FINAL
CSO CONCEPTUAL PLAN
AND SYSTEM MASTER PLAN

PART I
RECOMMENDED PLAN

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Massachusetts Water Resources Authority

M&E Metcalf & Eddy
An Air & Water Technologies Company

PART I
CHAPTER ONE
INTRODUCTION

In compliance with Schedule Six of the federal court order in the Boston Harbor case, the Massachusetts Water Resources Authority (MWRA) has completed its Final CSO Conceptual Plan, which is an integral part of its more comprehensive System Master Plan (SMP). The SMP effort included the examination of interceptor and transport system needs, infiltration/inflow (I/I) control, and secondary treatment capacity needs to determine the impacts of these strategies on the development of the conceptual plan for CSO control. The master planning process has resulted in the development of recommendations for CSO control, as well as recommendations for targeted I/I reduction, interceptor relief projects, and secondary treatment capacity. The final recommendations reflect the Authority's consideration of comments received on the Draft CSO Conceptual Plan/SMP, which was completed in September 1994. The proposed implementation plan and schedule for the conceptual CSO control plan is presented in Chapter Four.

PURPOSE AND SCOPE OF THE REPORT

This report presents the final results of the evaluations conducted to refine CSO control alternatives, including the assessments made to determine the impact of other strategies on CSO discharges. The purpose in developing the CSO Conceptual Plan in the context of the System Master Plan was to assess the benefits that other system improvements would provide for reducing CSO control needs. The broader, master planning approach, together with the results of updated and more detailed CSO investigations, has provided and correlated the information needed to determine the appropriate level of CSO control, as well as the sizing and design of new CSO control facilities. The conceptual plan for CSO control described in this report is composed of various CSO control alternatives that reflect site-specific needs for improving conditions in receiving waters throughout the system.

REVISIONS TO THE DRAFT CSO CONCEPTUAL PLAN AND SYSTEM MASTER PLAN

The Draft CSO Conceptual Plan and System Master Plan was submitted to the Court parties and available for public review on September 30, 1994. The MWRA presented the findings of the draft report through a series of meetings with state and federal agencies, the CSO communities, environmental groups, the MWRA Advisory Board, and interested citizens. A discussion of the Authority's outreach efforts is presented in Chapter Two. The Authority received numerous comments on the draft report and conducted further technical evaluations of the recommended CSO alternatives. This section summarizes the changes and refinements made to the recommendations, as well as other enhancements made to the report in response to the comments received.

Changes in Recommended Facilities and Project Costs

As a result of further evaluations and in response to comments received, the following changes have been made in the recommended projects and their associated costs.

North Dorchester Bay

The total cost of the regional project involving relocation of CSOs to a screening/disinfection facility in the Reserved Channel, which also serves a consolidation conduit along the Reserved Channel, has been reallocated such that the entire cost of the screening/disinfection facility is included under the North Dorchester Bay project. The cost allocated to the Reserved Channel now only includes the cost of the consolidation conduit along the Reserved Channel and the screens at the four remaining outfalls (BOS076 to BOS080). This change increases the cost of the North Dorchester Bay project from $79M to $86.1M, and decreases the cost of the Reserved Channel project from $41M to $34.5M.

South Dorchester Bay

Existing Fox Point and Commercial Point CSO Facilities will be decommissioned upon completion of sewer separation and all CSOs to South Dorchester Bay will be eliminated.

Backwater from the Columbus Park Headworks has been identified as a potential source of continued regulator activation in the BOS088 and BOS090 systems following sewer separation. It may be necessary to hydraulically isolate the southern Dorchester Interceptor area from the Columbus Park Headworks to allow closure of all BOS088 and BOS090 regulators without risk of flooding during extreme storm events. One method would be to construct a pump station on the Dorchester Interceptor downstream of the BOS088 and BOS090 regulators. This issue will be further evaluated in facilities planning.

Constitution Beach

Existing Constitution Beach CSO Facility will be decommissioned upon completion of sewer separation, based on comments from WAC and others.

The cost for this project does not change.

Upper Charles River

The previously-proposed screening/disinfection facility at CAM009 will be replaced with manually-cleaned screens, since CAM009 is predicted to activate only once in the typical year.

The previously-proposed screening/disinfection facility at BOS032 will be replaced by a project to enlarge the interceptor connection between regulator RE-032-1 and the Charles River Valley Sewer, along with the installation of screens on the BOS032 outfall. With the larger interceptor connection, BOS032 will not activate during the one-year storm.

In addition to BOS032 and CAM009, screens will be added to outfalls CAM007, CAM011, and BOS033, to comply with EPA's policy for Nine Minimum Controls.

The cost of the interceptor connection relief at BOS032 and the screens at a total of five outfalls balances the savings in deleting the screening/disinfection facilities at BOS032 and CAM009, resulting in no net change in the total cost for this receiving water segment.

Lower Charles River

An alternative site for the screening/disinfection facility for the Stony Brook Conduit flows upstream of BOS046 will provide treatment for the overflows at BOS046 and will allow more contact time for disinfection of flows before discharge at MWR023.

Screens will be added at outfalls MWR018 to MWR022, BOS028, BOS049, SOM010, and CAM017, to comply with minimum controls.

Regulators tributary to outfalls BOS042 and MWR010 will be blocked.

The cost for Lower Charles including Back Bay Fens has been increased by approximately $1M to include the screens at a total of nine outfalls, and the work to bulkhead the regulators at BOS042 and MWR010.

Alewife Brook

The following projects will be added to the previously-recommended sewer separation work at CAM004:

- Sewer separation upstream of CAM002. This work is necessary to reduce the annual activation frequency of CAM002 from 9 overflows per year to about 4.

- Separation of common manholes upstream of SOM001. The relatively low-cost project will allow the elimination of SOM001 as a CSO outfall.

- Addition of manually cleaned bar screens to the eight remaining CSO outfalls along Alewife Brook to comply with minimum controls.

The cost for Alewife Brook has increased from $3M to $12.4M, to account for the additional separation work at CAM002 and SOM001, and the installation of screens at eight CSO outfalls. Included in this increase in cost is an increase in the estimated cost of separation at CAM004 from $3M to $6M, based on further review of existing drawings of sewers in this area.

Upper Mystic River

Outfall SOM006 has been identified as a potentially active CSO outfall. The scope of work in this area has been expanded to include locating this outfall, and separating common manholes upstream of the outfall, if necessary.

The cost has been increased from $0.1M to $0.2M to account for potential additional separation work at SOM006.

Upper Inner Harbor

The previously-proposed storage facility at BOS019 has been replaced by a screening/disinfection facility. The incremental change in water quality between screening/disinfection and storage did not justify the increase in cost, as described in more detail in Chapter Eight. In addition, the screening/disinfection facility would require less space, and would be easier to site.

Manually cleaned bar screens will be provided at outfalls BOS009 to BOS013, to comply with minimum controls.

Although the change from a storage facility to a screening/disinfection facility at BOS019 saves $1.2M, the total cost for Upper Inner harbor will increase by $0.7M, due to the cost of screens at four outfalls, and a correction in the allocation of cost of the East Boston Branch Sewer relief project between Upper and Lower Inner Harbor.

Lower Inner Harbor

Manually cleaned bar screens will be provided at outfalls BOS003 to BOS007, to comply with minimum controls.

Although the cost of screens at five outfalls is added to the receiving water segment, the total cost decreases by $0.5M, due to a correction in the allocation of cost for the East Boston interceptor relief project noted above.

Mystic/Chelsea Confluence

The previously recommended screening/disinfection facilities at BOS014 and CHE008 will be replaced by manually cleaned bar screens only, as the activation frequency of these outfalls will be about 4 overflows per year.

The previously-recommended replacement of the Somerville Marginal CSO facility with a storage facility has been changed to replacement with a screening/disinfection facility which would include dechlorination. (The facility must be relocated due to the relocation of I-93.) The potential water quality benefits of a storage facility did not justify the additional costs, as described in more detail in Chapter Eight.

A project to repair/replace the CHE008 outfall pipe has been added, based on comments received regarding the poor condition of the existing outfall.

In addition to BOS014 and CHE008, manually cleaned bar screens will be installed at outfalls CHE002 to CHE004 to comply with minimum controls.

The total cost for this receiving water segment is reduced from $32M to $12.3M, due to the change from storage to screening/disinfection for the relocated Somerville Marginal facility, and the elimination of screening/disinfection facilities at CHE008 and BOS014. These savings are partially offset by the cost for screens at five outfalls, and the repair/replacement of the CHE008 outfall pipe.

Reserved Channel

Manually cleaned bar screens will be installed on outfalls BOS076 to BOS080, to comply with minimum controls. It is assumed that the regional screening/disinfection facility at the mouth of the Reserved Channel will require its own outfall.

The cost for the Reserved Channel is reduced from $41M to $34.5M due to the reallocation of costs with North Dorchester Bay described above.

Fort Point Channel

Manually cleaned bar screens will be added at outfalls BOS072 and BOS073, as well as at regulators 070/5-2, 070/6-1, and MH172 on the Roxbury Canal Conduit, to comply with minimum controls.

The cost for this receiving water segment does not change, as the cost for the additional screens is absorbed in the previous rounding-off of costs for screens at outfalls BOS062 to BOS068.

Summary of Cost Changes

	Estimated Cost (Millions)	
	Draft	Revised
Dorchester Bay	$185	$192
Constitution Beach	9	9
Charles River	36	37
Alewife/Upper Mystic	3	13
Boston Harbor	141	115
Facilities Planning	--	6
	$374	$372

A cost of $6 million has been included in the program costs to account for facilities planning.

General Text Revision/Additions

The Final CSO Conceptual Plan and System Master Plan has improved upon the draft report with the following additions to the text.

- The discussion of the water quality benefits of the recommended plan by receiving water segment has been expanded.
- The discussion of watershed planning has been expanded, and now includes recent information from the EOEA and the Charles River Watershed Association.
- An outline of the requirements and process for obtaining partial use designation and a summary of information within the CCP/SMP document which supports the application for a partial use designation is included.
- The implementation plan and schedule has been revised based on comments received and subsequent discussions with MWRA.

ORGANIZATION OF THE REPORT

The Final Conceptual CSO Plan/SMP is presented in five parts:

Part One	-	Recommended Plan
Part Two	-	CSO Strategies
Part Three	-	I/I Strategies
Part Four	-	Interceptor Relief Strategies
Part Five	-	Secondary Treatment Strategies

Part One describes the overall scope and context of the planning effort and presents a summary of the recommendations for all four strategy areas. It also presents a proposed implementation plan and schedule for the conceptual CSO control plan. Definitions of acronyms, as well as explanations of technical terms, used in this report are provided in a glossary found in Appendix A. A detailed explanation of the evaluations performed and

results obtained in the four master planning strategy areas is provided in the subsequent parts of the report.

RELATED PLANNING DOCUMENTS

This report represents the attainment of another milestone in the development of MWRA's long-term plan for CSO control. The conceptual plan is based upon new information on CSO flows and loads, system configurations and operations, and receiving water quality impacts obtained and evaluated over the past two and one-half years, since the need for additional study of the CSO problem was acknowledged. The plan builds upon the information and assessments contained in previously prepared reports, including the major documents prepared for this planning effort which may be referenced for more detailed information on some issues discussed in this report. These reports are listed in Table 1-1.

A number of other briefing documents, system inspection reports, planning methodologies, and technical memoranda also have been prepared during the development of the recommended plan. These documents provided information on the condition of the collection system components, flow metering, water quality, and methodologies for performing technical evaluations of CSO, I/I, interceptor and secondary treatment strategies.

ONGOING EFFORTS FOR CSO PLANNING

The Final CSO Conceptual Plan/SMP will be submitted to the Court parties on December 30, 1994, and distributed to the CSO communities, groups that participated in the review of the draft report, and other interested parties. Copies of the report also will be sent to the 20 library repositories, so that members of the neighborhood working groups and the general public can review the plan.

TABLE 1-1. DESCRIPTION OF RELATED SMP PLANNING DOCUMENTS

Title	Date	Contents
Interim CSO Report	February 1993	• Summary of past planning efforts. • Condition and operation of the MWRA and CSO community collection systems. • CSO flow and quality data. • Revised CSO flow and load projections. • Impacts on the 1990 recommended plan. • MWRA compliance with federal and state CSO policies.
CSO Flow Model Calibration and Verification	April 1993	• Description of the hydrodynamic model and its uses. • Design storm CSO flows.
System Optimization Plans for CSO Control	June 1993	• Detailed descriptions of CSO community collection systems. • Recommended system modifications to optimize storage and/or transport of flows. • Resulting CSO volume reductions.
Baseline CSO Flows	December 1993	• Description of baseline conditions. • Annual and design storm CSO discharges by outfall and receiving water segment.
Baseline Water Quality Assessment Summary	March 1994	• Description of 14 receiving water segments and comparison to water quality standards. • CSO, stormwater, and receiving water monitoring results. • CSO and stormwater pollutant concentrations. • Annual and design storm CSO flows and loads. • Identification of major sources of pollution by receiving water segment.
System Master Plan Baseline Assessment	June 1994	• Description of existing and future planned conditions. • CSO and interceptor system performance. • Relative contribution of CSO and stormwater flows and pollutant loads.
Alternatives for CSO Control	June 1994	• Regulatory framework for CSO control. • Watershed based approach for CSO control plan. • Development and screening of CSO control alternatives by receiving water segment. • Description of system-wide CSO strategies
Baseline Water Quality Assessment	August 1994	• Summary of water quality investigations. • Methodologies for development of CSO, stormwater, and upstream river flows and loads. • Water quality modeling results. • Characterization of the 14 receiving water segments.

TABLE 1-1 (Continued). DESCRIPTION OF RELATED SMP PLANNING DOCUMENTS

Title	Date	Contents
Draft CSO Conceptual Plan and System Master Plan	September 1994	• Evaluation of CSO control alternatives by receiving water segment. • Evaluation of the impact of I/I and interceptor strategies on CSO control. • Evaluation of secondary treatment capacity requirements. • Recommended plan for CSO control, I/I reduction, interceptor relief, and secondary treatment.
Report on CSO Community System Inspections	November, 1994	• Summary of inspection program. • Regulator-specific inspection results and conclusions. • Inspection logs and photographs for inspected locations.
Technical Memorandum on Intermediate Projects	November, 1994	• Identification, development, and evaluation of intermediate projects. • Summary of recommended intermediate projects.
Supplemental Report on System Optimization Plans for CSO Control	November, 1994	• Updated information for the Columbus Park/East Side, Prison Point, Dorchester, and Alewife subsystems from the June, 1993 SOP report. • Information for the Stony Brook subsystem similar to that presented in the June, 1993 SOP report. • Final recommendations for conditionally recommended SOPs.
Receiving Water Boundary Conditions	November, 1994	• Description of the development of boundary conditions for flows over the Watertown, Amelia Earhart, and Lower Mills dams.
Final Technical Memorandum - Estimation of Stormwater Flows and Loads	November, 1994	• Identifies stormwater drainage areas, flows and pollutant concentrations. • Presents stormwater flows and loads for historical storms, design storms, and annual conditions.
1993 Flow and Quality Monitoring Program and Results	November, 1994	• Describes the 1993 monitoring program and presents rainfall, flow, and quality monitoring results. • Presents field screening program results. • Presents statistical analysis of CSO quality data used to derive representative pollutant concentrations.

MWRA will continue discussions with the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (DEP), and the other Court parties on the recommended CSO Conceptual Plan and the schedule for its implementation. Agreement with the CSO communities on implementation responsibilities also must be reached. During the same time, the Authority will continue its planning efforts by preparing a scope of work for facilities planning and environmental review. Facilities planning is scheduled to commence in April 1995. Future planning will include continuation of public participation, as described in Chapter Four.

PART I
CHAPTER TWO
BACKGROUND AND PLANNING FRAMEWORK

This chapter summarizes the background and planning framework upon which the CSO control and master planning activities were based. Included is a discussion of important past CSO planning efforts, court schedule and regulatory requirements, the watershed-based approach to CSO control, and the overall master planning approach. It also includes a summary of the public participation program that has been conducted in association with the planning activities.

DESCRIPTION OF THE CSO SYSTEM

The MWRA provides wastewater services to 43 communities, including the city of Boston and the surrounding metropolitan area. The Authority owns and maintains 230 miles of large interceptor sewers that receive wastewater from 5,400 miles of municipal sewers at over 1,800 separate connections. The sewerage system is divided into two distinct service areas, a North System and a South System.

The South System contains separate sewer systems for wastewater and stormwater flows. Approximately 20 percent of the North System service area, which covers a watershed of 168 square miles, contains combined sewers that are designed to carry both wastewater and stormwater flows. These sewers are located in four communities: Boston, Cambridge, Somerville, and Chelsea. In addition, some sections of these cities have separate storm drain systems that discharge into combined sewers. There are 81 potentially active CSO outfalls that are controlled by the four communities or by the MWRA. Six of the largest active CSOs receive screening and disinfection at CSO treatment facilities that are owned and operated by the MWRA. Collectively, these facilities provide treatment of approximately 50 percent of the system-wide CSO volume generated during a typical storm.

The majority of flows from the North System are conveyed to the Deer Island treatment plant via three remote headworks facilities which discharge into two deep rock tunnels. The two tunnels have a combined capacity of 800 MGD. North System flows also can be conveyed to Deer Island through the North Metropolitan Trunk Sewer via a 125 MGD pump station located in East Boston. The Authority's trunk sewers, interceptor sewers, and pump stations, which are designed to carry wastewater flows to Deer Island, are not able in their present configuration to convey the total volume of flow from the combined sewer systems during large wet weather events. Combined flows in excess of the collection system's capacity are diverted to overflow conduits and, depending on the intensity and duration of the rainfall, excess flows are discharged through the overflow outfalls into Boston Harbor, the Alewife Brook, the Mystic River, the Charles River, and the Neponset River.

CSO PLANNING REQUIREMENTS

The completion of the Draft CSO Conceptual Plan/SMP evolved from a critical review of sewer system operations and past planning efforts, analysis of new CSO flows and loadings, and from an evaluation of the impacts of new national CSO policy on planning requirements.

Past Planning and Court Schedule

The MWRA's efforts to address the pollution caused by CSOs began in February 1987 when it accepted responsibility, as part of the Boston Harbor litigation (a Clean Water Act enforcement action), for development and implementation of a comprehensive CSO control program. A court-ordered schedule required the Authority to prepare a comprehensive CSO facilities plan, to construct selected additional CSO treatment facilities, and to develop and implement best management practices and system optimization plans. The Authority's initial planning efforts culminated in the 1990 Facilities Plan which recommended a combination of CSO controls, including a deep-rock tunnel CSO storage system and near-surface storage via consolidation conduits, along with a limited amount of in-system storage and sewer separation. During storm events, diversion structures would redirect excess combined flows

into consolidation conduits for transport to drop shafts connecting the surface facilities to the tunnel system. The deep tunnel system would augment the capacity of the existing collection system by providing 350 million gallons of storage capacity to reduce CSO discharges to approximately four per year. The plan included two pump stations that would lift stored flows to the existing Chelsea Creek and Columbus Park headworks facilities for conveyance to Deer Island for treatment. The recommended plan was predicted to reduce average annual CSO discharges from 70 to four events per year, corresponding to 80 percent volume captured. The total capital cost of the recommended plan was estimated at over $1.3 billion.

The 1990 Facilities Plan acknowledged that additional CSO investigations would be necessary prior to implementing the recommended plan. It provided suggestions for further study to confirm predicted CSO flows through additional flow monitoring and modeling and to assess the impacts of recent improvements to the collection system through detailed system inspections. Negotiations with EPA and the other court parties in 1991 resulted in a court-ordered, short-term CSO schedule to perform more extensive CSO flow monitoring and to complete system optimization plans for the MWRA and CSO community systems. The schedule required that two major reports be prepared. An interim report, submitted to the court parties in February 1993, included the new CSO flow measurements, results of system inspections, revised CSO flow and load estimates, and an analysis of the impacts of the new information on the 1990 Facilities Plan. A second report, submitted to the court parties in June 1993, included the results of system optimization evaluations and recommended System Optimization Plans (SOPs) for the MWRA and CSO community systems.

Upon completion of this work, further negotiations led to an additional court-ordered, short-term CSO schedule to perform detailed evaluations of CSO control alternatives and to develop a revised draft and final recommended CSO control plan by the end of 1994. A summary of the recent court-ordered milestones is listed in Table 2-1.

TABLE 2-1. SUMMARY OF COURT SCHEDULED MILESTONES

Date	Milestone
December 1993	Complete the collection and analysis of all data necessary to determine baseline CSO flows, including all data and analysis necessary to determine whether Stony Brook flows can be separated or must be treated as CSO flows.
March 1994	Complete the collection and analysis of all data necessary to determine baseline CSO water quality impacts.
June 1994	Evaluate alternative methods of CSO control, including a deep tunnel storage system modified (if appropriate) based on revised estimates of CSO flows. Include an estimate of the cost and performance of each alternative, the number, location, and volume of overflows which would remain after implementation of the alternative, and the water quality impacts of the remaining overflows.
September 1994	Produce a draft conceptual plan for CSO control, including the identification and evaluation of potential sites for any recommended facilities, and a proposed implementation plan and schedule.[1]
December 1994	Produce a final conceptual plan for CSO control, including proposed schedules for site acquisition, for completion of the facilities planning process, and for design and construction of the facilities.

[1] If the plan includes proposals to downgrade water quality standards (including the establishment of "partial use" designations) or bypasses of treatment facilities, it shall set forth the regulatory criteria for approval of such downgrades or bypasses, and shall present the data and analysis which establish that those criteria can be met.

The determination of baseline CSO flows and baseline water quality impacts was essential to identifying initial CSO control alternatives. The approach used to develop CSO control alternatives involved setting water quality goals and CSO control goals for specific receiving water segments. The range of alternatives for each segment, as well as system-wide strategies identified in the June 1994 report, have been evaluated further, resulting in the draft conceptual plan for CSO control.

Regulatory Requirements

Requirements for the development of CSO control plans are embodied in federal and state regulations and CSO policies. The approach used to develop the MWRA's CSO Conceptual Plan is consistent with the new national CSO policy and similarly focused on making a complete assessment of CSO impacts and evaluating the potential for meeting water quality goals through CSO controls. The development of the recommended plan also conforms to the state CSO policy which requires that elimination and relocation of CSOs, especially in critical use areas, be evaluated.

Federal Requirements for CSO Control. Although CSOs have long been recognized as significant sources of pollution in harbors, estuaries and upstream reaches, the U.S. EPA only recently developed a National CSO Strategy. The strategy, issued in September 1989, confirmed that CSOs are point sources of pollution and that both technology-based and water quality-based requirements must apply to their control to meet water quality standards and protect beneficial uses. The strategy was intended in part to establish a nationally consistent approach for developing long-term CSO control plans.

The technology-based requirements were to be achieved through application of the best conventional control technology (BCT) for conventional pollutants and the best available technology economically achievable (BAT) for toxic pollutants, based on best professional judgement (BPJ). Initially in 1989, the technology-based effluent limitations for CSOs were mandated to include six minimum technologies. Following further work to implement the National CSO Strategy, three more minimum technologies were added. Demonstration of the MWRA's compliance with the nine minimum technologies is discussed in Chapter Three.

Although the 1989 National CSO Strategy provided some guidance, there remained a need to develop a more standardized and balanced approach for defining and implementing CSO control plans. The EPA, with input from numerous state, municipal, and environmental organizations, published its final CSO Control Policy in April 1994. The new policy, which

expands upon the 1989 National CSO Strategy, provides greater flexibility in developing long-term CSO control plans. The intent of the policy is to allow CSO controls to be tailored to address site-specific impacts of CSOs. The policy requires that the nine minimum controls be implemented by January 1, 1997, and establishes a planning and implementation process for developing long-term CSO control plans by evaluating a range of CSO control alternatives that comply with water quality standards and protect designated uses. General requirements for developing a long-term CSO control plan in conformance with the federal policy are listed in Table 2-2.

TABLE 2-2. ELEMENTS OF A LONG-TERM CSO CONTROL PLAN

Thorough Characterization of the Collection and Treatment System
Public Participation and Agency Interaction
Priority for Protection of Sensitive Receiving Waters
Evaluation of Alternatives that Achieve a Range of CSO Control Levels
Cost/Performance Considerations
Maximum Treatment at the Wastewater Treatment Plant
Development of Operational Plans to Maximize Use of Facilities for CSO Control
Phased Implementation of Projects
Post Construction Compliance Monitoring

A long-term CSO control plan is to be developed as soon as practicable, but generally within two years following the issuance of an National Pollutant Discharge Elimination System (NPDES) permit, or on a schedule set forth in a court or administrative order mandating preparation of the plan. Implementation of the plan may be phased, such that projects impacting the most sensitive areas or designated uses are given priority. The financial capability of a community to implement CSO control projects also may be considered in prioritizing projects.

The CSO Control Policy also acknowledges that in certain cases modification of existing water quality standards to better reflect wet weather events may be part of an approved CSO control plan and requires that state authorities participate in the CSO planning process and determine whether changes in water quality standards are warranted. If CSO discharges cannot be eliminated, this provision would allow Massachusetts DEP to grant a "partial use" designation for specific CSO-impacted waterbodies. The designation "partial use" signifies that occasional wet weather discharges may exceed water quality standards, while overall beneficial uses of the waterbody are maintained. Since the MWRA's conceptual plan for CSO control will not completely eliminate CSO discharges in all receiving water segments, the Authority will apply to DEP for partial use designations for CSO-impacted waters. The process for obtaining a partial use designation is described in detail in Chapter Eight and summarized in the next section on state requirements for CSO control.

Under the new national CSO policy, plans for long-term CSO control and compliance with water quality standards can be developed by using either a "presumption" or "demonstration" approach. Under the ***presumption*** approach, compliance with water quality standards is presumed, if one of the following performance criteria are met:

i No more than an average of four overflow events per year on an annual average basis.

ii Elimination or capture for treatment of no less than 85 percent by volume of the combined sewerage collected on a system-wide annual average basis

iii Elimination or reduction of no less than the mass of pollutants causing water quality impairment for the volume reductions in number ii above.

The minimum level of treatment applicable to the presumption criteria is defined in the policy as primary clarification and disinfection of effluent, if necessary, to meet water quality standards and protect designated uses (including removal of harmful disinfection chemical residuals if necessary).

Selection of the presumption approach does not release municipalities from the overall requirement of meeting applicable water quality standards. If the permitting authority determines that the long-term CSO control plan will not result in attainment of water quality standards, more stringent controls may be required.

Under the ***demonstration*** approach, compliance with water quality standards is confirmed through the CSO planning process. This approach provides more flexibility in developing a long-term CSO plan. While not necessarily satisfying the performance criteria of the presumption approach, the plan can be proven to be adequate to meet water quality standards. The demonstration approach depends on a thorough understanding of receiving waters and the impacts of CSO discharges and other sources of wet weather pollutants on water quality.

The CSO Conceptual Plan was developed using the demonstration approach, because the MWRA had obtained sufficient data on CSO activations and receiving water quality impacts to assess the water quality benefits of CSO control alternatives. The demonstration approach allowed the impacts of non-CSO sources of pollutants to be considered in developing appropriate CSO control measures for specific receiving water segments. As required under the definition of a successful demonstration, the CSO Conceptual Plan meets the following criteria:

i The planned control program is adequate to meet water quality standards and protect designated uses, unless standards or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs;

ii The CSO discharges remaining after implementation of the planned control program will not preclude the attainment of water quality standards or designated uses, or contribute to their impairment. Where standards and uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load (TMDL) allocation

should be used to apportion pollutant loads, including a waste load allocation and a load allocation or other means;[1]

iii The planned control program will provide the maximum pollution reduction benefits reasonably attainable; and

iv The planned control program is designed to allow cost effective expansion or cost effective retrofitting if additional controls are subsequently determined to be necessary to meet water quality standards or designated uses.

Upon EPA's acceptance of the MWRA's long-term CSO control plan, and in conjunction with the issuance of a new NPDES permit, the Authority will be required to continue its implementation of the nine minimum controls and to implement the long-term CSO control measures in accordance with an approved implementation schedule. The CSO Control Policy requires that EPA, as the NPDES permitting authority, maintain an on-going relationship with the MWRA, DEP, and the general public as CSO controls are implemented to achieve applicable state water quality standards.

State Requirements for CSO Control. The Massachusetts Department of Environmental Protection (DEP) Division of Water Pollution Control is responsible for establishing water quality standards that classify all waters in the state. The water quality standards consist of designated uses for waterbodies, water quality criteria to protect those uses, an anti-degradation policy to protect water quality improvements that have been achieved, and other policies to implement the standards. Wherever attainable DEP designates the national goal uses of protection and propagation of fish, shellfish, other aquatic life and wildlife, and recreation, known as the "fishable/swimmable" goal. Federal regulations and guidance give states flexibility to adapt water quality standards to reflect site-specific conditions, including

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[1] The plan assumes designation of "partial use" subclassifications of some receiving water segments, as discussed below. Federal and state regulatory requirements for modifying water quality standards, including the performance of use attainability analyses and pollutant load allocations, would be fulfilled as part of the partial use application process.

those related to CSOs. The regualtions also require states to review their water quality standards and make appropriate modifications at least once every three years.

As part of the revision of the state's water quality standards in response to the 1989 National CSO Strategy, the Massachusetts CSO policy was issued in 1990. The overall goal of the state CSO policy is to eliminate the degradation of receiving waters by CSO discharges. The policy requires that complete elimination of CSOs through sewer separation be considered. To demonstrate that it is not feasible, sewer separation must be shown to cause "substantial and widespread adverse economic and social impact." Where elimination of a CSO is not feasible, relocation of CSOs away from "critical use" waters must be considered. ***Critical uses*** are defined in the state CSO policy as uses pertaining to public health and welfare, which are often regulated by other state agencies with superseding criteria. Public water supply intakes and shellfishing areas are specifically included. Public bathing beaches, recreation areas, wildlife refuges, and other areas of ecological or economic concern also may be identified as critical uses through the facilities planning and public participation process. The objective of CSO relocation is to achieve the maximum recovery of water uses and protection of critical uses by eliminating CSO discharges in segments of receiving waters having critical uses, while possibly achieving a lower level of CSO control in other segments without critical uses. The policy is consistent with the national policy's emphasis on water quality based planning and attainment of beneficial uses.

The state policy recognizes that each sewer system responds differently to precipitation events, and, therefore, does not specify a uniform treatment level for CSO discharges. A uniform analysis methodology, however, is identified which requires several planning elements and an opportunity for public comment. These elements are summarized in Table 2-3. The approach taken to develop the CSO Conceptual Plan is consistent with the methodology outlined in the policy.

TABLE 2-3. DEP REQUIREMENTS FOR A CSO PLAN

Inventory of Existing Combined System
Assessment of System Performance
Evaluation of CSO Characteristics (flows, loads, pollutants, etc.)
Evaluation of Receiving Water Impacts
Identification of Related Discharges or Sources
Estimation of Future Flows, Loads, Impacts
Development of Alternatives, Costs and Benefits for Mitigation of Impacts

The policy also states that a full range of alternatives and their costs for the entire CSO system must be examined, so that the maximum recovery of waterbody uses is achieved. The selection of the level of CSO control to be implemented must be based on an evaluation of cost/benefit for a range of hydrologic conditions.

Where elimination or relocation of the CSO discharge from a waterbody segment is not feasible, the waters affected by CSOs may be classified under a "partial use" subcategory. The ***partial use*** subclassification permits occasional short-term impairment of uses during and following wet weather events, as long as uses are supported most of the year and a generally viable aquatic life community is sustained. The engineering target level of CSO control in partial use segments is no more than four untreated overflows per year on average, unless site-specific factors, cost benefit analysis and availability of technology indicate that more stringent protection may be appropriate. Based on an average four-day duration of water quality impacts, four events per year corresponds to achievement of full use greater than 95 percent of the time. Where cost benefit analysis, availability of technology, and other environmental and economic factors indicate that less stringent control would be appropriate, documentation must be provided which shows that compliance with the four events per year target would result in substantial and widespread adverse economic and social impacts.

The technical basis for approving partial use designations is outlined in DEP's CSO policy and in an accompanying document entitled, "Request for Partial Use Designation: Issues to be Addressed. The information to support a partial use designation must be developed according to the evaluation methodology for establishing a long-term CSO plan and must clearly demonstrate that where elimination of CSOs is not feasible, water quality impacts are minimized to the maximum extent, achieving the highest water quality attainable. An outline of the information and the sequential evaluations required to justify a partial use designation is shown in Figure 2-1.

Under the recommended conceptual plan for CSO control, Dorchester Bay, the Neponset River, and Constitution Beach would not require a partial use designation because CSOs will be eliminated from these receiving waters. For the remaining receiving water segments, the MWRA will petition DEP to amend the water quality standard classification of these segments for partial use designation. DEP has issued interim guidance on a sequential procedure to be followed, in conjunction with facilities planning, for demonstrating compliance with these criteria and providing other information necessary for DEP to make its determination. This information includes a description of the affected area and its key resources, the uses impacted, frequency and duration of CSO discharges, and cost/benefit analyses of CSO control alternatives.

In accordance with state regulations (314 CMR 4.03(4)), DEP may designate a partial use subcategory only where it is demonstrated that:

(a) natural background conditions prevent the attainment of the use;

(b) human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(c) controls more stringent than technology-based controls required by the Clean Water Act would result in substantial and widespread adverse economic and social impact.

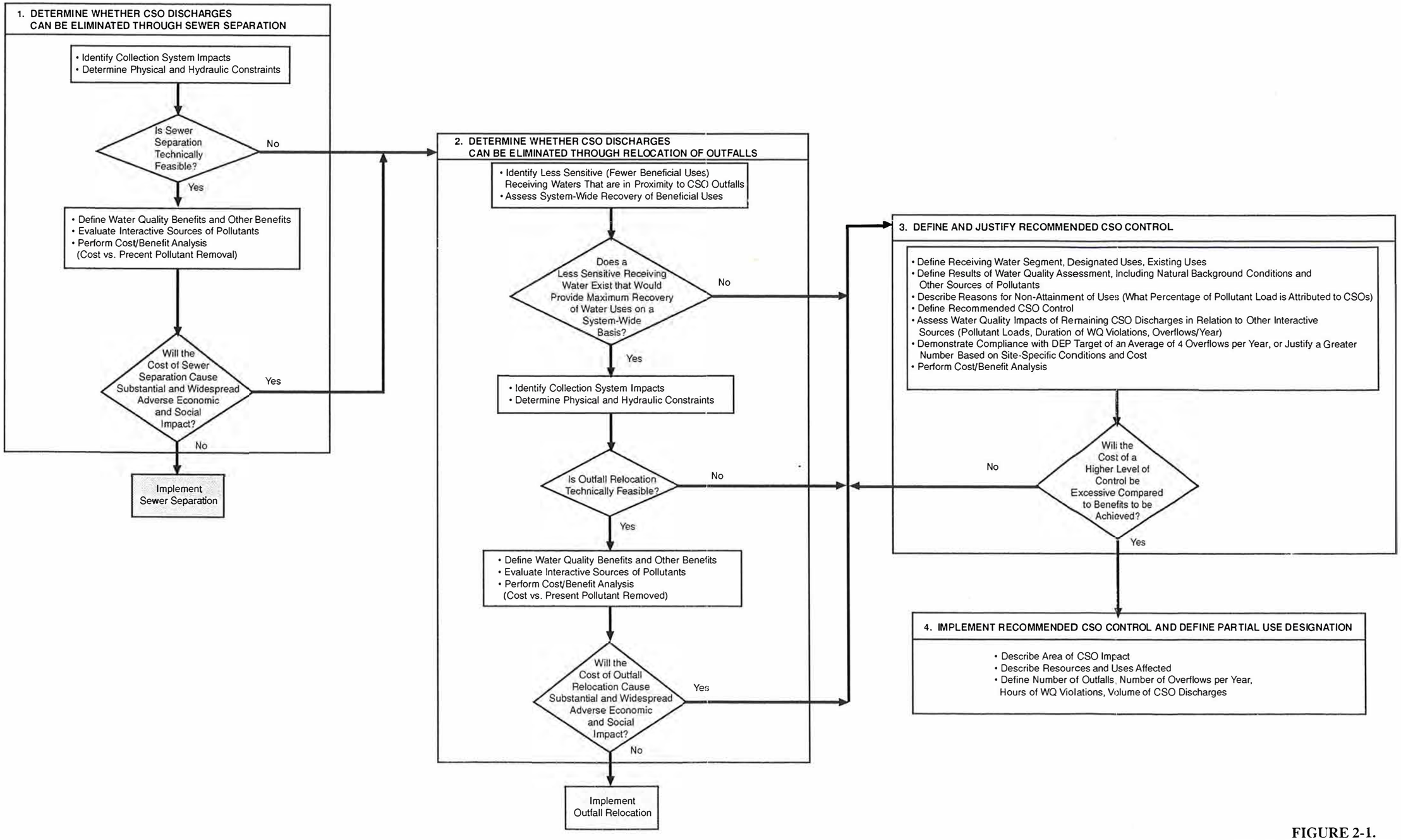


FIGURE 2-1.
SUMMARY OF PARTIAL USE DESIGNATION PROCEDURE

The CSO policy requires the petitioner for a partial use designation to satisfy all MEPA requirements associated with its proposed CSO facilities plan. DEP will not promulgate a final regulation creating a partial use until the petitioner has received final MEPA certification of its plan. The following steps are listed in the procedure for obtaining a partial use designation:

1. The applicant identifies the need and presents justification for partial use designation.

2. The applicant sends a request for partial use designation to the DEP Division of Water Pollution Control (DWPC).

3. DWPC determines the appropriateness of partial use designation.

4. DWPC notifies the EPA of its intent to allow pursuit of partial use designation.

5. DEP files an Environmental Notification Form (ENF) with the Massachusetts Environmental Policy Act Unit (MEPA) to amend the state's water quality standards.

6. A Public Notice is issued and a Public Hearing is held as part of Chapter 30A proceeding.

7. Based on the results of 5 and 6 above, DWPC renders approval or denial of the request for partial use designation.

8. If approved, the regulation revision is promulgated pursuant to MGL c. 30A and filed with the Secretary of State.

9. EPA issues its approval of the state's revised regulations.

In addition to complying with state regulatory requirements for amending the state water quality standards to allow a partial use designation, DEP is required by federal regulations to conduct a "use attainability analysis" (40 CFR 131.10(g)). The use attainability analysis is a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors. Completion of the use

attainability analysis is part of the process for obtaining EPA approval to amend existing water quality regulations.

Much of the information needed to justify a partial use designation for the applicable receiving waters has been obtained during this CSO conceptual planning process. Based upon discussions with EPA and DEP in conjunction with final approval of the long-term CSO plan and implementation schedule, additional information required to support application for partial use designations will be defined. Further explanation of how information on water quality impacts and cost/benefit analyses from the CSO Conceptual Plan provides justification for obtaining partial use designations is presented in Chapter Eight.

PLANNING FRAMEWORK

The CSO Conceptual Plan/SMP was developed from a framework of planning parameters used to define the present and future conditions of the wastewater collection and treatment systems and to describe the characteristics of the service area. Key assumptions and an explanation of the approach used in developing the conceptual CSO control plan are presented in this section.

Key Planning Parameters

CSO flows and loads were based primarily on 1992 and 1993 flow and quality data collected during this planning effort. The planning period assumes an initial year of operation for new CSO control facilities of 2005 with the planning period ending in 2025. Population projections were based on the Middle Series from Projections of Population, Households and Families in the MWRA Region: 1990-2020, Analysis and Forecasting, Inc. These numbers were adjusted to final 1990 census information and extrapolated from 2020 to 2025. The plan assumes a service area bounded by the current MWRA sewerage service district with 100 percent of that population served by 2025.

Existing Conditions and Future Planned Conditions

The "existing" conditions refer to the conditions of the system in 1992, when the extensive CSO monitoring program was conducted. Compared to 1988, when treatment plant and other improvements were initiated by the MWRA, existing conditions include a number of system improvements which have reduced the frequency and volume of CSOs. The MWRA has completed several projects to improve the operation and reliability of the existing Deer Island treatment plant which have significantly increased overall pumping capacity and increased the peak flow conveyance capacity of the collection system.

The system conditions characterized as "future planned conditions" include a number of system improvements and modifications which are under construction or will be completed under previous capital improvement commitments. Compared to existing conditions, future planned conditions include the following elements, which are further described below in Chapter Three.

- Four batteries of primary treatment at Deer Island
- Total pumping capacity of 1,270 mgd at Deer Island
- Full implementation of the following collection system projects as defined in already approved facilities plans:

  Braintree-Weymouth Extension Sewer
  Framingham Extension Relief Sewer
  New Neponset Valley Relief Sewer
  Quincy Pump Stations and Force Mains
  Wellesley Extension Sewer and Wellesley Extension Relief Sewer

- Full implementation of nine minimum controls, and recommended SOPs and Intermediate Projects

- Full implementation of currently defined I/I reduction programs, including:

  Established South System removal goals
  Other projects defined under the I/I financial assistance program
  Tidal inflow control program

The future planned conditions were used as the baseline in the CSO planning process to account for reduction in the frequency and volume of CSO discharges that have resulted, or will result, from completed or planned projects. The establishment of baseline CSO system performance under future planned conditions allowed the magnitude of the CSO problem to be accurately defined, so that the appropriate level of further CSO controls could be developed.

WATERSHED-BASED APPROACH FOR CSO PLANNING

The MWRA used a watershed-based approach for CSO planning, which addressed site-specific water quality conditions and CSO impacts, and developed CSO controls for particular locations. The approach was based on first establishing a thorough understanding of the combined sewer system and its response to wet weather events. Then assessments were made of the characteristics of the receiving waterbodies, sources of pollutants within the watershed, and the relative impacts of CSO discharges. The approach involved establishing a range of water quality goals for each receiving water segment, using information from an assessment of baseline receiving water conditions and designated uses. The receiving water assessment included consideration of major sources of pollution in the watershed, so that the relative impact of CSOs compared to other sources could be determined. In general, the watershed approach involved steps to define water quality goals, to define CSO control goals which would contribute to the achievement of the water quality goals, and to identify feasible alternatives which would achieve the CSO control goals. This approach, illustrated in Figure 2-2, for developing and evaluating CSO control alternatives is consistent with federal and state CSO policies.

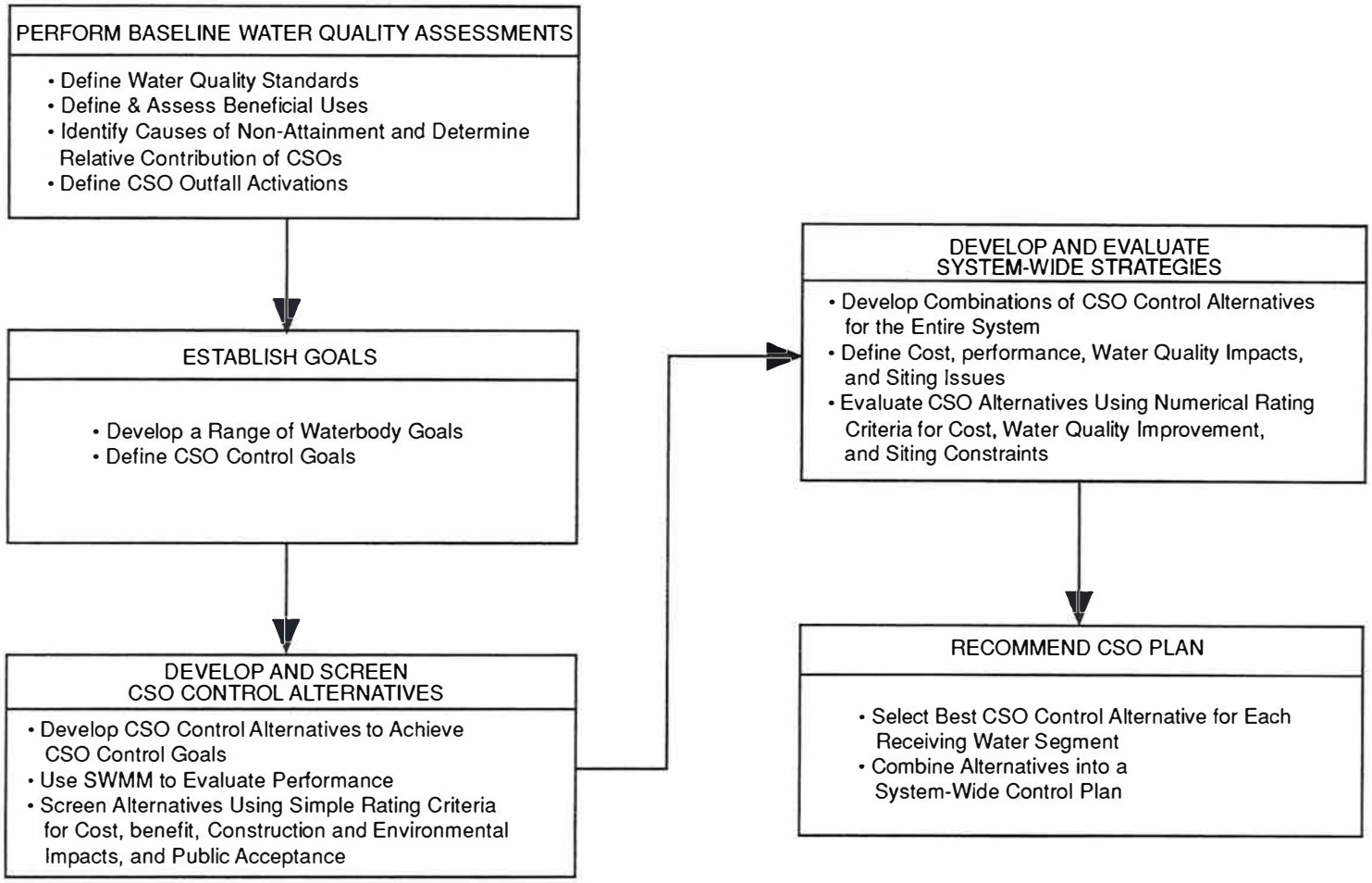


FIGURE 2-2. SUMMARY OF WATERSHED APPROACH

Perform Water Quality Assessments

The receiving water assessment provided information on baseline water quality conditions in each of 14 receiving water segments identified in the planning area. An assessment of each segment was made to determine whether or not the water quality criteria for specific pollutants, including both numeric and narrative limits from the state water quality standards, are met for the designated beneficial uses of the waterbodies. For those criteria that were not met, an indication of whether the non-attainment occurs during wet weather or during wet and dry weather conditions was noted. Other physical characteristics of the waterbodies, including access, depth, and other potential uses, also were considered.

Estimates of flows and loads from the major pollutant sources in the watershed of each receiving water segment also were prepared. Loads for CSO, stormwater, and upstream river inflow were included, derived from model flows generated for specific hydrologic conditions and from pollutant concentrations generated from statistical analyses of available site-specific quality data.

Receiving water model runs were made to assess the impact of CSO and stormwater on bacterial concentrations in each Boston Harbor and Charles River receiving water segment. The impacts of CSO sources only, stormwater and upstream sources only, and combined CSO, stormwater, and upstream sources on the attainment of bacteria standards for each segment were quantified.

Establish Water Quality Goals

Using the information from the receiving water quality assessment, in conjunction with an analysis of existing or desirable beneficial uses, a range of water quality goals were defined for each receiving water segment. In general terms, these goals were defined as follows:

Level I: Full attainment of beneficial uses.

Level II: Attain beneficial uses for most of the year.

Level III: Attain improvements over existing conditions (until other more severe sources of pollution are addressed).

Establish CSO Control Goals

CSO control goals were defined that would contribute to achievement of Level I, Level II, and Level III water quality goals for each receiving water segment. The CSO control goals address only the CSO-related conditions that contribute to non-attainment of beneficial uses. In several receiving water segments, pollution contributed by CSOs is only a fraction of the total pollutant loads from other sources. In these areas, even complete elimination of CSO discharges would not achieve the water quality goals, since the other sources prevent the attainment of beneficial uses. *The CSO control goals were developed with the assumption that if the other pollutant sources were remediated by the appropriate responsible parties, then the CSO control goals would be stringent enough for water quality goals to be met.* In general, CSO control goals are defined as follows:

Level I: Eliminate all CSOs by sewer separation or relocation of the outfalls.

Level II: Reduce untreated CSOs to about 4 overflows per year. (Partial use)

Level III: Control floatables and meet other aesthetic criteria and, in some cases, control bacteria. (Partial use)

Water quality goals that identified particular site-specific water quality problems were a factor in the development of CSO control goals. The impacts of one receiving water segment on another also were considered, so that CSO control goals in upstream segments were consistent with the goals in the downstream segments.

Develop and Evaluate CSO Control Alternatives

Once CSO control goals were established to address water quality goals in each receiving water segment, engineering and hydraulic analyses were conducted to develop and evaluate feasible CSO control alternatives. Alternatives were evaluated and screened based on a range of criteria, including performance, water quality improvements, cost, construction risks, mitigation concerns, and short-term and long-term environmental impacts. Compatible alternatives for the receiving water segments were combined to form regional and system-wide CSO control strategies, which were developed for comparison to the 1990 deep tunnel plan and to alternative tunnel plans that are based on the current assessment of CSO flows and volumes.

Further discussion of the watershed-based planning approach and CSO control evaluations is presented in Part Two - CSO Strategies, and in the June 1994 report, "Alternatives for CSO Control."

DEVELOPMENT OF A SYSTEM MASTER PLAN

Several questions were raised following the completion of the 1990 CSO Facilities Plan concerning the effect of collection and treatment system components on CSO discharges. The MWRA has addressed its need to develop a solution for CSO control in conjunction with an evaluation of the design and performance of the system as a whole.

Master Planning Approach

The overall goal of the SMP was to develop an integrated, system-wide approach to collection and treatment of wet weather flows that would maximize the effectiveness of existing facilities, including the new Deer Island wastewater treatment plant, before additional new facilities specifically for controlling or treating CSOs were designed and constructed. The SMP approach was initiated with the assumption that strategies for CSO

control are linked to alternative strategies and configurations for wastewater treatment, infiltration and inflow reduction, and collection system hydraulic capacity and operation. The integrated plan ensures that various program objectives (e.g., sufficient CSO control to comply with relevant federal and state laws and regulations) will be met, while at the same time it minimizes the overall costs of wastewater collection and treatment.

The specific objectives of the SMP were to:

- Comply with Clean Water Act requirements, federal and state CSO policy requirements, and protect or enhance beneficial uses in waterbodies
- Meet sewer service standards for 43 communities over the planning periods
- Control rate payer costs associated with capital investment and operations requirements

Trade-off Analyses and Integration of SMP Strategies

Initially the development of CSO, interceptor, I/I, and secondary treatment strategies progressed independently, with the impact of each strategy's alternatives measured against flows and loads under future planned conditions. As initially preferred alternatives for each of the four strategy areas developed, the following hydraulic and process interactions of CSOs, I/I reduction, interceptor capacity, and secondary treatment capacity were evaluated:

- The impact of an aggressive level of I/I reduction was assessed in relation to:
  - extent of interceptor surcharging
  - CSO volume
  - annual average and peak flow to the Deer Island plant
- The impacts of interceptor relief, in-system storage, and flow transfers were assessed in terms of:
  - CSO volume
  - peak flows and surcharging in downstream interceptor segments
  - peak flow to the Deer Island plant

- The impacts of a combination of CSO controls (e.g., sewer separation, in-system and off-line storage, and flow-through treatment) were assessed to determine impacts on:
  - annual average, 30-day maximum, 7-day maximum, and maximum day flows and loads to the Deer Island plant

The results of these evaluations showed that the appropriate level of control for one strategy area had a limited impact on the other strategies. Trade-off analyses were performed to determine whether the implementation of I/I and interceptor projects would be beneficial to CSO control. Aggressive I/I controls would not significantly impact the cost or sizing of CSO, interceptor, or secondary treatment options. Similarly, no in-system storage or flow transfer interceptor strategies were found that would significantly reduce CSO volume or peak flows to the treatment plant. The recommended interceptor relief projects to alleviate surcharging would not significantly increase CSO discharges or system-wide flows. The analysis of secondary treatment capacity requirements showed that implementing the recommended CSO control, I/I, and interceptor improvements included in the integrated system master plan would require more than two batteries of the designed secondary treatment capacity to meet hydraulic and unit process operational parameters and secondary effluent criteria. Although the results of the integrated evaluations did not reveal significant trade-off opportunities, where relevant, recommendations for each strategy were modified to incorporate the impacts of the other strategies. Detailed documentation of these evaluations and results is included in the following parts of this report.

OTHER RELATED PLANNING EFFORTS

Certain elements of the Deer Island treatment plant design are being re-evaluated under a separate study (DP-29) conducted by the MWRA Program Management Division, including examination of the possibility of reducing the size of the secondary treatment facilities and the potential for use of chemically enhanced primary treatment. As part of the CSO Conceptual Plan/SMP, flow and load analyses were performed to determine the secondary treatment capacity required to treat flows effectively and meet effluent quality criteria.

Results of these analyses have been provided to the DP-29 study group and have been incorporated into the evaluations made during that study, which is currently scheduled for completion in early 1995. Similarly, the findings of the DP-29 study are expected to refine the preliminary secondary treatment findings included in the SMP.

The development of the Draft CSO Conceptual Plan/SMP is also part of a larger planning process initiated by the MWRA Sewerage Division. This comprehensive planning process, initiated in the fall of 1993, is evaluating the current level of service, infrastructure conditions, and departmental support functions. An assessment of known or anticipated capital improvements and operation, maintenance, regulatory, and resource requirements will be made. The Comprehensive Plan is intended to guide and prioritize future projects and to coordinate the efforts of individual operating units within the Division. The plan is scheduled to be released in March 1995 and will cover the period from 1995 through 2025.

In addition, the MWRA is developing a Best Management Practices (BMP) plan for the four CSO communities. the plan will highlight low-cost stormwater quality and quantity controls that can be implemented by each community.

PUBLIC PARTICIPATION PROGRAM

The primary goals of the CSO public participation program were:

- Educate people on the issues associated with CSOs,
- Provide opportunities for them to review and comment on the work associated with the project, and
- Respond to questions and suggestions in a timely fashion.

The program was designed to bring all of the interested and affected parties up to date on the scope and status of each phase of work. The program brought parties into the discussion at

key decision points. The meeting and publication schedule allowed feedback on changes that occurred as part of the public participation process or information sharing on significant changes in expected status or schedule. The constituencies identified by the MWRA in its CSO public outreach program are groups with any interest in the outcome of the project, including residents of the four CSO communities, site abutters, and MWRA ratepayers at large who will finance the final plan.

1990 Facilities Planning Public Involvement

The court order directing a CSO Facilities Plan was issued in August 1987. The MWRA was working at the time with the Deer Island Facilities Planning Citizen's Advisory Committee (FPCAC). FPCAC membership was wide-ranging, including representatives of environmental, business, and neighborhood organizations, citizen activists, municipal and elected officials, with agency and regulatory representation. Given the complexity of the issues to be reviewed in the CSO plan and the rapid pace of the effort, FPCAC created a dedicated subcommittee known as the CSO Subcommittee of FPCAC to participate in the facilities planning that ensued. Other members of the public joined the group for its reviews. Members provided comments and feedback on draft plans. The subcommittee also called for other entities to contribute to solving regional water quality problems that were not the responsibility of the MWRA.

To provide additional opportunities for neighborhood review and comment on CSO planning, the MWRA organized neighborhood working groups in the CSO communities of Boston, Chelsea, Cambridge and Somerville. Groups were formed in Back Bay, Dorchester, South Boston, North End, East Boston, Chelsea, Cambridge and Alewife/Mystic. The membership included the groups represented on the CSO Subcommittee of FPCAC, municipal and elected officials, neighborhood activists and interested members of the public.

The CSO Bulletin was initiated to keep the neighborhood working groups apprised of work in progress on CSOs. The publication explains key CSO issues, notifies municipal officials and

working group members of upcoming meetings and events, and provides information on how CSOs fit into other MWRA planning and efforts.

Outreach Efforts for the CSO Conceptual Plan/SMP

The MWRA Wastewater Advisory Committee (WAC) currently has served as the Citizens Advisory Committee for the System Master Plan and CSO Facilities Plan. This successor organization to FPCAC meets monthly to review and comment on MWRA sewerage issues. Several of its members also served on the CSO Subcommittee to FPCAC. The CSO planning staff began briefing WAC in November 1992 as work began on data collection and modeling for the System Master Plan. In February 1994, WAC formed a subcommittee, including non-WAC members with an interest in CSO issues, to deal with recommendations that might arise on issues associated with CSOs and the System Master Plan. Members of the MWRA's CSO team and consultants have attended nearly every meeting of the two groups for several months to provide previews of upcoming reports, collect comments and answer questions.

A series of workshops were convened over several months as the MWRA reviewed volumes of data, the problems and target goals for 14 waterbodies, and more than 100 potential solutions to assorted CSO discharges. The MWRA CSO staff invited other MWRA staff, CSO community staff, regulators, representatives of environmental organizations, WAC, and the MWRA Advisory Board to seminar-like sessions in which problems and alternative solutions were posed and discussed. The goal of the sessions was to bring a range of interests, expertise and concerns to significant project milestones. Some sessions used case studies; others reviewed all of the data pertinent to resolving a problem.

Briefings were conducted for the MWRA's Board of Directors on a regular basis. The Board received staff summaries in advance of the meetings; CSO staff members attended Board briefings and provided detailed information on the project. The Authority conducted its first dedicated briefing for the Board members in July 1994. The meeting, open to the

public, centered on the work in progress and significant issues of public concern. The MWRA Advisory Board was also involved in review of this project through presentations to the membership and through Advisory Board staff participation in various CSO program forums.

Neighborhood working group meetings were used to present project updates and collect comments on specific CSO alternatives. These groups include local activists and residents, environmentalists, local and elected officials, and others. These smaller meetings allowed MWRA to lay out detailed information of importance to each neighborhood.

The environmental community participated in neighborhood working groups, workshops, WAC briefings and dedicated briefings for the membership and/or officers of specific organizations. Watershed support organizations, Save the Harbor/Save the Bay, and The Boston Harbor Association participated in major outreach events, including an Environmental Forum held in September 1994.

General community meetings were structured to provide updates on the project at major milestones. Meetings were held in the affected areas, but notices of the meetings were widely distributed to encourage attendance by the public at large. Material for these meetings was presented in language understandable to the public, and slides, maps and overheads were used to illustrate the concepts under discussion. Community meetings were held in June 1994 at the completion of CSO control alternatives development and in October 1994 upon completion of the Draft CSO Conceptual Plan/SMP. The fall community meetings were organized according to related waterbodies and included:

- East Boston, Constitution Beach
- Boston Downtown, Waterfront, Fort Point Channel
- North Dorchester, Reserved Channel, South Dorchester Bay and the Neponset River

- Charles River
- Alewife Brook/Mystic River

A special presentation for environmental organizations and regulators, a briefing for the Union Park Neighborhood Association, and individual meetings with regulatory agencies were also held to present the findings of the draft report. Minutes of the meetings are provided in Appendix B. Information gathered in all the meetings influenced decision-making on the project, assisted staff with concept formation, and changed aspects of the project planning. In addition, numerous letters of comment on the draft report were submitted and helped the Authority to refine its final recommendations. Copies of these letters are provided in Appendix C.

The CSO Bulletin was used through the planning effort to introduce, reinforce and re-explain some of these complex issues. A total of five bulletins were issued in the spring and summer of 1993, and in the spring, summer and winter of 1994.

PART I

CHAPTER THREE

OVERVIEW OF THE RECOMMENDED SYSTEM MASTER PLAN

The SMP consists of recommendations in four major areas, including CSO control, I/I reduction, transport system improvements, and secondary treatment. A summary of the recommended plan for each of these areas is provided in this chapter. More detailed information on the evaluations conducted and the results obtained in the four strategy areas can be found in the subsequent parts of this report.

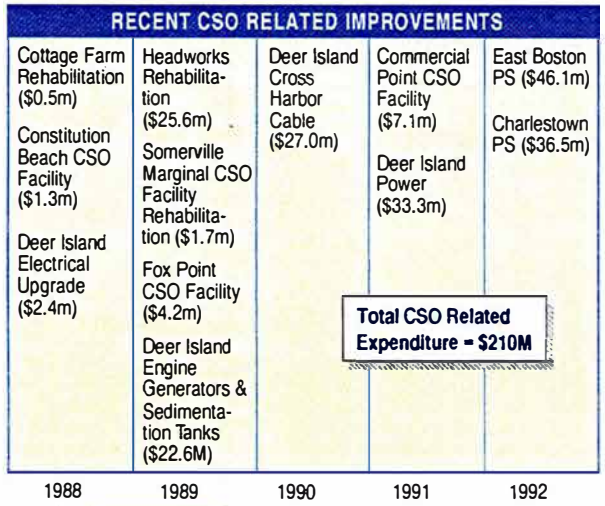
CSO CONTROL

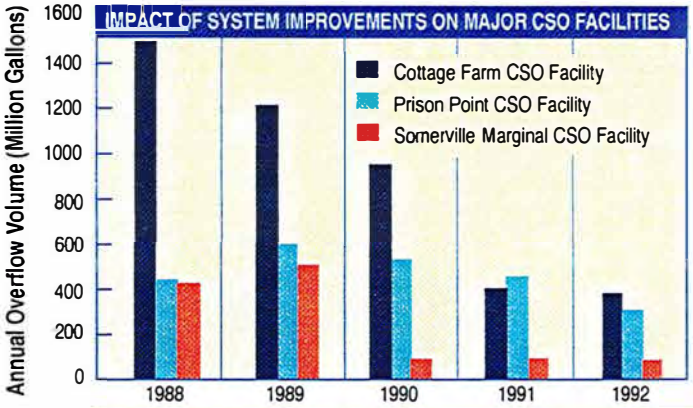
The MWRA's long-term CSO control program can be viewed as consisting of several phases:

- Phase I - Recent CSO Related Improvements (1988-1992)
- Phase II - Ongoing System Optimization and Improvements (1992 - 1997)
- Phase III - Recommended CSO Control Facilities (1997 - 2010)
- Phase IV - Watershed Planning Efforts

An overview of Phases I through III is presented in Figure 3-1. This figure demonstrates the dramatic reduction in CSO discharge volumes which have occurred due to recent improvements, are continuing to occur due to ongoing improvements, and are predicted to occur as the new recommended CSO control facilities are implemented. Annual CSO volumes have decreased from about 3.3 billion gallons in 1988 to about 1.5 billion gallons in 1992, and are predicted to decrease further to about 1 billion gallons in 1997 and 0.5 billion gallons after full plan implementation in 2010. Along with these decreases, the portion of the CSO flow which is treated will rise to 96 percent. The following paragraphs describe the major projects yielding these improvements during each phase of the CSO control program.

FIGURE 3-1. OVERVIEW OF MWRA CSO PROGRAM





CSO CONTROL PROGRAM HIGHLIGHTS

Phase I - Recent CSO Related Improvements

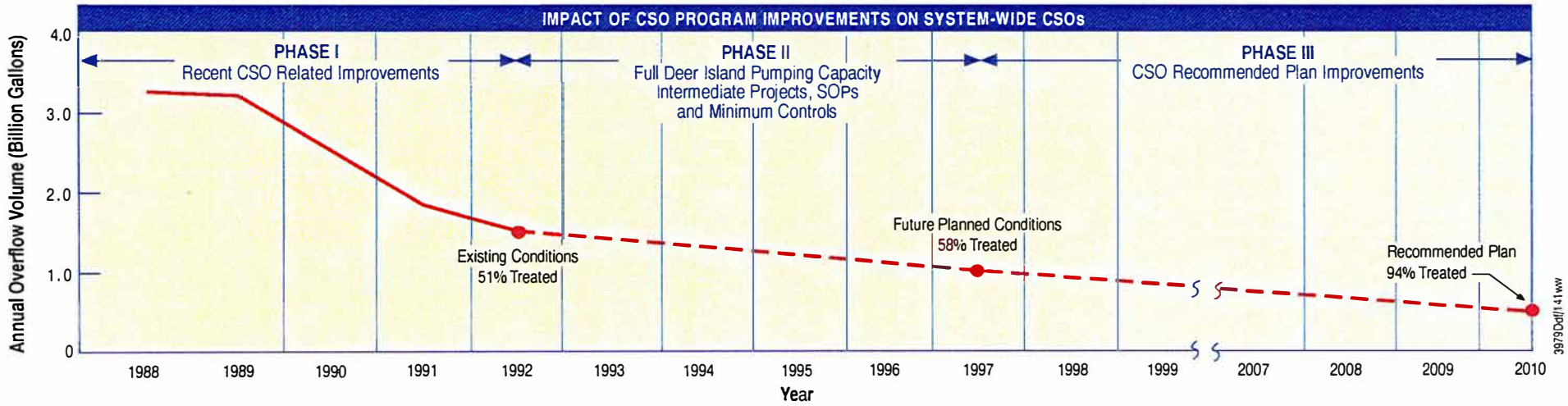
- Investment of over $200 million in CSO related improvements from 1988 to 1992.
- 55% reduction in annual CSO volume between 1988 and 1992 with at least screening and disinfection of over 50% of the CSO volume.

Phase II - Ongoing System Optimization and Improvements

- Due to SOPs, intermediate projects, minimum control implementation and further Deer Island improvements, by 1997 the CSO volume will have been reduced by 70% over 1988, with about 60% receiving at least screening and disinfection.

Phase III - Recommended CSO Control Facilities

- The CSO recommended plan will result in an 84% reduction in CSO volume over 1988 conditions, with 96% receiving at least screening and disinfection.
- Of the 80 CSO discharge locations, 22 will be closed; 12 will discharge treated flow; 35 will discharge untreated flow less than four times per year; and 9 will discharge untreated flow approximately four times per year.



Finally, the Authority's on-going involvement in watershed planning efforts undertaken by other groups is presented. If other sources of pollutant loads are addressed, such planning may result in further refinements to the long-term CSO plan.

Phase I - Recent CSO Related Improvements

The MWRA has undertaken a number of major capital improvement projects and has established programs and operational practices which have eliminated dry weather overflows, eliminated some CSOs, and greatly reduced the frequency, volume, and duration of the remaining CSOs. Projects which have contributed to improved pumping capacity and conveyance of wet weather flows to the Deer Island treatment plant or have increased CSO treatment are discussed below. A summary of these projects was shown in Figure 3-1. As indicated in the figure and described below, substantial financial investment by the MWRA in the transport and treatment systems already has yielded substantial reductions in CSO volumes.

Wastewater Treatment Facilities. During the years 1988 to 1991, the MWRA completed several projects to improve the operation and reliability of the existing Deer Island treatment plant, which must remain in operation until the new treatment facilities are on-line. Under the Fast-Track Improvements Program, the power supply was upgraded and augmented through repairs to the electrical distribution system and installation of new generators. Five new sewage pumps, along with four new electric pump motors, were installed in the North Main Pump Station to significantly increase overall pumping capacity. In addition, rehabilitation of the primary sedimentation tanks has reduced the time that tanks are off-line for maintenance and repairs. A new cross-harbor submarine electrical cable was installed, which in conjunction with the pump/drive replacements has increased pumping capacity and reliability. Increased pumping capacity at Deer Island has reduced the amount of time that flows are choked back at the headworks facilities and has increased the collection system's ability to convey peak flows. Table 3-1 lists the pumping and peak flow information for

TABLE 3-1. DEER ISLAND PEAK FLOW HANDLING IMPROVEMENTS, 1989 TO 1991

Year	Avg. No. Available Pumps	Available Pump Capacity (mgd)	Avg. Monthly Ppt. (in)	Avg. Monthly Choking Time (hrs)
1989	6	600	3.47	148
1990	7	623	3.94	114
1991	8	677	3.05	40

Deer Island for a three-year period, with the related flow choking time for the remote headworks.

At the existing Nut Island treatment plant, which also must remain in service until the new treatment facilities are on-line, the MWRA conducted several key programs to improve operations and reliability: an electrical system upgrade resulted in more reliable pumping operations; an outfall cleaning project had a significant effect on outfall capacity; and rehabilitation of the primary sedimentation tanks reduced the time that tanks are off line for maintenance and repairs.

Headworks Facilities. Also under the Fast-Track Improvements Program, new screens and grit collection equipment were installed and sluice gates rehabilitated at the three remote headworks. These facilities now provide more effective removal of grit and screenings before wastewater is conveyed to Deer Island. The MWRA also installed new microwave equipment at Deer Island and the headworks to provide a reliable communications system for transmitting flow and shaft level information to the North Main Pump Station. This has enabled operators at the North Main Pump Station to make real-time operating decisions to maximize the conveyance of wet weather flows to Deer Island.

CSO Treatment Facilities and Outfalls. As part of its initial CSO abatement efforts, the MWRA completed major repairs at the Cottage Farm CSO facility. This work included upgrading pumps, diesel engines, and screening equipment. Major repairs were also completed at the Somerville Marginal CSO facility, including improvements to the screening and disinfection systems. In addition, a new pipe and gate chamber, which were part of the Southwest Corridor CSO project, likely reduced discharges via one CSO outfall into Boston's Back Bay Fens.

At the same time, the MWRA initiated the design and construction of three new CSO treatment facilities at Commercial Point, Fox Point, and Constitution Beach. These facilities provide screening and disinfection of CSO flows discharged in proximity to Boston Harbor bathing beaches.

Interceptors and Pump Stations. The MWRA has undertaken several projects which have improved pumping capacity and conveyance of wastewater flows in the North System. Rehabilitation of the Alewife Brook and Bedford pump stations has been completed and three new pump stations in Reading, East Boston, and Charlestown have been constructed. The East Boston pump station project included the construction of a new Chelsea Screenhouse, and rehabilitation of the Winthrop Terminal and North Metropolitan Trunk Sewer.

Finally, the MWRA has instituted a wastewater metering program to measure flows from its user communities. This included pump station modifications and the installation of meters at nearly 200 sites. The metering program provides information for flow control, infiltration/inflow assessments, and collection system planning. It is also an integral part in the development of the Authority's knowledge of system operations.

Phase II - Ongoing System Optimization and Improvements (1992-1997)

Completed and on-going projects designed to maximize the delivery of flow to the Deer Island treatment plant create opportunities to further control CSOs through optimization of

the upstream collection and transport systems. In addition, extensive system inspections and flow monitoring conducted as part of this master plan during 1992 demonstrated the availability of significant storage volume in the combined sewer systems upstream of community regulators. For these reasons, prior to the development of comprehensive CSO control strategies as part of the SMP, detailed evaluations of the combined sewer systems in the four CSO communities of Boston, Cambridge, Chelsea, and Somerville were conducted to identify ways to reduce or eliminate CSOs through modification of existing sewer systems. These evaluations focused on system hydraulics in the combined system to ensure that the storage and transport capacity of community systems, and the transport capacity of the downstream MWRA system, were effectively utilized to limit overflows.

SOP Projects. The result of these evaluations was the development of system optimization plans (SOPs), formally defined in negotiations between the MWRA and EPA as:

> "hydraulic improvements that, in conjunction with ongoing programs of municipal sewerage agencies, might promote a balanced hydraulic system, including optimization of the collector/interceptor system upstream of regulators, to ensure that the storage and transport capacity of the system is maximized within constraints unalterable except for major structural modifications", and
>
> "certain minor modifications designed to maximize the capacity of the collection system, and thereby minimize CSO discharges, during the period before a more extensive control system is in phase." (Memorandum of the United States in Support of Assented to Motion to Amend the First CSO Schedule and Schedule Four, 1/31/92)

General types of SOP projects and their potential benefits are listed in Table 3-2, while the recommended projects and evaluation process are described in detail in the June 1993 report on "System Optimization Plans for CSO Control." Further SOP projects in the Stony Brook system were developed after June 1993 and are described in the November 1994 "Supplemental Report on System Optimization Plans for CSO Control." Constructing or raising a weir in the invert of the overflow conduit was the most commonly recommended SOP project.

TABLE 3-2. TYPICAL SOP PROJECTS AND BENEFITS

Project	Benefits
Block Overflow	Eliminates CSO outfall. Eliminates permit requirements.
Install/Raise Weir	Utilizes in-system storage capacity. Decreases CSO volumes and frequency. Allows for staged implementation.
Construct New Regulator	Similar to benefits of new weir.
Increase Size of Regulator Outlet to Interceptor	Increases flow to interceptor. Decreases CSO volume and frequency.
Replace Tidegate	Reduces tidal inflow. Increases system capacity for combined flows. Decreases CSOs at downstream locations.

The SOP projects are relatively low cost and easily implemented, and in effect are an expansion of efforts by the CSO communities over the last few years to improve system performance through similar types of projects. SOPs also are consistent with national and state policies on CSO abatement. EPA's CSO policy emphasizes the need to maximize storage within the existing collection system and maximize flows to the treatment plant as part of minimum controls, before proceeding with development of long-term CSO facilities. The Massachusetts DEP policy requires that CSOs be eliminated where feasible, or that CSO impacts be minimized by evaluating CSO relocation, prior to implementation of further CSO treatment/storage technologies.

SOPs were recommended at 125 locations at an estimated construction and monitoring cost of about $3.5 million. These low cost projects should provide substantial benefits. The predicted reduction in CSO volume for the three-month design storm volume is presented in Table 3-3.

TABLE 3-3. PREDICTED CSO FLOW REDUCTIONS DUE TO SOPs FOR A THREE-MONTH DESIGN STORM

Community	Number of Locations	Reduction in CSO (MG)	Approximate Cost
Boston	106	8.2	$250,000
Cambridge	7	-0.2	250,000
Chelsea	2	1.4	400,000
Somerville	10	1.3	300,000
TOTAL	125	10.7	$3,450,000

The recommended improvements included raising existing weir elevations, repairing regulators, constructing new regulators and weirs, plugging and abandoning certain overflow pipes, and replacing or repairing tidegates. The SOP improvements, if fully implemented, are expected to lower CSO discharges at over 30 outfall locations during a 3-month storm.

Many additional outfalls which do not activate for this size event would have reduced overflows during larger storm events. CSO discharges would minimally increase at approximately ten locations, as the result of relocating CSO discharges away from more sensitive environmental or critical use areas. The net increase in overflow in Cambridge reflects an increase in overflow to the Alewife Brook due to an SOP at Somerville regulator RE-01A. This SOP substantially reduces overflows to Alewife Brook from the Tannery Brook Drain, resulting in a net overall reduction in overflows to Alewife Brook from Cambridge and Somerville combined. Three outfalls, as well as eight CSO regulators, would be eliminated. Total system-wide CSO discharges to receiving waters during a 3-month design storm event (including discharges that are treated) would be reduced by approximately 15 percent. In addition, the untreated discharges would be reduced by approximately 27 percent. The Authority has developed Financial Assistance Agreements to facilitate the funding and implementation of SOPs by the communities. While some SOPs have already

been implemented by the CSO communities, it is expected that all recommended SOPs will be implemented by 1997.

Intermediate Projects. As a by-product of the detailed SOP analyses, a number of potential projects were identified which could contribute to optimizing the carrying and treatment capacity of the existing sewerage systems, but would involve more extensive design and implementation requirements than the SOP measures, and greater cost. These "Intermediate Projects," including such measures as modifications to existing pump stations, disconnection of storm drains serving separated areas from CSO systems, and interceptor relief projects, were evaluated separately, following the submittal of the June 1993 SOP report. The one intermediate project recommended from these evaluations, interceptor relief impacting Chelsea outfalls CHE002, CHE003, and CHE004, has now been incorporated into the preferred CSO control alternative for the Mystic/Chelsea Confluence receiving water segment.

Pumping Capacity at Deer Island. In addition to the above projects, continuing improvements to the system have been or are being made during the Phase II period. A major benefit in terms of reduced CSO volumes will be obtained due to increased pumping capacity at the North Main Pump Station. The North Main Pump Station draws the flows through the North Metropolitan Relief Tunnel and the Boston Main Drainage Tunnel. Under existing conditions, the distribution of flows between these tunnels during periods of high flows is controlled by the operators at the North Main Pump Station through throttling orders sent to the Chelsea Creek, Ward Street and Columbus Park Headworks. For future planned conditions, the capacity of the North Main Pump Station will equal the joint capacity of the two tunnels, so that the throttling should be limited to instances when flows reaching the headworks exceed tunnel capacities.

For the master planning analyses, the capacities listed in Table 3-4 show the progressive increase in capacities at various critical hydraulic locations.

TABLE 3-4. HEADWORKS AND PUMP STATION CAPACITIES

Facility	Capacity (MGD)		
	Historical (1988)	1992 Conditions (end of Phase I)	Future Planned (1997) Conditions (end of Phase II)
Chelsea Creek Headworks	109	160	350
Ward Street Headworks	85	200	256
Columbus Park Headworks	50	140	182
Charlestown Pump Station	48	78	93
East Boston (Caruso) P. Station	18	60	125
Nut Island	240	240	360

Nine Minimum CSO Control Measures. As defined in the EPA CSO policy, the nine minimum CSO controls are actions or measures that can reduce CSO discharges and their effect on receiving water quality, do not require significant engineering studies or major construction, and can be implemented in a relatively short time-frame. Implementing the nine minimum controls is among the first steps a permittee is expected to take in response to the federal CSO policy.

To support the intent of the new CSO policy, the EPA developed, "Guidance for Nine Minimum Control Measures," dated May 6, 1994. Also, on July 20, 1994, the EPA Region 1 released the NPDES Permit Policy which was developed to implement the final CSO control policy.

The EPA policy requires that the Nine Minimum Controls be implemented by January 1, 1997. As part of the CSO planning effort, the MWRA is documenting historical and ongoing activities which have served to implement the minimum control measures. Recommendations for additional activities to be implemented by the MWRA, CSO

communities and other agencies/entities to best meet the intent of the federal guidance are currently being developed.

The MWRA and CSO communities have implemented a number of programs and/or projects which are consistent with the intent of the nine minimum controls. Table 3-5 summarizes the programs outlined by the EPA as examples for each specific minimum control which they address. These examples are followed by a listing of the programs currently being conducted by the MWRA, CSO communities and other agencies/entities. Also included are projects which do not fit the minimum control definition (mainly because they involve significant capital costs), but clearly meet the intent of the minimum control measure.

Phase III - Recommended CSO Control Facilities (1997-2020)

The conceptual CSO plan, which will be implemented during this period, is the result of technical and economic analyses, site investigations and a series of workshops that comprise the CSO and system master planning efforts conducted by the Authority over the last two and one-half years. At the workshops, participants used a number of criteria to evaluate, rate and rank a range of CSO alternatives and achieved general consensus on overall waterbody goals, CSO control levels, and methods of control. Cost, based on the MWRA's Life Cycle Cost Analysis Policy, and siting requirements also were considered.

The MWRA's plan fulfills all the requirements for developing a long-term CSO control plan in accordance with federal and state CSO policies to achieve water quality goals and support beneficial uses. The planning was conducted using a watershed-based approach, so that site-specific water quality conditions and the water quality impacts of CSOs relative to impacts from non-CSO sources of pollution could be determined. In many receiving water segments, CSO discharges do not contribute significantly to violations of water quality standards. Even the complete elimination of CSOs in these segments would not improve conditions sufficiently to attain beneficial uses. CSO control beyond the recommended plan can not be justified until non-CSO pollution sources are controlled by the responsible parties.

Minimum CSO Control Technology	EPA Examples of Minimum Controls from Draft EPA Report October, 1992	MWRA Programs	CSO Community Programs	Other Programs
Proper Operations and Maintenance	• Regulator Maintenance/Repair • Tide Gate Maintenance Repair • Debris/Sediment Removal • Limited Pump Station Repairs • Inspection Program • Collection System Inspection	• Quarterly Tidegate/Regulator Inspections • NPDES Semi-Annual Inspection Reports • Collection System O&M Program	• NPDES Inspection/Monitoring Reports • Regulator/Tide Gate Maintenance • Community O&M Programs	
Maximum Use of Collection System for Storage	• Tidegate Maintenance/Repair • Regulator Adjustments • Remove Small System Bottlenecks • Retard Surface Runoff • Remove Flow Obstructions • Upgrade/Adjust Pumping Operations • Water Conservation	• MWRA SOP's • I/I Programs* • Water Conservation Program (See Pollution Prevention Below)	• Community SOP's • I/I Programs* • Regulator Adjustments/Blocking	
Review and Modification of Pretreatment Programs	Volume Control • Diversion Storage • Flow Restrictions • Reduced Runoff • Infiltration • Curbs/Dikes Pollutant Control • Effluent Limits • Process Modifications • Stormwater Treatment • Improved Housekeeping • BMP Plan	• TRAC Pretreatment Program		• Pretreatment Programs Implemented by Industries
Maximization of Flows to the POTW for Treatment	• Analyze Flows • Analyze Unit Processes • Analyze Head Loss • Evaluate Design Capacity • Modify Internal Piping • Use Abandoned Facilities • Analyze Sewer System	• DI Plant Improvements* • East Boston PS* • Winthrop TF* • Remote Headworks Improvements		
Prohibition of Dry Weather Overflows	• Routine Inspections • Remove Illicit Connections • Regulator Adjustment/Repair • Tide Gate Repair • Sewer Cleaning/Repair • Eliminate Bottlenecks	• Inspection Program (See Proper O&M)	• Inspection Program (See Proper O&M)	
Control of Solid and Floatable Materials in CSO Discharges	• Screening - Baffles, Trash Racks, Screens (Static and Mechanical), Netting, Catch Basin Modifications • Skimming - Booms, Skimmer Boats, Flow Balancing • Source Controls – Street Cleaning, Anti-Litter, Public Education, Solid Waste Collection, Recycling	• CSO Treatment Facilities*	• Community Street Sweeping/Catch Basin Cleaning/Solid Waste Programs	• MDC Street Sweeping/Park Maintenance • MassPort Skimmer Boat
Inspection – Monitoring-Reporting	• Develop a Record of Overflow Occurences • Monitor Overflow Quality • Monitor Receiving Water Quality • Summarize CSO Impacts/Incidences	• NPDES Monitoring • Harbor Studies Monitoring/Reporting • Data Collection for SOPs and System Master Plan	• NPDES Monitoring	
Pollution Prevention	• Source Controls (See Above) • Water Conservation	• Water Conservation Program	• Source Controls (See Control of Solids and Floatables) • TRAC Pilot Programs for Waste Oil, Household Hazardous Waste	• Source Controls (See Control of Solids and Floatables • Waste Oil Programs
Notification	• Posting (at Use Areas, Public Places) • TV/Newspaper Notification • Direct Mail Notification	• MWRA Public Relations • NPDES News	• Installation/Maintenance of Signs at CSO Outfalls	• MDC Notification Programs/Beach Signage • DMF Shellfish Conditions Notification

*Projects which do not fit EPA definition (low cost, easily implemented, limited engineering required) but accomplish the intent

TABLE 3-5.
SUMMARY OF MWRA AND CSO COMMUNITY PROJECTS INVOLVING MINIMUM CSO CONTROL TECHNOLOGIES

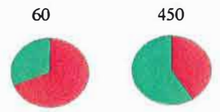
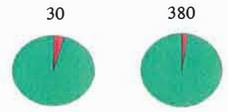
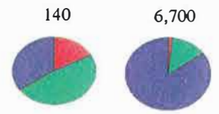
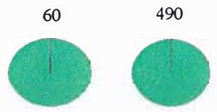
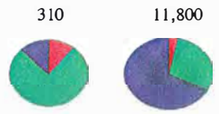
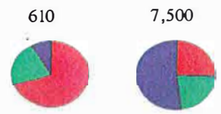
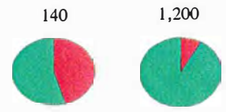
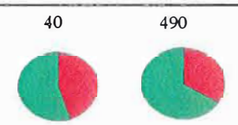
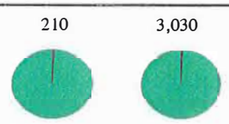
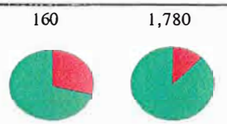
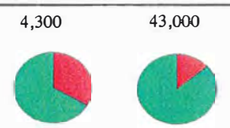
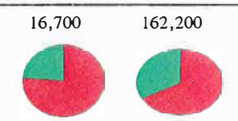
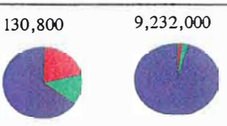
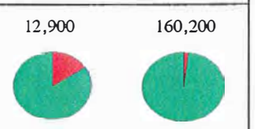
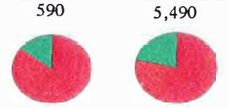
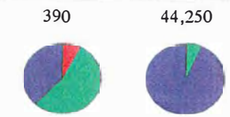
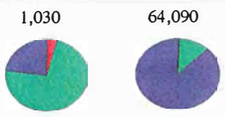
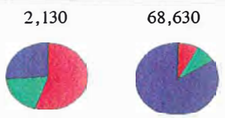
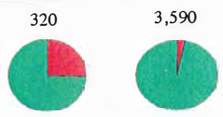
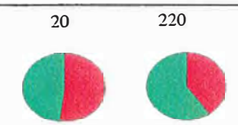
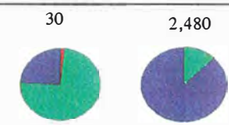
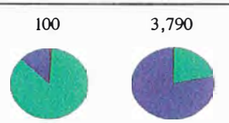
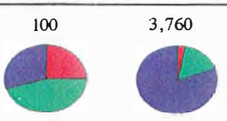
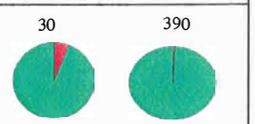
Watershed-Based Approach. The process for selecting the preferred CSO control alternatives for each receiving water segment involved the step-by-step watershed-based approach described in Chapter Two.

From this framework, selection of the preferred alternative for each receiving water segment involved identifying the appropriate CSO control level, and the appropriate alternative to meet that level. Protection of critical uses, cost benefit analyses, impact of CSO and non-CSO pollution on water quality, siting issues, potential for phased implementation, integration with on-going CSO control efforts within the CSO communities (particularly local sewer separation projects), and other issues regarding each alternative were considered in the selection. In some cases, the most cost effective control alternative dictated the appropriate control level, while in other cases, the desired control level dictated the appropriate control alternative. Examples of the latter case include the selection of sewer separation or CSO relocation to achieve elimination of CSOs in critical use areas. As discussed earlier, the objective of CSO elimination or relocation under the state CSO policy is to achieve the maximum recovery of water uses by eliminating CSO discharges in segments of receiving waters having critical uses, while possibly achieving a lower level of CSO control in other segments without critical uses.

Figure 3-2 presents for each receiving water segment the existing water quality standard, existing uses, sources of pollutants currently causing non-attainment of designated uses, selected waterbody goal, and preferred CSO control alternative. The methodologies used to estimate pollutant loadings presented in this figure were detailed in a report by MWRA entitled, "Baseline Water Quality Assessment," August 1994.

The integrated, master planning approach used in developing the conceptual plan for CSO control required the evaluation of how other system components, such as infiltration/inflow, collection and transport, and secondary treatment design, could be part of a comprehensive solution. An emphasis was placed on optimizing the operation of existing and planned facilities to store, transport and treat wet weather flows. The broader, system-wide

FIGURE 3-2. SUMMARY OF FUTURE PLANNED CONDITIONS WATER QUALITY PARAMETERS AND RECOMMENDED CSO CONTROL PLAN BY RECEIVING WATER SEGMENT

	DORCHESTER BAY / NEPONSET RIVER			CONSTITUTION BEACH	CHARLES RIVER		
	NORTH DORCHESTER BAY	SOUTH DORCHESTER BAY	NEPONSET RIVER		UPPER CHARLES RIVER	LOWER CHARLES RIVER	BACK BAY FENS
EXISTING WATER QUALITY STANDARD [1]	SB	SB	SB	SB	B	B	B
EXISTING USES (* = CRITICAL USE)	FISHING SHELLFISHING* SWIMMING* BOATING AESTHETIC VALUE	FISHING SHELLFISHING* SWIMMING* BOATING AESTHETIC VALUE	FISHING SHELLFISHING* BOATING AESTHETIC VALUE	FISHING SHELLFISHING* SWIMMING* BOATING AESTHETIC VALUE	BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	AESTHETIC VALUE
SELECTED USE CRITERIA; AND SOURCES OF POLLUTANTS AND TOTAL POLLUTANT LOAD CAUSING NON-ATTAINMENT [2]	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL
BACTERIA (FC, count, trillions)	60 / 450 	30 / 380 	140 / 6,700 	60 / 490 	310 / 11,800 	610 / 7,500 	140 / 1,200 
FLOATABLES (CSO & SW VOLUME, MG)		40 / 490 			210 / 3,030 	160 / 1,780 	
DO (BOD, lbs)	4,300 / 43,000 	16,700 / 162,200 				130,800 / 9,232,000 	12,900 / 160,200 
NUTRIENTS (TOTAL P, lbs)		590 / 5,490 	390 / 44,250 		1,030 / 64,090 	2,130 / 68,630 	320 / 3,590 
TOXICS (Cu, lbs)		20 / 220 	30 / 2,480 		100 / 3,790 	100 / 3,760 	30 / 390 
RECOMMENDED WATER QUALITY GOAL	- Meet unrestricted shellfishing and swimming bacteria standards - Meet aesthetic criteria - Meet DO standard - Control nutrients	- Meet restricted shellfishing bacteria standard - Meet aesthetic criteria	- Meet restricted shellfishing bacteria standard - Meet aesthetic criteria	- Meet unrestricted shellfishing bacteria standard - Eliminate potential Chlorine toxicity	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet aesthetic criteria	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet boating standard - Meet aesthetic criteria - Improve DO - Reduce nutrients - Reduce metals	- Meet Class B water quality standard except for less than 4 overflows per year
RECOMMENDED CSO CONTROL PLAN	CSO Relocation to Reserved Channel, and screening/disinfection	Upgrade Existing Facilities to Dechlorination; Sewer Separation	Sewer Separation	Sewer Separation	Screen and Disinfect CAM005; Enlarge interceptor connection at BOS032; Install manually-cleaned bar screen at 5 outfalls	Screen/ Disinfect Stony Brook Conduit;Upgrade Cottage Farm screens, dechlorination outfall; Plug regulators at 2 outfalls, Install manually-cleaned bar screens at 9 outfalls	Install manually-cleaned bar screen at BOS046

[1] Designated uses for Class SB water include: Aquatic life habitat, Primary Contact Recreation (swimming), Secondary Contact Recreation (boating), Restricted shellfishing, and Aesthetic value
Designated uses for Class B water include: Aquatic life habitat, Primary Contact Recreation (swimming), Secondary Contact Recreation (boating), Public water supply (with treatment), Irrigation/agricultural uses, Industrial cooling/process uses, and Aesthetic value

[2] Where a designated use criteria is currently not attained, the relative contributions of sources of the pollutant causing non-attainment are represented by the pie charts. Where no pie chart is indicated, the use is currently attained. The pie charts are color coded as follows: CSO STORMWATER BOUNDARY OR UPSTREAM FLOW, IF APPLICABLE

FIGURE 3-2 (continued). SUMMARY OF FUTURE PLANNED CONDITIONS WATER QUALITY PARAMETERS AND RECOMMENDED CSO CONTROL PLAN BY RECEIVING WATER SEGMENT

	ALEWIFE BROOK / UPPER MYSTIC RIVER		BOSTON HARBOR				
	ALEWIFE BROOK	UPPER MYSTIC RIVER	UPPER INNER HARBOR	LOWER INNER HARBOR	MYSTIC/CHELSEA CONFLUENCE	RESERVED CHANNEL	FORT POINT CHANNEL
EXISTING WATER QUALITY STANDARD [1]	B	B	SB	SB	SB	SB	SB
EXISTING USES (* = CRITICAL USE)	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE	FISHING BOATING AESTHETIC VALUE
SELECTED USE CRITERIA; AND SOURCES OF POLLUTANTS AND TOTAL POLLUTANT LOAD CAUSING NON-ATTAINMENT [2]	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL	1 YEAR / ANNUAL
BACTERIA (FC, count, trillions)	180 / 1,520	230 / 4,280	190 / 3,370	200 / 390	260 / 2,450	180 / 1,470	610 / 3,970
FLOATABLES (CSO & SW VOLUME, MG)	70 / 1,020	180 / 2,720	70 / 620	100 / 130	140 / 1,800		70 / 650
DO (BOD, lbs)	6,500 / 174,500	42,600 / 1,239,500	155,700 / 9,585,100	27,500 / 784,200	60,200 / 2,236,500		24,100 / 187,700
NUTRIENTS (TOTAL P, lbs)	370 / 4,060	820 / 19,820	1,980 / 68,180	210 / 1,610	1,030 / 21,310	250 / 2,050	850 / 6,050
TOXICS (Cu, lbs)	30 / 410	80 / 1,610	80 / 3,480	50 / 490	70 / 1,380	10 / 70	120 / 280
RECOMMENDED WATER QUALITY GOAL	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet DO standard - Meet aesthetic criteria - Control nutrients - Control toxics	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet boating standard - Meet aesthetic criteria	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet DO standard - Meet aesthetic criteria - Reduce toxics	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet DO standard - Meet aesthetic criteria - Reduce toxics	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet DO standard - Meet aesthetic criteria	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet aesthetic criteria	- Meet swimming bacteria standard except for ± 4 overflows per year - Meet aesthetic criteria
RECOMMENDED CSO CONTROL PLAN	Separate CAM002 and CAM004 Tributary Areas; Separate baffle MHs at SOM001; Install manually-cleaned bar screens at 8 outfalls	Separate baffle MHs at SOM006 and SOM007	Relieve East Boston Branch Sewer; Screen and disinfect BOS019; Add dechlorination at Prison Point; Install manually-cleaned bar screens at 6 outfalls	Relieve East Boston Branch Sewer; Install manually-cleaned bar screens at 5 outfalls	Screen and Disinfect BOS017 and MWR205; Interceptor Relief for CHE002-004; Install manually-cleaned bar screens at 6 outfalls	Consolidate, Screen and Disinfect near BOS080; Install manually-cleaned bar screens at 4 outfalls	Detention/Treatment at UPPS; Storage at BOS072&073 Storage in Dorchester Conduit; Install manually-cleaned bar screens at 3 regulators, 2 outfalls and in D.B.C.

[1] Designated uses for Class SB water include: Aquatic life habitat, Primary Contact Recreation (swimming), Secondary Contact Recreation (boating), Restricted shellfishing, and Aesthetic value
Designated uses for Class B water include: Aquatic life habitat, Primary Contact Recreation (swimming), Secondary Contact Recreation (boating), Public water supply (with treatment), Irrigation/agricultural uses, Industrial cooling/process uses, and Aesthetic value

[2] Where a designated use criteria is currently not attained, the relative contributions of sources of the pollutant causing non-attainment are represented by the pie charts. Where no pie chart is indicated, the use is currently attained. The pie charts are color coded as follows: CSO STORMWATER BOUNDARY OR UPSTREAM FLOW, IF APPLICABLE

evaluation and system optimization, together with the site-specific receiving water conditions, guided the selection of new CSO control measures.

Overview of the Recommended Plan. In general, the recommended plan focuses on the control of bacteria and floatables to increase swimming, shellfishing and aesthetic/recreational uses of waterbodies. Improvement of these uses through control of bacteria and floatables is measured by reduction in the annual frequency of untreated combined sewer overflow events, as well as the reduction in loading of these parameters. The plan includes limited near-surface storage of CSO at two of the existing CSO treatment facilities and new storage facilities in certain other segments where CSO flows are a major percentage of the total flow to the waterbody. The recommended plan involves:

- Elimination of CSOs discharging to "critical use" waters (Dorchester Bay, Neponset River estuary, and Constitution Beach).
- Reduction of untreated overflows (about 4 per year remaining) in other waterbodies.
- Upgrade of three existing CSO treatment facilities (Cottage Farm, Prison Point and Somerville Marginal). The other three existing CSO facilities (Commercial Point, Fox Point and Constitution Beach) would be decommissioned.

In some waterbodies, pollutants such as biochemical oxygen demand (BOD), total suspended solids (TSS), and nutrients, were not the major cause of water quality problems. For the waterbodies where these pollutants cause water quality problems, it was determined that in most cases non-CSO sources, such as stormwater and upstream river flows, were the dominant contributors of these pollutants. One exception is the Fort Point Channel.

With one exception, the recommended plan involves separate CSO controls for each receiving water segment, rather than a single system-wide solution. The exception is a screening and disinfection facility on the Reserved Channel that would handle consolidated overflows from both the Reserved Channel and North Dorchester Bay. Otherwise, the plan

includes a variety of controls, such as interceptor relief, upgrading of existing CSO storage and treatment facilities, sewer separation, and new screening and disinfection facilities. The recommended CSO control plan takes into account the effects of projected infiltration/inflow (I/I) reductions and recommended interceptor improvement projects, resulting from detailed hydraulic analyses of the entire MWRA sewerage system.

The plan calls for partial sewer separation in the Alewife Brook receiving water segment. For the Charles River Basin, construction of a new screening and disinfection facility to treat CSO and stormwater flows in Stony Brook and upgrading of the existing Cottage Farm CSO Facility are recommended. In these two areas, more extensive CSO controls were not warranted at this time because of the dominance of non-CSO sources of pollution, which would negate any real water quality improvement from higher levels of CSO control.

The recommended CSO control alternative for each receiving water segment, along with capital cost and impact on annual overflow frequency, are presented in Table 3-6. Following is a brief description of each of the recommended alternatives for the individual receiving water segments. Project fact sheets are provided in Appendix D. These projects are also shown on Figure 3-3 in the map pocket at the end of this report.

North Dorchester Bay. Swimming and shellfishing have been designated as critical uses for this waterbody. Consistent with the Massachusetts CSO policy regarding critical use areas, and the EPA CSO policy regarding sensitive areas, the recommended alternative for North Dorchester Bay is to eliminate the CSOs, in this segment through relocation to a less sensitive area (the Reserved Channel). A consolidation conduit sized to carry the maximum flow that could be passed through the outfalls will run parallel to Carson Beach from outfall BOS087 to BOS081, then to a screening and disinfection facility constructed near BOS080 on the Reserved Channel. This facility will also serve the consolidation conduit collecting CSOs located along the Reserved Channel. Once the new facilities are in place, outfalls BOS081 through BOS087 will be permanently blocked. CSO relocation is preferred

TABLE 3-6. RECOMMENDED CONCEPTUAL CSO CONTROL PLAN

Critical Uses in Parentheses

Basins	Level of Control	Recommended Plan	Annual CSO Activation Frequency(1) Ful. Planned Conds. Total	Ful. Planned Conds. Untreated	Recommended Plan Total	Recommended Plan Untreated	Reasons/Comments	Capital Cost (million $) (2)
Dorchester Bay								
N. Dorchester Bay (Swimming/Shellfishing)	I	CSO relocation to Reserved Channel	78	78	0	0	1. Eliminates CSOs to North Dorchester Bay; potential for SA designation 2. Relocated flow to Reserved Channel to receive screening and disinfection	$86
S. Dorchester Bay (Swimming/Shellfishing)	I	Sewer separation	22	1	0	0	1. Eliminates CSOs; potential for SA designation 2. Interim upgrade of existing facilities 3. Potential for use of Fox and Commercial Point CSO facilities for stormwater treatment by others	$95
Neponset River (Shellfishing)	I	Sewer separation	17	17	0	0	1. Eliminates CSOs 2. Requires separation of South Dorchester area also	$11
							Subtotal -- Neponset River/Dorchester Bay Subareas:	$192
Constitution Beach (Swimming/Shellfishing)	I	Sewer Separation	16	0	0	0	1. Eliminates CSOs; potential for SA designation 2. Critical use area; potential for use of CSO Facility for stormwater treatment by others.	$9
							Subtotal -- Constitution Beach Subarea:	$9
Charles River								
Upper Charles River	II	Screening and disinfection at CAM005; relieve interceptor connection at BOS032; provide screens at five CSO outfalls in Boston and Cambridge.	12	12	10	4	1. High recreational uses; heavy stormwater impact on Charles River 2. Reconsider after watershed planning; separation cost of $80 million	$5
Lower Charles River -- Cottage Farm	II	Upgrade of Cottage Farm CSO Facility with fine screens, effluent diffuser, upgrade chlorination, provide dechlorination	22	0	18	0	1. High recreational use; heavy stormwater impact on Charles River	$7
-- Stony Brook	II	Screening and disinfection facility for Stony Brook Conduit flows	30	30	26	0	1. Heavy stormwater impacts on Charles River 2. Treats stormwater and CSO from Stony Brook basin 3. Reconsider after watershed planning with State	$24
-- Other Lower Charles	II	Provide screens at nine CSO outfalls; block regulators at BOS042 and MWR010	6	6	3	3	1. Minimum control; infrequent outfall activation	$1
Back Bay Fens	II	Provide screens at outfall	2	2	2	2	1. Consistent with water quality goal	
							Subtotal -- Charles River Subareas:	$37
Alewife/Upper Mystic								
Alewife Brook	II	Separate CAM002, CAM004, and SOM001; provide screens at eight CSO outfalls	16	16	4	4	1. Approximately four overflows per year; large stormwater impacts 2. Reevaluate in conjunction with watershed planning by state	$12
Upper Mystic River	II	Separation of baffle manholes at SOM006 and SOM007 Continue treatment at Somerville Marginal CSO Facility (SOM007A)	11	2	8	0	1. Large stormwater impacts 2. No WQ benefit for higher controls	$0.2
							Subtotal -- Alewife/Upper Mystic Subarea	$13
Boston Harbor								
Upper Inner Harbor	II	Relieve East Boston Branch Sewer; add dechlorination to existing Prison Point CSO Facility; screen and disinfect BOS019; provide screens at seven CSO outfalls	38	38	25	5	1. Approximately four overflows per year from E.Boston; Industrial/shipping water uses 2. Allows full use of Caruso Pump Station capacity 3. Large impacts from stormwater and Charles R. discharge	$23
Lower Inner Harbor	II	Relieve East Boston Branch Sewer; provide screens at five CSO outfalls	29	29	5	5	1. Approximately four overflows per year from E. Boston	$20
Mystic/Chelsea	II	Screening/disinfection at BOS017 and at relocated Somerville Marginal CSO Facility; interceptor relief for CHE002--CHE004; provide screens at five CSO outfalls; repair/replace CHE008 outfall	35	35	31	3	1. Industrial/shipping water uses and Mystic R. discharge impacts 2. Dissolved oxygen deficit near existing Som. Marginal facility outfall	$12
Reserved Channel	II	Consolidation to regional screening/disinfection facility (joint with North Dorchester Bay)	44	44	6	0	1. High commercial/industrial use 2. Receives relocated CSO from N. Dorchester Bay	$34
Fort Point Channel	II	Detention treatment facility at Union Park P.S.; Consolidation storage at 072/073; screens at six CSO outfalls, three regulators, and the DBC; In-line storage in Dorchester Brook Conduit	74	74	15	4	1. Separation infeasible; aesthetics important 2. High commercial / industrial use	$26
							Subtotal -- Boston Harbor Subareas:	$115
							Total -- All Subareas:	$366
							Facilities Planning:	$6
							Grand Total:	$372

(1) For receiving water segments with multiple CSO outfalls, activation frequency is for the most active outfall tributary to the receiving water segment.
(2) Capital cost includes engineering, construction and contingency.

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over sewer separation because the cost is about the same, and sewer separation would introduce additional stormwater and its associated pollutant load to the receiving water.

South Dorchester Bay. Similar to North Dorchester Bay, swimming and shellfishing have been designated as critical uses in South Dorchester Bay. The recommended alternative involves upgrading the existing screening and disinfection facilities at Fox Point and Commercial Point to provide dechlorination in the short term, and implementing a multi-phased sewer separation program which will ultimately eliminate the three CSOs. Adding dechlorination to the existing facilities is a relatively easy-to-implement, low-cost project which will provide the benefit of lowering effluent chlorine residuals and reducing impacts on aquatic life, including shellfish resources. The separation program will target the major combined sources first, while distributing the financial burden and construction impacts of the project over a number of years. Upon completion of the separation work, the existing facilities at Fox Point and Commercial Point will be decommissioned.

SWMM output suggests that even with complete separation of the combined areas tributary to the regulators upstream of the Fox Point and Commercial Point CSO Facilities, backwater from the Columbus Park Headworks would cause periodic activation of BOS088 and BOS090 regulators during severe storm events such as the two-year storm unless the regulators are blocked. If blocked, SWMM output suggests that localized flooding could result due to the backwater effect. Additional measures may be required to isolate the South Dorchester system from the backwater effects of the Columbus Park Headworks, in order to allow the recommended complete closure of all regulators in the BOS088/089 and BOS090 tributary areas without risk of flooding. One such measure could be to construct a pump station on the Dorchester Interceptor downstream of the BOS088 regulators. This issue will be evaluated in more detail during facilities planning.

Neponset River. Elimination of the CSOs through sewer separation was selected as the recommended alternative for this receiving water segment because of a critical use (shellfishing) in the Neponset River. In addition, the cost of sewer separation is less than some of the storage alternatives and will not require siting of new facilities along the river. Sewer separation would not have been appropriate at outfall BOS095 without the proposed separation project for South Dorchester Bay, since BOS095 would still activate in large storms due to surcharging in the Dorchester Interceptor.

Constitution Beach. Complete sewer separation upstream of regulator RE-002-2 will eliminate the only source of CSO to this receiving water segment. Since shellfishing and swimming have been designated as critical uses in this waterbody, the elimination of CSO justified the relatively small incremental cost of sewer separation over one-year storm control alternatives. Upon completion of sewer separation upstream of RE-002-2, the existing Constitution Beach screening and disinfection facility will be decommissioned.

Upper Charles River. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. The recommended alternative for this receiving water segment includes a screening and disinfection facility at outfall CAM005, relief of the interceptor connection between RE-032-1 and the Charles River Valley Sewer, and manually cleaned bar screens at outfalls CAM007, CAM009, CAM011, BOS032, and BOS033. While the Upper Charles River receives substantial recreational use, the proportion of pollutants, such as fecal coliform, BOD, TSS, and nutrients, contributed by CSOs is minor compared to stormwater and other non-CSO sources. This is due to the large upstream watershed which contributes flow and pollution loads to this segment. With the exception of CAM005, the remaining outfalls to the Upper Charles River are predicted to activate less than four times per year. For these reasons, the selected levels of control were considered appropriate for these outfalls.

Lower Charles River. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. The recommended alternative for this receiving water segment involves providing a screening and disinfection facility to treat the Stony Brook Conduit flows; upgrading the existing Cottage Farm Facility with new effluent screens, an outfall diffuser, and dechlorination equipment; providing manually cleaned bar screens at outfalls MWR018 to MWR022, BOS049, BOS028, SOM010, and CAM017; and bulkheading regulators (which will eliminate CSO discharge) tributary to outfalls BOS042 and MWR010. CSO is a significant source of fecal coliform bacteria in the Lower Charles River, but other pollutants such as TSS, BOD, and nutrients are predominantly contributed by stormwater or upstream, non-CSO sources. Treating CSO bacteria is therefore appropriate for this waterbody, while providing higher levels of control for other constituents would not achieve a measurable benefit. The Cottage Farm facility currently provides a modest level of BOD and TSS reduction, particularly during small storm events. An additional benefit of providing a screening and disinfection facility for the Stony Brook Conduit flows is that a substantial reduction in stormwater bacteria load will also be achieved, without the potential adverse impact of capturing (hence removing) this flow from the Charles River basin. It is anticipated that dry weather flow in the Stony Brook Conduit will be bypassed around the facility directly to the Charles River. The nine outfalls at which manually cleaned bar screens will be provided are predicted to activate less than four times per year.

Back Bay Fens. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. Installation of manually cleaned bar screens at outfall BOS046 is the recommended alternative for this segment of the Muddy River; however, the proposed screening and disinfection facility for the Stony Brook Conduit flows may be located upstream of BOS046, in which case additional treatment would be afforded to overflows at BOS046. The selected water quality goal of less than four overflows per year is currently being met, and the screens would comply with the EPA CSO policy requirement for minimum controls.

Alewife Brook. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. The recommended alternative for Alewife Brook includes sewer separation upstream of CAM002 and CAM004, separation of common manholes upstream of SOM001, and manually cleaned bar screens at the eight CSO outfalls that will remain (even though the tributary areas upstream of CAM002 and CAM004 will be separated, these outfalls will remain open to provide relief for extreme events). This segment is dominated by stormwater pollutant loads. This alternative will control overflows from the three-month storm at a lower cost than other identified alternatives, since the reduction in stormwater inflow at the upstream (CAM004) end of the Alewife Brook Conduit influences the activation of downstream regulators. Local separation also is consistent with current and planned programs in both Cambridge and Somerville for separation of combined areas tributary to the Alewife Brook Conduit, Alewife Brook Branch Sewer, and the Tannery Brook Drain.

Upper Mystic River. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. Separation of common manholes upstream of SOM007 is a low-cost means for eliminating the CSO. The recommended plan also includes identifying whether outfall SOM006 exists, and if so, separating the common manholes upstream of this outfall as well. Lower levels of control were considered, but would not be substantially less expensive. Overflows at SOM007A will continue to receive screening and disinfection at the Somerville Marginal Facility.

Upper Inner Harbor. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. The recommended alternative for Upper Inner Harbor includes upgrading the existing Prison Point CSO Facility to provide dechlorination and revising facility start-up procedures, providing screening and disinfection at outfall BOS019, interceptor relief and manually cleaned bar screens for outfalls BOS009 to BOS013, and manually cleaned bar screens at outfalls BOS050 to BOS060. Interceptor relief in East Boston avoids the need to site a new facility in that densely populated area, while screening at outfalls BOS050 to BOS060 is

considered appropriate due to the relative inactivity of those outfalls (less than four activations per year under future planned conditions).

Lower Inner Harbor. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. Interceptor relief and manually cleaned bar screens for outfalls BOS003 to BOS007 in East Boston are recommended for the Lower Inner Harbor. This alternative is consistent with interceptor relief for outfalls BOS009 to BOS013 in the Upper Inner Harbor receiving water segment, and will provide full relief of the East Boston Branch Sewer. In turn, relief of the East Boston Branch Sewer more fully utilizes transport and treatment capacity available through the East Boston Pump Station, North Metropolitan Trunk Sewer, and Winthrop Terminal Headworks.

Mystic/Chelsea Confluence. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. Recommended alternatives for this receiving water segment include relocating the Somerville Marginal CSO Facility, in conjunction with a Massachusetts Highway Department project for Route I-93/Exit 29 improvements, and upgrading it to include dechlorination; providing a screening and disinfection facility at outfall BOS017; relieving the trunk sewer serving the area tributary to outfalls CHE002 to CHE004; repairing the CHE008 outfall pipe; and providing manually cleaned bar screens for outfalls CHE002 to CHE004, CHE008 and BOS014. The upgraded Somerville Marginal Facility and the proposed facility at BOS017 would support the existing uses for this waterbody.

Reserved Channel. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. Consolidation of outfalls BOS076 to BOS080 to a screening and disinfection facility in the vicinity of BOS080 is predicted to maintain fecal coliform levels below the criteria for secondary contact recreation, consistent with the existing uses of the Reserved Channel which include boating. The screening and disinfection facility will also treat flow from the consolidation conduit serving to

relocate overflows from North Dorchester Bay. Manually cleaned bar screens will also be provided on outfalls BOS076 to BOS080 downstream of the connection with the consolidation conduit.

Fort Point Channel. No Massachusetts DEP-designated critical uses are identified for this receiving water segment. The recommended alternative for this receiving water segment includes manually cleaned bar screens at outfalls BOS062 to BOS068 and at regulators RE-070/5-2 and RE-070/6-1, a detention/disinfection facility in the vicinity of the Union Park Pump Station, in-line storage and manually cleaned bar screens in the Dorchester Brook Conduit, and a consolidation/storage conduit between outfalls BOS072 and BOS073, as well as manually cleaned bar screens at these two outfalls. The construction of the consolidation/storage conduit for outfalls BOS072 and BOS073 will require close coordination with the Central Artery/Tunnel project. Manually cleaned bar screens are appropriate for outfalls BOS062 to BOS068, due to the relative inactivity of these outfalls. The detention/disinfection facility in the Union Park area will provide storage for small storms, and detention treatment with disinfection and dechlorination for the three-month storm. Through the installation of a hydraulic gate, a pump-out station, and piping modifications, the existing Dorchester Brook Conduit will be used to store overflows from up to the one-year storm from regulators RE070/8-11 to RE070/10-5 along the South Boston Interceptor North Branch. The consolidation/storage conduit with pump-out station running between outfalls BOS072 and BOS073 will store the overflows from the three-month storm. These facilities will provide a higher level of control of BOD and TSS to Fort Point Channel than flow-through screening and disinfection facilities and avoid the need to site larger above ground facilities.

Re-evaluation of Tunnel Alternatives. Using more accurate flow information, a re-evaluation of a system-wide tunnel comparable to the 1990 plan concluded that it is not justified because it would provide very minor, if any, additional water quality benefits compared to the recommended plan, yet would carry a very high cost ($1,050 million). A

smaller tunnel to serve only the Charles River also is not justified, because of the small contribution of CSOs relative to other pollution sources in the watershed and the high cost ($770 million). Numerous construction and siting problems associated with a deep tunnel plan for the Charles River must also be considered. If future efforts to control other sources of pollutant loads in the watershed are successful, storage alternatives other than the tunnel plan should be reassessed. Such an option could help to achieve beneficial uses, if major basin-wide reductions in other pollution sources are made.

An evaluation also showed that increasing tunnel storage capacity to provide peak-shaving flow storage and to allow a reduction of secondary treatment capacity at Deer Island would not be cost-effective, even if a tunnel for CSO control were to be recommended. The incremental cost of a larger CSO tunnel for peak-shaving would be about $200 million more than the cost of comparable secondary treatment capacity, or the cost of using chemically enhanced primary treatment.

Cost of the Plan. Total capital cost of the CSO control plan is estimated to be $372 million, allocated by major receiving water areas as follows:

Charles River Basin	$ 37 million
Inner Harbor Basin	$124 million
Dorchester Bay Basin	$192 million
Alewife/Mystic River Basin	$ 13 million
	$366 million

An additional $6 million for facilities planning associated with all the recommended projects for these basins is added to the total cost.

Facility Site Requirements. Much of the plan involves sewer separation and upgrading of existing CSO treatment facilities, and therefore, involves minimal new site requirements. Requirements for new sites include the following locations, where new screening and

disinfection facilities and one detention/treatment facility are recommended. Implementation issues related to siting facilities are discussed in Chapter Four.

- For Stony Brook overflows, use the existing MDC Fens Gatehouse at Storrow Drive and Charlesgate East, or an alternative site in the vicinity of the Ward Street Headworks.
- For Reserved Channel overflows, acquire a site in the industrial area along First Avenue.
- For Fort Point Channel overflows, use part of the Union Park Pump Station site or acquire a site in that vicinity for a detention/treatment facility.
- For an overflow to the Little Mystic Channel (BOS 019), acquire a small site on the west side of the channel.
- For overflows to the Charles River, acquire a site in Cambridge along Memorial Drive near Mount Auburn Hospital.
- For the Lower Mystic River overflow, a site for relocation of the Somerville Marginal CSO facility is required. The relocation is necessary because of the planned re-construction of I-93/Exit 29. Selection of a new site will be done in conjunction with the highway relocation.
- For overflows to the Mystic/Chelsea Confluence, acquire a small site in Charlestown near outfall BOS017.

Preliminary Implementation Schedule. Chapter Four contains a proposed implementation schedule for the recommended CSO plan. In summary, the plan will require approximately 15 years for full implementation. Key factors affecting the schedule include:

- Site selection and acquisition. In some cases, legislative transfers under Article 97 of the Massachusetts Constitution may be required.
- Requirements for amending the Massachusetts water quality standards to obtain partial use designations.
- Requirements for facilities planning and environmental review through the Massachusetts Environmental Policy Act (MEPA) process, and permitting for various construction activities.

- Phasing of extensive neighborhood projects, such as sewer separation in Dorchester and the Neponset River area.

- Constraints and uncertainties imposed by the Central Artery project in South Boston and the Fort Point Channel area; and the relocation of I-93/Exit 29 in Somerville affecting the Somerville Marginal CSO facility.

- Discussions with the CSO communities regarding implementation responsibilities, coordination of efforts and construction phasing.

Because the current recommendations are at a conceptual level, there remain numerous assumptions upon which the plan is based. The final implementation schedule should include a provision to allow full review and modification of the schedule, as necessary, following facilities planning and environmental review, in order to reflect appropriate changes resulting from those efforts.

Phase IV - Watershed Planning Efforts

A fourth phase of CSO control activities is related to on-going and future watershed planning efforts within the study area receiving waters. As discussed earlier, a watershed approach has been used in planning for CSO control. This approach involved defining existing conditions in the 14 receiving water segments, and the flows and pollutant loads into each segment, including both CSO and non-CSO sources.

As shown in Figure 3-2, the non-CSO contributions of key pollutants were generally much greater than the CSO contributions for most receiving water segments. The identification of non-CSO sources as a significant contributor to water quality problems in the study area receiving waters has coincided with a recognition by state officials and others that these other sources must be addressed if water quality standards are to be achieved. To that end, significant projects are now underway in Massachusetts that reflect the overall watershed approach as set forth by EPA in its CSO policy and other documents.

The Massachusetts Office of Executive Affairs (EOEA) has started a program to develop the Massachusetts Watershed Initiative. EOEA is developing "a model approach(es) to watershed-based, environmentally sensitive, and sustainable development and decision-making that will be transferable statewide." The Neponset River watershed was chosen as the pilot area to develop a program to improve water quality, increase public awareness and access to the river, promote shared responsibility for watershed management and build local capacity to protect natural resources. It is the intent of EOEA that the methodologies and organizational structures that develop from this pilot effort can be transferred to other watersheds. The MWRA has been actively working with EOEA on the watershed initiative activities and will continue to be involved in the Neponset River pilot study. The Authority's preferred alternative for CSO control in the Neponset River is sewer separation. This is based on the critical uses present and the relatively low cost associated with eliminating CSO discharges.

The Charles River Watershed Association (CRWA), in conjunction with citizens from watershed communities, business groups and academic institutions, has initiated a similar watershed planning effort for the Charles River. The watershed study, "Integrated Monitoring, Modeling and Management" (IM3), goal is to develop sufficient hydrodynamic information to determine the inter-relationships of water quality, water flow, water resources, and economic impacts. This information to be collected and analyzed over a five-year period, could potentially impact future planning of CSO control in the Charles River Basin. CSO control technologies chosen for the Charles River target bacteria and floatables pollution. This was done because Charles River recreational and aesthetic uses are directly affected by bacteria and floatables levels and because other pollutants were primarily contributed by non-CSO sources. The existing Cottage Farm CSO Treatment Facility would be upgraded and would continue to disinfect and screen overflows prior to their discharge. A new screening/disinfection facility is proposed to address currently untreated wet weather Stony Brook Conduit flows, including large amounts of stormwater. The MWRA is supporting the IM3 study, with financial and laboratory analytical resources because the

study will provide information on which to base future discussions on the long-term control level of all pollutant sources, including CSO, for the Charles River.

In addition, the Muddy River watershed is also undergoing a feasibility investigation by the Army Corp of Engineers to determine the water resource needs and improve the river's water quality. Even though there is only one CSO outfall (BOS046) on this receiving water, the MWRA is participating in the study to identify appropriate plans to improve water quality from the outfall and non-CSO pollutant sources. Due to the upstream water quality, low volume and frequency of this outfall, the proposed CSO control is screening. However, siting of the screening, disinfection, and dechlorination facility for the Stony Brook conduit may be located upstream of this outfall to allow bacteria treatment.

Although these three watershed initiatives on the Neponset River, Charles River and Muddy River are relatively different in scope and organization, they are each expected to lay the groundwork for improving water quality within their respective basins. It is expected that over time these and other receiving waters will experience significant progress in remediation of non-CSO sources. One example of this is the Alewife Brook, where the recommended level of CSO control limits discharges to approximately four overflows per year. There has been tremendous community interest in the brook as a resource area and several efforts have been proposed to further understand water quality and quantity issues. Simultaneous with these efforts, the MWRA will be encouraging additional investigations by the city of Somerville which may further reduce CSO discharges without the construction of major CSO control facilities.

The MWRA is an active participant in these efforts towards integrated management of water resources. These activities will continue concurrently with facilities planning/environmental review and throughout the timeframe proposed for design and construction of new CSO control facilities. By being a participant, the MWRA will be able to utilize relevant information from these efforts and to refine CSO planning and implementation as appropriate. For example, any additional CSO controls in the Charles River or Muddy River

must be evaluated based on a comprehensive watershed management plan that confirms whether designated used can be attained and defines specific basin-wide control measures for use attainment.

I/I REDUCTION

The I/I reductions identified in the SMP are based on the review and analysis of extensive data and on various assumptions regarding the effectiveness of I/I rehabilitation measures. Data used to develop the anticipated level of I/I control include the results of the MWRA Wastewater Metering Program, service area community I/I investigations and reports, and applicable data on I/I programs from other wastewater collection systems where extensive investigations and/or remediations have been conducted.

The I/I evaluation process assumed that I/I projects currently planned under the MWRA's Local Financial Assistance Program would be implemented, and the levels of I/I control evaluated as part of the SMP represented reductions above and beyond those anticipated to be achieved by the current projects. Currently planned infiltration reduction projects in Newton, Winchester, Melrose, Randolph, Weymouth, Braintree and Stoughton are expected to reduce flows by a total of 3 MGD, while inflow reduction projects in Norwood, Everett, Medford, Belmont and Boston are expected to reduce inflow by 11.3 MG for the 1-year, 6-hour storm. These projects are included in the future planned conditions baseline.

Initially, an I/I control plan was developed which represented an aggressive level of system-wide I/I reduction (20 percent infiltration reduction and 51 percent inflow reduction), and the impact of this plan on CSO volumes, interceptor surcharging, and Deer Island treatment plant flows was assessed using the system-wide hydraulic model. The results of this assessment, which are shown in Table 3-7 and Figure 3-4, indicate that aggressive I/I controls (with an estimated cost of $463 million) would not significantly impact the cost or sizing of CSO, interceptor, or treatment options.

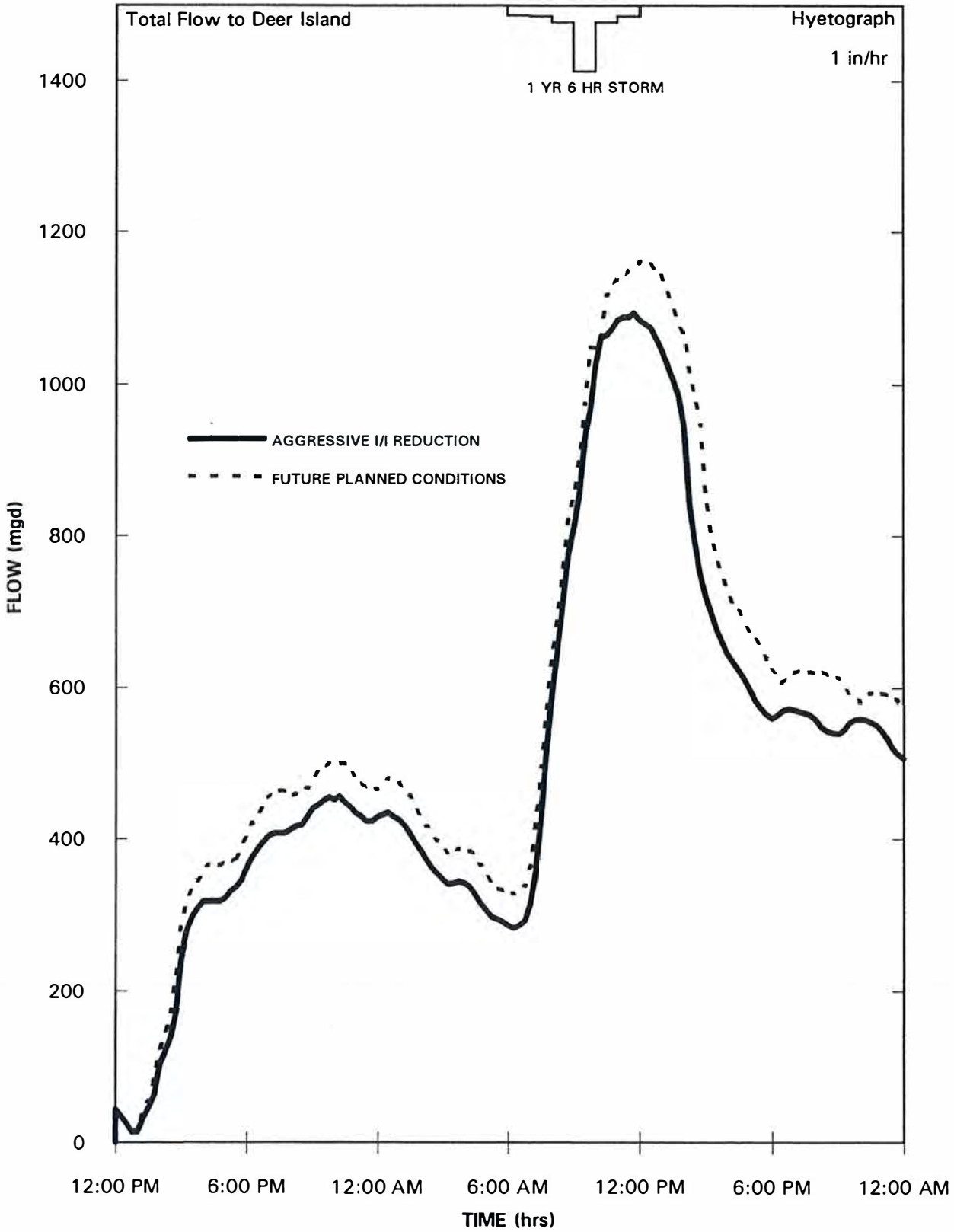


FIGURE 3-4. COMPARISON OF FUTURE PLANNED CONDITIONS AND AGGRESSIVE I/I REDUCTION

TABLE 3-7. RESULTS OF AGGRESSIVE I/I REDUCTIONS

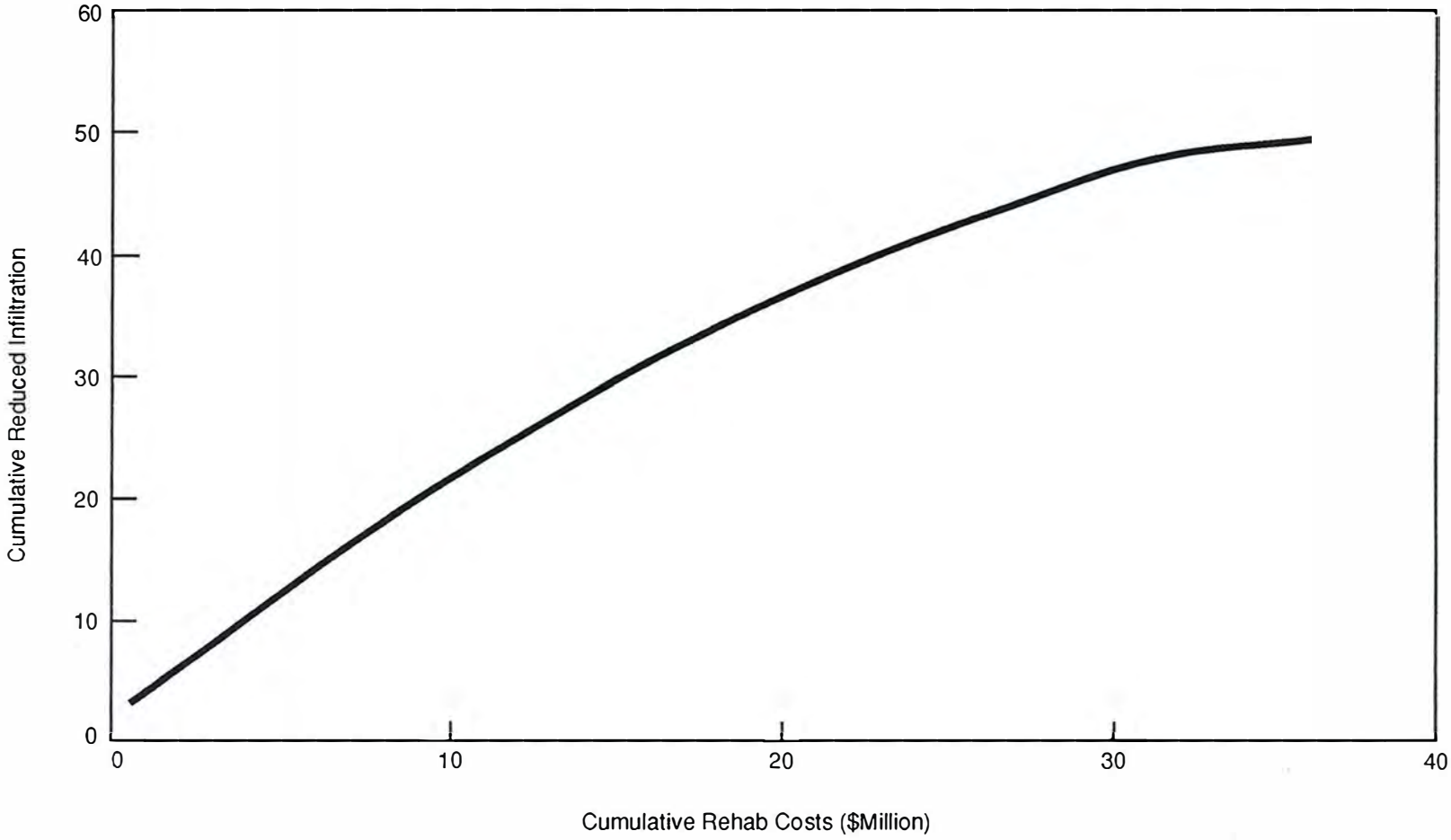
Parameter	Future Planned Conditions	Aggressive I/I Reduction	Percent Reduction
CSO Volume, mg	151	149	1
Surcharged Interceptor Junctions[1]	1,246	1,208	3
Predicted Overflow Volume, mg[2]	14	13	7

(1) This parameter reflects the number of nodes (junctions) within the hydraulic model at which interceptor surcharging occurred. It provides a relative measure of the extent of surcharging throughout the system under future planned versus aggressive I/I reduction conditions.

(2) Predicted overflow volume represents the volume of wastewater predicted to overflow from manholes within the MWRA interceptor system at non-CSO locations.

Based on these results, community specific, cost-benefit relationships were developed to attempt to discern a cost-beneficial level of I/I control. These plots were derived by assuming that I/I control would first address the portion of a community's system that has the highest infiltration or inflow rate first, and then address each successive area in order of descending infiltration/inflow rate. An example plot is shown on Figure 3-5. These relationships generally did not exhibit a clear cost-beneficial point (knee-of-the-curve) and suggested that even if I/I rehabilitation was prioritized to address the more extreme areas first, costs would increase relatively uniformly as higher levels of control were pursued. The curves also indicated that relatively few areas within community systems had infiltration/inflow rates that were significantly higher than others.

Based on the results of simulating a high level of I/I control, it did not appear that there would be a cost trade-off between I/I control and other strategy areas, and based on the evaluation of cost-benefit curves, a clearly cost-effective level of I/I control could not be determined. It was, however, judged reasonable to assume that some degree of I/I reduction would be achieved by communities in the MWRA service area during the planning period of the SMP. Factors such as aging community sewer trunk lines and laterals, and increasing



Note: Comprehensive reduction refers to rehabilitation of infiltration source on both public and private property. A maximum estimated infiltration reduction of 50% could be achieved

FIGURE 3-5. CUMULATIVE INFILTRATION REHABILITATION COST VERSUS INFILTRATION REDUCTION FOR MEDFORD

community costs (both in terms of MWRA flow-based charges and local costs for transporting wastewater) will continue to motivate communities to take steps to control I/I, and these anticipated reductions were factored into the SMP.

Recommended I/I Control Plan

There are no clear trade-offs or net cost savings to the MWRA in terms of CSO, interceptor, or secondary treatment strategies versus expenditures to reduce I/I. However, for the reasons outlined above, a level of I/I reduction has been assumed and included in the hydraulic analyses of CSO, interceptor, and secondary treatment strategies. The key assumptions in computing the level of I/I reduction are outlined in Table 3-8.

As indicated in Table 3-8, more aggressive I/I reductions are anticipated to occur in those portions of each community's collection system that have higher infiltration and inflow rates. Infiltration and inflow rates for the ranges used to vary the reduction percentages in Table 3-8 are shown geographically in Figures 3-6 and 3-7. These figures indicate that there are relatively few areas with the highest levels of infiltration and inflow, and that much of the system can be characterized as having only moderately high infiltration and inflow rates.

The anticipated I/I reductions outlined in Table 3-8 consist of a 9.8 mgd reduction in peak infiltration, which represents four percent of the 247 mgd peak infiltration total. A similar percentage reduction applied to average annual infiltration of 181 mgd represents a reduction of 7.2 mgd. The estimated cost of this infiltration reduction is $97 million.

Inflow reductions are assessed based on the one-year, 6-hour storm prescribed for use in I/I evaluations by DEP. Reductions in direct inflow volume on the order of 9.1 mg, or five percent of the 168 mg four-day inflow volume associated with the one-year, 6-hour storm are predicted. The estimated cost of this inflow reduction is $15 million. A 4.3 mg reduction in indirect inflow would occur as a result of the pipeline rehabilitation performed to achieve the 9.8 mgd peak infiltration reduction.

TABLE 3-8. BASIS OF ANTICIPATED I/I REDUCTION INCLUDED IN THE SMP

	INFLOW		
	• Inflow volume is 40% from direct sources (catchbasins, roof leaders) and 60% from indirect sources (leaks into pipes and manholes)		
	• Direct inflow volume is 50% from public sources and 50% from private sources		
INFILTRATION	Public Direct Inflow (20%)	Private Direct Inflow (20%)	Indirect Inflow (60%)
• Reductions anticipated through rehabilitation of public sector (service area community) sources. These typically include cracks in pipes and manholes and leaky pipe joints.	• Reductions anticipated through removal of catch basins and other public direct sources.	• Reductions anticipated through removal of roof leaders, area and perimeter drains and other private direct sources.	• Reductions anticipated through rehabilitation of infiltration sources (indirect inflow enters via the same sources as infiltration.)
1. >20,000 GPDIM; 10% reduction 2. 10,000-20,000; 7.5% reduction 3. 5,000-10,000; 5% reduction 4. 3,000-5,000; 2.5% reduction 5. <3,000 GPDIM; no reduction	1. >0.7 mg/mile; 50% reduction 2. 0.18-0.7; 37.5% reduction 3. 0.095-0.18; 25% reduction 4. 0.04-0.095; 12.5% reduction 5. <0.04 mg/mile; no reduction	1. >0.7 mg/mile; 10% reduction 2. 0.18-0.7; 7.5% reduction 3. 0.095-0.18; 5% reduction 4. 0.04-0.095; 2.5% reduction 5. <0.04 mg/mile; no reduction	1. Remove in same areas targeted for infiltration reductions 2. Remove at same percentages as infiltration (range from 0 to 10%)

Notes: 1. GPDIM is an abbreviation for gallons per day per inch diameter-mile of sewer, and is a measure of infiltration rate. Higher rates are generally conducive to greater reduction percentages. Rates and reductions are on a per public connection basis.

2. Mg/mile is an abbreviation for million gallons per mile, and is a measure of the degree of inflow. Higher degrees of inflow are generally conducive to greater inflow reductions.

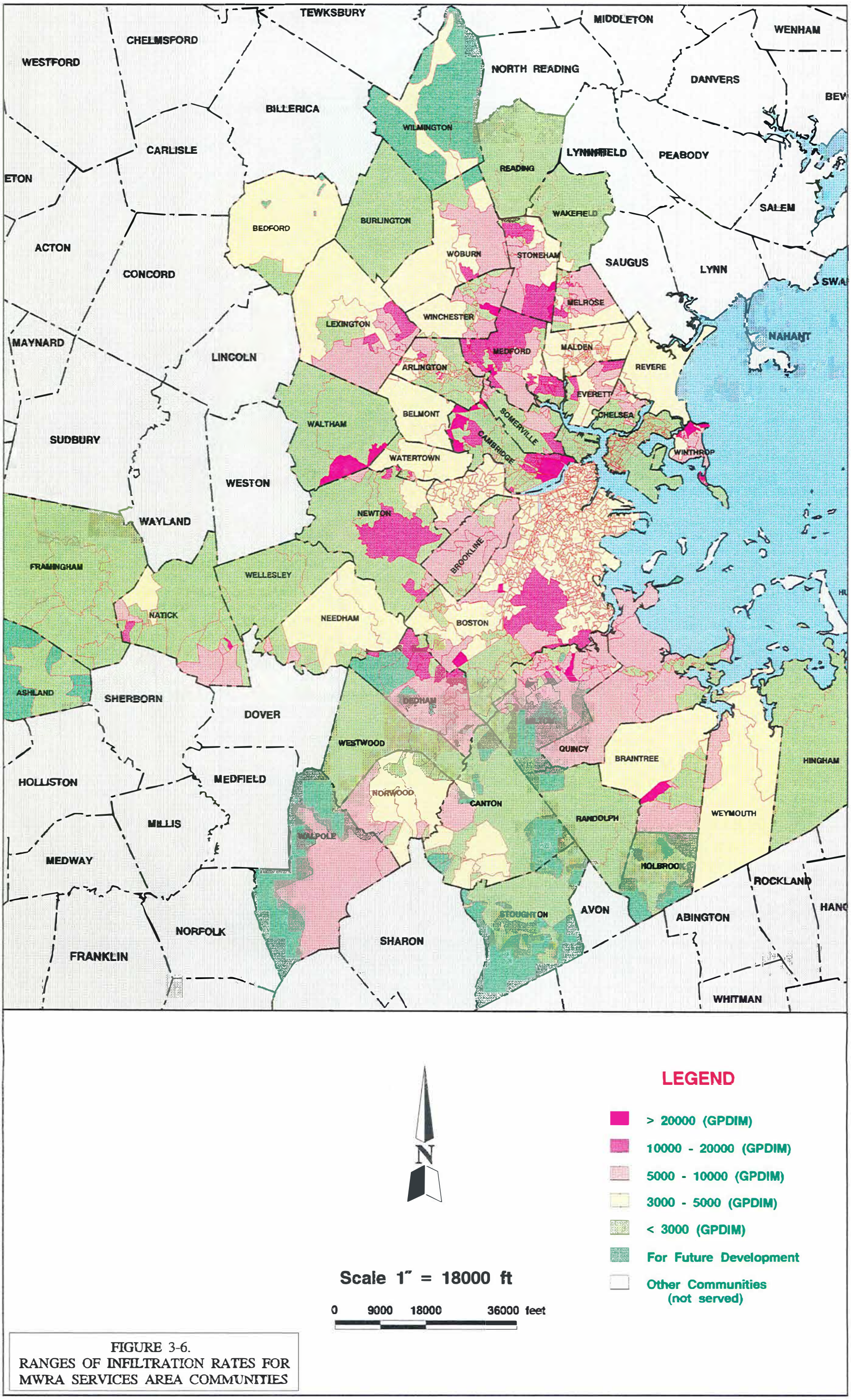


FIGURE 3-6.
RANGES OF INFILTRATION RATES FOR
MWRA SERVICES AREA COMMUNITIES

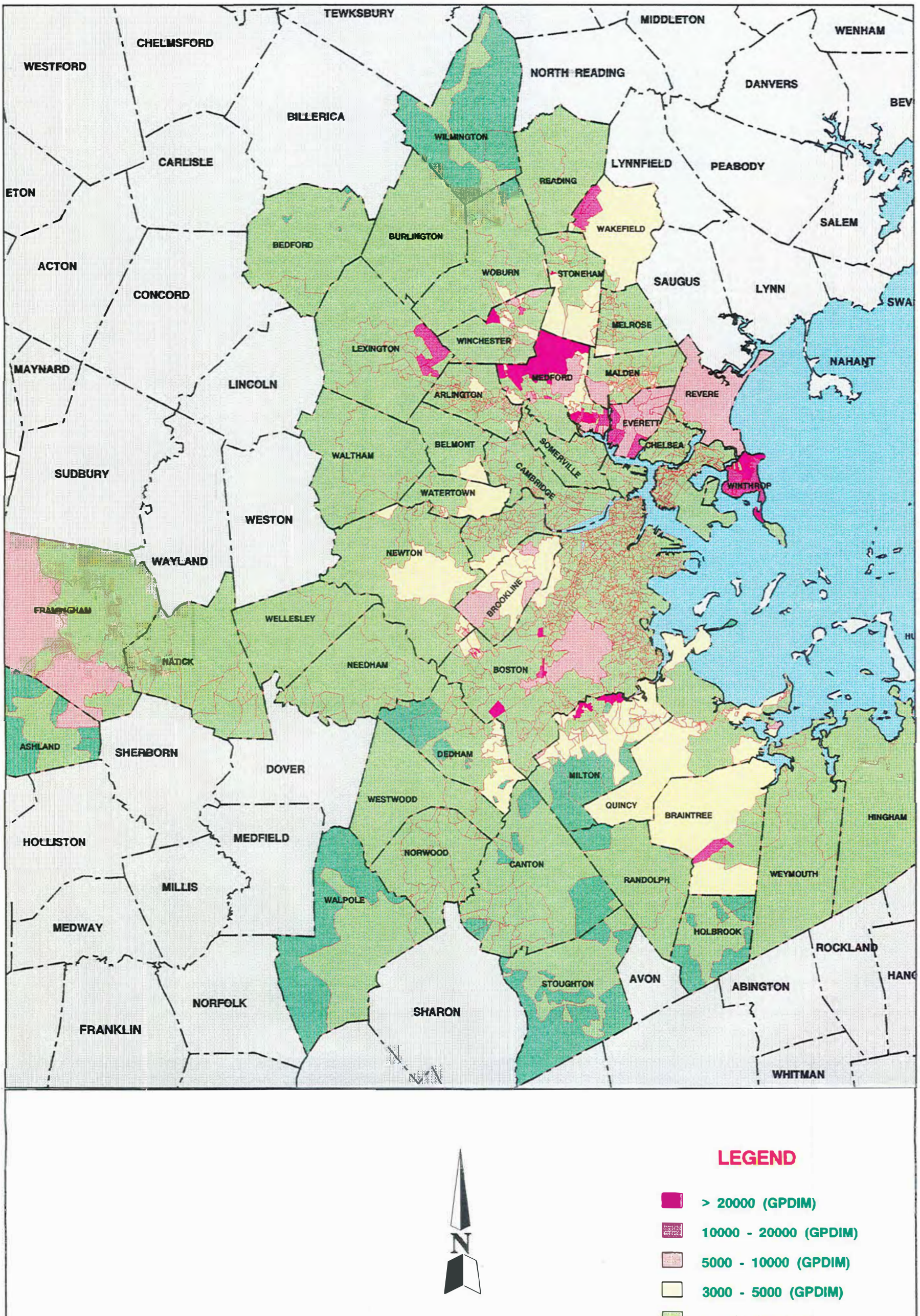


FIGURE 3-7. RANGES OF INFLOW RATES
FOR MWRA SERVICES AREA COMMUNITIES

It is anticipated that the infiltration and inflow reductions outlined above will be implemented by the service area communities throughout the SMP planning period at a total cost of $112 million. The impact of this level of I/I control on CSO volumes, interceptor surcharging, and treatment plant flows is presented in Table 3-9 and Figure 3-8. These indicate that the level of I/I control expected to be implemented will not impact the cost or sizing of CSO, interceptor, or treatment plant options.

TABLE 3-9. RESULTS OF I/I REDUCTIONS INCLUDED IN THE SMP

Parameter	Future Planned Conditions	I/I Reduction in SMP	Percent Reduction
CSO Volume, mg	151	150	1
Surcharged Interceptor Junctions[1]	1,246	1,244	0
Predicted Overflow Volume, mg[2]	14	13	7

(1) This parameter reflects the number of nodes (junctions) within the hydraulic model at which interceptor surcharging occurred. It provides a relative measure of the extent of surcharging throughout the system under future planned versus aggressive I/I reduction conditions.

(2) Predicted overflow volume represents the volume of wastewater predicted to overflow from manholes within the MWRA interceptor system at non-CSO locations.

TRANSPORT SYSTEM

The interceptor improvements recommended in the SMP are based on analyses of the hydraulic operating characteristics of the interceptor network. Operating water surface elevations (hydraulic gradients) were assessed based on future planned condition flows and system configuration. Reductions in I/I and interceptor network changes currently planned to be completed were included in the baseline conditions on which system operation was assessed. Interceptor projects included in the baseline conditions included the following:

- Braintree-Weymouth Extension Sewer
- Framingham Extension Relief Sewer

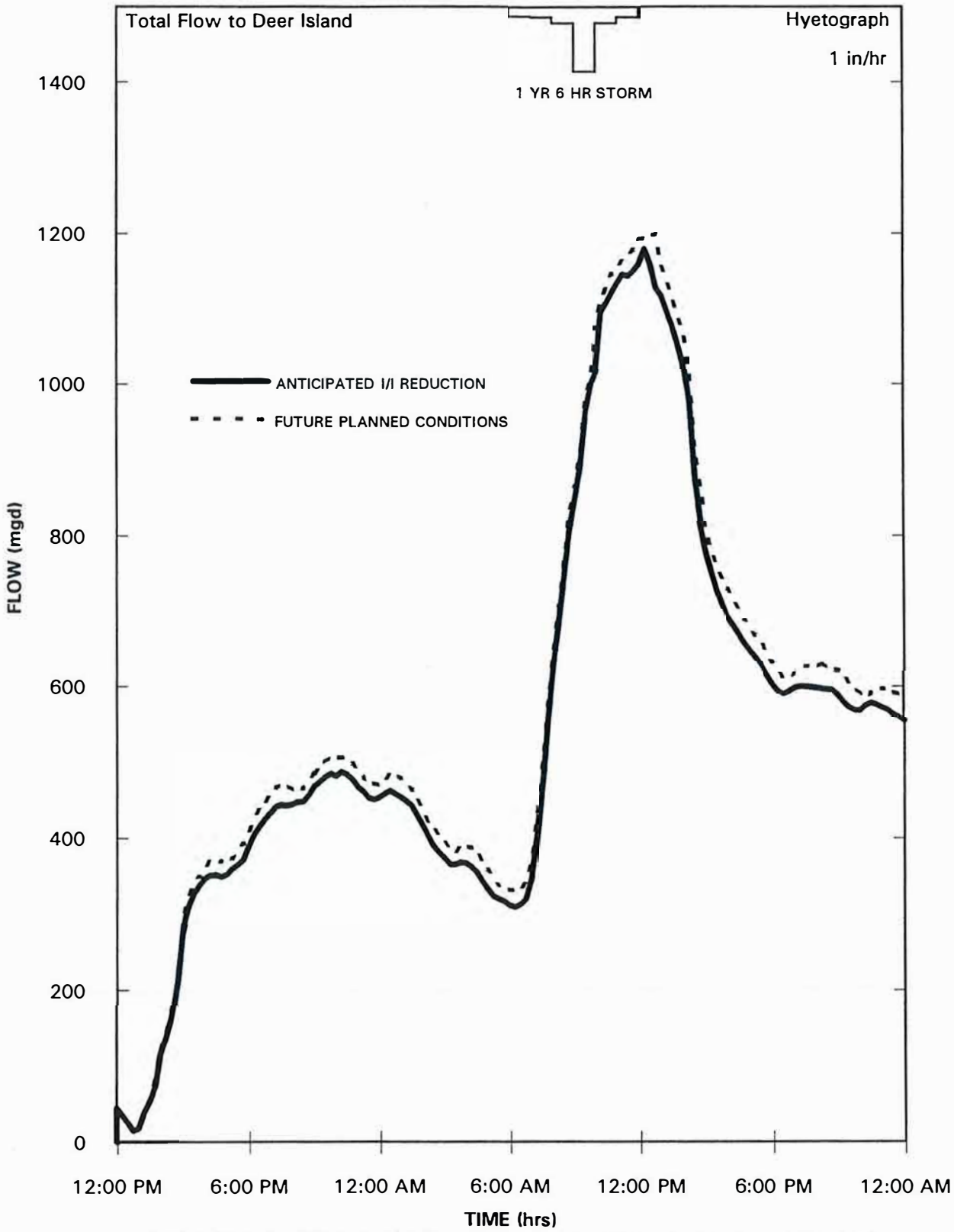


FIGURE 3-8. COMPARISON OF FUTURE PLANNED CONDITIONS AND I/I REDUCTIONS INCLUDED IN THE SMP

- Wellesley Extension Sewer and Wellesley Extension Relief Sewer
- Quincy Pump Stations and Force Mains
- New Neponset Valley Relief Sewer, including Walpole Extension Relief Sewer, Stoughton Extension Relief Sewer, New Neponset Valley Relief Sewer, pumping station and force main

The basis of flow for these assessments included peak sanitary flow (derived as 1.25 times average daily sanitary flow, then diurnally varied), peak infiltration, and inflow corresponding to a one-year, 6-hour storm event. The peak sanitary total daily flow was diurnally varied, with the maximum hour sanitary flow equal to 1.9 times peak sanitary flow. The storm was timed so its peak rainfall intensity would coincide with maximum hour sanitary flow.

Future planned condition hydraulic gradients and system configuration were assessed to determine interceptor reaches that require relief, had potential for in-system storage during peak flow conditions, or might be conducive to the transfer of flow from hydraulically overloaded to under-utilized segments. Both numeric criteria and engineering judgement were used in making these determinations.

For those interceptor relief, in-system storage, and flow transfer alternatives identified, both cost and non-monetary considerations were identified and assessed. The results of these evaluations were presented during workshops held with MWRA staff from the CSO, I/I, and transport programs to review findings and discuss key evaluation criteria.

As outlined above, evaluations conducted on the MWRA interceptor network and transport system under the SMP focussed on the hydraulic operating characteristics of the piping system. Other Authority programs are ongoing to address system needs in terms of structural, electrical, and mechanical function and are not addressed in the SMP.

Recommended Interceptor Improvements

A list of all the interceptor relief projects evaluated is presented in Table 3-10. The table presents the interceptor designation and section requiring relief, cost, and relief priority. A total of 15 interceptor relief projects (Priority A and B) are recommended. Two of the recommended projects (Cummingsville Branch Sewer and Upper Neponset Valley Sewer) are currently in facilities planning, and an estimated cost for these projects has not been included in this study. The estimated capital cost for the other 13 recommended interceptor relief projects is $35 million. The location of each interceptor relief project is shown on Figures 3-9 and 3-10.

Certain interceptor relief projects are designated as having highest implementation priority (A) based on potentially serious surcharging predicted during the one-year, 6-hour storm and peak flow conditions described above. Surcharging of an interceptor occurs when the operating water surface elevation (hydraulic gradient) is higher than the top (crown) of the pipe. For gravity flow (non-pumped) pipelines, this is an indication that the pipeline, or a pipeline downstream of it, likely has insufficient capacity to convey the flow which is tributary to it.

Hydraulic gradients at critical locations within the priority A interceptors are predicted to be surcharged to within six feet of the ground surface under peak flow conditions. Hydraulic gradients this close to the ground surface could result in back-ups into community sewers thus preventing the MWRA's system from providing adequate service to the community. In the most severe locations, the hydraulic gradient for certain priority A projects is predicted to reach the ground surface, showing potential for sanitary sewer overflows.

Interceptor relief projects designated as priority B are predicted to surcharge under the peak flow conditions described above. Based on the MWRA's criteria that interceptors should be capable of handling the flow from a one-year, 6-hour storm under peak flow conditions

TABLE 3-10. INTERCEPTOR RELIEF PROJECTS

Alt. No.	Interceptor	Section No.	Cost (Dollars)	Priority of Relief[1]	Comments
N-1a	Cambridge Branch Sewer	23	4,050,000	B	
N-2	Edgeworth Branch Sewer	20A	520,000	B	
N-4	Mystic Valley Sewer	160	1,110,000	A	
N-5	Malden Branch Sewer	54-55	890,000	B	
N-6b	Wakefield Trunk Sewer	49-50	4,180,000	A	Potential overflow, relief is required.
N-7	Lexington Branch Sewer	52-53	740,000	B	
N-8a	Alewife Brook Conduit	ABC	N/A	C	Downstream Pump Sta. is limiting (CSO)
N-9b	Alewife Brook Sewer	43	N/A	C	Downstream Pump Sta. is limiting (CSO)
N-10	Millbrook Valley Sewer	78" siphon	180,000	A	Potential overflow, relief is required.
N-11	Cummingsville Branch Relief Sewer	86	N/A	N/A	Model shows surcharge, but replacement of Cummingsville Branch Sewer is more effective.
N-12	Chelsea Branch Sewer	61	3,240,000	A	
N-13	Revere Branch Sewer	57	3,340,000	A	
N-14	Charlestown Branch Sewer	31	3,880,000	C	Backed up from Pump Sta. (CSO)
N-15	Somerville/Medford Branch Sewer	35	5,000,000	A	Backed up from Pump Sta.
N-16[2]	Cummingsville Branch Sewer	47	N/A	A	This replacement is to relieve Cummingsville Relief Sewer, Section 86. See N-11.
N-17	North Charles Metro Sewer	29	6,960,000	C	

TABLE 3-10 (Continued). INTERCEPTOR RELIEF PROJECTS

Alt. No.	Interceptor	Section No.	Cost (Dollars)	Priority of Relief[1]	Comments
N-18a	North Charles Relief Sewer	207B/ 204	5,180,000	C	Back up from Ward St. to H.W.
N-19	North Charles Relief Sewer	209	1,620,000	C	
N-20A	Cambridge Branch Sewer (Upper Section)	26	5,980,000	C	Back up from Charlestown Pump Sta.
		26		C	
		27		C	
N-25	South Charles Relief Sewer	5	2,660,000	C	
N-27a	North Metro Sewer	44	2,280,000	B	
N-29a	Reading Extension Sewer	72	340,000	A	
S-1[2]	Upper Neponset Valley Sewer	30	N/A	A	
S-1a	Neponset Valley Sewer	19	9,020,000	A	

(1) Priority of Relief is defined as follows:

A = Potential for sanitary sewer overflows, or there is less than 6 ft. from hydraulic gradient to ground surface.
B = Non-CSO area; no sanitary sewer overflows occur, there is greater than 6 ft. from hydraulic gradient to ground surface.
C = CSO area; downstream choke point contributes to surcharging.

(2) Project is currently under development by MWRA and the costs are not included in the SMP.

LEGEND

- MWRA INTERCEPTOR SEWER NORTHERN
- MWRA FORCE MAIN NORTHERN
- MWRA INTERCEPTOR SEWER SOUTHERN
- MWRA FORCE MAIN SOUTHERN
- MWRA MAIN DRAINAGE TUNNEL
- MUNICIPAL BOUNDARY
- MAJOR MUNICIPAL SEWER SOUTHERN
- MAJOR MUNICIPAL FORCE MAIN SOUTHERN
- SURCHARGE AREAS
- FLOODING AREAS

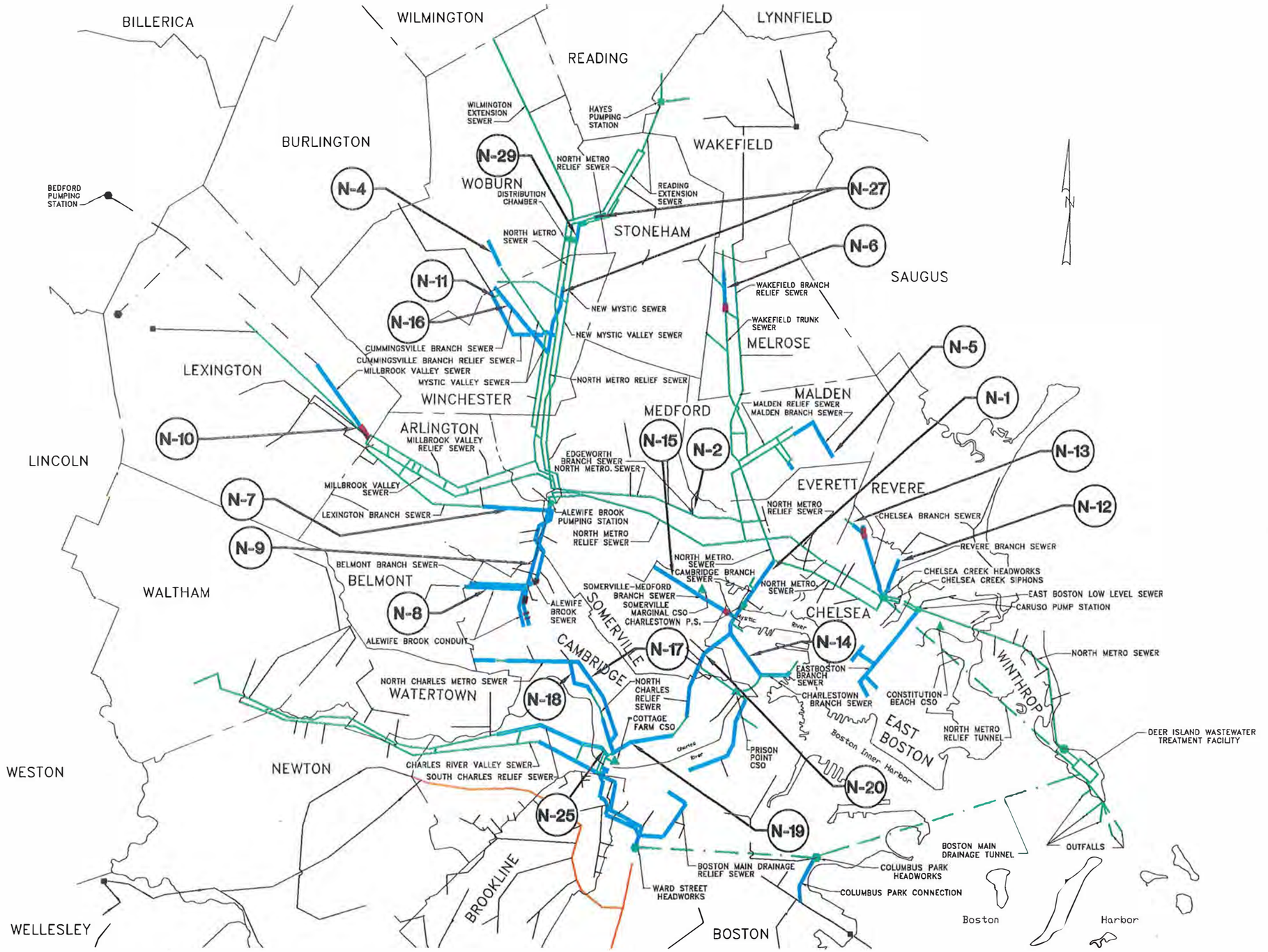


FIGURE 3-9.
NORTH SYSTEM INTERCEPTOR RELIEF PROJECTS

without surcharging, these interceptors require relief. Since the hydraulic gradient at critical locations within the priority B interceptors are predicted to be more than six feet below the ground surface, relief of these conduits should proceed, but can be a lower priority.

Interceptor relief projects designated as priority C are located within the CSO area of the MWRA system, upstream of pump stations or headworks that function as choke points under wet weather conditions. Surcharging in these interceptors is generally related more to the downstream choke points than to insufficient pipeline capacity. Even if these interceptors were relieved, the downstream choke points would likely still result in surcharging. In the CSO area of the system, the CSO outlets mitigate against loss of MWRA service even under extreme conditions. For these reasons, relief of the priority C interceptors is not recommended at this time; system performance issues in these areas are instead addressed in the CSO control recommendations.

There are no recommended interceptor storage or flow transfer projects in the SMP. A detailed analysis of the interceptor network indicated that significant in-system storage potential existed only in the South System or downstream of CSOs in the North System (in the North Metropolitan Trunk Sewer from East Boston to Winthrop). Interceptor and CSO system analyses showed no potential for cost-effective reduction of CSO flows through interceptor storage or flow transfer. The benefit of in-system storage was therefore limited to the potential for reducing peak flows to the Deer Island treatment plant. However, recent analyses showed that the available storage volume was not great enough to reduce secondary treatment capacity (e.g., the elimination of all or part of a secondary battery) at the treatment plant. There would also be an element of risk associated with reducing secondary treatment capacity through the use of in-system storage. In-system storage capacity can be defined for a specific hydrologic condition, but under more extreme conditions, less storage volume would be available. In such instances, the treatment plant capacity provided on the basis of an in-system storage volume could be exceeded, resulting in potential permit violations. In-system storage may also carry risks for the interceptor system, such as maintenance and conveyance problems.

Two potential flow transfer projects were identified and evaluated. Both would transfer flow during wet weather conditions from the North System to the South System, upstream of the Ward Street Headworks. The objective of these flow transfers was to cost-effectively reduce CSO control needs at CSOs in the vicinity of the Ward Street Headworks and at the Cottage Farm CSO Facility in particular. The evaluations conducted indicate that the flow transfers would not be cost effective compared to other CSO control alternatives.

SECONDARY TREATMENT

SMP planning included a critical review of the secondary treatment capacity required at the Deer Island treatment plant in the context of the CSO control, I/I reduction, and interceptor improvements. This review included close coordination with the on-going reassessment of secondary treatment capacity being conducted under contract DP-29 by the Program Management Division (PMD) of the Authority.

Key evaluation factors and criteria in the review included updated flows and loads, impacts of CSO, I/I, and interceptor strategies, review of process design criteria and estimates of effluent quality. The flows and loads on which the secondary treatment strategy evaluations were based are presented in Table 3-11.

TABLE 3-11. FLOWS AND LOADS FOR CONDUCTING SECONDARY TREATMENT STRATEGY EVALUATIONS

Operating Condition	Flow (mgd)	BOD (lb/d)	TSS (lb/d)
Annual Average	353	517,000	548,000
Maximum 30-Day	689	661,000	712,000
Maximum 7-Day	854	721,000	868,000
Maximum Day	998	974,000	1,092,000

Annual average flows and loads were used to size various treatment processes and to assess typical (average) plant performance. The maximum 30-day and maximum 7-day values were also used for sizing certain processes and are of importance in assessing whether the effluent quality resulting from these flows and loads and alternative process configurations are likely to meet maximum 30-day and maximum 7-day NPDES permit limits. Maximum day flows and loads were used to assess plant performance under maximum day conditions.

The annual average flow was derived from a year-long model simulation of a typical rainfall year, and annual average loads were developed by adding load associated with increased flow to historical annual loadings. The maximum 30-day, maximum 7-day, and maximum day flows were derived by simulating the severe hydrologic conditions that occurred during the spring of 1993, which represents a critical design period. Loads corresponding to these maximum flows were derived in the same manner as were the annual average loads.

These flows and loads were used to assess the performance of four secondary treatment alternatives:

- Two Battery Secondary (540 mgd secondary treatment capacity)
- Two Battery Secondary plus Chemically Enhanced Primary Treatment (CEPT) (540 mgd secondary treatment capacity)
- Two and two-thirds Battery Secondary (720 mgd secondary treatment capacity)
- Three Battery Secondary (810 mgd secondary treatment capacity)

A series of analyses were performed for each alternative to assess the operational characteristics of the primary and secondary process, sizing of residuals facilities (e.g., the number of gravity thickeners for primary sludge, or the number of centrifuges to thicken waste activated sludge), anticipated effluent quality and a comparison to potential permit limits, and to estimate each alternative's cost savings potential. This information was then presented in a workshop forum attended by MWRA staff and both the SMP and DP-29

consultants. Input from workshop attendees was used in conjunction with final flows and loads corresponding to the recommended CSO control program to refine secondary treatment alternatives.

Recommended Plan

Based on data currently available, the SMP analysis concluded that from 720 to 810 mgd of secondary treatment capacity would be needed. This corresponds to between two and two-thirds batteries and three batteries, based on the present battery configuration. The potential cost savings and a conservative prediction of effluent quality for the recommended secondary treatment plan is presented in Table 3-12. The estimated cost savings include potential reductions in the numbers of centrifuges and anaerobic digesters, in addition to reduced secondary treatment capacity.

The "Final Draft Recommended Plan for Completion of the Deer Island Facilities", prepared by the DP-29 consultant, recommends that a minimum secondary treatment capacity of 710 mgd is necessary in order to meet permit standards for maximum 7-day and maximum month. This conclusion was reached by performing a statistical flow blending analysis that predicted effluent quality during time periods when the secondary treatment unit capacity is exceeded. The analysis started with a base secondary treatment capacity of 530 mgd (adequate to treat all dry weather flows). The secondary treatment capacity was increased and effluent quality predicted, in an iterative fashion, until the secondary treatment size was adequate to avoid permit violations.

To provide for plant symmetry and provide an additional layer of operating safety, DP-29 recommended construction of the complete Battery C, with a capacity rating of 780 mgd, 70 mgd above the base recommendation.

TABLE 3-12. COST SAVINGS POTENTIAL AND EFFLUENT QUALITY FOR PRELIMINARY SECONDARY TREATMENT RECOMMENDATION

Peak Secondary Treatment Capacity (MGD)	Number of Batteries	Potential Construction Cost Savings ($M)	Predicted Effluent Performance[1,2]			
			Operating Condition	BOD, mg/l	CBOD, mg/l	TSS, mg/l
720	2 2/3	147	Annual Average	17	14	18
			Maximum 30-Day	30	25	36*
			Maximum 7-Day	38	32	43
810	3	120	Annual Average	16	13	16
			Maximum 30-Day	26	22	31*
			Maximum 7-Day	33	27	38

(1) Effluent permit limits are expected to be as follows: TSS, 30 mg/l maximum 30-day, 45 mg/l maximum 7-day; CBOD, 25 mg/l maximum 30-day, 40 mg/l maximum 7-day.

(2) When the WWTP flow exceeds the secondary treatment capacity, the effluent performance reflects blended primary and secondary treated effluent.

* These and other effluent concentrations in this table were based on no use of clarification aids. With provision of a polymer system (as recommended by DP-29) effluent TSS concentrations of less than 30 mg/l would be expected, resulting in no permit violations.

The potential for a 1 mg/l TSS violation was predicted for the 3 battery alternative by the SMP analysis. The DP-29 study rates the 3 battery secondary option at 780 mgd, and includes provision of a polymer system. This system will aid the settling process during high flow periods, and provide a level of safety to avoid permit violations for TSS in particular. With the provision of the polymer system for use during peak events, the SMP analysis and the DP-29 study both predict no permit violation with a 3-battery secondary treatment plant.

The MWRA's final recommendation for the wastewater treatment plant will be presented in the DP-29 report.

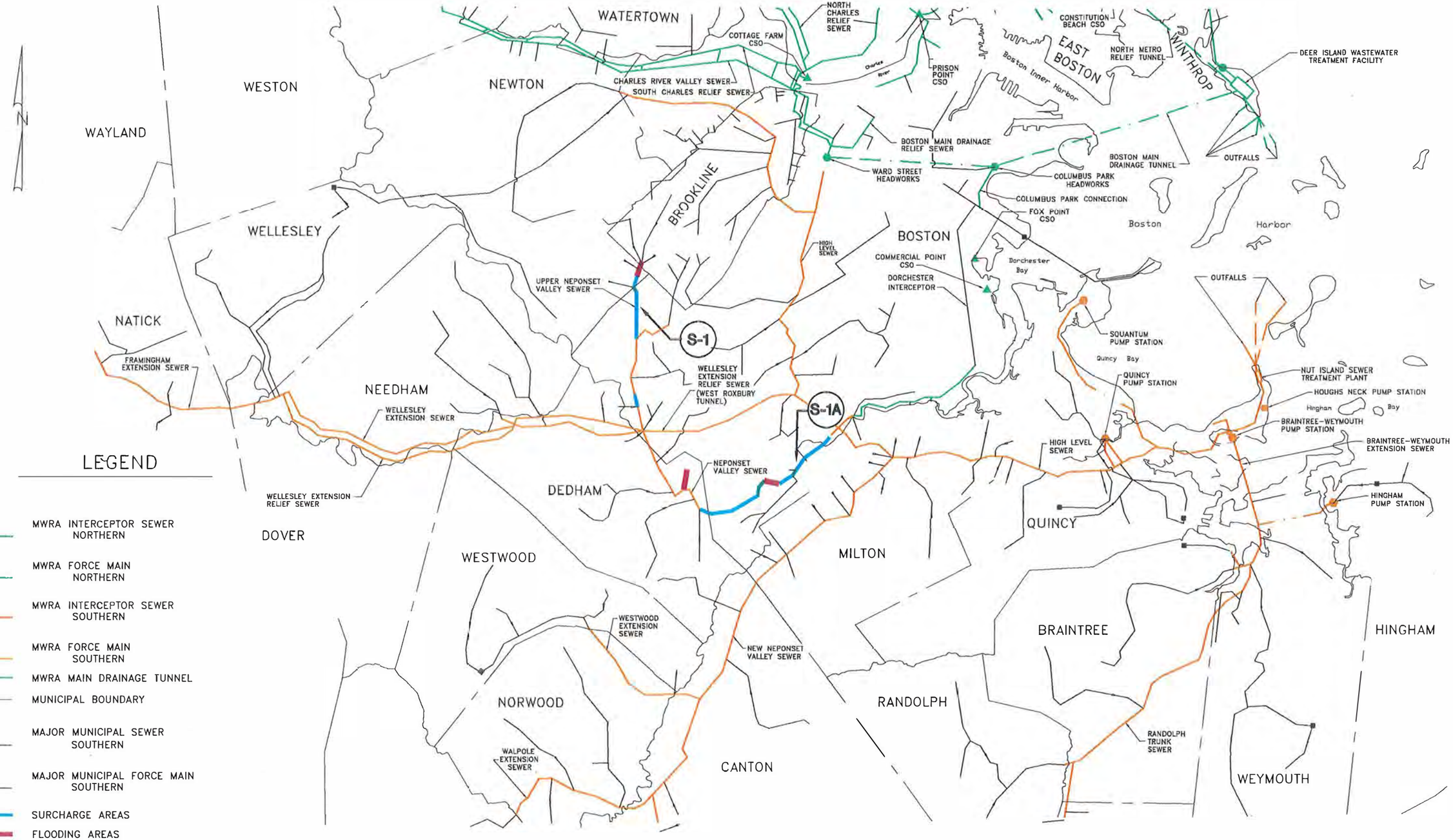


FIGURE 3-10.
SOUTH SYSTEM INTERCEPTOR RELIEF PROJECTS

PART I

CHAPTER FOUR

IMPLEMENTATION PLAN

Following the completion and acceptance of the Final CSO Conceptual Plan/SMP, a number of activities will be initiated to begin implementation of the recommended CSO control projects. This chapter describes those activities and presents a proposed plan and schedule. Changes to this proposed implementation plan and schedule will be made based on discussions with the Court parties, the CSO communities, and other parties, and with the consideration of other factors, some of which are described below. In addition, the implementation plan and schedule may be updated and revised upon completion of facilities planning/environmental review.

The proposed implementation plan and schedule presented herein is based on several assumptions regarding important factors that need to be considered following review and acceptance of the recommended CSO conceptual plan. These factors include:

- Determination of the best approach for implementing each of the recommended projects
- Facilities planning, environmental review, and permitting requirements for each project or group of projects
- Project and/or receiving water priorities and project phasing
- Impacts of other large construction projects, including construction of the Central Artery and I-93/Exit 29 improvements
- Site identification, assessment, and acquisition

REGULATORY COMPLIANCE

Refinement and implementation of the CSO Conceptual Plan/SMP will begin with facilities planning and environmental review. Facilities planning will move the recommended plan from the conceptual phase into a number of clearly defined projects.

Facilities Planning and Environmental Review

Facilities planning will include activities related to engineering development of the recommended plan; siting of new facilities, including geotechnical and hazardous material investigations; natural and cultural resource assessments; and updates/refinements of project cost estimates and implementation schedules. Environmental review will consist, in part, of activities to fulfill the requirements of the Massachusetts Environmental Policy Act (MEPA) for environmental impact assessment, and any necessary additional evaluations related to obtaining partial use designations for receiving water segments that will continue to have CSO discharges.

MWRA has met with staff of the MEPA Unit to discuss the best approach for conducting environmental review of the CSO Conceptual Plan/SMP. Given the significant differences between the current plan for CSO control and the 1990 CSO Facilities Plan, it was agreed that the MWRA will initiate a new MEPA review process by submitting a new Environmental Notification Form (ENF) that covers the entire CSO plan. The ENF will be supplemented with submittal of this report and the Baseline Water Quality Assessment Report (August 1994). Since the conceptual CSO control plan includes a number of individual projects and several different waterbody segments, and covers a large project area, the environmental review will be conducted under the process for a "major and complicated" project. This process will allow the projects to proceed on a staggered schedule, so that simpler projects or groups of projects with fewer potential environmental impacts can move forward as review of the overall impacts of the entire plan are assessed.

Environmental review will be conducted in compliance with federal and state regulatory requirements. Potential impacts from construction on land use, air and water quality, noise, traffic, and natural and cultural resources will be evaluated. The final facilities plan and environmental impact report will define mitigation measures for environmental and community impacts, as well as engineering and operational requirements.

Partial Use Designation

Development of any additional information necessary to support "partial use" designations in receiving water segments, which will continue to receive CSO discharges after implementation of the recommended plan, will be an important initial part of the facilities planning/environmental review phase. The partial use subcategory for Class B and Class SB waterbodies will define the affected segments and resources, and the conditions under which water quality criteria for swimming or other designated uses may occasionally be subject to short-term excursions. Justification for the partial use designations will include a demonstration that the water quality in these segments will support designated uses most of the year and will sustain a viable aquatic life community.

The CSO Conceptual Plan/SMP and the related planning documents leading to the development of the plan have provided a substantial amount of information to support the MWRA's application for partial use designations. The conceptual plan for CSO control has identified the need and presented the justification for the designations, as described in Chapter Eight.

If the DEP determines that a partial use designation is appropriate, it must file an Environmental Notification Form (ENF) with the MEPA Unit to begin public review of the proposed changes to the state's water quality regulations. DEP must also notify EPA of its intent to allow partial use designations, since water quality standards can not be revised without prior approval by EPA. Revision of the standards is also dependent on final MEPA certification of the CSO facilities plan. As discussed in the previous section, environmental

review of the facilities plan will be conducted using the "major and complicated" process, which will help to coordinate investigations related to partial use designations with other planning efforts.

No application for partial use designation in Massachusetts waters has yet been made, so the exact procedures for obtaining one are not firmly established. MWRA has discussed several issues related to filing of required information and will continue to clarify the process with DEP and the MEPA Unit.

Other Regulatory Requirements

Other regulatory reviews, permits, and approvals may be required for the construction of CSO control facilities. The specific requirements for each of the recommended projects will be identified during facilities planning and environmental review. A listing of federal and state permits that may be required is presented in Table 4-1. Application for permits and other required approvals typically occurs during the design phase of the project. A discussion of design activities is presented under "Design and Construction Requirements."

SITING

Initial site assessments were conducted to evaluate the existence of potential sites to accommodate CSO control alternatives under consideration. While further, more detailed site evaluations will be necessary during facilities planning, the initial site assessments were conducted to test the viability of recommended CSO controls from a siting perspective.

Site Assessment

Potential sites for each CSO control alternative in each receiving water segment were identified, and preliminary site investigations were conducted by teams of environmental planners and engineers. Field investigations were limited to a visual inspection of potential

TABLE 4-1. FEDERAL AND STATE PERMITS AND APPROVALS

Authority	Agency Responsible	Potential Project Applicability
FEDERAL		
Section 404 Clean Water Act	U.S. Army Corps of Engineers	Wetlands dredge and/or fill
Section 10 Rivers & Harbors Act	U.S. Army Corps of Engineers	Construction in and under navigable waters
Section 103 Marine Protection, Research & Sanctuaries Act	U.S. Environmental Protection Agency	Ocean disposal of dredged material
Fish & Wildlife Coordination Act	U.S. Fish & Wildlife Service, National Marine Fisheries Service (Joint with MA Department of Environmental Protection)	Construction in waters of the U.S.
Section 106 National Historic Preservation Act	Advisory Council on Historic Preservation	Construction in historic districts
Resource Conservation Recovery Act (RCRA)	U.S. Environmental Protection Agency	Transportation and Disposal of Hazardous Waste
Solid Waste Disposal Act	U.S. Environmental Protection Agency	Upland disposal of non-hazardous solid waste
National Pollutant Discharge Elimination System - General Permit	U.S. Environmental Protection Agency	Discharge of stormwater runoff to surface water or groundwater; discharge of groundwater from dewatering activities
National Flood Insurance Regulations	Federal Emergency Management Agency	Redelineation of flood zones
STATE		
Surface Water Discharge Permit	Department of Environmental Protection	Similar to federal NPDES; discharge of potentially contaminated discharges during construction
Water Quality Certification - Clean Water Act	Department of Environmental Protection	Construction period discharges into waters of the Commonwealth
Chapter 91 License	Department of Environmental Protection	Construction in or dredging of waters in filled or flowed tidelands

TABLE 4-1 (Continued). FEDERAL AND STATE PERMITS AND APPROVALS

Authority	Agency Responsible	Potential Project Applicability
Coastal Zone Management Act	MA Coastal Zone Management Office	Construction activities or placement of project facilities in the coastal zone
Wetlands Protection Act	Department of Environmental Protection, Local Conservation Commissions	Variance to Wetlands Protection Act performance standards for construction in a salt marsh; construction in wetlands resource areas
Groundwater Discharge Permit	Department of Environmental Protection	Discharge to groundwater during construction dewatering activities
Air Plans Approval - Limited - Comprehensive	Department of Environmental Protection	Pollutant discharge from facilities. Pollutant discharge from stand-by power generators
Article 97 Review	State Legislature	Use of parkland
MA Historical Commission Consultation	MA Historical Commission	Construction in historic areas
Solid Waste Management Regulations	Department of Environmental Protection	Upland disposal of any material classified as "Special Waste"
Massachusetts Hazardous Waste Management Act	Department of Environmental Protection	Storing, treating, transporting, and disposal of hazardous wastes
MA Oil and Hazardous Materials Release Prevention and Response Act	Department of Environmental Protection	Identification, assessment and remediation of hazardous materials
MA Environmental Policy Act	Executive Office of Environmental Affairs	EIR review and approval
Interbasin Transfer Act	Department of Environmental Management	Approval of capacity increase in interbasin transfer of wastewater
State Building Code	MA Department of Public Safety	Compliance with standards for construction.

sites. Siting issues evaluated included: the existence of potential sites (i.e. was a parcel available that could accommodate the CSO control technology); the constructability of a site, including construction issues and engineering requirements for the proposed CSO control technology; community impacts, both short-term (construction time period) and long-term (post construction), such as traffic, noise, and odor, as well as a preliminary assessment of community acceptance of the impacts; and environmental concerns, including potential natural resources impacts and the feasibility of obtaining environmental permits. In addition, other siting factors, such as zoning, presence of endangered species, and potential for the presence of hazardous materials, were reviewed.

Site Issues. The siting teams investigated the general geographic area of each proposed CSO control alternative to find potential parcels that could be utilized. Distance from the CSO regulator and receiving water, parcel size and/or shape, and compatibility of existing land uses with the proposed CSO control technology were evaluated to determine the appropriateness of each parcel. For some of the alternatives, more than one site was identified. Additional site investigations were performed subsequent to the draft CCP/SMP to address issues raised by further hydraulic analyses and community concerns.

Constructability. Construction issues such as site access, potential for the presence of hazardous materials, sub-surface utilities, and size/shape of each identified site were evaluated. This analysis included engineering, construction, and cost issues for each technology at each identified site.

Community Impacts. The effect on the surrounding community of constructing and operating the proposed CSO control alternatives was qualitatively assessed for each site. Issues examined included the impacts to the community during construction (e.g., traffic, street closings, vibrations, noise, and rodent controls) and after construction (e.g., aesthetics, odor, traffic, and maintenance), and if the technology would cause greater impacts at current MWRA sites. In addition, public meetings on the proposed plan and preliminary site options were held during October and November, 1994. Neighborhood associations, civic

organizations, and state agencies offered comments, concerns and alternatives to preliminary site options.

Environmental Considerations. The identified sites were inspected to assess potential environmental impacts. Potential impacts noted in the field were related to wetlands, tidelands, soil conditions and general conditions of the site. Other environmental issues, such as the presence of endangered species and/or habitats and Areas of Critical Environmental Concern (ACECs), were investigated.

Identified siting constraints were considered as part of the alternative ranking/rating process. However, siting was considered to prohibit the alternative only when it was determined that no site was available.

Siting Efforts

Further siting evaluations are a necessary component of the CSO implementation plan. Tasks to be conducted for each site during facilities planning include: an environmental assessment (EIR) if required by MEPA, site owner acquisition discussions for high priority sites, review of the Article 97 approval requirements for sites designated public open space, possible acquisition of high priority sites for projects that are being implemented quickly, and hazardous waste assessments.

Public review was initiated and comments regarding siting issues were obtained during the review of the draft version of this report. Community concerns and issues raised during public meetings were considered in finalizing this CSO Conceptual Plan/SMP. During the period between issuance of the draft and final reports (October to December, 1994), five neighborhood meetings, one neighborhood association meeting, one civic organization meeting, and numerous state, federal, and local agency meetings have been held. Further community input to siting decisions will be solicited throughout the facilities planning

process, so that neighborhood impacts during construction and post-construction can be fully identified and addressed.

DESIGN AND CONSTRUCTION REQUIREMENTS

The recommended CSO control projects vary in terms of design and construction requirements depending on project complexity. Some projects involve facilities for screening, disinfection, pumping and other process functions; while others involve pipeline construction. The pipeline projects range from the relatively simple separation of common sanitary/storm sewer manholes (such as upstream of SOM007) to large consolidation conduits that will likely be constructed using sophisticated soft ground tunnelling techniques (such as along the South Boston waterfront). Design and construction activities that are applicable to the range of recommended projects are discussed in this section. Estimated timeframes and durations for these activities are presented later under "Proposed Implementation Schedule."

Design Activities

Design activities typically begin following the regulatory approval of the project's Facilities Plan/EIR. Design activities are usually divided into preliminary and final design phases. Preliminary design typically represents the first 30 percent of the design process, and results in a preliminary design report that is reviewed by the MWRA, DEP, affected communities and other interested parties. Contacts with agencies from which permits will be required can often be initiated or continued at this time, and value engineering may be performed at this stage of design. Typical preliminary design activities are listed in Table 4-2.

Final design activities focus on the preparation of contract plans and specifications. Reviews are usually conducted at the 60 and 90 percent design completion milestones. Applications for permits that will be required in connection with a project are normally prepared and filed during final design. The project design phase typically concludes with the necessary

TABLE 4-2. TYPICAL PRELIMINARY DESIGN ACTIVITIES

Activity	Pipeline Projects	Facility Projects
Assemble Design Criteria	X	X
Project Layout	X	X
Topographic/Utility Survey	X	X
Subsurface Survey (Borings, etc.)	X	X
Hydraulic Profiles	X	X
Process Requirements		X
Structural Requirements	X	X
Electrical, Architectural, Building Services Requirements		X
Cost Estimating	X	X
Value Engineering (if cost > $10M)	X	X

regulatory approvals of the contract plans and specifications and the receipt of environmental permits.

Construction Activities

Construction activities begin following the regulatory approval of the project plans and specifications and the receipt of required permits, with the exception of certain construction and building permits that are typically obtained by the construction contractor.

Construction activities most often are divided into three phases:

- Bid and award
- Project construction
- Project start-up

During the bid and award phase, prospective contractors develop and submit bids for project construction. Prior to submission of bids, one or more pre-bid conferences may be held, and addenda may be issued to respond to bidder questions and to clarify the intent of the bidding documents (plans and specifications). Following bid submission, the bids are examined and steps are taken to award the contract to the lowest cost, responsive and responsible bidder.

The project construction phase involves the physical building of the project. During this phase, close coordination is required to ensure that the project is constructed in accordance with the plans and specifications, and that any necessary changes are issued to the contractor in a timely manner. Changed conditions (e.g., unforeseen subsurface conditions or hazardous materials) can significantly impact the project schedule during this phase.

As physical construction nears completion, the start-up phase begins. Typical activities for start-up of facilities include preparation of Operations and Maintenance manuals, staff training, equipment check-out, and facilities acceptance. For pipeline projects, activities include project check-out/final inspection and acceptance.

PROJECT PRIORITIZATION AND CONSOLIDATION

The recommended CSO control plan consists of 23 site-specific projects intended to achieve receiving water-specific CSO control requirements. In addition, one project to install manually cleaned bar screens at various outfalls where other CSO controls are not required is included. The plan is particularly suited to the prioritization and consolidation of projects for implementation.

Financial and staff resources can first be allocated to higher priority projects to ensure that environmental benefits are realized in the most critical areas first. Smaller projects (e.g., the manually cleaned bar screens can be combined with similar projects to achieve economy of scale. These factors have been considered in developing the preliminary implementation plan and schedule presented later in this chapter.

An initial plan for prioritization and consolidation of CSO control projects is presented in Table 4-3. This table identifies a total of 23 projects in the five major receiving water areas, as follows:

- Dorchester Bay/Neponset River, four projects
- Constitution Beach, one project
- Charles River, four projects
- Alewife Brook/Upper Mystic River, three projects
- Boston Harbor, eleven projects

Various criteria were defined to prioritize the 23 receiving water specific CSO control projects. Priorities are designated as A, B, and C, with A being the highest priority. As indicated in Table 4-3, a project was assigned an A priority if it met one of the following criteria:

- The project controls CSO discharges into a receiving water segment with critical use areas.
- The project involves implementation of one of the Nine Minimum Controls (in accordance with EPA's CSO Policy).
- The project provides a significant and immediate improvement to local sewer service (e.g., elimination of flooding).

The project to install manually cleaned bar screens at various outfalls throughout the study area was assigned priority A, because of its relationship to implementation of the Nine Minimum Controls, as set forth in EPA's CSO policy.

Projects were defined as priority B or C based on waterbody priority, volume of CSO controlled by the project, and the fraction of CSO versus non-CSO discharges into the applicable receiving water segment. Waterbody priority was determined as shown in

TABLE 4-3. PRIORITIZATION AND CONSOLIDATION OF SITE-SPECIFIC CSO CONTROL PROJECTS

Project	Receiving Water Segment	Priority A Criteria			Priority B and C Criteria							Project Priority
						Future Planned Condition CSO Volume (MGAL)			Future Planned Condition CSO Contribution to Segment, 1-Yr. Storm (%)[4]			
		Critical Use Segment	Nine Minimum Control	Immediate Service Benefit	Waterbody Priority	3-Mo. Storm	1-Yr. Storm	Annual	Fecal Coli.	BOD	TSS	
Dorchester Bay/Neponset												
1. CSO relocation to Reserved Channel, including Screen/Disinfect Facility	N. Dorchester Bay	X			1	0.4	2.2	9.0	69	34	32	A
2. Upgrade Fox & Commercial Point Facilities	S. Dorchester Bay	X			1	7.2[1]	20[1]	168[1]	4.2	77	75	A
3. Sewer Separation, BOS088-090	S. Dorchester Bay	X			1	1.4[2]	7.6[2]	40[2]	4.2	77	75	A
4. Sewer Separation, BOS093-095	Neponset River	X			1	0.3	2.8	5.8	1.5	0.2	0.4	A
Constitution Beach												
5. Sewer Separation at MWR207	Constitution Beach	X			1	0.04	0.4	1.4	0.2	1.7	3.7	A
Charles River												
6. Upgrade Cottage Farm Facility	Lower Charles River				2	9.6	27	128	70	22	35	B
7. Screen/Disinfect Stony Brook Conduit Wet Weather Flows	Lower Charles River				2	2.1[3] (45)	8.8[3] (81)	42[3] (1300)	70	22	35	B
8. Screen/Disinfect Facility at CAM005	Upper Charles River				2	0.00	1.1	4	11	1.5	2.2	B
9. Interceptor Connection Relief, BOS032	Upper Charles River				2	0.02	0.5	2	11	1.5	2.2	B

TABLE 4-3 (Continued). PRIORITIZATION AND CONSOLIDATION OF SITE-SPECIFIC CSO CONTROL PROJECTS

Project	Receiving Water Segment	Priority A Criteria			Priority B and C Criteria							Project Priority
						Future Planned Condition CSO Volume (MGAL)			Future Planned Condition CSO Contribution to Segment, 1-Yr. Storm (%)[4]			
		Critical Use Segment	Nine Minimum Control	Immediate Service Benefit	Waterbody Priority	3-Mo. Storm	1-Yr. Storm	Annual	Fecal Coli.	BOD	TSS	
Alewife/Upper Mystic												
10. Sewer Separation at CAM002 and CAM004	Alewife Brook				3	0.8	3.3	12.4	58	23	22	B
11. Baffle Manhole Separation at SOM001	Alewife Brook				3	0.02	0.13	0.4	58	23	22	B
12. Baffle Manhole Separation at SOM006 and SOM007	Upper Mystic River				3	0.0	0.01	0.04	0.1	0.02	0.02	B
Boston Harbor												
13. Upgrade Prison Point Facility	Upper Inner Harbor				4	14	35	197	70	16	31	B
14. Screen/Disinfect Facility at BOS019	Upper Inner Harbor				4	0.2	0.8	3.6	70	16	31	C
15. Interceptor Relief, E. Boston Branch Sewer (BOS003-014)	Upper Inner Harbor/Lower Inner Harbor				4	2.0	9.2	38	66	15	29	B
16. Trunk Sewer Relief, CHE002-004	Mystic/ Chelsea			X	5	0.0	0.1	0.7	36	16	21	A
17. Upgrade/Relocate Somerville Marginal Facility	Mystic/ Chelsea				5	4.8	11	100	36	16	21	B
18. Screen/Disinfect Facility at BOS017	Mystic/ Chelsea				5	0.1	0.5	2.5	36	16	21	C
19. Outfall Repairs & Manual Bar Screen, CHE008	Mystic/ Chelsea				5	0.2	2.6	8.3	36	16	21	C

TABLE 4-3 (Continued). PRIORITIZATION AND CONSOLIDATION OF SITE-SPECIFIC CSO CONTROL PROJECTS

Project	Receiving Water Segment	Priority A Criteria			Priority B and C Criteria							Project Priority
						Future Planned Condition CSO Volume (MGAL)			Future Planned Condition CSO Contribution to Segment, 1-Yr. Storm (%)[4]			
		Critical Use Segment	Nine Minimum Control	Immediate Service Benefit	Waterbody Priority	3-Mo. Storm	1-Yr. Storm	Annual	Fecal Coli.	BOD	TSS	
20. Consolidation to Screen/ Disinf. Facility, BOS076-080	Reserved Channel				5	3.7	8.6	67	94	82	81	B
21. Detention/Treatment of Union Park Pump Station Flows	Fort Point Channel				5	8.5	19	147	93	75	73	B
22. In-Line Storage, Dorchester Brook Conduit	Fort Point Channel				5	0.05	3.5	13	93	75	73	C
23. Consolidation Conduit Storage, BOS072, 073	Fort Point Channel				5	0.4	1.7	7.4	93	75	73	C

1. Volume includes stormwater which enters the system downstream of the regulators but upstream of the Fox Point and Commercial Point Facilities.
2. Volume includes overflow from regulators only.
3. The first volume includes overflow from regulators only. The volume in parentheses is the total volume at the outfall and includes stormwater which enters the system downstream of the regulators.
4. Values reflect percent of total pollutant load to the receiving water segment contributed by all CSO discharges to the segment.

Table 4-4. The volume of CSO controlled by each project was assessed using 3-month storm, 1-year storm, and annual CSO volumes, and the fraction of CSO versus non-CSO discharges was assessed in terms of 1-year storm fecal coliform, BOD, and TSS.

Projects assigned a B priority typically had a relatively high waterbody priority and/or a relatively high volume of CSO controlled and a high CSO/non-CSO pollution ratio. For example, Project 8, Screen/Disinfection Facility at CAM005, has a relatively high waterbody priority (Upper Charles River) and was assigned a B priority despite relatively low volumes of CSO controlled and the predominance of non-CSO pollution into this receiving water segment. Project 20, Detention/Treatment of Union Park Pump Station Flows, has a relatively low waterbody priority (Fort Point Channel), but provides control of a relatively high CSO volume in a receiving water predominantly impacted by CSOs during wet weather. This project was also assigned a B priority. Projects assigned a C priority typically had both a relatively low waterbody priority and a relatively low volume of CSO controlled.

PROPOSED IMPLEMENTATION SCHEDULE

The proposed implementation schedule presented below is the result of further scrutiny and revision of the preliminary implementation schedule that was presented in the Draft CSO Conceptual Plan and System Master Plan in September, 1994. Factors that contributed to the revisions include:

- More detailed assessment of the necessary planning, design, and construction phase durations for each project. This assessment reduced the phase durations for most projects.
- Consideration of additional information obtained since September, including information that resulted in modified project recommendations at several locations and information regarding the current planning and design status of certain projects that may have been partially planned and/or designed in the past.

TABLE 4-4. CONSIDERATIONS FOR ESTABLISHING WATERBODY PRIORITIES

Priority Ranking	Receiving Water Segments	Considerations
1	North Dorchester Bay, South Dorchester Bay, Neponset River, Constitution Beach	Critical use areas; shellfishing and/or swimming areas
2	Lower Charles River, Upper Charles River	Intensive secondary contact recreation areas
3	Upper Mystic River, Alewife Brook, Back Bay Fens	Important aesthetic areas, secondary contact recreation areas, no tidal flushing
4	Lower Inner Harbor, Upper Inner Harbor	Important aesthetic areas, secondary contact recreation areas, shipping area
5	Reserved Channel, Fort Point Channel, Mystic/Chelsea Confluence	Commercial/industrial/shipping areas, limited secondary contact recreation areas

- Consideration of and response to comments from reviewers of the Draft CSO Conceptual Plan. This resulted in a more aggressive schedule.

- Further consideration of the sharing of project implementation responsibilities among the CSO communities and the MWRA. This contributed to a general shortening of the schedule, but also contributed to minor phasing within the shorter overall period.

In general, the schedule proposes the following:

- All facilities planning and environmental review completed in 3 years.

- All projects except Dorchester Sewer Separation completed in 12 years.

- All priority A projects completed on an aggressive schedule (no phasing) in 8 years.

- All Charles River controls completed on an aggressive schedule (no phasing) in 7 years.

The proposed implementation schedule for the recommended CSO control projects calls for facilities planning/environmental review to begin as early as possible. Based on preliminary discussions with MEPA, not all projects are expected to require comprehensive facilities planning/environmental review. It is anticipated that any pre-design planning required for these projects will be conducted in the early phases of the comprehensive FP/EIR and that these projects may move quickly into design.

Design and construction of higher priority projects would immediately follow FP/EIR or pre-design planning activities, while the design and construction of lower priority projects would be phased to allow implementation coordination efforts to be focused on higher priority areas. Implementation of the highest cost project (sewer separation in South Dorchester Bay) would extend for the entire implementation period, into year 2010, because this project will likely involve multiple design and construction contracts.

The proposed implementation schedule is shown on Figure 4-1, bound at the back of this report. As mentioned earlier in this chapter, this implementation plan and schedule is subject to change over the next few months and possibly beyond.

Scheduling Assumptions

In developing the proposed implementation schedule, certain assumptions were made related to the level of facilities planning and environmental review that may be required, critical siting issues identified at this time, coordination with other major projects, and bidding requirements (Chapter 149 or Chapter 30). These assumptions are summarized in Table 4-5.

TABLE 4-5. PRELIMINARY IMPLEMENTATION SCHEDULE ASSUMPTIONS

Receiving Water	Project	Fac. Plan/EIR Required	Coordinate with Other Projects	Siting		Bidding Requirements
				Yes	Critical	
North Dorchester Bay	CSO Relocation to Reserved Channel & Treatment Facility	✓		✓	✓	149
South Dorchester Bay	Upgrade Fox Point and Commercial Point Facilities					149
South Dorchester Bay	Sewer Separation	✓		✓		30
Neponset River	Sewer Separation	✓	MBTA	✓		30
Constitution Beach	Sewer Separation	✓		✓		30
Lower Charles	Upgrade Cottage Farm Facility	✓				149
Lower Charles	Screen & Disinfect Stony Brook Conduit Flows	✓		✓	✓	149
Upper Charles	Screen & Disinfect CAM005	✓		✓	✓	149
Upper Charles	Interceptor Connection Relief, BOS032	✓		✓		30
Alewife	Sewer Separation at CAM002 & CAM004	✓		✓		30
Alewife	Baffle MH Separation at SOM001					30
Upper Mystic	Baffle MH Separation at SOM006 and 007					30
Upper Inner Harbor	Upgrade Prison Point Facility					149
Upper Inner Harbor	Screen & Disinfect BOS019	✓		✓	✓	149
Up & Low Inner Harbor	Interceptor Relief BOS003-BOS014	✓		✓		30
Mystic/Chelsea	Trunk Sewer Relief CHE002 to CHE004			✓		30
Mystic/Chelsea	Upgrade/relocate Somerville Marginal Facility	✓	I-93/Exit 29	✓		149
Mystic/Chelsea	Screen & Disinfect BOS017	✓		✓		149
Mystic/Chelsea	Outfall Repairs and Manual Bar Screen, CHE008	✓		✓		30
Reserved Channel	Consolidation to BOS080	✓		✓		149
Fort Point Channel	Detention/Treatment of Union Park Pump Station Flows	✓	CA/T	✓	✓	149
Fort Point Channel	In-Line Storage Dorchester Brook Conduit		CA/T	✓		149
Fort Point Channel	Storage/Consolidation Conduit BOS072-BOS073	✓	CA/T	✓	✓	149
--	Independent Manual Bar Screen/Outfall Closing Projects	✓				30

Activities shown on the implementation schedule include:

- Facilities planning/environmental review
- Site acquisition
- Design
- Permit acquisition
- Construction

Assumptions regarding each activity, activity durations, and the relationships and durations between the activities are discussed in the text that follows. These assumptions form the basis of the proposed implementation schedule (Figure 4-1) and may be subject to change.

There are a number of different types of projects that are recommended in this CSO control plan. Some of the projects involve facilities that may be wholly owned and operated by a CSO community, while other projects involve facilities that may be owned and operated by the MWRA. Implementation of some projects may be facilitated by a sharing of project implementation responsibilities with the various CSO communities. Criteria used to identify projects that may involve shared responsibilities in project implementation include:

- The project is totally within the limits of the community system and will likely be owned and operated by the community after construction.
- The project involves a modification of existing facilities (i.e., bar screens and conversion of the existing Dorchester Brook Conduit to storage).
- The project requires a very detailed understanding of the system and will involve extensive and detailed coordination with private owners (i.e., sewer separation).

Facilities Planning/Environmental Review. For projects that will require detailed facilities planning and environmental review and will be owned and operated by the Authority, facilities planning and environmental review would begin on April 1, 1995. For projects that do not require detailed facilities planning/environmental review, pre-design studies would also begin on that date with design commencing on January 1, 1996. Facilities planning for

projects involving facilities that may be community owned and operated will begin on January 1, 1996 to allow sufficient time for community coordination efforts. Necessary activities prior to April 1, 1995 include additional internal/external review of the recommended plan, final decisions on implementation/scheduling assumptions, MWRA Board of Directors approval, court acceptance and approval, and consultant contract development. Necessary activities prior to the January 1, 1996 facilities planning start date include final decisions on scheduling assumptions, including discussions with the communities; internal/external review of the recommended plan; development of formal agreements between the MWRA and the communities, which may also involve Court order/schedule issues; as well as consultant contract development.

Facilities planning/EIR ends upon receipt of the Certificate from the Secretary of Environmental Affairs. The maximum duration of this phase is assumed to be 18 months for preparation of the draft report, seven months for review of the draft and preparation of the final report, and two months for review of the final report and receipt of the Certificate (for a total of 27 months.) The schedule does not include provision for a supplemental facilities plan/EIR.

Site Evaluation and Acquisition. As indicated in Table 4-5, certain sites have been designated as critical. Critical sites are associated with projects that have very limited site options and/or involve a high level of coordination with other parties.

For the critical sites, site acquisition may take place in two phases: the first concurrent with facilities planning; and the second extending from the beginning of permit acquisition to the start of construction. During the first phase, sufficient work would be completed to determine whether early acquisition steps need to be taken (prior to design), or if the typical design/construction period schedule for site acquisition is suitable. For projects not involving critical sites, site acquisition procedures would be initiated after the start of design and would extend to the beginning of construction.

In general, siting activities include identification and discussions with parcel owners, both public and private, not only to allow site access for environmental assessment and hazardous material presence analyses, but also to establish a relationship with the site owner for appraisals and the potential purchasing of legal options for high priority sites. Furthermore, the legislative process may be initiated during facilities planning for sites which are located on publicly designated open space and require Article 97 approval.

Initiating owner discussions and possible acquisition of critical sites during the facilities planning process is intended to ensure that the sites will be available by the end of the final design, which in turn, would allow implementation/construction to proceed for high priority projects immediately following final design.

Acquisition procedures for the majority of the sites would occur during the design phase, after the facilities planning and EIR process. This process is intended to ensure that the non-critical sites meet project requirements and that permits can be obtained before site acquisition.

Procedures for site acquisition may differ between public and private owners. For example, eminent domain authority may be exercised on private parcels once negotiations with the owner have failed, while Article 97 approval, which takes a two-thirds vote of the legislature, is required for public open space parcels. Other differences between public and private parcels may include negotiation processes and/or scheduling timetables.

Design. The following discussion applies to projects that are currently anticipated to proceed directly from facilities planning to design and construction. Some projects are currently planned to be phased so that implementation of higher priority projects can proceed first. For these projects, design would be scheduled to coordinate with construction instead of immediately following facilities planning. This will ensure that the project designs are current at the time of advertisement for bids.

For projects that require preparation of a 27-month facilities plan/EIR, design would begin at the completion and acceptance of the Facilities Plan/EIR. Design services would be procured during the last nine months of the facilities planning process; procurement activities would be initiated when the draft facilities plan/EIR becomes available. For projects requiring a 12 or 18 month facilities planning timeframe, procurement of design services (estimated to require nine months) would be initiated upon completion of facilities planning. In other words, design would start nine months after completion of facilities planning for projects requiring a 12 or 18 month facilities planning timeframe.

For projects that do not require facilities planning, design would start on January 1, 1996 to allow sufficient time for any necessary pre-design study (which would begin on April 1, 1995), and for procurement of design services.

Regulatory approval of the design documents and permit acquisition (see below) are assumed to take place in a timely manner based on the continuation of close agency coordination and court schedule requirements.

Permit Acquisition. The permitting phase represents the time from submission of permit applications and supporting documentation to the receipt of the permit, including permit appeal periods. It is assumed that there will be up to an 18-month duration for the permitting phase of larger, more complex projects, and a minimum of a 6-month duration for smaller projects. Permit acquisition is expected to run concurrent with the design phase, with the end of the permitting phase coinciding with the end of design.

Construction. Advertisement for bids for construction is scheduled to begin after all permits are acquired, regulatory approval of the design documents is obtained, and sites are acquired. As such, physical construction is expected to begin six months after the end of design for projects involving only Chapter 30 bidding requirements, and nine months after the end of design for projects involving Chapter 149 requirements. This six or nine-month period is for

the bid and award phase. The subsequent construction duration is for both physical construction and start-up activities.

Project Phasing and Impacts of Other Projects

In addition to the assumptions regarding durations and relationships between the scheduled project activities, project prioritization and potential schedule impacts from other projects (e.g., Central Artery Project) are important considerations in developing the implementation plan and schedule. These are discussed in the text that follows.

Phasing. Project phasing is based on the prioritization of the CSO control projects described earlier in this section, and on external coordination requirements. By phasing design and construction efforts, available resources for project implementation can be focused on the highest priority projects first. Projects recommended to proceed immediately into design and construction upon completion of facilities planning and environmental review versus projects recommended to be phased are listed in Table 4-6.

Impacts of Other Projects. The implementation plan and schedule was developed with the knowledge that other projects (e.g., the Central Artery Project) could significantly impact the scheduling of certain CSO control projects. At this time, the somewhat undefined scheduling status of other projects makes it difficult to accurately assess their potential scheduling impacts. It will likely be necessary to modify the implementation schedule to account for the impact of other projects, and it is important that future court schedules make provisions for such modifications. Projects currently identified as being potentially impacted by other projects are listed in Table 4-7.

Facilities planning for these projects will be completed as early as possible to allow better coordination. Design and construction services likely will be scheduled as necessary to "tie in" with construction of the other project.

TABLE 4-6. PROJECTS RECOMMENDED FOR IMMEDIATE VERSUS PHASED START OF DESIGN AND CONSTRUCTION

Immediate Start	Phased Start
• CSO Relocation to Reserved Channel and Treatment Facility	• Interceptor Relief, East Boston Branch Sewer (BOS003-014)
• Upgrade Fox and Commercial Point Facilities	• Screen/Disinfection Facility at BOS019
• Sewer Separation, BOS088-090	• Screen/Disinfection Facility at BOS017
• Sewer Separation, BOS093-095	• Consolidation to Screen/Disinfection Facility, BOS076-080
• Sewer Separation at MWR207	• Detention/Treatment of Union Park Pump Station Flows
• Upgrade Cottage Farm Facility	• In-Line Storage, Dorchester Brook Conduit
• Screen/Disinfect Stony Brook Conduit Wet Weather Flows	• Consolidation Storage Conduit, BOS072-073
• Screen/Disinfection Facility at CAM005	• Outfall Repairs and Manual Bar Screen, CHE008
• Interceptor Connection Relief, BOS032	
• Sewer Separation at CAM002 and CAM004	
• Baffle Manhole Separation at SOM001	
• Sewer Separation at SOM006 and SOM007	
• Upgrade Prison Point Facility	
• Trunk Sewer Relief, CHE002-004	
• Upgrade/relocate Somerville-Marginal Facility	
• Independent Manual Bar Screen/Outfall Closing Projects	

TABLE 4-7. CSO PROJECTS POTENTIALLY IMPACTED BY OTHER PROJECTS

CSO Project	Potential Impacting Project
• Sewer Separation, BOS093-095	MBTA project in Port Norfolk area to include piping to facilitate separation
• Upgrade/Relocate Somerville-Marginal Facility	I-93/Exit 29 Improvements
• Manual Bar Screen at BOS062-068	Central Artery Project
• Detention/Treatment of Union Park Pump Station Flows	Central Artery Project
• In-Line Storage, Dorchester Brook Conduit	Central Artery Project
• Consolidation Conduit Storage, BOS072-073	Central Artery Project

FUTURE PUBLIC PARTICIPATION EFFORTS

Publication of the Final CSO Conceptual Plan/SMP is of great interest to a number of constituencies identified during the development of the plan. The MWRA will disseminate the plan and continue public outreach efforts to foster better understanding of CSO issues and encourage public participation in its future planning efforts.

Report Distribution

The final report will be submitted to the Court parties, public works officials in each CSO community, the Advisory Board, WAC, and other interested parties. The report also will be distributed to the 20 library repositories throughout the region currently offering material on CSOs to interested readers. Selected parts of this report will be sent to local and elected officials in the CSO communities; workshop participants; environmental, municipal and business organizations; and any interested citizen who requests a copy. Summaries of the

report's highlights will appear in the CSO Bulletin and in press releases and articles prepared by the Authority.

Targeted Interest Group Meetings

Some environmental groups and state agency representatives, from a very large list of invitees, attended a presentation on the draft conceptual CSO control plan on September 19, 1994. The MWRA has scheduled follow-up meetings with these organizations. In addition, briefings will be made available to municipalities, elected officials, community and business organizations.

Public Involvement During Facilities Planning

The MWRA is committed to continuing its full-scale public outreach program through CSO facilities planning. The outreach efforts of the last two and one-half years, while not required under law, have broadened the dialogue on CSOs among the CSO communities, the environmental groups, and the MWRA ratepayers. This work has helped to develop a greater understanding of the issues involved in CSO control, produced a CSO control plan that recognizes early the concerns of the various parties, and laid the groundwork for working with the affected constituencies through project implementation.

As part of the facilities planning and environmental review process, the MWRA will formally establish a Citizens Advisory Committee (CAC). The Authority will structure the CAC based on the participation of various constituencies during the development of the CSO Conceptual Plan/SMP. During the initial stage of facilities planning, the Authority also will develop a public participation program to ensure that all interested parties are given an opportunity to participate in the planning process.