New York City's Wastewater Treatment System

Cleaning the Water We Use • Protecting the Environment We Live In

New York City Department of Environmental Protection

Michael R. Bloomberg, Mayor

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List of Acronyms

NYCDEP . . . . . New York City Department of Environmental Protection
NYSDEC . . . . . New York State Department of Environmental Conservation
NYCDOS . . . . . New York City Department of Sanitation
USEPA . . . . . United States Environmental Protection Agency
NYPA . . . . . New York Power Authority
NYCSWCD . . . . . New York City Soil and Water Conservation District
ALS . . . . . American Littoral Society
WPCP . . . . . Water Pollution Control Plant
NYOFCo . . . . . New York Organic Fertilizer Company
IPP . . . . . Industrial Pretreatment Program
PERC . . . . . Perchloroethylene
CSO . . . . . Combined Sewer Overflow
EBPP . . . . . Enhanced Beach Protection Program
MGD . . . . . Million Gallons per Day
CWA . . . . . Clean Water Act
PCB . . . . . Polychlorinated Biphenols
PAHs . . . . . Poly-Aromatic Hydrocarbons
BOD . . . . . Biochemical Oxygen Demand
TSS . . . . . Total Suspended Solids
DO . . . . . Dissolved Oxygen
BNR . . . . . Biological Nutrient Removal

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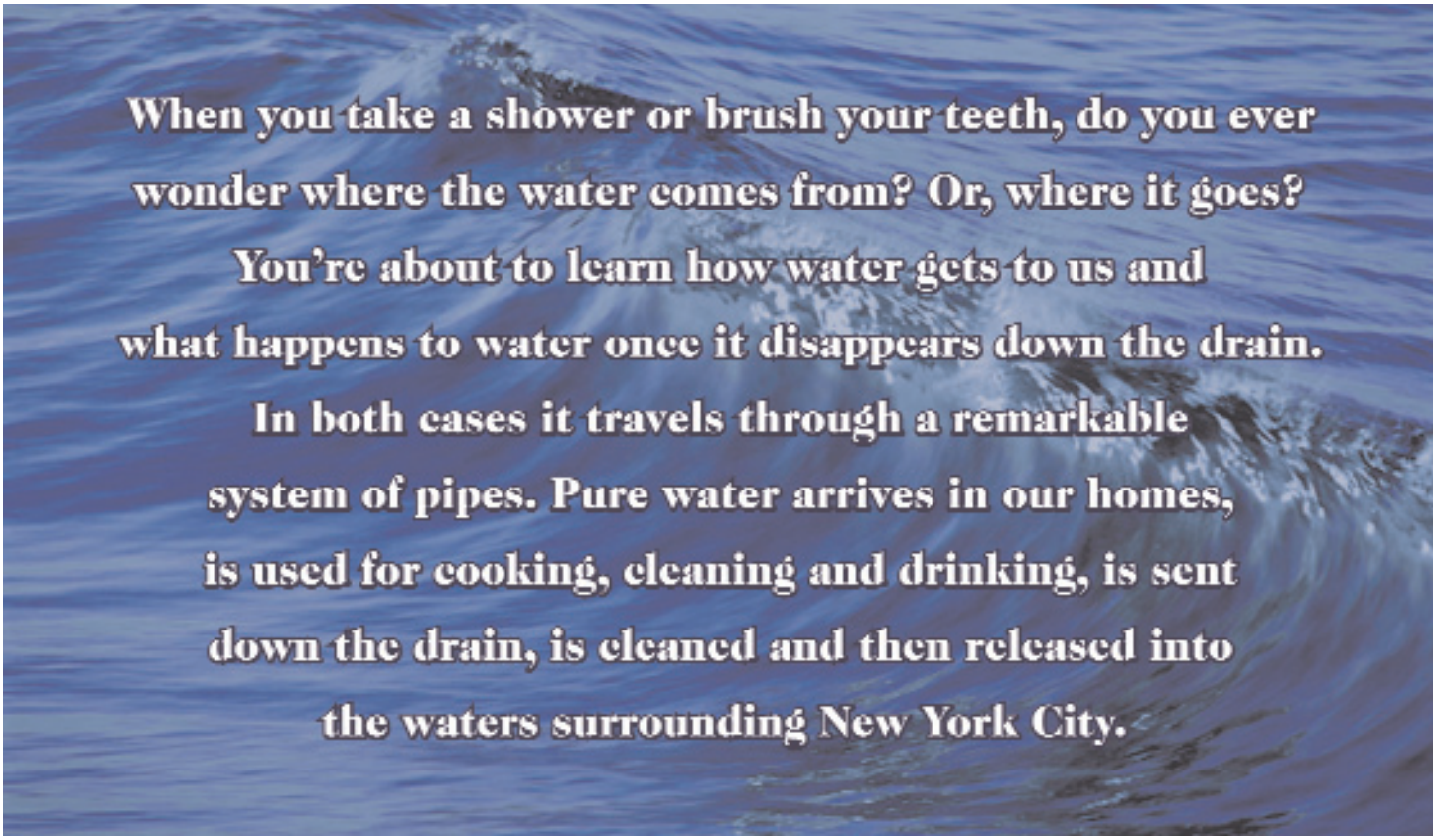


History of New York City Water

Where does New York City's water come from?

Each day New York City delivers about 1.3 billion gallons of safe drinking water to over 8 million City residents and another 1 million consumers who live in Westchester, Putnam, Ulster and Orange Counties north of the City. The source of New York City's drinking water is supplied by a network of 19 reservoirs and three controlled lakes in a 1,972 square-mile watershed that extends 125 miles north and west of New York City.

Between the water supply and wastewater treatment systems are millions of New Yorkers and visitors to the City and an elaborate network of sewers and water mains. Each person can help these systems run better by conserving water, disposing of garbage and household chemicals properly and being concerned about water quality in the City's surrounding waters.

Where does used water go?

Used water goes into New York City's extensive wastewater treatment system. This amazing network system that cleans our wastewater consists of: over 6,000 miles of sewer pipes; 135,000 sewer catch basins; over 494 permitted outfalls for the discharge of combined sewer overflows (CSOs) and stormwater; 93 wastewater pumping stations that transport it to 14 wastewater treatment plants located throughout the five boroughs.

The New York City Department of Environmental Protection (DEP), Bureau of Wastewater Treatment (BWT) is responsible for the operation and maintenance of all facilities related to the treatment of sewage. The Bureau of Wastewater Treatment has 1,900 employees, an annual operating budget of $262 million, and an annual capital budget of $114 million. With these resources, the 1.4 billion gallons of wastewater discharged by eight million residents and workers in New York City each and every day is processed at the treatment plants. After the treatment process is completed, the plants release high-quality, treated wastewater, called effluent, into the waterways surrounding New York City.

Ashokan Reservoir

Wastewater Treatment Past and Present

Before the City's first upstate reservoir system was developed in 1842, New Yorkers depended on well water – and enterprising street vendors – for their drinking water.

The Dutch, who first settled on the lower tip of Manhattan, got their water from ponds, streams and shallow wells. As the population multiplied, the demand for fresh water grew. With no system for disposing of sewage and garbage, human and animal waste polluted the water supply, causing frequent epidemics of contagious waterborne diseases, such as yellow fever and cholera. It soon became abundantly clear that something had to be done to rid NYC streets of human and animal waste and trash.

Wastewater treatment began in New York City in the late 1890s and early 1900s at two locations in Brooklyn and one in Queens. These became the 26th Ward, the Coney Island Water Pollution Control plants (WPCP) in Brooklyn and the Jamaica WPCP in Queens. Because of the tremendous use of the City public beaches, these three areas were considered a high priority. Wastewater treatment consisted of chemical coagulation for settling as well as seasonal disinfection with chlorine. The impetus was to keep the beaches clean and to protect the health of beach goers rather than maintaining water quality. As the population grew to 3.5 million, these plants became overburdened. When the link was made between waterborne bacteria and diseases in humans, it was recognized that a master plan was needed to study and protect the surrounding waterways. As a result, in 1904, the Metropolitan Sewerage commission was created. The commission undertook harbor surveys and water quality analysis. It performed studies of the tides, studied the harbor's natural flushing action, and developed a City Master Plan for wastewater treatment plants. The plan included construction of treatment plants to meet the needs of the growing population and identify the optimum locations for future sites.

Between 1935 and 1945 three new plants were constructed – Wards Island in Manhattan and Bowery Bay and Tallman Island in Queens. The Wards Island plant was built to handle flows from the east side of Manhattan and the lower part of the Bronx. This plant, which came on line in 1936, was the first to use the conventional activated sludge concept to treat sewage. Bowery Bay and Tallman Island also used activated

sludge. As the population approached 7.5 million, the Coney Island, 26th Ward and Jamaica plants were upgraded. These six plants brought the citywide capacity for treatment to 497 million gallons per day (mgd). Between 1945 and 1965, five new plants were built to meet the needs of the continually expanding population, which was now nearing eight million. These were Hunts Point in the Bronx, Oakwood Beach and Port Richmond in Staten Island, and the Rockaway and Owls Head plants in Brooklyn. During this period, the older Bowery Bay, Coney Island and Tallman Island plants underwent upgrades. These upgrades included the newly invented step-aeration process where primary effluent is added incrementally into the aeration tanks thereby reducing the detention times and allowing for a more flexible and accommodating process. With the addition of these five, there were eleven sewage treatment plants in the City and the citywide capacity for sewage treatment increased from 497mgd to 1,037mgd.

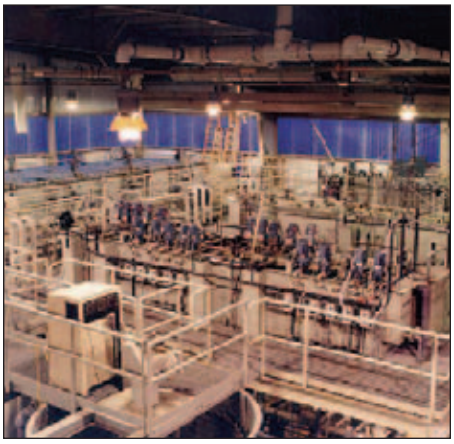
Between 1965 and 1979, the Newtown Creek wastewater treatment plant was built in Brooklyn. It was designed to treat 310mgd and was built on a relatively small footprint of 30 acres. Its design lacked primary tanks and, as a result, wastewater traveled from the grit chamber to the aeration tanks to the final tanks without intermediate channels, thereby conserving space and minimizing pumping requirements. The Spring Creek auxiliary plant was also built. (A pilot combined sewer overflow (CSO) facility, connected to the 26th Ward plant consisting of a 10 million gallon holding tank for storm water.)

By 1968, 12 wastewater treatment plants were operating in the area of New York City. They treated over one billion gallons a day and removed an average of 65 percent of pollutants from New York City wastewater. In 1972, the federal government passed the Clean Water Act (CWA). It dictated minimum standards for wastewater treatment plants throughout the country. That meant that plants had to be upgraded to secondary treatment, which removed up to 85 percent of pollutants. The CWA made people realize the importance of protecting the environment. Upgrades were performed at eight plants, bringing the citywide capacity to 1,390mgd. By 1979, nine of the city's plants had been upgraded to secondary treatment.

Between 1979 and 1995, the Coney Island and Owls Head plants were upgraded to full secondary treatment. Also during this time, two more treatment plants were completed, the Red Hook plant in Brooklyn and the North River plant, which was positioned on a platform in the Hudson River to treat flows from the west side of Manhattan. This brought the total number of wastewater treatment plants to 14. With their completion, virtually all raw sewage generated in New York City was being captured and treated. Today, the City's wastewater treatment plants have the capacity to treat dry weather flows of 1,805 millions gallons daily.

Nitrogen Control Applied Research Program

Applied Research Facilities


Interior of Applied Research Facilities


View of Centrate Tank at 26th Ward WPCP

Wastewater Treatment Process

Every day, wastewater goes down toilets and drains in homes, schools, businesses and factories and then flows into New York City's sewer system. Runoff from rain and melting snow, street and sidewalk washing, and other outdoor activities flows into catchbasins in the streets and from there into the sewers. In some New York City neighborhoods, runoff from the streets is carried by separate storm sewers directly to local streams, rivers and bays. In most areas of the City, sanitary and industrial wastewater, rainwater and street runoff are collected in the same sewers and then conveyed together to the City's treatment plants. This is known as a combined sewer system. Sometimes, during heavy rains or snow, combined sewers fill to capacity and are unable to carry the combined sanitary and storm sewage to the plants. When this occurs the mix of excess storm water and untreated sewage flows directly into the City's waterways. This is called combined sewer overflow (CSO). Approximately 70 percent of the City sewers are combined.

Wastewater treatment plants, also called sewage treatment plants or water pollution control plants, remove most pollutants from wastewater before it is released to local waterways. At the plants, physical and biological processes closely duplicate how wetlands, rivers, streams and lakes naturally purify water. Treatment at these plants is quick, taking only about seven hours to remove most of the pollutants from the wastewater. In the natural environment this process could take many weeks and nature alone cannot handle the volume of wastewater that New York City produces.

At the City's wastewater treatment plants, wastewater undergoes five major processes: preliminary treatment, primary treatment, secondary treatment, disinfection and finally, sludge treatment. Primary and secondary treatments remove about 85% to 95% of pollutants from the wastewater before the treated wastewater is disinfected and discharged into local waterways. Sludge, the by-product of the treatment process, is digested for stabilization and is then dewatered for easier handling. The resulting material, known as biosolids, is then applied to land to improve vegetation or processed further as compost or fertilizer. (See illustration – "Diagram of Treatment Process" on page 16-17.)

Preliminary treatment

Several stories underground, wastewater flows into the plants from sewers connected to New York City's homes and businesses. The incoming wastewater, called influent, passes through screens consisting of upright bars, spaced one to three inches apart. These bars remove large pieces of trash including rags, sticks, newspaper, soft drink cans, bottles, plastic cups and other similar items. This protects the main sewage pumps and other equipment. The garbage is transported to landfills. The main sewage pumps then lift the wastewater from the screening chamber to the surface level of the plant.

Primary treatment

Next, the wastewater enters primary settling tanks, also called sedimentation tanks, for one to two hours. The flow of the water is slowed, allowing heavier solids to settle to the bottom of the tank and the lighter materials to float. At the end of the process, the floatable trash, such as grease and small plastic material, rises and is skimmed from the top of the tanks surface.

Heavy solids – everything that has sunk – is then scraped off the bottom.

The settled solids, called primary sludge, are then pumped through cyclone degritters – devices that use centrifugal force to separate out sand, grit (such as coffee grinds) and gravel. This grit is removed, washed and taken to landfills.

The degritted primary sludge is pumped to the plant's sludge handling facilities for further processing. The partially treated wastewater from the primary setting tanks then flows to the secondary treatment system.

Secondary treatment

Secondary treatment is called the activated sludge process. This is because air and "seed" sludge from the plant treatment process are added to the wastewater to break it down further. Air pumped into large aeration tanks mixes the wastewater and sludge that stimulates the growth of oxygen-using bacteria and other tiny organisms that are naturally present in the sewage. These beneficial microorganisms consume most of the remaining organic materials that are polluting the water and this produces heavier particles that will settle later in the treatment process. Wastewater passes through these bubbling tanks in three to six hours.

The aerated wastewater then flows to the final settling tanks which are similar to the primary settling tanks. Here the heavy particles and other solids settle to the bottom as secondary sludge. Some of this sludge is re-circulated back to the aeration tanks as "seed" to stimulate the activated sludge process. The returned sludge contains millions of microorganisms that help maintain the right mix of bacteria and air in the tank and contribute to the removal of as many pollutants as possible.

The remaining secondary sludge is removed from the settling tanks and added to the primary sludge for further processing in the sludge handling facilities. Wastewater passes through the settling tanks in two to three hours and then flows to a disinfection tank.

Disinfection

Even after primary and secondary treatment, disease-causing organisms may remain in the treated wastewater. To disinfect and kill harmful organisms, the wastewater spends a minimum of 15-20 minutes in chlorine-contact tanks mixing with sodium hypochlorite, the same chemical found in common household bleach. The treated wastewater, or effluent, is then released into local waterways. Disinfection is an essential step because it protects the health of people who use local beaches and enjoy other recreational activities on or near the water.

Sludge treatment

The following are typical stages of the sludge treatment process.

Thickening

The sludge produced by primary and secondary treatment is approximately 99% water and must be concentrated to enable its further processing. Thickening tanks allow the sludge to collect, settle and separate from the water for up to 24 hours. The water is then sent back to the head of the plant or to the aeration tanks for additional treatment.

Thickening tanks allow the sludge produced by primary and secondary treatments to settle and thicken (an important step which aids the sludge digestion process).

Digestion

After thickening, the sludge is further treated to make it safer for the environment. The sludge is placed in oxygen-free tanks, called digesters, and heated to at least 95 degrees Fahrenheit for between 15 to 20 days. This stimulates the growth of anaerobic bacteria, which consume organic material in the sludge. Unlike the bacteria in the aeration tanks, these bacteria thrive in an oxygen-free or "anaerobic" environment. The digestion process stabilizes the thickened sludge by converting much of the material into water, carbon dioxide and methane gas. The black sludge that remains after digestion has the consistency of pea soup and has little odor. This is called digested sludge.

Methane gas is often used as an energy source at the City's wastewater treatment plants. The gas may be used in engines to produce electricity or directly drive plant equipment. Gas is also used in boilers to provide heat for digestion and plant-wide buildings. Currently, DEP and the New York Power Authority (NYPA) have jointly installed fuel cells at four of the City's water pollution control plants; 26th Ward, Red Hook, Oakwood Beach and Hunts Point. Fuel cells convert the methane gas and carbon dioxide into heat and electricity that is then used to operate the plants. This technology contributes to New York City's efforts to enhance clean air operations at its facilities. There is a significant reduction in air emissions as a result of using fuel cells.

Digester sludge is stored temporarily in a sludge storage tank prior to dewatering and while awaiting shipment to a plant with a dewatering facility

Digester sludge is pumped from sludge storage tanks to a dewatering facility. At some treatment plants, where there are no dewatering facilities on site, the sludge is transported for processing through a pipeline or by a sludge boat to a plant that has a dewatering facility. (See pictures of sludge vessels on page 25.)

Sludge dewatering

Dewatering reduces the liquid volume of sludge by about 90%. New York City operates dewatering facilities at eight of its 14 treatment plants. At these facilities, digested sludge is sent through large centrifuges that operate like the spin cycle of a washing machine. The force from the very fast spinning of the centrifuges separates most of the water from the solids in the sludge, creating a substance knows as biosolids. The water drawn from the spinning process is then returned to the head of the plant for reprocessing. Adding a substance called organic polymer improves the consistency of the "cake", resulting in a firmer, more manageable product. The biosolids cake is approximately 25 to 27percent solid material.

Beneficial Use of Biosolids

Since 1938, sewage sludge had been treated as a waste byproduct and removed from New York City treatment plants by barge and disposed of at sea. In 1988, Congress passed the Ocean Dumping Ban Act, forbidding ocean disposal of sewage sludge by June 30, 1992. DEP devised a three-pronged approach – an immediate, an interim, and a long-term program – to administer the 1,200 wet tons of sludge produced each day. The immediate program resulted in a final design of eight dewatering facilities with construction to begin in March 1991. By December 1991 the first facility went on line. The other seven were finished and became operational by June 1992 at a cost of$670 million. Today, the remaining six plants not served by onsite dewatering facilities transport their sludge for dewatering either through force mains or sludge vessels.

For the interim program, three contractors were hired through five-year contracts at a cost of $100 million per year to provide land-based biosolids management. The contractors were responsible for the processing, production and shipment of biosolids as high-quality soil amendments and the application thereof. The long-term program currently costs $50 million annually, and includes three 15-year contracts that were let for the city's entire biosolids production through June 2013. After dewatering, the sludge, now known as biosolids, is 100 percent beneficially used as a valuable resource because of its high nutrient and organic contents. Biosolids and biosolids products are used as fertilizers or soil conditioners which are spread on parkland, farmland, lawns, golf courses and cemeteries. Biosolids can also be used to cover inactive landfills or as a daily cover for active ones.

How Biosolids Are Used

Land application of Class 'B' biosolids to Texas rangeland.

Florida citrus grove where pellets have been applied.

Biosolids applied to corn crops in Virginia.

Fertilizer pellets used by New York City Department of Transportation to beautify highways.

Heat dried pellets are over 99% pathogen free – the nutrient content for pellets is: 5 – 4 – 3 (5% nitrogen, 4% phosphorus and 3% potassium)

Land Application – Biosolids are spread on land to return nutrients to the soil. Biosolids are spread less than a quarter inch thick and are sometimes plowed into the soil. Biosolids have been directly applied to corn crops, wheat and grazing land in Colorado and Virginia.

Composting – Biosolids are mixed with a bulking agent (for example – wood chips) which allows oxygen to mix with the biosolids more easily. The biosolids decompose, creating compost. This compost is similar to peat moss and is used as mulch or soil conditioner at golf courses, nurseries, home gardens, lawns, etc. New York City's biosolids are being composted at a facility in Pennsylvania.

Alkaline Treatment – Biosolids are mixed with a highly alkaline material, such as lime or Portland cement. This process results in a product, which resembles soil and is used as an agricultural liming agent. New York City's biolosids are alkaline stabilized at a facility in New Jersey.

All of these processes destroy disease-causing organisms and reduce moisture content, resulting in products that are easy to handle and have characteristics similar to many commercial agricultural products.

Heat Drying – Biosolids are heated to a very high temperature to remove moisture and kill pathogens. What remains are fertilizer pellets. New York City's biosolids are made into pellets at a facility in the Bronx. These pellets are sold across the country, many of them for use in citrus groves in Florida.

New York City is strongly committed to the continued beneficial use of its biosolids through environmentally safe land application programs.

Pelletizer plant in the Bronx

How New York City Protects Its Water Environment

DEP maintains and operates the City's wastewater treatment system; however, its responsibilities extend far beyond the management of the plants. Wastewater treatment is only one part of a very broad program to protect and improve the City's water environment that includes: pollution prevention and remediation; maintenance and upgrading of the City's sewer and wastewater treatment infrastructure; technically innovative wastewater collection and treatment; ecosystem protection; and ongoing scientific and technical research.

The ultimate goal is to reduce and control pollution before it reaches our wastewater treatment plants.

Testing New York City Waterways

DEP's Harbor Survey Program tests the New York Harbor waters and sediments at 37 locations. Sampling takes place year-round. Weekly sampling takes place from May through September and monthly from October thru April. Typical tests measure bacteria, turbidity, temperature and the level of dissolved oxygen in the water. The results are used to assess the effectiveness of all of the City's water quality programs and to monitor water quality trends. The Osprey, a vessel equipped with a small laboratory is used to sample the New York City Harbor waters. Since 1909, DEP has monitored water quality in New York Harbor, the East River and the Hudson River, and has published the results annually in its "New York Harbor Water Quality Report."

Environmental Concerns

DEP manages a comprehensive range of programs to address many of the most pressing concerns that threaten our water environment. Following are program summaries.

Toxic substances

Heavy metals and other toxic chemicals, such as cadmium and mercury, solvents and pesticides, enter our wastewater treatment plants every day. Many of these substances come from industries and business that dispose of chemicals in their wastewater as part of their regulated industrial processes. They also come from people who use and improperly dispose of hazardous household items such as cleaning products, paints and pesticides. One potential source of lead and copper in wastewater comes from corroding pipes in existing building plumbing systems. Some toxins in wastewater begin as air pollutants that have fallen to the ground and are carried by rain water to our plants and waterways. Wastewater treatment plants cannot destroy all of these substances so they remain in small amounts (still below standards set by the State and federal governments) in the treated wastewater discharged to local waterways.

DEP tests the treated wastewater effluent released from all 14 treatment plants daily for conventional pollutants, and annually for over 130 "priority pollutants" that the United States Environmental Protection Agency (EPA) lists as the worst pollutants to ensure that federal and State standards are met. These include metals and organic chemicals.

DEP runs programs aimed at reducing some key sources of toxic substances.

The Industrial Pretreatment Program (IPP): a federally authorized program, works to control commercial discharges by requiring industries targeted by federal and local pretreatment regulations to remove specific toxins from their wastewater before it is released into the City's sewer system.

IPP helps to protect the sewers, the wastewater treatment plants and the City's receiving waters. The EPA requires approximately 1,500 municipalities around the country to implement industrial pretreatment programs. DEP has been a control authority since January 1987. DEP's program is annually audited by either the New York State Department of Conservation (NYSDEC) of the EPA. Since 1987, the amount of heavy metals being discharged by regulated businesses fell from over 2000 lbs/day to 37 lbs/per day.

Two successful IPP programs are the ***Persistent Pollutant Track-down Program*** and the ***Perchloroethylene (PERC) Reduction Program***.

Persistent Pollutant Track-down Program: a collaborative effort between DEP and the DEC. Together, the two agencies work to track down the sources of PCBs (polychlorinated biphenols), PAHs (Poly-Aromatic Hydrocarbon), mercury and other organic chemical compounds found in our harbor waters. When businesses responsible for pollution are identified, DEP and DEC work with them to help establish improved (or first-time) methods of pretreatment.

PERC Reduction Program: enforces special sewer regulations that require dry cleaners to implement a best management program to limit *perchloroethylene* (PERC) discharges into the sewer system. (PERC is a solvent widely used by drycleaners.) DEP regularly inspects the City's dry cleaning establishments to make sure owners are adhering to PERC regulations.

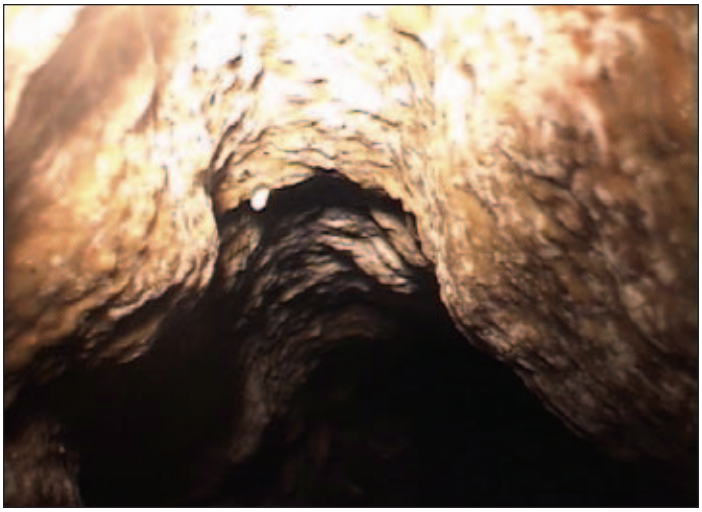
DEP regulates industrial users of the public sewers in a variety of categories such as electroplating, metal finishing, organic chemical and pharmaceutical manufacturing. As part of the IPP, DEP issue permits setting forth applicable pollutant limits as well as wastewater sampling and reporting requirements. DEP also regularly inspects IPP facilities and performs its own wastewater monitoring to ensure that the regulated facilities are in compliance with pretreatment standards. Whenever it is determined that a facility is not meeting its permit limits due to a failure in operating and maintaining its pretreatment system, or not installing the proper equipment, DEP will require, through Notice of Violation and/or Commissioner's Order, that remedial action be taken.

Pollution Prevention Program: Pollution Prevention Programs focus on reduction of toxins from commercial sources through education and information about "green" technology and good business management practices.

Dry Weather Discharges: In 1988 DEP initiated the *Shoreline Survey Program*. Its purpose was to identify and eliminate sources of raw sewage discharge into the City's waters during dry weather. This program in conjunction

Osprey Vessel

Chlorine Residual Analysis performed by Operations personnel.



Sewer backup – caused illegal discharge of grease into the sewer system

with a more recent one, DEP's *Sentinel Monitoring Program*, has enabled the elimination of 99 percent of dry weather discharges. DEP continues to work on controlling the remaining discharges by constructing new sewers and taking enforcement action to correct illegal connections to storm sewers.

Grease: Discharges of grease (cooking oil) into the sewer system from restaurants and other food related establishments can block sewers, causing backups and bypasses. To ensure proper disposal of grease, and prevent sewer backups, the City requires by law that grease generating establishments correctly install, operate and maintain properly sized grease interceptors. Special DEP staff inspect these establishments to make sure that the required equipment is installed and working properly. DEP has initiated an educational program to address grease discharges from the over 21,000 restaurants in New York City. The *Grease Response Education and Strategic Enforcement Program* approaches the problem with a combination of education materials, including foreign language material, which are distributed to restaurants in target areas. Sewer blockages can also be caused by grease and oil improperly disposed of in kitchen sinks and toilets in homes and apartments.

Grease thrown down kitchen sinks in homes and apartments can also cause sewer blockages.

Pumping Station Telemetry: Telemetry is the ability to send "real-time" (as it is happening) data to a remote terminal (computer) by utilizing a radio signal or telephone line. Since 1998, telemetry has been in operation at DEP's 93 wastewater pumping stations enabling personnel to check the daily operation of these facilities from a remote computer. This program has already succeeded in reducing dry and wet weather discharges by allowing DEP pumping station operators to respond more rapidly to station malfunctions, breakdowns and other potentially serious system disruptions.

Combined Sewer Overflows (CSO): The completion of the Red Hook WPCP (on the lower East River in Brooklyn) in 1987 ended the last, permitted, dry weather discharge of raw sewage into New York Harbor. However, the City still faces the problem of combined sewer overflows. As noted earlier, CSOs can occur in wet weather when wastewater treatment plants and/or parts of the sewer system fill to capacity with rain or snow. To relieve pressure on the already filled to capacity wastewater treatment system, the excess flow is forced into the open waters of a river, bay or inlet. These overflows can increase the number of harmful bacteria and add other organic pollutants that consume dissolved oxygen, which marine plants and animals need to survive. CSOs also carry trash and litter washed from streets and may contain toxic chemicals.

As a part of a multi-year, $1.8 billion CSO Abatement Program, the City is building retention tanks to hold the overflows near heavily impacted bays and tributaries, installing separate sewers where no sewers exist, and exploring other innovative solutions. The planning, design and construction of some of these facilities has already begun. In addition to construction of these retention tanks, CSO pollution has already been noticeably controlled through improvements in DEP's operation of its treatment plants and intercepting sewer system during wet weather.

Floating debris: Litter that washes down storm drains in the street can easily wind up in local waters and on City beaches. This unsightly pollution, called floatables, can kill birds, turtles and other marine animals that mistake trash – especially plastic – for food. Street litter that goes to the treatment plants must be separated from the wastewater so it won't damage plant equipment. Litter can also clog storm drains and cause sewer backups and flooding.

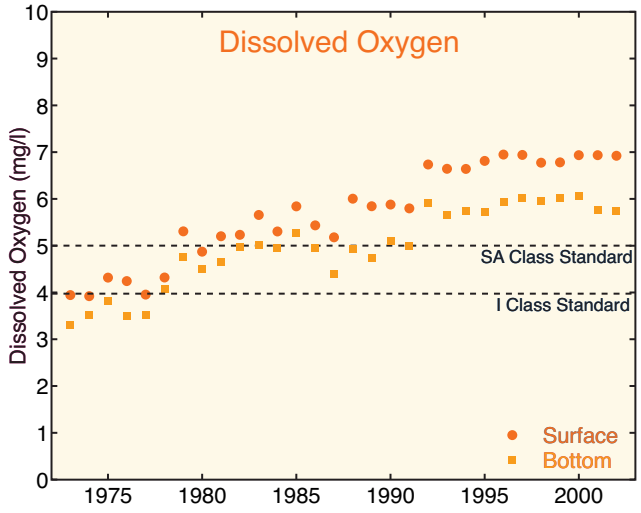
The City is also tackling the problem of debris with a multi-faceted program that includes increased street cleaning in critically located neighborhoods; regular catch basin maintenance; replacement of hoods on catch basins that trap debris before it enters the sewer system; the booming and netting of sites where combined sewer overflows enter local waters; operational improvements at

treatment plants and collections systems, and a fleet of skimmer vessels that collect floatables from the open waters.

To eliminate illegal shoreline dumping (another source of floatable materials), DEP set up a Shoreline Dumping Prevention Program to monitor the City's many miles of shoreline for evidence of recent illegal disposal activities. Findings are reported to the Department of Sanitation (DOS) Police for follow-up and possible apprehension of illegal dumpers.

Additional programs credited with limiting the discharge of floatables into the Harbor include the use of demolition vessels to remove decaying piers, and collaborative efforts by the US Army Corps of Engineers, EPA and DEC to collect large floatable debris and skim litter from the open waters and shorelines.

Water quality monitoring: To gauge the effectiveness of wastewater treatment plant programs, water quality is analyzed at 37 sampling stations throughout New York Harbor. Since 1970, DEP's Annual Harbor Survey has tracked trends showing increases in dissolved oxygen and decreases in fecal coliform – indicators of improved water quality. The following diagrams detail these improvements through fecal coliform measurements. Before 1974, there was a large area suitable for "fish survival only" (the worst indicator) and very few areas were labeled as suitable for bathing. By 1985, the number of "fish survival only" areas had decreased dramatically while the bathing areas had increased. By 1988, the "fish survival only" indicator was issued only for an area of the Hudson River west of Manhattan and for another small area near Manhattan in the East River. By 2001, many of the waterways around New York City were suitable for bathing. (See Diagram "Fecal Coliform in Surface Waters.") There have been no beach closures since 2001, except for precautionary closings, during the 2003 blackout.



Area-wide decreases in sewage loading have resulted in greater environmental improvement in the Harbor. Indicative of this improvement has been the increase of dissolved oxygen (DO) to levels that better support aquatic life.

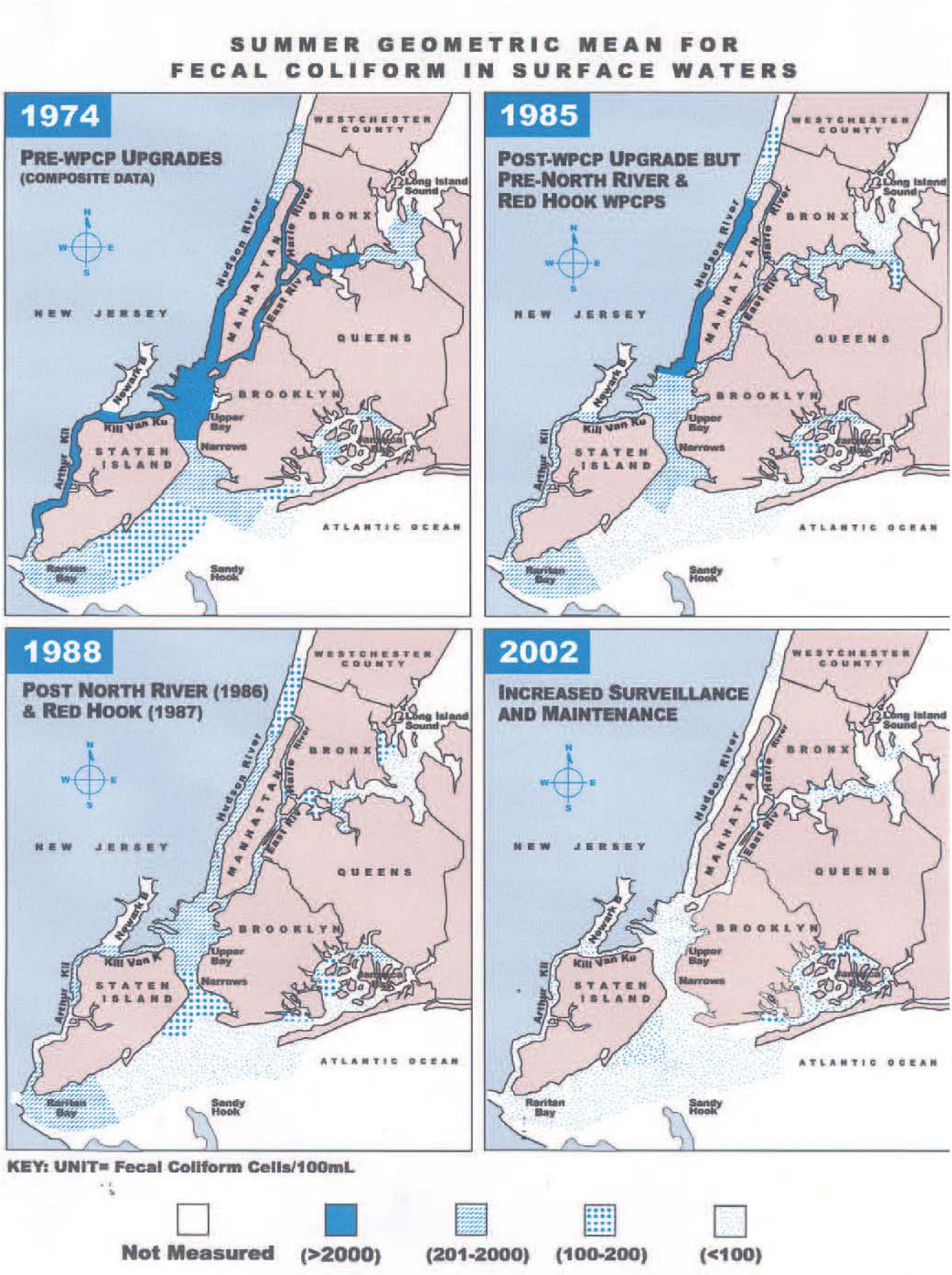
Harbor Survey monitoring has documented significant Harbor-wide increases in DO concentrations (~2 mg/L) over the past 30 years (see below). Today, portions of the Harbor have DO concentrations above levels first recorded at the beginning of the 20th century.

Regulator Telemetry System "Enhanced Beach Protection Program": Regulator telemetry systems are, at present, fully installed and operational at 102 regulators. (A regulator is a device used in New York City's combined sewers to control or regulate the diversion of sewage flow to the treatment plants during dry and wet weather.) These systems are links to an internet software package that allows DEP to monitor each individual site continuously. The telemetry system transmits alarms as soon as the level of the water reaches a predetermined elevation in the regulator. DEP initiated the "Enhanced Beach Protection Program" (EBPP) in 1997 to monitor pumping stations and regulators that could have an impact on the City's beaches. The immediate goal of the program is to prevent negative water quality impacts that may result as a consequence of unintended dry weather bypasses and, ultimately, to prevent beach closures. This program incorporated the use of telemetry to replace site visits. The successful implementation of the regulator telemetry system has had a significant impact in the reduction of raw sewage bypasses, most important during the recreational beach season.

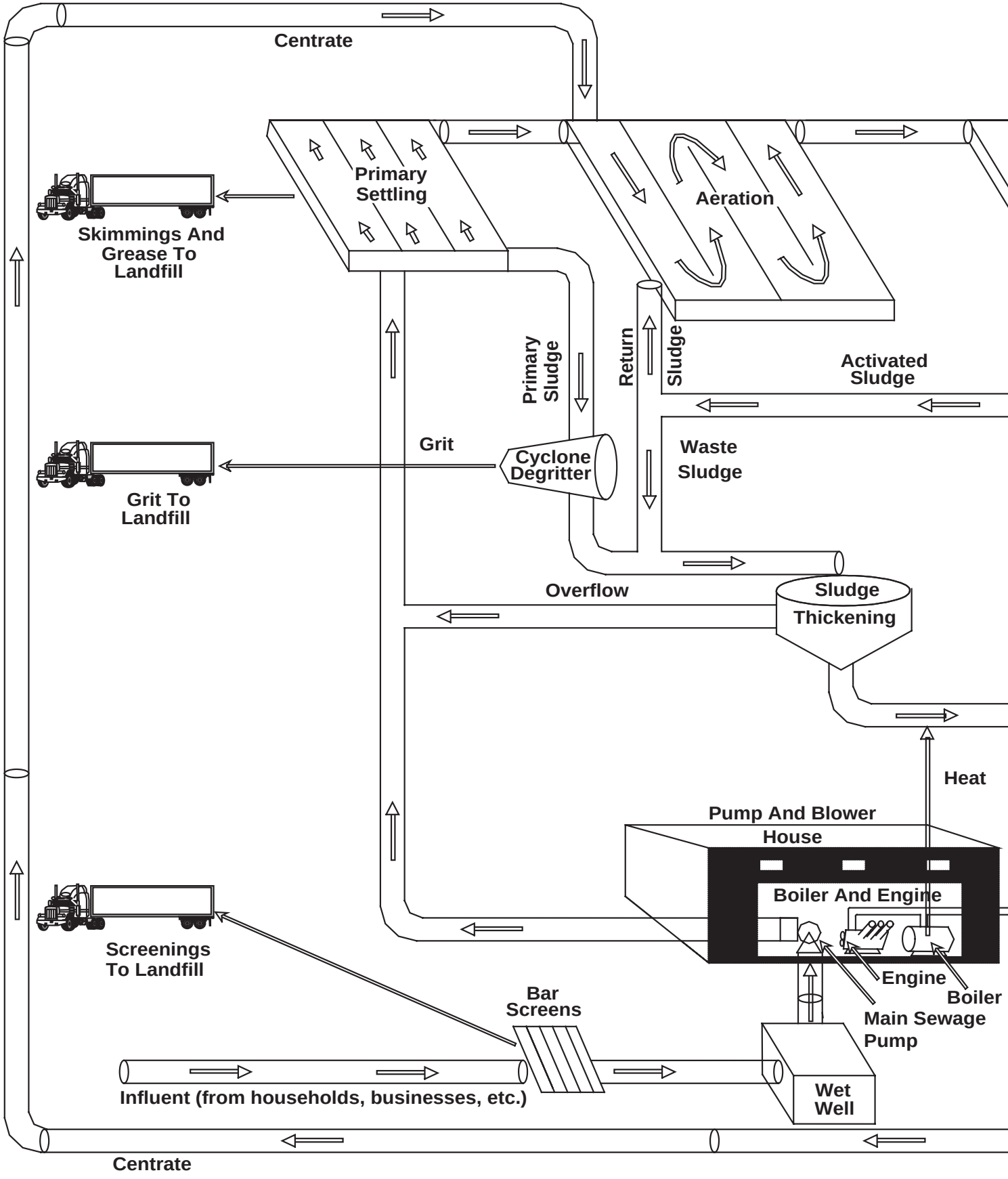
Nutrients: Carbon, nitrogen and phosphorus are substances that are excreted by humans and thus found in wastewater. Excess nutrients can stimulate the growth of algae and other aquatic plants. When these plants die and decompose, they may reduce the amount of oxygen in the water. This condition, called hypoxia, can affect the survival of fish and other aquatic organisms.

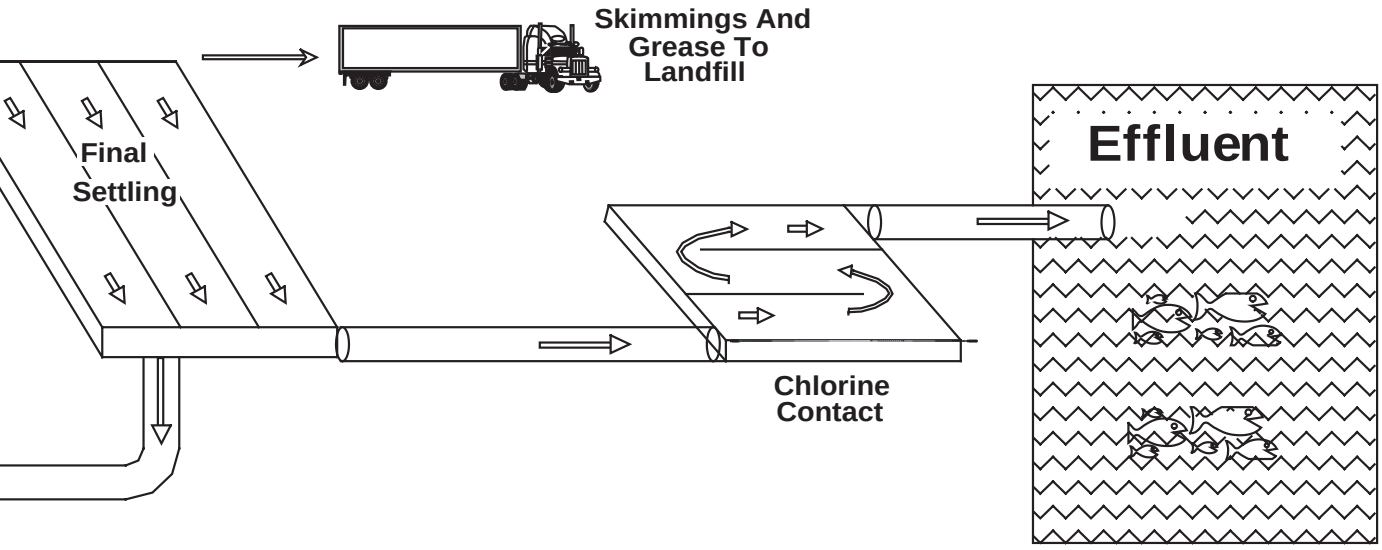
Nutrients can also get into wastewater from industrial discharges, common household detergents and cleaners, runoff from streets and lawns and air pollutants that fall to the ground. Treatment plants cannot remove all nutrients from the wastewater. They can be reduced by controlling pollution that comes from lawns, farmland, streets and construction sites.

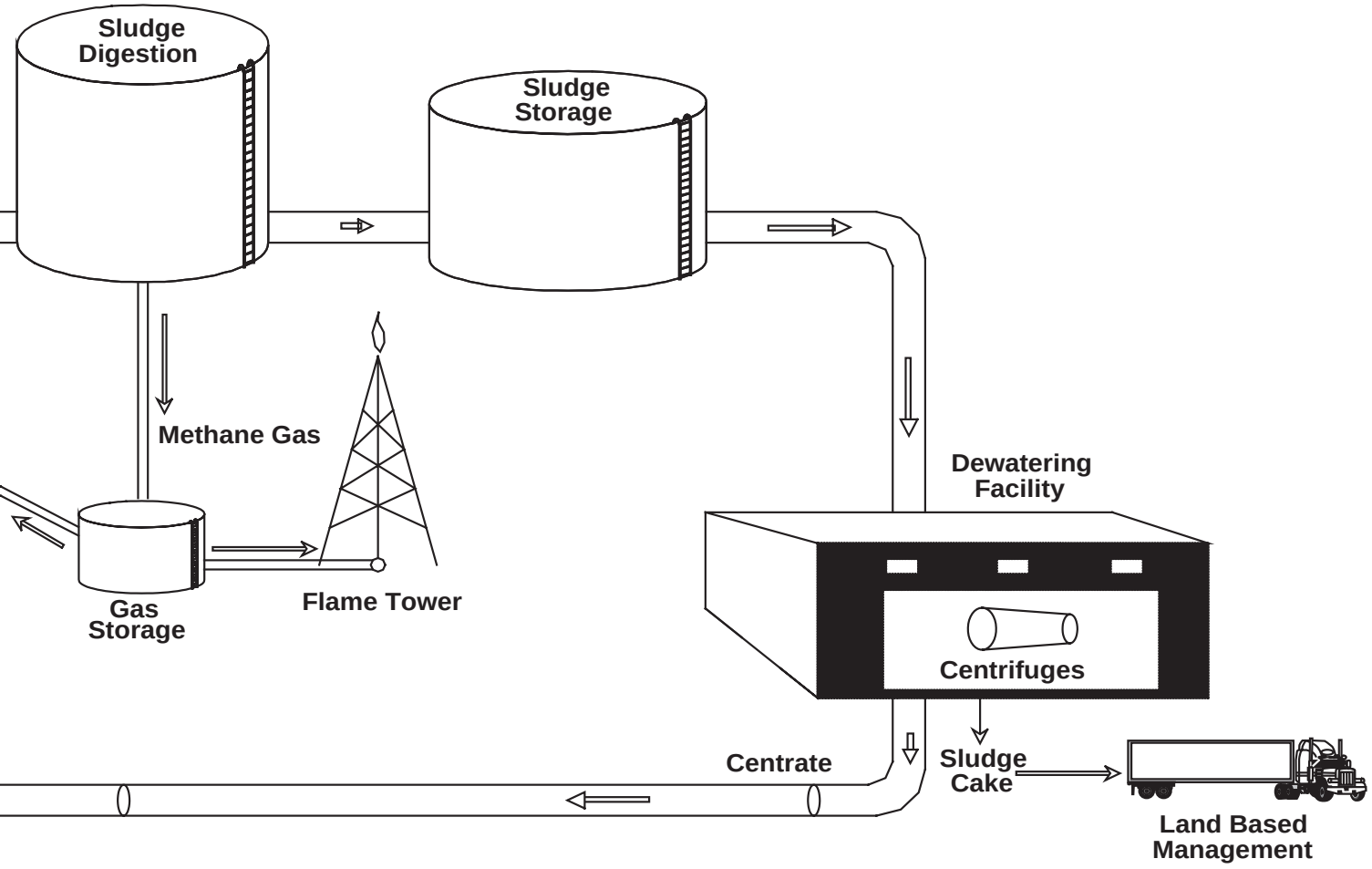
Map of New York Harbor and Historical Sampling Sites



Process Layout of a Typical New York City Water Pollution Control Plant




Skimmings And
Grease To
Landfill
Final
Settling
Effluent
Chlorine
Contact


Sludge
Digestion
Sludge
Storage
Methane Gas
Dewatering
Facility
Gas
Storage
Flame Tower
Centrifuges
Centrate
Sludge
Cake
Land Based
Management

DEP has developed a long-term plan to reduce nitrogen in the effluent that is discharged into New York waters by the City's wastewater plants. This process is called Step Feed Biological Nutrient Removal (BNR). Because hypoxia is a particular problem in Long Island Sound and Jamaica Bay, the plan will focus primarily on wastewater treatment plants that discharge into the upper East River and Jamaica Bay. To remove nitrogen at these plants, existing treatment facilities and processes are being modified. Some interim changes are already in operation at several of the critically located plants, and additional work will be in place at the other treatment plants by the end of 2010. While costly, the test results show that this technology has been successful in lowering nitrogen concentrations in the affected bodies of water. The City has been and continues to invest millions of dollars in the research and development of new, more cost-effective technologies, programs and processes that will reduce nitrogen levels in the wastewater.

Water waste: On average, each New Yorker uses about 100 gallons of water daily – twice as much as residents of most European cities and many other places in this country. Naturally, the more water we use, the more wastewater the treatment plants must process. Since each New York City plant is designed to handle a certain amount of wastewater, when too much comes into a plant, it reduces its spare capacity. Unless flows can be lessened, added treatment capacity may be required.

DEP has initiated a comprehensive program to encourage water conservation and to reduce flows into the City's treatment plants. The program, which began in 1989, included the following:

- installation of almost 630,000 residential water meters;
- electronic water main leak detection;
- commercial and residential surveys to locate leaks within buildings;
- incentives to replace old toilets and showerheads with low flow fixtures;
- permanent and seasonal year-round restrictions on water use such as watering lawns, and hosing sidewalks;
- installation of fire hydrant locking devices;
- public education for school children and City residents.

These programs and others, have proven successful and cumulatively together have reduced water consumption in the City by approximately 200 million gallons per day in the last ten years.

How You Can Make a Difference

Although wastewater treatment seems like an enormous and technical process, New Yorkers can help to maintain a healthy water and environment. Here are some of the things everyone can do:

Conserve water: There are many simple ways to use less water every day, such as taking shorter showers, turning off the faucet when you brush your teeth or shave and fixing leaks.

Keep hazardous substance out of the sewer system: Reduce the use of hazardous household products. Never pour hazardous materials down a sink or toilet or dump them into a storm drain. Save hazardous wastes for a DOS household waste collection day or wrap them safely in plastic and call the DOS for instructions. And remember, it's against the law to dump used motor oil down a storm drain. It should be taken to a gasoline service station for recycling.

Don't litter: Everyday items like coffee cups, straws and candy wrappers tossed into the street may wash down storm drains and end up on our beaches. If you've got litter to discard, look for a corner waste can or take it home with you.

Use Mass Transportation: Vehicles are responsible for 90 percent of the carbon monoxide in the air and are the greatest contributor to ground-level ozone, the major component of smog. By taking public transportation or carpooling, you help reduce the toxic chemicals that enter the wastewater treatment systems as a result of air pollution.

Dispose of grease properly: Don't throw used cooking oil down the sink or toilet as grease accumulations in the sewer system can cause serious blockages. Every time you cook, place the leftover oil in a non-recyclable, plastic container (like a yogurt container or a clear, plastic, take-out food container). Cover and store the container in the refrigerator. When the container is filled, throw it out with your regular trash.

Volunteer for Shoreline Cleanup and Survey Programs: These efforts are co-sponsored by DEP, the New York City Soil and Water Conservation District (NYCSWCD) and the American Littoral Society (ALS). Scheduled beach surveys take place throughout the City. Volunteers record the amounts and types of floatable materials that wash up on the beaches. This information helps DEP keep track of the effectiveness of its floatables capture programs. If you are interested in participating, contact the NYCSWCD at (212) 431-9676 and the ALS at (718) 471-2166.

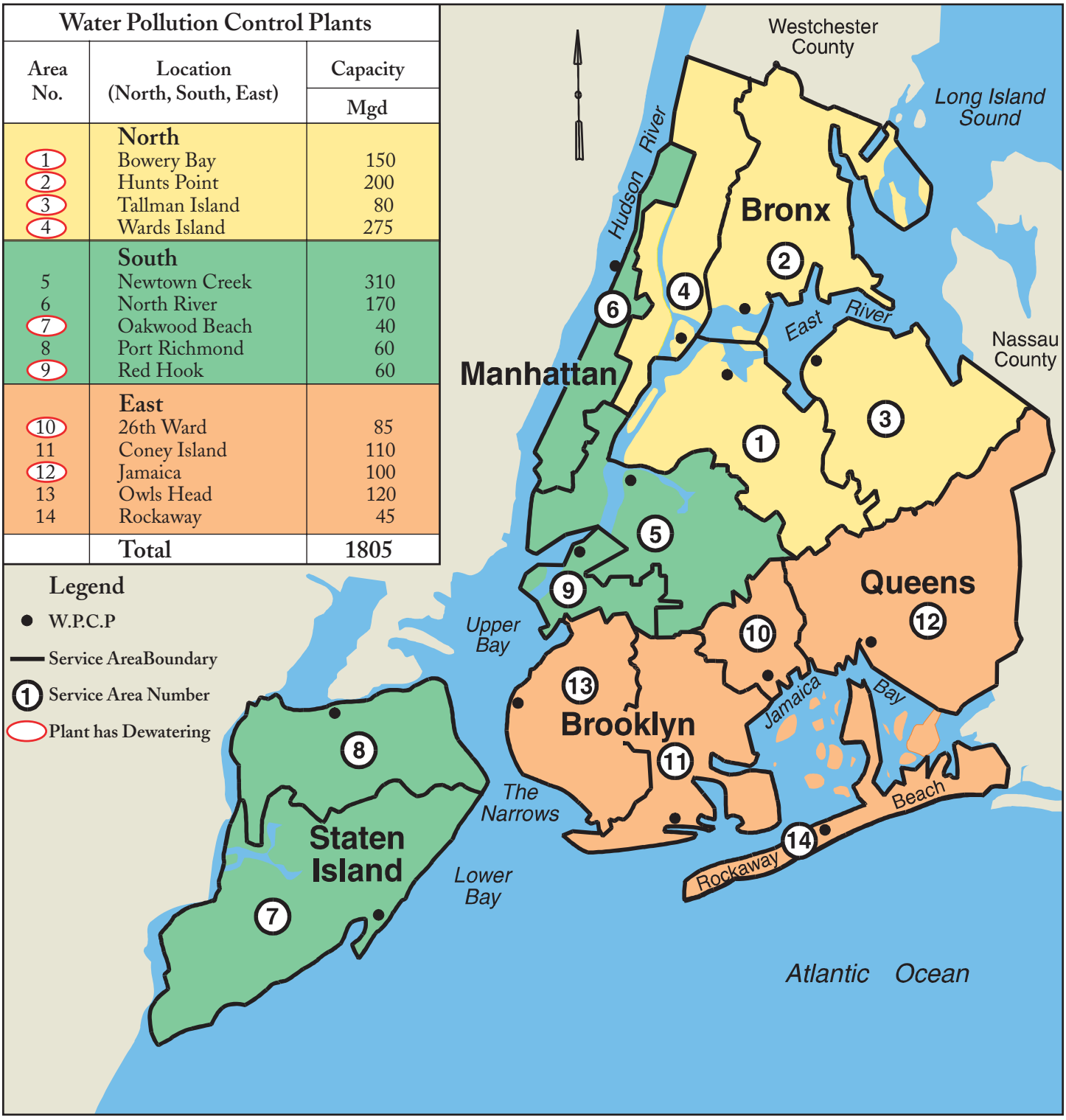
The Cormorant Skimmer Vessel patrolling the New York Harbor for floatables

Report dry weather: If you see dry weather sewage discharges from any of New York City's 700 combined sewer outfalls (an outfall is an outlet along the waterfront connecting the City's sewers to the open waters) report it to the City's Citizen Service Center at 311.

Each outfall has a sign with the identification number assigned to it by DEC. Be sure to give the 311 operator the outfall number when calling to report a problem.

New York City Plant Locations and Capacities

Water Pollution Control Plants		
Area No.	Location (North, South, East)	Capacity Mgd
	North	
1	Bowery Bay	150
2	Hunts Point	200
3	Tallman Island	80
4	Wards Island	275
	South	
5	Newtown Creek	310
6	North River	170
7	Oakwood Beach	40
8	Port Richmond	60
9	Red Hook	60
	East	
10	26th Ward	85
11	Coney Island	110
12	Jamaica	100
13	Owls Head	120
14	Rockaway	45
	Total	1805



New York City Wastewater Treatment Plants

26th Ward WPCP

Plant in operation:	1944
Design Capacity:	85 MGD
Dewatering:	26th Ward
Population Served:	283,428
Receiving Waterbody:	Jamaica Bay
Drainage Area:	5,907 Acres, eastern section of Brooklyn, near Jamaica Bay
Plant Staff:	93

Bowery Bay WPCP

Plant in operation:	1939
Design Capacity:	150 MGD
Dewatering:	Bowery Bay
Population Served:	848,328
Receiving Waterbody:	Upper East River
Drainage Area:	15,203 Acres, northeast section of Queens
Plant Staff:	81

Coney Island WPCP

Plant in operation:	1935
Design Capacity:	110 MGD
Dewatering:	26th Ward
Population Served:	596,326
Receiving Waterbody:	Jamaica Bay
Drainage Area:	15,087 Acres, south and central Brooklyn
Plant Staff:	69

Hunts Point WPCP

Plant in operation:	1952
Design Capacity:	200 MGD
Dewatering:	Hunts Point
Population Served:	684,569
Receiving Waterbody:	Upper East River
Drainage Area:	16,664 Acres, eastern section of the Bronx
Plant Staff:	108

Jamaica WPCP

Plant in operation:	1903 / 1943
Design Capacity:	100 MGD
Dewatering:	Jamaica WPCP
Population Served:	728,123
Receiving Waterbody:	Jamaica Bay
Drainage Area:	25,313 Acres, southern section of Queens
Plant Staff:	66

Newtown Creek WPCP

Plant in operation:	1967
Design Capacity:	310 MGD
Dewatering:	Hunts Point WPCP
Population Served:	1,068,012
Receiving Waterbody:	East River
Drainage Area:	15,656 Acres, south and eastern midtown sections of Manhattan, northeast section of Brooklyn and western section of Queens
Plant Staff:	88

North River WPCP

Plant in operation:	1986
Design Capacity:	170 MGD
Dewatering:	Wards Island WPCP
Population Served:	588,772
Receiving Waterbody:	Hudson River
Drainage Area:	6,030 Acres, west side of Manhattan above Bank Street
Plant Staff:	109

First and only Wastewater Treatment Plant in NYC to have a public park built on top.

Oakwood Beach WPCP

Plant in operation:	1956
Design Capacity:	39.9 MGD
Dewatering:	Oakwood Beach WPCP
Population Served:	244,918
Receiving Waterbody:	Lower New York Bay
Drainage Area:	10,779 Acres, southern section of Staten Island
Plant Staff:	59

Rockaway WPCP

Plant in operation:	1952
Design Capacity:	45 MGD
Dewatering:	26th Ward WPCP
Population Served:	90,474
Receiving Waterbody:	Jamaica Bay
Drainage Area:	6,259 Acres, Rockaway Peninsula
Plant Staff:	41

Owls Head WPCP

Plant in operation:	1952
Design Capacity:	120 MGD
Dewatering:	26th Ward/ Wards Island WPCPs
Population Served:	758,007
Receiving Waterbody:	Upper New York Bay
Drainage Area:	12,947 Acres, western section of Brooklyn
Plant Staff:	68

Wards Island WPCP

Plant in operation:	1937
Design Capacity:	275 MGD
Dewatering:	Wards Island WPCP
Population Served:	1,061,558
Receiving Waterbody:	Upper East River
Drainage Area:	12,056 Acres, western section of the Bronx and upper east side of Manhattan
Plant Staff:	118

Tallman Island WPCP

Plant in operation:	1939
Design Capacity:	80 MGD
Dewatering:	Tallman Island WPCP
Population Served:	410,812
Receiving Waterbody:	Upper East River
Drainage Area:	16,860 Acres, northeast section of Queens
Plant Staff:	71

Port Richmond WPCP

Plant in operation:	1953
Design Capacity:	60 MGD
Dewatering:	Oakwood Beach WPCP
Population Served:	198,128
Receiving Waterbody:	Kill Van Kull
Drainage Area:	9,665 Acres, northern section of Staten Island
Plant Staff:	46

Red Hook WPCP

Plant in operation:	1987
Design Capacity:	60 MGD
Dewatering:	Red Hook WPCP
Population Served:	192,050
Receiving Waterbody:	Lower East River
Drainage Area:	3,200 Acres, northwest section of Brooklyn and Governor's Island
Plant Staff:	55

DEP Sludge Vessels

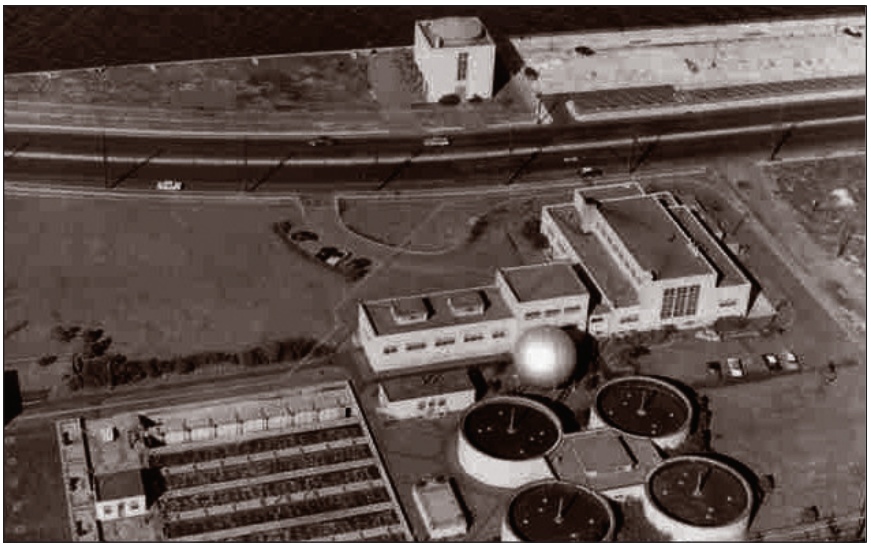
Presently, NYC-DEP Marine Section uses these three sludge vessels for the transportation of liquid sludge from wastewater treatment plants without dewatering capabilities.

North River sludge vessel

Newtown Creek sludge vessel

Owls Head sludge vessel

Wastewater Treatment Plants Before Modernization



Rockaway

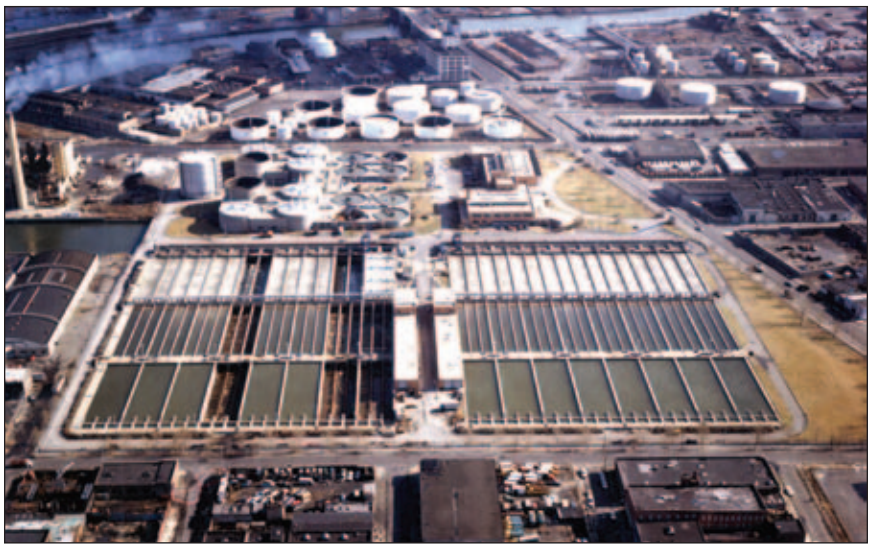
Oakwood Beach

Owls Head

Wastewater Treatment Plants Before Modernization

Port Richmond

Red Hook



Newtown Creek

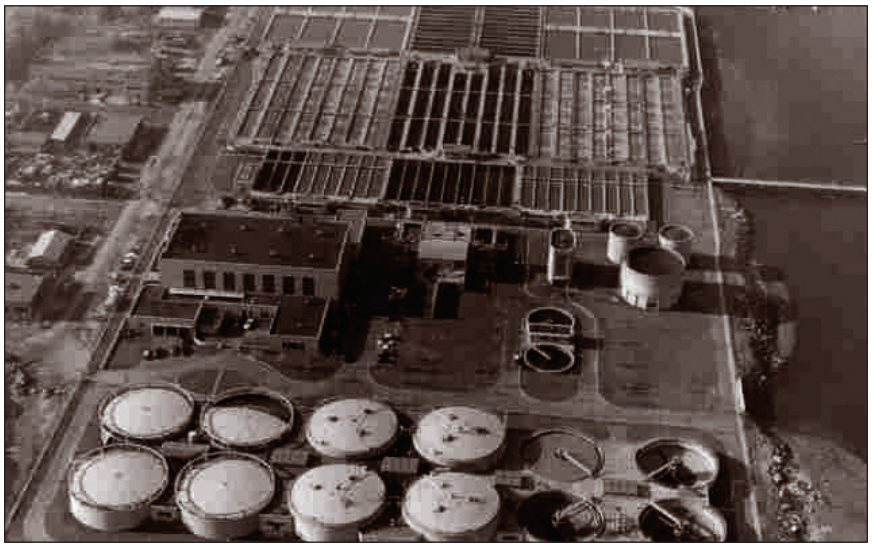
Wastewater Treatment Plants Before Modernization

26th Ward

Coney Island

Jamaica

Wastewater Treatment Plants Before Modernization



Bowery Bay

Hunts Point

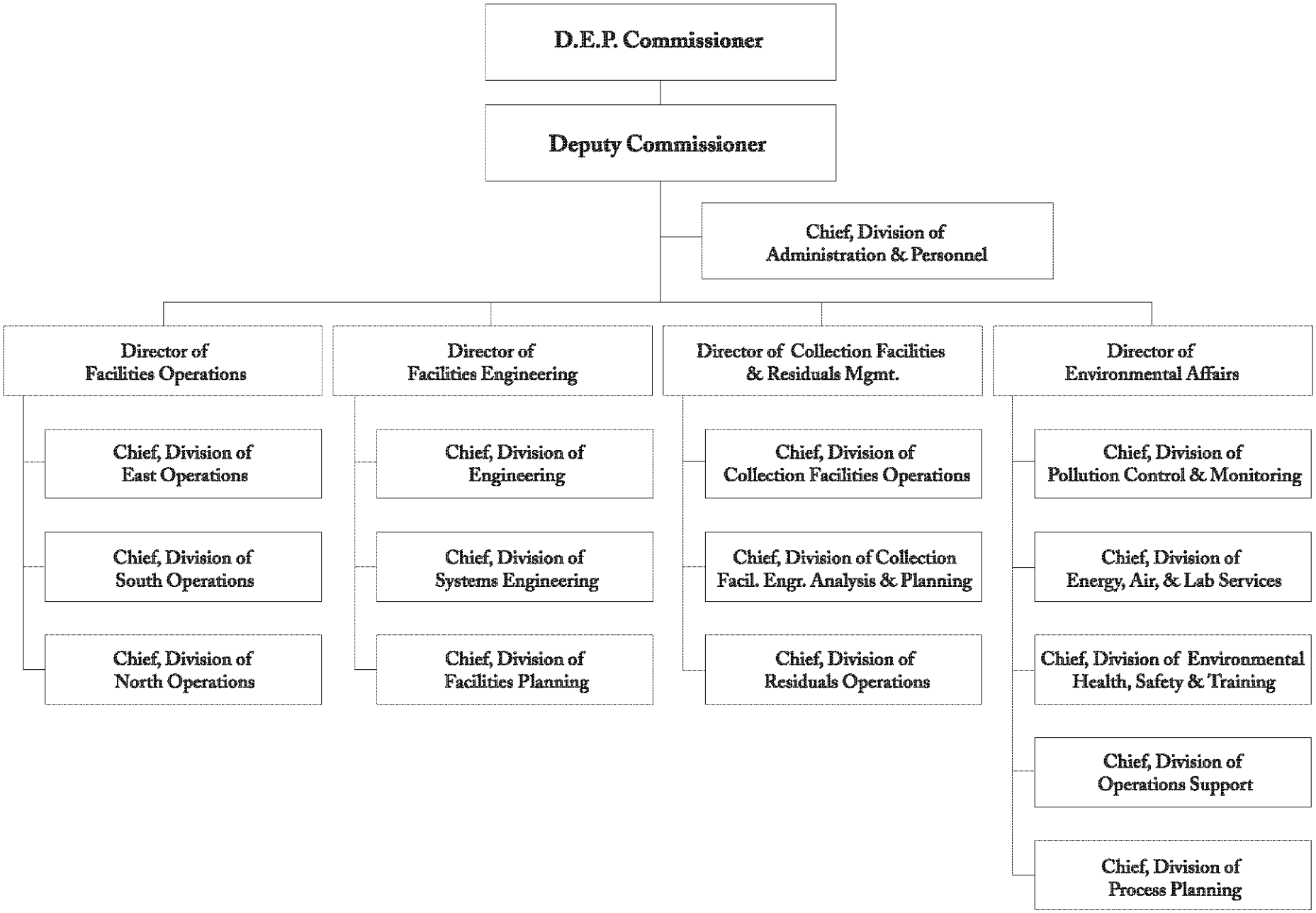
Tallman Island

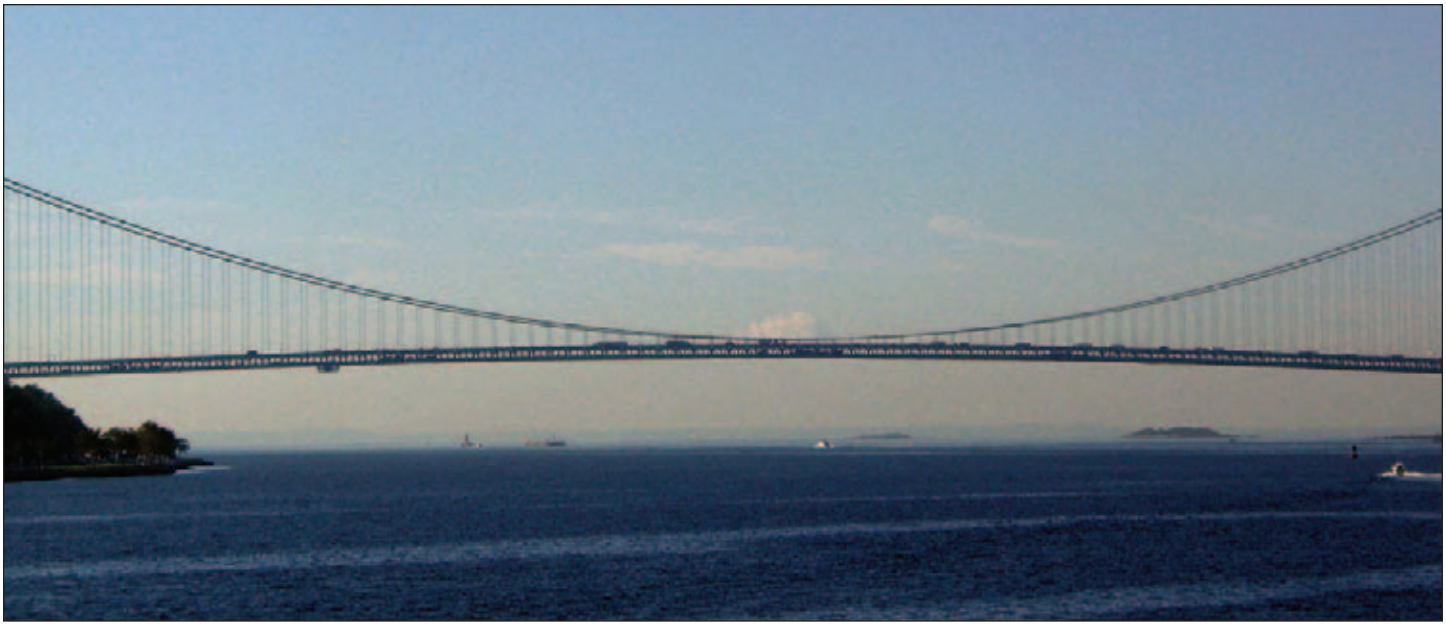
Wastewater Treatment Plants Before Modernization

North River

Wards Island

Bureau of Wastewater Treatment





The New York City Department of Environmental Protection distributes publications about wastewater treatment, the water supply system, water conservation and other environmental issues. For further information, or to obtain publications, or report water main breaks, streets leaks, open fire hydrants, sewer or storm drain backups and other problems, contact **New York City's 24-hour Citizen Service Center at 311.**

You may also visit the New York City DEP web site at:

www.nyc.gov/dep

Call 311 for assistance.

New York City
Department of Environmental Protection
59-17 Junction Blvd., Flushing, New York 11373

Michael R. Bloomberg, Mayor

Emily Lloyd, Commissioner

Bureau of Wastewater Treatment
Alfonso R. Lopez, P.E. Deputy Commissioner

Wards Island Wastewater Treatment Plant - 1938

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DEP

www.nyc.gov/dep