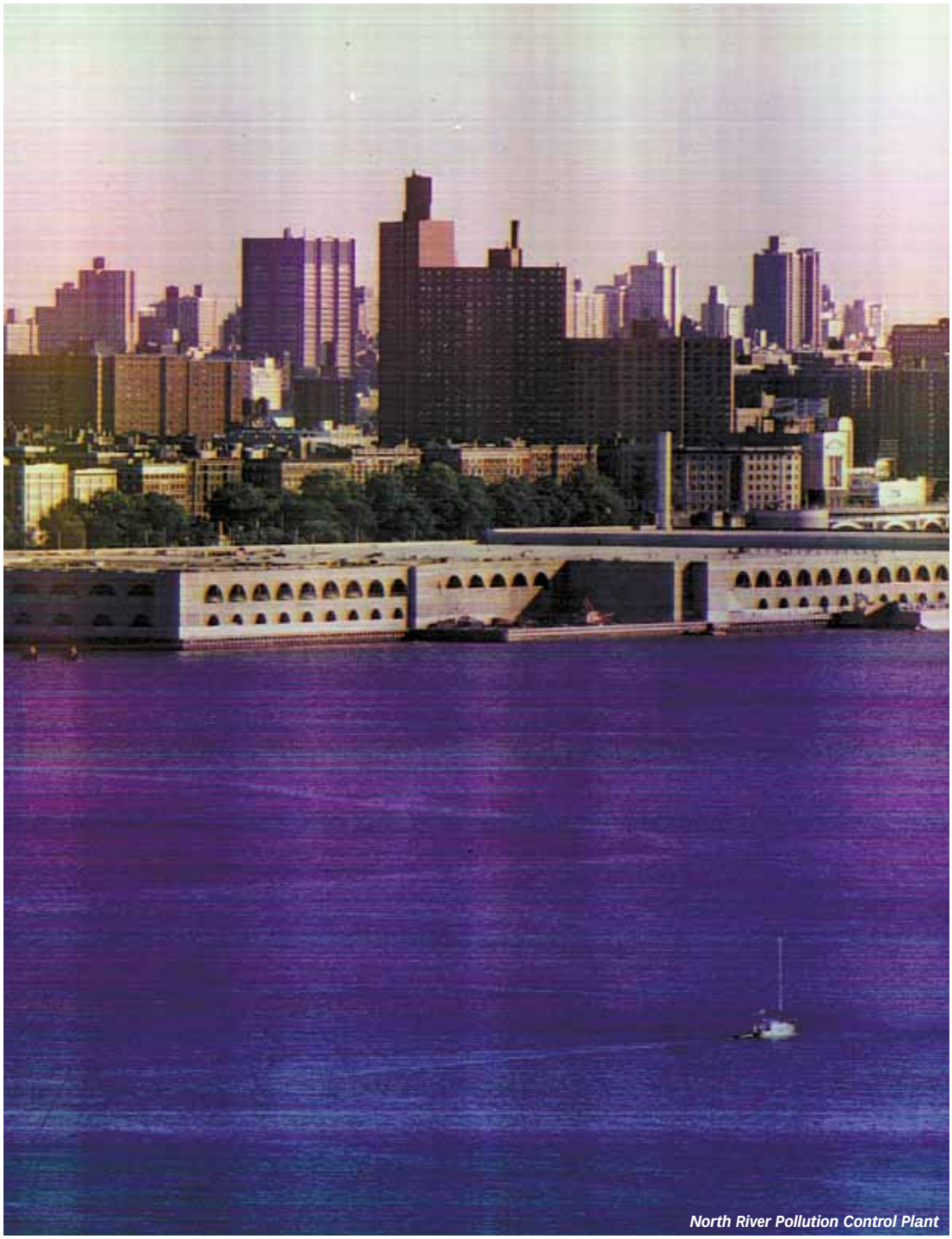
2001 New York Harbor Water Quality Report



North River Pollution Control Plant

www.nyc.gov/dep

Michael R. Bloomberg, Mayor

Christopher O. Ward, Commissioner

May, 2002

The 2001 New York Harbor Water Quality Report represents the 92nd year of comprehensive monitoring of the water quality in New York Harbor, and demonstrates the continued improvements of the City's waterways and the regeneration of their aquatic ecosystems. In fact, the Harbor is in better shape today than it has been in more than thirty years.

Under the management of the Department of Environmental Protection (DEP), the City's advanced wastewater treatment and pollution prevention programs are clearly producing positive results. Largely because of these efforts, our bathing waters are cleaner and our aquatic environment is flourishing. What's more we are committed to do better next year. With further enhancements to our treatment plants and other infrastructure upgrades already underway, the quality of the Harbor, and of City life, will surely continue to improve.

I encourage all New Yorkers to review this report to gain an appreciation for the extensive efforts the City has undertaken to reduce pollution in the Harbor and to protect our wonderful natural resources.

Sincerely,

Michael R. Bloomberg
Mayor

May, 2002

The New York City Department of Environmental Protection (DEP) performs an intensive annual survey of the water quality in New York harbor. The purpose of the Harbor Survey Program is to assess the effectiveness of the City's various pollution control programs, and their combined impact on water quality.

The 2001 New York Harbor Water Quality Report provides data summaries for the four significant regions of the harbor and includes discussion of our monitoring results as well as trend data dating back to 1970. Additional features, this year, are descriptions of the DEP's pollution control programs and summaries of special studies conducted on harbor-related subjects.

We are continually striving to improve our programs and to enhance the usefulness of this report. Your comments are encouraged. Questions or suggestions may be directed to Mr. Robert Ranheim of the DEP's Marine Sciences Section at (212) 860-9378.

We are proud of the results of our efforts to improve the quality of New York City's waterways. Your interest in the success of our programs is greatly appreciated.

Sincerely,

Christopher O. Ward
Commissioner

2001 New York Harbor Water Quality Report

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OVERVIEW

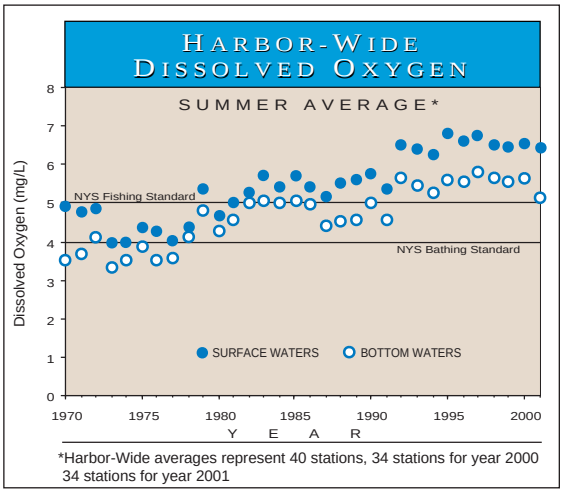
Harbor-wide water quality has shown great improvements for the past thirty years. Fecal coliform concentrations have decreased nearly two orders-of-magnitude from 1974 through 2001. The accompanying graph illustrates this dramatic improvement. Prior to secondary upgrades of the City's Water Pollution Control Plants (WPCPs) (1974), Harbor waters did not meet levels appropriate for fishing in the Inner Harbor Area, nor bathing in outlying waters. Significant improvement can be seen following treatment plant expansions and upgrades (1985) and start-up of the City's last two WPCPs (1988). Together, operation of the new North River and Red Hook plants ended the discharge of 210 million gallons per day (mgd) of untreated sewage to the Manhattan and Brooklyn shorelines.

Further improvements since 1989 are attributed to the increased surveillance and improved maintenance and operation of the entire sewage collection system and wastewater treatment plants. This has resulted in the abatement of illegal discharges, the elimination of raw sewage bypassing, and the increased capture of rainfall that enters the combined sewer system.

Area-wide decreases in sewage loading into the water ways have resulted in greater environmental improvement in the Harbor. Indicative of this improvement are dissolved oxygen (DO) levels. Harbor Survey monitoring has documented significant Harbor-wide increases in DO concentrations (~2 mg/L) over the past 30 years. Today, Harbor waters have DO concentrations above levels first recorded at the beginning of the 20th century.

The Harbor Survey program has been in existence for over 90 years. In that time the program has documented dramatic improvements in the water quality in New York Harbor. Recent improvements have not been as dramatic but water quality continues to improve and the current water quality is as good as it has been since the Harbor Survey began. Upgrades and the increase in monitoring and surveillance have documented improvements in more than just the harbor waters. Several of these items are:

- All the City's public beaches have remained open during the bathing season. Wet weather advisories have been eliminated from all but three of these public beaches.
- No major fish kills have been reported in the last two years.
- The number of nuisance algal blooms has been greatly reduced.

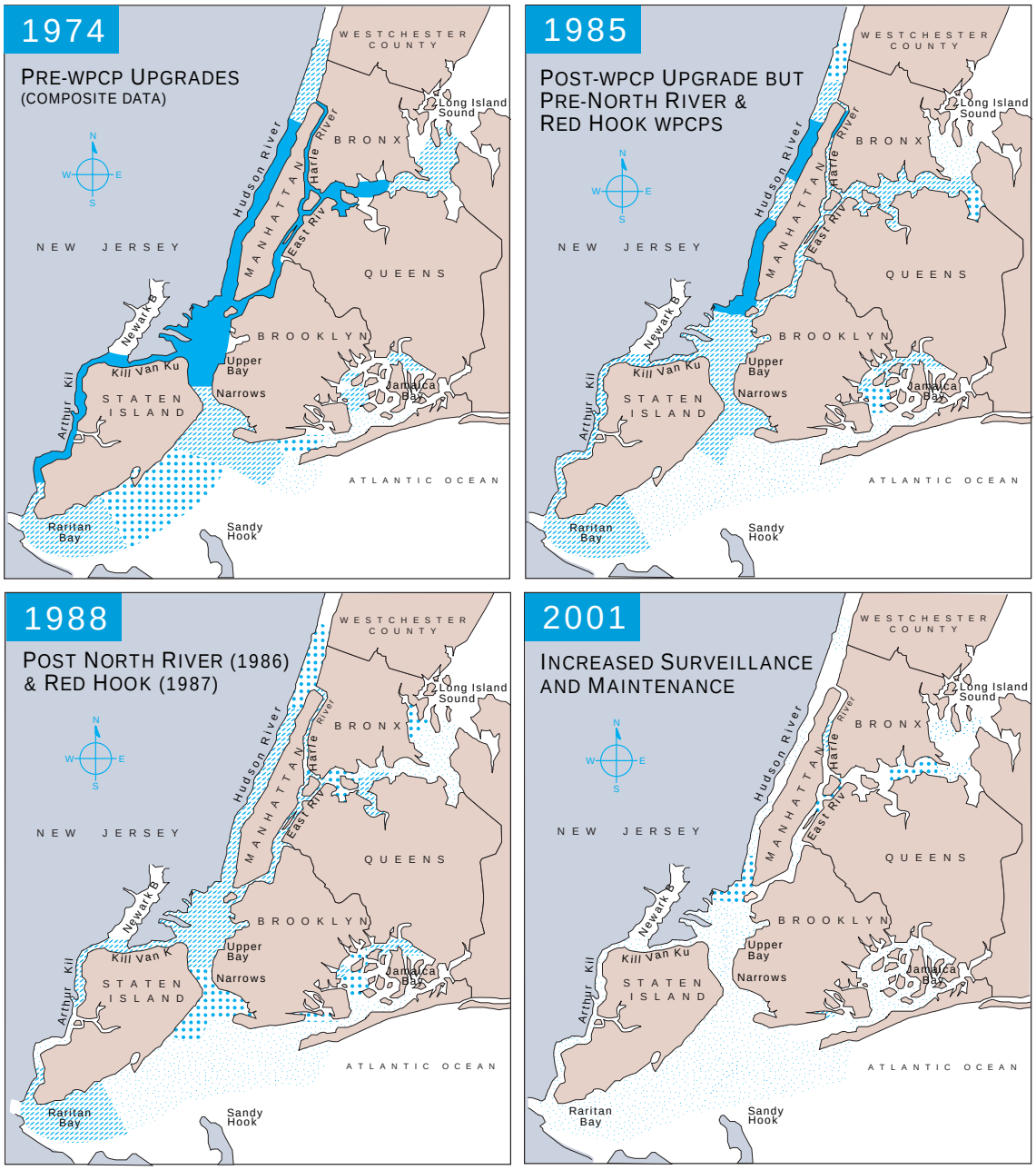


- Return to the harbor of several species of birds, such as egrets and herons, and fish, such as sturgeon, as well as the "wood-borers".
- Elimination of 99% of "dry weather" sewage discharges.
- Capture of 71% of floatables entering the system during wet weather.
- Capture of 62% of rainfall in 2001 that enters CSO system.
- Reduction of toxic metals loadings from industrial sources by over 95% .

The above list, while comprehensive, is by no means the end of the story. The City of New York is committed to continuing the programs mentioned in this report, and has begun several projects to solve the remaining problems in New York Harbor. The remaining challenges will require the cooperative efforts of citizens and local, state, and federal governments. Limited resources must be used wisely; accordingly, DEP managers and staff strive to do more with less. Remaining water quality problems are much more limited in scope than they were at the turn of the last century. It is therefore, critical that existing infrastructure be maintained to prevent backsliding and maintain a platform to provide further water quality improvement. Pollution prevention including the track down and control of toxicants of concern (PCB's, mercury, etc) remain of paramount concern to improve sediment quality and reduce fish advisories. However, the potentially enormous cost for the control of nitrogen and combined sewer overflows must be balanced with the incremental benefits that will be attained.

HARBOR-WIDE WATER QUALITY IMPROVEMENTS

SUMMER GEOMETRIC MEAN FOR
FECAL COLIFORM IN SURFACE WATERS



KEY: UNIT= Fecal Coliform Cells/100mL

NYC DOH requirements preclude bathing near sewer outfalls and where rainfall may substantially increase coliform levels.

Not Measured (>2000) (201-2000) (100-200) (<100)

NYS Best-Use Classifications: 200 FC/100mL=SB (Bathing); 2000 FC/100mL=I (Fishing)
Poor does not meet fishing standards; Superior does not imply shellfishing quality

REGIONAL SUMMARY

PARAMETER SYNOPSIS

This brief synopsis examines trends of four major indicators of environmental change in the Harbor Estuary.[1] These four indicators are:

Fecal Coliform (FC) Bacteria – Fecal coliform concentrations are measured in NY Harbor as human-health related indicators of sewage-related pollution. Fecal coliform bacteria are found primarily in human and animal intestines and associated with sewage waste. These bacteria are widely used as indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic (disease-producing) bacteria.

Chlorophyll 'a' – Chlorophyll 'a' is a plant pigment, the concentration of which in water is used as an estimate of productivity or phytoplankton abundance. Phytoplankton, minute free-floating aquatic plants, form the basis of the food web. Since these organisms respond quickly to environmental changes, their abundance may serve as a measure of water quality and an indicator of greater ecosystem change. The Harbor Survey measures chlorophyll 'a' (as a surrogate for phytoplankton) to provide an assessment of ecosystem health. Levels above 20 µg/L are considered indicative of enriched or eutrophic[2] conditions, indicating a decline in water quality.

Dissolved Oxygen (DO) – The levels of oxygen dissolved in the water column are critical for respiration of most aquatic life forms, including fish and invertebrates, such as crabs, clams, zooplankton, etc. Dissolved oxygen concentration is therefore one of the most universal indicators of overall water quality and a means of determining habitat and ecosystem conditions.

Secchi Transparency – A Secchi disk is used to estimate the clarity of surface waters. High Secchi transparency (greater than 5 feet) is indicative of clear water, with declines in transparency typically due to high suspended solid concentrations or plankton blooms. Low Secchi readings (less than 3 feet) are typically associated with degraded waters. These conditions are indicative of light limiting conditions, which in turn affect primary productivity and nutrient cycling.

Coliform and dissolved oxygen indicators are used in New York State Department of Environmental Conservation (NYSDEC) standards, to quantify ecosystem health or degradation. NYSDEC standards reflect a range of acceptable water quality conditions corresponding to the State-designated "best usage" of the water body. Common uses and NYSDEC standards for fecal coliform and dissolved oxygen are noted in the adjacent chart.

NYSDEC STANDARDS FOR SALINE WATERS

Class	Best Usage of Waters	Fecal Coliform	Dissolved Oxygen (never-less-than)
SA	Shellfishing and all other recreational use.	No standard	5.0 mg/L
SB	Bathing and other recreational use	Monthly geometric mean less than or equal to 200 cells/100mL from 5 or more samples	5.0 mg/L
I	Fishing or boating	Monthly geometric mean less than or equal to 2,000 cells/100mL from 5 or more samples	4.0 mg/L
SD	Fish survival	No standard	3.0 mg/L

[1] ***Estuary*** *– a semi-enclosed coastal body of water where fresh water and salt water mix.*

[2] ***Eutrophic conditions*** *– a condition in which nutrient-rich waters allow for excessive growth of algae, often leading to reduced water clarity and DO levels.*

INTRODUCTION

The City of New York has been collecting water quality data in New York Harbor since 1909. These data are utilized by regulators, scientists, educators and citizens to assess impacts, trends and improvements in the water quality of New York Harbor.

The Harbor Survey Program has been the responsibility of the New York City Department of Environmental Protection's (NYCDEP) BWT Marine Sciences Section (MSS) for the past 15 years. This effort evolved from the initial surveys by the Metropolitan Sewerage Commission that began 92 years ago and encompassed 12 stations around Manhattan. These initial surveys were performed in response to public complaints about their quality of life near such a polluted waterway. The initial effort has grown into a Survey that consists of 45 stations, 33 in the open waters of the Harbor, and 12 stations in smaller tributaries. The number of water quality parameters measured has also increased from five in 1909 to over 20 at present.

Harbor water quality has improved dramatically since the initial surveys. Infrastructure improvements and the capture and treatment of virtually all sewage that was dumped into the Harbor are two of the primary reasons for this improvement. During the last decade, water quality in NY Harbor has improved to the point that the waters are now utilized for recreation and commerce throughout the year. These improvements in water quality have brought attention to much smaller areas within the harbor that remain impaired.

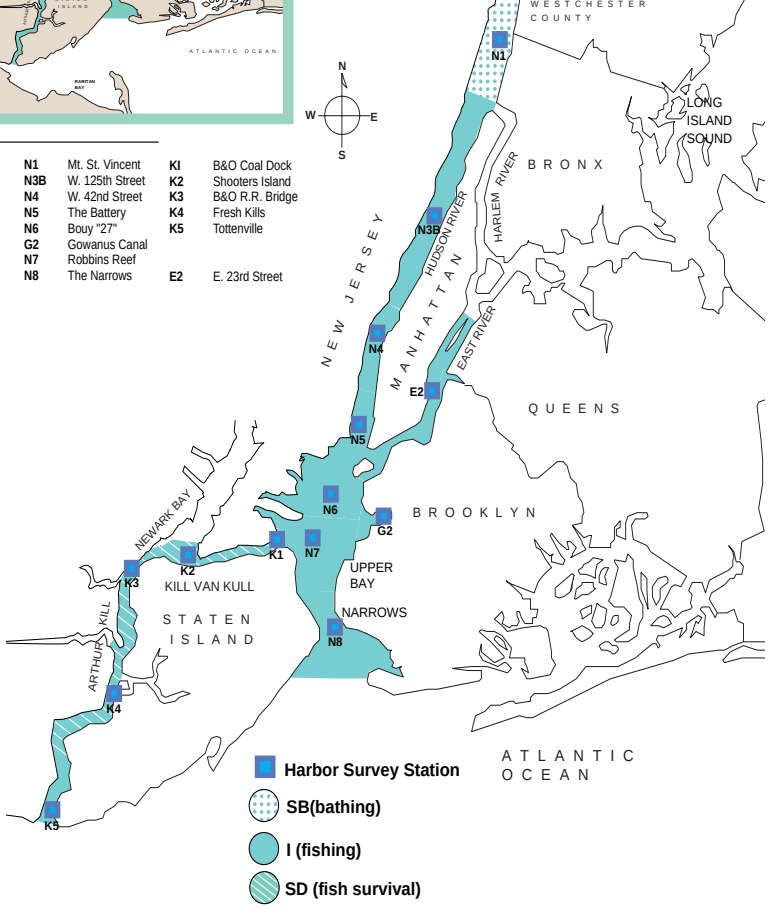
The NYCDEP's Urban Watershed Program has begun to focus on those areas within the harbor that remain impacted. This project will look at 23 waterbodies and their drainage basins and will develop a comprehensive plan for each waterbody to attain its best use classification.

This year's report focuses on the water quality data collected by the NYCDEP during 2001. Data will be presented in four sections, each delineating a geographic region within the Harbor. Four water quality parameters will be used as indicators of water quality. The four parameters are; fecal coliform bacteria, chlorophyll 'a', dissolved oxygen, and Secchi transparency. These parameters and their relevance are explained in a subsequent synopsis. In response to the events of 9/11, the NYCDEP conducted additional monitoring cruises. No observable impacts were measured but samples were given to the US EPA for further analysis.

The Harbor Survey program has modified its sampling program over the last several years. The number of open water stations sampled has been reduced from fifty-three to thirty-three. The statistics presented in this report reflect comparisons with only the current Harbor Survey stations.

Other groups and agencies have contributed to the water quality improvements seen in New York Harbor. Several of these efforts will be presented in a separate section following the discussion of the Harbor Survey data.

INNER HARBOR AREA



The Inner Harbor is defined as the area including: the Hudson River from the NYC- Westchester line, through the Battery to the Verrazano Narrows; the Lower East River to the Battery; and the Kill Van Kull-Arthur Kill system. This area contains 14 Harbor Survey monitoring stations that have been grouped together due to common water uses and functions, as well as similarities in point source loadings. Waters of the Inner Harbor are often continuous, through connecting branches or straits, and cover a large and diverse geographic expanse.

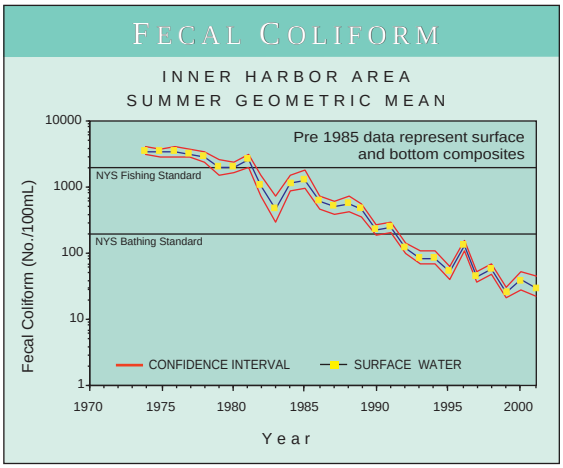
Most of the Inner Harbor Area, excluding the Kills, is classified by NYSDEC as I, for uses such as fishing or boating. The area in the Kills is classified for fish survival only (SD). The Hudson River, from North of the Harlem River to Westchester County is designated for bathing (SB).

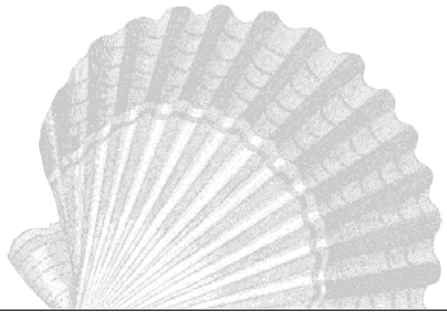
FECAL COLIFORM

All Inner Harbor stations complied with current fecal coliform (FC) standards for the water body they are located in. Thirteen of the fourteen sites had means below 100 cells/100ml. Past data has indicated that the Inner Harbor is prone to short duration episodic degradation following rain events due to additional FC loadings from storm drains and combined sewer overflows (CSOs). While this continues to be true the overall impact has been lessened. This can be seen from the fact that on only a single occasion, at two stations, did the FC levels exceed 2000 cells /100ml.

TRENDS

Fecal coliform levels in the Inner Harbor have dramatically declined over the last three decades. The FC levels averaged over 2000 cells/100ml in the early 70's and have declined to below 100 cell/100ml currently. This improvement has allowed for the opening of Inner Harbor waters for most recreational activities. This improvement has been attributed to the cessation of raw sewage from New York City's Water Pollution Control Plants (WPCPs), the elimination of illegal discharges into the waterbody, and the reduction of CSOs. Year to year variations have become more apparent with the reduction of FC to levels below standards.



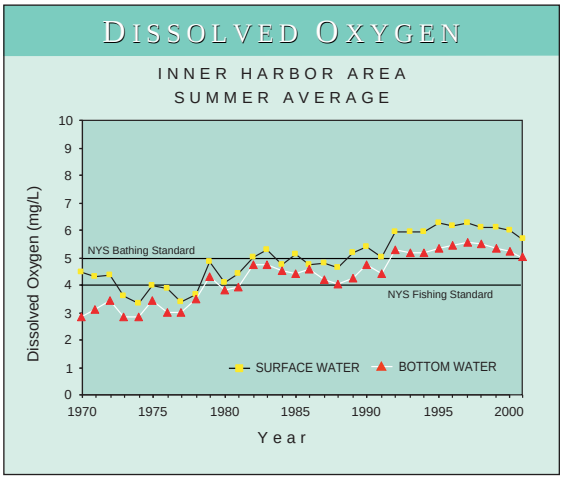


DISSOLVED OXYGEN

Dissolved oxygen (DO) values in the Inner Harbor area declined slightly from 2000. Two stations within the Inner Harbor had average values below the NYSDEC standards for the bottom waters. All surface values were above the standards. Discrete DO measurements failed to comply with NYSDEC standards 8.3% of the time as compared with 5.6% in 2000.

TRENDS

Average summer DO values in the Inner Harbor have risen to levels above NYSDEC standards for primary contact recreation and commercial fisheries. Bottom water values have risen from approximately 3mg/l in 1970 to 5mg/l at present. The mitigation of impacts from the WPCPs and CSOs has shown that swings in DO may be due to the natural phenomenon such as weather.



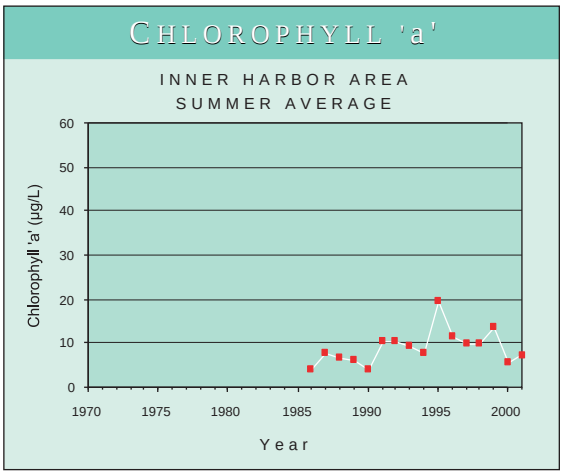
INNER HARBOR AREA

CHLOROPHYLL 'a'

All stations within the Inner Harbor area had average summer chlorophyll values below the 20µg/l level. Twelve of the fourteen stations had levels below 10µg/l.

TRENDS

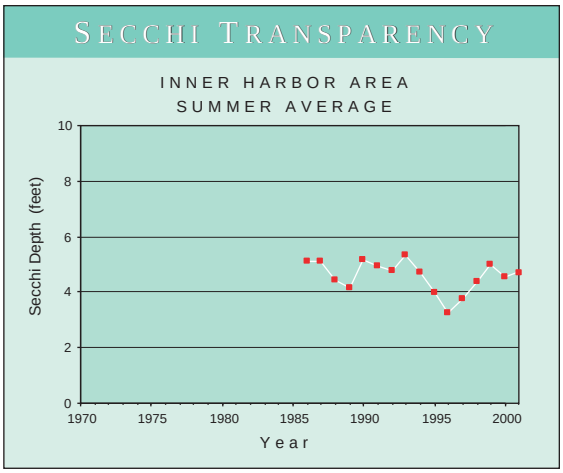
The Inner Harbor shows the least inter-annual variability in chlorophyll concentrations. Levels rarely vary more than a few percent, most likely as a result of higher flushing rates from Hudson River flow. There seems to be a slight overall increase in chlorophyll since 1985 when measurements began.



SECCHI TRANSPARENCY

Secchi depth does not have a criteria or standard in New York Harbor. Lower Secchi depths indicate turbid water that may be light limiting or contain a high biomass of phytoplankton that could indicate future water quality problems.

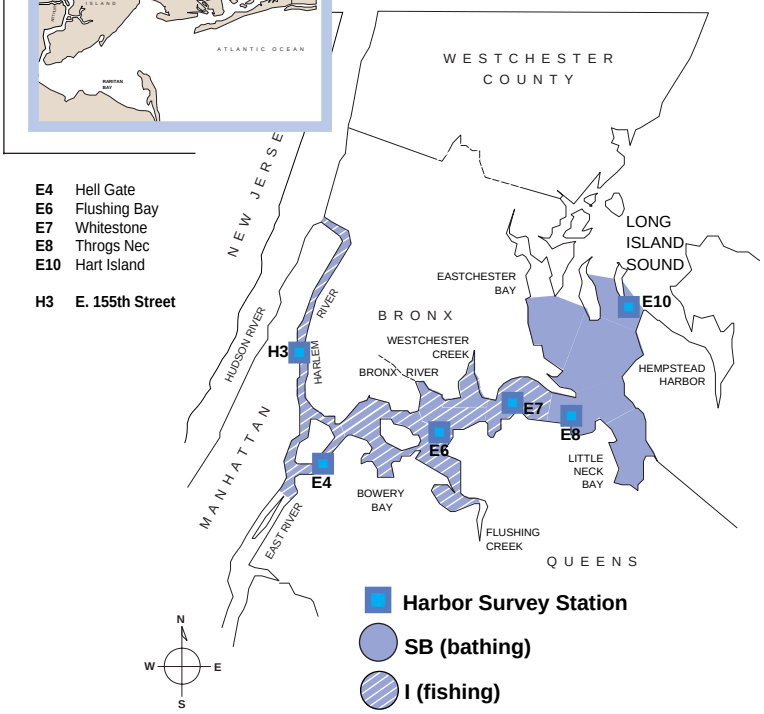
Average Secchi values for 2001 were virtually identical to past years. The average value for stations in the Inner Harbor remained slightly below five feet with a slight increase from 2000.



TRENDS

Secchi values have remained relatively constant in the Inner Harbor since measurements were begun in 1986. There has been only a couple of percent variation over the last 16 years. This can most likely be attributed to the flow from the Hudson River. The Hudson flushes the Inner Harbor rapidly and the dominant signature would be the suspended sediment load in Hudson River water.

UPPER EAST RIVER– WESTERN LONG ISLAND SOUND

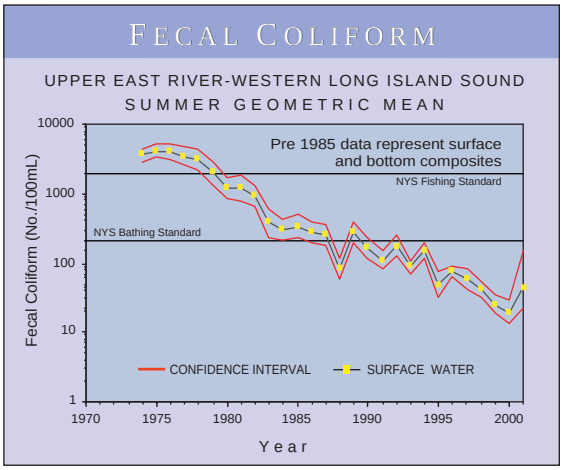


The Upper East River-Western Long Island Sound (UER-WLIS) represents the north-eastern portion of NY Harbor, from Hell Gate in the East River, up into the Western Long Island Sound (WLIS). ***The Harbor Survey Program*** *provides coverage of this area, including the Harlem River and the East River, from Roosevelt Island to Hart Island at the NYC- Westchester County boundary. This area contains 6 Harbor Survey monitoring stations. Waters of this vicinity, though divergent in salinity and depth, share similarities in pollutant loadings and are targeted for intensive management efforts as part of the* ***Long Island Sound National Estuary Program****.*

The majority of the Upper East River-Western Long Island Sound complex is classified as I, for uses such as fishing or boating, with the area east of the Bronx-Whitestone Bridge designated for bathing (SB).

FECAL COLIFORM

The Upper East River/Long Island Sound (LIS) showed a slight increase in FC for 2001. Average fecal coliform levels increased from 19 cells/100 ml to 65 cells/ 100ml. Weather and illegal connection are suspected of causing this upturn. Weather in 2001 was particularly dry and warm, which may have led to conditions favorable for the growth of FC bacteria. Several recently discovered illegal discharges from apartment buildings have been identified bordering the Harlem/Hudson River confluence. These may be contributing to the high levels of FC observed at H3. Corrective action is on-going.

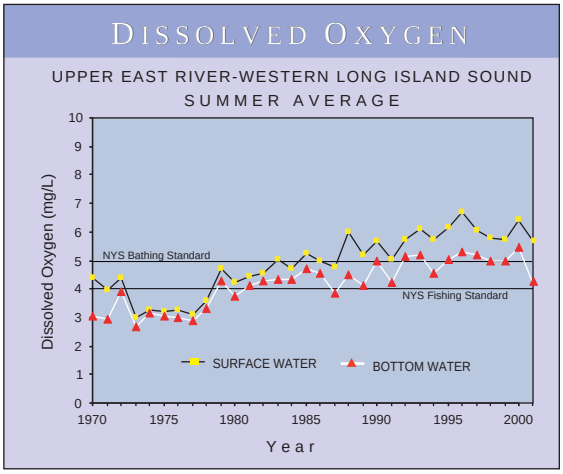


TRENDS

Fecal coliform levels in 2001 reversed the trend that has been observed in the Upper East River/LIS for the past twenty years. While the percent increase was relatively large there were only two instances of FC levels exceeding NYSDEC standards and average values at all stations were well below the standard levels. A similar upturn was observed in 1989, and subsequently continued the downward trend evident for the past two decades.

DISSOLVED OXYGEN

Average summer DO values in the Upper East River/LIS showed a pattern similar to fecal coliform. However, at all stations the surface waters met or exceeded state standards, and only two stations showed average levels below standards in the bottom waters. This is a reduction from the three stations observed in 2000 and each of these stations was above the hypoxia threshold of 3mg/l.



TRENDS

The DO levels in the Upper East River/LIS have increased almost 2 mg/l for surface waters and 1.5 mg/l for bottom waters since 1970. This improvement has resulted in the waters attaining average values that meet the bathing standards for much of the water body in the surface waters. Inter-annual variability as seen from 2000 to 2001 could be the result of the weather patterns.

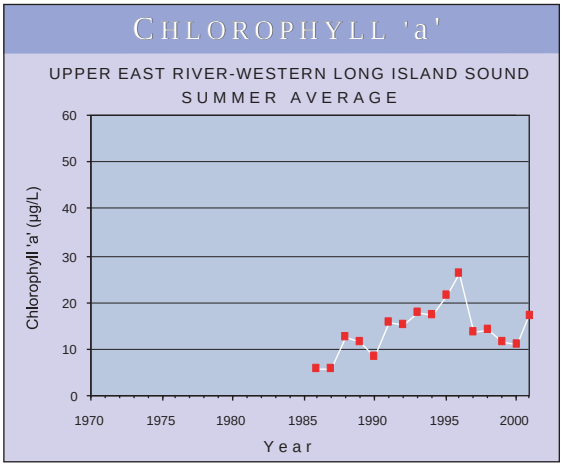
UPPER EAST RIVER–WESTERN LONG ISLAND SOUND

CHLOROPHYLL 'a'

Chlorophyll concentrations for the Upper East River/LIS also exhibited a pattern similar to that of FC and DO. The summer average value for all stations was 17.4µg/l, and three stations had average values higher than the 20µg/ level used by the NYCDEP to indicate eutrophic conditions.

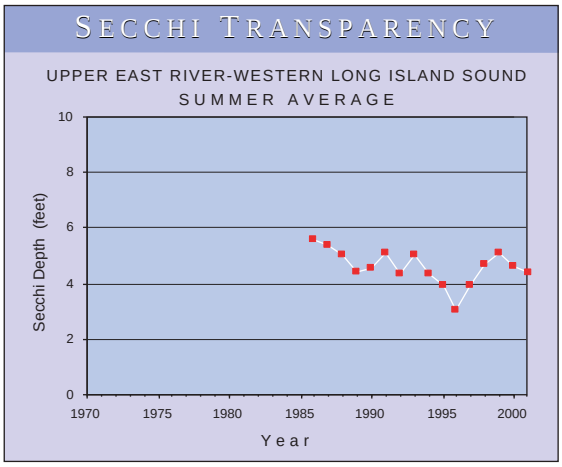
TRENDS

Chlorophyll values in 2001 reversed a trend that had been evident since the sharp decrease in values in 1997. A comprehensive plan is being developed to reduce nutrient discharges into the Upper East River/LIS. Elements of this plan include upgrading of all UER treatment plants and the development of Total Maximum Daily Loads (TMDLs) for the waterbody. This plan should be completed by 2014. This should reduce the amount of nutrients available for algal growth and continue the downward trend observed in past years. More information on the nitrogen plan for NY harbor is available at the NYCDEP website www.nyc.gov/html/dep/html/nitrogen.html.



SECCHI TRANSPARENCY

Average Secchi values for the Upper East River/LIS showed a slight decrease (4.6 ft to 4.4 ft) from 2000 sampling. This would be expected with higher chlorophyll levels indicating that there were more particles in the water column thus reducing the Secchi depth.

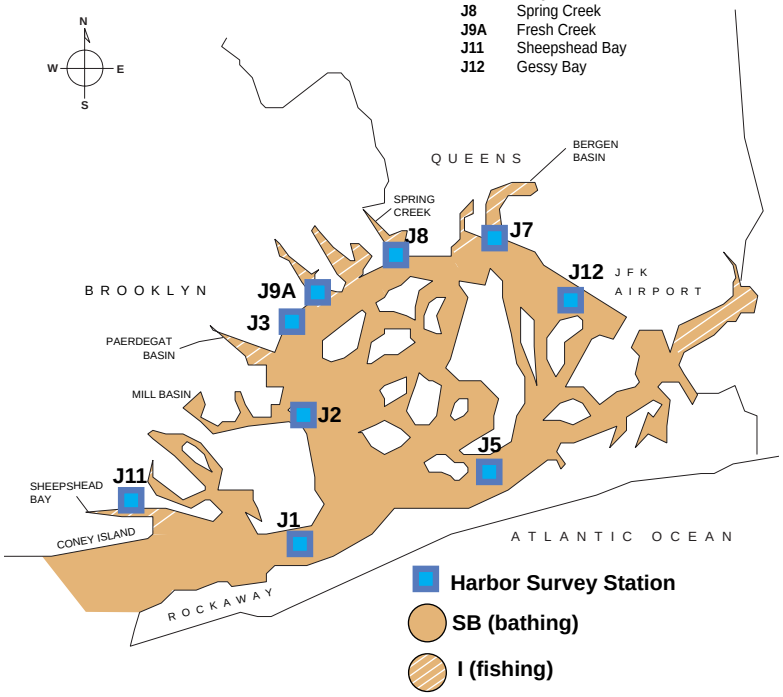


TRENDS

Average Secchi depth has varied between 4 and 5 feet since measurements began in 1986. An increasing trend begun in the late 1990's was reversed in 2000 and continued into 2001. Secchi depths correlate very well with chlorophyll values. An increase in the average chlorophyll for the region generally indicates a corresponding decrease in the Secchi depth.

JAMAICA BAY

J1	Rockaway Inlet
J2	Mill Basin
J3	Canarsie Pier
J5	Railroad Trestle
J7	Bergen Basin
J8	Spring Creek
J9A	Fresh Creek
J11	Sheepshead Bay
J12	Gessy Bay



Jamaica Bay is located at the southwestern end of Long Island. This urban, estuarine embayment and national park consists primarily of tidal wetlands, upland areas, and open waters. The Bay and its drainage area are almost entirely within the boroughs of Brooklyn and Queens, except for a small area at the eastern end that is in Nassau County. Jamaica Bay joins the New York Harbor to the west, via the Rockaway Inlet at the tip of Breezy Point and includes the Rockaway Peninsula, which forms the southern limit of the Bay and separates it from the Atlantic Ocean. This estuarine water body, consisting of approximately 20 square miles of open water, is covered by 9 Harbor Survey monitoring stations.

Open waters of Jamaica Bay are classified for bathing or other recreational use (SB). Areas within the Bay's tributaries and dead-end canals are prone to reduced water quality due to direct surface runoff and poor flushing. These areas are designated for secondary contact use (I), such as fishing or boating.

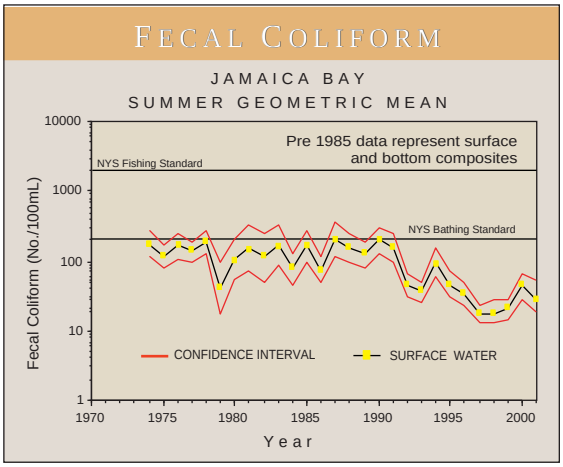
FECAL COLIFORM

Eight of nine stations in Jamaica Bay had average summer fecal coliform values well below the bathing standard set by the NYSDEC. The one exception is located in Sheepshead Bay, that experiences a localized impact. The cause of this is under investigation, but vessel traffic is suspected. The average summer value at that station (J11), while above the NYSDEC standard (SB) that the rest of Jamaica Bay is classified under, is well below the 2000 cells/ 100ml (NYSDEC class I) that the waterbody it is located in, is subject to.

Wet weather conditions have traditionally caused short term localized degradation of water quality in the northern portion (Mill Basin to Bergen Basin) Jamaica Bay. During these events, much of the northern portion of the Bay will have individual values above the 200 cells/100ml standard. These events are short in duration and typically return to base conditions during the next dry weather sampling event.

TRENDS

Fecal coliform in Jamaica Bay has shown a slight increase during the last two years after stabilizing for three years. The trend is slight and the average values are still well below water body standards. Weather related events may have accounted for this increase. The NYCDEP is in the process of constructing CSO storage tanks and upgrading its treatment facilities, which should further mitigate any impact from these sources into the Bay.



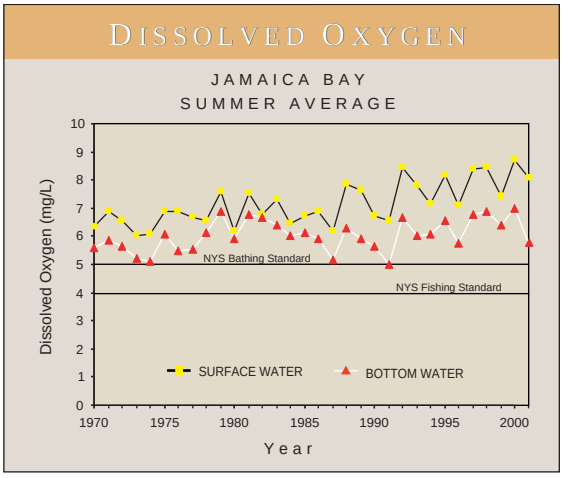
DISSOLVED OXYGEN

All stations in Jamaica Bay had average surface concentrations higher than the 5mg/l standard. Two stations (J7, J12) had average values slightly below the standard. J12 is a new station located in a deep area of Grassy Bay that would be expected to exhibit lower levels because of summer stratification that occurs in this portion of Jamaica Bay.

This stratification is “normal” considering the bathymetry of the area. Grassy Bay was created by dredging to create JFK runways. The resulting depression allows water to become isolated and stratify during the summer months. When this occurs, there is little or no turnover of water from the surface and biological activity depletes any oxygen in the water. Unless a major storm event or other mixing occurs, the water may remain oxygen depleted for several months.

TRENDS

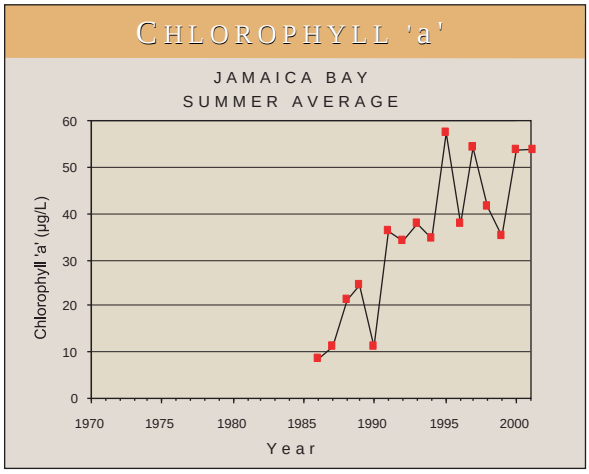
DO concentrations in Jamaica Bay have shown steady improvement since 1970, with recent levels often above 8mg/l. Average surface values have traditionally been high in the Bay, the most probable cause being the large algal blooms that regularly occur in the Bay.



JAMAICA BAY

CHLOROPHYLL 'a'

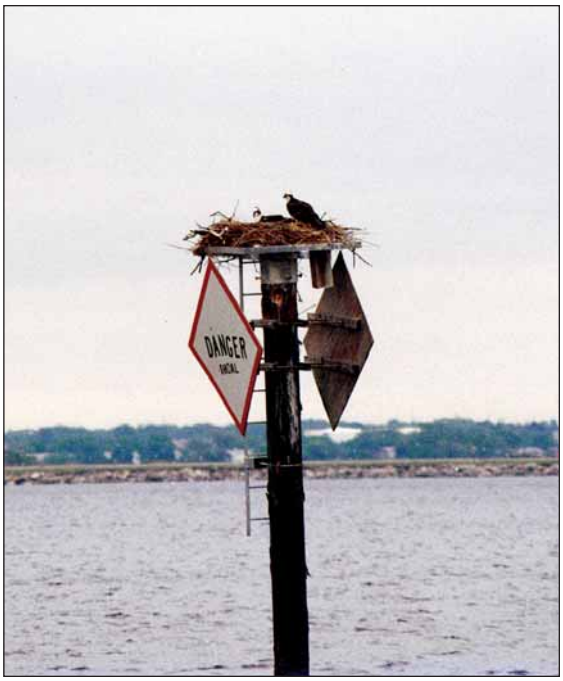
High chlorophyll concentrations in Jamaica Bay are common during the summer. The Bay traditionally has the highest chlorophyll levels found in New York Harbor. The average value for the Bay was greater than 50µg/l during 2001. These values indicate eutrophic conditions that have existed in the bay for some time.



TRENDS

Chlorophyll levels have increased 81% since 1986, with recent years showing wide inter-annual variations. Levels seemed to have peaked in 1995 and chlorophyll levels actually exhibited a slight (4%) decrease for 2001. Complaints of nuisance algal blooms and fish kills were also substantially reduced in 2001. Weather or a reduction in the input of nutrients to the bay may account for this reduction. The NYCDEP is currently upgrading its treatment facilities with biological nutrient reduction (BNR), which will further reduce nutrient inputs into the Bay.

The NYCDEP has recently initiated the Urban Watershed Program to develop comprehensive plans for each water body to enable it to attain its best use. The National Parks Service (NPS) has formed a blue ribbon panel to investigate the loss of wetlands within the Bay consisting of federal, state and local agencies, scientists and concerned citizens.

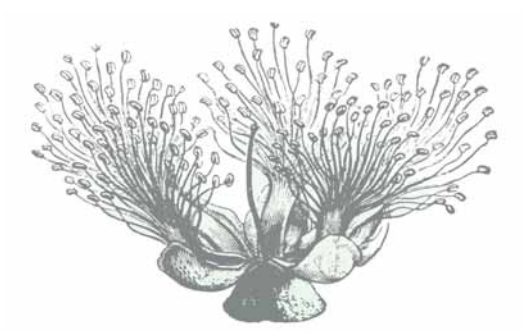


SECCHI TRANSPARENCY

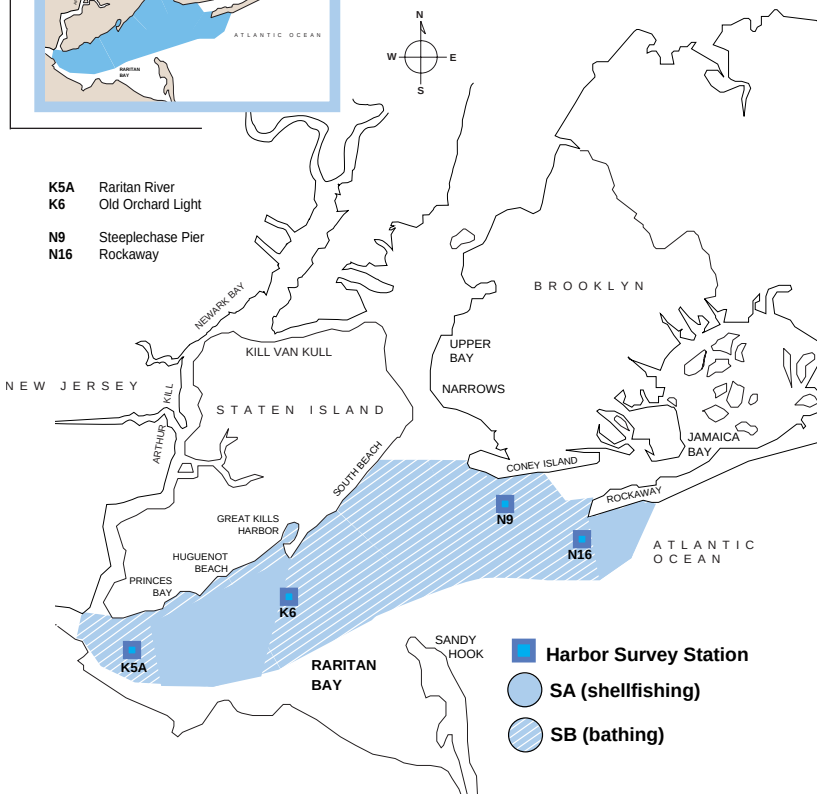
Average Secchi transparency showed a reduction from 2000 levels. The Summer average declined to 3.6 feet from 4.4 in 2000, a decrease of 22%. This decline was not reflected in an increase of chlorophyll in the Bay, as was the case in other areas of the Harbor. This indicates that phytoplankton were most likely not responsible for this decline. All sites within the Bay showed average values between three and four feet.

TRENDS

Annual Secchi averages had remained fairly constant since the mid-1990's. The decrease in 2001 is not as precipitous as the one in 1993, but is significant. One possible explanation could be the increased rate of marshland decline. As the wetlands break up more sediment is released into the water column and, combined with the slow flushing rate in the Bay, could result in an increase in the suspended solids load. Further study by the DEP and the NPS Blue Ribbon Panel is underway.



LOWER NEW YORK BAY–RARITAN BAY



*The Lower NY Bay-Raritan Bay (LNYB-RB) vicinity represents the most oceanic portion of the **Harbor Survey Program**. This area of 100 square miles is represented by 4 Harbor Survey monitoring stations and is composed mostly of open shallow waters, partially confined by Brooklyn's Coney Island to the north, Staten Island to the northwest, and New Jersey's Middlesex and Monmouth Counties and Sandy Hook to the south. The remainder of its eastern boundary is open to Rockaway Inlet and the greater Atlantic Ocean.*

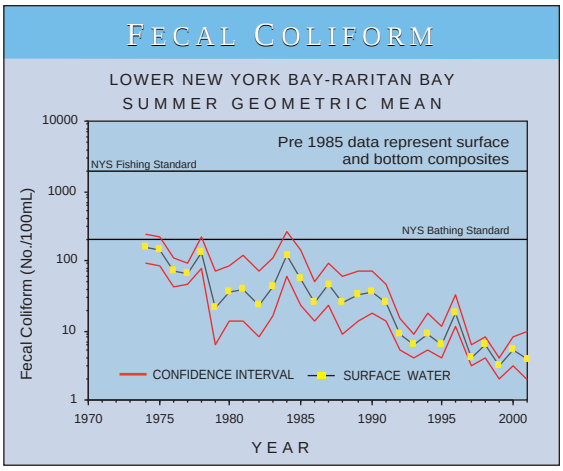
This area of the Harbor is classified for bathing and other recreational use (SB). Portions of those waters are also designated for the permitted use of shellfishing (for relay to cleaner waters, but not direct consumption), having a stricter use classification of SA.

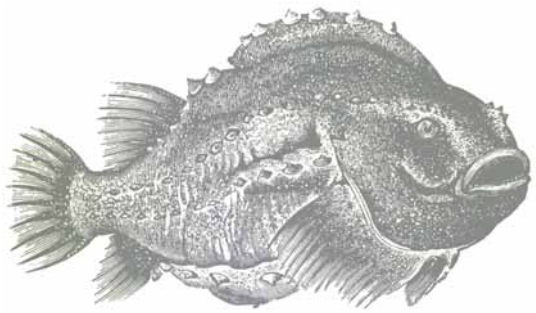
FECAL COLIFORM

Fecal coliform levels in the Lower Bay/Raritan area surpassed NYS standards and all stations had average summer values below 20 cells/100ml. Only one sample taken over the summer showed a level above 200 cells/100ml.

TRENDS

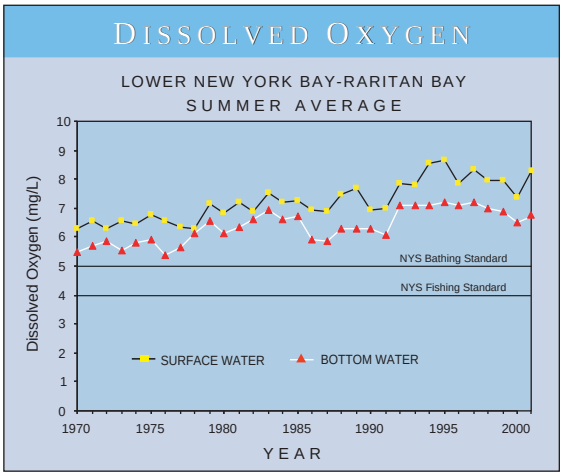
The Lower New York Bay/Raritan area has seen an order of magnitude drop in fecal coliform concentrations since 1974. Since 1997, the trend has flattened out at approximately an average 5 cells/100ml. That trend continued in 2001, which showed a summer average of 6 cells/100ml. Shellfishing beds in Raritan Bay, which were opened as a result of these water quality improvements, remained unaffected by any problems in 2001.





DISSOLVED OXYGEN

Average DO concentrations met NYS bathing standards for all sites in both surface and bottom waters for the Lower New York Bay/Raritan. Actual DO samples were below the standard on only 8 occasions out of 66 samples during 2001.



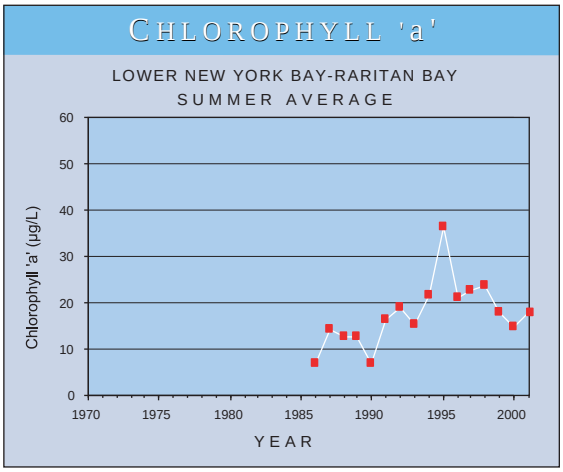
TRENDS

Concentrations of DO in the Lower Bay have remained above NYS standards since 1970. Recent levels seem to have steadied at approximately 8mg/l for surface waters and 6 mg/l for bottom waters.

LOWER NEW YORK BAY–RARITAN BAY

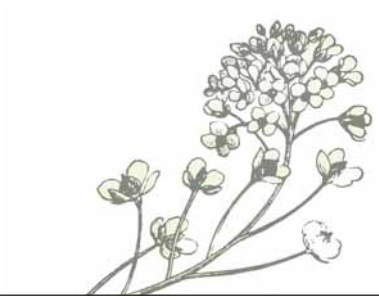
CHLOROPHYLL 'a'

Average chlorophyll concentration for the Lower Bay was almost 18µg/l. This level is typical of levels seen during recent years. The relatively shallow waters of Raritan Bay combined with the nutrient input from the Upper Bay and East River provide an ideal environment for phytoplankton blooms to occur. These blooms are not as intense or as extensive as those in Jamaica Bay because of the greater flushing within the Lower Bay.



TRENDS

Following a large peak in 1995 and the subsequent drop in 1996, chlorophyll values have remained relatively stable in the Lower Bay. The recent three year decline was reversed in 2001, with an increase in average chlorophyll of 16% in the Lower Bay.

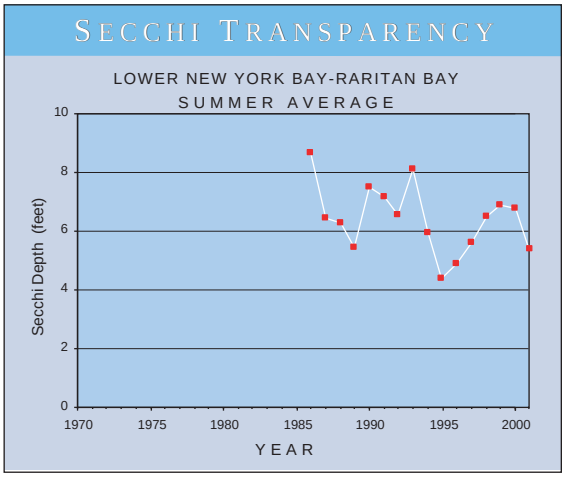


SECCHI TRANSPARENCY

Secchi depths in the Lower Bay show large variability up to 1995. Secchi depths then began a steadily increasing trend until 1999, leveling off in 2000 at approximately seven feet. Average Secchi depths at all stations in the Lower Bay remained above 5 feet for 2001.

TRENDS

2001 saw a Secchi depths decline similar to those in Jamaica Bay. The Lower Bay, however, showed a slight increase in chlorophyll concentration that could account for some of this decline. Another likely cause is the weather. Dryer weather during 2001 most likely caused a reduced flow in the Hudson River. The sediment load would have remained approximately the same as previous years, and this would result in a higher net concentration of solids in the waters of the Lower Bay.



SUMMARY OF NYCDEP POLLUTION CONTROL PROGRAMS

INTRODUCTION

Although water pollution control has been a concern in NY Harbor since the late 1800's, a massive waste-water treatment plant construction did not begin in the City until 1931, which was accelerated in the 1970's with Clean Water Act (CWA). In 1985 and 1986, the last of 14 treatment plants, North River and Red Hook, went into operation. As startling as it may now seem, until North River went on line, sewage from the entire west side of Manhattan, north of Canal Street, went into the Hudson River untreated!

Today, North River treats 125 MG daily and the 14 plants treat a total of 1.2 billion gallons per day of wastewater. It is important to understand that municipal wastewater treatment systems were originally designed to treat organic material and bacteria during dry weather. During wet weather, the system (sewers & plants) was designed to overflow to local waterways without treatment; commonly called combined sewer overflows (CSO). Furthermore, the plants are not designed to treat metals, other toxics or grease and oil. Toxics that entered the sewers ended-up in either bio-solids, plant effluent or as air emissions without reduction. Neither were the plants designed to treat nitrogen; a nutrient in residential sanitary sewage. These factors (control of toxics and grease, treatment of wet weather flow and nutrients) remain a continuing challenge to improving environmental quality in NYC.

Wastewater treatment program managers are constantly striving to do more with existing resources. For instance, the pollution prevention control program has expanded from 1,000 regulated firms to 30,000 regulated firms over the last 12 years, without an increase in staff.

During that time, metals in wastewater have dropped from 7800 to 2800 pounds per day, city-wide. In fact, heavy industry now accounts for less than 1% of metals in raw sewage, city-wide. Accordingly, DEP strives to shift our resources to other problem areas including control of PCB's, mercury, and other toxicants of concern; as well as quality of life issues related to grease, e.g. sewer backups. New DEP regulations are developed jointly with our Citizens Advisory Committee (CAC), which has been in place for over 10 years.

Treatment plant operations programs have also expanded dramatically over the last 10 years. The practice of Ocean Dumping of sludge was banned in 1992. This required construction of eight sludge dewatering facilities at a cost of about $1 billion and the development of a land based biosolids program. Nearly 200 staff were required to operate this program. Virtually all were drawn from the operations and maintenance staff of existing plants. At about the same time, the plants began treatment of wet-weather flow through
a series of Best Management Practices which have largely been adopted as the standard by EPA for all communities with CSO's. Last but not least, in 1996, our state permits were expanded to require Biological Nitrogen Removal (BNR).

As a direct result of Bureau of Wastewater Treatment (BWT) programs, there is overwhelming evidence that New York Harbor's environment is cleaner and the water quality better than at any time since the early 1900's. All public beaches have been open since 1992. Wet weather beach advisories have been lifted at all but three of these beaches. Priority pollutants are in decline in sediment and bottom dwelling creatures have recovered. Shore birds have returned to breed in several areas of the harbor. Fish advisories and shellfish restrictions have been relaxed.

During these next 10 years, DEP anticipates a further need to do more with existing resources or with modest increases at best. This challenge results from several developing programs including:

- more stringent effluent limits at 8 plants due to nutrient restrictions, which are being addressed by retrofitting the plants for Biological Nutrient Removal (BNR) processes;
- operation & maintenance (O & M) of several new wet weather treatment facilities, to be built at cost of more than $1 billion under the CSO program;

- plant upgrades, mentioned above, that will modernize these facilities but also add, significant O & M needs for the additional equipment and for the odor control systems; and
- trackdown and control of toxicants of concern including mercury, PCB's and various solvents (VOC's) involving potentially thousands of NYC commercial or industrial firms; using innovative regulatory approaches to minimize impact on the regulated community and DEP resources.

WATER POLLUTION CONTROL PLANTS

The challenges the BWT faces in the next 10 years are still evolving and will further improve harbor water quality. However, it is essential that the existing plants continue to meet existing State permits requirements thus retaining recent water quality improvements throughout the Harbor which provide a "platform" for additional improvements. Many of the plants operate with aged and obsolete equipment and will be upgraded because equipment is worn out and stringent treatment requirements dictate improvements.

DEP owns and operates 14 sewage treatment plants within the City. All but one, the Newtown Creek Plant in Brooklyn, have been upgraded or built to provide full secondary treatment of sewage in accordance with the applicable State and Federal regulations. An interim upgrade is underway at Newtown Creek to keep the plant operating efficiently while the long-term plan to achieve full secondary treatment is developed. Construction of the interim upgrade began in 1994 and will continue until Calendar 2003. The interim upgrade includes measures to reduce odor and air emissions and tests of pollutant removal efficiencies. Final upgrade construction began in Calendar 1998 and operation will commence in 2007. Upon completion of the final upgrade, the Newtown Creek Plant will provide full secondary treatment.

In addition, the following plants are either in the facility planning, design or construction phase of capital projects: Wards Island in Manhattan; Tallman Island, Jamaica Bay and Bowery Bay, in Queens; Hunts Point in the Bronx; and 26th Ward in Brooklyn. The upgrade of these facilities, which includes equipment replacement and the installation of additional controls, will improve performance and reliability. As part of the upgrade, the nitrogen removal capability at these plants will be improved. Hunts Point, Tallman Island, and 26th Ward are in the design phase, and the remaining plants are in design and construction phases. In Fiscal 2002, DEP began the facility planning stage for the Staten Island Treatment Plants (Port Richmond and Oakwood Beach) and the Rockaway Treatment Plant in Queens. In addition the DEP is installing a computerized maintenance management system throughout its facilities to allow more efficient deployment of staff; saving limited resources and improving plant reliability.

SHORELINE SURVEY/SENTINEL MONITORING PROGRAMS

DEP initiated a program to investigate and eliminate the dry weather discharge of raw sewage into New York Harbor in 1988. This program originally involved a detailed evaluation of the entire 425 miles of shoreline within the City. DEP personnel examined over 3,000 outfalls for dry weather discharges and conducted sampling of those found to be discharging. The initial survey found over 3 million gallons per day of raw sewage discharging into the harbor waters during dry weather. To date, DEP has abated 96% of these discharges and continues to work to abate those remaining through capital construction of new sewers and enforcement actions to correct illegal connections to storm sewers.

While the initial shoreline survey was extremely effective in identifying and abating dry weather discharges, it reached a point of diminishing returns. DEP thus modified its program by the establishment of the Sentinel Monitoring Program that operates in conjunction with the Shoreline Survey Program. The Sentinel Monitoring Program established 80 stations within NY harbor and its tributaries. DEP sampled all 80 stations to establish a Fecal Coliform ambient baseline. DEP samples each station on a quarterly basis and compares these results with the baseline fecal coliform readings. Exceedances trigger a mini shoreline survey to determine the source of the exceedance. This new system has proved successful in identifying new dry weather discharges and in also effectively maximizing the productivity of DEP staff resources. DEP recently relocated a number of its Sentinel Stations to further enhance the reliability of this program.

TELEMETRY

Installation of telemetry at 91 City pumping stations since 1998 has improved monitoring and communications between these facilities and NYCDEP operators. This system enables NYCDEP personnel to view from computers historical or real-time data for all connected pump stations. Automatic alarms for a dozen critical values notify shift engineers as to condition changes, including: force main pressure, wet and dry well liquid level, electric power supply, pump operation, and sluice gate position. In its third year of operation, this program has already succeeded in reducing dry weather bypasses by enabling NYCDEP personnel to respond more quickly to malfunctions, breakdowns, or other system disruptions. Currently telemetry is being installed at 102 regulators to further improve monitoring of the system and reduce potential bypassing.

ENHANCED BEACH PROTECTION PROGRAM

As a response to a series of collection facilities failures and beach closures in June of 1997, on July 2, 1997, the DEP instituted an annual Enhanced Beach Protection Program (EBPP) to implement increased levels of surveillance and improved corrective maintenance procedures for critical pumping stations and regulations.

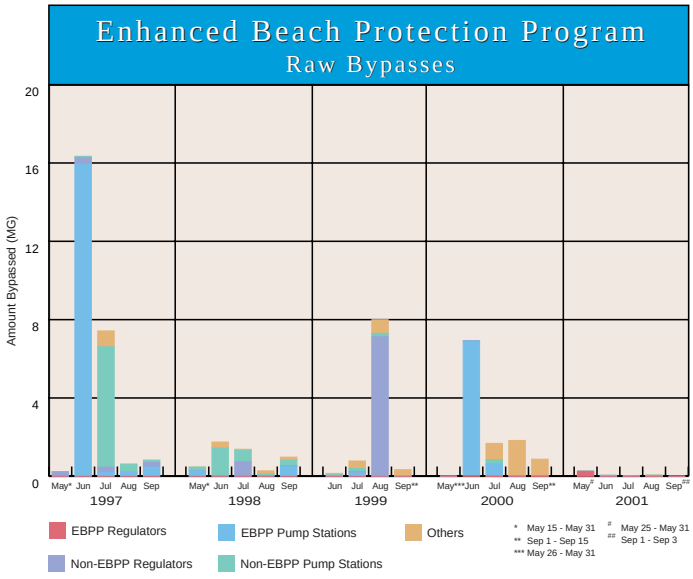
For 2001, the new program's goals included: 1) an average bypass response time of eight hours versus 24 hours previously, 2) starting the program on May 25th, prior to the beginning of the bathing season, 3) monitoring additional beach sensitive that have been identified as high maintenance facilities, 4) increasing the frequency and locations monitored through the use of Harbor Marine Programs, and 5) using telemetry to monitor virtually all pumping stations.

As a result of the EBPP, the total amount of raw sewage bypassed during dry weather from all pump stations and regulators during the 2001 season was less than 0.0002% of total dry weather flow treated at the fourteen WPCPs during that period. This represents a 97% decrease from the previous year. See figure.

There were no public beach closures due to Collection Facilities bypasses during the 2001 EBPP.

INCREASED WET WEATHER CAPTURE

During Fiscal 2001, DEP continued the program to control CSO. In wet weather, the City's sewer system receives rainwater drained from streets. The rainwater combines with the sanitary wastewater from homes and businesses that is carried in the same system of pipes. During heavy rainfalls, part of this combined flow is directed to City treatment plants, and the remainder is discharged into the surrounding waters as CSOs. The City has gradually increased its capture of the mixture of



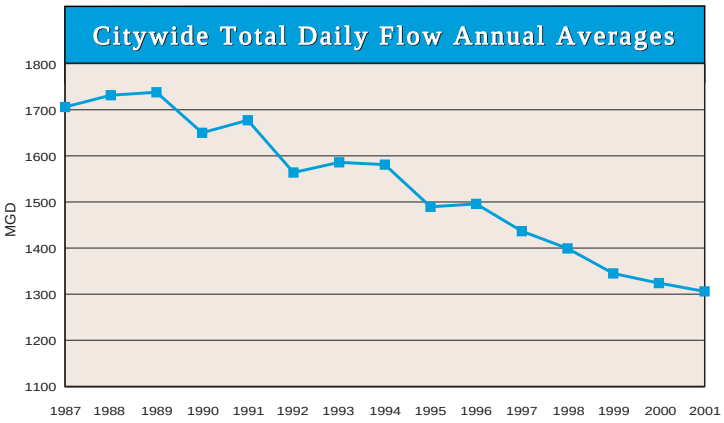
rainwater and sanitary sewage that flows through the combined sewer system during wet weather. In 1987, the City captured and treated only 18 percent of the wet water flow. By Calendar 2001, the City captured and treated 62 percent of the wet weather flow. Water conservation has also increased capacity for Combined Sewer Overflow (CSO) capture at the plants.

WATER CONSERVATION

Since 1992, dry weather flow at all 14 treatment plants has dropped over 250 MGD. Most of this reduction is due to water conservation. This phenomenal success story is the result of a comprehensive program that includes water metering, leak detection, toilet rebates, residential water survey, commercial audits and a host of education efforts.

During FY2001, the department performed 42,635 residential water surveys and 21,289 water saving kits were distributed. More than 94% of accounts had been metered by the end of 2001. Of the remaining unmetered accounts approximately 25,000 have been surcharged for failing to take appropriate steps to have a meter installed; the remainder have active work orders in queues with DEP contractors for meter installations. The total number of water/sewer bills that are estimated has dropped steadily, from approximately 42 percent at the end of Fiscal 1996, to 15 percent by the end of Fiscal 2001.

DEP continued its privatized meter reading program in Staten Island and the Bronx during Fiscal 2001, saving approximately $480,000 annually. The Department awarded a contract in August 2001 to Con Edison who now does all 5 boroughs. In conjunction with the meter installations, NYC Housing Authority will incorporate an automated meter reading system into its water meters to establish a new, comprehensive database for billing and auditing water consumption of all its developments.



Data through to November 2001.

FLOATABLES CONTROL

Floatables consist primarily of manmade debris that floats on or below the water surface. They contribute to several problems in the region including beach closings, interference with navigation, entanglement of wildlife, and aesthetic impairments. Excluding pier debris, approximately 95% of floatables in the Harbor have been estimated to originate from street litter conveyed via combined sewers and storm sewers.

To better control and capture floatables, NYCDEP began an interim Boom and Skim Program in 1993. This program currently consists of 22 containment booms and 2 netting systems placed at key tributary locations and four skimmer vessels. For calendar year 2001, this program collected some 583 yd^3 of floatable trash. NYCDEP's custom-built, open water vessel, the HSV CORMORANT collected 224 tons in 2001. Approximately 40 tons were plastics, metal, rubber, and other trash.

Catch basins that transport street runoff to combined or storm sewers serve as a major conduit for street litter to Harbor waters and local beaches. The placement of a hood on a catch basin outlet pipe can serve as a baffle, preventing floatable debris from entering the sewer system. Efficiency tests have shown hooded basins to substantially reduce the number of floatable items

discharged by an average of 72% (Grey and Oliveri, 1998). As part of its long-term strategy to control floatables, NYCDEP initiated a citywide Catch Basin Program in 1996. This program inspected, cleaned, (and where necessary) replaced hoods on approximately 125,000 City catch basins by the end of 1999. Another 12,000 basins (for which hoods could not originally be placed) are being considered for reconstruction or modified hood placement. Placement of hoods and re-inspection and cleaning of catch basins continue to prevent street litter from ending up as 'floatables.'

ABATEMENT OF COMBINED SEWER OVERFLOWS

As part of a multi-year Citywide CSO Abatement Program, the City has committed $1.5 billion for construction of CSO abatement facilities over the period 1998-2008. Water quality studies have been used to determine where and to what extent capture and treatment of CSOs are necessary to meet New York State Department of Environmental Conservation (DEC) water quality standards. In Fiscal 2001, DEP continued construction of a 28.4 million-gallon underground CSO storage tank facility beneath Flushing Meadow-Corona Park in Queens. The CSO storage tank will abate combined sewer discharge into Flushing Bay. As part of the last phase of the project, DEP bid a contract to complete tank construction and equip the CSO facility in Fiscal 2001. The award of the contact was delayed due to an increase in the scope of work at the facility. Work is expected to begin in Fiscal 2002.

The design of an underground tank that will abate CSO into the Paerdegat Basin in Brooklyn, a tributary of Jamaica Bay, is also underway. DEP has completed construction of influent channel structures. In Fiscal 2002, DEP will advertise and bid out a contract for the foundation and substructure of the underground tank.

More immediate steps to reduce CSO impacts have also been achieved through full implementation of the US Environmental Protection Agency (EPA) recommended Nine Minimum Controls (NMCs). Some elements of the NMCs implemented over the past ten years are described below.

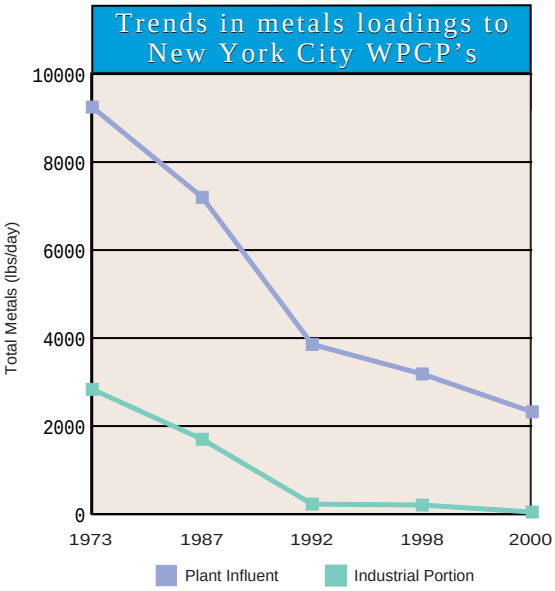
STORM WATER PROGRAM

To estimate City storm water loadings, NYCDEP is completing a characterization of storm water runoff from five different land use locations, including: highways, commercial areas, heavy industrial zones, and high and low density residential areas. As part of this effort, an inventory of industrial and waste handling facilities that discharge to the municipal separate storm system was compiled to better regulate these entities. Storm water provisions have now been incorporated into discharge permits or directives for industrial pretreatment firms. The effectiveness of the storm water program, now mandated through the City's State Pollutant Discharge Elimination System (SPDES) permits, in terms of the expected reduction of pollutant loadings, is now being evaluated. Other planned initiatives under the Storm Water Program include: control of construction and contaminated site runoff, assessment of the effectiveness of a Spill Response/Slug Control Program, enforcement against improper disposal of spent vehicle fluids, and the implementation of a program to control release of specific toxicants from non-industrial pretreatment firms that discharge to the municipal sewer system.

THE INDUSTRIAL PRETREATMENT PROGRAM

DEP is the federally authorized Control Authority for the Industrial Pretreatment Program (IPP) within the City of New York. DEP received its Control Authority status in March 1987. The IPP was mandated by the Clean Water Act to apply uniform wastewater discharge limits for heavy metals, organic and inorganic chemicals, and other toxic components from industrial sources.

DEP currently regulates 551 facilities that discharge into its sewer system. The industries regulated include, electroplating, metal finishing, organic chemical, plasters and synthetic fibers, pharmaceuticals, centralized waste treatment, inorganic chemical, drum recycling, and paint and ink manufacturing. The industrial facilities are issued permits, and must conduct periodic wastewater testing and reporting to DEP to certify compliance with applicable discharge limits. Additionally, DEP staff conducts periodic, unannounced inspections and sampling of these facilities.



NOTE: The metals are: Ag, As, Cd, Cr, Cu, Hg, Pb, Ni, Zn

The IPP has successfully addressed the discharge of heavy metals from industry into the sewer system as indicated in the graph above. Total metals discharges have been reduced from over 9,000 pounds per day to less than 2,900 pounds per day. Moreover, industrial metals' discharges have been reduced from over 2,800 pounds per day to less than 40 pounds per day. The ongoing program is geared to maintain the success in the metals discharge arena and reallocate resources to the other toxic discharges as discussed in more detail below.

POLLUTION PREVENTION - CITIZENS ADVISORY COMMITTEE

DEP has utilized a Citizens Advisory Committee (CAC) for its pretreatment program since March 1989 and its biosolids program since the end of ocean dumping in the early 1990's. As the interests of the two overlap, these two CAC's were recently combined to form the Pollution Prevention CAC. The CAC is composed of private citizens, environmental organizations, members of Academia, and industry stakeholders. Its meetings are also attended by local officials and other governmental agencies.

The CAC meets every other month (except in the summer) to address issues concerning the DEP's wastewater management programs. The CAC motto is **"Pro-Business-Anti-Pollution"**. The CAC encourages and assists DEP in implementing environmentally sound public policy involving acceptable and economically feasible short and long term programs. The CAC is currently focusing its efforts on the toxic pollutant trackdown of PCB's and mercury.

PERSISTENT POLLUTANT TRACKDOWN

DEP is continually adapting its wastewater environmental programs to address new issues of concern. Some of the current projects in progress under the Persistent Pollution Trackdown program, include the trackdown of the sources of PCB's, PAH's, mercury, and other organic compounds. DEP has worked hand in hand with the NYSDEC on the PCB trackdown program for a number of years. This fiscal year the program hit pay dirt with the identification of a major, previously unknown, source of PCB's into the sewer system and NY Harbor. A large pigment manufacturing plant, Sun Chemical, was found to be discharging PCB's, an unintended by-product, in its wastewater discharge from a certain type of pigments it manufactures. This facility entered into a Consent Order with DEP and has completed the process of phasing out all production of this specific pigment line by April 1, 2002. The facility will also conduct a plant cleanup and followup testing under DEP oversight. DEP continues to work with NYSDEC to identify other sources of PCB's within the city.

MERCURY

Mercury concentration limitations in the ambient waters of the harbor are currently exceeded. In order to address this issue, DEP is working with the New York Academy of Science on its study of sources of mercury in the harbor. The report "Pollution Prevention and Management Strategies for Mercury in the NY/NJ Harbor" is expected to be finalized in the coming months. Based on preliminary drafts of this report, wastewater effluent is a significant source of the mercury in the harbor. Additionally, a major mercury impact to the sewer system appears to be from dental facilities. As a first step, DEP is conducting further sampling of dental facilities to confirm this conclusion. At this time, it is anticipated that DEP will be proposing a Best

Management Practice regulation to control the mercury discharges from dental facilities into the sewer system. The Academy study also indicates that hospitals and laboratories are sources of mercury. These sources will subsequently be investigated and addressed.

DRY CLEANERS - PERC

Perchloroethelyne (PERC) is a widely used dry-cleaning solvent. PERC is also found in the water of the New York Harbor in excess of ambient water quality standards. DEP has initiated its PERC Dry Cleaner program to address the issue. In 1998, DEP amended its sewer use regulations to require dry cleaners to implement a best management program to limit PERC discharges into the sewer system. DEP is actively inspecting over 1,500 dry cleaners throughout the city and issuing Notices of Violations to those who continue to discharge PERC into the sewer system in violation of regulatory limitations.

GREASE ENFORCEMENT

The illegal discharge of grease into the sewer system by restaurants and other food related establishments is a leading cause of sewer backups within New York City (see photos). Through a reallocation of resources and by implementing program efficiencies, DEP has initiated a program to address grease discharges from the over 21,000 restaurants. The Grease Response Education and Strategic Enforcement Program approach the problem with a combination of educational materials, including foreign language materials, which are distributed to restaurants in a target area. Owners are encouraged to conduct self audits to bring their facilities into compliance. DEP staff then conducts inspections to ensure that grease traps are properly sized and maintained. To date, over 3,800 restaurants have been educated and inspected. Over 60% of the restaurants inspected have been found to have inadequately sized grease traps and were ordered to upgrade their equipment. This effort has resulted in the installation of over 5,100 grease interceptors. After a restaurant's equipment is brought into compliance, DEP conducts random, unannounced inspections, to ensure proper maintenance is being performed. Reinspections have found a 94% compliance rate for proper maintenance.

NUTRIENT REMOVAL

To achieve the 58.5% nitrogen reduction goal called for as part of the Long Island Sound Study Agreement (LISS, 1997), NYCDEP is facilitating plans for nutrient removal through adaptive management. This approach will look first at cost-effective actions based on retrofits and operational improvements at existing facilities. Reductions are to be phased in over a 15-year period, beginning in 1998, and call for an assessment of costs/benefits to be conducted every five years, pursuant to improved technologies and ecological conditions.

To offset the impacts of increased nitrogen loads due to biosolids dewatering operations, NYCDEP implemented retrofit biological nutrient removal within existing plants at seven WPCPs (Tallman Island, Hunts Point, Bowery Bay, Wards Island, Red Hook, Oakwood Beach, and 26th Ward). In addition, feasibility studies and pilot tests for biological and physical-chemical

Clean 10" sewer

Grease Blocked 10" sewer

nutrient reduction were conducted to develop interim nitrogen removal programs for each WPCP. Removals at plants have been improved through optimizing current treatment processes, including: increasing sludge age, seperate centrate treatment, chemical feed systems, installation of retrofit step biological nutrient removal (BNR) and diffuser retrofits, as well as shifting of sludge loads.

Compliance with nutrient removal targets includes use of a 12-month rolling average and maximum monthly levels for dry weather nitrogen loadings to the Upper East River and Jamaica Bay. Throughout 2001, the four Upper East River WPCPs (Wards Island, Hunts Point, Bowery Bay and Tallman Island) achieved compliance with the aggregate nitrogen discharge limits specified in SPDES permits. Total nitrogen discharges from these facilities have dropped by over 30,000 lbs/day since 1993 through separate centrate treatment at the Bowery Bay, Wards Island, and Hunts Point facilities, and the implementation of BNR retrofit technologies. These retrofits have included the installation of membrane diffusers, anoxic zone mixers, aeration tank baffles, and froth control systems. Upper East River dry weather discharges from these four WPCPs averaged 66,379 lbs/day in 2001.

Throughout 2001, the four Jamaica Bay WPCPs (26th Ward, Coney Island, Jamaica Bay and Rockaway) met the 12-month rolling average discharge limit of 45,300 lbs/day. The average dry weather nitrogen discharged from these plants decreased through implementation of separate centrate treatment and BNR retrofits at the 26th Ward WPCP, as well as the shifting of nitrogen loads. Beginning in October 1999, Owls Head sludge was no longer treated at the 26th Ward facility, but re-directed to several other dewatering facilities, including Wards Island, Hunts Point, and Oakwood Beach via Port Richmond. In addition, sludge from the Jamaica WPCP began to be transported to the 26th Ward WPCP for dewatering, to more fully take advantage of centrate treatment capabilities at that location. Dry weather loadings from these four Jamaica Bay WPCPs averaged 36,428 lbs/day in 2001.

BIOSOLIDS PROGRAM

As mandated by the Ocean Dumping Ban Act of 1988, June 30, 1992 marked the last day of biosolids disposal at the 106-Mile Dumpsite in the Atlantic Ocean. As an alternative to open water disposal, NYCDEP's Beneficial Reuse Program transformed biosolids into products for use in soil remediation/restoration and as fertilizer for crop enrichment. Going beyond heat treatment and direct land application employed during an interim program, NYCDEP has contracted with a composting company and a lime stabilization company, as part of its Long Term Biosolids Management Plan. This program, which has reduced its original costs by almost 50%, won several awards in 1999 and 2000 including: the EPA National First Place Award for Outstanding Efforts Toward Gaining Public Acceptance for the Beneficial Use of Biosolids; and the New York Water Environment Association Biosolids Award, in recognition of outstanding efforts toward beneficial use of biosolids. In June of 2001, the DEP improved efficiency and reduced cost by reducing the number of contractors from 5 to 4.

NYCDEP's efforts have been endorsed by the Citizens Advisory Committee for Pollution Prevention and DEP has conducted some small demonstration projects throughout the five boroughs.

As a result, the Department has received numerous testimonials from satisfied recipients of the City's biosolids compost. For example, Former Department of Parks and Recreation Commissioner Stern wrote, "Parks has used DEP biosolids and has been pleased with the results," and the "Parks would like to continue using the composted biosolids as fertilizer in upcoming projects, including ballfields and large hill slope forest restorations." The Department of Transportation, Deputy Commissioner Heyward wrote, "We are strong believers in biosolids compost. We have found that incorporating DEP compost into existing soil on highway landscapes has caused the grass to grow much more thickly and remain greener throughout the summer." DEP intends to expand the City's use of Biosolids in the next few years.

SPECIAL WATER QUALITY STUDIES

INTRODUCTION

The NYCDEP has been monitoring the water quality in New York Harbor for over 90 years and periodically issuing data reports & analysis of DEP collected data. This year in an effort to expand the scope of the Harbor Survey report, the NYCDEP solicited the authors of relevant special studies or programs conducted in the Harbor during 2001. These projects were either conducted by NYCDEP or its contractors or by EPA, IEC or NYSDEC.

The following authors contributed their time and effort to these narratives and the NYCDEP would like to recognize these efforts. The authors contact information has been provided below, but any questions about this report should be directed to Mr. Beau Ranheim at 212-860-9378 or beaur@dep.nyc.gov.

Mr. William E. McMillin Jr., P.E. a Senior Project Manager at Hydroqual, Inc. contributed the Urban Watershed Program narrative. Mr. McMillin can be reached at wmcmillin@hydroqual.com if there are additional questions.

Mr. Peter Young, P.E. of Hazen and Sawyer, PC contributed the Shellbank Destratification narrative. Mr. Young can be reached at pyoung@hazenandsawyer.com.

The VOC Sampling narrative was provided by Mr. Bob Nyman and Ms. Cathy Yuhas of the USEPA Region II New York/New Jersey Harbor Estuary Program. Mr. Nyman can be reached at nyman.robert@epamail.epa.gov.

The Summary of IEC Programs was provided by Mr. Peter Sattler, Principal Environmental Planner at the Interstate Environmental Commission. Mr. Sattler can be reached at psattler@iec-nynjct.org.

The PCB narrative was provided by Dr. Simon Litten, a Research Scientist with the NY State Department of Environmental Conservation. Dr. Litten can be reached at splitten@gw.dec.state.ny.us.

The Gowanus Fish Community narrative was provided by Dr. Peter Woodhead of the SUNY Stony Brook Marine Sciences Center. Dr. Woodhead can be reached at peter.woodhead@stonybrook.edu.

The Enterococcus and Volunteer Beach Survey narratives were written by Mr. Beau Ranheim, Dr. Egbert Lord and Mr. John Sexton of the NYCDEP Marine Sciences Section. They can be reached at 212-860-9378.

URBAN WATERSHED PROGRAM

The Urban Watershed Program is being conducted by the New York City Department of Environmental Protection (DEP) for waterbodies throughout New York Harbor to address compliance with water quality standards and designated uses. The goals of the Urban Watershed Program are to:

- Define, through a public process, more specific and comprehensive long-term beneficial use goals for each waterbody, including habitat, recreational, wetland and riparian uses, in addition to water quality goals, thus maximizing the overall environmental benefit;
- Develop technical, economic, public and regulatory support for prioritizing and expediting implementation of projects and actions needed to attain the defined goals; and
- Provide the technical, scientific and economic bases to support the regulatory process needed to define water quality standards for the highest reasonably attainable use, to allow water quality standards to be attained upon implementation of recommended projects, and to fulfill the fishable/swimmable goals of the Clean Water Act for New York City waters.

Waterbody/Watershed assessments are being conducted for 23 waterbodies throughout New York Harbor. The waterbodies include major open water areas of New York Harbor and selected urban tributaries. The Urban Watershed Program started on August 5, 1999. The following is a brief description of Urban Watershed Program activities during the year 2001.

WATERBODY/WATERSHED ASSESSMENTS

The Urban Watershed Program is conducting focused waterbody/watershed assessments on each of the 23 waterbodies that are organized into four groups. These groups include waterbodies in Jamaica Bay, the East River, the Kills and the open waters of NY Harbor. The waterbody/watershed assessments include various activities including existing data and information gathering/compilation, watershed/waterbody field investigations and data collection, public outreach in the form of stakeholder teams, land use and shoreline characterizations, data management, watershed and receiving water mathematical modeling, ecosystem (habitat) evaluations, waterbody use evaluations, problem identification and prioritization, engineering analysis, and waterbody/watershed planning.

WATERBODY/WATERSHED STAKEHOLDER TEAMS

Local Waterbody/Watershed Stakeholder Teams are being formed for each waterbody being assessed by the Urban Watershed Program as an integral part of the assessment process, as well as an important component of the project's public outreach program. The composition of the stakeholder teams includes community leaders, local residents, and waterbody users. The teams are providing information on waterbody and watershed uses, water quality issues, and long-term intentions and desires for the waterbody. Teams have been formed for the Bronx River and Paerdegat Basin and several meetings were held in 2001.

FIELD INVESTIGATIONS

Biological field sampling and analysis programs were completed in 2001 for investigating the Bronx River, Paerdegat Basin, the Group 2 (Jamaica Bay) and Group 3 (East River) waterbodies, harbor-wide ichthyoplankton, and harbor-wide epibenthic recruitment and survival. Procedures characterized subtidal benthos, epibenthic recruitment and survival, fish abundance and diversity, ichthyoplankton, pathogens and water column toxicity. Benthos samples were collected to determine the invertebrate community composition, species richness and diversity, as well as bottom sediment composition [grain size distribution and total organic carbon]. Fish are motile organisms that can choose which habitats they enter and utilize, and their presence or absence can be used to evaluate water quality. Relative abundances of fish populations were sampled using an otter trawl, gill net and crab/killi pots. Ichthyoplankton samples were collected to characterize the ichthyoplankton community and to determine what species, if any, spawn in New York Harbor waterbodies. Samples were collected using fine-mesh plankton nets. Surface water samples were also collected and tested for pathogens (total and fecal coliform bacteria and Enterococci) to evaluate compliance with recreation water quality standards. Acute water column toxicity was also evaluated for surface water samples. Shoreline investigations were conducted for many of the project waterbodies.

WATERBODY/WATERSHED MATHEMATICAL MODELING

An important component of the Urban Watershed Program is assessing existing conditions in waterbodies, as well as projecting the long-term benefits of DEP's various water quality improvement projects. Mathematical modeling consists of both watershed modeling and receiving water modeling. Watershed modeling is being performed for New York City and surrounding areas to simulate wet weather pollutant loadings to New York Harbor waters. The Urban Watershed Program is currently updating, upgrading, and utilizing DEP's receiving water models representing all waters of New York Harbor and its tributaries. Model simulations are being compared to current and developing water quality criteria and standards.

ECOSYSTEM EVALUATIONS

Data collected during field investigations are being used to comprehensively analyze existing ecological conditions of Urban Watershed Program waterbodies. Comparisons are being made between waterbodies of similar and differing water quality and habitat conditions both within and outside New York Harbor. Information developed by mathematical modeling is also being used to assess existing benthic and water quality biological conditions and to assess future potential conditions with anticipated water quality improvements of facility plans and other pollution abatement programs. Evaluations of existing and potential dissolved oxygen conditions are being conducted for larval growth, larval survival, and juvenile growth of aquatic species for dissolved oxygen conditions. Evaluations were completed for Paerdegat Basin during this reporting period and are now focused on the Bronx River and Jamaica Bay waters.

ENGINEERING ANALYSIS

Engineering analyses are being conducted to identify control alternatives that would be implemented in addition to WPCP and combined sewer overflow (CSO) facility plans such that water quality goals are met. Costs, constructability, implementation schedule, environmental impact, and other associated issues are being developed with conceptual planning of these alternatives. Evaluations of engineering alternatives were conducted in 2001 to support waterbody/ watershed planning for Paerdegat Basin and the Bronx River.

SUMMARY

The Urban Watershed Program is a continuing effort that will be delivering interim reports as necessary. A website is being developed to allow project updates and results to be posted as quickly as possible.

SHELLBANK DESTRATIFICATION

The New York City Department of Environmental Protection (DEP) is currently testing a technology designed to address the poor water quality that has historically existed in Shellbank Basin. Shellbank Basin, one of the tributaries to Jamaica Bay, is located in the Howard Beach community in Queens. The technology being tested, known as destratification, has been used effectively in lakes and reservoirs to vertically mix these waterbodies and prevent undesirable water quality conditions from occurring. A full-scale demonstration test has been in operation for two summer seasons (from May to September of 2000 and 2001) and has produced positive water quality results.

STRATIFICATION: HOW DOES IT AFFECT THE WATER QUALITY OF SHELLBANK BASIN?

Shellbank Basin is a long narrow basin with varied depth. The basin is very deep at the northern head end (50 ft.), while the southern end of the basin, where it meets Jamaica Bay, is relatively shallow (10 ft.). This variance in depth hinders the natural tidal mixing with Jamaica Bay. Without this natural mix of water, layers of water with varied temperatures form in the basin. The warmer water stays in the top layer of the basin and cooler water is trapped at the bottom. This separation of the basin's water into warm and cool layers is known as "stratification".

Stratification of the basin results in poor mixing and eventually the water in the bottom layers becomes devoid of oxygen ("anoxic"). The warmer weather conditions of summer cause the basin to "turn over", bringing anoxic water to the surface. During this period, marine life is affected, leading to fish kills and dead crabs in the basin. Also, the basin becomes very odorous due to the release of hydrogen sulfide, which has a characteristic "rotten egg" smell.

HOW IT WORKS

The destratification system consists of a shoreline electric-powered compressor station, feeding 3 diffused-air lines running along the bottom of the basin. The station is currently located at the privately owned Captain Mike's Marina, at 159th Avenue and Cross Bay Boulevard on the west shoreline of Shellbank Basin. Compressed air is delivered through the diffuser lines along the basin bottom. Air bubbles released from the diffuser lines vertically mix the water column to prevent stratification from occurring. The compressed air distribution system is designed to effectively transport bottom water to the upper layer. The diffuser lines are made of high-density polyethylene tubing. Two parallel lines run north from the compressor station and a single line runs south from the compressor station.

THE SPECIFICS

The compressor equipment is housed within a pre-engineered fiberglass building. The pre-engineered fiberglass building is constructed of double wall construction with a foam core for noise minimization. The pre-engineered building also has automatic louvers and intake fans, which supply air for the compressor. To reduce the noise levels emanating from the compressor building, soundproofing material was installed in the building.

The diffuser lines are made of one inch high-density polyethylene tubing typically used for lawn irrigation purposes. The dual diffuser line is positioned in a longitudinal pattern running to the head end of the basin, the single line runs mid-basin, with a total length of 1250 feet of tubing.

The diffuser lines are anchored to the bottom with concrete blocks, and suspended approximately 6" above the basin bottom. The diffuser system is equipped with a buoyancy system and does not require the use of divers for deployment or routine maintenance. The land based 15 HP compressor occupies an area approximately 200 ft^2 (20 ft. x 10 ft.), and requires 230 V electric service.

DATA SAMPLING

The head end portion of Shellbank Basin was divided into 30 sampling stations. Water quality parameters were collected at each station. Data samples were gathered at 2-week intervals, for 2 consecutive summer seasons in 2000 and 2001. Dissolved oxygen concentrations, salinity, and temperature were measured at increasing depths at each station.

RESULTS AND CONCLUSIONS OF THE STUDY

Stratification was evident at the start of the two summer seasons before the demonstration facility was put into service, and was characterized by a ten-degree Celsius temperature difference as shown in (see figure 1).
If the system were not utilized, a ten to fifteen degree difference would have most likely occurred throughout the summer. After the system was placed into service, temperature data collected had shown that enough water circulation was achieved by use of the diffused-air de-stratification system to totally eliminate the stratified layers. This was apparent by the average temperature gradient of less than 1° Celsius (see figure 2) in the water column, for all of the stations. A similar constant temperature gradient trend continued throughout the course of this study, the data for the remaining sampling events showing a nearly uniform temperature throughout the entire vertical water column of the basin.

The 2-year pilot operation has indicated that Shellbank Basin can indeed be successfully destratified through a diffused air system and this has resulted in an immediate positive change in the water quality. No odor complaints were received by the DEP from the residents living on or near Shellbank Basin during the period of operation, because stratification was not able to occur with the demonstration facility operating.

It has been recommended to install a permanent facility to continue to destratify Shellbank Basin. Possible locations are being evaluated and a site selection process is underway.

Community Concerns
The project was designed so as not to affect the recreational use of Shellbank Basin. The compressor is housed in a pre-engineered double-wall fiberglass building with additional soundproofing treatment to minimize noise levels.

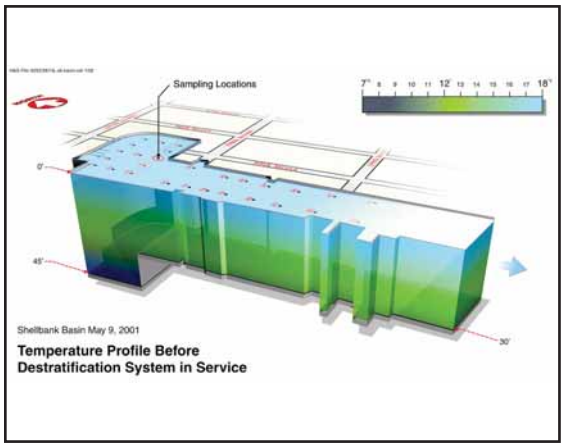


figure 1

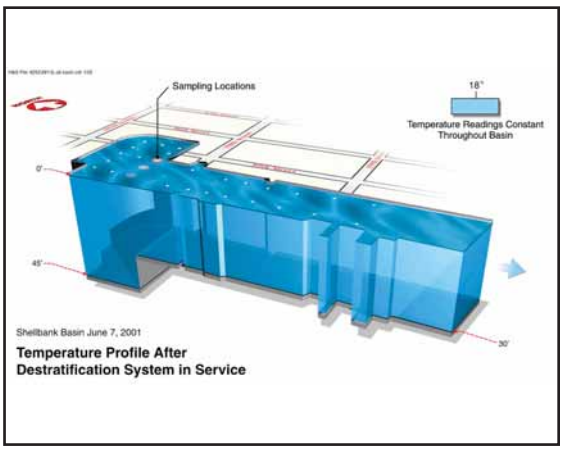


figure 2

VOC SCREENING FOR NEW YORK/ NEW JERSEY HARBOR ESTUARY

New York - New Jersey
Harbor Estuary
Program

INTRODUCTION

This article was provided by Bob Nyman and Cathy Yuhas of the New York- New Jersey Harbor Estuary Program Office (HEP). HEP is one of 28 National Estuary Programs sponsored by the US Environmental Protection Agency, and is focused on the protection and restoration of the harbor. Participants include members of federal, state and local government agencies, nonprofit organizations, academicians, and others. Additional information about the program is available from the website www.harborestuary.org.

During the routine New York City (NYC) Harbor Survey in 1992, volatile organic compounds (VOCs) were detected in some of the Harbor waters. The reported values from this survey for one of the VOCs, tetrachloroethylene (PERC), were above the New York State (NYS) guidance values in more than half of the waters in the Harbor. Since that time, the City of New York has undertaken a program to reduce discharge of PERC from one of the main sources, drycleaning operations.

In 1999, the New York - New Jersey Harbor Estuary Program (HEP) Toxics Work Group (TWG) began a reevaluation of the Chemicals of Concern on its list from the HEP Comprehensive Conservation and Management Plan (CCMP) that was developed in 1996. Some chemicals were removed from the list because more recent data showed that they were no longer a problem. However, the group found that there was little recent data to evaluate whether PERC, or other VOCs were still of concern in the Harbor. As a result, the TWG recommended that a screening be undertaken for VOCs in Harbor ambient waters.

In February 2000 and again in February 2001, the HEP TWG coordinated a VOC assessment of ambient waters by various groups including: US Environmental Protection Agency, Passaic Valley Sewerage Commissioners (PVSC), NYC Department of Environmental Protection (NYCDEP), NYS Department of Environmental Conservation, and NJ Department of Environmental Protection. NYCDEP collected the bulk of the samples as part of their ongoing Harbor Survey, while PVSC collected samples from the Passaic and Hackensack Rivers and Newark Bay. Samples were transferred to the USEPA laboratory in Edison, NJ for analysis.

RESULTS

The VOC analysis was based on USEPA Drinking Water Method 524.2 and included approximately 60 VOCs.

February 2000 Sampling

Most of the VOCs were reported as “not detected” to a level of 1 µg/L. Those VOCs reported above the detection limit of 1 µg/L included methyl tert-butyl ether (MTBE), 2-butanone, 2-chlorotoluene, and 1,2-dichlorobenzene. All the levels were below the guidance values or standards (one of the MTBE results

exceeded the guidance value or standard for freshwater, but because the samples were in marine waters, the values are not applicable). Acetone was detected in nearly every sample; however, it was also detected in the field blank samples that were collected for the survey indicating the results are likely due to contamination. In addition, samples that were collected from nine stations in the Hudson, Harlem, and East Rivers may have been compromised due to improper storage. Those results should be considered as biased low.

February 2001 Sampling

Most of the VOCs were reported as "not detected" to a level of 1 µg/L. Those VOCs reported above the detection limit of 1 µg/L included methyl tert-butyl ether (MTBE), 2-butanone, 2-hexanone, 1,2-dichlorobenzene, acrylonitrile, and chloroform. All but one of the levels were below the guidance values or standard. The results for acetonitrile exceeded the guidance value or standard; however, acetonitrile was also detected in the some of the field blank samples that were collected for the survey indicating the results are likely due to contamination. Acetone was again, detected in nearly every sample; however, it was also detected in the field blank samples that were collected for the survey indicating the results are likely due to contamination.

DISCUSSION/CONCLUSIONS

The PERC levels found in 1992 are not apparent in the 2000 and 2001 sampling events. This decrease in PERC in the Harbor could be related to the regulations that were imposed upon dry cleaners. Dry cleaners have decreased their waste from 2,000 gallons/year/cleaner to 200 gallons/year/cleaner and waste disposal is no longer allowed to be placed in the municipal sewer system. They have also stopped doing the cleaning at their own facilities. Dry-cleaning equipment has been upgraded due to regulations. In 1992, VOC levels were found above guidance values and standards, and in 2000 and 2001 levels were not above the guidance values and standards although some of the contaminants were detected in the 2000 and 2001 sampling events.

The change in VOC levels in the Harbor from 1992 to 2001 indicates that the dry-cleaning regulations had a positive impact on water quality in the Harbor. The HEP TWG has recommended that VOCs be removed from the HEP list of Chemicals of Concern.

TABLE 1 VOLATILE ORGANIC COMPOUNDS DETECTED IN THE FEBRUARY 2000 AND 2001 SAMPLING EVENTS

Chemical	Highest Value (µg/L)		Guidance Value/Standard (µg/L)
	Feb 2000	Feb 2001	
Methyl Tert-Butyl Ether (MTBE)	10.7	2.3	10 for fresh water in NY, but not applicable to marine waters. No value for marine waters or NJ.
2-Butanone	1.35	2.0	No value for NY or NJ.
2-Chlorotoluene	3.35	NA	5 for fresh water in NY, no value for marine waters or NJ.
2-Hexanone	NA	2.0	No value for NJ. NY does not have standards that are applicable to the Harbor for this substance.
1,2-Dichlorobenzene	1.01	1.4	5 for aquatic life chronic marine value in NY and 50 for aesthetic in SD waters in NY (total of 1,2; 1,3; and 1,4- dichlorobenzene). NJ value for human health based on fish consumption is 16,500.
Acrylonitrile	NA	2.0	0.665 in NJ. NY does not have standards that are applicable to the Harbor for this substance.
Chloroform	NA	1.6	470 in NJ. NY does not have standards that are applicable to the Harbor for this substance.

IEC 2001 WATER QUALITY MONITORING ACTIVITIES

The Tri-State Compact establishing the Interstate Sanitation Commission (now Interstate Environmental Commission- IEC) was enacted in 1936. The Commission initially consisted of the States of New York and New Jersey; the State of Connecticut joined the Commission in 1941. As its structure suggests, the Commission has an overall responsibility of protecting the environment by viewing the District from a regional, impartial and unbiased perspective. Whereas, each state deals with issues within its own political borders, the Commission can and does cross state lines.

The Commission's ambient water quality monitoring programs are comprised of intensive surveys conducted over an extended period of time on a particular waterway for specific reasons, i.e., to study sanitary condition of shellfish beds, to document hypoxia, or to determine bathing beach water quality. The surveys conducted during the calendar year 2001 are summarized below.

Great Kills Park, part of the Gateway National Recreation Area, is located on the eastern shore of Staten Island, New York, on Raritan Bay. The 1,455-acre park is maintained under the auspices of the National Park Service (NPS). In late August 1998, the NPS measured high levels of coliform bacteria and subsequently closed the bathing beach for a total of 12 days. A sampling network of 12 stations was jointly established with NYCDEC and DEP in order to monitor this condition. The samples were analyzed for fecal and total coliforms, fecal streptococcus and enterococcus. Additional samples were collected in Fox Creek, a tributary of Raritan Bay. Although high values of coliform bacteria were detected, a source could not be determined. This plan will continue in 2002 to determine the source of bacterial contamination.

To address an ongoing need to document the hypoxic conditions in **Long Island Sound**, the IEC participated in a cooperative sampling effort, with NYCDEP and CTDEP, during the summer season. The information will be used to measure the effectiveness of management activities and programs implemented under the Comprehensive Conservation and Management Plan. A cruise plan consisting of 21 stations is conducted weekly from July through mid-September. In-situ measurements are made for dissolved oxygen, temperature and salinity at 3 depths (1 meter below the surface, mid-depth and 1 meter above the bottom) when the water column is less than 15 meters and 5 equidistant depths when greater than 15 meters. Every other week samples are collected for chlorophyll 'a'. At 3 stations located in Little Neck Bay, Manhasset Bay and Hempstead Harbor, additional surface samples are collected for phytoplankton identification. In addition, during one cruise, additional samples are collected at a subset of stations to detect the presence of pfiesteria.

Ambient water quality monitoring for pathogens in the New York-New Jersey Harbor Complex was conducted at the request of the US Environmental Protection Agency (EPA), Region 2, under the auspices of the **New York-New Jersey Harbor Estuary Program (HEP)**, to collect fecal coliform, total coliform and enterococcus data. The scope of work was determined by the HEP's Pathogens Work Group which is comprised of IEC, NYSDEC, NJ DEP, NYCDEP, US Army Corps of Engineers, and EPA. The results were supplied to contract modelers for refinement of a water quality model for pathogens based on the New York City Combined Sewer Overflow (CSO) model and System-wide Eutrophication model. The sampling network consisted of 42 stations throughout the New York-New Jersey Harbor Complex. The Complex has been divided into four areas of concern: East River, Hudson River and Upper New York Harbor, Arthur Kill/Kill Van Kull and tributaries (Elizabeth River, Rahway River and Raritan River), and Raritan and Sandy Hook Bays. The station locations were supplied to the Commission by NYCDEP and NJ DEP's Bureau of Marine Water Classification and Analysis (BMWCA). The sampling stations are those recommended by the HEP modeling contractor. There is an historic data base at these established stations and, to better represent the interstate characteristics of the waterways, a subset of the NYCDEP Harbor Survey stations on the Hudson River from Yonkers south to the Battery were moved to mid-river.

Samples for fecal and total coliforms, fecal streptococcus and enterococcus were taken at all stations. In addition, temperature and salinity measurements were made in-situ. IEC contracted two boats to conduct simultaneous sampling two (2) days per week; IEC field personnel conducted all sample collection and performed all in-situ measurements aboard the contract vessels. A sampling regime of two (2) survey runs per week per boat in each area of concern was planned over a five (5) week period. That is, over the course of ten (10) weeks, all four (4) sampling areas would yield ten (10) data sets per station. The events of September 11th, as well as other commitments resulted in the data not being collected over ten consecutive weeks, but sampled ten times over a 17-week period (August through November).

The New Jersey Department of Environmental Protection, Bureau of Marine Water Classification and Analysis (BMWCA), regularly conducts ambient water quality monitoring of the State's 750,000 acres of shellfish harvesting beds. The BMWCA requested the IEC assist in sample collection in the **New Jersey waters of western Raritan Bay**. The surveys were triggered by storm events with an intensity of at least 0.2 inch of rain. A window of 48 hours subsequent to the rain gave ample time to document the effects of the runoff. All samples were collected from surface waters at 18 sampling stations. All samples were transported to the US EPA's Edison, NJ, laboratory for analysis of fecal and total coliform bacteria. From November 16, 2000 until mid-April 2001, four survey runs were completed.

A NEW KIND OF PCB

A QUICK BACKGROUND REVIEW

PCBs (polychlorinated biphenyls) are well known as possibly cancer-causing industrial chemicals. They had been manufactured in the United States from 1929 until 1977 and used as insulators in electrical equipment, as heat exchangers, sealants, hydraulic fluids, and as microcapsules for carbonless copy paper. Their occurrence in wildlife, human breast milk, and their involvement in two mass poisoning episodes led to banning and removal. Today government scientists are still finding these long-lived chemicals in fish tissue, sediments, soils, and water. Currently, the USEPA is studying removal of PCB contaminated sediments in the upper Hudson and others are finding PCBs in and around New York Harbor.

What is less well known is that PCBs may also be formed inadvertently as the result of making various chemicals. At the time that PCBs were banned, the Chemical Manufacturers Association alerted EPA to this possibility and rules were written to take these inadvertent PCBs into account. In 1984, when the rules were published, the analytical methods for detecting and measuring PCBs were not as good as they are today. Also, the rules made assumptions about the toxicity and environmental distribution of inadvertent PCBs that New York State DEC does not share in 2002.

CONTAMINANT ASSESSMENT AND REDUCTION PROJECT (CARP)

In 1998, the NYSDEC, NYCDEP, EPA, and others began an extensive monitoring project undertaken to gain a better understanding of toxic chemicals, including PCBs, in New York Harbor. The Port Authority of NY/NJ faced the problem of increasingly stringent regulations making the disposal of harbor dredge material extremely expensive. The Clean Water Act had also identified New York Harbor as an estuary requiring a thorough environmental assessment and a management plan. The coincidence of the management plan and the clear-cut economic imperative lead to the creation of the Contaminant Assessment and Reduction Project (CARP). CARP called for extensive monitoring of chemicals from sewage treatment plants, landfills, major and minor tributaries, and ambient waters. It also included monitoring sediments throughout the harbor and biota (birds, fish, shellfish, and benthos).

PCBs were sold in the United States under the trademark “Aroclor”. These aroclors are composed of mixtures of PCB congeners that have properties appropriate for various applications. Some congeners are abundant and others are rare. Some were not expected to occur at all in commercial Aroclors.

During the early discussions about possible laboratory methods, we learned that a new technique had been developed that would allow all the PCB congeners to be measured. The new analytical methods used for CARP samples would be able to detect all 209 congeners, even those not anticipated in local waters.

DISCOVERY OF A NEW KIND OF PCB

As results of the monitoring were reported some of the patterns of congener abundance conformed very closely to our expectations. For example, PCBs in the upper Hudson looked like they had originated from the materials used in the manufacture of capacitors. Samples from the harbor area showed evidence of heavier PCBs that might be expected from PCBs used in transformers. However, a few samples, particularly from three (later four) sewage treatment plants, showed an unexpected pattern. In these, a single congener accounted for as much as 90% of the total PCB. Even more surprisingly, this congener, called 3,3’-dichlorobiphenyl or “BZ 11” for short, was not expected to occur at all in commercial Aroclor mixtures. And not only was this congener relatively more abundant than expected, it also was responsible for the highest PCB concentrations of the sewage treatment plant discharges.

After a review of the literature we learned that BZ 11 was associated with the pigment industry, particularly with pigments made from the intermediate 3,3’-dichlorobenzidine. In discussions with the NYCDEP, we learned that the treatment plant with the highest concentrations of BZ 11 experienced colored influents

and that there was a pigment factory in the service area. We interviewed the plant manager of the pigment factory who told us that the pigment industry had been aware
of inadvertent synthesis of BZ 11 in connection with production of an orange-yellow pigment called diarylide yellow. Numerous manufacturers both in the United States and elsewhere make this color that is used in plastics and is routinely seen as the yellow line painted down the middle of roads.

Further sleuthing revealed explanations for the two other New York State sewage treatment plants with high proportions of BZ 11. One plant dewatered sludges from the plant directly connected to the pigment factory and the other plant received wastewaters from a second pigment manufacturer. An efficient way to find potential BZ 11 sources is to query the EPA Toxic Release Inventory (TRI) web site for facilities using 3,3'-dirchlorobenzidine http://www.epa.gov/enviro/html/tris/tris_query.html, search for 3,3'-dichlorobenzidine as CAS # 000091941). Once alerted to the importance of BZ 11, we started discovering that this supposedly non-existent chemical was in fact very wide-spread. It is the single most abundant PCB congener in Lake Ontario. An internet search showed that a manufacturer outside of Toronto, Ontario would be happy to sell diarylide yellow. An observation of BZ 11 comprising 20% of the total PCB in Long Island Sound waters may have its origin in a Connecticut 3,3'-dichlorobenzidine user. And abundant BZ 11 in a New Jersey wastewater treatment plant could be explained by the presence in its service area of two separate pigment making facilities reporting 3,3-dichlorobenzidine. However, we have also seen BZ 11 comprising about 23% of total PCBs in samples from the New York Bight collected 75 miles southeast of the harbor. The origin of this material is yet to be understood but might be that the congener is volatile and would be relatively easily transported by air.

New York State ambient water quality standards regulate PCBs as total PCBs and disregards congener distribution. The ambient water quality standard for the protection against cancer in humans eating fish is 1 picogram/L (part per quadrillion). The concentration of BZ 11 alone exceeded the total PCB WQS in 96% of our ambient water samples. While few samples have been analyzed for BZ 11 in biota, those that have show very little. This congener would not be expected to be strongly held by fatty tissue. Sediment concentrations of BZ 11 are also not as abundant as those in water.

DIOXIN-LIKE PCBS

While NYS WQS look only at total PCBs, some scientists believe that a few PCB congeners exert a dioxin-like toxicity. These "toxic" or "co-planar" PCB congeners are not included in the NYS definition of dioxin but are included in new EPA criterion for dioxin in wastewater treatment plant sludges. The waste waters from the NYC pigment manufacturer was rich in "co-planar" PCBs, particularly 3,3',4,4'-tetrachlorobiphenyl or BZ 77 and 3,3',4,4',5-pentachlorobiphenyl (BZ 126). The sludges from the sewage treatment plant receiving the pigment waste also had significant concentrations of these two congeners. On the other hand, the New Jersey sewage treatment plant receiving discharges from two pigment manufacturers was not found to have much of the co-planars. The chemistry behind the occurrence of the co-planars is still unknown but NYSDEC is currently having several pigments and technical grade 3,3'-dichlorobenzidine analyzed to see if light could be shed on the origins of the potentially dangerous co-planars.

The NYC pigment manufacturer has announced its intentions to move the diarylide yellow operation to Denmark and is tightening up operation in NYC to reduce wastage. The degree to which these changes will affect the co-planar generation is not yet known but we expect that it will greatly reduce emissions of BZ 11.

Editors Note: In December 2001, the Sun Chemical Corporation, in Staten Island, New York, voluntarily entered into a Consent Order with the NYCDEP. The company agreed to cease the production of all pigments that utilize 3,3'Dichlorobenzidine in the manufacturing process by April 1, 2002. Additionally, the company will be conducting a facility wide cleanup, with follow up testing, to remove any residue from that manufacturing process.

The author looks for inadvertent PCBs in NYC sewers

SURVEYS OF THE GOWANUS FISH COMMUNITY

In 2001, a series of boat surveys was made of the biota inhabiting Gowanus Bay and the Gowanus Canal, by the Marine Sciences Research Center (MSRC) of Stony Brook University. The purpose of the surveys was to describe the biota currently inhabiting the Gowanus system and to measure related environmental conditions. A particular focus of the surveys was to identify the fish populations present and assess their abundance, by trawling and by hydroacoustic surveys. Results from boat surveys made during summer and fall, are summarized here as a short report.

GOWANUS FISH COMMUNITY

Fish were sampled with a ground otter trawl, 8 m wide, lightly rigged. During the surveys, about 30 species of finfish were caught in Gowanus Bay. However, most species were represented in trawl samples by only a few individuals. A smaller number of fish species were common or abundant in catches. The abundant species comprised striped bass, weakfish, scup, bay anchovy, alewife, and American shad. All abundant species were present only as juvenile life-stages, except for the ubiquitous bay anchovy. Those fish were all small, young-of-the-year, their total lengths ranged from about 5 to17 cm. The Gowanus Bay appeared to be a nursery habitat for juvenile stages of common finfish species important to the community of the Harbor-estuary.

During the survey series, there was notable change in the composition of the fish community in Gowanus Bay. In initial summer surveys, dominant fishes caught were juveniles of striped bass, weakfish, and scup, with bay anchovies. In November surveys, these species had all decreased in numbers in trawl samples, catches were then dominated by small, young-of-the-year river herrings, alewife and American shad.

Important predators feeding on the young fish in the Bay during summer were large fluke about 20 to 40 cm long, and adult blueclaw crabs. The fluke had left Gowanus by November, although blueclaw crabs were still commonly caught.

The fishing surveys expressed the abundance of fish as the numbers caught in a standard trawl haul, during a 6 min. tow on the seabed (termed, 'catch per unit of fishing effort', - cpue). Highest community abundance occurred in summer. Fish were especially abundant in Gowanus Bay, with a standard catch average of 2852 fish. Trawl sampling at comparator sites in Red Hook Channel in summer, the average cpue was 283 fish, only 10% of the Bay catch. During the survey series through the fall, catch numbers in Gowanus Bay and in the Channel fell markedly to only about 5% to 10% of the summer abundances. On all surveys, the numbers of individuals caught were always greater in Gowanus Bay than at the comparator sites in the Channel; during fall the mean cpue in the Bay was about 3x to 6x more abundant. Equally, on each fishing survey the number of fish species caught was greater in Gowanus Bay than at the sites in Red Hook Channel.

By late November the mean cpue in Gowanus Bay had fallen to 139 fish and in Red Hook Channel the mean was only 22 fish. This decrease in abundance of the finfish community was typical for the Harbor-estuary system. During the fall, many fish species emigrate to the sea, leaving the Harbor when water temperatures decline. Contrary to that general trend of decrease in community abundance during fall, juvenile river herrings migrating out of the upper Hudson in November appeared in greater numbers in the Harbor, including Gowanus Bay.

Fish were commonly observed in the waters of the Gowanus Canal during surveys, the fish were also recorded by an echosounder. In August and September, many fish were seen singly at, or near, the water surface, all through the Canal. In shallow reaches of the Canal schools of hundreds of small fish were observed swimming below the surface. The schools of small fish appeared similar to those caught in the Bay, and were believed to be juvenile weakfish and/or striped bass. Large adult blueclaw crabs were also common, swimming in the Canal. Swimming fish and crabs apparently occurred all through the Canal, they were observed as far as the head waters at Union St. bridge.

Most fish in the Canal were not identified directly, nor their densities determined, although echosurveys were made through the Canal, also through Gowanus Bay. Echorecords were made of acoustic reflections from 'fish', - which were distinguished from gas bubble reflections. The echorecordings were subsequently analyzed and counted. Comparison of echosurvey recordings for the counts of 'fish' records, found no difference between the counts or densities of 'fish' records made in Gowanus Bay and the densities in Gowanus Canal.

In the Gowanus survey area, measurements were made of standard water variables: a) at depth 1m above bottom, and b) at the surface, for salinity (S), temperature (T), dissolved oxygen (DO) and density. In the Canal S, T, and density showed little top to bottom variation. The summer water temperatures were maximum, at 23°-24°C. During fall, temperatures cooled to 11°C in November. Gowanus Bay is 10 m deep, most water measurements had similar values to the Canal for both T and S. Dissolved oxygen concentrations measured in the water column of the Gowanus Canal were moderately high, about 4 to 6 mg O_2/L. Bottom DO concentrations were slightly higher than at the surface of the Canal, by about 0.5 to 1 mg O_2/L. Generally higher levels of DO were measured in Gowanus Bay, at about 5 to 7 mg O_2/L.

Black, organic-rich muds cover the bottom of the Canal, the muds are likely to be oxygen-deficient. During all Canal surveys, bubbles of gas were frequently seen breaking the water surface. The bubbles were spontaneously released from bottom muds. Gas bubbles are strong acoustic reflectors, and ascending bubbles were clearly marked on echo-records. Disturbance of the muds produced copious release of gas bubbles. Methane gas is commonly produced by catabolism in strongly-reducing, anoxic bottom sediments of the Harbor. It is likely that methane was important among the gases released in the Canal.

The Gowanus flushing tunnel pumps water from the Harbor to replenish the waters of the Canal, at a rate of about 200 million gallons per day. Stopping, or slowing the rate of pumping Harbor water into the Canal, would likely be associated with increased depletion of oxygen from Canal waters, caused by the reducing conditions at the seabed. During the course of the present surveys, the rate of pumping volumes of Harbor water through the flushing tunnel to the Canal is known to have varied, and included periods when the pump was stopped. It is expected that such variations in daily volume rates of

water replenishment could result in rise or fall in overall levels of DO in the Canal.

The DO levels measured in Gowanus Canal were not strongly hypoxic. That seemed to indicate that the flushing tunnel system was usually working well enough to replenish potentially stagnant waters of the Canal with oxygenated Harbor water pumped through from the Buttermilk Channel.

CONCLUSIONS

- Measurements of standard water variables, salinity, temperature, and density differed rather little between Gowanus Canal, Gowanus Bay and outside in the Upper Bay of the Harbor. Average DO concentrations measured in the Canal were about 4 to 6 mg O_2/L., which appeared to indicate that Canal waters were exchanged sufficiently.
- In summer 2000, the Gowanus Bay was inhabited by abundant populations of small fish. Fish densities in the Bay were 10 times higher than at sites outside, in Red Hook Channel. The fish in the Bay were all young-of-the-year of common species that are important in the Harbor-estuary. Gowanus Bay was functioning as a nursery area.
- Above Gowanus Bay, in the Gowanus Canal, schools of similar small fish were observed, up to the Canal headwaters. Most Canal fish were not identified, nor their densities directly determined. Nevertheless, counts of 'fish' records on the echosurveys found no difference between densities of 'fish' records made in the Bay or in the Canal.

The abundance of the finfish community generally decreased in the Harbor during fall, as water temperatures cooled. However, river herrings emigrating from upstream increased in numbers to dominate trawl samples, including Gowanus Bay.

2001 VOLUNTEER BEACH FLOATABLES SURVEY

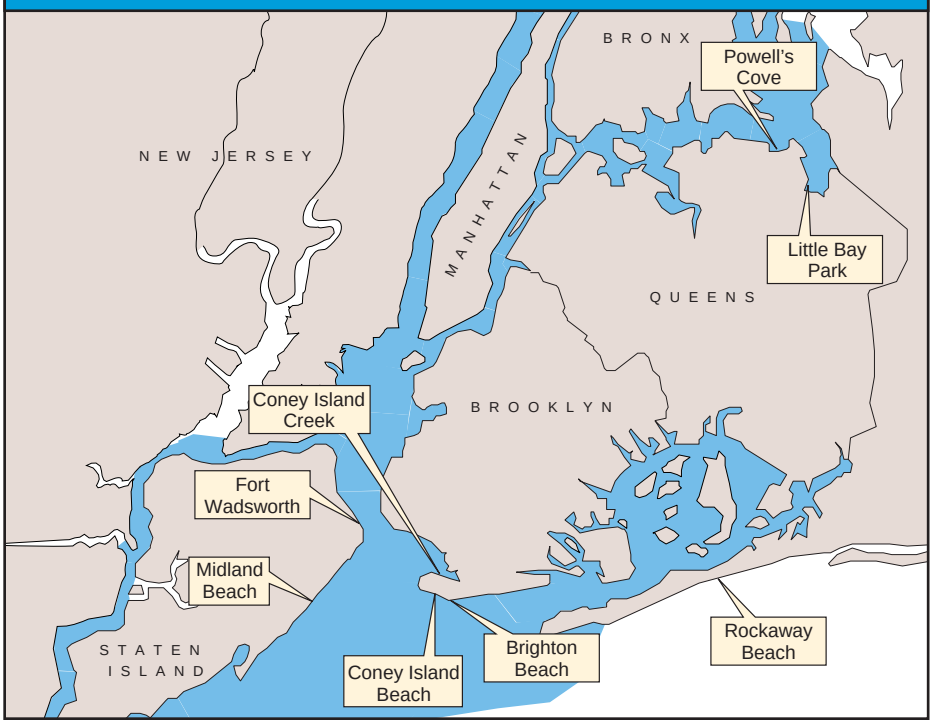
The beach floatables survey, a volunteer based program, finished the third year of data collection. This is a continuing effort to build a database of information specifically for the Harbor Survey on floatable debris washing up along the shorelines of the city beaches. The voluntary program was designed to encourage community participation and stewardship at the local city recreational facilities. The aim of each survey was to identify and quantify the floatable debris that was being washed up along the shoreline of the local areas in order to provide data to evaluate a variety of Department of Environmental Protection (DEP) floatable control efforts.

Each of the NYCDEP surveys was performed within a designated 200 foot length of beach at each location. Surveys were conducted at least one hour after high tide and/or after one foot of tidal recession from the high water mark. The survey schedule was coordinated with local authorities so that they occurred at least 12 hours (one tidal cycle) after the local cleaning and prior to the current daily beach cleaning. This procedure was an attempt to account and categorize debris items that were deposited by the previous high tide. The volunteers tried to adhere to this protocol but the cleaning schedule from location to location did vary.

The 1999-2001 DEP Volunteer Survey has expanded each year from 19 surveys at 4 beach locations in 1999, to 112 surveys and 17 locations in 2001. Consequently the items counted also increased from 1228 items and 3800 feet of beach in 1999, to 12,842 items recorded along 22,400 feet of beach in 2001.

The survey data, from the past three years, was classified into one of six most representative material

NEW YORK CITY BEACHES FLOATABLES (2000) SURVEY LOCATIONS



categories. The individual percentages of the total material counts have remained relatively consistent, as is seen in figure 2. The density of items per 1000 feet varied widely by location (figure 1). After closer inspection the individual areas were broken down by location and the item densities for each were graphed. This chart, figure 3, displays a definite trend. There appears to be a decrease in the floatables density number at the more active swimming beaches.
It is clear that item counts at less populated or non-swimming beaches are higher. It is suspected that at these locations there may be less maintenance and consequently some multiple counting of items. These non-swimming areas were also usually within a proximity of recreational facilities such as marinas. Any of these factors would have the ability to skew the data.

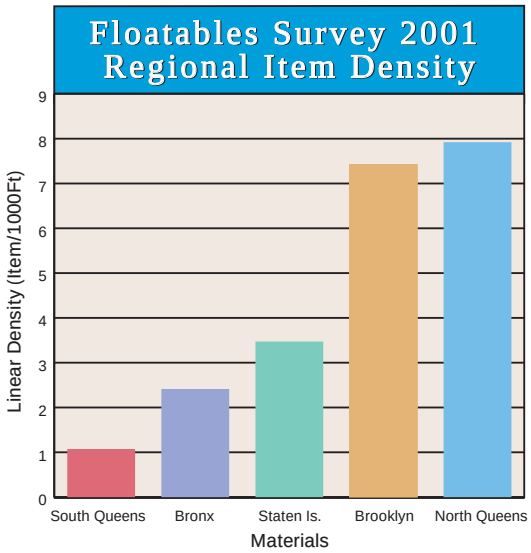


figure 1

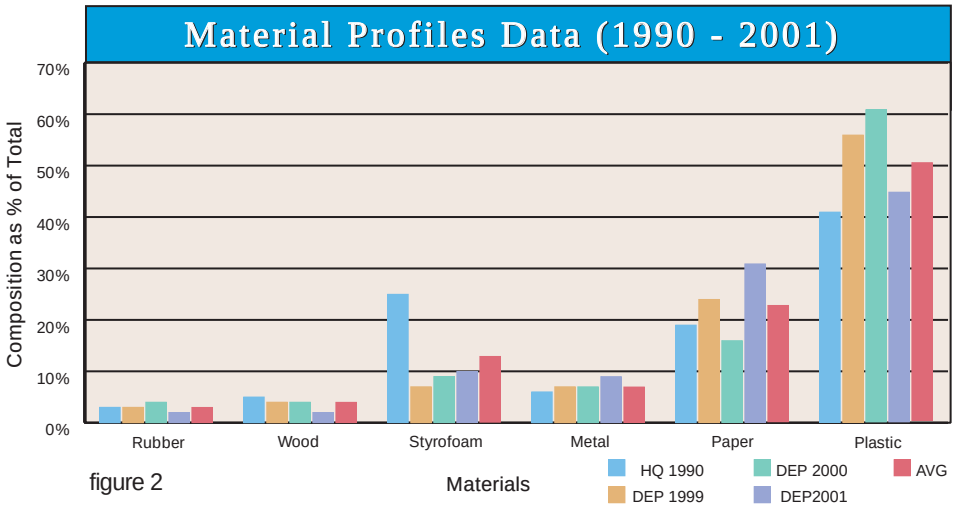


figure 2

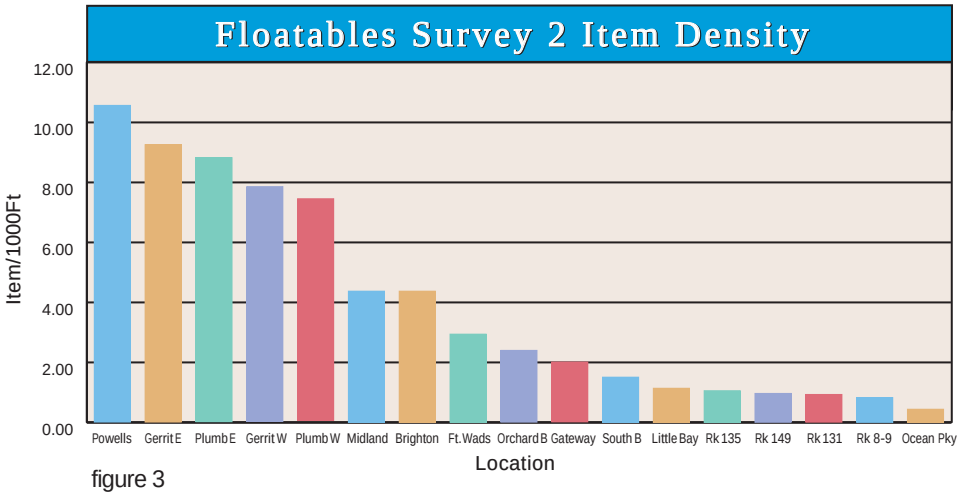


figure 3

NYCDEP ENTEROCOCCUS SAMPLING PROGRAM

The NYCDEP Marine Sciences Section began a harbor wide sampling program for Enterococcus bacteria in 2001. This sampling program was begun to investigate the impact of switching to the Enterococcus ambient water bacteria standard, as mandated by the BEACH Act of 2000. This act mandates that all states adopt criteria for the best available pathogen indicator (enterococcus) no later than 2004. NYS currently recommends use of fecal or total coliform bacteria.

Enterococcus, are a group of bacteria very similar to fecal coliform. They are present in the intestinal tract of humans and other mammals, and are an excellent indicator for the presence of sewage waste. Sampling and analysis methodologies remain similar to that of the fecal bacteria, with the changes being a different media and temperature to culture the bacteria.

Currently New York State has several classifications for bacteria in saline waters. All waters within NYC with an applicable standard are either I (2000 cells /100ml) and SB (200 cells /100ml). As previously stated in the report during normal dry weather conditions most of the waters in New York Harbor meet these criteria.

Switching to enterococcus as the indicator organism will require different criteria values. As currently written the Act has several levels of exceedances built into it depending on the water's proximity to areas being utilized recreationally or commercially. For waters commonly used for primary human contact (designated beaches) a single sample must not at any time exceed 104 cells/ 100ml, or during a 30 day period the geometric mean of 5 samples must not exceed 35 cells /100ml. Waters not commonly used for primary contact may have a value of 500 cells/100ml for a single value.

Using these values as a reference the Harbor Survey began a sampling program to compare fecal coliform and enterococcus levels at existing stations. Samples were taken during each Harbor Survey cruise for both fecal and enterococcus. The samples were incubated and analyzed using standard methods currently used by the NYCDEP Microbiological Laboratory.

Figure 1 shows the results of this sampling effort. The graph shows the yearly average for both fecal coliform and enterococcus at each of the Harbor Survey stations. All stations had average values below the criteria value of 35. Looking at individual samples also provides a promising picture. Only seven individual samples taken during 2001 exceeded the criteria, and only one of these was during dry weather.

There appears to be little or no correlation between enterococcus and fecal coliform levels as was previously thought by water quality experts. These data, however, seem to show that when the criteria is switched in 2004 there will not be any increases of the number or duration of bacterial criteria exceedances in New York Harbor. The MSS will continue with this investigation during the 2002 sampling season.

The NYCDEP Mircobiology Lab has also begun an investigation into the levels of enterococcus present in the effluent of NYC's sewage treatment plants. A pilot program was initiated in July of 2001 at three treatment plants, Tallman Island, Hunts Point and Bowery Bay. Levels of enterocccus, fecal coliform in the effluent were compared with the total residual chlorine (TRC). The chlorine is added to disinfect the effluent in order to meet SPDES requirements.

For a comparison treated effluent was compared to the average swimming criteria, virtually all effluent samples met the bacterial criteria for open waters. These preliminary results, however, do not indicate an apparent correlation between bacteria levels and TRC. As with the ambient waters there also does not appear to be any relationship between fecal coliform and

enterococcus numbers. The results of this experiment are summarized in figure 2. Further investigation is needed before any firm conclusions are reached. The NYCDEP intends to expand this program to more treatment plants and also will begin sampling for enterococcus in the influent of several treatment plants. Results from both the ambient water and treatment plant sampling will be published in future reports.

figure 1

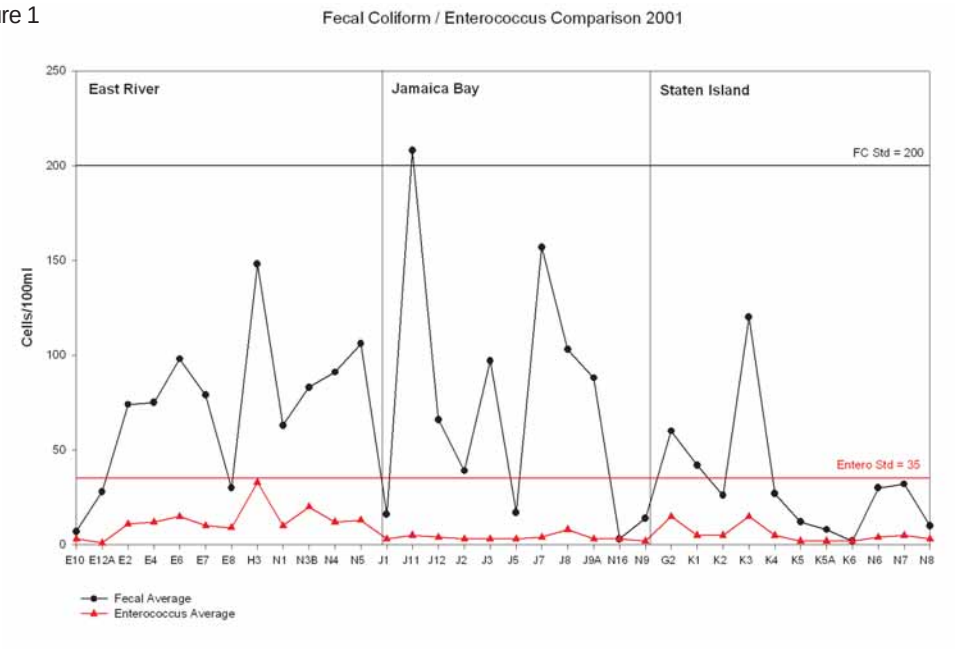
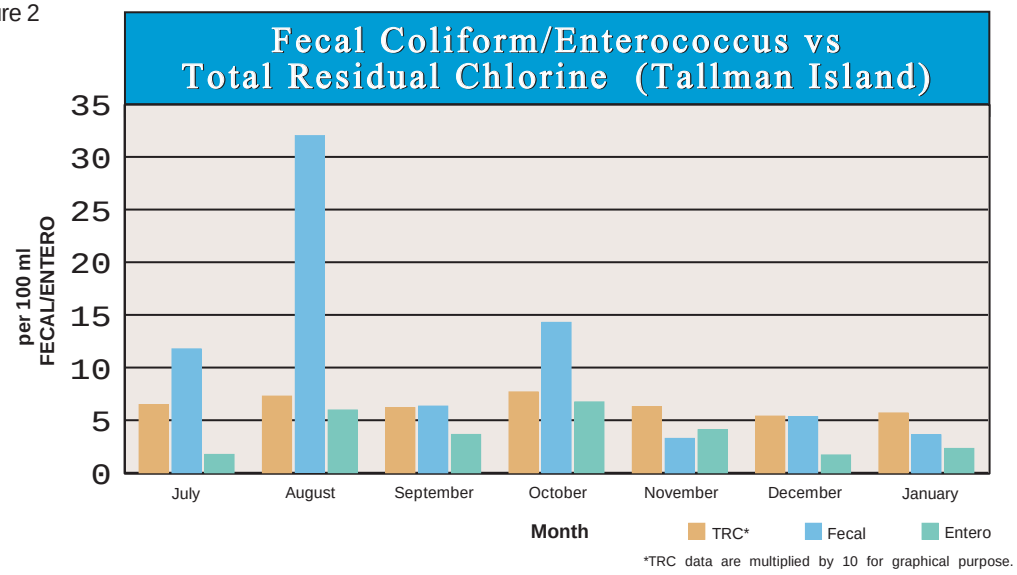



figure 2