Detroit Water and Sewerage Department

Wastewater Master Plan
Executive Summary

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CDM Camp Dresser & McKee

October 2003

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Regional Sewer Service Today

Serving the People and Economy of Southeast Michigan. The Detroit Water and Sewer Department's regional wastewater system has supported the growth of Southeast Michigan for over 130 years. In 2003, the regional system serves the City of Detroit and 76 customer communities which include 3 million people. Since 1950, the regional sewer service area has almost doubled in size. Approximately 1.8 million people are employed by businesses connected to the regional sewer system.

The regional system conveys and treats wastewater for a metropolitan economy that the Detroit Regional Chamber of Commerce estimates as $500 billion per year. Over 2,500 persons are employed by DWSD, and its first and second tier customers to operate and maintain the treatment facilities pumping stations, combined sewer overflow control facilities, and over 14,200 miles of publicly-owned sewers. Also, the regional wastewater system protects the water supply for the city of Detroit and 126 communities in Southeast Michigan – approximately one half of the population of the state.

Largest Treatment Plant in the World. The Detroit wastewater treatment plant processed an average annual flow of 656 million gallons per day in 2002. Wet weather flows will exceed 1,700 million gallons per day during heavy rain events, after the current expansion program at the plant is complete. Detroit's wastewater treatment plant is among the top ten in the world as measured by average daily flow. The existing plant was built in 1940, and expanded three times since. When construction is completed on the current expansion, it will have the largest peak hour flow capacity of any plant in the world. The wastewater treatment plant is operated in compliance with federal and state requirements for pollution control, and it discharges treated wastewater to the Detroit River.

Regional Sewer Service for the Next 50 Years

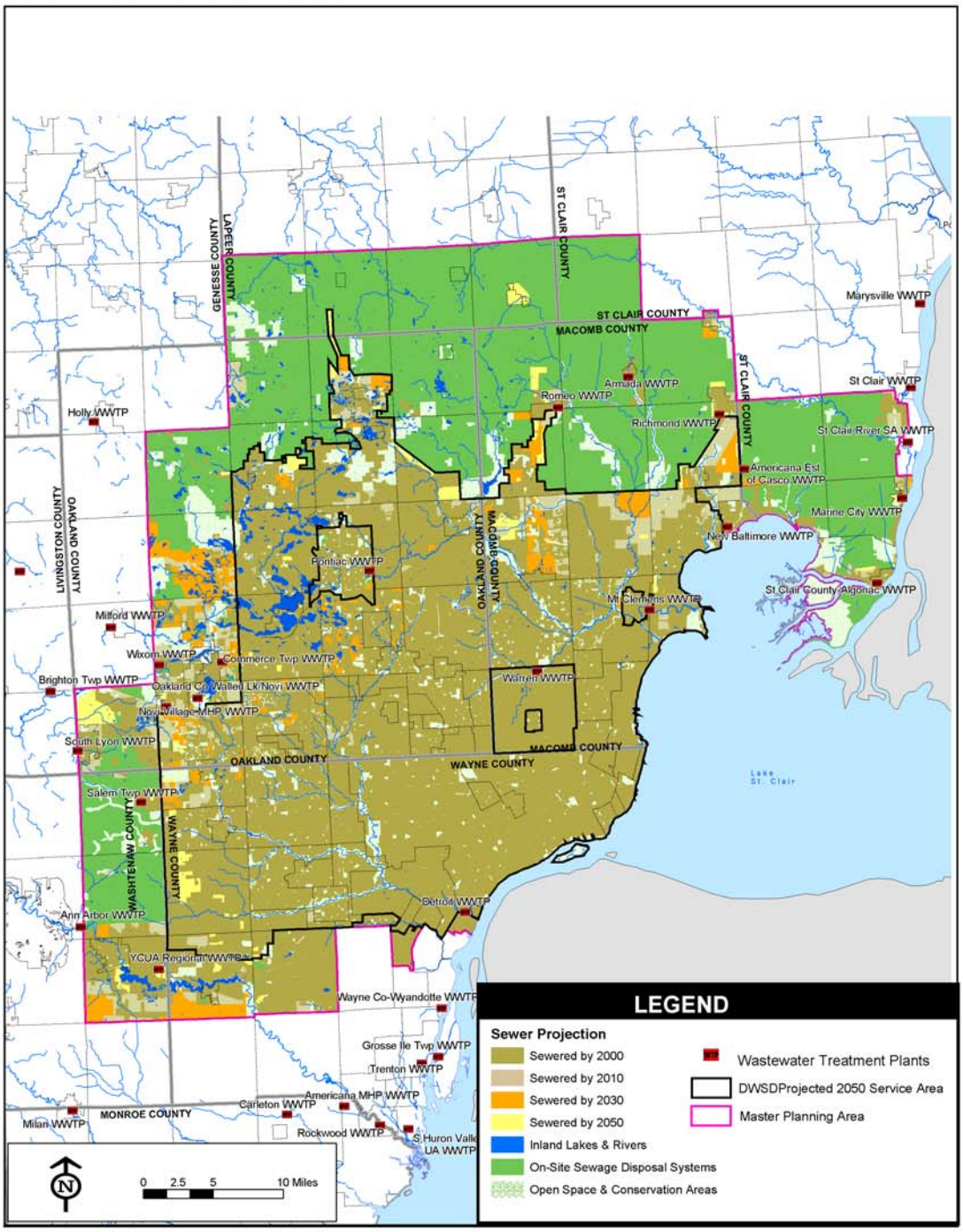
Population Growth and System Expansion. The next 50 years is anticipated to see continued growth of the DWSD regional system, along with growth of the other major wastewater treatment providers. The planning area established for this study included 124 communities. Based on projections made by the Southeast Michigan Council of Governments (SEMCOG), the population in these communities is expected to grow from 3.8 million in 2000 to 4.3 million in 2050. Employment is expected to grow from 2.2 million to 2.5 million. The Regional Transportation Plan for the SEMCOG area includes $24 billion for transportation improvements from 2000 to 2025, and new house construction will exceed 300,000 housing units.

The service area of the regional system is expected to grow by about 100 square miles — the equivalent of almost three townships — by 2050. Detroit's regional sewer system is expected to serve approximately 3.2 million persons in 2050, an increase of about 215,000 persons compared to the present. Figure 1 shows the projected sewer service area in the years 2010, 2030, and 2050.

Each new square mile of typical residential development will include approximately 20 to 30 new miles of public sewer pipeline at a cost of $20 to $25 million, plus an equal length of privately owned service connections from the homes to the sewers at a cost of $3 to $5 million. These costs are typically part of the cost of development and are paid by homeowners as a part of the price of a new home.

Development and Infrastructure for Healthy Watersheds. The planning area for this study is approximately based on the boundaries of the three major watersheds – the Rouge, the Clinton, and the Lake St. Clair/Detroit River. The regional wastewater system currently serves 80 percent of the population in this planning area. The other 20 percent of

Figure 1: Projected Sewer Growth to 2050 in the Planning Area



the population — approximately 650,000 people — is served by 36 smaller wastewater treatment plants and by on-site sewage disposal systems. By the year 2050, it is expected that the regional system will serve about 75 percent of the planning area population, while the rest of the population will be served by other wastewater treatment providers, decentralized wastewater systems, or on-site sewage disposal systems.

Watershed planning done by others indicates a desire to maintain rural, less developed areas in a number of headwater communities. Also, in several communities, there are land use controls and policies to rely on on-site sewage disposal systems, rather than sewers. This Master Plan provides a process for cost-effectively balancing the growth of the regional system with the environmental concerns of communities that favor decentralized wastewater systems or individual on-site disposal systems.

Customer Needs and Regulatory Requirements

The Detroit Water and Sewerage Department (DWSD) has prepared this Master Plan to guide the growth, rehabilitation, and upgrade of the regional system to the year 2050. A similar plan for regional water service for the City and 126 suburban communities will be completed in June 2004.

Prior to this Master Plan, the DWSD had identified needs for control of combined sewer overflows (CSO) and for its wastewater treatment plant. The DWSD now has major construction projects underway for CSO control and for the upgrade and expansion of the wastewater treatment plant. Available results from the CSO program and the wastewater treatment plant program, including projected future costs, have been included in this Master Plan. The Master Plan identifies how the results of these major programs will be used in DWSD's overall 50-year strategy.

DWSD met with a series of groups representing its internal divisions plus retail customers, wholesale customers, and regional stakeholders during the development of the plan. Based on this input, DWSD has identified the following major customer service needs to the year 2050:

- Help customer communities control their sanitary sewer overflows (SSOs).
- Optimize the use of existing facilities to control SSOs through the regional conveyance system and by using the capacity of CSO treatment facilities.
- Eliminate capacity constraints and adjust contract limits with the DWSD collection system through new wastewater service contracts, so that there is a consistent level of service to all customers.
- Expand efforts for rehabilitation of infrastructure to maintain and extend the useful life of the system.
- Perform and promote cost-effective reductions of dry weather inflow/infiltration (DWI/I).
- Provide wastewater service to a projected 215,000 new residents in communities now under contract to the DWSD.
- Provide the option of wastewater service to potential new customers outside of the current contract area.
- Increase operational efficiency through a coordinated regional operational plan, new technology, and continuing performance improvements within the workforce.
- Meet current and future regulatory requirements and become prepared to address emerging regulatory requirements.

What Was Learned

A complete set of findings and conclusions is presented in Volume 7, Section 3 of the Master Plan. Key conclusions are presented below.

Capacity is Available for Projected Growth. The Detroit wastewater treatment plant has capacity for anticipated growth within the current contract service area of the regional system. There is no need to build another wastewater treatment plan for the regional system. There is also capacity available for expansion of the system beyond the current contract service area. More capacity can be made available if flow and capacity management efforts (described below) are successful in removing non-sewage flows. With successful flow and capacity management efforts, the existing regional system can accommodate flows from approximately 200,000 more homes, in addition to the population served today.

Contract Capacity Must be Managed. DWSD is in the process of creating new standardized contracts for its wastewater customers. It is recommended that the new contracts have uniform technical standard for assigning contract capacities. The proposed uniform technical standard would provide for dry weather flows for each decade to 2050, plus allowable wet weather flows up to the 10-year 1-hour design storm (about 1.9 inches per hour of rainfall. Beyond this standard, each community would be responsible for managing its excess wet weather flows.

This Master Plan recommends that DWSD and its wholesale customers review the sewer rate structure and develop a plan to allocate costs on both contract capacity plus metered flow. Today, wholesale customers and retail customers pay only for the flows that they deliver to DWSD. However, DWSD must build and maintain its infrastructure to be able to convey peak flows from the customers that may only occur for a few hours or days per year. A rate structure that allocates costs to both peak capacity and metered flow could provide a benchmark for customers to determine the cost-effectiveness of flow reduction measures in their systems.

Non-Sewage Flows Can be Reduced. Today, over 40 percent of dry weather flows at the treatment plant are non-sewage flows. An older combined sewer system like that of Detroit is expected to have 30 percent or more non-sewage flow. However, some customers and areas of the city have non-sewage flows that exceed the total annual rainfall. Thus, there are large sources of leakage from rivers or from the public water systems that are entering the sewer system.

This Master Plan recommends a reduction in dry weather non-sewage flow where removals are cost-effective. Reductions can be achieved through footing drain disconnections, reductions in flows from leaking water mains that enter the sewers, removal of storm water from separated systems, and removal of river inflows from the combined sewer system. These dry weather reductions will yield even greater reductions of flow during times of wet weather. Several communities in the planning area are already proceeding with such flow reduction measures. On a unit basis, any non-sewage flow of 1 gallon per day that can be removed for $5 or less should be removed. The unit cost of new facilities to provide satisfactory treatment of 1 gallon per day of flow would be at least $6.

Rehabilitation Efforts Need to Increase. DWSD now cleans and inspects 20 to 30 miles of pipe per year in response to customer complaints and service requests. DWSD has many older large brick sewers that are in good condition, as well as many smaller clay lateral sewers that need substantial rehabilitation work. Approximately 90 percent of the sewers in the City of Detroit are older than 50 years. Half of the sewers connected to the wastewater treatment plant are private service connections extending from homes and businesses to the public sewers. These private service connections can be

significant sources of non-sewage flow, sedimentation, and root intrusion. Ordinances for inspection of older service connections at the time of sale of the property are recommended for the City of Detroit and all of its wholesale customers.

On-Site Sewage Disposal Systems. There is an interest in several communities to maintain on-site sewage disposal systems in the future, rather than build sewers. This Master Plan recommends that additional facilities for septage receiving and disposal be constructed to keep pace with the expected increase in regular inspection and pumping of on-site sewage disposal systems. Population projections show that some townships in Oakland and Macomb may experience growth which could exceed the capacity of the soils and lot sizes for on-site sewage disposal. Progress with on-site sewage disposal systems in these townships should be reviewed each decade to determine if sewers or decentralized wastewater treatment systems will be needed in the future.

Dewatering of Flows from CSO Control Facilities. Existing and proposed combined sewer overflow control facilities to be completed by DWSD and several of its customer communities, will store approximately 950 million gallons of CSO. After a storm event, the stored CSO will need to be dewatered and treated within 24 to 72 hours. DWSD is working with its customer communities to develop a regional operations plan that includes operational strategies for dewatering and treating the stored CSO flow and optimization of the system.

Revenue Requirements. An analysis of revenue requirements for wastewater work shows that planned expenditures over the next 5 to 7 years are significantly higher than the needs forecasted beyond that time. The next 5 to 7 years include major expenditures for CSO controls and treatment plant upgrades. This Master Plan has, for the first time, provided DWSD with a long-term forecast of expenditures and revenue requirements. DWSD, its customers and MDEQ should review the long-term forecast and determine what opportunities exist for adjusting capital improvement schedules to meet water quality improvement goal while managing sewer rate increases.

Sanitary Sewer Overflows. SSO's occur in 17 of DWSD's wholesale customers. From July 2000 to June 2002, there were 83 events and 41 million gallons reported. Of the 41 million gallons of SSOs, about 26 million gallons were reported from July 10, 2000 through July 10, 2001. The other 15 million gallons were reported the following year. This plan looked at alternatives for removing excessive wet weather flows from local sewer systems, local storage of SSO, and conveying SSOs to the regional system for treatment. A regional approach has been identified that provides cost savings to customer communities and slightly increases the annual volume of treated CSO discharged.

Shared Responsibility for Success. There is a shared responsibility among DWSD, its wholesale customers, property owners, and regulatory agencies for successful implementation of this Master Plan. This shared responsibility is best understood in terms of the ownership of pipelines connected to the wastewater treatment plant. There are approximately 28,500 miles of pipe connected to the treatment plant. 15 percent is owned by DWSD, 35 percent by its customer communities, and 50 percent is on private property connecting individual homes and buildings to the public sewer system. Shared responsibility can also be understood in terms of the role of DWSD, its wholesale customers, and the Michigan Department of Environmental Quality for Act 451 permit approvals.

Detroit cannot implement the Master Plan alone, neither can its wholesale customers proceed with individual solutions as cost-effective as those provided by a regional approach.

What We Need To Do

The desired outcomes of this Master Plan can be expressed in simple, environmental and public health protection and operational terms:

- **Clean Rivers and Beaches**: The proposals of this Master Plan provide continued measurable progress to improve the quality of receiving waters and beaches.
- **Healthy Watersheds**: The proposals of this Master Plan include new procedures for coordinating sewer service extensions with local zoning and land use plans and improvements to septage management facilities.
- **Dry Basements**: The proposed SSO solutions will reduce basement flooding.
- **Smaller Rate Increases**: The recommended flow management strategy and proactive asset management and rehabilitation efforts result in future sewer rate increases that are at or near the projected rate of inflation.
- **Excellence in Innovation and Operational Efficiency**: Detroit and its wholesale customers that are served by combined sewers are already recognized as a leader in combined sewer overflow controls. This Master Plan outlines technology and human resources initiatives to extend this recognition for dry weather wastewater service and system rehabilitation.

Volume 7 Section 4 of this Master Plan provides detailed recommendations under seven major capital improvement and management programs for three planning intervals over the next 50-years to meet these desired outcomes. The planning intervals are:

Early Period: 2004 to 2015

Middle Period: 2016 to 2030

Late Period: 2031 to 2050

Recommendations are more specific for the earlier period. This Master Plan should be updated every ten years to incorporate new information such as census updates, and to learn from and improve on the results of the preceding times.

In the next 10 years, DWSD is expected to spend over $3.5 billion in work on its combined sewer controls, wastewater treatment plant and new programs recommended under this Master Plan. There will be over $200 million spent within the City of Detroit on sewer rehabilitation and improvements. Customer communities are expected to spend up to $800 million on programs of their own for SSO control, flow management and system extensions.

In addition to DWSD's wastewater treatment and combined sewer overflow programs now underway, this Master Plan recommends three new areas of concentration:

- Expanded Rehabilitation Efforts
- Managing Capacity and Flows
- Increasing Operational Efficiency

Rehabilitation. DWSD inspects and rehabilitates its pipes on a continuing basis. Operation and maintenance programs are in place to deal with urgent problems on a day-to-day basis. Rehabilitation projects that are complaint-based should be transformed into proactive efforts driven by accurate data from condition assessment activities. Uniform criteria should be used for prioritizing the rehabilitation efforts. This Master Plan recommends that DWSD begin to accelerate its inspection program to achieve a rate of approximately 70 miles per year by the year 2010.

The Master Plan also recommends increased use of new technology to inspect and track of the condition of sewers and equipment to minimize the cost of replacement and rehabilitation. DWSD should expand its current systems for asset management to assure that future expenditures for system rehabilitation are minimized, while maintaining the reliability and level of service. Ongoing rehabilitation costs in the future are estimated to be about $300

million per year, or about $90 per year for each person served.

Managing Flows and Capacity. The regional wastewater treatment plant serves an area of over 900 square miles. About 25 percent of the service area has combined sewers that carry wastewater and storm water, the remaining 75 percent of the service area has separate sanitary sewers, and storm water is carried in other pipes. DWSD proposes to leverage a number of its efforts involving wastewater flows, dry weather infiltration/inflow reduction, and assistance to customers with SSO issues into a program for capacity management. Growth predictions show that the potential for future flow increases from new customers are relatively small compared to the opportunities for DWSD to manage flows and capacity to allow for new growth without building extensive new treatment facilities and new conveyance systems.

This Master Plan has identified a number of system bottlenecks where capacity is limited. The timing and cost of these improvements has been prioritized over the planning period.

Operational Efficiency. Water and sewer rates are a universal concern. With this Master Plan the DWSD has a guide to help plan its future expenditures and manage rate increases. In the last two years, DWSD has made a number of changes in its organization and policies that have resulted in cost savings and improved efficiency for all customers. The Master Plan recommends continuing efforts for efficiency, cost-saving measures to deal with new regulations and requirements, and increasing the involvement of customers in major decisions.

DWSD will continue to improve on – and demonstrate to its customers – its progress on improving operational efficiency. DWSD has projected its wastewater revenue requirements and the sewer rate impacts of the 50-year Master Plan recommendations. These projections show that it is possible for DWSD to manage sewer rate increases through careful attention to its rehabilitation efforts, determining the most cost-effective way to perform each of its programs, completing the regional operations plan, and by expanding its initiatives in human resources.

Tools for Implementation

The major tools to begin to implement this Master Plan over the next 24 months are listed below.

Adoption of the Plan. This Master Plan is unique in DWSD's recent history. Such a long-range evaluation of needs has not been performed before. There is no regulatory requirement for a Master Plan, but the plan does impact several regulatory programs. DWSD will work with its Board of Water Commissioners, and its First Tier Partnering Steering Committee to determine how this plan might be adopted and implemented.

New Contracts. The effort now underway by DWSD to update and standardize its sewage disposal agreements with its wholesale customers offers an important legal step which DWSD can use to introduce recommendations of this Master Plan through contracts.

Use of Cooperative Forums. DWSD can use several cooperative forums to advance the goals of this Master Plan: the Southeast Michigan Consortium on Water Quality, DWSD's First Tier Partnering Steering Committee and its associated work groups, Michigan Land Use Task Force and SEMCOG's Wastewater Service Provider's Forum.

Act 451 Permits. Construction permits (Act 451 permits) are extremely important in managing additions and improvements to the system. MDEQ, DWSD, and DWSD's customers all have a role. They also require coordination with the watershed management plans for the Rouge River, and the plan now being prepared for the Clinton River.

DWSD Internal Reorganization. The current reorganization effort at DWSD and new efforts to

reduce costs and improve performance measurement are consistent with the long-term human resources planning and performance benchmarking recommendations of this Master Plan.

Regional 5-Year and 10-Year CIP. In recent years, DWSD has increasingly involved its wholesale customers in review of its annual capital improvement program. This Master Plan recommends a next step to coordinate a long term regional CIP with other customers, transportation agencies, and city departments in 5-year and 10-year forecasts. This type of regional CIP coordination effort will improve the ability to plan for funding requirements through the State Revolving Loan Fund program and other funding sources.

Organization of the Report

The Master Plan report is presented in 8 volumes, including a CD with 67 technical memoranda. One of these technical memoranda titled *Comments and Responses on the Draft Master Plan* provides a listing of all comments received on the draft report and responses to those comments.

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Volume 1. Planning Criteria

Volume 2. Flow Management and Critical Facilities

Volume 3. Wastewater Service Alternatives

Volume 4. Capital Improvement Program

Volume 5. Customer Service and Technical Support

Volume 6. Control of Sanitary Sewer Overflows

Volume 7. Implementation

Volume 8. Table of Contents and Glossary

The CD version of the Master Plan provides all report graphics and maps in color.