational and Maintenance Program Summary and Updates

Water Supply and Treatment Operations. NYCDEP strives to increase the reliability, flexibility and redundancy of overall water supply operations. The interconnection of the Delaware Aqueduct with the Catskill Aqueduct at Shaft #4, which allows water from the Delaware Aqueduct to be diverted to the Catskill Aqueduct has been operational since 2015. This interconnection gives operational flexibility and an additional tool in dealing with turbidity incidents following high rainfall in the Catskill watershed. The upgrades at the Croton Falls Pump Station and the Cross River Pump Station provide conveyance flexibility to NYCDEP and provide the ability for Croton water to be supplied to the Delaware Aqueduct, if required in emergencies. The connection between the Catskill Aqueduct and Croton allows blended water to be sent to the Croton WFP if necessary.

Croton Operations. The Croton WFP began sending treated drinking water to the NYC distribution network in May 2015. In November 2015, Croton demonstrated operating at full capacity, 290 MGD. The operations at the Croton WFP have varied depending upon the operational needs of the overall water supply and distribution system. Depending upon the needs of the overall water system, NYCDEP will continue to vary the operations at the Croton WFP.

UV Operations. The Cat/Del UV Facility has been in operation since October 2012. NYCDEP BWS Operations staff successfully took over 100% control of the facility on June 15, 2013. The facility is operated and maintained with approximately 52 NYCDEP BWS staff. The UV facility is the largest UV water disinfection facility in the world and consists of fifty-six 40 MGD UV disinfection units. It is currently receiving and providing UV disinfection to all Cat/Del waters and it is designed to disinfect 2.4 billion gallons per day. Currently water is transferred from the Kensico Reservoir to the Cat/Del UV Facility via the Delaware Aqueduct. The Consent Order for the Cat/Del UV Facility was terminated July 2016.

Drinking Water Quality and Quantity. NYCDEP released the *New York City 2018 Drinking Water Supply and Quality Report* in February 2019. NYCDEP conducts significant monitoring of the source water and in-city water quality. In FY 2018, NYCDEP collected 37,500 samples from the in-city distribution system and performed approximately 414,000 analyses, meeting all state and federal monitoring requirements. In addition, NYCDEP collected more than 15,700 samples and performed approximately 240,000 analyses from the upstate reservoir watersheds, and completed approximately 1.3 million robotic monitoring measurements to support FAD watershed protection programs and to optimize water quality. Microbiologists, chemists and other scientists with the BWS test water from key locations across the watershed and the City at NYCDEP laboratories. NYCDEP water quality laboratories are located in Hawthorne, Kingston, Grahamsville and Queens. As of February 28, 2019, the overall storage in NYC's water supply system stands at 95.1% of capacity, compared to the normal levels at this time of 87.2% of capacity.

NYCDEP utilizes the Operation Support Tool (OST) for various decision making and operating modes. The OST model links water quality and water quantity models, uses near real-time data for reservoir levels, stream flows entering reservoirs, snowpack and water quality in streams and reservoirs, and it includes National Weather service forecasts.

Wastewater Operations. In FY 2018, the percent of critical equipment out-of-service at wastewater treatment plants was 1.5% below the minimum, which continued to improve and remained well below the target of 5.0 percent. For first four months of FY 2019, 1.1% below the minimum of critical equipment was out-of-service at wastewater treatment plants. BWT has implemented an enhanced equipment maintenance program which is predictive based minimizing the downtime of critical equipment. This program is anticipated to save on capital replacement and energy costs.

BNR Operations at the Wastewater Treatment Plants. NYCDEP has been operating in Step Feed BNR mode at several of the NYCDEP WWTPs (Hunts Point, Bowery Bay, Tallman Island, Wards Island, 26th Ward and Jamaica WWTPs). Due to the long-term planning and significant capital projects that have been implemented, NYCDEP operations had been achieving the final total nitrogen (TN) removals established for the Upper East River. Due to the required upgrades at the plants, the UER WWTPs have seen an approximate 61% reduction in total nitrogen in the effluent. However, NYCDEP received a NOV from NYSDEC due to exceedance of the UER TN aggregate limits for the time period of May through August 2018. NYCDEP and NYSDEC are in discussions regarding a settlement of the NOV and NYCDEP is providing monthly compliance reports on nitrogen removal performance to NYSDEC. The final TN load for Jamaica Bay will be performance-based once the BNR upgrades at the remaining two Jamaica Bay WWTPs (Rockaway and Coney Island) are completed.

Harbor Water Quality. NYC has been collecting and maintaining records of water quality data for over 100 years. The New York Harbor Water Quality Survey currently consists of 89 sampling stations harbor-wide. NYCDEP has increased the number of monitoring sites throughout the harbor and at the mouth of key tributaries in order to evaluate the effectiveness of the NYCDEP stormwater management and CSO control projects. The number of water quality parameters measured has increased from five in 1909 to 27 water quality parameters at present.

The water quality in the harbor has continued to improve as a result of the maintenance and operation of the wastewater treatment plants and the combined sewer overflow programs. Figures 19 and 20 below demonstrate the improvements in water quality over the past 50 years as indicated by the increased dissolved oxygen concentrations and reduced Fecal Coliform counts. The trend graphs for the 2018 Harbor Survey data have been modified to reflect the extension of the bathing season by the NYC City Council. All trend graphs that are presented include data collected from the extended recreational bathing season, beginning of May to the end of October, rather than the beginning of June to the end of September, as previous graphs have shown. In FY 2018, 92% of the harbor survey stations met the fishable standard of 5 mg/L for dissolved oxygen.

Sludge Vessels. In FY 2014, NYCDEP commissioned three new sludge vessels, the Motor Vessel (M/V) Hunts Point, the M/V Port Richmond and the M/V Rockaway. The three new ships join the M/V North River and the M/V Red Hook sludge vessels. The sludge vessels transport liquid sludge from the six wastewater treatment plants not served by onsite dewatering facilities to those wastewater treatment plants with dewatering facilities.

Biosolids. NYCDEP typically produces 1,400 wet tons per day of biosolids from the wastewater treatment operations at the 14 WWTPs. NYCDEP is developing a Biosolids Strategic Plan to identify alternative end uses for NYCDEP biosolids. The majority of biosolids from NYCDEP WWTPs have been landfilled in recent years. However, BWT plans to increase the beneficial reuse of biosolids, starting with a beneficial reuse contract for 10% of NYC biosolids, and increasing the amount of beneficial reuse contracts going forward. Beneficial reuse of biosolids supports the OneNYC mayoral initiative of zero waste to landfills by 2030 due to the significant environmental and sustainability benefits it provides.

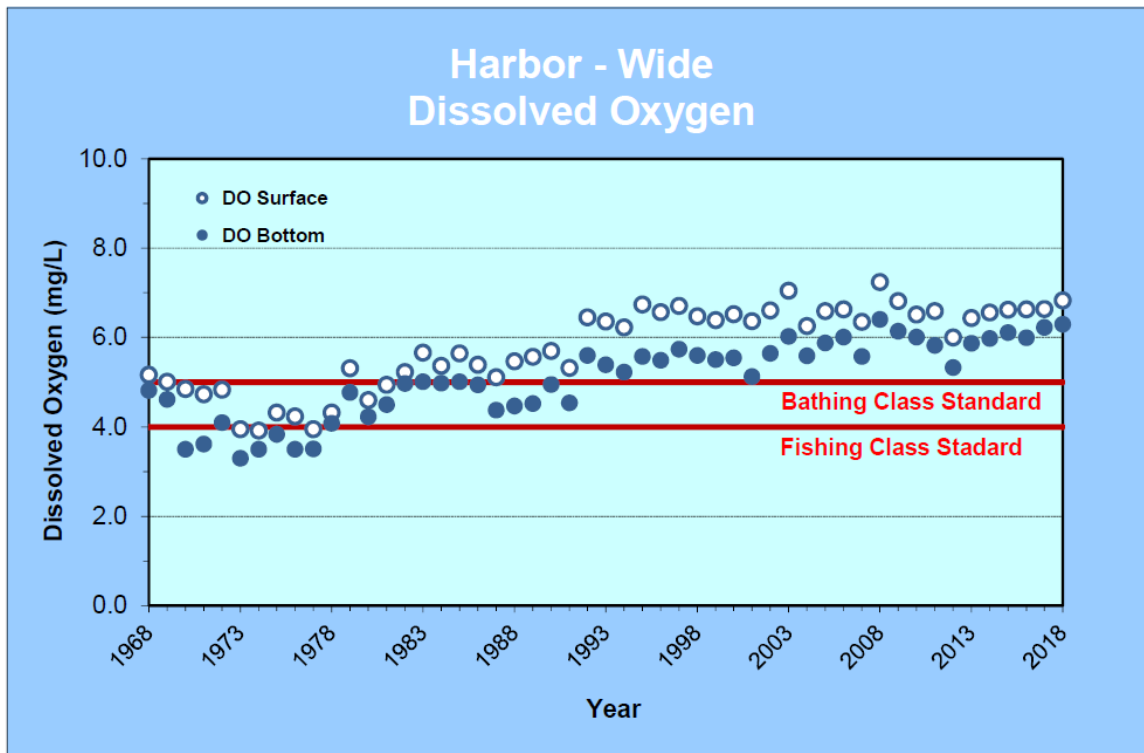


Figure 19: Dissolved Oxygen for Harbor Survey Key Stations (1968-2018)

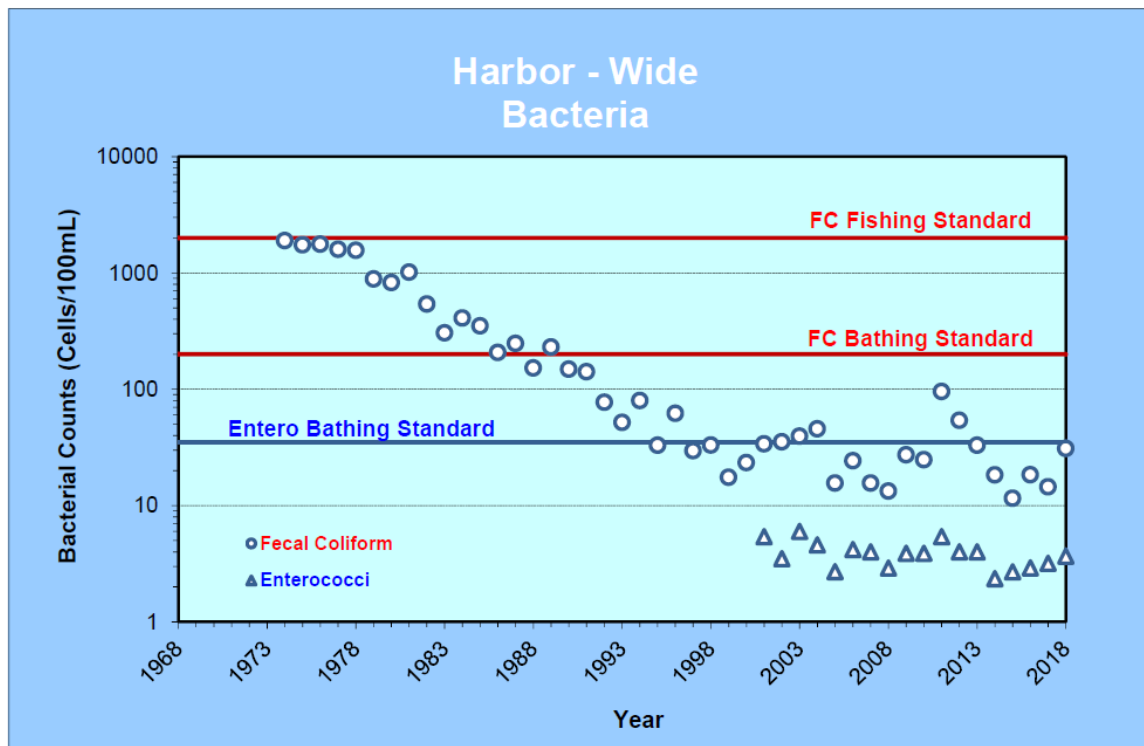


Figure 20: Fecal Coliform Counts and Enterococci for Harbor Survey Key Stations (1974-2018)

Environmental Health & Safety (EH&S). NYCDEP maintains a robust and comprehensive EH&S program across all bureaus throughout the NYCDEP. NYCDEP provides consistent EH&S training so that staff can carry out their work responsibilities safely and in compliance with the many local, state and federal regulations. The EH&S Group is responsible for a comprehensive EH&S compliance program, all EH&S training, audits, EH&S employee surveys and the NYCDEP internal compliance office. EH&S is carried out by in-house NYCDEP management and staff as well as EH&S contracts.

Permit Updates

Wastewater Treatment. NYSDEC issued final State Pollutant Discharge Elimination System (SPDES) permits for the 14 NYC WWTPs on October 15, 2015. NYCDEP has begun discussions with NYSDEC to plan for new SPDES permits since the current SPDES permits for the 14 WWTPs are expiring in 2020. NYCDEP is operating in accordance with the current SPDES permits for 14 WWTPs. Based upon diligent wastewater treatment plant operations, 99.7% of the NYCDEP wastewater treatment plant effluent met federal standards in FY 2018. For the first four months of FY 2019, 99.7% of the NYCDEP wastewater plant effluent met federal standards.

Stormwater. NYSDEC issued a final municipal separate storm sewer system (MS4) permit for NYC on August 1, 2015. A portion of New York City has separate storm and sanitary sewer systems. The storm sewers are addressed under the MS4 permit and the separate sanitary sewers send flows to the WWTPs, which operate under the SPDES permits. NYC is the permit holder since the MS4 requirements covers 14 city chartered agencies. However, NYCDEP coordinates all required activities under the permit. In October 2013, an Executive Order was signed addressing coordination and implementation of stormwater controls and MS4 permit requirements for NYCDEP and other NYC agencies. Memorandums of Understanding (MOUs) have been developed between NYCDEP and the chartered city agencies that are impacted by the MS4 permit. As required by the MS4 permit, NYC established legal authority in 2017 with the passage of Local law 97. The city has established a Stormwater Controls Working Group that includes representatives from each agency that meet quarterly to discuss stormwater program development tasks and permit-related information. The MS4 permit includes robust requirements, which significantly expand the city's obligations to reduce pollutants discharging to the storm sewers. The MS4 permit requires NYC to submit a Stormwater Management Program (SWMP) Plan within three years of the effective date of the permit. The SWMP was submitted August 1, 2018. Key components of the SWMP include public education and outreach, mapping, illicit discharge detection and elimination (IDDE), construction site stormwater runoff control, post-construction stormwater management, pollution prevention and good housekeeping for municipal operations, industrial stormwater sources, control of floatables and settleable debris, monitoring and assessment of controls, and impaired waters. The MS4 includes annual reporting requirements. Among other requirements, NYC submitted a fiscal analysis of the capital, operating and maintenance costs necessary to meet the requirements of the permit August 1, 2018.

As part of NYCDEP's public outreach and education, in June 2017 NYCDEP announced the launch of *Don't Trash Our Waters*, a public awareness campaign aimed at reducing litter and improving the health of New York City's waterbodies.

9.0 OTHER NOTEWORTHY ISSUES AND COMMENTS

Lead

NYCDEP has been in compliance with the current Lead and Copper Rule. NYCDEP has an active corrosion control program in place in order to reduce lead absorption from service lines and internal plumbing. NYCDEP treats the water with food grade phosphoric acid and sodium hydroxide. Sodium hydroxide is added to raise the pH and reduce corrosivity, which prevents the leaching of lead from pipes into the drinking water. Phosphoric acid is added to create a protective film on pipes that reduces the release of metals, such as lead, from household plumbing. Under the federal Lead and Copper Rule, mandated at-the-tap lead monitoring is conducted at select households throughout New York City. In 2018, based on the results of this monitoring, the 90th percentile did not exceed 15 µg/L, the established standard or Action Level for lead. The at-the-tap monitoring results are presented in the annual New York City Drinking Water Supply and Quality Report.

The USEPA is considering Long-Term Revisions to the Lead and Copper Rule to improve public health protection by making practical changes and to streamline the rule requirements. NYCDEP has been engaged with the National Drinking Water Advisory Council (NDWAC) Lead and Copper Rule Working Group. NYCDEP will expand its current lead research program.

In January 2019, Mayor deBlasio released a plan called LeadFreeNYC, a comprehensive roadmap to eliminating lead exposure in NYC children, which includes many ways to eradicate lead exposure.

A NYS Health Department grant of \$5.3 million will be used for NYCDEP to pilot a program to replace lead service lines for low-income single family homeowners. As part of this program, NYCDEP has also posted a map of NYC with potential lead service lines on the LeadFreeNYC website.

NYC residents can request a free lead kit to test their water. NYCDEP's Water Quality Lead Unit has made improvements to the free lead testing program by revising the sampling and mailing instructions to better explain the procedures. NYCDEP plans to start a marketing campaign to inform more New Yorkers that NYC offers free water testing kits for any resident that requests one.

Awards

NYCDEP capital program, operations and customer service have been recognized throughout the industry by professional and trade organizations. This past year the American Council of Engineering Companies (ACEC) New York awarded 2019 Engineering Excellence Awards to the Jamaica Bay CSO Long Term Control Plan (Diamond Award) and to the Green Infrastructure for Newtown Creek DEP CSO Tributary Area (Platinum Award).

NACWA awarded the 2017 Peak Performance Gold Award to Coney Island WWTP, Hunts Point WWTP, Oakwood Beach WWTP, Red Hook WWTP, Rockaway WWTP, and Tallman Island WWTP. NACWA awarded the 2017 Peak Performance Silver Award to 26th Ward WWTP, Bowery Bay WWTP, Jamaica WWTP, Newtown Creek WWTP, and Wards Island WWTP. NACWA's Peak Performance Awards recognize Member Agency facilities for excellence in wastewater treatment as measured by permit compliance.

10.0 SUMMARY AND CONCLUSIONS

Considering the magnitude of the overall infrastructure and the level of operational service required, it is our opinion that:

- The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users within the available funding.
- The physical condition of The System receives an adequate rating. However due to the size and complexity of The System, NYCDEP requires future capital investments for the continuous replacement and/or repair of aging infrastructure in a systematic and cost-effective manner.
- NYCDEP capital and expense budget projections for FY 2019 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 31% of the capital budget for FY 2019.
- NYCDEP capital budget projections for FY 2020 satisfy the immediate needs for The System including legally mandated projects, which comprise approximately 27% of the capital budget for FY 2020. Expense budget projections for FY 2020 are currently being evaluated based upon the projected new needs of The System and may require adjustment when the evaluation is complete.
- NYCDEP capital planning is an ongoing iterative process addressing priorities and needs of The System. The NYCDEP is responsive to the long-term requirements of the service area.
- Staffing levels are approximately 92% of current allocations. NYCDEP has identified additional needs and skill sets to meet more complex facility operation requirements and managing the capital program. NYCDEP is also evaluating their future needs focusing on succession planning, transfer of knowledge and staff retention in anticipation of departure of experienced NYCDEP employees that are eligible for retirement in the near future.

Regarding System Management

In our opinion, The System continues to be managed in a professional and prudent manner with an appropriate regard for the level of service afforded to the users. The physical condition of The System receives an adequate rating, our highest rating. In our opinion, the NYCDEP facilities and infrastructure are in adequate condition. NYCDEP faces similar issues to many other large urban areas nationwide, such as aging infrastructure, strict regulatory requirements and ongoing climate change resiliency concerns. NYCDEP continues to successfully manage the overall operations of the NYC large and complex water and wastewater system, and prioritize the most important projects and programs. An Asset Management program is being used by NYCDEP that better identifies the needs and costs for infrastructure upgrades. Capital funding will need to be allocated to address the state of good repair of aging infrastructure in order to avoid critical failure of essential processes. These needs will have to continue to be addressed and implemented in a systematic way. NYCDEP is taking a proactive approach prioritizing its needs and spending money (capital investment and operating expenses) where it will have the greatest impact to the water and wastewater system operations, reliability and redundancy, and to the water quality in the upstate watershed and the surrounding NYC waterways. NYCDEP has started to move from the planning stage to implementation phase of climate change adaptation based upon sound cost-effective analysis and this process will need to continue. Prioritization of greatest need is a significant factor in moving forward with implementation of climate change resiliency. NYCDEP must remain diligent to make sure operational needs continue to be met while capital programs are identified and implemented in a

timely manner. Because of the vast and extensive nature of the NYCDEP facilities and its aging infrastructure, continued diligence and future capital improvements will continue to be required in the near term and long term.

Regarding the Capital Improvement Program (CIP)

Projects/Programs that will require additional funding in future budgets include:

- *SOGR*: As indicated throughout the report, significant additional funding in future budgets will be required for the continuation of SOGR projects due to the aging infrastructure throughout the wastewater and water system. Specifically, additional funds have been identified for the Hunts Point sludge thickening projects.
- *Climate Change Resiliency, Energy/ GHG Reduction, and Sustainability Projects*: NYCDEP is seeking supplemental funding mechanisms for climate change resiliency and energy/ GHG reduction projects. There might be a need in the future for additional NYCDEP funding to pursue these projects. This might result in an incremental cost added to some state of good repair projects or entirely new projects. Additional funding needs may be identified in the next budgeting cycle.
- *Combined Sewer Overflow (CSO) Program*: NYCDEP has submitted ten Long Term Control Plans (LTCPs) and is required to submit one remaining LTCP. Additional funding will continue to be required for implementation of the CSO projects that have been identified in the LTCPs in the future budget cycles beyond the ten year horizon.
- *Hillview Cover*: Based upon the schedule in the Hillview Consent Decree, significant funding will need to be added to future capital plans.
- *Superfund Sites*: Additional funding will be required for Gowanus Canal Superfund Facility. Once studies have been completed, funding will be required for other Superfund sites.

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11.0 LIST OF ACRONYMS

ACE	Accelerated Conservation and Efficiency
ACCO	Agency Chief Contracting Officer
ADG	Anaerobic Digester Gas
AUV	automated underwater vehicle
BEC	Bureau of Environmental Compliance
BEDC	Bureau of Engineering, Design, and Construction
BEPA	Bureau of Environmental Planning and Analysis
BGD	Billion Gallons per Day
BNR	Biological Nitrogen Removal
BWS	Bureau of Water Supply
BWSO	Bureau of Water and Sewer Operations
BWT	Bureau of Wastewater Treatment
CAG	Community Advisory Group
Cat/Del	Catskill/Delaware
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIP	Capital Improvement Program
CM	construction management
CMOM	Capacity, Management, Operations and Maintenance
CRUC	Canadian Radium & Uranium Corporation
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CY	calendar year
DAF	Dissolved Air Flotation
DCAS	Department of Citywide Administrative Services
DOE	Department of Education
ECM	Energy Conservation Measure
EDC	Economic Development Corporation
EIS	Environmental Impact Statement
ESCR	Eastside Coastal Resiliency
ePMIS	Enterprise Project Management Information System
EH&S	Environmental Health & Safety
ExCEL	Expenses for Conservation and Efficiency Leadership
FAD	Filtration Avoidance Determination
FEIS	Final Environmental Impact Statement
FEMA	Flood Emergency Management Agency
FERC	Federal Energy Regulatory Commissioner
FOG	fats, oils and grease
FY	Fiscal Year
GBT	gravity belt thickeners
GHG	Greenhouse Gas
GI	Green Infrastructure
HDD	Horizontal Directional Drilling
IDDE	illicit discharge detection and elimination

THE NEW YORK CITY MUNICIPAL WATER FINANCE AUTHORITY
Fiscal Year 2019 Consulting Engineer's Report

ISI	Institute for Sustainable Infrastructure
GBT	gravity belt thickeners
KEC	Kensico Eastview Connection Tunnel
KPI	Key Performance Indicator
LIRR	Long Island Railroad
LL	Local Law
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
LTCPs	Long Term Control Plans
mg/L	milligrams per liter
MGD	Million Gallons per Day
MOU	Memorandums of Understanding
MS4	Municipal Separate Storm Sewer System
MW	megawatt
M/V	Motor Vessel
NACWA	National Association of Clean Water Agencies
NASEM	National Academies of Sciences, Engineering and Medicine
NDWAC	National Drinking Water Advisory Council
NOV	Notice of Violation
NYC	New York City
NYCDDC	New York City Department of Design and Construction
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NPCC	New York City Panel on Climate Change
NRDC	Natural Resources Defense Council
NYCDOT	New York City Department of Transportation
NYCHA	NYC Housing Authority
NYSDOH	New York State Department of Health
NYSERDA	New York State Energy Research and Development Authority
OACE	Office of the Agency Chief Engineer
OTPS	Other than Personal Services
OST	Operation Support Tool
PMF	probable maximum flood
PRP	Potential Responsible Party
PS	Personal Services
PV	Photovoltaic
ROD	Record of Decision
ROV	remote operated vehicle
ROW	Right of Way
RWB	Rondout-West Branch
SBU	Sewer Backup
SCA	School Construction Authority
SCADA	Supervisory Control and Data Acquisition
SIRR	Special Initiative for Rebuilding and Resiliency
SOAP	Sewer Operations and Analysis Program

SOGR	State of Good Repair
SOPs	Standard Operating Procedures
SPDES	State Pollutant Discharge Elimination System
SMLP	Storm Mitigation Loan Program
SWMP	Stormwater Management Program
TBM	tunnel boring machine
TMDL	Total Maximum Discharge Limit
tpd	tons per day
TPL	Trust for Public Land
TRC	Total Residual Chlorine
TSIP	Targeted Sewer Inspection Pilot
UER	Upper East River
µg/L	micrograms/L
ULURP	Uniform Land Use Review Procedure
USDOJ	United States Department of Justice
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
WM	Waste Management
WFF	Water for Future
WFP	Water Filtration Plant
WRRF	Wastewater Resource Recovery Facility
WUCA	Water Utility Climate Alliance
WWTP	Wastewater Treatment Plant

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AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately \$18.2 billion during fiscal year 2017. See how we deliver what others can only imagine at aecom.com and [@AECOM](https://www.instagram.com/AECOM).

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