CHAPTER 2
SYSTEM CHARACTERIZATION

Once the administrative structure for long-term combined sewer overflow (CSO) control planning has been established, characterization of the combined sewer system (CSS) and receiving water should begin. System characterization includes analysis of existing data and monitoring and modeling of the CSS and receiving water.

Chapter 2 focuses on the establishment of existing baseline conditions. The objective of this chapter is to provide an overview of how the components of the system characterization contribute to LTCP development. As a prelude to the description of the technical activities that make up the system characterization, this chapter discusses the importance of input from the public and the appropriate regulatory agencies during LTCP development and integration of the nine minimum controls (NMC) with the LTCP. The chapter includes a case study documenting the watershed approach to system characterization used by a small CSO municipality. *Combined Sewer Overflows—Guidance for Monitoring and Modeling* (EPA, 1995d) contains a more comprehensive description of these components.

2.1 PUBLIC PARTICIPATION AND AGENCY INTERACTION

Public participation and agency interaction facilitate system characterization. The public participation effort might involve public meetings at key points during the system characterization phase of the control plan development process. For example, meetings could be held to discuss the scope of the various technical activities that make up the system characterization, identification and consideration of the different watershed systems in the analysis of existing data and development of the monitoring and modeling programs, identification and status of implementation of the NMC, and the process for evaluating alternative CSO controls. The municipality could present the following information to the public as it is developed during system characterization:

- Scope of monitoring and assessment programs for system characterization

- The watershed approach to CSO control planning
- Identification of watersheds in the CSO area
- Identification and quantification of non-CSO sources
- Existing sewer system conditions and problems (e.g., flooding, basement backups)
- Quantification of CSO flows and loads and impacts of CSOs on receiving waters
- Results of CSS and receiving water monitoring programs
- Development and calibration of the CSS and receiving water models
- Identification and implementation status of the NMC
- Process for evaluating alternatives.

Input from the public, obtained during the early phases of the planning process, will enable a municipality to better develop an outreach program that reaches a broad base of citizens. In addition to public meetings, municipalities can obtain input in a number of ways, including telephone surveys, community leader interviews, and workshops. Each of these activities can give the municipality a better understanding of the public perspective on local water quality issues and sewer system problems, the amount of public concern about CSOs in particular, and public willingness to participate in efforts to eliminate CSOs.

As noted in Exhibit 1-2 (Chapter 1), interaction between the municipality and the regulatory agencies, including State WQS and National Pollutant Discharge Elimination System (NPDES) permitting authorities, should be initiated in the early stages of CSO control planning and continue through the development of the LTCP and the CSO plan re-evaluation and update. An important outcome of this interaction during system characterization should be agreement between all parties "*...on the data, information and analysis needed to support the development of the long-term CSO control plan and the review of applicable WQS, and implementation procedures, if appropriate*" (III.A).

2.2 OBJECTIVE OF SYSTEM CHARACTERIZATION

The primary objective of system characterization is to develop a detailed understanding of the current conditions of the CSS and receiving waters. This assessment, a crucial component of the planning process, establishes the existing baseline conditions and provides the basis for determining receiving water goals and priorities and identifying specific CSO controls in the LTCP. In the context of the CSO Control Policy: "*The purpose of the system characterization, monitoring and modeling program initially is to assist the permittee in developing appropriate measures to implement the nine minimum controls and, if necessary, to support development of the long-term CSO control plan. The monitoring and modeling data also will be used to evaluate the expected effectiveness of both the nine minimum controls and, if necessary, the long-term CSO controls, to meet WQS*" (II.C.1).

As discussed in Section 1.6.6, the municipality should characterize the system in the context of entire watersheds. By characterizing both CSO and non-CSO sources of pollution within each watershed, the causes of WQS nonattainment can be addressed more effectively, and receiving water body goals can be established. Coordination of data collection and analysis efforts throughout each watershed will also provide greater consistency with the LTCP objectives.

System characterization and implementation of the NMC, described in this chapter, can follow the sequential order shown in Exhibit 1-2. In practice, however, this sequential approach might not always be possible or necessary, and the CSO Control Policy recognizes the need for flexibility. In some cases, municipalities will not need to include every step in this process. For example, some systems are already well understood by system engineers and planners through ongoing monitoring, O&M, or other efforts and, therefore, need not revisit their current approaches to monitoring and modeling. In other cases, because of time constraints, some municipalities might be characterizing their combined systems and receiving waters, implementing the NMC, and conducting monitoring programs concurrently.

2.3 IMPLEMENTATION OF THE NINE MINIMUM CONTROLS

One of the goals of the CSO Control Policy is to achieve an early level of CSO control, even as the municipality is involved in developing the LTCP. Although the CSO Control Policy recommends flexibility for municipalities to plan and implement the LTCP on a phased, iterative basis, it recommends that the NMC be implemented no later than January 1, 1997. Following an assessment of NMC effectiveness, municipalities should ultimately integrate the NMC into their LTCPs (EPA, 1995g).

2.3.1 Existing Baseline Conditions

The validated CSS and receiving water models can be used to predict the existing baseline conditions, which are used to evaluate the effectiveness of the NMC and the performance of the long-term CSO controls.

2.3.2 Summary of Minimum Controls

Exhibit 2-1 summarizes the NMC, based on the detailed discussion presented in *Combined Sewer Overflows—Guidance for Nine Minimum Controls* (EPA, 1995b). The NMC were developed to provide low-cost technology-based controls that can be implemented by January 1, 1997, to reduce the magnitude, frequency, and duration of CSOs.

In practice, the implementation of NMC and their integration with the LTCP will be an iterative process. For example, several of these minimum controls might already be ongoing as part of regular operation and maintenance procedures. In some cases, others could be implemented early in the process, before completion of system characterization. However, to effectively maximize the use of the collection system for storage and maximize flow to the POTW for treatment, an adequate understanding of the conveyance system and its hydraulic characteristics is essential.

Although the NMC will generally not significantly reduce runoff entering the CSS, the overflow volume to be addressed by the LTCP can be reduced by maximizing NMC effectiveness, thus reducing potential program costs for the municipality.

2.4 COMPILATION AND ANALYSIS OF EXISTING DATA

As indicated in Exhibit 1-2, one of the first technical activities within system characterization is the compilation and analysis of existing data. This section discusses

Exhibit 2-1. Summary of the Nine Minimum Controls

Minimum Control	Examples of Control Measures	
Proper Operation and Maintenance	• Maintain/repair regulators • Maintain/repair tidegates • Remove sediment/debris • Repair pump stations • Develop inspection program • Inspect collection system	
Maximum Use of Collection System for Storage	• Maintain/repair tidegates • Adjust regulators • Remove small system bottlenecks • Prevent surface runoff • Remove flow obstructions • Upgrade/adjust pumping operations	
Review and Modify Pretreatment Requirements	Volume Control • Diversion storage • Flow restrictions • Reduced runoff • Curbs/dikes	Pollutant Control • Process modifications • Storm water treatment • Improved housekeeping • BMP Plan
Maximum Flow to the POTW for Treatment	• Analyze flows • Analyze unit processes • Analyze headloss • Evaluate design capacity • Modify internal piping • Use abandoned facilities • Analyze sewer system	
Eliminate Dry Weather Overflows	• Perform routine inspections • Remove illicit connections • Adjust/repair regulators • Repair tidegates • Clean/repair CSS • Eliminate bottlenecks	

Minimum Control	Examples of Control Measures
Control of Solid and Floatable Materials in CSOs	• 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
Pollution Prevention	• Source controls (see above) • Water conservation
Public Notification	• Posting (at outfalls, use areas, public places) • TV/newspaper notification • Direct mail notification
Monitoring	• Identify all CSO outfalls • Record total number of CSO events and frequency and duration of CSOs for a representative number of events • Summarize locations and designated uses of receiving waters • Summarize water quality data for receiving waters • Summarize CSO impacts/incidents

watershed mapping, analysis of existing collection system information, CSO and non-CSO source characterization, field inspections, and receiving water characterization. It concludes with a case study.

Data collection activities are often the most expensive aspect of the CSO planning process; therefore, it is important to maximize the use of available data, as well as to coordinate efforts with other Federal, State, and local water quality agencies. By using existing information, data gaps can be identified and efforts to collect new data can be more focused.

Investigating and describing existing conditions is generally a prerequisite to monitoring and modeling, problem assessment, and evaluation of controls. Extensive applicable information can usually be obtained from municipal government departments, State and Federal agencies, and searches of maps, files, and data bases of environmental data. An investigation of existing data should include gathering, reviewing, analyzing, and summarizing hydrological, water quality, and other environmental data, as well as maps and municipal planning information for the watershed. A description of existing conditions has two major components:

- Watershed characterization, which describes the sources of runoff and the causes of water quality problems. The watershed characterization defines the watershed area and its subwatersheds and further identifies relevant geographic and environmental features (e.g., land use, geology, topography, wetlands), infrastructure features (e.g., sewerage and drainage systems), municipal data (e.g., population, zoning, regulations, ordinances), and potential pollution source data (e.g., landfills, underground tanks, point source discharges). This description can also include historic, social, and cultural characterizations.

- A receiving water body characterization, which describes the receptors of the pollutant sources within the watershed and the effects of those sources. The receiving water body characterization provides water quality and flow information for water bodies (e.g., rivers, streams, lakes, estuaries and their sediment and biota) in the watershed.

These data collection efforts will provide support for future phases of CSO control planning by:

- Providing a basis for establishing and reassessing water quality goals

- Identifying pollutants of concern and their effects on water resources
- Identifying sensitive areas where pollutant loadings pose a high environmental or public health risk and where control efforts should be focused
- Providing watershed base maps for locating pollution sources and controls.

2.4.1 Watershed Mapping

A watershed includes a water body and the entire land area that drains into that water body. A single study area might include several watersheds because many wet weather and CSO control programs are based upon political rather than watershed boundaries.

The first step is to delineate the watershed and its subwatersheds, using base maps or digital mapping resources (if available) or topographic maps. The map should include the municipalities and other entities with jurisdiction, as well as land use categories that could contribute significantly to receiving water impacts. Additional information should then be added as necessary to aid in CSO control planning; this includes topography, soils, infrastructure, natural resources, recreational areas, special fish and habitat areas, and existing pollution control structures. If this information is several years old, field validation might be necessary. Exhibit 2-2 summarizes the types of data typically used in CSO planning.

Watershed maps can be generated by computer. One way of organizing and analyzing data is in a Geographic Information System (GIS). The data in a GIS are organized into thematic layers, such as infrastructure, land use, water bodies, watersheds, topography, or transportation, which can be overlaid and plotted in any combination. In addition, a GIS includes a data management system that can organize and store text and numerical descriptive information. A well-developed GIS can contain most of the data needed. This descriptive information can be very basic, such as land use type (e.g., residential or industrial), or very sophisticated with multiple tables of related data, such as land ownership records, sewer system physical configuration, discharge monitoring report data, soils information, and water quality data.

Exhibit 2-2. Data Types For CSO Planning

Watershed Data	Source Input/Receiving Water Data
Environmental	**Source Inputs (Flow and Quality)**
Land use	CSO
Recreational and open areas	Storm water
Soil and surface/bedrock geology	Other point source and nonpoint source
Natural resources	**Receiving Water**
Temperature	Physiographic and bathymetric data
Precipitation	Flow characteristics
Hydrology	Sediment data
Infrastructure	Water quality data
Roads and highways	Fisheries data
Storm drainage system	Benthos data
Sanitary sewer (and combined sewer) system	Biomonitoring results
Treatment facilities	Federal standards and criteria
Municipal	State standards and criteria
Population	
Zoning	
Land ownership	
Regulations and ordinances	
Potential Sources/BMPs	
Municipal source controls	
Direct (NPDES) and indirect dischargers	
Pollution control facilities	
Storm water control structures	

Source: EPA, 1993b

The use of a GIS might not be feasible for all municipalities undertaking CSO control programs, because of the technical expertise required and the capital expenditures for computer hardware (e.g., an appropriate personal or mainframe computer and a graphics plotter) and software. Although full GIS capabilities can require expensive hardware and advanced training, recently developed software, such as PC-based GIS and "view" systems, are making many GIS functions more accessible to average PC users.

2.4.2 Collection System Understanding

Understanding the physical and hydraulic characteristics of the existing collection system is crucial to any CSO control program. The CSO Control Policy recommends that the municipality "*...evaluate the nature and extent of its combined sewer system through evaluation of available sewer system records, field inspections and other activities necessary to understand the number, location and frequency of overflows and their location relative to sensitive areas and to pollution sources in the collection system, such as indirect significant industrial users*" (II.C.1.b).

The municipality should compile existing information on the collection system. Drawings and records are usually kept by the local public works department, city and county planning offices, and municipal archives. Available information can provide an understanding of the existing system and can also be used to identify areas where plans need to be verified or updated during field inspections. Information should be compiled for sewers, regulators, diversion chambers, pump stations, interceptors, outfalls, and any other key hydraulic control points. Separate sewers, industrial connections, and other related information can be added as appropriate. The municipality will need to know which drainage areas are combined and which are separate or the location of partially separated or combined sewers. The CSO program team can use these data for subsequent monitoring, modeling, and LTCP development.

2.4.3 CSO and Non-CSO Source Characterization

As noted in Section 1.6.6, an advantage in developing an LTCP using a watershed-based approach is that it allows the site-specific determination of the relative impacts of CSOs and non-CSO sources of pollution on water quality. The municipality should identify areas that contain probable sources of significant loadings, such as industrial areas with significant indirect industrial users (i.e., industrial users discharging to the POTW rather than directly to the receiving water body). For many of these sources, the municipality can use existing data collected through the pretreatment program. If the monitoring data are not available, the municipality should consider the collection of such data in the monitoring plan.

2.4.4 Field Inspections

The most effective method for accurately determining the operational status and condition of a CSS is to conduct field investigations. Whereas watershed mapping and review of the collection system information verify a system's design, field inspections help to determine actual operation. Municipalities should inspect their CSSs for many reasons, including the following:

- To characterize areas of the watershed not adequately described by available information
- To identify locations to conduct water quality sampling and install flow measurement equipment
- To determine the structural integrity of the system
- To assess the mechanical condition and operational performance of the system components
- To check for problems, including illegal connections, dry weather overflows, or sediment buildup.

Field inspections can also provide the information necessary to begin assessing and implementing the NMC. The complete implementation of certain minimum controls, such as maximizing the use of the collection system for storage and maximizing flow to the POTW for treatment, will be enhanced greatly by the hydraulic analysis conducted during system characterization. This analysis must proceed from a correct and current understanding of the system.

The extent of the inspection effort necessary will be a function of the adequacy of the municipality's current records and inspection activities. In some cases, the CSS will be large and available funds will dictate the investigation schedule. The municipality should develop a list of inspection priorities related to the project objectives. A first priority might be to inspect elements of the collection system where conflicting information exists, field modifications have been made, or information is missing. A review of the existing drawings, maintenance crew inspection reports, public complaint files, infiltration/inflow (I/I) reports, a sewer system evaluation survey (SSES), or treatment plant upgrade studies might reveal areas of inconsistency or undocumented modifications.

2.4.5 Receiving Water

The main impetus for CSO control is attainment of WQS, including designated uses. To this end, the review of existing information should include characterizing the receptors of CSOs and other watershed pollutant sources and their effects as completely as possible. In many cases, multiple receiving waters will exist, such as tributaries, larger rivers, estuaries, or lakes.

Identification and use of existing receiving water data can shorten the LTCP schedule and reduce cost, particularly sampling and analysis cost. The municipality should review the types of historical receiving water data and information summarized in Exhibit 2-2. These data should be gathered to assist in developing a profile of the conditions in the CSO-impacted receiving water. Often, pollutant source discharge, hydraulic, chemical, sediment, and biological data will exist because of past studies conducted in the watershed. By gathering this information, the municipality can describe existing conditions, as well as data gaps that need to be addressed with the monitoring program. In addition, this effort is important to LTCP development because it provides a basis for:

- Establishing and reassessing priorities for improvements to receiving water quality by water body
- Documenting the type and extent of receiving water impacts caused by CSOs and other point and nonpoint sources
- Identifying sensitive areas
- Quantifying pollutant loads
- Documenting impairment or loss of beneficial uses and water quality criteria exceedances
- Identifying areas with good water quality that might be threatened or that should be protected.

Various agencies at the local, State, and Federal levels might have receiving water data. The municipality should contact each agency that might have been involved in the study area, obtain any existing data, and inquire about other potential data sources. The following list provides possible sources at each level:

- **Local**—Municipal departments, including water, health, and public works, can be useful sources of data and information generated as part of previous studies, wetland or other permit applications, or routine receiving water monitoring. Data will be available from NPDES monitoring records. Municipal departments responsible for reviewing construction and wetlands permit applications can track local water quality conditions as part of local water resource regulations designed to prevent cumulative degradation of sensitive resources. Local permit applications can contain recent and historical water quality, source discharge, and hydrologic data used to demonstrate compliance with local or State wetlands and water quality regulations. Data might also be available for water bodies in special drinking water or flood control districts.
- **State**—Most States have several agencies that deal directly or indirectly with water quality issues: water resources, pollution control, clean lakes, transportation, fisheries, environmental review, wetlands, and coastal zone management. States periodically monitor important water resources and record affected receiving water segments as part of CWA Section 305(b) requirements.
- **Federal**—The Federal Government is an excellent source of hydrology and water resources data through a number of agencies, including EPA, Soil Conservation Service (SCS), U.S. Geological Survey (USGS), and U.S. Fish and Wildlife Service. A number of major Government agencies have water data, including water quality, hydrology, meteorology, biomonitoring, and sediment quality data. In some cases, information can be obtained through the mail; in other cases, such as the USGS National Water Data Exchange and the National Weather Service, the information can be accessed using a computer modem. Many of these agencies also have regional or field offices that are additional sources of data.

An important objective of the initial receiving water investigation is the identification and classification of areas potentially affected by CSOs. A more complete description of the possible impacts to these receiving waters can be developed during monitoring, which is conducted as part of the LTCP. When defining the wet weather receiving water impacts, the municipality should consider the applicable WQS, as well as the existing and desired uses of the receiving water. In developing the LTCP, a "use attainability" approach (40 CFR 131.10) can be an effective method to ensure that recommended improvements in receiving water quality result in the attainment of actual desired uses and that these desired uses are reasonably related to costs. Chapter 3 addresses this issue under the discussion of the demonstration approach.

CASE STUDY: LEWISTON-AUBURN, MAINE—CSO PLANNING

Lewiston and Auburn are located on opposite sides of the Androscoggin River in southwestern Maine. Together, the communities serve as the industrial, commercial, and service center for the south-central-western region of Maine. Lewiston, with a population of approximately 40,000, occupies about 35 square miles of land along the east bank of the Androscoggin River. The city of Auburn has a population of 20,000 and occupies about 65 square miles on the west bank. Combined wastewater flows from both cities are conveyed to the Lewiston-Auburn Water Pollution Control Facility (LAWPCF), located in Lewiston. The LAWPCF provides secondary treatment (conventional activated sludge) with effluent wastewater discharged to the Androscoggin River.

During wet weather conditions, excess flows within the Lewiston CSS and Auburn Sewer District (ASD) CSS discharge directly to the Androscoggin River and its tributaries. On the east side of the river, CSOs from the Lewiston CSS occur along the bank of the Androscoggin River and along drainage courses tributary to the river, including Gully Brook, Jepson Brook, Stetson Brook, and Goff Brook. As indicated in Exhibit 2-3, CSOs from the ASD sewer system on the west side occur along the banks of the Androscoggin and Little Androscoggin Rivers.

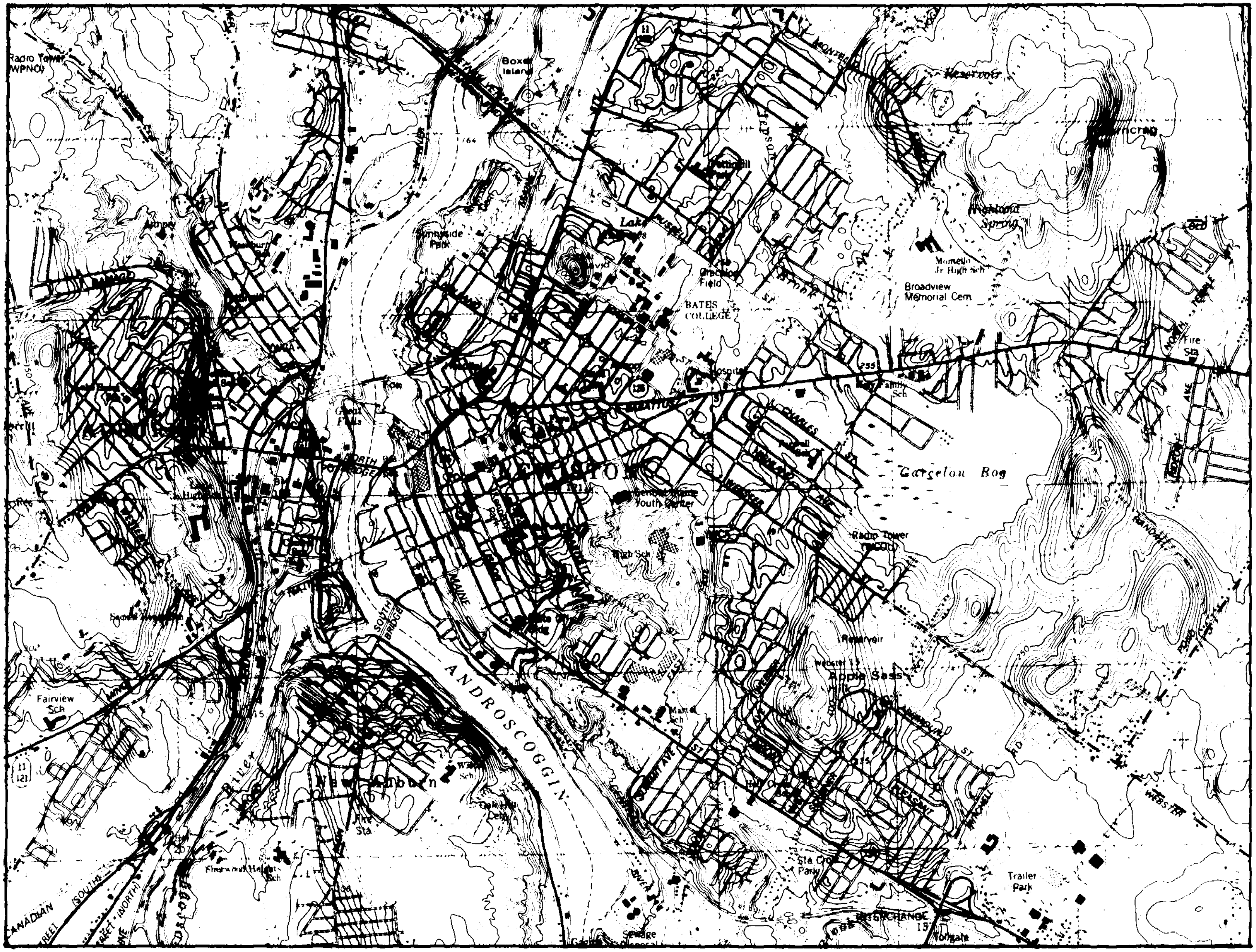
In 1991, the cities embarked on a planning program to address a number of issues, including CSO impacts, storm water management, and nonpoint source control. They decided to incorporate these considerations into an overall planning effort. This case study, which is divided into three separate sections within Chapter 2, outlines CSO planning efforts in Lewiston and Auburn. The first portion of the case study focuses on Lewiston for the early steps in the planning process. The second section describes the CSO and receiving water monitoring efforts, and the third section summarizes the CSO and receiving water modeling.

PUBLIC PARTICIPATION AND AGENCY INTERACTION

The Department of Public Works (DPW) assumed responsibility for the program in Lewiston. The DPW formed a team of representatives from the planning department, LAWPCF, highway department, and the general public who would meet periodically and guide and provide input to the planning process. In addition, the DPW secured funding (100 percent from city funds), developed a scope of services, and hired an engineering consultant to perform technical tasks beyond the capability or available resources of the city.

One of the first tasks undertaken by the program team was to compile information on current Federal and State regulations that were potentially pertinent to the planning effort. The team made a series of contacts, especially with the State regulatory personnel, to determine the status of regulatory activities. They gathered information on Federal and State policies and programs for CSO control, storm water NPDES permitting, Safe Drinking Water Act compliance, nonpoint source pollution control, coastal zone nonpoint source pollution control, and agricultural nonpoint source controls. Changes were occurring in several areas, especially in CSOs and storm water, that needed to be monitored and incorporated into the program.

The team developed initial goals for the program in conjunction with an assessment of existing conditions using available data. Initially, the overall area was divided into watersheds representing the land draining to each of the water bodies in the city, and goals were set for each of these watersheds and receiving water bodies. Exhibit 2-4 lists the characteristics of the watersheds in the city of Lewiston. Because the program was initiated prior to the release of the CSO Control Policy, the team established a basic goal that the program should result in an understanding of and compliance with current and upcoming regulations related to CSO, storm water, and nonpoint source (NPS) control.



Source: USGS Topographic Maps
Lewiston, Maine 1979
Minot, Maine 1981
Lake Auburn East, Maine 1979
Lake Auburn West, Maine 1981

2000 0 2000
SCALE IN FEET

Exhibit 2-3. Lewiston-Auburn Location Plan

Exhibit 2-4. Watershed Characteristics in the City of Lewiston

Watershed Name	Size (acres)	Land Use Description
No Name Pond	750	Rural/residential - shore line cottages
No Name Brook	10,000	Mainly undeveloped - some residential
Stetson Brook	3,000	Ranges from rural to residential to commercial/industrial
Hart and Goff Brooks	1,600	Residential, commercial, and industrial
Salmon/Moody Brooks	1,900	Primarily undeveloped, minor agriculture
Jepson Brook	1,500	Residential and institutional
Androscoggin River	2,300	Urban in central core, undeveloped or industrial in outlying area

The program team held a workshop to facilitate discussion and obtain input on the city's water resources and initial goals for the program. The workshop included discussion of each watershed and the water quality classifications, current uses, known problems, desired uses, and goals completed. A qualitative assessment or "ranking" of the individual watersheds was included to indicate the relative importance of the water resources to the city. The results indicated that CSOs exist mostly in water resources used primarily for non-contact recreation, as shown in Exhibit 2-5.

In some cases, the desired uses of the water resource were being met. For these, maintaining and protecting the uses was set as an initial goal. For some of the brooks, aesthetics was the only use of concern, even though the Class B standard allows fishing and swimming. For these, the initial goal of meeting Class B standards was set. For Jepson Brook, which is a channelized drainage ditch, there was no desire to meet Class B standards. For No Name Brook, there was a desire to upgrade the standard from Class C to Class B. The range of initial goals reflects the variety of watersheds and water resources being addressed.

ANALYSIS OF EXISTING DATA

The program team assessed existing information and data and made the following conclusions pertaining to the initial goals of the planning program:

- The city has an aggressive and extensive regulatory control system that addresses many NPS and storm water control issues. With minor improvements, this system could fulfill the goals of maintaining and protecting existing uses.

- There were virtually no water quality data or information on any of the brooks in the city. More information is needed to better assess the existing conditions and establish goals for these systems.

- There are extensive data on the Androscoggin River, which does not meet the Class C standards. Most pollution appears to be from upstream sources, but the contribution of CSOs needs to be defined better.

Exhibit 2-5. Initial Water Resource Goals for Lewiston

Watershed Name	Water Quality Class	Current Uses	Known Problems	Qualitative Assessment of Importance	Desired Uses	Goals
No Name Pond	GPA	Aesthetics Recreation—fishing, boating	Algal blooms Septic tank discharges	Most important town water resource	Same as current	Maintain and protect existing uses
No Name Brook	C	Aesthetics	Erosion from use of all terrain vehicles Debris	Second most important town water resource	Same as current	Maintain and protect existing uses Upgrade to Class B
Stetson Brook	B	Aesthetics	Erosion CSOs	Third most important town water resource	Same as current plus fishing	Meet Class B
Hart and Goff Brooks	B	Aesthetics	Erosion Industrial areas Interceptor sewer surcharging	Fourth most important town water resource	Same as current	Meet Class B
Salmon/Moody Brooks	B	Aesthetics	Agriculture	Small watercourses of minor importance	Same as current	Meet Class B
Jepson Brook	B	Drainage	CSOs (no visual/odor) Debris	Channelized drainage ditch	Same as current	Maintain current use
Androscoggin River	C	Aesthetics Recreation—fishing, boating	Point sources (paper mills) Erosion (gravel pits) CSOs	Large regional water resource	Same as current	Meet Class C
Groundwater	GWA	Drinking water supply (for town of Lisbon)	None	Of limited current importance to town	Same as current	Maintain and protect existing uses

Proceeding from these conclusions, the program team made numerous contacts and held meetings with individuals who might have pertinent data. Exhibit 2-6 lists the data compiled.

Potential Pollution Sources

In addition to CSOs, a number of possible pollution sources existed within the city's watersheds; however, these had never been mapped. The city compiled extensive information on underground and above-ground storage tanks, landfills, vehicle maintenance areas, salt storage and snow dumping areas, CSOs, and storm drain cross-connections. These were plotted on a base map, along with watershed boundaries, receiving waters, and other important features, such as gaging stations, recreational areas, and flood control structures, to provide a convenient way of reviewing watersheds and potential pollution sources within them, possible threats to receiving waters, and the underlying zoning districts.

The mapping showed that most of the potential pollution sources exist within the Jepson Brook, Hart Brook, and Androscoggin River watershed areas, because these are the most developed watersheds. Stetson Brook watershed has several potential sources, and Salmon/Moody Brook has almost none. The No Name Brook and No Name Pond watersheds did not have many source areas. One area of medium density residential development on Sabattus Street with a concentration of underground tanks was noted. This area is of concern because it is located in the downstream portion of No Name Brook near No Name Pond.

Nonstructural Controls

Nonstructural controls include regulatory controls that prevent pollution problems by controlling land development and land use. They also include source controls that reduce pollutant buildup or lessen its availability for washoff during rainfall. The program team reviewed the city's land use and zoning code and other development guides to determine the status of nonstructural controls. It was determined that the city has a comprehensive set of nonstructural controls. These were analyzed and presented in a series of matrices, which were used to assess the strengths and weaknesses of the regulations. The major areas of existing regulatory authority included conservation districts, performance standards, and development review standards. These controls provide pollution control by reducing the amount of storm water runoff and improving the runoff quality as new development and redevelopment occurs.

Municipal Source Controls

The team also conducted interviews to summarize the city's current source control activities. Most of the activities appeared to correspond to standard practices of similar size municipalities. Areas that appeared to need further consideration included sewer cross-connection removal, road salting, and household hazardous waste pickup. The city identified some cross-connections and plans to implement a removal program. Many communities are involved in household hazardous waste pickup programs. Such a program could prove beneficial, and it would be consistent with the other aggressive solid waste programs of the city. Such programs also can be expensive, however. The team plans further evaluation of municipal BMP/source control activities after collection of data and evaluation of various possible BMP programs.

Receiving Water Data

The program team located limited data on receiving waters and on the major pollution sources to the receiving waters, as listed in Exhibit 2-7. Data were available for the Androscoggin and Little Androscoggin (which feeds into the Androscoggin River in Lewiston) Rivers only. The USGS maintains monitoring stations on both rivers, and published data on dissolved oxygen, temperature, pH, and conductivity are available. Maine DEP collected grab samples on a weekly basis during summer months,

Exhibit 2-6. Lewiston Watershed Data

Description	Source
Environmental	
Topography	USGS topographical maps; city's 100 and 200 scale maps
Land Use	"Zoning Map Lewiston, Maine" revised 11-7-91; Comprehensive Land Use Plan (1987)
Recreational Areas	Parks Department inventory
Soil and Surface/Bedrock Geology	USDA Soil Conservation Service soil survey
Vegetation	USGS quadrangle sheets & Maine DOT aerial photos
Natural Resources	Comprehensive Land Use Plan (1987)
Temperature	NOAA
Precipitation	National Climatic Data Center; four rainfall gages owned and operated by Lewiston
Hydrology	FEMA flood mapping
Infrastructure	
Roads and Highways	Various maps of the city exist
Storm Drainage System	Record drawings provided by the city
Sanitary Sewer and Combined Sewer System	Record drawings provided by the city
Treatment Facilities	Record drawings provided by the city
Other Utilities	Gas, New England Telephone maps
Municipal	
Population	U.S. Census data; Maine Department of Data Research and Vital Statistics; Comprehensive Land Use Plan (1987)
Zoning	Zoning regulations; city zoning map; Comprehensive Land Use Plan (1987)
Land Ownership	City Assessor's maps
Regulations and Ordinances	"Draft. Development Permit" provided by the city; Comprehensive Land Use Plan (1987)
Municipal Source Control BMPs	Interviews with various city departments and staff
Potential Sources/BMPs	
Landfills	Locations developed by city
Waste Handling Areas	Locations developed by city
Salt Storage Facilities	Locations developed by city
Vehicle Maintenance Facilities	Locations developed by city
Underground Tanks	Maine DEP list supplemented by the city
NPDES Discharges	Locations developed by city
Pollution Control Facilities	Lewiston Area Water Pollution Control Authority
Retention/Detention Ponds	Public Works Department inventory
Flood Control Structures	Public Works Department inventory

Exhibit 2-7. Lewiston Source Input and Receiving Water Data

Description	Source
Source Inputs (Flow and Quality)	
CSO	None
Storm Water	None
Other NPS	None
Receiving Water	
Physiographic and Bathymetric Data	Some available - see water quality data below
Flow Characteristics	USGS flow data
Sediment Data	International Paper - Androscoggin River
Water Quality Data	Maine DEP, USGS, CMP, Union Water Power Co. (Note: all water quality data in Androscoggin River only)
Fisheries Data	International Paper - Androscoggin River
Benthos Data	International Paper - Androscoggin River
Biomonitoring Results	None
Federal Standards and Criteria	EPA
State Standards and Criteria	Maine DEP

and data on dissolved oxygen, *E. coli* or fecal coliform bacteria, phosphorus, TKN, NO_3, NH_3, and conductivity are available for several years. The most comprehensive set of data available was collected by International Paper Company relative to its wastewater discharge upstream of Lewiston. Although the available data do not cover the entire reach of the Androscoggin River in Lewiston, significant data on fisheries and sediment exist. None of the existing data were oriented toward definition of wet weather impacts in the receiving water. Some of the Maine DEP grab samples were taken during or after storm events, and the bacteria data indicate elevated bacteria levels during these periods.

Due to the limitations in the available data, the program team identified two major areas for new data collection: (1) CSO flows, loads, and impacts, which were required as part of CSO planning efforts by the State and (2) water resources where no data currently exist. These programs are described in the next section of the case study, following Section 2.5.3.6.