

The Boston Harbor Project: History & Planning

Plans to regulate water quality in Boston Harbor historically have been complicated by numerous factors, not the least of which is institutional management.

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The Massachusetts Water Resources Authority (MWRA) is constructing new wastewater treatment facilities to serve its 43 constituent communities in the greater Boston metropolitan area. These facilities include a new secondary treatment plant located on Deer Island in Boston Harbor. The construction of these new facilities, and in fact the creation of the MWRA itself, are actually the most recent events in what has been a long history of planning and reassessment for providing the region with adequate sewerage services and for restoring the harbor as a vital natural resource.

The planning for new treatment facilities occurred in a context created by evolving environmental regulations and intense public scrutiny of the potential impacts of new facilities on

communities and the environment. Public controversy often led to the need for further studies and documentation of issues, which resulted in significant delays in making final decisions on the location and type of facilities to be constructed. Years of public debate, lack of clear regulatory guidance and the continuing degradation of the harbor finally inspired a coalition of political forces within government, special interest groups, and the community-at-large to create a new agency (the MWRA) that could provide the leadership required to plan, promote and implement the cleanup of Boston Harbor.

History of the Sewerage System & Service Area

The city of Boston was founded in 1630 and even its earliest regulations included prohibitions against the fouling of Boston Harbor and its shoreline. Despite initial efforts to prevent pollution, outbreaks of virulent diseases in the 1700s and 1800s were blamed in part on the unhealthy, degraded water quality in Boston Harbor. In 1850, organized collection and removal of refuse from the city streets began and recommendations were made to construct the first sewage drainage system.

Construction began in 1876 on the Boston Main Drainage System — the city's first system

— and it was completed in 1885. The system consisted of 25 miles of main and branch sewers, including a large brick sewer running from Boston under Dorchester Bay to Squantum. It terminated with a pumping station at Calf Pasture and an outfall sewer tunnel to Moon Island, located off Columbia Point between Dorchester Bay and Quincy Bay. The city acquired Moon Island in 1878 and constructed four granite tanks that could hold up to 50 million gallons of sewage. Sewage collected via the Boston Main Drainage System was stored in these tanks and discharged from the Moon Island outfall to the outer harbor twice a day with the outgoing tides. During this same period, cities and towns upstream of Boston were constructing local sewer systems that discharged wastes into the three major rivers that are tributary to Boston Harbor — the Mystic River, the Charles River, and the Neponset River.

The combined impacts on the harbor from all the discharges prompted the Massachusetts legislature in 1889 to create the Metropolitan Sewerage District (MSD). This regional agency was responsible for building, maintaining and operating a sewerage system for the communities surrounding Boston. Initially, the MSD service area consisted of 18 cities and towns and parts of Boston that were not served by the Boston Main Drainage System. From 1895 to 1898, the Boston Main Drainage System was expanded to serve MSD communities discharging to the Charles River Valley Sewer and the Neponset Valley Sewer. Also by 1895, new sewers leading to pumping facilities and outfalls constructed on Deer Island were conveying sewage from communities located north of Boston. The historical growth of the service area is shown in Figure 1.

In 1904, a third outfall system was constructed on Nut Island to serve communities located south and west of the city. By this time the Boston Main Drainage System was severely overloaded and the Charles River Valley and the Neponset Valley sewer systems were diverted to the Nut Island system. As shown in Figure 1, by 1905 the MSD consisted of two separate systems. The South System, discharging from Nut Island, included seven communities and portions of Boston and Cambridge. The North System, discharging from Deer Is-

land, included 14 communities and a section of Cambridge. The majority of sewage from Boston continued to be discharged from the Moon Island outfall.

In 1919, the MSD was combined with the metropolitan water district and metropolitan parks district agencies to form the Metropolitan District Commission (MDC). The MDC became the agency responsible for providing regional sewerage services for the North System and the South System. The MDC acted as the wholesaler of sewerage services to its member communities, while the responsibility for constructing, operating and maintaining the local sewerage systems remained with each individual community. Subsequently, in 1969, as part of a major reorganization of state government, the MDC became part of the new Executive Office of Environmental Affairs (EOEA). As a state agency, the MDC had the authority to administer its own planning programs, but the state legislature had the power to set overall policy and to make appropriations for maintenance and construction projects.

Early Wastewater Treatment Planning

The metropolitan area continued to grow and communities were added to the sewerage systems, especially in the South System. By 1935, two new communities had joined the North System and eight communities had joined the South System (see Figure 1). The discharges from Deer Island, Nut Island, and Moon Island at this time received no treatment. As sewage flows increased, concern for the pollution of Boston Harbor also increased.

From 1900 to 1939, a legislatively established commission, known as the "Special Commission on the Investigation of the Discharge of Sewage into Boston Harbor and Its Tributaries," conducted studies and investigations of pollution abatement alternatives. The commission recommended partial treatment of sewage discharges from Deer Island and Nut Island, and the possible extension of the existing outfalls into Massachusetts Bay.

In 1940, engineering and design for the construction of a wastewater treatment plant to treat South System flows at Nut Island were initiated. Completed in 1952, the Nut Island

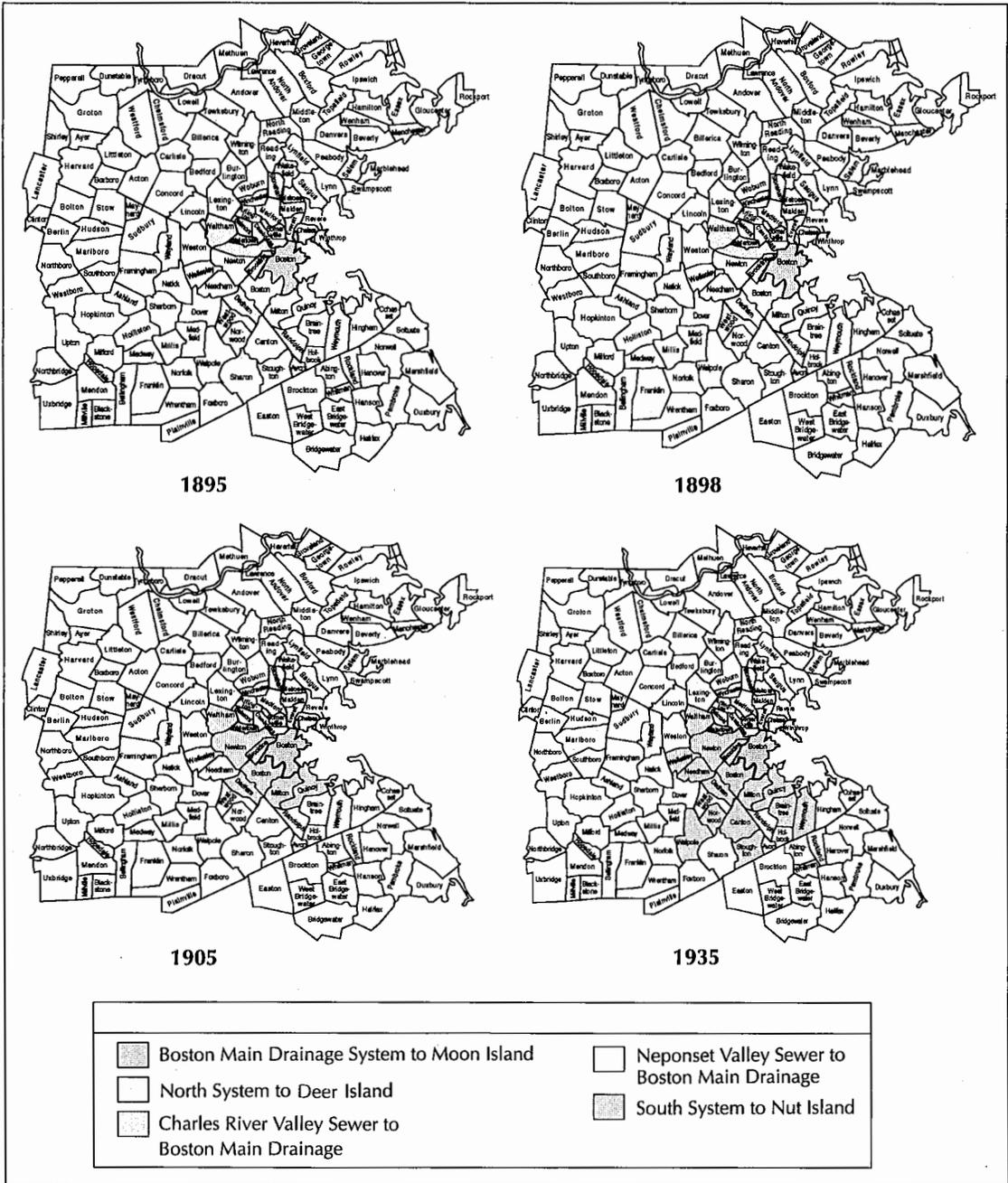


FIGURE 1. Growth of the sewerage service area.

plant provided primary treatment, which consisted of screening, sedimentation and chlorination for an average flow of 112 million gallons per day (mgd) and a peak flow of 270 mgd.

A primary treatment plant was subsequently constructed on Deer Island to treat

North System flows. The Deer Island plant, which began operation in 1968, was designed to treat an average daily flow of 343 mgd and a peak flow of 848 mgd. With the startup of the Deer Island plant, flows that had been tributary to the Boston Main Drainage System from the Charles River Valley Sewer and portions of

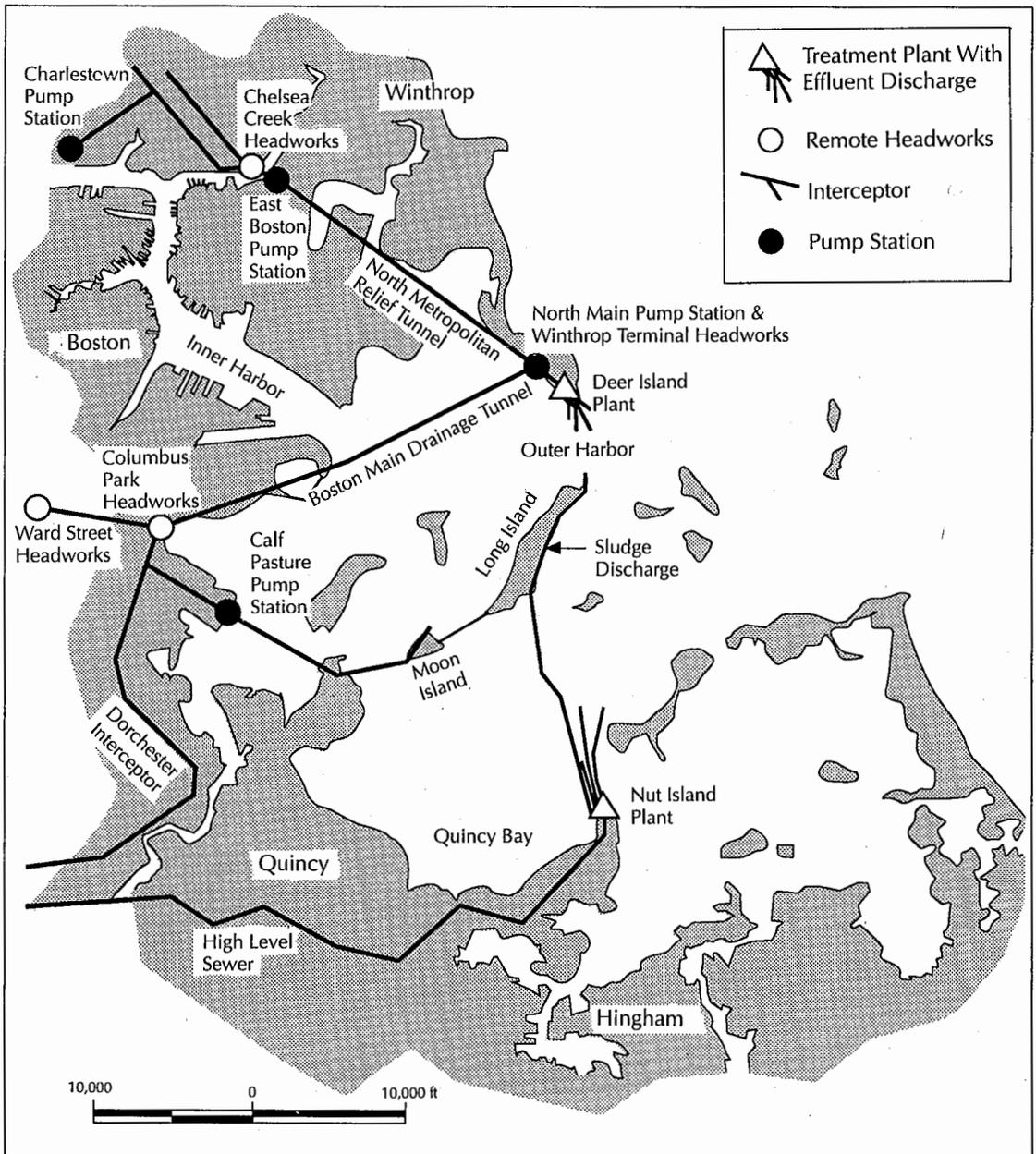


FIGURE 2. Major wastewater conveyance and treatment facilities.

Dorchester, Roxbury and West Roxbury were diverted to Deer Island for treatment. These flows were conveyed via a new Boston Main Drainage Tunnel. Digested sludge from the Deer Island plant was discharged with chlorinated effluent through the main outfall into the Presidents Road shipping channel on outgoing tides. Similarly, digested sludge from Nut Island was discharged to the channel via a four-

mile pipeline that terminated at the northeastern end of Long Island. A schematic of these major wastewater conveyance and treatment facilities is depicted in Figure 2.

The Present Collection Systems & Service Area

Once the two treatment plants were operational, further expansion of the MDC sewerage

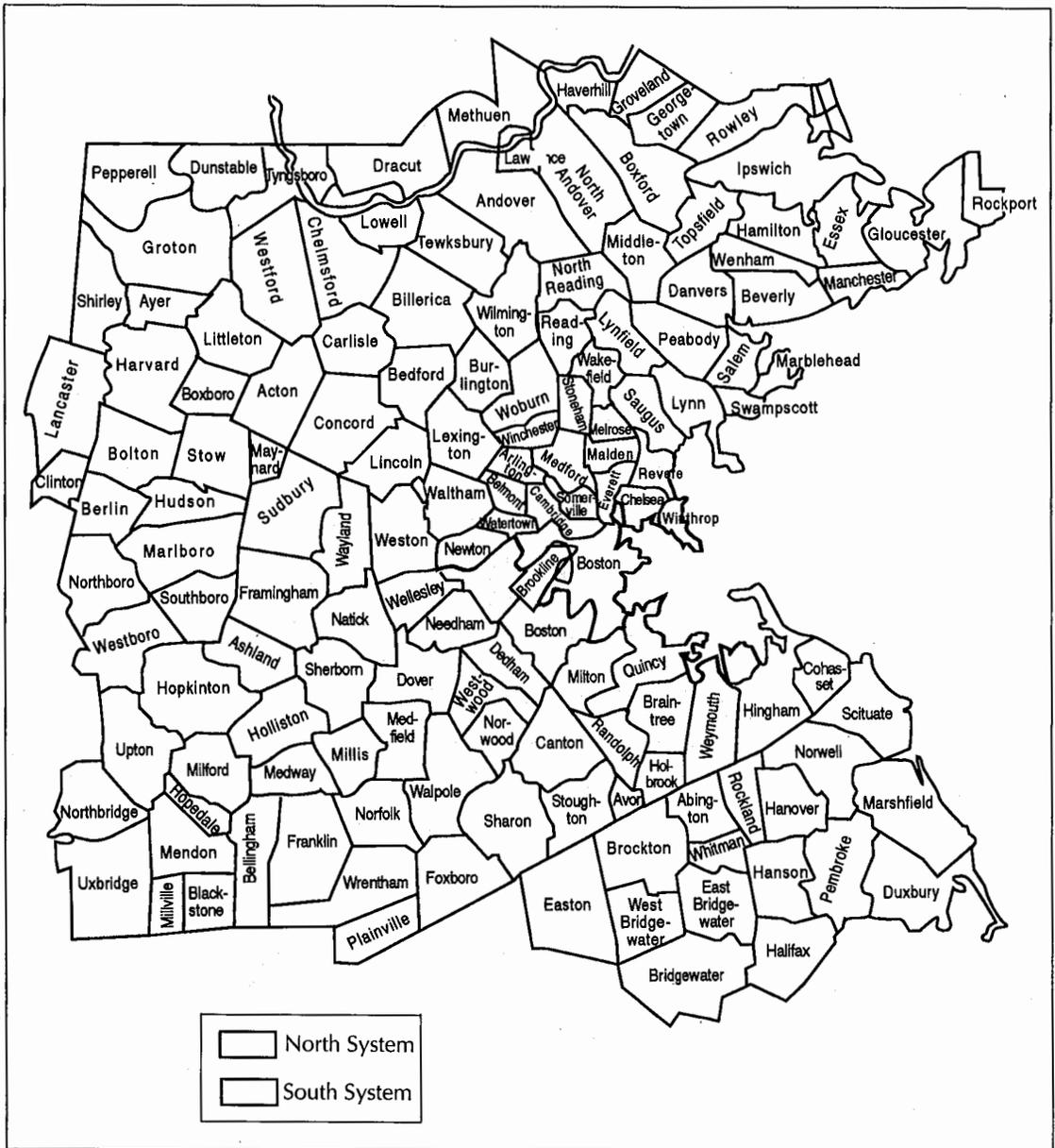


FIGURE 3. The present sewerage service area.

service area continued until the last communities were added in 1968. The system now serves a total of 43 communities (shown in Figure 3 and listed in Table 1). Part of the wastewater flow from the city of Boston went to the North System and part to the South System. Use of the Moon Island facilities was then reserved for emergency discharges if flows to the Deer Island plant exceeded its pumping capacity.

Most of the major MDC interceptor sewers were constructed prior to 1940. With the exception of only the most recent sewer extensions, interceptor relief projects and other collection system improvements, the major components of the system have remained substantially unchanged since that time. Schematics of the North System and the South System facilities — including interceptors, headworks and pump stations — are provided in Figures 4 and

TABLE 1
Sewerage Service Area

<i>North System</i>	
Arlington	Milton*
Bedford	Newton*
Belmont	Reading
Boston*	Revere
Brookline*	Somerville
Burlington	Stoneham
Cambridge	Wakefield
Chelsea	Waltham
Everett	Watertown
Lexington	Wilmington
Malden	Winchester
Medford	Winthrop
Melrose	Woburn
<i>South System</i>	
Ashland	Needham
Boston*	Newton*
Braintree	Norwood
Brookline*	Quincy
Canton	Randolph
Dedham	Stoughton
Framingham	Walpole
Hingham**	Wellesley
Holbrook	Westwood
Milton*	Weymouth
Natick	

* Partial service in both systems

** Limited service

5, respectively. Extension of the system to provide permanent sewer service to additional communities can only be implemented with legislative approval and only if no other feasible wastewater disposal alternatives exist.

The large number of communities to be served, extending well beyond Boston and its harbor, increased the difficulty of finding feasible wastewater treatment solutions. Upstream communities were experiencing the most growth and their need for increased treatment capacity conflicted with the interests of the downstream communities that would be most likely to bear the greatest impacts from the construction and operation of new facilities.

Need for Improved Treatment

The Federal Water Pollution Control Act was passed in 1965, followed one year later by the

formation of the Massachusetts Division of Water Pollution Control (DWPC). These events heralded a new emphasis on the need for improved wastewater treatment and the restoration of Boston Harbor, which despite the construction of the two treatment plants, remained seriously polluted.

In May 1968 the "Conference in the Matter of Pollution of Navigable Waters of Boston Harbor and Its Tributaries" was convened by the Federal Water Pollution Control Administration (FWPCA) to investigate problems related to the operation and performance of the MDC sewerage system and treatment facilities. This conference was followed by two additional enforcement conferences held in 1969 and 1971. The last conference culminated in a Memorandum of Agreement signed by the MDC, the Massachusetts DWPC and the U.S. Environmental Protection Agency (USEPA), which had succeeded the FWPCA in providing federal regulatory oversight. The agreement included a schedule for the preparation of a series of engineering reports that would better define harbor pollution, investigate alternatives for sludge disposal and initiate planning for combined sewer overflow control.

Since the 1930s a number of studies have been conducted that examined the need for additional wastewater treatment facilities. A chronology of a selection of these reports is provided in Table 2. The major initial reports relevant to the siting and design of new facilities on Deer Island and Nut Island are:

- Boston Harbor-Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study
- Draft Environmental Impact Statement
- First 301(h) Secondary Treatment Waiver Application
- Phase 1 Site Options Study
- Second 301(h) Secondary Treatment Waiver Application
- Supplemental Draft Environmental Impact Statement/Draft Environmental Impact Report on the Siting of Wastewater Treatment Facilities in Boston Harbor

EMMA Study. The first comprehensive study, directed and funded by the MDC and the

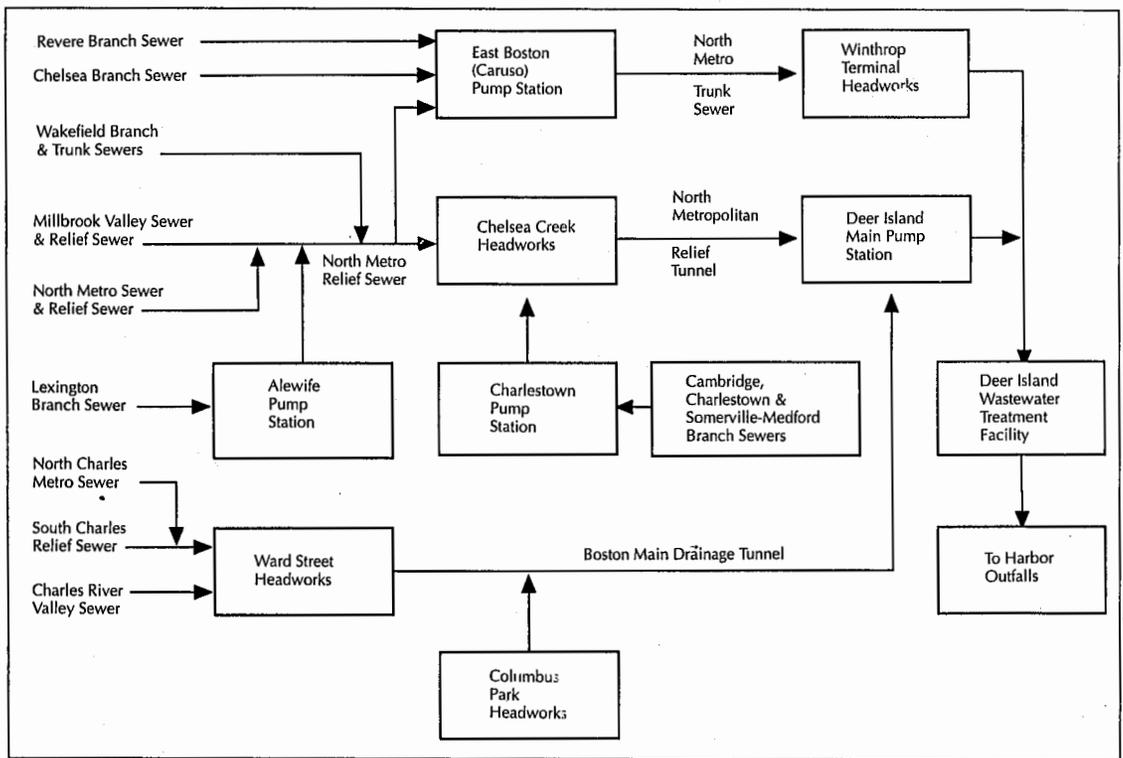


FIGURE 4. North System schematic.

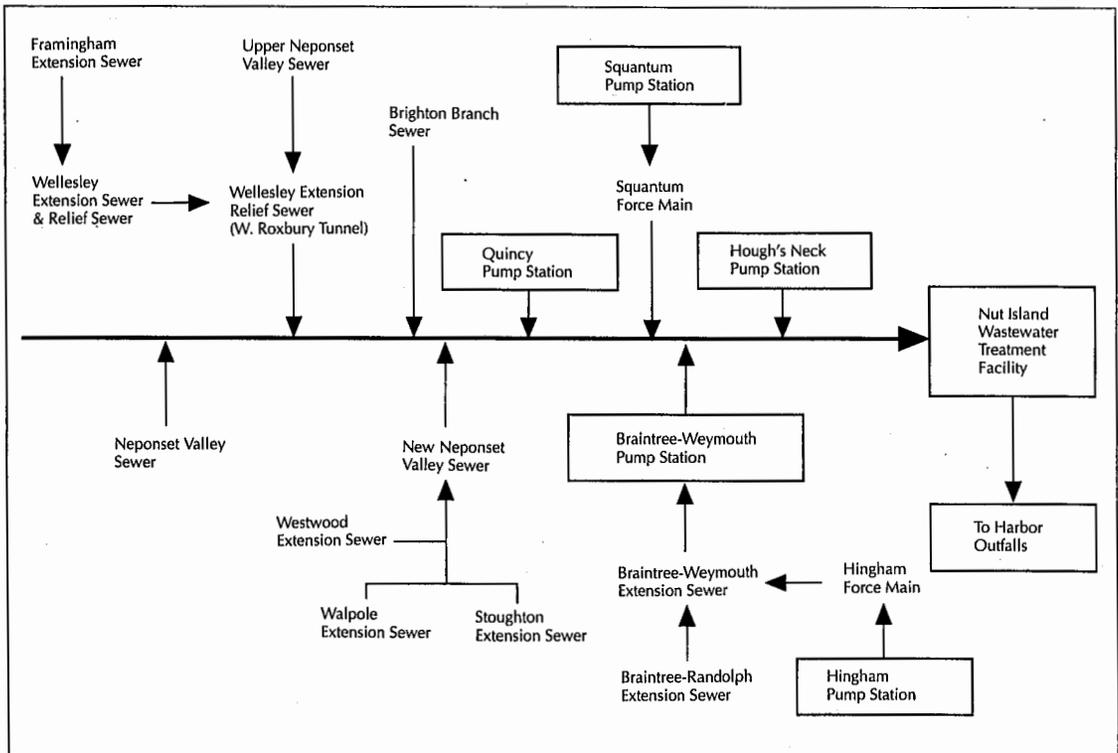


FIGURE 5. South System schematic.

TABLE 2
Chronology of Selected Wastewater Treatment Planning Studies

Date Completed	Title	Author or Prepared by	Prepared for
1937	Report of the Special Commission on the Investigation of the Discharge of Sewage into Boston Harbor & Its Tributaries	Massachusetts House Report 1600	
1939	Report of the Special Commission Investigating Systems of Sewerage & Sewage Disposal in the North and South Metropolitan Sewerage Districts & the City of Boston	Massachusetts House Report 2465	
January 1941	Sewerage and Sewage Disposal Studies Under Chapter 512 of 1939: General Design Drawings & Final Report	Metcalf & Eddy and Greeley and Hansen	Commonwealth of Massachusetts
April 1950	Report on the Comprehensive Plan of Sewage Disposal Needs & Alternate Plans	Charles A. Maguire and Associates	MDC
February 1951	A Proposed Plan of Sewerage and Sewage Disposal for the Boston Metropolitan Area	Charles A. Maguire and Associates	MDC
September 1967	Improvements to the Boston Main Drainage System	Camp Dresser & McKee	City of Boston
July 1971	Final Report on Development of Water Quality Model of Boston Harbor	Hydroscience	Commonwealth of Massachusetts
August 1973	A Plan for Sludge Management	Havens and Emerson	MDC
October 1974	Environmental Assessment Statement for a Plan for Sludge Management	Havens and Emerson	MDC
February 1976	Draft Environmental Impact Statement: Proposed Sludge Management Plan	Metropolitan District Commission	USEPA Region I
March 1976	Wastewater Engineering & Management for Boston Harbor-Eastern Massachusetts Metropolitan Area: Main Report and Summary Report	Metcalf & Eddy	MDC
May 1976	Joint Task Force Report on Major Manned MDC Facilities Located in the Greater Boston Area	USEPA Region I	
July 1976	Wastewater Management Planning: Boston Metropolitan Area Phase I Study	Urban Systems Research and Engineering Inc.	MAPC
July 1976	Phase I Engineering Report Boston Case Study	Kennedy Engineers	USEPA Region 1
August 1976	Phase I Final Report on Greater Boston Water Quality Issues in Planning for Pollution Control	Verlex Corporation	
November 1976	Boston Metropolitan Area Waste Treatment Feasibility Study	Stone & Webster Engineering	City of Boston
September 1997	Management Plan for EMMA Plan Implementation	Metcalf & Eddy	MDC
1978	Compost Demonstration & Marketing Study	Energy Resources Company	MDC
March 1978	Draft Area-wide Waste Treatment Management Plan for the Boston Metropolitan Area	Metropolitan Area Planning Council	
September 1978	Draft Environmental Impact Statement on the Upgrading of the Boston Metropolitan Area Sewerage System	Greeley & Hansen	USEPA Region I
November 1978	Final Area-wide Waste Treatment Management Plan/EIS for the Metropolitan Boston Area	Metropolitan Area Planning Council	

(continued)

TABLE 2
Chronology of Selected Wastewater Treatment Planning Studies (continued)

Date Completed	Title	Author or Prepared by	Prepared for
January 1979	Wastewater Treatment Facilities Planning in the Boston Metropolitan Area—A Case Study	Kennedy Engineers	Federal Study Team
March 1979	Final Environmental Impact Statement on MDC Proposed Sludge Management Plan	EcolSciences, Inc.	USEPA Region I
September 1979	Application for Modification of Secondary Treatment Requirements for Discharges into Marine Waters of Boston Harbor & Massachusetts Bay for the MDC Deer Island & Nut Island Wastewater Treatment Plants	Metcalf & Eddy	MDC
December 1980	MDC Headworks Grit and Screenings Removal Systems—Preliminary Report	Whitman and Howard	MDC
June 1982	Nut Island Wastewater Treatment Plant Facilities Planning Project: Phase 1 Site Options Study	Metcalf & Eddy	MDC
1982	Nut Island Wastewater Treatment Plant Immediate Upgrading	Metcalf & Eddy	MDC
August 1982	Wastewater Sludge Management Update Study	Havens & Emerson	MDC
1984	Deer Island Facilities Plan	Havens & Emerson	MDC
June 1984	Application for a Waiver of Secondary Treatment for the Nut Island & Deer Island Treatment Plants	Metcalf & Eddy	MDC
December 1984	Supplemental Draft Environmental Impact Statement & Draft Environmental Impact Report on Siting of Wastewater Treatment Facilities in Boston Harbor	C.E. Maguire	USEPA & EOE A
November 1985	Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor	Camp Dresser & McKee	MWRA
December 1985	Final Environmental Impact Statement on Siting of Wastewater Treatment Facilities for Boston Harbor	C.E. Maguire	USEPA Region I
1986	Phase I Residuals Management Facilities Plan Studies		MWRA
October 1987	Draft Facilities Plan/Draft EIR for MWRA Secondary Wastewater Treatment Facilities	Camp Dresser & McKee	MWRA
March 1988	Final Facilities Plan/Final EIR for MWRA Secondary Wastewater Treatment Facilities	Camp Dresser & McKee	MWRA
April 1988	Draft Supplemental Environmental Impact Statement on Boston Harbor Wastewater Conveyance System	Metcalf & Eddy	USEPA Region I
July 1988	Final Supplemental Environmental Impact Statement on Boston Harbor Wastewater Conveyance System	Metcalf & Eddy	USEPA Region I
February 1989	Draft Residuals Management Facilities Plan/Draft Environmental Impact Report	Black & Veatch	MWRA
May 1989	Draft Supplemental Environmental Impact Statement: Long-Term Residuals Management for Metropolitan Boston	Metcalf & Eddy	USEPA Region I
May 1989	Boston Harbor Project-Deer Island Related Facilities: Final Plant Wide Concept Design Report	Metcalf & Eddy	MWRA
August 1989	Residuals Management Facilities Plan: Final Environmental Impact Report	Black & Veatch	MWRA
November 1989	Final Supplemental Environmental Impact Statement: Long-Term Residuals Management for Metropolitan Boston	Metcalf & Eddy	USEPA Region I

U.S. Army Corps of Engineers, was the Boston Harbor-Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study (commonly referred to as the EMMA Study). It was initiated in 1972 to determine what repair, replacement, relief, extension and expansion of sewage conveyance and treatment facilities were necessary so that the regional wastewater treatment system could provide adequate capacity to accommodate growth in the service area over the next 50 years. In October 1972, the Federal Water Pollution Control Act Amendments were enacted and the scope of the study was expanded to examine options that would allow the MDC to comply with the new statute's requirement for secondary treatment by 1977.

The EMMA Study was completed in March 1976. Based on the results of the study, the following changes to the MDC sewerage system were recommended:

- The existing primary treatment facilities at Deer Island and at Nut Island would be rehabilitated and repaired at their present locations. Both plants would be expanded somewhat to provide sufficient capacity to treat wastewater flows projected for the year 2000. Average flows were estimated to be 400 mgd for Deer Island and 130 mgd for Nut Island.
- Secondary treatment at both treatment plants would be provided to comply with the 1972 statutory requirement.
- Two satellite advanced wastewater treatment plants would be constructed in the South System. One would be located in Wellesley (discharging to the Charles River) and the other would be in the Norwood and Canton area (discharging to the Neponset River).
- The regional service area would be expanded by eight communities to a total of 51 communities.
- New facilities would be constructed to control pollution associated with the overflow of combined sewage to Dorchester Bay, the Charles River Basin, the Neponset River and the Inner Harbor.
- Relief of several MDC interceptors to remedy existing conditions of overloaded

sewers, especially in the South System, would be required. In addition, extension of interceptors would be needed to serve the communities that were recommended to be added to the system.

- All system components that had reached or exceeded either their design life or their design capacity (or both) should be rehabilitated or replaced. For example, the study proposed that each of the ten pump stations along the MDC interceptor systems be replaced or repaired.

Altogether 52 separate projects were recommended for construction over a 20-year span. The projects were ranked in terms of priority for reducing water pollution and conforming with the mandate for secondary treatment by 1977. The total capital cost to implement all of the recommended projects was estimated at \$855 million (1975 dollars). After the study was completed, a management study was prepared to determine what resources and staff the MDC would need to implement the recommended projects.

The final recommendations of the EMMA Study generated considerable public opposition. The greatest controversy centered around the siting of satellite treatment facilities for the South System and the filling of 28 acres of Quincy Bay to create a land area for the expanded Nut Island treatment facilities. As a result of the continued vigorous opposition to the placing of fill in Quincy Bay, legislation (Chapter 296 of the Acts of 1977) subsequently was enacted expressly forbidding such filling for the construction of additional sewage treatment works.

Draft Environmental Impact Statement. Due to the controversy raised by the EMMA Study recommendations, the USEPA decided to prepare an Environmental Impact Statement (EIS) before the MDC initiated its facilities planning. A draft EIS was published in September 1978. It recommended eliminating the satellite treatment plants, replacing the existing facilities at Nut Island with a headworks facility for preliminary treatment prior to conveying South System flows to Deer Island and expanding the facilities at Deer Island to provide primary and secondary treatment of all North System and South System flows.

As with the EMMA Study, USEPA's findings created extensive public comment and the EIS process was not finalized for several years.

First 301(h) Secondary Treatment Waiver Application. Congress enacted the Federal Clean Water Act in 1977, which included several amendments to the preceding statute. The act included a provision under section 301(h) that authorized the USEPA to grant waivers (for five-year renewable periods) from the law's requirement for secondary treatment to facilities that discharged to marine waters. The waiver was to be granted only if the applicant could meet a number of stipulations for removing toxic pollutants, achieving water quality standards and monitoring the effects of the effluent discharge. Final 301(h) regulations were promulgated on June 15, 1979. The question of whether waivers should be granted created extensive technical and political debate among legislators, federal and state environmental regulators, as well as the public, thus causing decisions regarding new treatment facilities for Boston Harbor to be further delayed.

The requirement for providing secondary treatment raised a number of issues concerning increased construction and operating costs, land requirements and energy needs. The quantity of sludge produced by secondary treatment also would be nearly double that generated by primary treatment, which would complicate the options for its disposal. In addition, it was unclear whether the water quality benefits that were anticipated from a higher level of treatment would actually be realized. The MDC was compelled by the importance of all these issues to explore its option for obtaining a 301(h) waiver. The MDC submitted a preliminary 301(h) waiver application to the USEPA and initiated its field investigations in September 1978. Results of the studies and the final application were filed in September 1979.

The application proposed that primary treatment would be performed at both Deer Island and Nut Island, that Nut Island effluent would be pumped via a 4.7-mile pipeline to Deer Island, and that the combined effluents would be discharged through an outfall and diffuser system extending 7.5 miles into Massachusetts Bay at a depth of 105 feet. Subsequent information to support the application

was provided at USEPA's request in September 1981 through three addenda submitted in June, August and October 1982. While a decision on the waiver was pending, the MDC continued planning for its new treatment facilities.

Nut Island Wastewater Treatment Plant Facilities Planning Project: Phase 1 Site Options Study. In April 1978, the USEPA and the MDC had entered into a formal agreement so that the MDC could move forward with certain projects that would be required regardless of the outcome of the pending final EIS on the EMMA Study or the evaluation of the waiver application. This Site Options Study was initiated as the first phase of facilities planning. The purpose of the study was to identify the options for locating treatment facilities that would be needed for either primary or secondary treatment.

The Phase 1 Site Options Study was completed in June 1982. It evaluated 12 siting options, including various combinations for primary and secondary treatment facilities at Deer Island and Nut Island, and one option for utilizing Long Island. Table 3 lists the options evaluated. Seven options involved secondary treatment with local outfalls, two involved upgraded primary treatment with a new deep-ocean outfall equipped with diffusers, and three options involved upgraded primary treatment with improved local outfalls. The report concluded that the existing primary treatment facilities at Deer Island and Nut Island were in need of immediate improvements to achieve even the requisite primary treatment and that substantial facility improvements were necessary to meet future treatment needs and to protect harbor resources.

The Phase 1 Site Options Study evaluated all the options and presented the best primary and secondary treatment options. The MDC Sewerage Division issued a statement of its preferred options based on consideration of environmental impacts, engineering, cost and public acceptability. Option 10, which included upgraded primary treatment at both Deer Island and Nut Island with improved local outfalls, was selected as the preferred alternative. The MDC felt that this option distributed effluent loadings to the harbor in a manner that would improve existing conditions, meet state water

TABLE 3
1982 Site Options

Option	North System		South System		Treatment Facilities**	Outfall Location
	Primary	Secondary	Primary	Secondary		
1	DI	DI	DI	DI	Separate	Local
2	DI	DI	DI	DI	Combined	Local
3	DI	DI	NI	DI	Combined Secondary	Local
4	DI	DI	NI	DI	Separate	Local
5	DI	DI	NI	LI	Separate	Local
6	DI	DI	LI	LI	Separate	Local
7	DI	DI	NI	NI	Separate	Local
8*	DI	—	DI	—	Combined	Deep Ocean
8A*	DI	—	DI	—	Combined	Local
9*	DI	—	NI	—	Separate	Deep Ocean
10*	DI	—	NI	—	Separate	Local
11	DI	LI	NI/LI	LI	Combined Secondary	Local

Note: DI = Deer Island; NI = Nut Island; LI = Long Island

* Upgraded Primary Treatment

** Indicates whether treatment of North System and South System flows would be separate or combined.

quality standards, diminish environmental concerns and equitably distribute impacts on communities between two sites. Option 10 also was less expensive and could be implemented in stages to achieve more immediate water quality improvements.

Selection of upgraded primary treatment as the preferred alternative was supported by the results of water quality and marine biological monitoring that was conducted in 1978 and 1979 as part of the 301(h) waiver application. This monitoring indicated that water quality standards could be met and marine biota would not be adversely impacted by the discharge of primary effluent. The construction of a deep-ocean outfall was not precluded as a potential future necessity. A decision on the need for a longer outfall would be made following the five-year harbor monitoring program that would be mandated if a waiver was granted. If the outfall was deemed to be unnecessary, funds remaining after the plant upgrades were completed would be used to address combined sewer overflows and other pollutant inputs to the harbor.

If secondary treatment were required, Option 4 would be selected as the preferred alternative. This option involved maintaining primary treatment on Nut Island and pumping

the effluent to Deer Island, where secondary treatment of the combined primary flows would be performed. Secondary treatment on Nut Island was considered to be unacceptable, since it would require extensive filling of adjacent waters to increase the site for expanded facilities and would create adverse impacts on the neighboring residential area that could not be adequately mitigated. Since the costs for implementing secondary treatment were extremely high and the water quality benefits were not demonstrated to be significant, the MDC continued its pursuit of the 301(h) waiver.

Second 301(h) Secondary Treatment Waiver Application. In June 1983, almost five years after the initial application was filed, the USEPA announced a tentative decision to deny the MDC request for a waiver from the requirement for implementing secondary treatment. The decision document prepared by USEPA headquarters listed the following reasons for the tentative denial:

- Potential violation of Massachusetts water quality standards for dissolved oxygen;
- Restricted circulation at the proposed discharge site;

- The negative impact of solids deposition on dissolved oxygen and benthic organisms;
- Adverse impacts on the protection and propagation of a balanced indigenous marine population; and,
- Deficiencies in the proposed programs for harbor monitoring and toxic pollutant reduction.

Based on discussions with representatives from USEPA headquarters, the MDC decided that the reasons for the tentative denial could be resolved through further investigations and in January 1984 submitted a proposed Plan of Study. The MDC, with support from the USEPA Region I and the state DWPC, continued to pursue a waiver based on the merits of several factors. First, if a waiver were granted, the required five-year monitoring program would evaluate the impacts of the primary effluent at the discharge site and determine the need for secondary treatment. During the same period, environmental review for the siting of the treatment facilities could be completed. The cost differential also was substantial. It was estimated that a waiver would save about \$200 million in the cost of construction of new facilities and \$20 million per year in operation and maintenance.

A revised application was submitted to the USEPA in June 1984, with the understanding that the results of a summer field program would be submitted in October 1984. The additional field work was conducted to assess biological and water quality impacts during critical summer months, when dissolved oxygen concentrations are typically low due to higher water temperatures and stratification in Massachusetts Bay. This work helped to determine the final location of the proposed outfall.

Information in the revised application demonstrated compliance with the state water quality standards for dissolved oxygen, suspended solids, and pH; therefore, the state DWPC issued the required water quality certification. The proposed discharge location was extended about 1.7 miles farther into Massachusetts Bay (a total of 9.2 miles to a depth of 120 feet). The proposed outfall would be 18 feet in diameter and include a 1.3-mile diffuser manifold.

Revised effluent flow and load estimates and additional testing indicated that the depo-

sition of solids at the proposed discharge site would not be significantly greater than natural sediment accumulation. These results, coupled with the results of nutrient testing and phytoplankton and benthic community sampling, indicated that the existing balanced indigenous population of marine life would be maintained.

The MDC and the state DWPC felt that the revised application fully complied with all federal and state requirements and that upgraded primary treatment with a deep-ocean outfall was an environmentally sound alternative to secondary treatment. Implementation of the preferred primary treatment option would cost less, require less land, reduce negative impacts on communities and simplify sludge management.

Supplemental Draft Environmental Impact Statement/Draft Environmental Impact Report (SDEIS/DEIR) on the Siting of Wastewater Treatment Facilities in Boston Harbor. In 1983, the USEPA decided to update its 1978 draft EIS that had followed the EMMA Study and to evaluate the options for facilities siting that were presented in the new Site Options Study. The MDC agreed to prepare the report in cooperation with the USEPA, so that it also could serve as the draft EIR and fulfill the requirements for state environmental review.

The document was completed in December 1984. It examined a total of 22 alternatives for siting both primary and secondary treatment facilities. Eight alternatives — four for primary treatment and four for secondary treatment — were selected for detailed evaluation. All the primary treatment scenarios assumed the need for a deep-ocean outfall. The range of alternatives included locating all treatment facilities on Deer Island, all facilities on Long Island, and various combinations utilizing two or more of the potential sites. These alternatives are presented in Table 4.

No preferred alternative was recommended so that the full range of options could undergo public review. Assumptions on the types of treatment processes, outfall locations, sludge management options and mitigation efforts were made for the purpose of evaluating the wastewater treatment siting alternatives. Final decisions and environmental reviews of these

TABLE 4
1984 Treatment Plant Siting Alternatives

Option	North System		South System		Treatment Facilities*	Outfall Location
	Primary	Secondary	Primary	Secondary		
1	DI	DI	DI	DI	Combined	Local
2	DI	DI	NI	DI	Combined Secondary	Local
3	LI	LI	LI	LI	Combined	Local
4	DI	LI	LI	LI	Combined Secondary	Local
5	DI	—	DI	—	Combined	Deep Ocean
6	DI	—	NI	—	Separate	Deep Ocean
7	DI	—	LI	—	Separate	Deep Ocean
8	LI	—	LI	—	Combined	Deep Ocean

Note: DI = Deer Island; NI = Nut Island; LI = Long Island

* Indicates whether treatment of North System and South System flows would be separate or combined.

specific aspects of the project would be part of future planning efforts.

While the document was being completed, other important developments in the history of the planning for new wastewater treatment facilities were unfolding.

Creation of a New Regional Sewerage Agency

The enormous task of operating, maintaining and improving a large regional sewerage system proved to be too great for the MDC, an agency with a budget and staff that were often constrained by the actions of the state legislature. Historically, MDC budget requests for system improvements and maintenance were not funded, since infrastructure repairs comprised a relatively invisible need compared to the need for other projects and programs competing for limited state resources. The lack of funding led to chronic, and occasionally catastrophic, malfunctions at the Deer Island and Nut Island treatment plants, and stalled the initiation of the projects that would have provided reliable collection and adequate treatment of the region's wastewater flows.

In addition, as documented by the number of studies undertaken to determine the type and location of new treatment facilities, for almost fifteen years the MDC was unable to resolve key management issues. These issues included:

- Determining the level of wastewater treatment to be provided;
- Deciding where new treatment facilities would be constructed; and,
- Selecting a disposal method for sewage sludge.

The size and age of the sewerage system, the complexity of its problems, and the level of public opposition to proposed facilities plans and siting options all contributed to both a critical deficiency in the MDC's ability to provide reliable sewerage services as well as the continuing degradation of Boston Harbor. Changes in environmental regulations, and the delayed and frequently conflicting opinions rendered by the state and federal agencies involved, also forestalled decision making to determine how the sewerage system should be upgraded so that services would be improved and the cleanup of the harbor would begin.

Of particular concern was the fact that as the years had elapsed, federal funds for the construction of new wastewater treatment facilities had diminished. Available federal and state grants had been given to other projects in Massachusetts that were perhaps lower in environmental priority, but had obtained the necessary approvals for construction.

In May 1983, Governor Michael Dukakis appointed a special committee to address the historical delays in resolving Boston Harbor water quality management issues. The committee

was headed by former Governor Francis Sargent and was composed of representatives from the state legislature, state environmental agencies, University of Massachusetts, business associations, environmental advocates and residents of the communities of adjacent to the Deer Island and Nut Island facilities — Winthrop and Quincy. The "Sargent Committee," which was the first to involve representatives of groups having disparate interests, was mandated to investigate the key issues and to make recommendations that would improve the management of regional sewerage services and initiate the recovery of Boston Harbor.

The Secretary of Environmental Affairs, James Hoyte, and his staff were charged with assisting the committee in fulfilling its mandate. Recommendations were drafted that endorsed pursuing a secondary treatment waiver and the composting of sewage sludge. However, while the committee was attempting to address the problems, actions by other parties had a dramatic impact on its future planning and implementation efforts.

State Court Actions. On December 17, 1982, the city of Quincy filed a complaint in Norfolk County Superior Court against the Boston Water and Sewer Commission, the MDC, and the Commonwealth of Massachusetts for violations of the state water quality standards and the chronic pollution of Boston Harbor, Quincy Bay and adjacent waters. On July 8, 1983, Judge Paul Garrity appointed Charles Haar, a Harvard Law School professor, as Special Master for the case to hear evidence from the parties, clarify disputed facts and make recommendations for remedies.

On September 9, 1983, Judge Garrity issued a procedural order that included a schedule of activities to resolve problems and delays. Based on one of the Special Master's recommendations, the order directed the Commonwealth to develop a financial plan that could secure the funds that would be needed to rehabilitate and maintain the region's sewerage facilities. In response, the EOEА retained the Bank of Boston as its independent financial consultant to assist in developing this plan.

The Bank of Boston evaluated the existing MDC funding structure and conducted a national survey of water and sewerage agencies

to identify successful financing mechanisms. In its February 1984 report, the bank found that the current structure of the MDC, operating under the fiscal constraints of the state budgetary process, was inadequate to fund and implement the operating and capital programs that would be needed to improve the sewerage system. In addition, the management and financial issues that had led to the deterioration of the sewerage system were posing a similar threat to the drinking water delivery system. The report recommended that a new independent authority be established to fund operating and capital outlay costs on a user charge basis and to secure debt with system revenues. It also determined that maintaining and improving the water and sewerage systems could be more efficiently funded through a combined authority. Finally, the report included several recommendations on how to structure the new authority so that it could raise sufficient revenues to undertake the necessary projects.

Legislative Initiative. Following a review of the Bank of Boston report, the Sargent Committee endorsed the recommendation to create an independent metropolitan water and sewer authority. EOEА staff, with assistance provided by the law firm of Palmer and Dodge, began an intensive effort to coalesce the support of various interest groups and draft the comprehensive legislation that described the responsibilities and organization of the proposed authority in detail. Governor Dukakis filed a bill for the new water and sewer authority on April 19, 1984. While the bill was being examined, several members of the legislature made important contributions in clarifying how the authority would operate. A particularly key point that was successfully included in the legislation stipulated that the authority's user charges would not be subject to Proposition 2½, a law that had been passed to limit the rate of growth of assessments imposed by state government on municipalities. Without the constraint of Proposition 2½, the authority would be able to set charges that could provide the financial resources needed to construct and maintain new facilities.

In November 1984, while the bill was still being debated and refined, Judge Garrity placed a moratorium on new connections to the

MDC sewerage system and announced his intention to place the MDC in receivership. The added pressure created by these actions resulted in the passage by the state legislature of Chapter 372 of the Acts of 1984 on December 19, which established the MWRA as the new regional water and sewer authority.

Resolution of Issues & Final Facilities Planning

Although the MWRA was not to assume its full control of the water and sewer services until July 1, 1985, its first Board of Directors began to meet immediately to discuss how the many historical problems should be resolved. During the transition phase to the new organization the MDC continued with its planning efforts and proposals, which included a reapplication for a secondary treatment waiver.

Final Waiver Decision. On March 29, 1985, the USEPA denied the MDC's second application for a waiver from secondary treatment requirements. The decision document, prepared and issued by USEPA Region I, listed the following reasons for denial:

- Violation of the state's dissolved oxygen standard during summer sediment resuspension events;
- Interference with a balanced indigenous population outside the zone of initial dilution due to low dissolved oxygen concentrations; and,
- Deficiencies in monitoring and pretreatment programs.

These findings caused a great deal of contention regarding how the USEPA had used the dissolved oxygen data from the first and revised waiver applications to calculate the worst case conditions and whether the discharge would, in fact, violate the state's standard for dissolved oxygen. The state DWPC had certified that the discharge would comply with the state standard, but the USEPA did not agree that the standard should be based on a depth-averaged concentration. The USEPA was most concerned with the impacts of low dissolved oxygen concentrations on bottom-dwelling organisms.

The 301(h) regulations provided that if a waiver was denied, the applicant's last resort

would be to contest its new discharge permit, which would be written to require that the treatment plant meet effluent limits for secondary treatment. The waiver denial was issued at an important juncture in the history of the planning process by testing the managerial and technical acumen and responsiveness of the new organization.

Important MWRA Decisions. The first major decisions by the MWRA Board of Directors were made on July 10, 1985. Based on the report prepared by the MDC and the USEPA in 1984, it selected a "preferred" site for the construction of new wastewater treatment facilities. Although further environmental review would be conducted, its decision was to retain Deer Island as the site for either a new primary plant or a new secondary plant to treat the combined flows from the North and South Systems. At the same time, the board voted that facilities for final treatment and disposal of wastewater residuals (sludge) should not be located on the same site. Planning for the siting and design of residuals management facilities then proceeded independently from final planning for the new wastewater treatment facilities.

Following the denial of the MDC's second application for a waiver from secondary treatment requirements, the USEPA in August 1985 issued a new draft discharge permit to the MWRA that included effluent limits based on secondary treatment. The MWRA Board voted to decline its option to appeal the draft permit and to begin planning for secondary wastewater treatment facilities.

Therefore, within its first months of operation, the MWRA had made strides in resolving two of the most important management issues regarding the cleanup of Boston Harbor:

- Where future treatment facilities would be located; and,
- What level of treatment would be provided.

Final Environmental Review on Siting of Treatment Facilities. When it came time to finalize the SDEIS/DEIR on the siting of treatment facilities, the USEPA and the MWRA mutually decided to prepare their own separate documents. The MWRA's Final Environmental

Impact Report (EIR) was completed in November 1985. The MWRA evaluated the eight siting options identified in the draft EIR against eight criteria. The MWRA concluded that three criteria — implementability, impacts on neighbors and reliability — were essentially neutral in the siting decision. The criterion of equitable distribution of regional resources was found to favor alternatives involving treatment facilities located on Nut Island or Long Island. The remaining four criteria — harbor enhancement, impacts on cultural and natural resources, cost and non-environmental mitigation — were found to favor Deer Island as the site recommended for wastewater treatment facilities. Based on its evaluation of the criteria, the MWRA Board voted to designate Deer Island as the site for the construction of new treatment facilities with the stipulations that the prison on the island be removed and that residuals treatment facilities be constructed at another location.

Along with the selection of Deer Island, the final EIR included considerable commitments by the MWRA to immediate and long-term mitigation measures that would reduce adverse impacts on communities where facilities would be constructed. These commitments included a cap on flows and growth of the system, proper operation and maintenance of facilities, limits on noise and odors, and the barging and busing of construction materials and workers.

The MWRA's final EIR was followed in December 1985 by USEPA's final EIS. The USEPA recommendations on siting of facilities differed only in that relocating the prison from the island was not viewed as mandatory. Following public review and comment, in February 1986 the MWRA Board of Directors took a final vote confirming the selection of the Deer Island site and commenced planning for the new treatment facilities.

Federal Court Action. In June 1983, the Conservation Law Foundation (CLF) had filed a suit in U.S. District Court against the MDC and the USEPA for polluting Boston Harbor and violating the state's Clean Water Act. In March 1984, Judge David Mazzone stayed the case pending the outcome of the suit filed in state court by the city of Quincy in 1982. Despite the

MWRA's demonstration of its ability to make expeditious progress in resolving long outstanding issues, the federal government on behalf of the USEPA filed a suit on January 31, 1985, against the MDC, the Commonwealth of Massachusetts, the Boston Water and Sewer Commission and the MWRA. The suit alleged violations of the federal Clean Water Act, federal discharge permits and USEPA administrative orders. On May 22, 1985, the stay on the CLF suit was vacated and a motion was granted to consolidate the case with that filed by the federal government. The MWRA, as successor-in-interest to the MDC, was enjoined as the key defendant in the federal action.

In September 1985, Judge Mazzone found the MWRA to be liable for certain violations of the Clean Water Act. This finding was followed by a series of hearings during which each party to the suit presented its proposed schedule of remedial actions. Although the implementation of a program to improve wastewater treatment and disposal was a shared goal of all the parties, the MWRA took the lead in developing the proposed schedule of activities. The court also recognized that although the MWRA would carry the greatest burden for implementing the schedule, it could not fulfill its obligations without the cooperation of the other parties, especially the federal and state regulatory agencies. Therefore, the court made it clear that failure of any party to assist in complying with the schedule would result in future actions by the court.

Comprehensive Harbor Cleanup Schedule. On December 23, 1985, the U.S. District Court issued its first remedial order that mandated that the MWRA adhere to a schedule of activities that would be undertaken to help achieve and maintain compliance with the Clean Water Act. The schedule defined monthly activities through December 1999 in four categories, including:

- Deer Island primary treatment plant upgrading;
- Short-term sludge and scum management;
- Long-term sludge management; and,
- New secondary treatment plant construction.

TABLE 5
Schedule of Major Court Milestones for Deer Island Related Facilities

Milestone	1986 Order	Current Schedule
Attain Operational Status of On-Island Piers	October 1989	October 1989*
Attain Operational Status of On-Shore Piers & Staging Areas	June 1990	June 1990*
Complete Construction of Outfall	July 1994	July 1995
Complete Construction of Under Harbor Transmission Tunnels	December 1994	December 1994
Complete Construction & Initiate Operation of Primary Treatment Facilities	July 1995	July 1994
Complete Construction & Initiate Operation of Secondary Treatment Facilities	During 1999	October 1996 (Phase 1) June 1998 (Phase 2) December 1999 (All)

Note: *Completed on schedule.

The schedule embodied the MWRA's own proposal for a comprehensive cleanup program for Boston Harbor, starting with initial milestones that required the draft facilities plan for the project to be completed by December 1987, the draft EIR by February 1988 and the final facilities plan by May 1988.

The first schedule was followed in May 1986 with a long-term scheduling order that included the milestones for constructing new facilities. The court was aware that with a project as large as the Boston Harbor project, alteration of the target dates might be necessary, but the schedule would provide the framework for achieving the goals of the harbor cleanup as quickly as possible.

The CLF and the USEPA had proposed more aggressive completion dates, but in adopting the MWRA's schedule the court found that the USEPA's proposal for simultaneous construction of primary and secondary facilities, with a resultant deadline earlier than 1999, was overly compressed and that in the long term it would result in treatment facilities that would be less reliable, more expensive to maintain and more burdensome to the neighboring communities.

Complete implementation of the Boston Harbor Project was estimated to require the expenditure of approximately two billion dollars over a 15-year period and would represent

the largest consolidated pollution abatement program ever undertaken in New England.

The initial major milestones for the Boston Harbor Project, related to the construction of new Deer Island treatment facilities, are shown in Table 5. Some of the dates for completing milestones were revised in 1989. These current milestones are also listed in Table 5. The schedule has been amended and expanded by subsequent orders to include additional categories for the planning and construction of residuals management facilities, and the development and implementation of programs to control combined sewer overflows.

Secondary Wastewater Treatment Facilities Plan and EIR. In March 1988, the MWRA completed for public review a comprehensive facilities plan and EIR for the Deer Island secondary treatment plant, the Nut Island headworks facility, the inter-island conveyance system and the effluent outfall. The final recommended plan was designed to meet wastewater treatment needs for a planning period through 2020. It included pumping South System flows from Nut Island to Deer Island, primary treatment to a peak flow rate of 1,270 mgd and secondary treatment using the oxygen activated sludge process. To fulfill the MWRA's commitment to minimize odor impacts, all of the treatment units, except the secondary clarifiers and disinfection basins,

would be covered and the exhaust air would be treated. (Details of the treatment facilities design and operation are discussed in "Design of the Deer Island Treatment Plant" on pages 49 to 66.)

The USEPA did not prepare an EIS on the facilities plan, since it viewed the final EIS on siting of the Deer Island facilities to have sufficiently assessed the impacts of the project. It did, however, prepare a supplemental EIS on the proposed effluent outfall and inter-island tunnel systems. USEPA's July 1988 report concurred with the proposed location of the deep-ocean outfall and diffuser, but also suggested that further physical hydraulic model studies be performed for effective dilution analysis and saltwater purging. The MWRA conducted these studies to confirm its compliance with effluent discharge requirements.

Concurrent Planning Efforts

The magnitude and complexity of the Boston Harbor Project required that a number of individual facilities planning efforts to address specific issues be undertaken concurrently.

Water Transportation System. One of the first crucial plans to be completed was a water transportation and access study. This study determined what pier facilities and staging areas would be required to construct the project in compliance with mitigation commitments. The plan described the transportation strategy needed to move workers, materials and equipment. This report was followed by facilities plans and EIRs for both on-shore and on-island piers.

Plans for the water transportation system included constructing piers at Deer Island and the Fore River staging area in Quincy for the barging of construction equipment and materials, and piers in Squantum and Revere for transporting construction workers.

Short- & Long-Term Sludge Management. The selection of a sludge management policy and completion of facilities planning suffered from a historical lack of resolution similar to that related to the siting and construction of new wastewater treatment facilities. In 1971, the first model analysis of currents in Boston Harbor revealed that approximately 20 percent of the sludge discharged from the two MDC

plants returned to the harbor on incoming tides and settled west of Deer Island.

In response to these findings, the MDC initiated its first comprehensive sludge management study. The study evaluated three disposal options — land application, incineration and wet air oxidation followed by landfilling. Completed in August 1973, the report recommended pumping sludge from Nut Island to Deer Island, where the combined sludge would be incinerated. Sludge ash would be stored in a man-made lagoon on the west side of the island and ultimately would be disposed off site.

The proposed plan caused a great deal of public controversy, so the USEPA decided to prepare an EIS. The draft EIS, completed in February 1976, assessed the impacts of primary sludge disposal, deferring the study of secondary sludge disposal to a separate EIS to be prepared in conjunction with plant upgrading. The study included an evaluation of the environmental and economic impacts of incineration, land application and ocean disposal, but concurred with the 1973 recommendation for incineration on Deer Island. In May 1976, the Secretary of Environmental Affairs deemed the draft EIS to be inadequate in meeting the requirements of the Massachusetts Environmental Policy Act. The secretary requested that further analysis of co-incineration of the sludge with municipal refuse as well as land application options be performed.

Three years elapsed before completion of the final EIS, which was issued in March 1979. The final EIS agreed with the draft and recommended the construction of three incinerators on Deer Island, but also required that an update of the 1973 plan be prepared to further assess air quality impacts and to determine the feasibility of composting. The state again determined that the EIS was inadequate. In March 1980, USEPA issued a Record of Decision that recommended further study and evaluation.

In response to the concerns raised by the state and the general public, the MDC prepared an update of the 1973 sludge management study. Completed in 1982, the update recommended a plan similar to the 1973 plan, except sludge would be barged to Deer Island from Nut Island and sludge ash would be deposited in a landfill at the south end of Deer Island.

Action on the proposed plan was deferred while the recommendations were reviewed by the Sargent Committee. In March 1984, the EOE, in concert with the state DWPC and the MDC, issued a policy statement that selected composting as the most preferred method of disposal; incineration was determined to be the least preferred option. The Sargent Committee endorsed the policy, but a plan for action was further delayed since efforts to create the MWRA were underway.

As discussed previously, the federal court schedule included milestones for short- and long-term sludge management. The MWRA's short-term plan to cease discharging sewage sludge into Boston Harbor was initially to file an application to barge liquid sludge to a federally approved deep-water municipal sludge disposal site located off the coast of New Jersey (known as the 106-mile site). This alternative was viewed only as an interim measure and represented the most expedient method of disposal, since dewatering facilities for land-based disposal options would take some time to construct. Land-based disposal of sludge produced by the existing facilities, though not necessarily implemented for the new secondary facilities, was to begin upon expiration of the three-year ocean disposal permit.

Ocean disposal could have been implemented by February 1988; however, Congress reacted with intense opposition to allowing Massachusetts to use the 106-mile site. The MWRA and the USEPA determined that ocean disposal would be politically infeasible and filed a joint motion to delete the dates for its implementation from the court schedule. The milestone for completing all facilities associated with land-based alternatives was December 1991.

The MWRA elected to pursue a privatization option that would permit fast-track implementation of land-based sludge disposal. It contracted with New England Fertilizer Company in June 1988 to operate the sludge treatment facilities that would be constructed and owned by the MWRA. The interim plan, which commenced by the court deadline and extends through 1995, involves barging liquid sludge from Deer Island and Nut Island to the Fore River shipyard. There the sludge is dewatered

and heat dried into pellets that are purchased by a variety of end users. The MWRA's long-term residuals management plan must be operating by the 1995 court milestone.

Beginning in 1985, the MWRA assumed supervision of the residuals management planning initiated by the MDC and began a comprehensive evaluation of all technologies, sites and transportation alternatives for treating and disposing of primary and secondary sludge. Once the siting decision for the secondary treatment plant was made, the alternatives focused on how sludge would be moved from Deer Island and processed off site. In 1986, two interim reports, comprising Phase I of the residuals management facilities plan, were completed. Together, these reports identified 14 process trains (composed of various processing technologies), presented the results of initial site screening for residuals processing and disposal, and recommended further study.

Phase II of residuals management planning was conducted according to a special procedure issued by the Secretary of the EOE that structured how the analyses of options and sites would be performed. The draft facilities plan was completed in February 1989 and included, in accordance with the vote of the MWRA Board, the designation of the Fore River staging area in Quincy as the site for long-term sludge processing. Consistent with the MWRA's commitment to recycling of sludge into soil conditioning products, processing would consist of composting and pelletizing. A landfill to be constructed in Walpole was selected as the site for the disposal of grit and screenings, and for emergency backup for sludge disposal.

The final facilities plan was released in August 1989 and included a revision to eliminate composting and utilize pelletizing only. By the end of the planning process, a total of 229 candidate processing and/or landfill sites had been evaluated, as well as over 300 general system alternatives (or technology/site combinations). The final plan recommended integration and expansion of the interim pelletizing operation into a long-term facility.

While new facilities were being constructed at the new Fore River staging area, the MWRA continued investigating alternatives to the

Walpole landfill site. Most recently, the MWRA has received USEPA approval to utilize an out-of-state site for emergency backup sludge disposal.

Abatement of Combined Sewer Overflows. One of the early plans for controlling combined sewer overflows (CSOs) recommended constructing a deep tunnel storage system to collect wet weather flows and discharge them through an eight-mile outfall into Massachusetts Bay. This concept was re-evaluated in the 1976 EMMA Study, but decentralized storage was the recommended option. In 1982, the MDC completed a set of facilities plans and a comprehensive EIR on CSO control. The recommendation of these studies was to construct a total of 38 projects including sewer separation, conduit cleaning, system repairs and new facilities for storing, screening and disinfecting CSO flows.

The MWRA first undertook planning to develop CSO control measures as part of its broad mandate and commitment to abate the pollution of Boston Harbor. In February 1987, the MWRA and the USEPA jointly entered a stipulation clarifying the MWRA's responsibility and legal liability for developing and implementing a comprehensive CSO control program. This filing was followed in August 1987 by a court-ordered schedule requiring the MWRA to construct additional CSO treatment facilities, to prepare a comprehensive CSO facilities plan, and to develop and implement best management practices and system optimization plans.

As discussed in "Combined Sewer Overflow Abatement in Boston Harbor" which begins on page 83, the MWRA has continued its efforts on CSO planning and is now developing a system master plan that will integrate CSO controls with other plans for secondary treatment, interceptor relief, and infiltration and inflow reduction. In addition, the MWRA is now conducting a re-evaluation of the design concept of its secondary treatment facilities that will help to determine how CSO flows can be treated at the new Deer Island plant.

Conclusions

The creation of the MWRA was the catalyst for resolving years of infrastructure neglect and

the needless pollution of Boston Harbor. The political will of the state government, coupled with environmental advocacy, resulted in an agency that now has the autonomy and power to plan projects and raise revenues to implement them.



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ADDITIONAL READING

In addition to the papers and reports listed in Table 2 on pages 18 and 19, the following papers, reports and sources

are recommended for additional reading on the history and planning of the Boston Harbor Project.

Langdon, P.E., "The Deer Island Sewage Treatment Works," *Journal of the Boston Society of Civil Engineers*, October 1959.

Flaherty, J.F., "Status and Proposed Control of Pollution in Boston Harbor and Its Tributaries," *Journal of the Boston Society of Civil Engineers*, October 1968.

Horsefield, D.R., "The Deep Tunnel Plan for the Boston Area," *Journal of the Boston Society of Civil Engineers*, October 1968.

U. S. Environmental Protection Agency Office of Marine Discharge Evaluation, *Analysis of the Section 301(h) Secondary Treatment Waiver Application for the Boston Metropolitan District Commission*, June 1983.

Haar, C.M., & Horowitz, S.G., *Report of the Special Master Regarding Finding of Fact and Proposed Remedies*, Norfolk Superior Court Civil Action No. 138477, August 1983.

Bank of Boston, *Protecting Water Resources: A Financial Analysis*, Prepared for the Massachusetts Executive Office of Environmental Affairs, February 1984.

U.S. Environmental Protection Agency Region I, *Analysis of the Revised Section 301(h) Application of the Metropolitan District Commission*, March 1985.

Haar, C.M., ed., *Of Judges, Politics and Flounders: Perspectives on the Cleaning Up of Boston Harbor*, Lincoln Institute of Land Policy, Cambridge, Mass., 1986.

Camp Dresser and McKee, *Secondary Treatment Facilities Plan: Preliminary Design Report Wastewater Treatment Facilities*, Prepared for the Massachusetts Water Resources Authority, June 1988.

Dolin, E.J., *Dirty Water/Clean Water: A Chronology of Events Surrounding the Degradation and Cleanup of Boston Harbor*, MIT Sea Grant College Program, 1990.

Massachusetts Water Resources Authority, *Final Updated M.G.L. C.30 Section 6I Revised Final Findings by the Massachusetts Water Resources Authority on the Secondary Treatment Facilities Plan/EIR for Boston Harbor*, EOEA File #6136, October 1990.

Hague, M.A., *Improving the Wastewater Treatment System and Cleansing Boston Harbor: The History of the Massachusetts Water Resources Authority*, unpublished dissertation prepared for Political Science Dept., Boston College, 1994.