CHAPTER 1: INTRODUCTION

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION AND BACKGROUND

The Louisville and Jefferson County Metropolitan Sewer District (MSD) owns, operates and maintains the wastewater and stormwater facilities servicing approximately 700,000 residents of the Louisville Metro area. Facilities include six regional and 15 small water quality treatment centers (WQTC), approximately 300 pump stations, and over 3,200 miles of sanitary sewers. The 385 square mile service area managed by MSD includes Louisville Metro and extends into portions of Oldham County. Geographically, the MSD service area includes 11 watersheds, all of which are part of the Ohio River Watershed. MSD also owns, operates and maintains the Ohio River Flood Protection System that includes 16 flood pump stations and 29 miles of floodwall or levee.

Over the last 150 years, MSD's sewer system has extended into a network of both sanitary and combined sewers, diversion structures, and other flow control devices. In the combined sewer system (CSS), dry weather flows are conveyed to the Morris Forman WQTC for treatment prior to discharge into the Ohio River. During wet weather events, when the total combined sewage flow exceed the capacity of the sewer, a mixture of sewage and stormwater runoff is discharged to the South Fork of Beargrass Creek, Middle Fork of Beargrass Creek, Muddy Fork of Beargrass Creek, and the Ohio River. The CSS service area is approximately one-third of the Morris Forman WQTC service area and encompasses approximately 37 square miles of area. Presently there are 106 active combined sewer overflows (CSO) within the MSD area.

To address the wet weather overflows, MSD initiated a CSO abatement program in 1991 dedicated to developing a comprehensive understanding of the CSS and an approach to reducing CSOs. MSD continues to enhance and expand the resources and a significant amount of work has been conducted including: characterization of the system, development of hydraulic computer models, compliance with the U.S. Environmental Protection Agency's (EPA) Nine Minimum Controls (NMC), and implementation of various CSO Long-Term Control Plan (LTCP) elements. Figure 1.1.1 at the end of this chapter shows the CSO abatement program accomplishment timeline. The figure illustrates most of MSD's major activities over the last 15 years that have provided a foundation for the development of this Final CSO LTCP.

MSD's initial efforts at CSO abatement occurred before the EPA issued the final CSO Control Policy in 1994. MSD performed model development and flow monitoring during the early 1990s to help better understand how the CSS functioned during periods of wet weather. In addition, MSD investigated preliminary CSO controls by evaluating potential CSS best management practices (BMP). The implementation of BMPs and NMCs during the mid to late 1990s, provided additional reductions in the frequency of occurrence and volume of CSO discharges, at relatively low capital cost.

From 1998 to 2005, MSD devoted additional resources to more capital-intensive projects such as Real Time Control (RTC), pump station improvements, sewer separation, construction of storage basins, solids and floatables (S&F) removal facilities, and the elimination of several CSOs. Completion of these projects demonstrates the significant impact MSD's CSO initiative of the 1990s has had on the overall progress of the CSO Abatement Program and poises MSD for successful completion of the Final CSO LTCP.

On August 12, 2005, MSD entered into a Consent Decree in Federal Court with the EPA and the Kentucky Environmental and Public Protection Cabinet. The Consent Decree was developed in response to an enforcement action taken by EPA and Kentucky Department of Environmental Protection (KDEP) alleging violations of the Clean Water Act (CWA) primarily related to sewer overflows. One of the requirements of the Consent Decree is the development and submittal of a CSO LTCP.

On December 1, 2008, a draft Amended Consent Decree (ACD) was released for public comment. The draft ACD addressed alleged violations of the CWA primarily related to WQTC performance, record-keeping, and reporting. Public comment closed on the draft ACD on December 31, 2008. The ACD was entered into Federal Court on April 15, 2009.

The Consent Decree amendments were negotiated over several months, and the terms of the draft amendments were known to MSD during the final stages of development of this Integrated Overflow Abatement Plan (IOAP). For the purposes of the IOAP, except where specifically noted otherwise, the term “Consent Decree” will be understood to mean the ACD as it was entered into Federal Court on April 15, 2009.

A significant undertaking that has become the foundation of the current CSO LTCP is the RTC Program. The objective of this ongoing program is to maximize the existing in-line storage capacity of large conduits for cost-effective reduction of CSOs within both the Beargrass Creek and Ohio River basins. The RTC Program is an application of advanced technology which uses available meteorological data and sewer capacity information monitored over the sewer network, and predicted by the Radar Rainfall Data System, to determine the best flow management strategy.

Along with the RTC Program, MSD has implemented other CSO controls, including demonstration programs, to establish the applicability and effectiveness of various CSO technologies. Additional details and an expanded listing of projects are presented in Section 1.6.1.

Design and installation for CSO controls has been completed, and facilities are in operation for the following:

- Established a private property program to develop public support for removal of downspouts, sump pumps, etc.
- Installed screens, baffles, and bar racks to capture S&F at individual CSOs.
- Installed an inflatable dam within the Sneads Branch Relief sewer, an 11-foot diameter semi-elliptical drain that recaptures CSS flows from eleven CSOs and pumps the flow back into the sewer for treatment at Morris Forman WQTC.
- Installed a combination of inflatable dams and control gates in the Southwestern Outfall sewer that provides retention of wet weather flows in the system from a large portion (about 7,500 acres) of the CSS in southwestern Louisville Metro.

- Separated combined sewers in several CSO drainage basins, to eliminate CSOs.
- Installed two earthen storage basins for both CSO and surface flooding control with a combined storage volume of 33 million gallons (MG) on the grounds of the Kentucky Fair and Exposition Center.
- Installed three million gallons per day (mgd) screening devices at two CSO locations and a 32 mgd Continuous Deflection Separator (CDS) at one CSO location to screen the CSO discharge.
- Reconstructed a 140 mgd CSO pump station, reducing CSO volume by 70 MG per year.
- Modified flood control protocols for the Ohio River Flood Protection System Infrastructure to reduce CSOs.
- Installed thousands of backwater valves on residential laterals to prevent basement backups.

Two other key, long-standing, planning projects that have been active for several years and critical to MSD's CSO LTCP planning process for 2008 include the Ohio River Sanitation Commission (ORSANCO) water quality study and the Beargrass Creek Total Maximum Daily Load (TMDL) project. The ORSANCO water quality study includes a preliminary analysis of the bacterial impacts of CSO on the Ohio River and the Beargrass Creek TMDL project uses the Water Quality Tool (WQT) to determine TMDL allocations for bacteria. Both of these projects play important roles in the development of the Final CSO LTCP.

MSD completed and submitted a draft CSO LTCP for the Beargrass Creek area in 1996 and a draft CSO LTCP for the Ohio River area in 1997. Both plans were required by the EPA CSO Guidance Policy of April 1994. These plans presented the current plan to address CSOs within the MSD service area. Upon submittal of these plans, MSD appropriately began initiating implementation of the CSO LTCP.

This document is the Final CSO LTCP, which is a major modification of the 1996 and 1997 draft LTCPs and an expansion of the Interim LTCP submitted in September 2006. As its name implies, the Final CSO LTCP defines the long-term objectives of MSD's CSO control objectives, the analyses undertaken to arrive at the appropriate CSO control solution, a detailed description of the various measures recommended for implementation, and a schedule of implementation based on MSD's financial capability and water quality compliance needs.

1.2 HISTORY OF CSO CONTROL POLICY

The CSO Control Policy published by EPA on April 19, 1994, provided guidance to permittees with CSOs, National Pollutant Discharge Elimination System (NPDES) authorities and State water quality standards authorities on coordinating the planning, selection, and implementation of CSO controls that meet the requirements of the CWA. The policy contains provisions for developing appropriate, site-specific NPDES permit requirements for all CSS that overflow due to wet weather events and allows for public involvement during the decision-making process.

Four key principles of the policy ensure that CSO controls are cost effective and meet the requirements of the CWA. These principles are as follows:

- Provide clear levels of control that would meet appropriate health and environmental objectives.
- Provide sufficient flexibility to municipalities, especially financially disadvantaged communities, to consider the site specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements.
- Allow a phased approach for implementation of CSO controls considering a community's financial capability.
- Review and revise, as appropriate, water quality standards and their implementation procedures when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs.

The CSO Control Policy became law in December 2000 and establishes two main objectives for permittees: implementation of the NMCs, and the development and implementation of a CSO LTCP. A separate report entitled "NMC Compliance Report" details the implementation and status of the NMCs and was originally submitted by MSD to the regulatory authorities in February 2006 and ultimately approved in 2007.

The CSO Control Policy directs the permittee to develop and implement a LTCP based on system characterization, water quality and quality monitoring, and stream and sewer system modeling of the CSS. To develop a comprehensive plan, the LTCP should consider the site-specific nature of CSOs and utilize a public participation process involving stakeholders such as the ratepayers, industrial users, persons residing downstream of CSOs, and other interested parties. The CSO Policy also requires that the plan give highest priority to controlling overflows in sensitive areas.

A major part of the LTCP is the CSO alternatives. To develop and evaluate the alternatives, MSD conducted a review of the current and proposed water quality standards to define the levels of pollutant load reductions that are required to meet water quality standards, and thus set the performance expectations for the CSO controls.

General indications of past water quality studies throughout the United States show that CSOs are only one of several sources that can significantly affect the pollutant concentrations in the receiving waters. Control of CSOs alone may not be sufficient to achieve the standards or restore the water bodies to their designated uses. Various wet weather source discharges also exist within the MSD service area. Under the Continual Planning Process in the CWA, an appropriate approach for dealing with these complex combinations of pollutant sources is to evaluate the effectiveness of controls and, from time-to-time, the appropriateness of the water quality standards.

As MSD implements CSO controls and conducts post-construction compliance monitoring of the Final CSO LTCP, review and revision of the water quality standards may be appropriate as indicated by the EPA 2001 Guidance: "Coordinating CSO Long-Term Planning with Water Quality Standards Reviews" (EPA-833-R-01-002). ORSANCO also adopted a provision in its water quality standards for the Ohio River allowing for development and application of alternative criteria if CSO communities have submitted a LTCP and a Use Attainability Analysis (UAA) (ORSANCO, 2006). Therefore, the intent of MSD is to implement the controls recommended in the updated LTCP and then evaluate whether developments of a UAA or additional CSO or other pollutant source controls are warranted.

1.3 KEY ELEMENTS OF CSO CONTROL POLICY

EPA developed guidance documents to assist agencies in preparing CSO LTCPs in compliance with the CSO Policy. MSD's Consent Decree requirements generally follow existing EPA guidance, with the inclusion of additional requirements to address specific MSD issues, such as overflows from the flood pump stations. The Consent Decree specifies that MSD's LTCP shall achieve the following three goals:

- Ensure that if CSOs occur, it is only as a result of wet weather (this goal shall include addressing those discharges resulting from MSD's compliance with the requirements of the United States Army Corps of Engineers' {USACE} "Ohio River Flood Protection System Pumping Operations Manual," dated 1954 and revised 1988).
- Bring wet weather CSO discharge points into compliance with the technology-based and water quality-based requirements of the CWA; and,
- Minimize the impacts of CSOs on water quality, aquatic biota, and human health.

Additionally, as specified by the Consent Decree, the MSD Final CSO LTCP shall include, at a minimum, the following elements:

- The results of characterization, monitoring, modeling activities, and design parameters as the basis for selection and design of effective CSO controls (including control to address those discharges resulting from MSD's compliance with the requirements of the USACE's "Ohio River Flood Protection System Operations Manual," dated 1954 and revised 1988.
- The results of an evaluation of WQTC peak flow treatment capacity for any WQTC, other than Morris Forman WQTC, that will receive additional flow based on the MSD LTCP project. Such evaluation shall be consistent with the EPA publications "Improving POTW Performance Using the Composite Correction Approach," (EPA CERI, October 1984), and "Retrofitting POTWs," (EPA CERI, July 1989).
- A report on the public participation process.

- Description of how the MSD Final CSO LTCP addresses sensitive areas as the highest priority for controlling overflows.
- A report on the cost analyses of the alternatives considered.
- Operational plan revisions to include agreed-upon long-term CSO controls.
- Maximization of treatment and evaluation of treatment capacity at Morris Forman WQTC.
- Identification of and an implementation schedule for the selected CSO controls.
- A post-construction compliance monitoring program adequate to verify compliance with water quality-based CWA requirements and ascertain the effectiveness of CSO controls.

1.4 GUIDANCE TO SUPPORT IMPLEMENTATION OF THE CSO CONTROL POLICY

Implementation of the Consent Decree program and both the CSO LTCP and the Sanitary Sewer Discharge Plan (SSDP), will continue for many years. Recognizing the need for consistent, long-term direction for the Consent Decree, along with planning, coordination, and reporting activities, MSD initiated Project WIN (Waterway Improvements Now). As presented in Volume 1, Project WIN's mission is to provide oversight and guidance of the activities required to comply with the terms and conditions of the Consent Decree. This requires initiating, organizing, coordinating and managing a diverse set of elements, programs, and projects to successfully discharge all Consent Decree obligations.

Project WIN's goals are as follows:

- Identify, design, and implement projects and programs that reduce CSO events and mitigate their impact to comply with the CWA and the CSO Policy.
- Identify, design, and implement projects and programs that eliminate unauthorized discharges in both the separate SSS and the CSS, providing the level of protection indicated by the selected design event.
- Select projects and programs that satisfy the Consent Decree requirements, and at the same time support and protect a broad spectrum of community values.
- Implement the projects and programs in a manner that will efficiently use MSD's available resources while creating benefits related to Louisville Metro's community values.

1.5 CSO LTCP DOCUMENT ORGANIZATION

As the second volume of the IOAP, the Final CSO LTCP focuses on the control and mitigation of CSOs. The LTCP outline as well as a brief description of each chapter is given below. The second volume of the IOAP focuses on the control and mitigation of the CSOs.

Chapter 1 Introduction

This chapter includes a history of MSD's control policy for CSOs and a summary of the policy's key elements. Also provided are general descriptions of the current CSO control efforts, control processes, and criteria for success. Sections outlining the public's participation and agency interactions specifically relative to the Final CSO LTCP are included.

Chapter 2 System Characterization

This chapter provides extensive analysis of CSO areas. Analysis includes existing baseline conditions of the CSO area, monitoring of CSO flows, CSO quality sampling, and combined modeling of the sewer system and receiving waters.

Chapter 3 Development and Evaluation of Alternatives for CSO Control

This chapter discusses the approach and factors used to identify, develop, evaluate, and select projects that make up the recommended projects and programs in the Final CSO LTCP.

Chapter 4 Selection of the Long-Term Control Plan

This chapter includes an explanation of the values-based risk management process used to select and prioritize the Final CSO LTCP alternatives. Issues discussed include community values, benefit/cost analysis, environmental impact, technical concerns, prioritization of projects, and implementation schedules compatible with the Consent Decree requirements.

1.6 LONG-TERM PLANNING APPROACH SUMMARY

1.6.1 Initial Activities

Since the development of MSD's initial LTCP, MSD has been implementing plan elements to reduce the pollutant load on receiving streams from CSOs. The following sections provide a summary of CSO LTCP Implementation accomplishments through December 2008.

1.6.1.1 January 1991 to December 1992

During 1991 and 1992, MSD's CSO program focused on characterization, monitoring, and modeling activities to assist in the selection and design of effective CSO controls. Specific activities included the inventorying of CSS assets and developing the tools required to move forward with the development of a CSO LTCP.

The accomplishments achieved during this period included:

- Maintenance Programs for CSS Assets: Development of a detailed inventory that determined the operational status of all assets.
- System Evaluated: Evaluation of CSS included pump stations, overflows and regulators.
- Flow Monitoring Program: Conducted a program to provide calibration data for the CSO Stormwater and Wastewater Management Model (SWMM) model and developed a SWMM model of the CSS.
- CSO and Stream Sampling Program: Executed a CSO and stream-sampling program to quantify the impact of CSOs on the receiving streams.
- CSO Nutrient Release Estimates: Estimated annual CSO nutrient release to quantify the impact of CSOs on the receiving streams.
- CSS Flooding Analysis: Performed a flooding analysis associated with the CSS focused on the Ohio River North and Ohio River West regions.
- Evaluated Impacts to CSS: Evaluated major stormwater impacts and industrial loadings to the CSS.
- Public Education Program Summary: Summarized MSD's public education program relative to the CSS.

1.6.1.2 July 1993 to November 1998

During this period, MSD continued to focus on the development and implementation of a long-term capital program for planning, design, and construction of new facilities and the improvement of existing facilities and systems to minimize the frequency and volume of CSS overflows.

MSD evaluated alternatives in its plan based on cost, performance in meeting the programmatic objectives, contribution toward attainment of water quality standards, and operational performance. The prioritized projects were incorporated into a rolling five-year Capital Improvement Program and budget. Specific program accomplishments from 1993 - 1998 relative to implementation of the LTCP are summarized below:

- LTCP for Beargrass Creek Region developed.
- LTCP for the Ohio River North and Ohio River West Regions developed.
- System Flow Monitoring and Sampling: Setup at selected CSO outfalls.
- Evaluated localized surface flooding issues: Evaluations at various locations throughout the CSS that were typically a result of limited inlet capacity.
- CDS Unit at CSO050 for S&F control: Constructed and installed a CDS which is a liquids-solids separation technology typically used for stormwater management. The facility began operations in February 1998 and is used for S&F control.

- Wheeler Avenue CSO/Flood Control Basin: Constructed the basin to provide flooding relief for the area and to reduce overflows at CSO015. The project was accomplished by constructing a 4.9 MG flood control basin, constructing a 553,000-gallon CSO Basin inside the flood control basin, providing 1.1 MG of storage in the 78-inch combined sewer, regulating the rate of flow to the Mill Creek Trunk and preventing the Mill Creek Trunk from backing up into the area. The conveyance pipe for Wheeler Avenue storage basin is operated as part of the RTC System. The RTC component of the Wheeler Avenue storage basin conveyance was completed in December 2008.
- Plumbing Modification Program: Implemented on a countywide basis. The Plumbing Modification Program was initially intended to provide protection to designated critical areas in the CSS experiencing chronic problems due to basement backups. A major accomplishment was the minimization of public health concerns resulting from the combined and sanitary sewer systems backing up into customer basements. The program resulted in the removal of downspouts directly connected to the CSS thereby reducing storm flow into the CSS. To-date over 8,100 backflow prevention devices have been installed. This program is currently being implemented on a priority area and evaluated need basis.

1.6.1.3 December 1998 to December 2008

During this period, MSD's CSO LTCP continued to focus on program development and implementation to achieve compliance with the CSO policy through the continued evolution and development of its LTCP efforts. Below is a summary of specific accomplishments during this period.

- CDS Unit: Installed a CDS Unit as a demonstration project for S&F control on CSO108. This liquids-solids separation technology had typically been applied to stormwater management. The CDS facility project became part of an EPA and National Sanitation Foundation International partnership with the Environmental Technology Verification Program and Water Quality Protection Center program to verify commercial-ready technologies that protect surface waters from contamination.
- Screenings Facility: Installed gross screenings facility at Beargrass Creek using two diversion booms and two trash baskets to collect S&F from the creek. This concept differed from other S&F control facilities because it screened the entire stream channel. The objective was to remove S&F within the stream channel, capture S&F originating from point and non-point sources, and create a more aesthetically pleasing environment suitable for recreation.
- Sewer Separation on CSO206, located in Cherokee Park: Evaluated, designed, and initiated construction for sewer separation on CSO206. The field investigation was completed during October 1999. Recommendations included a three-phased sewer separation project for the elimination of CSO206. Projects included reconnection of sanitary and storm sewers to their proper conveyance pipe, manhole remodeling, downspout disconnection, relining of sanitary sewers and relining of home services that run under the parallel storm sewers. Design of the sewer separation for the CSO206

area was initiated in 1999. The CSO206 Project was separated into 15 sub-areas, the design was completed, and construction began in 2000. Sub-areas 1 through 9 were completed by 2005 and remaining sub-areas will be completed by March 31, 2009.

- CSO211 In-line Storage Project: Constructed the CSO211 In-line Storage Project located at the main diversion structure. The goal of this project was to reduce overflow volume and maximize flows to the Morris Forman WQTC (up to the full Morris Forman WQTC capacity) from the Southern Outfall during wet weather. To provide treatment for the maximum flow possible, an inflatable gate was placed at the overflow from the main diversion structure. The gate provides the ability to raise the water level to provide sufficient head to provide the short duration peak 350 mgd flow rate to the Morris Forman WQTC. The gate reduces the annual overflow volume at CSO211. Operation of the gate will ultimately be incorporated into the RTC effort for achieving in-line storage of wastewater.
- Eliminated CSO209 through Sewer Separation: The 105-acre area served through CSO209 consists of approximately 350 residential properties. The system was separated and the CSO permanently closed in September 2005 following completion of the related downspout removal project.
- Constructed the Sneads Branch Relief In-line Storage Facility: The facility uses the Sneads Branch Relief Drain as a CSO storage facility via the operation of an inflatable rubber gate. The gate is located approximately 200 feet from the outlet of the Sneads Branch Relief Drain to the South Fork of Beargrass Creek channelized section. The storage capacity of this facility when the gate is fully inflated is approximately 2.5 MG. The facility is designed to capture flows from the eleven CSOs tributary to the Sneads Branch Relief Drain and pump the stored volume to the Beargrass Interceptor to be conveyed to the Robert J. Starkey Pumping Plant (formerly known as the Buchanan Street Pump Station) and then on to the Morris Forman WQTC for treatment. Cleaned the Northeastern Sanitary Trunk Sewer: Cleaning increases the sewer's carrying capacity and reduce overflows. The Northeastern Sanitary Trunk Sewer Cleaning project involved the removal of an estimated 15-inch of deposition within the 5.5-foot diameter Northeastern Sanitary Trunk Sewer. The cleaning restored full capacity to the Northeastern Sanitary Trunk Sewer and greatly increased usable storage volume for smaller, more frequent storm events.
- Expanded the Robert J. Starkey Pumping Plant: The expanded plant increased pumping capacity from 125 mgd to 140 mgd and reduced overflows at CSO020 and CSO062. Estimates show this project resulted in a reduction of approximately 70 mgd in the average annual overflow volume (AAOV). The upgraded pumping plant included a new wet well adjacent to the old wet well; four new variable speed, submersible pumps capable of handling 35 mgd each; two channel grinders with hydraulic motors for screening; hydraulically operated slide and sluice gates for control of flow through the pump station; a new electrical substation; new instrumentation and control, and included provisions for telemetry.
- Constructed the Upper Dry Run Trunk Storage Basins (Executive Inn and Brady Lake Basins): Basins provide flooding relief and reduce overflows at CSO015. The project included the construction of two earthen basins (17.3 MG and 15.3 MG) on the Kentucky

Fair and Exposition Center property, and the construction of 1,922 linear feet of 60" diameter sewer. Both the Executive Inn Basin and the Brady Lake Basin are operated as part of the RTC System.

- Implemented Phase One of the RTC Program: The initial phase of RTC consisted of remotely controlling five sites by means of a centralized-decision-making system. The objectives for this program are a better use of the existing in-line storage capacity, a decrease of CSO volumes in the Beargrass Creek and Ohio River Watersheds, and an increase of the wastewater volume conveyed to the Morris Forman WQTC. The RTC approach is both global and predictive, which means that the decision making system will use available information monitored on the sewer network, and predicted by the Radar Rainfall Data System, to determine the best flow management strategy. The initial phase included the set up of a centralized decision making system, a radar rainfall data system to predict weather over a two-hour window, and remote control of five sites within the CSS. The initial five sites included Southeastern Diversion Structure, Nightingale Pump Station (CSO018), Southwestern Pump Station (CSO015), Upper Dry Run Trunk Storage Basins (CSO015), and Sneads Branch Relief In-line Storage Project.
- Developed Radar Rainfall Data System: The intent of the Radar Rainfall Data System project is two-fold: to calibrate Next-Generation Radar (NEXRAD) radar with rain gauge data, and to provide predictive rainfall data two hours in advance of rainfall. The information provided by the Radar Rainfall Data System is utilized by the RTC system in an effort to better utilize the in-line storage capacity of the existing CSS.
- Remediated the 11th Street and Rowan Street Connections: The project corrected improperly connected property service connections tied to the storm sewer system near the intersection of 11th Street and Rowan Street, and the sanitary services located at the 10th Street Flood Pump Station.
- Completed Riverside Area Sewer Reconnection Project: Separate storm and sanitary sewers were provided at the area west of the Beargrass Creek Pump Station, east of Second Street and inside the floodwall. However, 27 commercial and residential properties were left connected to the storm sewer resulting in dry weather overflows. These properties were successfully reconnected to the sanitary sewer in 1997 and the dry weather overflows were eliminated.

Other accomplishments during 1998 to present include:

- Installed S&F controls on CSO109, CSO113, CSO126, CSO127 and CSO166 using Copa Cross Wave Static Screens. The static screen reduces the volume of S&F within the overflow stream.
- Installed S&F controls on CSO028, CSO030, CSO034, CSO054, CSO082 and CSO119 using Copa Cyclone Screen. The device is a low maintenance S&F screen.
- Installed S&F controls on CSO125 and CSO144 using Hydro International Wave Static Screens. Both of the CSOs utilized static screens to reduce the amounts of S&F within the overflow stream.

- Eliminated CSO123 through sewer separation.
- Reduced the AAOV at CSO088 through sewer separation. The original combined sewer was transformed into a sanitary sewer and a new storm sewer was constructed.
- Eliminated CSO080 through sewer separation.
- Upgraded wet weather capacity at Morris Forman WQTC which was completed in 2000.
- Modified the headworks at Morris Forman WQTC which was completed in 2000.
- Eliminated CSO209, CSO087 and CSO147 through sewer separation by transforming the existing combined sewer into a sanitary sewer and a new storm sewer.
- Replaced the four Northern Ditch Pump Station Pumps with new 14,000 gallons per minute (gpm) submersible tubular casing pumps. These renovations of the pump station greatly increase the station reliability and improve the functioning of the RTC system.
- Eliminated CSO030, CSO032, CSO033, CSO081 and CSO194 based on quick closure effort.
- Willow Pond Disconnection Project at CSO127 in progress.
- CSO131 S&F control device replaced baffle with cyclone screening device.
- CSO206 sub-areas 10-15 sewer separation completed.

1.6.2 Public Participation

To meet the requirements of the CWA, the public program as required by the CSO Control Policy was based upon two concepts: public notification and public participation. The CSO Policy (NMC 8) requires public notification of overflows. Public participation includes public engagement in the decision making process and selection of long-term controls. Volume 1 of the IOAP presents a detailed description of the public participation program.

In addition to the requirements of the CSO Policy, MSD considered the public participation program essential to ensure public acceptance of the Final CSO LTCP priorities and projects and to ensure there is public willingness to pay for the infrastructure program over a long time period. Additionally, the public needs to be informed that the Final CSO LTCP will not eliminate all overflows under all conditions nor will it guarantee that no harmful pollutants will be discharged to Beargrass Creek and the Ohio River under certain conditions.

MSD's Public Program is made up of four major components; Public Notification, Wet Weather Team (WWT) Engagement, General Programmatic Outreach and Educational Activities, and Regulatory Reporting and Agency Meetings. A continued participation of the public and a continued public outreach program will be essential throughout the entire life of the program in order to continue the support for ongoing rate increases and tolerance for the nuisance and inconvenience of project construction.

1.6.2.1 Public Notification

Public notification, as required by the CSO policy, is intended to inform the public of potential CSOs, their location, and the possible public health and environmental effects of the overflows. The public notification of potential or actual CSOs also informs the public to curtail recreational activities or commercial activities in areas directly or indirectly affected by overflows. MSD's public notification efforts include permanent CSO signage, temporary overflow warning signs, email notification of events (public and regulators), and Web page notification.

1.6.2.2 Wet Weather Team (WWT) Engagement

MSD assembled a WWT to participate in the development and implementation of the Final CSO LTCP. To address the engineering, economic, environmental, and institutional issues raised during the evaluation and implementation of the Final CSO LTCP, local WWT members included elected officials, union and community leaders, and other stakeholders. The WWT was charged with preparing a plan for funding the MSD Wet Weather Program, and developing a program for public information, education and involvement. Other objectives of the WWT were to advise MSD on overall investment, policy, and performance choices in the development, and implementation of the Wet Weather Program.

MSD's public outreach program successfully gained the approval of the elected officials to enter into debt and raise rates to cover that debt in order to finance Project WIN projects. MSD fully understands that it was not only the WWT team process, but also the public meetings and the public hearing that helped MSD establish the priorities and schedule for the overflow abatement program. All documents from the WWT meetings are available on the Project WIN website.

1.6.2.3 Public Meetings

To gain public input and acceptance of the recommended plan, MSD convened four rounds of public meetings. The first round of meetings, held in April and May of 2007, provided the public with the history and evolution of MSD's sewer system, how the proposed sewer rate increase is related to the Consent Decree, as well as to identify the actions individual property owners can implement to help improve stream water quality within Louisville Metro.

The second round of public meetings held October through December 2007, provided an update on the LTCP planning process and obtained feedback from the public on the proposed rate increase necessary to fund the plan. The third round of public meetings, held in May 2008, was designed to give the public and impacted neighborhoods details of the types, locations, and size of facilities that would be constructed as well as their proposed schedule of construction. The fourth round of public meetings held in November 2008, continued a dialogue and created a level of interest with the public about the content of the Final CSO LTCP.

1.6.3 Regulatory Reporting and Agency Meetings

Throughout the development of the LTCP, MSD scheduled meetings with regulatory agencies having jurisdiction over the program in order to facilitate open communication between MSD and the regulators regarding progress and compliance with Consent Decree requirements. Electronic reporting updates requested by KDEP and EPA were developed and implemented to provide current information. The electronic reporting tools developed by MSD to improve communication with EPA/KDEP and the public are described below:

- The Initial Discharge Report for any overflow that reaches the Waters of the US is sent to EPA and KDEP via email. If the overflow report has not been closed when initially sent because data is not yet available, a second email is sent with updated information when the report is closed. This Initial Discharge Report system polls the Hansen database twice a day and sends emails on qualifying overflows.
- MSD posts the Discharge Monitoring Reports for all WQTCs on the Project WIN webpage. DMRs are posted within 10 days of the required submittal date.
- MSD posts information on any blending event at the Jeffersontown WQTC on the Project WIN webpage.
- MSD enhanced the overflow notification system. Emails are automatically sent to subscribers to inform them when a rain event has occurred that may trigger overflows or when a large volume dry weather overflow has occurred. A second email is sent 48 hours after the end of the event to notify subscribers that conditions have returned to normal.
- On both the MSD and Project WIN webpages, the Overflow Advisory Level displays green when conditions are normal, yellow when a dry weather overflow over 2,000 gallons has occurred, and red during a rain event.
- MSD added an interactive CSO/SSO Location Maps webpage on the Project WIN website. The interactive maps and tools allow the public to select an area and view active CSOs or documented SSOs. The user can also review a fact sheet with detailed information about each site. Refer to the following webpage to use this tool, http://www.msdlouky.org/projectwin/county_cso_sso.htm.

MSD prepares reports for each of the four quarters of the calendar year and submits them to EPA and KDEP within 30 days of the end of the new quarter. MSD also prepares and submits annual reports to the respective agencies. MSD posts these reports on its website at http://www.msdlouky.org/projectwin/docs.html for public review.

Quarterly reports include specific information about activities consistent with the requirements of the Consent Decree, and the progress toward the development of the Final CSO LTCP. In addition, MSD initiates periodic face-to-face meetings with technical team members from the KDEP and EPA to discuss the progress of the Project WIN overflow abatement program.

1.6.4 Coordination with State Water Quality Standards Authority

Water quality standards are intended to protect human health, aquatic life and its habitat, and recreational use of the nation's waterways. CSOs can cause water quality standards exceedances because of the pollutants that are present in sanitary sewage and stormwater runoff. The CSO Policy requires permittees to evaluate whether CSOs are causing exceedances of the water quality standards and to develop "clear levels of control that would be presumed to meet appropriate health and environmental objectives" (59 Federal Register

18689). The CSO Policy also recognizes the site-specific challenges that CSO communities can face in determining cost-effective controls to meet water quality standards at all times, under all conditions.

A key principle of the CSO Policy is the "[r]eview and revision, as appropriate, of water quality standards and their implementation procedures when developing CSO control plans to reflect site-specific wet weather impacts of CSOs" (59 (Code of Federal Register {CFR} 18689). Coordinating CSO Long-Term Planning with Water Quality Standards Reviews (US EPA, 2001) provides guidance on conducting these reviews. Some states, such as Indiana (IDEM, 2008); Massachusetts (MassDEP, 2007), and Maine (MDEP, 2003), have established revisions to their water quality standards to specifically address the challenges associated with CSO control.

If current standards cannot be met in a reasonable timeframe with cost-effective levels of control, permittees will work with the state water quality standards authority (KDEP) to determine the appropriate mechanism for ensuring that the LTCP will meet water quality standards. The role of the Kentucky water quality standards authority is to review standards in CSO-impacted receiving water bodies; coordinate the review with the LTCP development; and revise the standards as appropriate. These revisions can include development of site-specific criteria modification of the designated use or establishing a temporary variance.

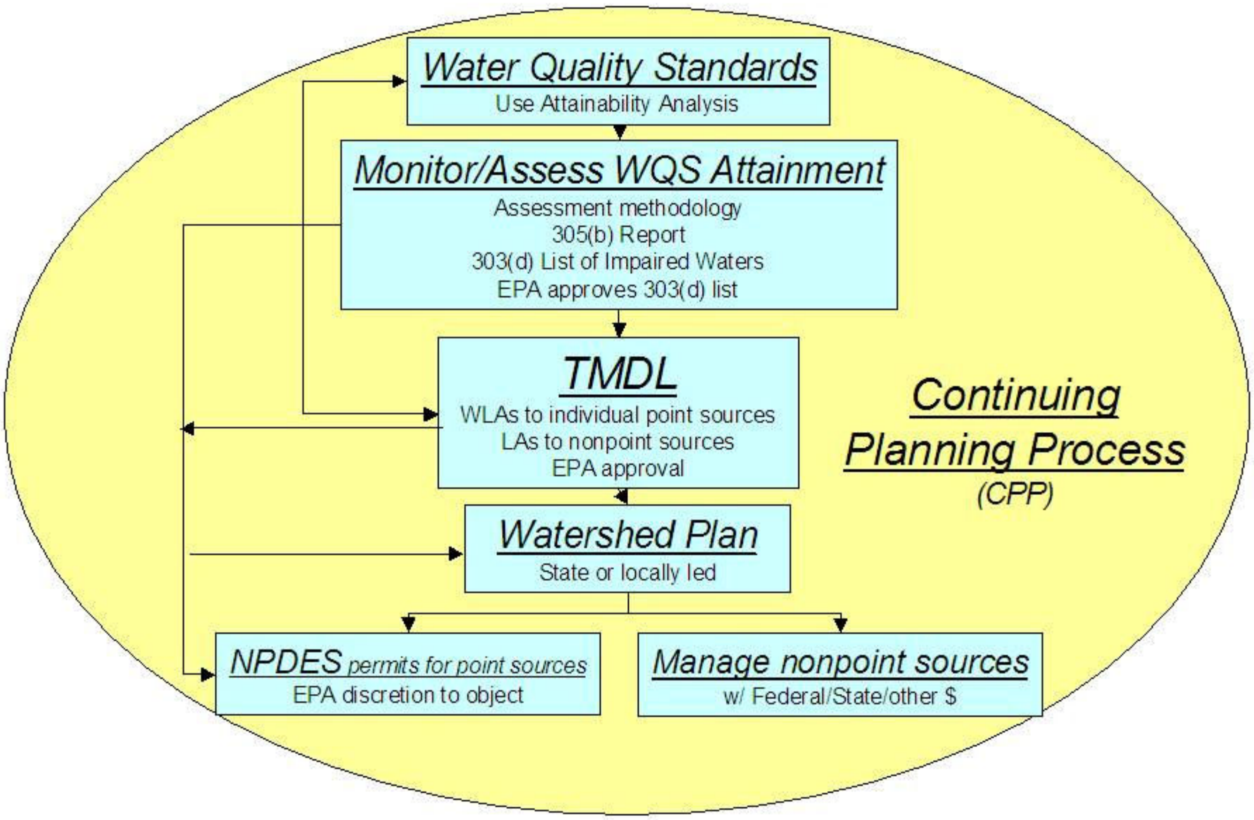
This approach is consistent with the Continual Planning Process contained in the CWA, as shown in Figure 1.6.1. This figure shows how the CWA framework result in appropriate water quality standards and reasonable TMDLs, NPDES permit limits, and nonpoint source controls.

The first step is to start with appropriate water quality standards, and monitoring and assessing whether a water body is meeting these standards. If not, a TMDL is required to establish allowable loads for point sources (such as WQTCs, CSOs, or stormwater discharges) and nonpoint sources (like agriculture runoff).

A watershed or implementation plan is then developed to identify how to achieve these load reductions. This can be challenging since load reductions, particularly for bacteria, can often be 90 percent (or more) of current loads because of the existing water quality standard. If the load reductions are not feasible, then the process for establishing achievable and appropriate water quality standards is the UAA, which is shown at the top of Figure 1.6.1.

As MSD implements CSO controls and conducts additional updates to its LTCP, review and revision of the water quality standards may be appropriate. ORSANCO adopted a provision in its water quality standards for the Ohio River allowing for development and application of alternative criteria if CSO communities have submitted a LTCP and a UAA (ORSANCO, 2006). MSD intends to implement the controls recommended in the updated LTCP and then evaluate whether development of a UAA or additional CSO or other pollutant source controls are warranted.

FIGURE 1.6.1 USE ATTAINABILITY ANALYSES IN THE CONTINUAL PLANNING PROCESS (US EPA, 2006)



1.6.4.1 Kentucky's Water Quality Use Classifications

Kentucky's Water Quality Regulations establish surface water use classifications for all waters of the Commonwealth. Table 1.6.1 summarizes the identified use classifications.

TABLE 1.6.1

KENTUCKY'S WATER QUALITY REGULATIONS

SURFACE WATER USE CLASSIFICATIONS

Kentucky's Water Quality Regulations	Surface Water Use Classifications
WAH	Warm Water Aquatic Habitat
CAH	Cold Water Aquatic Habitat
PCR	Primary Contact Recreation
SCR	Secondary Contact Recreation
DWS (Domestic Water Supply)	Applicable at existing points of public water supply disposal
OSRW	Outstanding State Resource Water

Table 1.6.2 summarizes the designated stream uses for the surface water bodies within the Ohio River near Louisville Metro and the Beargrass Creek Basin.

TABLE 1.6.2

STREAM USE DESIGNATION

Stream	Use Designation
Ohio River - Main Stem	WAH, PCR, SCR, DWS
South Fork Beargrass Creek and Tributaries	WAH, PCR, SCR
Middle Fork Beargrass Creek and Tributaries	WAH, PCR, SCR
Muddy Fork Beargrass Creek and Tributaries	WAH, PCR

For warm water aquatic habitat, the water quality standards require the following:

- The dissolved oxygen is to be maintained at a minimum concentration of 5.0 milligrams per liter (mg/l) daily average; the instantaneous minimum shall not be less than 4.0 mg/l.
- Total dissolved solids and total suspended solids (TSS) are not to be changed to the extent that the indigenous aquatic community is adversely affected.
- The addition of settleable solids that may alter the stream bottom and adversely affect productive aquatic communities is prohibited.
- The concentration of un-ionized ammonia shall not be greater than 0.05 mg/l at any time in-stream after mixing.

For recreational waters that are designated for primary contact recreation, the fecal coliform or Escherichia Coli (E. Coli) shall not exceed 200 colonies/100 milliliter (ml) or 130 colonies/100 ml, respectively, as a geometric mean based on not less than five samples taken during a 30-day period. Further, the fecal coliform concentration shall not exceed 400 colonies/100 ml in 20 percent or more of all samples taken during a 30-day period, or 240 colonies/100 ml for E. Coli. The above limits apply to the recreational season defined as May 1 to October 31.

For the non-recreational period from November 1 to April 30, the fecal coliform concentration criteria are the same as the criteria for secondary contact recreation. These criteria require that the fecal coliform content be no greater than 1,000 colonies/100 ml as a 30-day geometric mean, and no greater than 2,000 colonies/100 ml in 20 percent or more of the samples taken during a 30-day period.

For the main stem of the Ohio River, the dissolved oxygen is to be 5.0 mg/l or higher per day, and shall not be less than 4.0 mg/l, except during the August 15 through June 15 spawning season when a minimum of 5.1 mg/l is to be maintained.

Kentucky Department for Environmental Protection (KDEP) 2004 303(d) listing of impaired water in Kentucky provides additional insight into the ability of these surface waters to meet its designated uses, and lists the pollutants of concern that are the likely causes of the impairments. See Table 1.6.3 for details.

TABLE 1.6.3

2004 KENTUCKY 303(D) LIST

Streams	Priority	Impaired Use	Pollutant of Concern
Beargrass Creek of Ohio River (mile 0.0 to 1.5)	**First**	Aquatic Life (Nonsupport)	Metals, Organic Enrichment/Low dissolved oxygen
Middle Fork of Beargrass Creek (mile 0.0 to 2.3)	**First**	Aquatic Life (Nonsupport) Swimming (Nonsupport)	Organic Enrichment/Low dissolved oxygen, Habitat Alteration (other than flow), Metals (Cadmium), Pathogens
Middle Fork of Beargrass Creek (mile 2.3 to 15.2)	**First**	Aquatic Life (Partial support) Swimming (Nonsupport)	Metals (Cadmium), Pathogens
Muddy Fork of Beargrass Creek (mile 0.0 to 6.9)	**First**	Swimming (Nonsupport)	Pathogens
South Fork of Beargrass Creek (mile 0.0 to 2.7)	**First**	Swimming (Nonsupport) Aquatic Life (Partial Support)	Metals (Cadmium), Pathogens, Organic Enrichment/Low dissolved oxygen
South Fork of Beargrass Creek (mile 2.7 to 14.6)	**First**	Aquatic Life (Partial Support) Swimming (Nonsupport)	Pathogens, Organic Enrichment/Low dissolved oxygen
Ohio River (main stem) (mile 317.1 to 981.0)	**Second**	Fish Consumption (Partial Support)	Chlordane
Ohio River of Mississippi River (mile 609.7 to 617.6)	**Second**	Swimming (Partial Support)	Pathogens
Ohio River of Mississippi River (mile 606.8 to 609.7)	**Second**	Swimming (Nonsupport) Fish Consumption (Partial Support)	Pathogens, Poly-chlorinated Biphenols (PCBs), Dioxin
Ohio River of Mississippi River (mile 617.6 to 629.9)	**Second**	Swimming (Nonsupport), Fish Consumption (Partial Support) Domestic Water Supply (Nonsupport)	Pathogens, PCBs, Dioxin

1.6.4.2 Ohio River Considerations

ORSANCO conducted a study of wet weather impacts on the Ohio River beginning in 2000, concluding with a final report in late 2004. The report is entitled, "Wet Weather Impact Study on the Ohio River - Louisville/Southern Indiana Area, 2004." This study examined on a preliminary basis the impacts on water quality from wet weather discharges from major tributaries, WQTCs and CSOs in Kentucky and Indiana. The study area lay within the McAlpine Locks and Dams and Cannelton pools of the Ohio River, with the major communities of Louisville Metro, Kentucky, and Jeffersonville, Indiana being the major communities in the study area. The following is a summary of the major conclusions from the ORSANCO study.

- CSO sources account for about 18 percent of the fecal coliform load and 22 percent of the E. Coli load to the Ohio River on an annual basis. Louisville Metro's share of the total annual fecal coliform load was 15.7 percent, and 16.9 percent of the annual E. Coli load.
- CSOs cause the pathogen criteria to be exceeded between five percent and 10 percent of the days during the recreation season. Although other days exceeded criteria, sources other than CSOs (tributary and upstream loads) were believed to be the causes.
- The ORSANCO model was believed to be very useful as a planning tool, but was not well-suited for use as a predictor of absolute concentrations in the river.
- The report indicated that the most realistic CSO reduction scenario (control of most, but not all CSOs) would have very little benefit in reducing the frequency of days that exceed the single sample maximum water quality standard. Although, the report noted that the alternative would have a noticeable benefit in reducing peak in-stream concentrations.
- Eliminating CSOs appeared to be less beneficial than eliminating upstream and tributary sources (by five to 10 percent). It appears that either CSOs or tributaries alone will cause water quality exceedences because removing either one alone will not significantly reduce the days of exceedences; rather, reducing both would achieve significant benefits. This supports the watershed approach to achieving water quality standards.

The ORSANCO study also showed that controlling CSOs by 100 percent could reduce the number of days exceeding the fecal coliform and instantaneous maximum criterion from 60 percent to 40 percent, a 20 percent reduction. Data was presented for the removal of the total CSO load (without stormwater), and for the removal of only the sanitary component of the wet weather load (with stormwater). The latter includes the wet weather stormwater runoff loads that would continue to discharge to the river if sewer separation were implemented. Comparison of the two options indicate that sewer separation would be of negligible benefit, since the number of days exceeding the instantaneous maximum would be nearly the same for the sewer separation case as it is for the existing condition case. Thus, the 20 percent reduction seems to be achievable only if both the CSO and stormwater loads of bacteria were substantially reduced (>95 percent).

1.6.4.3 Beargrass Creek Watershed

Many efforts have been undertaken over the past 13 years to obtain better information on the pollutant load characteristics being discharged into Beargrass Creek from CSOs, sanitary sewer overflows (SSOs), and stormwater discharges. One effort included a sampling program in 1992 and 1993 in which samples were taken at several CSOs and at several locations in-stream. Other sources of data were included in The Synthesis Report of 1999, which summarized sampling results taken in the Beargrass Creek Basin over several years.

Beginning in 2005, a significant monitoring and modeling effort was undertaken to support the development of TMDLs as well as development of a WQT model. The continuous monitoring effort consisted of 14 in-stream, "continuous" monitors collecting water temperature, pH, dissolved oxygen, dissolved oxygen saturation (percent dissolved oxygen), and specific conductance at 15-minute intervals. Ammonia data were also collected using continuous monitors at some locations. Three United States Geological Survey (USGS) gauges monitored "continuous" (15-minute interval) stream flow data. Discontinuous data was collected during both dry and wet weather conditions. Sampling occurred within the stream, at CSO locations, and from runoff from specific landuses according to the Quality Assurance Project Plans (QAPPs) developed specifically for the Beargrass Creek WQT/TMDL project.

An additional discrete event sampling project was conducted to support the WQT Model calibration/validation. Eight CSOs in the Beargrass Creek watershed were selected based on a sample population of 15 percent of the total CSO population. Each of these sites was sampled for E. Coli, total phosphorus, total nitrogen, TSS, and biochemical oxygen demand. The eight sites also had flow meters in place recording flow and probes were in place measuring temperature, conductivity, pH, and dissolved oxygen. The maximum CSO samples collected per site is nine, which include eight grab samples and one event composite at a time interval of 15 minutes for the first hour and every two hours up to six hours.

In-stream samples were collected to define background loading as well as to characterize the individual impacts of the CSOs on the receiving waters of Beargrass Creek. A total of 23 sites are currently being sampled for the same parameters as CSOs.

1.6.4.4 CSO Discharges and Water Quality Issues

The ORSANCO study showed that CSOs are a significant source of bacteria loadings to the Ohio River. However, other sources, such as tributaries and stormwater discharges, also contribute substantially to the bacteria loadings. Further definition of the relative significance of these sources has been undertaken during the development of the Final CSO LTCP. Dissolved oxygen was not identified as a concern in the 303(d) listing for the Ohio River (see Table 1.6.3).

In the Beargrass Creek watershed, the presence of pathogens, organic enrichment, some metals and low dissolved oxygen, is common in all the tributaries. The Beargrass Creek TMDL effort currently under way in the watershed will identify the respective contributions of CSOs, stormwater discharge loads, and potential other sources, and develop a strategy for controlling the varied sources to meet water quality standards, if possible.

1.6.5 Integration of Current CSO Control Efforts

In accordance with Paragraph 24a of the Consent Decree, MSD was required to implement an Early Action Plan (EAP). The purpose of the EAP is the immediate reduction of overflow events through improved operation and control of MSD's collection, conveyance, and treatment system.

As outlined in Volume 1, Chapter 4, MSD's EAP for CSO Program is based on the EPA document, "Combined Sewer Overflows Guidance for Nine Minimum Controls", plus capital improvements and SSO related initiatives. The NMC are technology-based actions or measures designed to reduce the number of CSO events and to mitigate their effects on water quality. As required by the Consent Decree, MSD submitted a NMC Compliance Report to the EPA and the KDEP on February 10, 2006. MSD received an approval letter dated February 22, 2007, for the NMC Compliance Report.

The following is an overview of MSD's implementation of the NMCs.

NMC 1- Proper Operation and Maintenance Program

MSD established an integrated program to train responsible staff on the inspection and maintenance of critical assets of the CSS system to allow for their effective operation. These critical assets included the collection system, catch basins, CSO structures, pump stations, and the Morris Forman WQTC.

NMC 2- Maximization of Storage in the Collection

MSD maximized the in-system storage capacity of the existing CSS, thereby reducing the discharge volume, frequency, and duration of CSO events. MSD achieved compliance by documenting actions that increased the usable storage capacity of the CSS. Examples of maximizing in-system storage capacity included installation of flap gates on selected CSO outfalls tributary to Beargrass Creek and the Ohio River and raising the dams and weirs of selected CSO structures to achieve an increase in available storage capacity. Other actions taken by MSD to reduce the flow of water into the CSS included the repair of a leaking water reservoir and the installation of pervious pavement to reduce the volume of stormwater runoff entering the CSS during wet weather events. Additionally, the Plumbing Modifications Program was expanded to increase the removal of direct downspout and sump pump connections from the CSS. A significant increase of in-system storage capacity was also achieved with the implementation of the Supervisory Control and Data Acquisition (SCADA) and RTC systems that allow MSD to maximize the storage capacity of the CSS by predicting wet weather events, and monitoring and controlling the flow through the CSS.

NMC 3- Review and Modification of Pretreatment Requirements

MSD routinely inventories and inspects the facilities of private businesses within its service area when necessary, evaluates feasible modifications to the existing Pretreatment Program, Hazardous Materials Ordinance/Spill Prevention and Control Plan and the Industrial / Commercial Plumbing Plan Review Program.

NMC 4- Maximization of Flow to the Publicly Owned Treatment Works for Treatment

Using the RTC system to divert wet weather flow from CSO locations to the Morris Forman WQTC, MSD developed and implemented a program to increase the wet weather treatment capacity of the Morris Forman WQTC. The wet weather treatment capacity of the Morris Forman WQTC was increased from 225 mgd to a short duration peak flow capacity of 350 mgd with a sustainable capacity of 325 mgd via construction completed in 2000. In addition, MSD increased the capacity of select pump stations to convey additional wastewater flow to the Morris Forman WQTC. Upgrades and modifications of certain pump stations have allowed MSD to further increase wet weather flow to the Morris Forman WQTC. Typical modifications at these pump stations included increasing their wet well volume, or raising the dam levels to allow more wastewater to be stored in-system. The stored wastewater is then pumped to the Morris Forman WQTC as capacity becomes available.

NMC 5- Elimination of CSOs during Dry Weather

MSD reviewed and assessed the causes of previous dry weather overflows and took immediate corrective actions necessary to remediate each occurrence. Examples included mechanical repairs or upgrades at the WQTCs and pump stations, installment of back-up power generators, increasing the elevation of overflow dams, and removal of CSS blockages. To prevent the occurrence of additional dry weather overflows, MSD uses a variety of programs such as routine inspection and maintenance of the CSS as well as computer models simulations of the CSS to predict the location of potential DWOs and evaluate cost-effective solutions.

NMC 6- Control of Solids and Floatable Materials in CSOs

MSD evaluated modifying in-line controls such as dams and weirs and installing end-of-pipe control devices to remove S&F materials from CSO discharges. In-line control devices function by keeping S&F within the CSS, thereby preventing them from exiting the system and entering the receiving waters. End-of-Pipe control devices also remove S&F, but are placed external to the CSS. MSD has installed appropriate S&F controls on CSOs including constructed steel screen/cages placed over the discharge points as well as constructed baffles immediately upstream of the CSO dam. MSD personnel maintain manual cleaning of the S&F devices on a regular basis to maintain the effectiveness. MSD routinely cleans approximately 30,000 catch basins in the CSS per year. Additionally, MSD partnered with the Louisville Metro Government and other community organizations to implement watershed level activities to reduce S&F from entering the CSS.

NMC 7- Pollution Prevention Programs to Reduce Contamination in CSOs

MSD administers several programs to address pollution prevention. These include the Erosion Prevention and Sediment Control Program and the Hazardous Materials Ordinance Program. MSD also takes an active role in administering the Industrial Pretreatment Program and the distribution of educational materials discussing BMPs for fats, oils, and grease (FOG) and mercury disposal. Wet weather flow minimization and water conservation are also relevant factors to this minimum control because they can reduce the frequency, volume, and duration of CSO events. MSD promotes water conservation by providing incentives for significant industrial users to reduce their discharge volumes and promotes and financially supports rain barrel and rain garden programs. MSD also supports and participates in numerous public education programs that target pollution prevention, including mass media campaigns and involvement with the Beargrass Creek Watershed Council, and the Youth Environmental Leadership Institute.

NMC 8- Public Notification

To ensure the public is aware of potential and actual overflows, MSD informs the public as to the location of existing CSO outfalls, as well as ongoing programmatic outreach and educational activities. Event based activities are initiated when a CSO event occurs, or is likely to occur. Examples of event based notification activities include door hangers, verbal and e-mail alerts, as well as a Sewer Overflow Advisory Level on MSD's website. Programmatic outreach and educational activities vary in an effort to reach the public and include warning signs posted at all CSO outfalls and at public access areas that are downstream of CSO outfalls. Lastly, MSD mails and posts on its website newsletters to notify, inform, and update the public as to the progress of various programs and efforts of programs and projects to reduce the frequency, volume, and duration of CSOs.

NMC 9- Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls

MSD updates infrastructure mapping and databases to record the geographical locations and physical conditions of existing CSS and CSO structures. In addition, MSD collects an extensive number of measurements and stores this data in a database. The measurements taken describe the quantity of CSO, and the quantity and quality of both the CSS waste stream and the receiving waters. Measured values include flow rates, nutrients, pH, biochemical oxygen demand, chemical oxygen demand, TSS, temperature, and dissolved oxygen. Using this information, MSD is able to assess the effectiveness of previously implemented CSO control measures. An important outcome of such extensive monitoring and documentation are the production of computer simulations of the existing CSS. The computer simulations allow MSD to estimate the impact of CSO events upon the receiving waters, and to predict the effect of implementing various alternatives upon the frequency, volume, and duration of CSOs.

1.6.6 Watershed Approach to CSO Control Planning

MSD has promoted the use of a watershed approach for improving water quality. The watershed approach, as it is commonly defined, provides a holistic framework for managing all the factors that influence water quality with a specific drainage area. MSDs watershed overall approach is described in Volume 1 of the IOAP.

For the Final CSO LTCP, the watershed approach is multi-scale, ranging from a site-specific end-of-pipe solution to a regional scale source reduction program. The watershed approach incorporates both "gray" technologies and "green" infrastructure solutions as well as other solutions that bridge the separate SSS and CSS.

1.6.6.1 Integration of SSS and CSS

The current CSS baseline condition receives approximately 45 percent of the total sanitary flow conveyed to Morris Forman WQTC from the separate SSS. Six boundary points separate sanitary flows that contribute to the CSS.

The boundary points are shown on the system map in Chapter 2, Figure 2.4.27 and are as follows:

- Beargrass Creek Interceptor, downstream of Southeastern Diversion Structure
- Goldsmith Lane Trunk Sewer
- Middle Fork Trunk Sewer at Park Boundary Road
- Northern Ditch Pump Station
- Ohio River Force Main (ORFM)
- Mellwood Trunk Sewer

The approach taken to integrate the SSS and the CSS for development of the Final CSO LTCP was to apply the benefit/cost analysis to projects at or near these six boundary points. Chapter 3 details a comprehensive list of projects developed at the onset of the CSO LTCP process. Some projects evaluated included benefit for both the SSS and the CSS. Examples of solutions developed within the SSS that also benefited the CSS included traditional end of pipe control technologies and separate SSS projects that off-loaded flow upstream of the CSS. Likewise, CSS projects, which reduced the inflows, created capacity in the interceptor pipe and thus benefit the SSS projects. As presented in Chapter 4, several of these projects were selected as the best alternatives.

1.6.6.2 Green Infrastructure Initiative

Throughout the public outreach program, MSD received a recurring appeal to integrate green technologies to reduce the frequency and volume of CSO discharges. Because of this encouragement and the dedication of leadership, MSD made a commitment to integrate green technologies into the Final CSO LTCP.

Green opportunity evaluations were performed on each sewershed that contained an active CSO. This process was a coarse evaluation to determine potential opportunities to implement green infrastructure within each sewershed. The goal of this exercise was to identify strategies to reduce the amount of stormwater runoff that enters the CSS, thus reducing overflow frequency, duration and volumes. This evaluation led to the identification of specific green projects and programs that could be implemented throughout the combined system.

The system-wide evaluation led to a recommendation to develop and implement a series of Green Infrastructure Programs that includes downspout disconnection, residential rain gardens, a rain barrel program, and green roof incentives. In an effort to estimate conservatively the net benefits of these programs in terms of CSO mitigation, MSD considered only the reductions from the proposed downspout disconnect program in the modeled reduction in runoff volume.

To determine the impact of the disconnection program on CSO activity, each sewershed was evaluated in terms of the anticipated number of downspouts that could reasonably be expected to be removed. This value was translated into a total impervious area removed from the CSS. This reduction was then applied uniformly across each sub-sewershed in the model, resulting in an estimated reduction in CSS activity. It is important to note that very conservative estimates were used in the basic assumptions from which these CSO reductions are derived. Chapter 3 Section 2.5 provides a detailed description of this analysis.

In addition to the proposed green programs, 19 green demonstration projects sites have been identified and evaluated. Project site locations were selected based on soils, geology, public visibility, property ownership, etc. For each proposed demonstration project, a project location and associated drainage area was determined. Each proposed project was then evaluated to estimate the effective reduction in impervious area for that particular site. This information was then input into the CSS model to evaluate the impact on CSO activity associated with the particular project.

It is important to note that the location of the project within the site drainage area as well as the overall size of the CSO drainage area has a significant bearing on the impact of the proposed project. For example, when evaluating the impact of a single project located within a large sewershed with an active CSO, the model may indicate little benefit in terms of reducing CSO activity. However, when this same project is evaluated on a site level comparing existing runoff to post development runoff using green infrastructure, significant reductions in loadings to the CSS are usually realized. In addition, cumulative effects of numerous site level reductions will, over time, result in overflow reductions. Therefore, when evaluating the benefits of green infrastructure, care should be taken in the interpretation of the results to ensure that a fair and accurate assessment is made.

Once the green demonstration projects and programs have been implemented, monitoring and modeling will determine the effectiveness of these controls on the reduction of stormwater runoff entering the CSS and the corresponding impact on CSO activity. The net result of the Green Infrastructure Program will potentially allow the proposed gray CSO controls, such as tanks and pipes, to be downsized or possibly eliminated due to the reduction in stormwater runoff entering the CSS.

1.6.7 Sensitive, Priority, and Recreational Use Areas

EPA's CSO Control Policy requires a recreational use survey and a sensitive area study be performed in preparation of a CSO LTCP. This work is to assist with identifying locations along the stream with the greatest potential for public contact and to prioritize implementation of CSO controls.

1.6.7.1 Sensitive Areas

EPA's CSO Control Policy requires that sensitive areas be given the highest priority for implementation of CSO controls. Typically, identifying sensitive areas within the watershed of concern provides a framework for developing a cost-effective, phased approach to CSO control implementation and selection of abatement alternatives. However, all waters of Beargrass Creek within the CSS have been identified as sensitive, based on their designation as primary contact waters and their potential to contain species identified as threatened, endangered, or of special concern. Thus, additional prioritization was necessary to develop a phased approach to implementing CSO controls.

MSD conducted an ecological reach characterization of Beargrass Creek, in support of the CSO control decision-making process, to implement effectively a phased approach to CSO control in the Beargrass Creek watershed. A characterization framework for prioritizing sensitive areas was constructed based on the degree of benefit anticipated to be gained by various control measures. A summary of this work is below. A more detailed presentation of this work follows in Chapter 2, Section 2.8 of this Volume.

The basis of this characterization framework was to segment Beargrass Creek within the CSS into discreet stream reaches and rate them based on an ecologically-sensitive, multi-parameter approach. This framework addressed ecological factors for evaluating CSO control project alternatives, which were then used in conjunction with the various other factors for overall control efforts prioritization. The rating scale reflects the ecological condition of each stream reach and the degree of benefit to be gained by water quality improvements. "Ecological condition" for these purposes was considered to be the existing, or realistic potential of, stream-related communities in terms of biological integrity, ecological function, and aesthetic/public health value. Based on this approach, reaches with high ratings would realize greater benefit from water quality improvements and, therefore, should be given higher priority during the CSO control and implementation decision process.

Ten parameters were identified to measure the ecological condition of each stream reach. A multi-parameter approach was necessary to accurately characterize existing/potential condition of stream reaches, especially in this highly urbanized environment. The parameters used for this characterization include:

- Accessibility – A measure of the potential for human contact with the creek. Data was obtained through field observations.
- Threatened/Endangered Species – A defined component of sensitive area study. This data was obtained from the Kentucky State Nature Preserves Commission.
- Stream Rapid Bioassessment Protocol – A method for assessing stream habitat quality and its ability to harbor a healthy ecological community.
- Bank Erosion Hazard Index – A measure of the potential for streambank erosion.

- Index of Biotic Integrity – An index developed for rating fish community assemblages as an indicator of the degree of impact from pollutants.
- CSO AAOV – Discharge modeled for each CSO for a synthetic typical year rainfall.
- Landuse – A classification system describing the types of human activities for a given area. For example, parks, residences, industrial uses.
- Landcover – Types of vegetative or manmade features covering a landscape.
- Restoration Potential – A qualitative assessment of benefits a stream reach may realize considering the level of effort required to restore aquatic/riparian habitat functions.
- Reach Length – The physical measurement of each reach.

Because CSOs impact a diverse set of constituents, numerous factors must be considered when prioritizing and evaluating CSO control alternatives. The ecological reach characterization is one component of a multifaceted decision process framework that was used in CSO LTCP development. The tool provided a means for comparing individual stream reaches of Beargrass Creek within the CSS in terms of ecological condition. The results do not imply that stream reaches with high priority ratings should be the sole target for CSO abatement activities since all portions of Beargrass Creek must meet water quality standards. Results of this prioritization process and ecological reach ranking were one of several variables integrated into the Final CSO LTCP projects selection process and implementation schedule.

1.6.7.2 Recreational Use

EPA's CSO Control Policy also requires that a Recreational Use Survey be performed to assist in identifying the locations with the greatest potential for public contact with sewer overflows. MSD conducted a Recreational Use Survey within the Beargrass Creek and Ohio River Watersheds. An overview of the study is below and details are presented in Chapter 2, Section 2.7 of this Volume. The Beargrass Creek watershed was further subdivided into three forks: Muddy Fork Beargrass Creek; Middle Fork Beargrass Creek; and South Fork Beargrass Creek.

TABLE 1.6.4

LIST OF RECREATIONAL USE SURVEY SITES

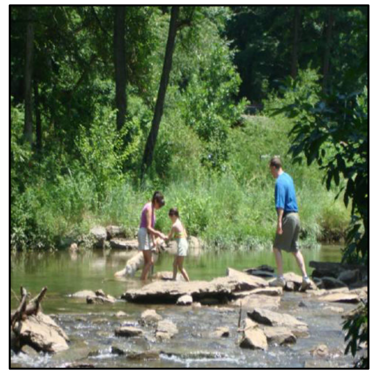
Site Number	Site Name	Watershed
1	Riverside, Farnsley-Moremen Landing	Ohio River
2	Riverview Park	Ohio River
3	Waterfront Park	Ohio River
4	Cox Park (Public Boat Ramp)	Ohio River
5	Louisville Soccer Park	Beargrass Creek Muddy Fork
6	Cherokee Golf Course	Beargrass Creek Middle Fork
7	Cherokee Park	Beargrass Creek Middle Fork
8	Seneca Park (Scenic Loop and Maple)	Beargrass Creek Middle Fork
9	Seneca Park (Big Rock)	Beargrass Creek Middle Fork
10	Seneca Golf Course (1 mile stretch)	Beargrass Creek Middle Fork
11	Brown Park	Middle Fork Beargrass Creek
12	Joe Creason Park	Beargrass Creek South Fork
13	Louisville Junior Academy	Beargrass Creek South Fork
14	Eva Bandman Park	Ohio River
15	Eva Bandman Park	Beargrass Creek Confluence
16	Beargrass Creek at Irish Hill	Beargrass Creek Middle Fork
17	Butchertown Trail	Beargrass Creek Confluence

The Recreational Use Survey was conducted from May 1, 2007, through November 29, 2007, to coincide with the Kentucky recreational season. During site visits, field data at each site was reported on a form entitled, "Field Data Sheet for Recreational Use Stream Survey." Additionally, a minimum of three photos were taken per site (upstream, downstream, and observed recreational activity). Field data reported on the form included:

- Site Information: Name, Location Description, Global Positioning Satellite (GPS) Coordinates
- Photo IDs
- Date and Time
- Personnel
- Current Weather Conditions
- Weather Conditions for Past Seven Days
- Number of People Observed
- Recreational Activities Observed
- Type of Water Contact

A summary sheet was created to summarize the field data for all the survey sites. Field data included on the summary sheets include the site description, number of people observed, recreational activities observed, and magnitude of water contact.

Results were divided in the following categories:



- Adults observed at the site
- Children observed at the site
- Adults observed participating in non-contact activities
- Children observed participating in non-contact activities
- Adults observed participating in contact activities
- Children observed participating in contact activities
- Contact observed

In order to provide assistance in evaluating and selecting overflow control approaches that protect public health, the recreational use survey site locations with the greatest potential contact with CSOs were identified and prioritized. The final results of this survey were used in the evaluation of overflow control measures.

The following four parameters were selected to rank and prioritize the survey site locations:

- Average number of people observed per site visit
- Percent contact observed
- Potential for water contact
- Percent children observed

1.6.8 Measures of Success

The NMC and the LTCP requirements under the CSO Policy require that the effectiveness of the controls be measured to determine if the goals of the Policy and the requirement of the CWA have been met. The evaluation of the effectiveness of the IOAP against the NMC and CSO LTCP requirements will be measured based upon the EPA published guidelines. In addition to these required measures of success, the IOAP will also focus on five project specific values as identified by the stakeholders (refer to Volume 1, Chapter 2). These five project specific values are:

1. Enhancement of public health
2. Enhancement of the environment
3. Regulatory performance
4. Implementation of eco-friendly solutions
5. Protection of the community's assets

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FIGURE 1.1.1
CSO PROGRAM ACCOMPLISHMENTS

MILESTONE:	YEAR:
MSD Initiated CSO Abatement Program	1991
First Combined Sewer Operational Plan (CSOP) to KDOW	1993
Yearly Reporting to KDOW	1994
CSO LTCP Submittal	1996
Nine Minimum Controls	1998
	2000
	2001
	2002
	2004
Entered Into Consent Decree	2005
Interim LTCP	2006
	2008

CSO ABATEMENT PROJECTS:

1991–1993

- BMP Evaluations Conducted
- Sewer System Flow Monitoring
- CSO Inventory
- CSO & Stream Sampling
- CSO Model Developed

1994–1998

- Solids & Floatables Demonstration Projects
- Central Relief Drain Cleaning
- BMP Evaluations
- Increase Overflow Weir Height
- CSO143 Elimination
- CSO065 Elimination
- CSO162 Elimination

1998–2001

- Sneads Branch In-Line Storage
- Increase Overflow Weir Height
- Upper Dry Run Trunk Storage
- Wheeler Basin Storage
- Robert J. Starkey Pumping Plant Modification
- CSO108 CDS Facility
- CSO123 Elimination
- CSO088 Sewer Separation Project
- CSO080 Elimination
- CSO209 Sewer Separation Project
- CSO147 Sewer Separation Project
- CSO049 Elimination
- CSO204 Elimination

2001–2005

- Airport Deicing Project
- Stormwater Drainage Improvements
- Pumping Station Upgrades
- Morris Forman WWTP Upgrade
- MDS Inflatable Dam
- Flow Maximized to Morris Forman WWTP
- Real Time Control Studies
- Real Time Control Phase I Improvements
- Sewer Diversions
- Solids & Floatables Facilities
- Sewer Cleaning at NSTS
- CSO080 Elimination
- CSO145 Elimination

2005–2006

- Prepared Consent Decree Documents
- Real Time Control Phase I Implementation Project
- CSO209 Elimination Project

2006–2008

- Solids & Floatables Control - System Wide
- CSO206 Sewer Separation Project (On-Going)
- CSO147 Elimination Project
- CSO087 Sewer Separation and Elimination Project
- Real Time Control Phase II Implementation Project
- CSO081 Elimination Project
- CSO194 Elimination Project
- CSO032 Elimination Project
- CSO033 Elimination Project
- CSO030 Elimination Project

MSD Metropolitan Sewer District

PROJECT WIN Waterway Improvements Now